Appendix 08 Geotechnical Investigation

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Project Number #20651.000.001

Geotechnical Investigation - Factual and Interpretative Report

Bolivar, South Australia

Submitted to:
Renascor Resources Limited
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1 Introduction

1.1 Background

ENGEO Australia Pty Ltd (ENGEO) was engaged by Renascor Resources Limited (Renascor) to undertake desktop and intrusive geotechnical investigation - factual and interpretative reporting for their Battery Anode Materials (BAM) Project, which involves the development of an Uncoated, Purified Spherical Graphite (UPSG) processing facility, to supply the lithium -ion battery market.

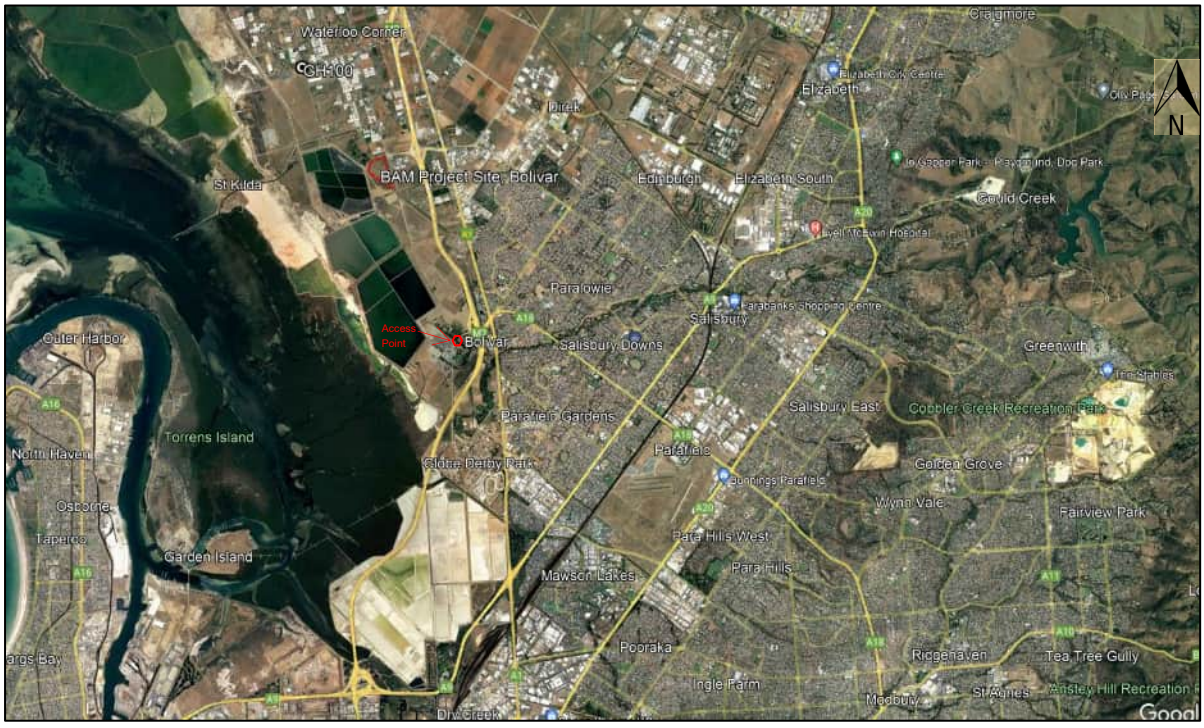
This work has been carried out in general accordance with the provided scope briefing document, (Specification / Scope: Geotechnical Investigation and Reporting, Reference: 12813 3517714:P:rs Revision B, dated June 2022), as prepared by GR Engineering Services (GRES), and with our signed agreement with Renascor, (Ref: P2022.001.446_01), dated 1 July 2022. The work reported presented herein represents the combined Site Investigation Factual Report (Section 2), and Geotechnical Interpretive Report (Section 3).

1.2 Project location details

The BAM Project, UPSG plant and associated infrastructure is proposed to be located at Robinson Rd, Bolivar, South Australia, herein referred to as 'the site', approximately 20 km north of Adelaide, (refer to Figure 1).

Access to the site is currently controlled by SA Water, who operate the adjacent Bolivar Waste-Water Treatment Plant, (WWTP). Site access for the investigative works was gained through the WWTP front gate located approximately 3.3 km south of the Project Site Area. The Site and access point are shown on Figure 1 below.

Figure 1: BAM Project Site Location



Source: Google Earth imagery, (2022)

1.3 Geotechnical Scope of Works (SOW)

Based on the information provided in the scope briefing document, the geotechnical scope of works (SOW) comprises two phases as follows:

- Phase 1 – Geotechnical site investigation and materials testing, including:
  - Desktop study, involving review of relevant and available reports, geological maps, information and datasets relevant to the geology, soil quality and embankment design(s) at the Project site.
  - Intrusive (subsurface) test pitting, borehole(s) and associated *in situ* and laboratory testing.
  - Preparation of a Geotechnical Factual Report including the outcomes of the site investigation and materials testing.
- Phase 2 – Geotechnical Evaluation and Interpretative Report, including:
  - Provision of geotechnical design parameters and recommendations for both shallow and deep foundations (as applicable), retaining structures, and bulk earthworks (BEW), including safe batter slopes, allowable bearing pressures and recommendations on use / reuse of on-site materials for construction.

Please note again, this report represents a combined factual and interpretive geotechnical report.

2 Phase 1: Desktop Study, Site Investigation and Factual Reporting

The provided scope briefing outlined the key areas of investigation and proposed the required geotechnical investigations to be undertaken for the infrastructure elements associated with each of those key areas. The various key areas of investigation the following:

- UPSG Processing Plant.
- Purification Area.
- Water Treatment Facilities.
- Associated Non-processing Infrastructure.
- Access Roads.
- Site Drainage Ponds.
- Electrical HV Switchyard.
- Available extractable site materials suitable for structural fill.

Preliminary proposed site investigation locations were provided in Appendix B of the scope briefing document.

Investigation methods, scale and indicative depths were provided in Section 3.4 of the scope briefing document.

In general, wherever possible ENGEO have undertaken investigative works in accordance with what was proposed within the scope briefing. The outcomes and findings of these investigations are presented in this Section 2 of the combined factual and interpretive geotechnical report.

2.1 Geotechnical Desktop Study

2.1.1 Published Geology

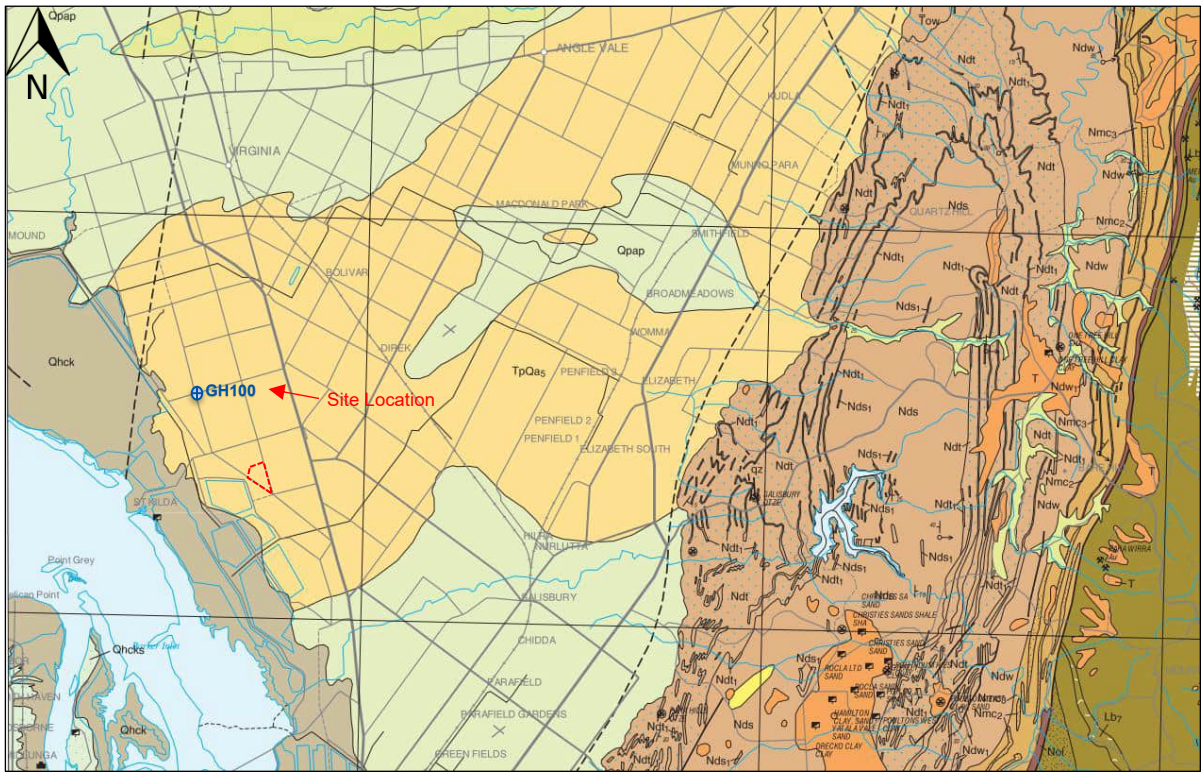
A review of the 1:100,000 Geology Map of Adelaide (Sheet 6628), 2012 published by the Department for Industry, Trade, Resources and Energy indicates that the site is underlain by Pliocene-Pleistocene Alluvial / Fluvial Unit 5 ($TpQa_5$): Hindmarsh Clay, Carisbrooke Sand, Ochre Cove Formation.

