GEOTECHNIQUE® PTY LTD

ABN 64 002 841 063

Job No: 14577/1
Our Ref: 14577/1-AA
8 January 2020

Presida Constructions Pty Ltd
Suite 140, Level 4, 14 Lexington Drive
BELLA VISTA NSW 2153
Email: jamesg@presida.com.au

Attention: Mr J Grausam

Dear Sir

re: **Proposed Industrial Development**
Lot 14 in DP286568 - 7 Renshaw Street, Cranebrook
Geotechnical Investigation

This report provides the results of a geotechnical investigation at the subject site. The work was conducted as per our fee proposal Q8992 dated 19 November 2019 and was approved by Mr J Grausam of Presida Constructions in a signed confirmation of engagement dated 26 November 2019.

Proposed Development

We understand that the proposed development includes construction of 28 industrial units with mezzanine level for some units. Construction of rigid concrete pavements for internal access roads with parking spaces is required as part of the development. Site preparation for the proposed development may involve minor cut and fill.

In this regard, a geotechnical investigation was required to assess subsurface conditions across the site in order to provide geotechnical recommendations on the design of pavement, floor slabs and footings. Recommendations on subgrade preparation and specification for engineered fill were also required.

Regional Geology

The Geological Map of Penrith (Geological Series Sheet 9030, Scale 1:100,000, Edition 1, 1991), published by the Department of Minerals and Energy indicates that the site is underlain by Quaternary deposits comprising gravel, sand, silt and clay.

The Soil Landscape Map of Penrith (soil Landscape Series Sheet 9030, Scale 1:100,000, 1989), prepared by the Soil Conservation Service of NSW, indicates that the site is located within the Richmond landscape area and typically consists of clays, clay loams, sands and ironstone nodules.

Field Work

Field work for the investigation was conducted on 9 December 2019 and the following was completed:

- Obtain and review available geological and geotechnical information relevant to the site.
- Obtain and review services plans from "Dial Before You Dig" to identify locations of underground services within and in the vicinity of the site.
- Carry out a walk over survey to assess existing site conditions and establish preferred locations for test pits.
- Scan proposed test pit locations for underground services to ensure that services are not damaged during field work. We engaged a specialist services locator for this purpose.
- Excavate ten (10) test pits to depths ranging from 1.5m to 2.5m, using a 5t excavator equipped with an auger. Engineering test pit logs and explanatory notes are attached to the report. Test pit locations are shown on the attached Drawing No 14577/1-AA1.
- Carry out Dynamic Cone Penetration (DCP) tests at selected test pit locations to assess the strength characteristics of sub-surface soils.
- Recovery of the representative soil samples for visual assessment and laboratory testing.
- Measure depths to groundwater level or seepage in the test pits, where encountered.

Field work was supervised by a Geotechnical Engineer from this company who was responsible for walk over survey, nominating test pit locations, supervising field work, sampling and preparation of field logs.

Site Description

The site is of irregular shape and is bounded by Andrews Road to the south, Lakeview Drive to the north, and a small creek to the west. The site was covered with long grass and was devoid of trees. Topography of the site is generally flat with a gentle slope towards the west.

Subsurface Conditions

Sub-surface conditions encountered in the test pits are detailed in the attached logs, and summarised below in Table 1.

Table 1 – Sub-surface Conditions

Test Pit	Surface RL (m, AHD)	Termination Depth (m)	Fill (m)	Natural Soil (m)
TP1	27.5	2.5	0.0 –> 2.5	NE
TP2	27.4	2.5	0.0 –> 2.5	NE
TP3	26.5	2.5	0.0 –> 2.5	NE
TP4	26.7	2.5	0.0 –> 2.5	NE
TP5	26.3	1.5	0.0 –> 1.5	NE
TP6	26.3	2.0	0.0 –> 2.0	NE
TP7	26.2	2.5	0.0 –> 2.5	NE
TP8	26.0	2.5	0.0 –> 2.5	NE
TP9	25.6	2.5	0.0 –> 2.5	NE
TP10	25.6	2.5	0.0 –> 2.5	NE

Note : RL and depths measured from existing ground surface are approximate only

Subsurface materials are described as follows:

Fill	Silty Clay, low to medium plasticity, with shale fragments, gravels and occasional cobbles/boulders Silty Sand, fine to coarse grained, with gravels Silty Clayey Sand, fine to medium grained, with gravels

The ten test pits excavated at the site encountered fill comprising silty clay, silty sand and silty clayey sand to the terminated depths. No non-soil or deleterious materials were found in the fill. Grass roots were encountered at the ground surface.

DCP tests conducted at selected test pit locations indicated the fill to be well compacted.

Groundwater Conditions

Groundwater was not encountered to the terminated depths of the test pits. It should be noted that levels of groundwater generally vary due to changes in temperature, rain and other factors not evident during drilling.

Laboratory Testing

California Bearing Ratio

Three (3) subgrade samples were collected from the test pits to conduct 4-day soaked California Bearing Ratio (CBR) tests. The tests were conducted on samples compacted to 100% standard dry density at moisture content close to optimum moisture content, in the NATA accredited laboratory of Geotech Testing Pty Ltd. The test results are summarised below and detailed in the attached certificate.

Table 2 – CBR Test Results

Test Pit	Sample Depth (m)	Soil Description	MDD (t/m^3)	OMC (%)	FMC (%)	Variation From OMC (%)	CBR (%)
TP1	0.2 – 0.8	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	2.07	9.4	7.1	2.3% Dry	20
TP3	0.6 – 0.9	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	1.94	11.7	5.5	6.2% Dry	5
TP6	0.3 – 0.6	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	2.00	10.6	7.6	3% Dry	10

MDD: Maximum Dry Density, FMC: Field Moisture Content, OMC: Optimum Moisture Content, CBR: California Bearing Ratio

The above results indicate that the field moisture content is generally dry of OMC. Moisture conditioning may be required during pavement construction to bring the field moisture close to OMC.

Atterberg Limits

The samples were also tested to determine Atterberg limits in order to assess soil plasticity. The results are summarised below and detailed in the attached certificate.

Table 3 – Atterberg Limits Tests Results

Test Pit	Sample Depth (m)	Soil Description	W_L (%)	W_P (%)	I_P (%)	LS (%)
TP1	0.2 – 0.8	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	22	12	10	4.5
TP3	0.6 – 0.9	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	28	14	14	8.5
TP6	0.3 – 0.6	Fill : Silty Clayey Sand, fines to low plasticity, red-brown, some fine to medium gravel	23	13	10	4.0

W_L : Liquid Limit; W_P : Plastic Limit; I_P : Plasticity Index; LS : Linear Shrinkage

The above results generally indicate that the fines are of low plasticity.