The Hindmarsh Clay is described in the Geoscience Australia Stratigraphic Units Database as, “Unconsolidated to semi-consolidated, mottled, mainly red-brown clay and sandy clay with granules and gravels; massive, unsorted alluvial-fan breccia”, (Sheard and Bowman).

The nearest mapped geological boundary is with the Holocene age St Kilda Formation (Qhck), which is located approximately 1.25 km west of the site, (proximal to the St Kilda Tramway Museum). The St Kilda Formation is described as, “Coastal marine sediment: Calcareous, fossiliferous sand and mud of intertidal sand flats, beaches and tidal marshes; organic, gypseous clay of supratidal flats.”

Figure 2 presents an extract from the published 1:100,00 scale geological map.

Figure 2: Extract from 1:1000k Geology Map of Adelaide (Sheet 6628)



Department for Industry, Trade, Resources and Energy, (2012)

2.1.2 Existing Engineering / Geological Boreholes

Review of the online mapping available via the Geoscience Australia Portal (GA Portal), (https://portal.ga.gov.au) indicates there is a relatively nearby borehole GH100, (located approximately 2.5 km northwest of the site), drilled to approximately 10m depth, for engineering purposes, (location indicated on above Figure 2).

The Department of Mines and Energy South Australia, '*Soils, Stratigraphy and Engineering Geology of Near Surface Materials of the Adelaide Plains',* Volumes 94-99 of Report Book 1996, provides a log that describes the subsurface profile encountered in borehole GH100. The GH100 borehole log is summarised in the following Table 1.

Table 1: Summary of Subsurface Profile at borehole GH100

Depth (m BGL)	Material (Generalised)	Geological Unit
0.0 to 0.30	Silty SAND / Loamy SAND, moderate brown	Undifferentiated Quaternary Sediments (Qa) / Red-brown Earth Soil (RB7), developed in estuarine deposits (EMS) of the St Kilda Formation (Qhck)
0.30 to 1.20	Sandy CLAY / Silty CLAY, low to medium plasticity, pale orange-yellow to moderate brown	
1.20 to 2.00	Clayey GRAVEL / Gravelly CLAY, rubbly calcreted clay, pale grey-brown	Glanville Formation (Qpcg)
2.00 to 3.80	Sandy CLAY / Silty CLAY, low to medium Plasticity, carbonate impregnated clays, nodular	
3.80 to 7.00	CLAY, medium to high plasticity, grey-brown to yellow-brown	Hindmarsh Clay Formation (TpQa5)
7.00 to 7.40	Clayey SAND / SAND, grey-brown and yellow-brown, water bearing	
7.00 to 9.80 (EOH)	CLAY, medium to high plasticity, grey-brown and yellow-brown	

Note: Groundwater was encountered at 4.3 m BGL (below ground level) in GH100, and the sandy lens encountered in the Hindmarsh Clay Formation between 7.00 m and 7.40 m BGL was water bearing.

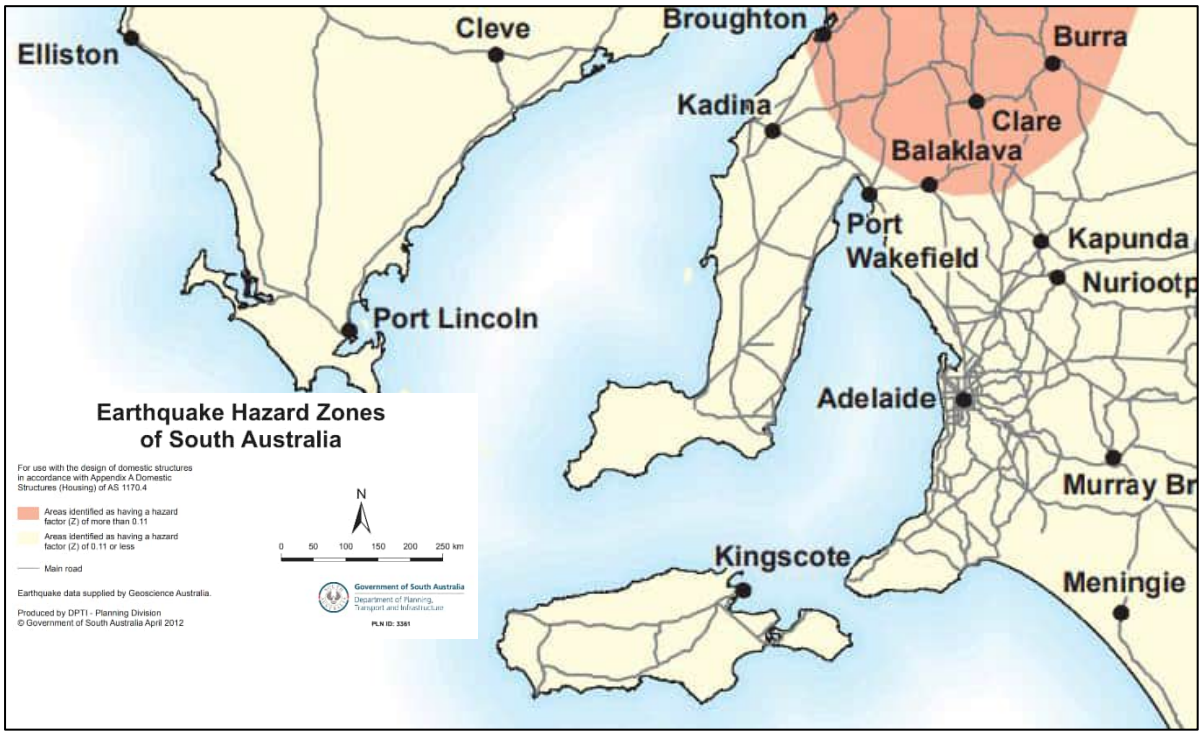
2.1.3 Geohazards Hazards

Earthquake Hazard Factor

The Earthquake Hazard Map of Australia is a critical input to Australian Standard AS1170.4, "Structural design actions Part 4: Earthquake actions in Australia" which outlines actions for seismic design, The Standard, as prepared by Standards Australia. This standard sets out procedures for determining earthquake actions and detailing requirements for structures and components to be used in the design of structures. It also includes requirements for domestic structures. The earthquake actions requiring consideration are based on the level of ground shaking for a given location, as represented on the current earthquake hazard map. The ground shaking is expressed as a hazard factor which is equal to the effective peak ground acceleration (PGA) with an exceedance probability of 1 in 500 years.

The Earthquake Hazard Zones of South Australia map produced by DPTI, 2012 indicates the project area is located within an area identified as having a hazard factor (z) of 0.11 or less. Figure 3 provides an extract of the relevant earthquake hazard zones map.

Figure 3: Extract from The Earthquake Hazard Zones of South Australia Map, 2012



South Australian Department for infrastructure and Transport, 2012.

Other Geohazards

Other geohazards include historical and / or active mine workings or associated features, and landslides. Interrogation of the GA Portal online mapping shows there are no known active or historical mine working in the immediate or nearby project site area, nor is there any landslide risk perceived to the project.

2.1.4 Hydrogeology

The GA Portal online mapping indicates the occurrence of several nearby water wells. However, no borehole logs or subsurface profile were able to be access for existing water wells.

From the Geoscience Australia hydrogeology dataset, potential groundwaters beneath the site are described as “Porous, extensive highly productive aquifers”.