Chemical Tests

Samples recovered from the test pits excavated at the site were tested to determine pH and Electrical Conductivity (EC), in order to assess soil aggressivity and salinity. The results are summarised below and detailed in the attached certificates.

Table 4 – Chemical Tests Results

Test Pit	Sample Depth (m)	pH	EC (µS/cm)
TP1	0.5-0.7	8.3	200
TP1	1.0-1.2	7.7	280
TP2	0.2-0.5	7.0	310
TP2	1.0-1.3	7.8	260
TP3	0.6-0.8	7.6	180
TP3	1.5-1.7	6.9	220
TP4	0.5-0.7	7.8	350
TP4	1.3-1.5	4.8	380
TP5	0.3-0.5	8.3	280
TP5	1.0-1.2	7.9	190
TP6	0.3-0.6	8.3	340
TP6	1.0-1.3	8.0	570
TP7	0.5-0.7	8.4	310
TP7	1.5-1.7	7.6	240
TP8	0.5-0.7	6.8	300
TP8	1.5-1.7	7.6	640
TP9	0.2-0.5	8.3	280
TP9	1.0-1.2	5.9	260
TP9	1.8-2.0	5.5	500
TP10	0.5-0.7	7.7	250
TP10	1.0-1.2	7.7	240
TP10	1.5-1.7	7.0	410

DISCUSSION AND RECOMMENDATIONS

Nature of Fill

Based on visual inspection of the material recovered from the test pits and the DCP test results, the fill encountered at the site was assessed as well compacted.

Excavation Conditions

We understand that the site will be developed by minor cut and fill operations. The ten test pits excavated at the site encountered fill comprising silty clay, silty sand and silty clayey sand to the terminated depths. It is expected that these materials could be easily removed using conventional earthmoving equipment such as excavators and dozers.

Selection of excavation equipment should be based on site access, strength of sub-surface materials and the likely impact of vibration to structures in the vicinity of the excavation. We anticipate that existing structures in the vicinity of the site can tolerate ground vibration of more than 10.0mm/s. This will have to be ascertained by a Structural Engineer after a dilapidation survey, if deemed necessary.

Groundwater/seepage was not encountered in any of the borehole locations. We do not anticipate significant groundwater inflow during excavation. Groundwater inflow during excavation, if any, could be adequately managed using a conventional pump and sump system. However, trafficability problems might arise locally during wet weather or if water is allowed to pond at the site. A layer of recycled gravel can be used to provide a good working platform.

Batter Slopes

Cut and fill slopes should be battered as recommended below.

Temporary condition	:	1V:1H
Permanent condition	:	1V:2.5H

The above batter slopes are recommended, providing:

- Cut and fill slopes are at sufficient distance from structures in the vicinity of the site.
- Adequate surface and sub-surface drainage is provided.
- Appropriate erosion protection in the form of vegetation is provided.

Retaining Structures

If battered slopes steeper than those recommended above are required then excavation faces would need to be retained by engineered retaining structures. Appropriate retaining structures for the proposed development would include gravity wall etc.

Retaining structures can be designed for the following recommended earth pressure parameters:
Coefficient of active pressure, K_a : 0.3
Coefficient of passive pressure, K_p : 3.0
Soil Unit weight, γ : 19 kN/m^3

Footings

We expect that the proposed structures will be supported either on shallow footings (pad or strip) or deep footings (bored piers). Shallow footings founded on well compacted fill at or below 0.5m depth can be designed for an allowable end bearing pressure of 125kPa. Deep footings founded at least 2.5m below the ground level on well compacted or natural soils (stiff/dense) can be designed for an allowable end bearing pressure of 450kPa and shaft adhesion of 15kPa.

It is important that all footings are inspected and tested as deemed necessary by an experienced geotechnical engineer to ensure that footings are founded on appropriate material to achieve the design bearing pressure values. Under no circumstances should footings be founded on soft/loose, wet or undesirable materials. If such materials are encountered then they should be removed to firm material and replaced with controlled fill or mass concrete.

Floor Slabs

Floor slabs for the proposed structures could either be supported on ground or suspended on footings. Ground floor supported slabs can be designed for a modulus of subgrade reaction of 20kPa/mm. Considering that floor slabs may be subjected to traffic loading (fork lifts etc.) it is recommended that 150mm of granular sub-base is provided.

Pavement Design

We understand that rigid concrete pavement will be constructed for the proposed internal access road and parking spaces.

Based on the test pits excavated at the site we expect that pavement subgrade will consist of fill material comprising silty clay, silty sand or silty clayey sand. CBR tests conducted on the samples recovered from the site showed CBR values of 5%, 10% and 20%. Considering that variations in subgrade conditions are likely to be encountered across the site we recommend that a design CBR of 5% is adopted for determining pavement thickness.

No information regarding the design traffic loading was available. For the purposes of pavement thickness design we have assumed a design traffic loading of $3x10^5$ Heavy Vehicle Axle Groups (HVAG).

The pavement design is based on the Austroads publication "Guide to Pavement Technology, Part 2: "Pavement Structural Design", (2010). Based on the above design CBR and traffic loading values, we recommend the following pavement composition.

Table 5 – Recommended Pavement

Road No / Name	Design Traffic Loading (HVAG)	Design CBR (%)	Concrete Base (m)	Sub-base (mm)	Total (mm)
Internal Access Road and Parking Spaces	$3x10^5$	5	170	150	340

The following are assumed in the design of the above recommended pavement:

- Compressive strength of concrete base : 32MPa
- Sub-base material : Granular (crushed rock)
- Shrinkage reinforcement and dowels shall be provided as per structural engineers design.

The pavement depths are only valid if the subgrade and pavement materials are compacted to the following Minimum Dry Density Ratios (AS1289 5.4.1) as per Penrith City Council Specifications.

Sub-base	95% Modified
Subgrade	100% Standard

The pavement design assumes provision of adequate surface and sub-surface drainage of the pavement and adjacent areas. It is recommended that a sub-surface drainage system is installed, as directed by Council Engineers.

Subgrade Preparation and Placement of Controlled Fill

We recommend the following procedures for subgrade preparation and placement of controlled fill:

- Strip existing topsoil (if present) and stockpile for possible future use in landscaping.
- In areas where grade raise fill will be provided the exposed material after removal of topsoil shall be proof rolled (using an 8 to 10 tonnes roller) to detect potentially weak spots (ground heave). Excavate areas of localised heaving to depth of about 300mm and replace with granular material or low plasticity clay and compact as recommended below.
- Repeat proof rolling of soft spots backfilled with granular material or low plasticity clay. If the backfilled area shows movement during proof rolling, this office should be contacted for further recommendations.
- Place suitable fill materials on proof rolled surface in horizontal layers of 250mm to 300mm loose thickness (depending on the size of equipment) and compact to achieve a minimum density ratio of at least 98% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). Suitable fill materials may comprise granular or low plasticity clay. The top 300mm of the fill forming pavement subgrade shall be compacted to a minimum density ratio of at least 100% Standard, at moisture content within 2% of Optimum Moisture Content (OMC).
- In cut areas the top 300mm of the pavement subgrade shall be scarified and compacted to a minimum density ratio of at least 100% Standard, at moisture content within 2% of Optimum Moisture Content (OMC).
- Fill placement should be supervised to ensure that material quality, layer thickness, testing frequency and compaction criteria conform to the specifications. We recommend "Level 1" supervision, in accordance with AS3798-2007.

Salinity and Aggressivity Assessment

Salinity Assessment

Electrical Conductivity (EC) testing was carried out to assess soil salinity. The Department of Land and Water Conservation (DLWC) publication (Reference 1) defines various classes of saline soils, as follows.

Classification	EC_e (dS/m)
Non-saline	<2
Slightly saline	2 – 4
Moderately saline	4 – 8
Very saline	8 – 16
Highly saline	>16

Where EC_e is corrected electrical conductivity and is obtained by multiplying the laboratory obtained EC value with a multiplication factor (MF). This factor generally ranges from 6 to 17 and is based on the texture of the soil sample. For this investigation, multiplication factors of 8 and 10, considering that the soils at the site are generally silty clay, silty clayey sand and silty sand are used. Test results and salinity assessment are shown below in Table 6.

Table 6 – Salinity Assessment

Test Pit	Sample Depth (m)	EC (µS/cm)	MF	EC_e (dS/m)	Assessment
TP1	0.5-0.7	200	10	2.0	Slightly saline
TP1	1.0-1.2	280	8	2.2	Slightly saline
TP2	0.2-0.5	310	8	2.5	Slightly saline
TP2	1.0-1.3	260	8	2.1	Slightly saline
TP3	0.6-0.8	180	10	1.8	Non-saline
TP3	1.5-1.7	220	10	2.2	Slightly saline
TP4	0.5-0.7	350	8	2.8	Slightly saline
TP4	1.3-1.5	380	8	3.0	Slightly saline
TP5	0.3-0.5	280	8	2.2	Slightly saline
TP5	1.0-1.2	190	8	1.5	Non-saline
TP6	0.3-0.6	340	10	3.4	Slightly saline
TP6	1.0-1.3	570	8	4.6	Moderately saline
TP7	0.5-0.7	310	8	2.5	Slightly saline
TP7	1.5-1.7	240	8	1.9	Non-saline
TP8	0.5-0.7	300	8	2.4	Slightly saline
TP8	1.5-1.7	640	8	5.1	Moderately saline
TP9	0.2-0.5	280	8	2.2	Slightly saline
TP9	1.0-1.2	260	8	2.1	Slightly saline
TP9	1.8-2.0	500	8	4.0	Moderately saline
TP10	0.5-0.7	250	8	2.0	Slightly saline
TP10	1.0-1.2	240	8	1.9	Non-saline
TP10	1.5-1.7	410	8	3.3	Slightly saline

Majority of the samples showed non to slightly saline conditions. A few samples indicated moderately saline conditions. Based on the above results the soils at the site are generally assessed as non to slightly saline.

Aggressivity Assessment

Based on the pH results (Table 4) and as per Australian Standard AS2159-2009 “Piling-Design & installation”, soils at the site are classified as below:

Table 7 – Aggressivity Assessment

Test Pit	Sample Depth (m)	pH	Aggressivity Assessment
TP1	0.5-0.7	8.3	Non-aggressive
TP1	1.0-1.2	7.7	Non-aggressive
TP2	0.2-0.5	7.0	Non-aggressive
TP2	1.0-1.3	7.8	Non-aggressive
TP3	0.6-0.8	7.6	Non-aggressive
TP3	1.5-1.7	6.9	Non-aggressive

Test Pit	Sample Depth (m)	pH	Aggressivity Assessment
TP4	0.5-0.7	7.8	Non-aggressive
TP4	1.3-1.5	4.8	Mildly Aggressive
TP5	0.3-0.5	8.3	Non-aggressive
TP5	1.0-1.2	7.9	Non-aggressive
TP6	0.3-0.6	8.3	Non-aggressive
TP6	1.0-1.3	8.0	Non-aggressive
TP7	0.5-0.7	8.4	Non-aggressive
TP7	1.5-1.7	7.6	Non-aggressive
TP8	0.5-0.7	6.8	Non-aggressive
TP8	1.5-1.7	7.6	Non-aggressive
TP9	0.2-0.5	8.3	Non-aggressive
TP9	1.0-1.2	5.9	Non-aggressive
TP9	1.8-2.0	5.5	Non-aggressive
TP10	0.5-0.7	7.7	Non-aggressive
TP10	1.0-1.2	7.7	Non-aggressive
TP10	1.5-1.7	7.0	Non-aggressive

The above results indicate that the soils at the site are generally non-aggressive. Based on the results we recommend that the minimum concrete strength (f_c') shall be 32MPa and concrete cover shall be 45mm. Concrete cover can be reduced to 30mm where damp proofing is provided.

General

As the recommendations presented in this report are based on information from 10 test pits and site observation; actual sub-surface conditions across the site might differ from those expected (interpreted). If such differences are encountered during construction, we recommend that this office is contacted for further advice. This can also occur with groundwater conditions, especially after climatic changes.

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

Yours faithfully
GEOTECHNIQUE PTY LTD

ZIAUDDIN AHMED
Senior Associate

Attached
Drawing No 14577/1-AA1 Test Pit Locations Plan
Engineering Borehole Logs, Legends & Explanatory Notes
Laboratory CBR & Atterberg Limits Tests Results
Chemical Tests Results

References

1) Lillicrap, A and McGhie, S., Site Investigation for Urban Salinity, Department of Land and Water Conservation, 2002.