2.1.5 Published Soils Information (Acid Sulfate Soils and Australian Soils Classification)

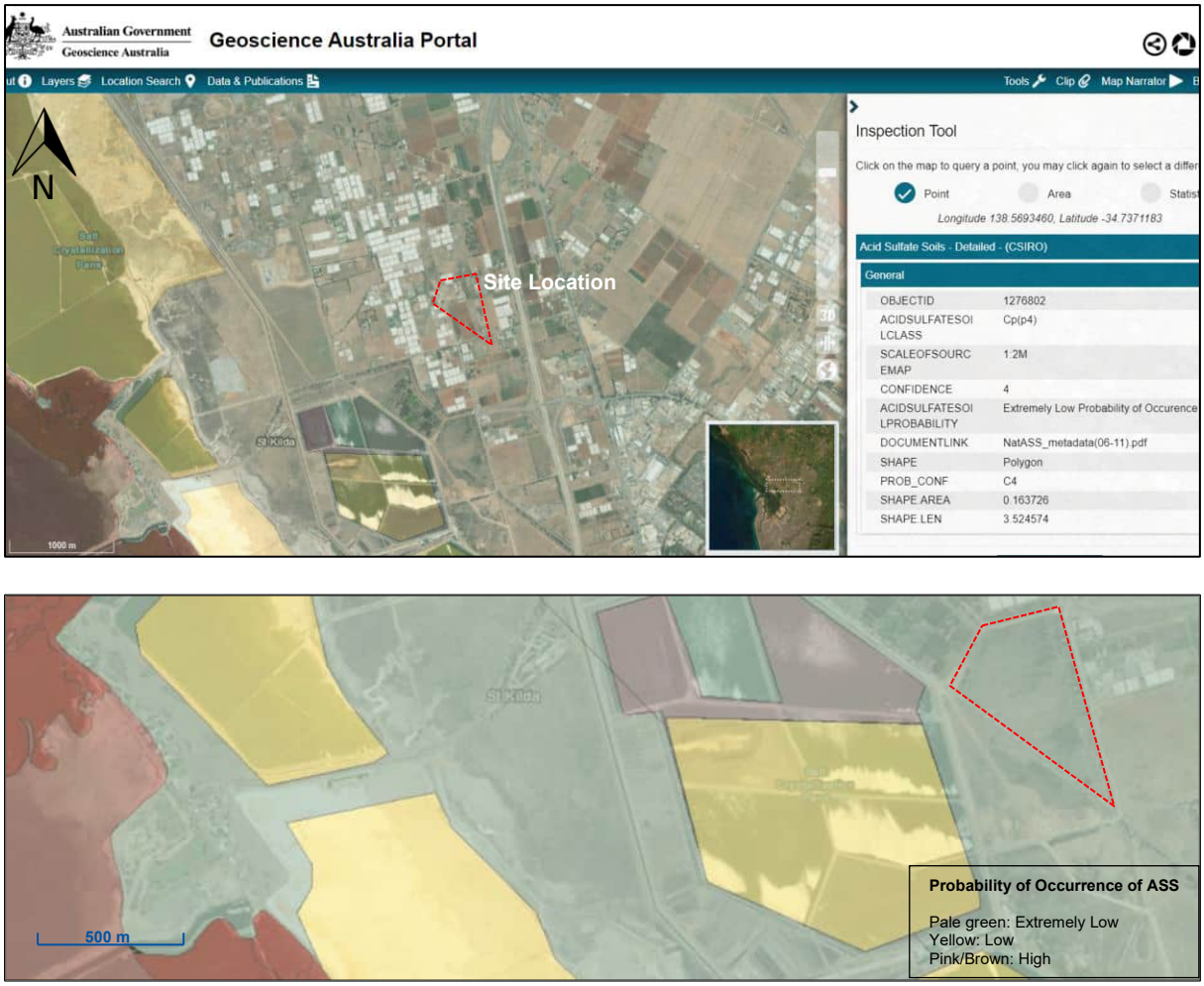
Acid Sulfate Soils (ASS)

Interrogation of the GA Portal, Acid Sulfate Soils – Detailed – (CSIRO) layer indicates the site is mapped as having an “Extremely Low Probability of Occurrence” of ASS.

Notably, the adjacent site to the west is mapped as having a “High Probability of Occurrence” of ASS.

Figure 4 below provides an extract of the published ASS mapping available on the GA Portal. The CSIRO ASS mapping is also publicly available through the ASRIS – Digital Atlas of Australian Soils at www.asris.csiro.au.

Figure 4: Extract from GA Portal Acid Sulfate Soils Map Layer



Australian Soils Classification (ASC)

Interrogation of the GA Portal, Australian Soils Classification (ASC) layer indicates the site is mapped as containing Calcarosols (CA), which are defined under the CSIRO Australian Soils Classification Scheme, as quoted below:

- "Are either calcareous throughout the solum - or calcareous at least directly below the A1 or Ap horizon, or within a depth of 0.2 m (whichever is shallower). Carbonate accumulations must be judged to be pedogenic (The carbonate is a result of soil-forming processes, in contrast to fragments of calcareous rock such as limestone), i.e., are a result of soil forming processes *in situ* (either current or relict). Soils dominated by non-pedogenic calcareous materials such as fragments of limestone or shells are excluded".

- "Do not have deep sandy profiles that have a *field texture* of sand, loamy sand or clayey sand in 80% or more of the upper 1.0 m".

2.2 Geotechnical Site Investigation

2.2.1 Site Description

At the time of site investigations, the project area was described as relatively flat and moderately well vegetated with grasses, shrubs and small trees, with areas of more dense vegetation and medium sized trees located in the northeast and southeast portions of the site. The south-eastern portion of the site was relatively boggy. Elevations across the site varied between approximately 5 m and 6 m AHD.

A stock fence ran approximately parallel to Robinson Rd, separating the eastern portion of the site. A swale drain was situated on the northern site boundary. SA Waters wastewater lagoons were located generally to the west of the site. A known aboriginal heritage site is located within the north-eastern corner of the site.

The site geotechnical investigation location plan is attached in Appendix 1 of this report. Photographs depicting general site conditions are presented in Figure 5.

Figure 5: Site Photographs

Photo 1: General Site Conditions – view across site looking east.

Photo 2: Boggy Southeast portion of the site.

Photo 3: Northeast portion of the site.

Photo 4: Excavator setting up at TP06.

2.2.2 Intrusive Investigations

Site works for this geotechnical investigation were undertaken in two stages:

- Stage 1 was undertaken on 10/08/2022, and comprised:
    - Excavation of eleven (11) test pits (TP01-TP06, TP17-TP19, and TP21-TP22).
- Stage 2 was undertaken between 14/11/2022 and 25/11/2011, and comprised:
    - Excavation of thirteen (13) test pits (TP07-TP17, TP20, TP23 and TP25).
        - TP24 was not excavated due to cultural heritage permit requirements that restricted access to north-eastern portion of the site.
    - Drilling of four (4) geotechnical boreholes that were drilled to a target depth of 25.0 m bgl.
    - Electrical Resistivity Testing (ERT) within the northwest section of the site, and Thermal Resistivity Testing (TRT) at one test pit location (TP05).

All investigation locations were recorded using a hand-held GPS and the indicative test pit locations are shown on the Geotechnical Investigation Location Plan presented as Appendix 1.

All logging of intrusive subsurface investigations was carried out in accordance with AS1726:2017 Geotechnical site investigations. The test pit and borehole logs are included in Appendix 2. An explanatory note applicable to the terms, symbols and abbreviations used on the logs is included in Appendix 4. A glossary of terms applicable to aspects of this report pertaining to sampling and testing for Acid Sulfate Soils is included in Appendix 5.

Test Pit Methodology

The total twenty-four (24) test pits were excavated to depths BGL ranging from to 1.00 m (TP07) to 3.00 m BGL (TP09), using an 8 - tonne excavator, with a 450 mm toothed bucket.

Disturbed samples of all encountered materials were taken to enable visual and tactile assessment, and to enable laboratory testing wherever required or deemed appropriate.

Photographs of all test pit excavations were taken and are displayed shown on the logs.

In situ testing associated with the test pits comprised Dynamic Cone Penetration (DCP) testing, undertaken adjacent to each test pit locations to depths BGL ranging from 0.6 m (TP16) to 3.0 m (TP02). DCP profiles are shown on the Test Pit Logs in Appendix 2.

Practical refusal was encountered in all the test pits due to the presence of a shallow groundwater table.

For all the test pit excavations, the topsoil was separated from the balance of the spoil, so as to be placed back on top after backfilling, to meet the pre-existing ground surface conditions and levels. All the test pits were backfilled with excavated spoil in compacted layers. This was achieved by tamping with the bucket and rolling with the excavator tracks.

Boreholes Methodology

The total four (4) boreholes were drilled using a truck mounted Mark 5 Investigator drill rig, utilising hollow flight auger and split spoon sampling techniques, all to a target depth BGL of 25 m.

Standard Penetration Testing (SPTs) was undertaken at 1.5 m intervals down hole in all the boreholes. Two (2) undisturbed samples (U50s) were undertaken at selected boreholes/depth as reported in the borehole logs.

Pocket Penetrometer testing was undertaken on samples of excavated materials at regular intervals.

All the boreholes were backfilled with excavated spoil and sealed with a bentonite and grout plug to meet the pre-existing ground surface conditions and prevent surface water ingress.

Electrical and Thermal Resistivity Testing

Electrical Resistivity Testing (ERT) was undertaken at one discrete location nominated by Renascor and *in situ* Thermal Resistivity Testing (TRT) was undertaken at select intervals in TP08 using a TLS-100 Thermal resistivity / conductivity meter, the result is documented in Appendix 2.

2.2.3 Summary of Ground Conditions

The materials encountered in the test pits and boreholes were generally consistent with the published geological mapping and are summarised in Table 2 below.