LEGEND

■ Test Pit

GEOTECHNIQUE® PTY LTD

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NOTES

1. Site features are indicative and are not to scale.
2. This drawing has been produced using a base plan provided by others to which additional information e.g test pits, borehole locations or notes have been added. Some or all of the plan may not be relevant at the time of producing this drawing

Presida Constructions Pty Ltd
Proposed Industrial Development
Lot 14 in DP 286568
7 Renshaw Street, Cranebrook

Test Pit Locations

Drawing No: 14577/1-AA1
Job No: 14577/1
Drawn By: MH
Date: 10 December 2019
Checked By: MT

File No: 14577-1
Layers: 0, AA1

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP1
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅27.5
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry					0			FILL: Silty Clay, low plasticity, with shale fragments, and grass roots				Well Compacted
			DB/DS		0.5			FILL: Silty Clayey Sand, fine to coarse grained, red brown, with gravels, fines of low plasticity				
			DS		1			FILL: Silty Clay, low plasticity, grey, with shale fragments, and gravels				
					1.5							
					2							
					2.5			Test Pit No 1 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook
Job No : 14577/1
Pit No : TP2
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅27.4
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS DS	CONE 20 22 R	0 0.5 1 1.5 2 2.5 3 3.5 4 4.5			FILL: Silty Clay, low plasticity, brown red, with cobbles and gravels FILL: Silty Clay, low plasticity, brown, dark brown, with shale fragments FILL: Silty Clay, medium plasticity, brown Test Pit No 2 terminated at 2.5m				Well Compacted

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP3
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.5
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry					0			FILL: Silty Clay, low plasticity, grey, with shale fragments				Well Compacted
			DB/DS		0.5			FILL: Silty Clayey Sand, fine to medium grained, red-brown, with gravels and boulders, fines of low plasticity				
			DS		1.5			FILL: Silty Clayeg Sand, fine to medium grained, yellow brown with gravels				
					2.5			Test Pit No 3 terminated at 2.5m				

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP4
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.7
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS		0			FILL: Silty Clay, low plasticity, brown, with gravels/cobbles, and grass roots				Well Compacted
			DS		0.5							
					1			FILL: Silty Clay, low to medium plasticity, brown, yellow				
					1.5							
					2							
					2.5			Test Pit No 4 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP5
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.3
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS		0			FILL: Silty Clay, low plasticity, brown, with grass roots, and shale fragments				Well Compacted
			DS		0.5			FILL: Silty Clay, low plasticity, brown, with gravels and cobbles				
					1							
					1.5			Test Pit No 5 terminated at 1.5m due to refusal on gravels/cobbles				
					2							
					2.5							
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook
Job No : 14577/1
Pit No : TP6
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.3
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DB/DS	COVE 8, 12, 12, 8, 6, 12	0			FILL : Silty Sand, fine to medium grained, red-brown, with gravels, fines of low plasticity				Well Compacted
					0.5			FILL : Silty Clayey Sand, fine to medium grained, red-brown, with gravels, fines of low plasticity				
			DS	22, 24, R	1			FILL: Silty Clay, low plasticity, brown, with gravels/cobbles				
					1.5							
					2			Test Pit No 6 terminated at 2.0 due to refusal on gravels/cobbles				
					2.5							
					3							
					3.5							
					4							
					4.5							

GEOTECHNIQUE
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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook
Job No : 14577/1
Pit No : TP7
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.2
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				CONE 7, 8, 12, 11, 11, 7, 12, 22, 20, 21, R	0			FILL: Silty Clay, low plasticity, brown, with shale fragments, gravels, and grass roots				Well Compacted
			DS		0.5							
					1			FILL: Silty Clay, low plasticity, brown with gravels				
			DS		1.5							
					2							
					2.5			Test Pit No 7 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook
Job No : 14577/1
Pit No : TP8
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅26.0
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS DS	CONE 12, 20, 21, 10, 12, 11, 20	0 0.5 1 1.5 2 2.5 3 3.5 4 4.5			FILL: Silty Clay, low plasticity, grey brown, with shale fragments FILL: Silty Clay, medium plasticity, grey Test Pit No 8 terminated at 2.5m				Well Compacted

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP9
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅25.6
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS		0			FILL: Silty Clay, low plasticity, brown, with gravel, shale fragments, and grass roots				
			DS		0.5			FILL: Silty Clay, low plasticity, brown, with ironstone gravels				
			DS		1							
					1.5			FILL: Silty Clay, medium plasticity, grey				
					2							
					2.5			Test Pit No 9 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Presida Constructions Pty Ltd
Project : Proposed Industrial Development
Location : Lot 14 in DP286568, 7 Renshaw Street, Cranebrook

Job No : 14577/1
Pit No : TP10
Date : 09/12/2019
Logged/Checked by: MT

Equipment type and model: Yanmar Excavator
R.L. surface : ≅25.6
Excavation dimensions : 3.0 **m long** 0.6 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS		0			FILL: Silty Clay, low plasticity, brown, with gravels, shale fragments, and grass roots				Well Compacted
			DS		0.5			FILL: Silty Clay, low plasticity, brown, with ironstone				
			DS		1							
					1.5			FILL: Silty Clay, medium plasticity, grey				
					2							
					2.5			Test Pit No 10 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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KEY TO SYMBOLS

Symbol Description

Strata symbols

Fill

Notes:

1. **Exploratory borings were drilled on 09/12/2019 using a 4-inch diameter continuous flight power auger.**

2. **No free water was encountered at the time of drilling or when re-checked the following day.**

3. **Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.**

4. **These logs are subject to the limitations, conclusions, and recommendations in this report.**

5. **Results of tests conducted on samples recovered are reported on the logs.**

Log Symbols & Abbreviations (Non-cored Borehole Log)

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

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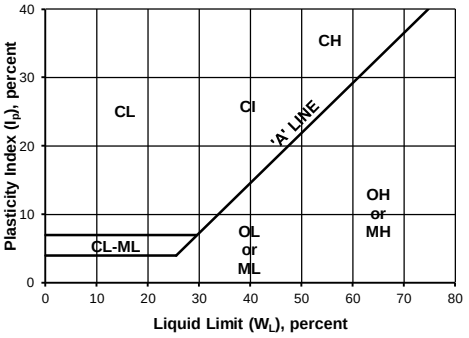
AS1726 – Unified Soil Classification System

Major Divisions		Particle size (mm)	Group Symbol	Typical Names	Field Identifications Sand and Gravels			Laboratory classification				
								% (2) < 0.075mm	Plasticity of Fine Fraction	$C_u = D_{60}/D_{10}$	$C_c = (D_{30})^2/(D_{10}D_{60})$	Notes
COARSE GRAINED SOILS (more than half of material less 63mm is larger than 0.075mm)	BOULDERS	200										
	COBBLES	63										
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	Coarse 20	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength			0-5	-	>4	between 1 and 3	1. Identify lines by the method given for fine grained soils
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength			0-5	-	Fails to comply with above		
		Medium 6	GM	Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength			12-50	Below 'A' line or I_p<4	-	-	2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.075mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols e.g. SP-SM, GW-GC
		Fine 2.36	GC	Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength			12-50	Above 'A' line or I_p>7	-	-	
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	Coarse 0.6	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength			0-5	-	>6	between 1 and 3	
		Medium 0.2	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength			0-5	-	Fails to comply with above		
		Fine 0.075	SM	Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength			12-50	Below 'A' line or I_p<4	-	-	
			SC	Clayey sand, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength			12-50	Above 'A' line of I_p>7	-	-	
FINE GRAINED SOILS (more than half of material less than 63mm is smaller than 0.075mm)	SILTS & CLAYS (liquid limit < 50%)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	**Dry Strength**	**Dilatancy**	**Toughness**					
					None to low	Quick to slow	None					
			CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium					
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low					
	SILTS & CLAYS (liquid limit > 50%)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Low to medium	Slow to none	Low to medium					
			CH	Inorganic clays of medium to high plasticity, fat clays	High to very high	None	High					
			OH	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Low to medium					
	HIGHLY ORGANIC SOILS		Pt	Peat and highly organic soils	Identified by colour, odour, spongy feel and generally by fibrous texture			Effervesces with H_2O_2				

Use the gradation of material passing 63mm for classification of fractions according to the criteria given in 'Major Divisions'

More than 50% passing 0.075mm

Plasticity of Fine Fraction	Plasticity Index (I_p), percent
Below 'A' line	CL-ML
Above 'A' line	CL
Below 'A' line	CI
Below 'A' line	OL or ML
Above 'A' line	CH
Below 'A' line	OH or MH



Log Symbols & Abbreviations (Cored Borehole Log)

Log Column	Symbol	Description
Core Size		Nominal Core Size (mm)
	NQ	47
	NMLC	52
	HQ	63
Water Loss		Complete water loss Partial water loss
Weathering	FR	Fresh — Rock shows no sign of decomposition or staining
	SW	Slightly Weathered — Rock is slightly discoloured but shows little or no change of strength from fresh rock
	DW	Distinctly Weathered — Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased by deposition of weathering products in pores
	EW	Extremely Weathered — Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrate or can be remoulded, in water
	RS	Residual Soil — Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but soil has not been significantly transported
Strength		Term — Point Load Strength Index (I_{s50}, MPa)
	EL	Extremely Low — ≤0.03
	VL	Very Low — >0.03 ≤0.1
	L	Low — >0.1 ≤0.3
	M	Medium — >0.3 ≤1
	H	High — >1 ≤3
	VH	Very High — >3 ≤10
	EH	Extremely High — >10
Defect Spacing		Description — Spacing (mm)
		Extremely closely spaced — <20
		Very closely spaced — 20 to 60
		Closely spaced — 60 to 200
		Medium spaced — 200 to 600
		Widely spaced — 600 to 2000
		Very widely spaced — 2000 to 6000
		Extremely widely spaced — >6000
Defect Description		
Type	Bp	Bedding parting
	Fp	Foliation parting
	Jo	Joint
	Sh	Sheared zone
	Cs	Crushed seam
	Ds	Decomposed seam
	Is	Infilled seam
Macro-surface geometry	St	Stepped
	Cu	Curved
	Un	Undulating
	Ir	Irregular
	Pl	Planar
Micro-surface geometry	Ro	Rough
	Sm	Smooth
	Sl	Slickensided
Coating or infilling	cn	clean
	sn	stained
	vn	veneer
	cg	coating

AS1726 – Identification of Sedimentary Rocks for Engineering Purposes

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

AS1726 – Identification of Metamorphic and Igneous Rocks for Engineering Purposes

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

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PRESIDA CONSTRUCTIONS PTY LTD
SUITE 410, LEVEL 4, 14 LEXINGTON DRIVE
BELLA VISTA NSW 2153

GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT, LOT 14 IN DP 286568, 7 RENSHAW STREET, CRANEBROOK

CALIFORNIA BEARING RATIO TEST REPORT

CBR Test Procedure	Laboratory Compaction Method	Sampling Method	Date of Test
AS1289 6.1.1	AS1289 5.1.1	AS1289 1.2.1 Clause 6.5.4	16/12/2019
Job No: 14577/1	Tested By: BG	Checked By: AK	Lab Penrith

Laboratory Number		14577/1-1	14577/1-2	14577/1-3	
Drawing No		Test Pit 1 14577/1-AA1	Test Pit 3 14577/1-AA1	Test Pit 6 14577/1-AA1	
Sample No		1	2	3	
Depth (m)		0.2 - 0.8	0.6 - 0.9	0.3 - 0.6	
Date Sampled		09/12/2019	09/12/2019	09/12/2019	
Sample Description		FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel	FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel	FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel	
Maximum Dry Density	t/m3	2.07	1.94	2.00	
Optimum Moisture Content	%	9.4	11.7	10.6	
Field Moisture Content	%	7.1	5.5	7.6	
% Retained 19mm		5.0	6.1	7.4	
Excluded (Yes / No / Not Applicable)		Yes	Yes	Yes	

CBR TEST RESULTS

Dry Density t/m^3	Before soaking	2.02	1.91	2.00	
	After soaking	2.02	1.88	2.00	
Density Ratio %	Before soaking	97.5	98.5	100	
Moisture Content %	Before soaking	9.3	11.2	10.5	
	After soaking	10.6	12.7	11.9	
Moisture Ratio %	Before soaking	99	95.5	99	
Number of Days Soaked		4	4	4	
Surcharge	kg	9	9	9	
Moisture Content after test %	Top 30mm	11.6	13.1	11.5	
	Whole Sample	10.5	12.6	11.8	
Swell after soaking	%	Nil	1.5	Nil	
Penetration	mm	5.0	5.0	5.0	
CBR VALUE	%	**20**	**5**	**10**	

Form No R003 Version 04 06/13 - issued by ER

A Kench 18/12/2019
Approved Signatory

NATA
Nata Accreditation Number 2734
Corporate Site Number 2727

Accredited for compliance with ISO/IEC 17025 - Testing.

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GEOTECH TESTING PTY LTD ®
ABN 71 076 676 321

PRESIDA CONSTRUCTIONS PTY LTD
SUITE 410, LEVEL 4, 14 LEXINGTON DRIVE
BELLA VISTA NSW 2153

GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT, LOT 14 IN DP 286568, 7 RENSHAW STREET, CRANEBROOK

TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

Job No:	14577/1	Tested By:	BC & BG
Laboratory	Penrith	Checked By:	AK
Date Tested	16/12/2019		

Sample Identification	Test Pit 1	Test Pit 3	Test Pit 6
Laboratory Number	14577/1-1	14577/1-2	14577/1-3
Depth (m)	0.2 - 0.8	0.6 - 0.9	0.3 - 0.6
Test Description			
Liquid Limit (W_L)	22%	28%	23%
Plastic Limit (W_P)	12%	14%	13%
Plastic Index (I_P)	10%	14%	10%
Linear Shrinkage (LS)	4.5%	8.5%	4.0%
Mould Length (mm)	127	127	125
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel	FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel	FILL: Clayey Sand, fines of low plasticity, red-brown, some fine to medium gravel

Form No R004 Version 12 - 06/13 - Issued by ER

A Kench 18/12/2019
Approved Signatory

NATA
Accredited for compliance with ISO/IEC 17025 - Testing.