Table 2: Summary of Ground Conditions (General Ground Profile beneath the Site)

Typical Depth [1] (m bgl)	Material Description(Generalised) [2]	Indicative Strength	Inferred Geological Unit
GL to 0.20	TOPSOIL: Silty SAND.	-	Topsoil
0.20 to 0.70/2.00 (EOH)	Sandy CLAY, low to medium plasticity, pale orange-brown, with lenses of Clayey SAND [3], fine to coarse grained.	Firm to Stiff	Undifferentiated Quaternary Alluvium
0.70/2.00 [4] to 2.00	Clayey GRAVEL / Gravelly CLAY, pale grey-brown, fine to coarse grained, rounded, calcareous, low plasticity clay.	Dense / Stiff	Glanville Formation
2.00 to 3.40/4.00	Sandy CLAY / CLAY, low to medium plasticity, fine to coarse grained sand, with variable proportions of calcareous gravel (calcrete).	Stiff to Very Stiff	Glanville Formation
3.40/4.00 to 5.50/7.80	Sandy CLAY / CLAY, medium to high plasticity, orange-brown mottled grey, with variable proportions of sand and gravel.	Very Stiff to Hard	Hindmarsh Clay Formation
5.50/7.80 to 6.50/11.50	Clayey SAND / SAND / Gravelly SAND, fine to coarse grained sand, grey and orange-brown, fine to coarse grained sub-rounded gravel, low plasticity clay.	Medium Dense	
6.50/11.50 to 19.20/25.00 [5]	CLAY / Sandy CLAY, medium to high plasticity, orange-brown and red mottled grey, with variable proportions of sand and gravel.	Hard	

Typical Depth [1] (m bgl)	Material Description(Generalised) [2]	Indicative Strength	Inferred Geological Unit
19.20/21.70 to 25.00 [6]	SAND / Clayey SAND, fine to coarse grained sand, grey-brown, fine to coarse grained, sub-rounded gravel.	Medium Dense to Dense	Carisbrooke Sand Formation

Notes:

1. Depth below ground surface level (bgl).
2. Reference should be made to individual borehole and test pit logs presented in Appendix 2.
3. Only encountered in TP17.
4. Only encountered in TP03, TP04, TP06, TP07 and TP09.
5. BH03 terminated at a target depth within the Hindmarsh Clay Formation.
6. End of Hole (EOH) at a target depth of 25.0 m bgl.

2.2.4 Groundwater

Groundwater was encountered in all the test pits at depths ranging between 0.60 m (TP13) and 1.80 m BGL (TP19 and TP21).

Additionally, the groundwater was encountered in the borehole locations at depths ranging from 1.50 m (BH01 and BH04) to 2.50 (BH02).

It should be noted that groundwater levels are likely subject to tidal and seasonal variations.

2.3 Laboratory Testing

Laboratory testing was undertaken under the following categories detailed in Sections 2.3.1 and 2.3.2. All Geotechnical and Geochemical certified laboratory test reports are included in Appendix 4 and Appendix 5, respectively.

2.3.1 Geotechnical Laboratory Testing

Geotechnical laboratory testing of selected samples recovered from the borehole investigation was undertaken at SMS Geotechnical Pty Ltd's National Association of Testing Authorities (NATA) accredited laboratory. Testing was generally carried out in accordance with the methods set out in AS 1289-2000 Method of testing soils for engineering purposes, or the relevant American Society for Testing and Materials (ASTM international) Standards.

The following geotechnical laboratory testing was undertaken, (quantities and methods as indicated):

- 1 – Thermal Resistivity with dry back curve (ASTM D5334).
- 2 – Unconsolidated Undrained (UU) tri-axial tests (1289.6.4.2).
- 3 – Remoulded Permeability Tests (AS 1289.6.7.3).
- 15 – Particle Size Distribution (AS1289.3.6.1).
- 15 – Atterberg Limits (AS1289.3.1.2, 3.2.1, 3.3.1, 3.4.1).
- 5 – California Bearing Ratio (CBR) test including modified compaction (AS1289.6.1.1).

- 15 – Standard Compaction Test (AS1289.5.1.1).

The following tables provide a summary of geotechnical test results.

The thermal resistivity results have been summarised in Table 3 below.

Table 3: Thermal Resistivity Test Results

Moisture Content (%)	Compacted Dry Density (t/m^3)	Thermal Conductivity (W/mK)	Thermal Resistivity (mK/W)
0.0	1.73	0.58	1.70
3.4	1.73	0.81	1.24
10.1	1.73	1.05	0.95
16.7	1.73	1.42	0.71

The UU tri-axial and permeability tests are summarised in Tables 4 and 5 below.

Table 4: Summary of Unconsolidated Undrained Triaxial (UU) Laboratory Test Results

Sample ID	Sample Depth (m)	Soil Type	c (kPa)	Φ' (°)
BH01	13.0 to 13.5	Silty CLAY, Medium plasticity	289	-
BH03	14.5 to 15.0	Silty CLAY, Medium plasticity	308	-

Note: c – Undrained Cohesion, Φ' - Effective Friction

Table 5: Summary of permeability tests – Constant head (triaxial method)

Sample [1] (ID)	Sample Depth (m bgl)	Soil Type	Standard Maximum Dry Density (t/m^3)	Optimum Moisture Content (%)	Permeability [2] (m/sec)
TP09	0.8 to 1.2	CLAY, Medium plasticity	1.72	18.5	1.0×10^{-10}
TP12	0.6 to 0.9	CLAY, Medium plasticity	1.73	18.0	3.0×10^{-10}
TP13	0.2 to 0.6	Silty CLAY, Medium plasticity	1.64	21.2	7.0×10^{-10}

Notes:

1. Remoulded samples to a target of 98% SMDD @ OMC

The remainder of the geotechnical testing is summarised in Table 6 below as follows.

Table 6: Summary of Geotechnical Testing

Borehole (ID)	Sample Depth (m bgl)	Soil Type	Moisture Content (%)	Atterberg Limits (%)				Particle Size Distribution (% Passing)			Standard Compaction		Modified Compaction		4-Day Soaked CBR (%)
				LL	PL	PI	LS	19 mm	2.36 mm	0.075 mm	MDD (t/m^3)	OMC (%)	MDD (t/m^3)	OMC (%)	
TP01	0.20 to 0.50	Sandy CLAY	13.3	-	-	-	-	-		-	-	-	1.86	13.0	14
TP01	1.70 to 1.90	Sandy CLAY	22.5	23	15	8	1.0	100	98	49	-	-	-	-	-
BH01	5.50 to 5.95	CLAY	15.4	32	18	14	7.0	98	97	77	-	-	-	-	-
TP02	0.20 to 0.50	Sandy CLAY	20.3	-	-	-	-	-		-	1.68	19.5	-	-	-
TP02	1.60 to 1.90	Sandy CLAY	12.3	25	13	12	4.0	100	99	47	-	-	-	-	-
BH02	11.50 to 11.95	CLAY	16.8	45	18	27	11.5	100	89	70	-	-	-	-	-
TP03	0.20 to 0.50	Sandy CLAY	23.1	-	-	-	-	-		-	1.68	20.0	-	-	-
BH03	2.50 to 2.95	Sandy CLAY	18.6	26	15	11	6.0	100	89	50	-	-	-	-	-
BH03	7.00 to 7.45	SAND	13.3	22	17	5	2.5	94	78	12	-	-	-	-	-
TP04	0.80 to 1.10	Sandy CLAY	12.8	-	-	-	-	-		-	-	-	1.82	13.0	9
BH04	17.50 to 17.95	Sandy CLAY	16.5	31	17	14	7.5	100	100	67	-	-	-	-	-
TP05	0.20 to 0.50	Sandy CLAY	21.8	-	-	-	-	-	-	-	1.76	17.0	-	-	-

Borehole (ID)	Sample Depth (m bgl)	Soil Type	Moisture Content (%)	Atterberg Limits (%)				Particle Size Distribution (% Passing)			Standard Compaction		Modified Compaction		4-Day Soaked CBR (%)
				LL	PL	PI	LS	19 mm	2.36 mm	0.075 mm	MDD (t/m^3)	OMC (%)	MDD (t/m^3)	OMC (%)	
TP05	1.70 to 2.00	Sandy CLAY	26.3	-	-	-	-	-		-	1.85	14.0	-	-	-
TP06	0.20 to 0.50	Sandy CLAY	21.3	36	18	18	9.0	92	75	44	-	-	-	-	-
TP06	0.70 to 1.00	Gravelly CLAY	19.8	30	14	16	7.0	90	64	36	1.83	15.0	-	-	-
TP08	0.30 to 0.60	Sandy CLAY	-	-	-	-	-	-	-	-	-	-	1.65	18.5	-
TP09	0.80 to 1.20	Sandy CLAY	-	-	-	-	-	-	-	-	-	-	1.72	18.5	-
TP12	0.60 to 0.90	Sandy CLAY	-	36	15	21	11.5	100	99	55	-	-	-	-	-
TP13	0.20 to 0.60	Sandy CLAY	-	-	-	-	-	-	-	-	-	-	1.64	21.0	-
TP15	0.20 to 0.60	CLAY	23.6	37	16	21	9.0	98	81	56	-	-	1.90	12.0	20
TP16	0.20 to 0.60	Sandy CLAY	-	-	-	-	-	-	-	-	-	-	1.65	21.0	-
TP17	0.10 to 14.00	Sandy CLAY	17.5	-	-	-	-	-		-	1.82	13.5	-	-	-
TP17	1.70 to 1.90	Clayey SAND	18.8	20	16	4	0.5	100	98	27	-	-	-	-	-
TP18	0.20 to 0.50	Sandy CLAY	14.6	-	-	-	-	-	-	-	-	-	1.87	14.0	12
TP20	1.00 to 1.50	Sandy CLAY	-	-	-	-	-	-	-	-	-	-	1.71	18.0	-

Borehole (ID)	Sample Depth (m bgl)	Soil Type	Moisture Content (%)	Atterberg Limits (%)				Particle Size Distribution (% Passing)			Standard Compaction		Modified Compaction		4-Day Soaked CBR (%)
				LL	PL	PI	LS	19 mm	2.36 mm	0.075 mm	MDD (t/m^3)	OMC (%)	MDD (t/m^3)	OMC (%)	
TP21	0.20 to 0.50	Sandy CLAY	18.5	35	14	21	9.0	94	84	43	1.75	14.0	-	-	-
TP21	1.80 to 2.00	Sandy CLAY	28.6	34	16	18	8.5	100	100	84	-	-	-	-	-
TP23	0.20 to 0.50	Sandy CLAY	21.8	27	15	12	5.0	93	89	43	-	-	2.00	10.5	20

Notes:

"-"not tested

LL – Liquid Limit

PL – Plastic Limit

PI – Plasticity Index

LS – Linear Shrinkage

MDD – Maximum Dry Density

OMC – Optimum Moisture Content Refer to the 'Glossary of Terms Specific to this Report' included in Appendix 4 of this report.

2.3.2 Geochemical Laboratory Testing

The soil geochemistry of selected samples recovered from the borehole investigation was also assessed by analyses conducted at the Eurofins Environmental Testing Australia Pty Ltd, NATA accredited laboratory, quantities and purposes as follows:

- 5 – Chemical aggressiveness tests to assess exposure classification (pH, chloride, sulphate, and resistivity).
- 5 – Qualitative field screenings and quantitative testing to assess the presence / absence of any Actual or Potential Acid Sulfate Soils, (pH $_F$, pH $_{FOX}$, SPOCAS).

Chemical Aggressiveness Testing - AS2159 and AS3600

Soils that exhibit low pH values or high concentrations of Sulfate and chloride have the capacity to affect the durability of in-ground structures and services. Section 6 of AS2159-2009 'Piling – Design and Installation' provides information on exposure classification for concrete and steel piles and Section 6 of AS3600 'Concrete structures'.

Table 7 provides a summary of chemical aggressiveness test results. Laboratory test certificates from Eurofins for the laboratory testing are provided in Appendix 5.

Table 7: Summary of Chemical Aggressiveness Testing

Borehole ID	Sample Depth (m bgl)	pH (pH unit)	Sulfate as SO_4^{-2} (mg/kg)	Chloride (mg/kg)	Resistivity (Ω.cm)
BH01	0.70 to 0.80	8.1	420	1100	380
BH01	1.50 to 1.60	7.3	720	2100	870
BH02	2.10 to 2.20	8.0	1600	4600	480
BH03	11.60 to 11.70	7.5	640	1200	1600
BH04	4.80 to 4.90	8.6	680	1600	1200

Guidance on exposure classifications is provided below:

- For concrete and steel piles founded above groundwater (i.e., soil conditions B – AS2159): Mild to Moderate.
- For concrete and steel piles founded in groundwater (i.e., soil conditions B – AS2159): Moderate to Severe.
- For concrete footings (e.g., shallow footings) in contact with the ground, reference has been made to Tables 4.3 and 4.8.1 of AS 3600 and an exposure classification of A2 to B1 is recommended.

Acid Sulfate Soils Testing

Acid Sulfate Soils (ASS) are present in coastal areas of South Australia and can create both environmental and structural durability issues if disturbed and exposed to the atmosphere during earthworks. Coastal / Lowland ASS are associated with areas below RL 5 m (AHD), and particularly with Holocene age estuarine deposits.

Given the proximity of the project site to mapped “High Probability of Occurrence” areas of ASS, and the nearby occurrence of Holocene age Estuarine deposits (the Saint Kilda Formation), mapped approximately 1.5 km to the west, and the low-lying topography, we have undertaken a preliminary assessment of assess whether any Actual or Potential Acid Sulfate Soils (AASS or PASS) are likely present at the site. Laboratory testing to inform this assessment comprised both indicative, qualitative field screening tests and more definitive, quantitative testing, performed on samples for five (5) test locations across the site.

The results of laboratory ASS testing are presented in Table 8 below.

Table 8: ASS Field Screening and Laboratory Test Results

	Sample ID	TP04-ASS1	TP08-ASS2	TP20-ASS3	TP12-ASS4	TP11-ASS5
Indicative (qualitative) screening tests	Depth (m bgl)	0.10 to 0.20	0.40 to 0.50	1.50 to 1.60	1.80 to 1.90	0.80 to 0.90
	pH $_{F}$	7.1	9.2	9.2	8.8	9.7
	pH $_{FOX}$	3.7	9.3	9.5	8.8	9.9
	Δ pH	3.4	0.1	0.3	0	0.2
	Reaction Rate	Extreme	Extreme	Extreme	Extreme	Extreme
Definitive (quantitative) ASS tests	Retained Acidity (S-NAS) (Mol H+/t)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
	Acid Neutralising Capacity (ANCbt) (Mol H+/t)	< 2.0	7700	810	89	3600
	Net Acidity (Including ANC) (Mol H+/t)	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
	% Oxidisable sulphur	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Refer to the ‘Glossary of Terms Specific to this Report’ included in Appendix 5 of this report.

The Laboratory sample receipt, Chain of Custody (CoC) and Certificate of Analysis (CoA) for the tests are included in Appendix 5.

2.3.3 Interpretation of ASS Field Screening and Laboratory Results

The following shows the ASS Field Screening Test result criteria, or indicators of AASS and PASS materials, as published in the National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual, Table 5.1, Indicators of ASS materials.

Table 9: ASS Field Screen Results as indicators of AASS and PASS

Soil Type	Field Screening Indicators
AASS	$pH_F < 4$
PASS	$pH_F > 4$ and commonly neutral
	$pH_{FOX} < 4$,
	large unit change from pH_F to pH_{FOX}, (i.e., $\Delta pH > 1$), together with a vigorous or volcanic reaction to peroxide

Note: When soil $pH_F > 4$ but < 5.5 this may indicate some existing acidity (acidic soil) and other indicators should be used to confirm presence or absence of ASS.

Field Screening criteria shown in Table 9 above are applied to the Field Screening results presented in Table 8, then **none** of the tested samples are indicative of AASS. Note also that none of the other characteristics (visual, tactile and olfactory) listed in the National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual, Table 5.1 were evident on-site.

The Field Screening results from only one sample tested, (TP04 0.1-0.2 m), meet the pH_F and pH_{FOX} criteria indicative of PASS. Notably, this sample from location TP04 (0.1-0.2 m) was the uppermost sample taken from the site, and as such was representative of higher - level materials across the site.

The following Table 10 shows the Net Acidity criteria as published in the EPA Guidelines (SA) Site contamination - acid sulfate soil materials, Appendix C – Criteria for Acid Sulfate Soil Material.

Table 10: EPA Guidelines - Criteria for Acid Sulfate Soil Material

Soil or Sediment Texture	Criteria	
	Sulphur trail % oxidisable sulphur (oven dried basis)	Acid trail mol H+/tonne (oven dried basis)
Sands to loamy sands	0.03	18
Sandy loams to light clays	0.06	36
Medium to heavy clays and silty clays	0.10	62

Interpreted in accordance with Appendix C of the EPA Guidelines, the results of the five samples were not indicative of the presence of ASS. Given the Acid Neutralising Capacity of the material present on-site, owing the presence of calcareous material (i.e. gravel and portions of the Glanville Formation), we consider the risk negligible of encountering acid Sulfate soils in natural soils at the site and an acid Sulfate soil management plan will not be required.

3 Phase 2: Evaluation and Interpretive Reporting

General recommendations relating to geotechnical aspects of the site and analysis of the laboratory testing are presented in the following sections. This is based on our understanding that the proposed development at the site comprises the construction of a UPSG Processing Plant, Purification Area, Water Treatment Facilities, Associated Non-processing Infrastructure, Retaining Structures, Access Roads, Site Drainage Pond, and an Electrical HV Switchyard.

3.1 Geotechnical Design Parameters

Preliminary geotechnical design parameters for a generalised sub-surface profile are presented in Table 11 below.