Nata Accreditation Number 2734
Corporate Site Number 2727

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Ziauddin Ahmed
Client	Geotechnique
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Facsimile	02 4722 6161
Email	ziauddin@geotech.com.au
Project	**14577/1 7 Renshaw St Cranebrook**
Order Number	(Not specified)
Samples	22

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE201068 R0**
Date Received	10/12/2019
Date Reported	17/12/2019

COMMENTS

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

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Kamrul AHSAN
Senior Chemist

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 16/12/2019

PARAMETER	UOM	LOR	TP2 SOIL 0.2-0.5 9/12/2019 SE201068.003	TP3 SOIL 1.5-1.7 9/12/2019 SE201068.006	TP5 SOIL 1.0-1.2 9/12/2019 SE201068.010	TP6 SOIL 1.0-1.3 9/12/2019 SE201068.012	TP8 SOIL 1.5-1.7 9/12/2019 SE201068.016
Sulfate	mg/kg	5	270	190	100	610	260

PARAMETER	UOM	LOR	TP10 SOIL 1.5-1.7 9/12/2019 SE201068.022
Sulfate	mg/kg	5	81

pH in soil (1:5) [AN101] Tested: 17/12/2019

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.7 9/12/2019 SE201068.001	TP1 SOIL 1.0-1.2 9/12/2019 SE201068.002	TP2 SOIL 0.2-0.5 9/12/2019 SE201068.003	TP2 SOIL 1.0-1.3 9/12/2019 SE201068.004	TP3 SOIL 0.6-0.8 9/12/2019 SE201068.005
pH	pH Units	0.1	8.3	7.7	7.0	7.8	7.6

PARAMETER	UOM	LOR	TP3 SOIL 1.5-1.7 9/12/2019 SE201068.006	TP4 SOIL 0.5-0.7 9/12/2019 SE201068.007	TP4 SOIL 1.3-1.5 9/12/2019 SE201068.008	TP5 SOIL 0.3-0.5 9/12/2019 SE201068.009	TP5 SOIL 1.0-1.2 9/12/2019 SE201068.010
pH	pH Units	0.1	6.9	7.8	4.8	8.3	7.9

PARAMETER	UOM	LOR	TP6 SOIL 0.3-0.6 9/12/2019 SE201068.011	TP6 SOIL 1.0-1.3 9/12/2019 SE201068.012	TP7 SOIL 0.5-0.7 9/12/2019 SE201068.013	TP7 SOIL 1.5-1.7 9/12/2019 SE201068.014	TP8 SOIL 0.5-0.7 9/12/2019 SE201068.015
pH	pH Units	0.1	8.3	8.0	8.4	7.6	6.8

PARAMETER	UOM	LOR	TP8 SOIL 1.5-1.7 9/12/2019 SE201068.016	TP9 SOIL 0.2-0.5 9/12/2019 SE201068.017	TP9 SOIL 1.0-1.2 9/12/2019 SE201068.018	TP9 SOIL 1.8-2.0 9/12/2019 SE201068.019	TP10 SOIL 0.5-0.7 9/12/2019 SE201068.020
pH	pH Units	0.1	7.6	8.3	5.9	5.5	7.7

PARAMETER	UOM	LOR	TP10 SOIL 1.0-1.2 9/12/2019 SE201068.021	TP10 SOIL 1.5-1.7 9/12/2019 SE201068.022
pH	pH Units	0.1	7.7	7.0

Conductivity and TDS by Calculation - Soil [AN106] Tested: 17/12/2019

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.7 9/12/2019 SE201068.001	TP1 SOIL 1.0-1.2 9/12/2019 SE201068.002	TP2 SOIL 0.2-0.5 9/12/2019 SE201068.003	TP2 SOIL 1.0-1.3 9/12/2019 SE201068.004	TP3 SOIL 0.6-0.8 9/12/2019 SE201068.005
Conductivity of Extract (1:5 as received)	µS/cm	1	180	250	290	240	160
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	200	280	310	260	180

PARAMETER	UOM	LOR	TP3 SOIL 1.5-1.7 9/12/2019 SE201068.006	TP4 SOIL 0.5-0.7 9/12/2019 SE201068.007	TP4 SOIL 1.3-1.5 9/12/2019 SE201068.008	TP5 SOIL 0.3-0.5 9/12/2019 SE201068.009	TP5 SOIL 1.0-1.2 9/12/2019 SE201068.010
Conductivity of Extract (1:5 as received)	µS/cm	1	190	330	320	260	180
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	220	350	380	280	190

PARAMETER	UOM	LOR	TP6 SOIL 0.3-0.6 9/12/2019 SE201068.011	TP6 SOIL 1.0-1.3 9/12/2019 SE201068.012	TP7 SOIL 0.5-0.7 9/12/2019 SE201068.013	TP7 SOIL 1.5-1.7 9/12/2019 SE201068.014	TP8 SOIL 0.5-0.7 9/12/2019 SE201068.015
Conductivity of Extract (1:5 as received)	µS/cm	1	310	530	280	210	280
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	340	570	310	240	300

PARAMETER	UOM	LOR	TP8 SOIL 1.5-1.7 9/12/2019 SE201068.016	TP9 SOIL 0.2-0.5 9/12/2019 SE201068.017	TP9 SOIL 1.0-1.2 9/12/2019 SE201068.018	TP9 SOIL 1.8-2.0 9/12/2019 SE201068.019	TP10 SOIL 0.5-0.7 9/12/2019 SE201068.020
Conductivity of Extract (1:5 as received)	µS/cm	1	540	250	230	400	230
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	640	280	260	500	250

PARAMETER	UOM	LOR	TP10 SOIL 1.0-1.2 9/12/2019 SE201068.021	TP10 SOIL 1.5-1.7 9/12/2019 SE201068.022
Conductivity of Extract (1:5 as received)	µS/cm	1	220	330
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	240	410

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 16/12/2019

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.7 9/12/2019 SE201068.001	TP4 SOIL 1.3-1.5 9/12/2019 SE201068.008	TP7 SOIL 1.5-1.7 9/12/2019 SE201068.014	TP9 SOIL 1.8-2.0 9/12/2019 SE201068.019
Exchangeable Sodium, Na	mg/kg	2	**73**	**310**	**410**	**1100**
Exchangeable Sodium, Na	meq/100g	0.01	**0.32**	**1.3**	**1.8**	**4.9**
Exchangeable Sodium Percentage*	%	0.1	**4.1**	**32.1**	**17.7**	**26.1**

Moisture Content [AN002] Tested: 16/12/2019

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.7 9/12/2019 SE201068.001	TP1 SOIL 1.0-1.2 9/12/2019 SE201068.002	TP2 SOIL 0.2-0.5 9/12/2019 SE201068.003	TP2 SOIL 1.0-1.3 9/12/2019 SE201068.004	TP3 SOIL 0.6-0.8 9/12/2019 SE201068.005
% Moisture	%w/w	1	7.1	11.7	7.6	7.7	11.4