Table 11: Preliminary Geotechnical Design Parameters

Material Type[1] (Consistency / Density)	Typical Layer Depth Interval[1] (m)	Bulk Unit Weight γ (kN/m³)	Undrained Shear Strength Su (kPa)	Effective Friction Angle Φ' (°)	Effective Cohesion c' (kPa)	Poisson's Ratio		Young's Modulus (MPa)	
						Short Term V_u	Long Term v'	Short Term E_u	Long Term E'
TOPSOIL: Silty SAND	GL to 0.20	16	-[2]	-	-	-		-	
Sandy CLAY (Firm to Stiff)	0.20 to 0.70/2.00	18	50 to 100	26	25	0.35	0.25	10	15
Clayey Gravel/Gravelly CLAY[3] (Medium Dense / Stiff)	0.70/2.00 to 2.00	19	50 to 100	36	15	0.3		40	
Sandy CLAY / CLAY (Stiff to Very Stiff)	2.00 to 3.40/4.00	18	100 to 150	26	40 to 50	0.35	0.25	20	35

Material Type[1] (Consistency / Density)	Typical Layer Depth Interval[1] (m)	Bulk Unit Weight γ (kN/m³)	Undrained Shear Strength Su (kPa)	Effective Friction Angle Φ' (°)	Effective Cohesion c' (kPa)	Poisson's Ratio		Young's Modulus (MPa)	
						Short Term V_u	Long Term v'	Short Term E_u	Long Term E'
CLAY / Sandy CLAY (Very Stiff to Hard)	3.40/4.00 to 5.50/7.80	18	150 to 200	28	50 to 75	0.40	0.30	40	30
Clayey SAND / SAND / Gravelly SAND (Medium Dense)	5.50/7.80 to 6.50/11.50	20	-	32	0 to 5	0.30		30	
CLAY / Sandy CLAY (Hard)	6.50/11.50 to 19.20/25.00 (EOH)[4]	18	200	28	75 to 100	0.40	0.30	40	30
SAND / Clayey SAND (Medium Dense to Dense)	19.20/21.70 to 25.00 (EOH)[5]	20	-	34 to 36	0	0.30		40 to 50	

Notes:
1. Reference should be made to individual geotechnical logs presented in Appendix 2.
2. "-" not applicable.
3. May not be encountered across the entire site.
4. BH03 terminated at target depth within the Hindmarsh Clay Formation
5. End of Hole at target depth of 25.0 m bgl.

3.2 Foundations Recommendations

We consider that conventional foundations including pads, strips and rafts founded on natural materials (Alluvial Soils) are suitable for the site. The selection of the specific foundation system and founding depth will depend on the type of the structures and expected loads. If larger loads are expected or structures likely to have low tolerance to settlement a gravel raft (reinforced) or piles should be considered.

3.2.1 Achievable Ultimate Bearing Capacity – Conventional Foundations

Based on the results of our investigation, we consider the use of conventional foundations such as strip, pad, or raft and / or slab on grade suitable for the proposed development.

Consideration could also be given to placing new foundations, placed at current ground level, on at least 1.0 m thick layer of structural fill (all topsoil and any soft / unsuitable material shall be removed prior fill placement) placed on top of the natural material comprising (firm clay) compacted to 98% of the MDD and placed under Level 1 supervision – see Section 3.3.4.

For new foundations placed into either natural soils or a structural fill layer, the following embedment depths and Ultimate Bearing Capacity (UBC) in Table 12 can be used.

Table 12: UBC for Suitable Founding Stratum

Foundation Type	Minimum founding depth (m BGL)	Footing Size	Founding Stratum	Indicative Strength	UBC (KPa)	Modulus of Subgrade Reaction (K) (KN/m²/m)
Isolated Foundation (Pads)	0.45	1.5 x 1.5	CLAY / Sandy CLAY	Firm to Stiff	350	10600
			Structural FILL layer (minimum of 1.0 m thick)	Medium Dense to Dense	600	36600
	0.50	9.0 x 2.0	CLAY / Sandy CLAY	Firm to Stiff	290	8000
			Structural FILL layer (minimum of 1.0 m thick)	Medium Dense to Dense	630	27400
Mat/Raft Foundation	0.60	15.0 x 4.0	CLAY / Sandy CLAY	Firm to Stiff	350	4000
			Structural FILL layer (minimum of 1.0 m thick)	Medium Dense to Dense	820	13700

The footing dimensions, footing depth and loading specifications of UPSG Rotary Kiln Building and Filtration Building – reference: Footing Drawings "12813-Siviour-Foundations-RJS-221017" - have been considered for the estimation of the bearing capacity. The UBC value shall be factored by appropriate reduction factors as per AU Standards.

Based on the UBC recommendations above, we have estimated the elastic settlement for foundations founded in the 1.0 m thick structural fill are likely to range up to 28 mm for Filtration Building. However, the settlement is expected to reach to 43 mm for the Rotary Kiln Building raft foundation founded over the 1.0 m thick structural fill. About 70% of the total settlement is expected to occur during construction. To estimate the expected settlement, a maximum allowable pressure of 200 kPa is considered as preliminary assumption.

Differential settlements for the foundations are dependent upon the stiffness of the foundation system adopted. A preliminary assessment indicates that differential settlements up to approximately half the estimated total settlement could be possible. This assessment should be re-evaluated as design of the foundation system further develops.

The provided recommendations for bearing capacity assume that any loose, disturbed, or softened materials will be stripped from the excavations prior to foundation construction. It is important that the excavation surface is as clean as reasonably practicable prior to pouring concrete. If the soil at the base of the excavation becomes wet and softens, it must be over-excavated until competent soil is encountered and replaced with lean mix concrete or compacted engineered granular fill. It will be necessary to ensure that the soils are not disturbed during excavation, do not dry out, or soften due to the pooling of groundwater, rainfall or surface water inflow. It is recommended that the base of the excavation be graded to drain and surfaced with lean mix concrete immediately following excavation and removal of loose material.

We recommend that all foundations are inspected by a suitably qualified and experienced geotechnical practitioner during excavation to verify that founding conditions are consistent with the recommendations of this report.

3.2.2 Piled Foundations

The following sections provide initial commentary and preliminary parameters to assist with the design of piled foundations. We have undertaken this initial foundation assessment based on the encountered soils' parameters and initial assumptions of likely foundation (piles) dimensions. The initial assessment presented in this report shall be validated and refined during a detailed foundation design.

The provided parameters assume that the piles will be designed and installed in accordance with Australian Standard AS2159-2009. A suitably experienced piling contractor should be consulted in regard to the best piling method. The piling equipment used must be of appropriate size and power to achieve the required embedment depths and pile diameters. The piling contractor should be made aware of available geotechnical information for the site (i.e. expected subsurface conditions and groundwater table depth).

Driven Piles and Screw Piles

Driven piles and screw piles are considered technically viable options.

Bored Piles and CFA Piles

Bored, cast *in situ* piles or Continuous Flight Auger (CFA) piles are considered suitable to be drilled into the inferred Hindmarsh Clay Formation encountered during the investigation. If bored piles are considered by piling contractors, then temporary support such as bentonite or casing will be required below groundwater levels.

CFA piles provide a construction advantage if pile depths extend well below the groundwater table.

We have provided preliminary parameters and commentary below for piles designed in accordance with the Australian Standard for Piling – Design and Installation (AS 2159 – 2009).

AS 2159 – 2009 requires a pile to be proportioned such that the pile design geotechnical strength (Rd,g) is not less than the pile design action effect (Ed). The design geotechnical strength is calculated as the design ultimate geotechnical strength (Rd,ug) multiplied by a geotechnical strength reduction factor (ϕg). Assuming that pile testing is not undertaken at this site, a geotechnical strength reduction factor (ϕg) of 0.50 shall be adopted. If dynamic pile testing is undertaken on at least 5% of the preformed piles, a geotechnical strength reduction factor (ϕg) of 0.70 could be adopted increasing the achievable capacity.

Initial pile design parameters have been calculated based on the materials encountered during the intrusive investigation. These have been summarised in Table 13 below, reference should be made to individual borehole logs when the proposed 25.0 m boreholes are drilled.

Table 13: Initial Pile Design Parameters for 600 mm Diameter Piles

Material Type	Layer Depth Interval (m)	Average Ultimate Skin Friction[1], fms (kPa)	Ultimate End Bearing Resistance, fb (kPa)[2]
TOPSOIL	GL to 0.20	Ignore	N/A
Sandy CLAY (Firm to Stiff)	0.20 to 1.00	Ignore	N/A
	1.00 to 2.00	0 to 25	N/A
Clayey Gravel / Gravelly CLAY[3] (Medium Dense Clayey Gravel or Stiff Gravelly CLAY)	0.70/2.00 to 2.00	25 to 50	N/A
Sandy CLAY / CLAY (Stiff to Very Stiff)	2.00 to 3.40/4.00	15	N/A
CLAY / Sandy CLAY (Very Stiff to Hard) with lenses of	3.40/4.00 to 5.50/7.80	20	1550
Clayey SAND / SAND / Gravelly SAND (Medium Dense)	5.50/7.80 to 6.50/11.50	30	2600
CLAY / Sandy CLAY (Hard)	6.50/11.50 to 19.20/25.00 (EOH)[(4)]	80	1550
SAND / Clayey SAND (Medium Dense to Dense)	19.20/21.70 to 25.00 (EOH)[(5)]	95	4800

Notes:

1. For piles in uplift, skin friction should be reduced by a factor of 0.8.
2. Assumes pile is embedded at least 2 pile diameters into this layer and pile length is >4 times diameter.
3. May not be encountered across the entire site.
4. Further geotechnical investigation must be undertaken to confirm these assumptions.

3.2.3 Working Platform

Based on our experience, large CFA and bored piling rigs can apply pressure beneath the tracks during piling up to about 350 kPa. Due to the presence of natural clayey soils close to surface that are prone to soften upon wetting, we recommend that allowance be made for the construction of a working platform (crushed rock material) across the site to protect the surface against changed weather conditions and trafficking.

The required thickness of the piling platform will be dependent on the imposed pressure beneath the tracks and the nature of the exposed subgrade materials.

Following appointment of a piling contractor and provision of the track loads, we can provide advice on procedures for the preparation and placement of a piling platform and the minimum thickness of any platform that may be required.

3.2.4 Solider Pile Wall Retention Systems

Consideration could be given to use of the piles as a long term retaining structure. This could be designed as either a continuous pile wall or soldier pile wall with infill shotcrete panels in between the piles, particularly if the retention systems are to extend beneath the groundwater table.

3.2.5 Retaining Walls

We understand that single cantilever retaining structures are proposed at the site. We have not received any information in regard to the depths and lateral extents of the excavations, however we expect that they will occur within materials close to the surface, i.e. stiff sandy clays and / or medium dense clayey gravels / gravelly clays. We have assumed that the retaining will be constructed bottom up within an excavation (i.e. parameters have been provided for gravity wall design).

The design and construction of a retention system is dependent on the nature of the materials to be retained, the sequence of construction, the nature and extent of adjacent structures and footings, allowable lateral ground movements and associated settlements behind the wall, groundwater conditions and the magnitude of any vertical loads to be supported by the wall.

Lateral earth pressure coefficients for use in retaining wall design have been summarised in Table 14 below. These parameters are applicable for long term (permanent) structures and assume horizontal ground behind the wall. If an inclined slope is proposed behind the wall, or additional surcharge loads from traffic or structures are imposed during or after construction, then these additional loadings should be allowed for in the design. To form these retaining walls, cuts at safe batter angles will be required - presented in Section 3.5.2.

Retaining walls should be designed in accordance with the recommendations of AS4678-2002, ‘Earth Retaining Structures’.

Table 14: Earth Pressure Coefficients for Basement Retention Design

Layer Material Type (Consistency / Density)	Effective Friction Angle Φ' (°)	At-Rest Earth Pressure Coefficient (K_o)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
Sandy CLAY (Firm to Stiff)	26	0.63	0.39	3.62
Clayey Gravel / Clayey Gravel[3] (Medium Dense / Stiff)	36	0.41	0.26	7.11

Notes:

1. This table assumes no head-slope.
2. The interface friction angle between the wall and the soil, δ, is taken as 1 x ϕ for concrete block walls.
3. The interface friction angle against sliding, is taken as 2/3 x ϕ.
4. The skin friction for ground anchors e.g. geosynthetics or metallic strip reinforcements can be taken as 2/3 x ϕ (higher value can be adopted upon manufacturer confirmation.
5. May not be encountered across the entire site.

Retaining structure design should include weep holes to allow drainage of the soil behind the retaining wall. We have assumed that free-draining backfill will be used for construction and that water will be prevented from building up behind the wall. For compacted free draining granular backfill, we recommend adopting an assumed effective friction angle (Φ') of 34°, zero cohesion (c') and unit weight of 20 kN/m^3. If an alternative approach is adopted, we recommend that further advice should be sought.

Compaction plant can increase the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2.0 m of any retaining walls to minimise compaction pressures.

3.2.6 Groundwater and Drainage

Given the presence of shallow groundwater ranging from 0.6 to 2.5 m BGL encountered during the investigation, consideration should be given to the proximity of groundwater to the base of the excavation. Compaction of soils below groundwater will not be achievable without dewatering. When compacting soil in close proximity to the groundwater level (i.e. within about 1.0 m), non-vibratory compaction equipment is recommended to prevent groundwater from being drawn up.

We recommend provision of subfloor drainage in a form of perimeter drain to collect groundwater seepage from strip drains located behind retaining wall. Any groundwater collected in the subsurface drainage system should be directed to a sump for collection and off-site disposal. The relevant statutory authority shall be consulted regarding regulations for off-site disposal of groundwater.

3.3 Earthworks

3.3.1 Reuse of Site-won Materials

Table 3.1 of The Department of Infrastructure and Transport (DIT) specification, *Part R10 Construction of Earthworks*, outlines the selection criteria for engineered fill. This selection criteria are summarised in Table 15 below.

Table 15: Extract from DIT Specification: Part R10 – Material Classification

Classification		A	B	C	General Fill (GF)
Material Type		Sand-clay, Sand, Rubble, Quarry or Pit overburden or by-product	Sand-clay, Sand, Rubble Quarry or Pit overburden or by-product	Sand-clay Sand, Clay, Rubble, Quarry or Pit overburden or by-product	Refer to Contract Specific Requirements
Max. Particle Size (mm)		75	106	150	150
Particle Size Distribution (% passing)	75 mm	100	-	-	Refer to Contract Specific Requirements
	37.5 mm	80-100	80-100	80-100	
	0.075 mm	0-25	0-35	0-35	
Max. Plasticity Index		12	15	-	
Max. Linear Shrinkage		6	7	-	

Based on the results of the laboratory testing undertaken to date (presented in Section 2.3), the material encountered during the investigation within the top layers generally comprised of cohesive clayey materials. This cohesive material generally had a fines proportion (% passing 0.075 mm) greater than 35% and a Plasticity Index that ranged from 8% to 21%. Due to the high content of fines, these materials are not suitable for use as structural fill. However, the material can be used as engineered fill (bulk earthworks) providing that appropriate fill placement, compaction and validation is carried out in accordance with Section 3.3.4. The presence of potential acid Sulfate soils in this material should also be considered.

3.3.2 Imported Fill Materials

In the event that imported engineered and / or structural fill is required during construction of access roads and building platforms, attention will need to be paid to the permeability and reactivity of the imported material. This imported fill material shall be free of organic matter and deleterious materials (i.e. salvaged material, asphaltic concrete or concrete rubble). The geotechnical properties of imported fill materials shall be in accordance with '*Classification A'* presented in Table 15 above.

3.3.3 Site Preparation

If shallow footings are to be placed on top of a layer of structural fill, the following site preparation steps will need to be followed in order to reduce the risk for settlements and provide a reliable foundation for building footing systems:

- Excavate existing materials to the required depth, based on expected loads of the proposed infrastructure (up to a maximum of 1.0 m BGL), from an area extending a minimum of 2.0 m laterally beyond the footprint of the proposed infrastructure.

- Care should be taken to separate and stockpile the topsoil from the natural cohesive materials. In addition, the presence of potential acid Sulfate soils in the excavated material should be considered when stockpiling materials.
- Undertake a proof roll of the exposed surface, removing any weak or soft material and replacing with compacted structural fill.
- Backfill the excavation using suitable imported structural fill to the proposed underside of the footing in accordance with the recommendations provided in Section 3.3.4. It is likely that some moisture conditioning will be required prior to compacting these materials.

3.3.4 Placement and Compaction of Fill

Any fill should be placed in horizontal layers, no greater than 300 mm loose thickness. Each layer should be compacted by approved compaction equipment, carefully controlled to ensure an even compaction over the full area and depth of each layer.

The level of compaction achieved in all placed fill and below the base of slabs and footings should be commensurate with a minimum dry density ratio of 98% relative to the Standard Maximum Dry Density, in accordance with AS 1289 5.1.1.

Consideration should be given to the proximity of groundwater to the base of the excavation. Compaction of soils below groundwater will not be achievable without dewatering. When compacting soil in close proximity to the groundwater level (i.e. within about 1 m), non-vibratory compaction equipment is recommended to prevent groundwater from being drawn up.

It is recommended that earthworks, including subgrade preparation and bulk fill placement, be supervised by suitably experienced geotechnical personnel, in accordance with AS3798-2007 *(Guidelines for earthworks for commercial and residential developments)*. Level 1 supervision as defined in AS3798 is recommended where subgrades / fill are required to support building / structure loads.

3.4 Pavements

We understand that pavements are currently proposed at the site. We have considered a number of methods to assess the design CBR for the site. These are summarised below.

Soaked CBR values were reported for five (5) samples and are ranging between 9% (TP 04) and 20% (TP15 & TP23). The samples were remoulded to a dry density ratio of approx. 95% compared with Modified Compaction (AS1289.5.2.1), with an applied surcharge of 4.5 kg. The reported CBR values, sample depth and the soil type description are summarised in Table 16.

We have also calculated Estimated CBRs based on the method presented in DPTI TP133. This method is applicable for materials with at least 75% passing the 2.36 mm sieve, and the Estimated CBRs calculated with this method can be considered to be equivalent to a four-day soaked CBR remoulded to a density ratio of 95% compared with Modified Compaction (AS1289.5.2.1). Based on this method we have estimated CBRs ranging from 11% (TP21 0.20-0.50 m) for medium plasticity sandy clay material. Basedon this method we have calculated estimated CBRs presented in Table 16.