PARAMETER	UOM	LOR	TP3 SOIL 1.5-1.7 9/12/2019 SE201068.006	TP4 SOIL 0.5-0.7 9/12/2019 SE201068.007	TP4 SOIL 1.3-1.5 9/12/2019 SE201068.008	TP5 SOIL 0.3-0.5 9/12/2019 SE201068.009	TP5 SOIL 1.0-1.2 9/12/2019 SE201068.010
% Moisture	%w/w	1	14.4	6.4	17.2	7.9	6.9

PARAMETER	UOM	LOR	TP6 SOIL 0.3-0.6 9/12/2019 SE201068.011	TP6 SOIL 1.0-1.3 9/12/2019 SE201068.012	TP7 SOIL 0.5-0.7 9/12/2019 SE201068.013	TP7 SOIL 1.5-1.7 9/12/2019 SE201068.014	TP8 SOIL 0.5-0.7 9/12/2019 SE201068.015
% Moisture	%w/w	1	7.6	7.9	9.0	10.7	5.3

PARAMETER	UOM	LOR	TP8 SOIL 1.5-1.7 9/12/2019 SE201068.016	TP9 SOIL 0.2-0.5 9/12/2019 SE201068.017	TP9 SOIL 1.0-1.2 9/12/2019 SE201068.018	TP9 SOIL 1.8-2.0 9/12/2019 SE201068.019	TP10 SOIL 0.5-0.7 9/12/2019 SE201068.020
% Moisture	%w/w	1	16.3	10.1	13.5	19.4	9.6

PARAMETER	UOM	LOR	TP10 SOIL 1.0-1.2 9/12/2019 SE201068.021	TP10 SOIL 1.5-1.7 9/12/2019 SE201068.022
% Moisture	%w/w	1	10.2	18.3

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

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

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

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

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

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

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

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

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

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

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STATEMENT OF QA/QC PERFORMANCE

SE201068 R0

CLIENT DETAILS

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Facsimile	02 4722 6161
Email	ziauddin@geotech.com.au
Project	**14577/1 7 Renshaw St Cranebrook**
Order Number	(Not specified)
Samples	22

LABORATORY DETAILS

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Email	au.environmental.sydney@sgs.com
SGS Reference	**SE201068 R0**
Date Received	10 Dec 2019
Date Reported	17 Dec 2019

COMMENTS

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

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

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

Extraction Date	Conductivity and TDS by Calculation - Soil	22 items
	pH in soil (1:5)	22 items
Analysis Date	Conductivity and TDS by Calculation - Soil	22 items

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	None
Samples received in correct containers	Yes	Sample counts by matrix	22 Soil
Date documentation received	09/12/2019@03:56p	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	18.7°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

HOLDING TIME SUMMARY

SE201068 R0

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

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

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Conductivity and TDS by Calculation - Soil

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE201068.001	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP1	SE201068.002	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP2	SE201068.003	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP2	SE201068.004	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP3	SE201068.005	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP3	SE201068.006	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP4	SE201068.007	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP4	SE201068.008	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP5	SE201068.009	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP5	SE201068.010	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP6	SE201068.011	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP6	SE201068.012	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP7	SE201068.013	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP7	SE201068.014	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP8	SE201068.015	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP8	SE201068.016	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP9	SE201068.017	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP9	SE201068.018	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP9	SE201068.019	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP10	SE201068.020	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP10	SE201068.021	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†
TP10	SE201068.022	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	16 Dec 2019	17 Dec 2019†

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE201068.001	LB190092	09 Dec 2019	10 Dec 2019	06 Jan 2020	16 Dec 2019	06 Jan 2020	17 Dec 2019
TP4	SE201068.008	LB190092	09 Dec 2019	10 Dec 2019	06 Jan 2020	16 Dec 2019	06 Jan 2020	17 Dec 2019
TP7	SE201068.014	LB190092	09 Dec 2019	10 Dec 2019	06 Jan 2020	16 Dec 2019	06 Jan 2020	17 Dec 2019
TP9	SE201068.019	LB190092	09 Dec 2019	10 Dec 2019	06 Jan 2020	16 Dec 2019	06 Jan 2020	17 Dec 2019

Moisture Content

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE201068.001	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP1	SE201068.002	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP2	SE201068.003	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP2	SE201068.004	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP3	SE201068.005	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP3	SE201068.006	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP4	SE201068.007	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP4	SE201068.008	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP5	SE201068.009	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP5	SE201068.010	LB190044	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP6	SE201068.011	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP6	SE201068.012	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP7	SE201068.013	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP7	SE201068.014	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP8	SE201068.015	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP8	SE201068.016	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP9	SE201068.017	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP9	SE201068.018	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP9	SE201068.019	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP10	SE201068.020	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP10	SE201068.021	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019
TP10	SE201068.022	LB190045	09 Dec 2019	10 Dec 2019	23 Dec 2019	16 Dec 2019	21 Dec 2019	17 Dec 2019

pH in soil (1:5)

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE201068.001	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP1	SE201068.002	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP2	SE201068.003	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP2	SE201068.004	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019

HOLDING TIME SUMMARY

SE201068 R0

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

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

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

pH in soil (1:5) (continued)

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP3	SE201068.005	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP3	SE201068.006	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP4	SE201068.007	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP4	SE201068.008	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP5	SE201068.009	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP5	SE201068.010	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP6	SE201068.011	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP6	SE201068.012	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP7	SE201068.013	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP7	SE201068.014	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP8	SE201068.015	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP8	SE201068.016	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP9	SE201068.017	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP9	SE201068.018	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP9	SE201068.019	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP10	SE201068.020	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP10	SE201068.021	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019
TP10	SE201068.022	LB190149	09 Dec 2019	10 Dec 2019	16 Dec 2019	17 Dec 2019†	18 Dec 2019	17 Dec 2019

Soluble Anions (1:5) in Soil by Ion Chromatography

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP2	SE201068.003	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019
TP3	SE201068.006	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019
TP5	SE201068.010	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019
TP6	SE201068.012	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019
TP8	SE201068.016	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019
TP10	SE201068.022	LB190018	09 Dec 2019	10 Dec 2019	16 Dec 2019	16 Dec 2019	13 Jan 2020	17 Dec 2019

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

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

No surrogates were required for this job.

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

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

Conductivity and TDS by Calculation - Soil

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

Sample Number	Parameter	Units	LOR	Result
LB190149.001	Conductivity of Extract (1:5 as received)	µS/cm	1	<1
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	0.9

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB190092.001	Exchangeable Sodium, Na	mg/kg	2	0

Soluble Anions (1:5) in Soil by Ion Chromatography

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

Sample Number	Parameter	Units	LOR	Result
LB190018.001	Sulfate	mg/kg	5	<5.0

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

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

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

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

Conductivity and TDS by Calculation - Soil

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE201068.010	LB190149.014	Conductivity of Extract (1:5 as received)	µS/cm	1	180	190	31	4
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	190	01.418225709	31	4
SE201068.020	LB190149.025	Conductivity of Extract (1:5 as received)	µS/cm	1	230	230	31	0
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	250	51.963975155	31	0

Moisture Content

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE201068.004	LB190044.011	% Moisture	%w/w	1	7.7	8.3	42	8
SE201068.010	LB190044.018	% Moisture	%w/w	1	6.9	8.0	43	15
SE201068.020	LB190045.011	% Moisture	%w/w	1	9.6	10.1	40	5

pH in soil (1:5)

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE201068.010	LB190149.014	pH	pH Units	0.1	7.9	8.0	31	1
SE201068.020	LB190149.025	pH	pH Units	0.1	7.7	7.9	31	3

Soluble Anions (1:5) in Soil by Ion Chromatography

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE201068.010	LB190018.007	Sulfate	mg/kg	5	100	03.609535304	35	1

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

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

Conductivity and TDS by Calculation - Soil

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB190149.002	Conductivity of Extract (1:5 as received)	µS/cm	1	310	303	85 - 115	102
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	102

pH in soil (1:5)

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB190149.003	pH	pH Units	0.1	7.4	7.415	98 - 102	99

Soluble Anions (1:5) in Soil by Ion Chromatography

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB190018.002	Sulfate	mg/kg	5	98	100	70 - 130	98

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

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

No matrix spikes were required for this job.

MATRIX SPIKE DUPLICATES

SE201068 R0

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

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

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

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

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

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

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

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

E-MAILED 9/12/19 @ 3.56p

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

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

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

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

Sampling By: MT
Job No 14577/1
Project: Proposed Industrial Development
Project Manager: ZA
Location: 7 Renshaw St Cranebrook

Sampling details

Results required by:

	Location	Depth	Soil	Water	EC (1:5)	pH	Sulphate	ESP					Notes	Keep Sample
1	TP1	0.5-0.7	DSP		✓	✓		✓						✓
2	TP1	1.0-1.2	DSP		✓	✓								✓
3	TP2	0.2-0.5	DSP		✓	✓	✓							✓
4	TP2	1.0-1.3	DSP		✓	✓								✓
5	TP3	0.6-0.8	DSP		✓	✓								✓
6	TP3	1.5-1.7	DSP		✓	✓	✓							✓
7	TP4	0.5-0.7	DSP		✓	✓								✓
8	TP4	1.3-1.5	DSP		✓	✓		✓						✓
9	TP5	0.3-0.5	DSP		✓	✓								✓
10	TP5	1.0-1.2	DSP		✓	✓	✓							✓
11	TP6	0.3-0.6	DSP		✓	✓								✓
12	TP6	1.0-1.3	DSP		✓	✓	✓							✓
13	TP7	0.5-0.7	DSP		✓	✓								✓
14	TP7	1.5-1.7	DSP		✓	✓		✓						✓
15	TP8	0.5-0.7	DSP		✓	✓								✓
16	TP8	1.5-1.7	DSP		✓	✓	✓							✓
17	TP9	0.2-0.5	DSP		✓	✓								✓
18	TP9	1.0-1.2	DSP		✓	✓								✓
19	TP9	1.8-2.0	DSP		✓	✓		✓						✓
20	TP10	0.5-0.7	DSP		✓	✓								✓
21	TP10	1.0-1.2	DSP		✓	✓								✓
22	TP10	1.5-1.7	DSP		✓	✓	✓							✓

SE 201068

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	
Mrigesh Tamang		9/12/2019	Suba		10/12/19 @ 3:30

Legend:
WG
WP Form No 4.7F2-5 SGS

USG Undisturbed soil sample (glass j
DSG Disturbed soil sample (glass jar)

DSP Disturbed soil sample (small plastic bag)
✓ Test required

* Purge & Trap
# Geotechnique Screen

SAMPLE RECEIPT ADVICE

SE201068

CLIENT DETAILS

Contact	Ziauddin Ahmed
Client	Geotechnique
Address	P.O. Box 880 NSW 2751
Telephone	02 4722 2700
Facsimile	02 4722 6161
Email	ziauddin@geotech.com.au
Project	**14577/1 7 Renshaw St Cranebrook**
Order Number	(Not specified)
Samples	22

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Tue 10/12/2019
Report Due	Tue 17/12/2019
SGS Reference	**SE201068**

SUBMISSION DETAILS

This is to confirm that 22 samples were received on Tuesday 10/12/2019. Results are expected to be ready by COB Tuesday 17/12/2019. Please quote SGS reference SE201068 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	None
Samples received in correct containers	Yes	Sample counts by matrix	22 Soil
Date documentation received	09/12/2019@03:56pm	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	18.7°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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

COMMENTS

Sampling date was not provided. It is assumed to be as date samples were relinquished.

SAMPLE RECEIPT ADVICE

SE201068

CLIENT DETAILS

Client Geotechnique

Project 14577/1 7 Renshaw St Cranebrook

SUMMARY OF ANALYSIS

No.	Sample ID	Conductivity and TDS by Calculation - Soil	Exchangeable Cations and Cation Exchange Capacity	Moisture Content	pH in soil (1:5)	Soluble Anions (1:5) in Soil by Ion Chromatography
001	TP1 0.5-0.7	2	3	1	1	-
002	TP1 1.0-1.2	2	-	1	1	-
003	TP2 0.2-0.5	2	-	1	1	1
004	TP2 1.0-1.3	2	-	1	1	-
005	TP3 0.6-0.8	2	-	1	1	-
006	TP3 1.5-1.7	2	-	1	1	1
007	TP4 0.5-0.7	2	-	1	1	-
008	TP4 1.3-1.5	2	3	1	1	-
009	TP5 0.3-0.5	2	-	1	1	-
010	TP5 1.0-1.2	2	-	1	1	1
011	TP6 0.3-0.6	2	-	1	1	-
012	TP6 1.0-1.3	2	-	1	1	1
013	TP7 0.5-0.7	2	-	1	1	-
014	TP7 1.5-1.7	2	3	1	1	-
015	TP8 0.5-0.7	2	-	1	1	-
016	TP8 1.5-1.7	2	-	1	1	1
017	TP9 0.2-0.5	2	-	1	1	-
018	TP9 1.0-1.2	2	-	1	1	-
019	TP9 1.8-2.0	2	3	1	1	-
020	TP10 0.5-0.7	2	-	1	1	-
021	TP10 1.0-1.2	2	-	1	1	-
022	TP10 1.5-1.7	2	-	1	1	1

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