Table 16: Summary of CBR Testing and Estimated Values

Evaluation Method	Sample ID	Sample Depth (m BGL)	Soil Type	Moisture Content (%)	Modified Compaction		
					OMC (%)	MDD (t/m^3)	CBR (%)
Tested	TP01	0.2 – 0.5	Sandy CLAY	13.3	13.0	1.86	14
	TP04	0.8 – 1.1	Silty / Sandy CLAY	12.8	13.0	1.82	9
	TP15	0.2 – 0.6	CLAY, medium plasticity	12.3	12.0	1.90	20
	TP18	0.2 – 0.5	Sandy CLAY	14.6	14.0	1.87	12
	TP23	0.2 – 0.5	Sandy CLAY, low plasticity	10.6	10.5	2.00	20
Estimated	TP02	1.6 – 1.9	Sandy CLAY, medium plasticity	21.3	-	-	13
	TP06	0.2 – 0.5	Sandy CLAY, low plasticity	21.3	-	-	12
	TP17	1.7 – 1.9	Clayey SAND	18.8	-	-	17
	TP21	0.2 – 0.5	Sandy CLAY, medium plasticity	18.5	-	-	11

Notes: OMC – Optimum Moisture Content, MDD – Maximum Dry Density, CBR – Californian Bearing Ratio at 2.5 mm.

On this basis we recommend a conservative CBR value of 5% for Sandy CLAYS and 10% for Clayey SAND for the pavement design. If the subgrade is reworked and compacted a higher CBR can be achieved.

3.5 Other Considerations

3.5.1 Excavatability

Drilling resistance encountered in soil strength materials in the borehole was typically described as Easy Penetration (EP) in natural materials i.e. Sandy CLAY and Clayey GRAVEL. On this basis we expect that the materials encountered on-site could be excavated using conventional earthmoving machinery (i.e. excavators and dozers) as per the recommendations in Section 3.5.2 below. However, selection of plant and equipment will depend on the contractor's proposed methodology and reference should be made to the logs provided in Appendix 2.

3.5.2 Cuts and Batters

For temporary excavations up to 1.0 m we recommend adopting batter slopes no steeper than 2H: 1V (27°) in TOPSOIL and 1H: 1V (45°) in the Sandy CLAYS and Clayey GRAVEL. For long term stability of batter slopes, we recommend adopting batter slopes no steeper than 2H: 1V (27°) in TOPSOIL and 1.5H: 1V (33°) in Sandy CLAYS and Clayey GRAVEL. For deeper excavations further assessment by a Geotechnical Engineer will be required.

We recommend that loads are excluded from the area extending back from the excavation crest for a distance equal to the excavation depth. Further assessment would be required to justify adoption of steeper slope angles. Excavation stability should consider issues such as the excavation geometry, subsurface conditions, groundwater levels, surcharge loads, construction methodology and the consequence of instability.

All cuts and batters should be in line with the SafeWork Code of Practice Guidelines for Excavation Work (October 2018).

3.5.3 Stormwater Drainage

Stormwater management is expected to be an important factor during the construction. Care should be taken during construction to prevent water from washing out of the faces of the cuts and batters and ponding in the base of any open excavation. The ponding of water could result in softening of the soils, collapse and additional post construction settlement or soil movements.

4 References

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5 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Renascor Resources Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the General Conditions of Contract for Engagement of Consultants.

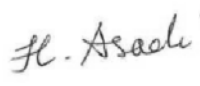
v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on 1800 136 436 if you require any further information.

Report prepared by

Rhys Matthews

Geotechnical Engineer



Hoda Asadi

Senior Geotechnical Engineer

Report reviewed by

Simon Foley, RPGeo

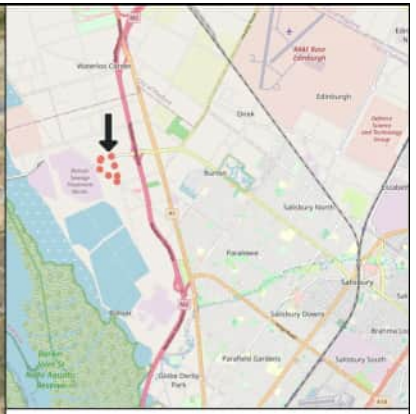
Associate Engineering Geologist

Tomasz Krawczynski, RPEQ

Associate Geotechnical Engineer

APPENDIX 1:

Geotechnical Investigation Location Plan



Legend

- Site Boundary
- Test Pit Locations
- Borehole Locations
- Cultural Heritage Exclusion Zone
- Electrical Resistivity Testing

0 50 m 100 m

Aerial imagery: Government for South Australia

ENGEO

Produced by **Datanest.earth**

Title: Investigation Location Plan		
Client: Renascor Resources		Figure No: 1 Size: A4
Project: Bolivar	Drawn: RAM	
Date: 14-09-2022	Checked: CL	
Proj No: 20651	Scale: 1:4500	Version: 01

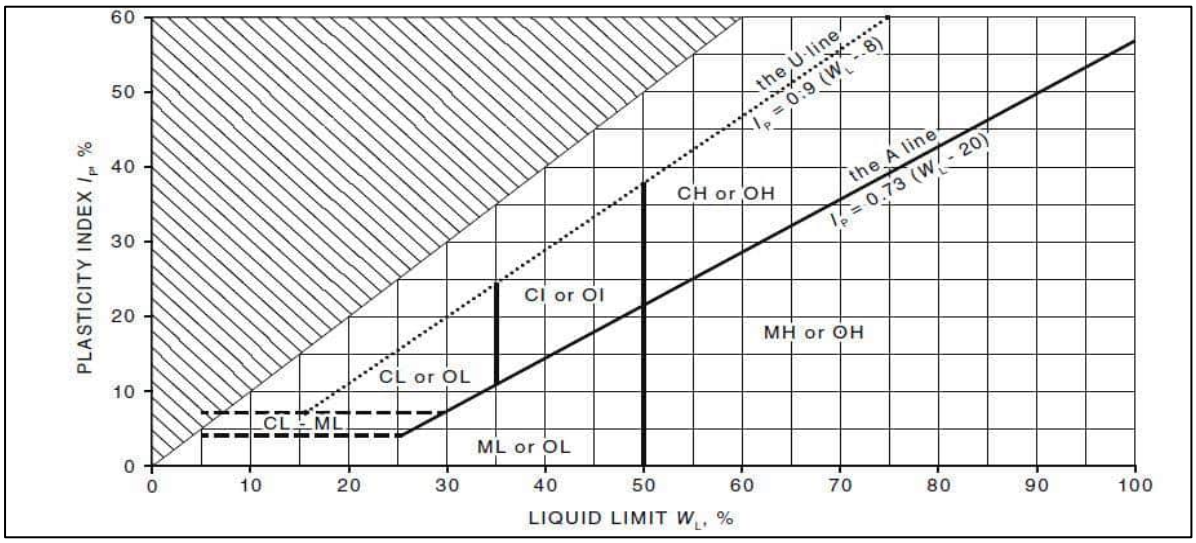
APPENDIX 2:
Geotechnical Logs

SYMBOLS AND ABBREVIATIONS USED ON GEOTECHNICAL LOGS

Abbreviation	Description	Abbreviation	Description
METHOD (SOIL DRILLING)		METHOD (ROCK DRILLING); core diameter (mm)	
NDD	Non Destructive Drilling	RR	Rock Roller
HA	Hand Auger	DDC	Diamond Drill Coring
HSA	Hollow Stem Auger	NMLC	Conventional 51.9 mm
SSA	Solid Stem Auger	NQ	Double Tube Wireline
VB	Steel “V” Auger Bit	NQ3	Triple Tube Wireline 45.1
TC	Tungsten Carbide Auger	HQ	Double Tube Wireline
WB	Wash Boring	HQ3	Triple Tube Wireline 61.1
AC	Aircore Soil Drilling	SON	Sonic Rock Drilling
METHOD (EXCAVATOR)		PENETRATION / RESISTANCE	
BB	Bladed Bucket	EP	Easy / Low Resistance
TB	Toothed Bucket	MP	Moderate Resistance
SUPPORT		DP	Difficult / High
CAS	Casing (Nominal)	PR	Practical Refusal
MUD	Drilling Mud Used	SAMPLES	
CAT	Casing Advancement Tool	ASS	Acid Sulfate Soil Sample
GROUNDWATER		B	Bulk
▽	At Depth Encountered	D	Disturbed
▼ 31/12/2022	At Depth Measured BGL	U50, U75, U100	Undisturbed 50, 75, 100
GNO	Not Observable	ES	Environmental Sample
GNE	Not Encountered	WS	Water Sample
IN SITU TESTS		*IN SITU* TESTS	
SPT	Standard Penetration	DCP	Dynamic Cone Penetrometer
N	SPT Penetration	PP	Pocket Penetrometer
rw	Rod Weight Only (SPT)	FSV	Field Shear Vane
hb	Hammer Bounce (SPT)	PID	Photoionisation Detector
ATV	Acoustic Televiewer	PM	Pressure Meter
OTV	Optical Televiewer	COT	Core Orientation Tool

Abbreviation	Description	Abbreviation	Description
SOIL PARTICLE SIZE RANGES (mm)		RELATIVE DENSITY (coarse grained, non-cohesive soils)	
Bo	Boulders (> 200)	VL	Very Loose
Co	Cobbles (63 – 200)	L	Loose
cGr	Coarse Gravel (19 – 63)	MD	Medium Dense
mGr	Medium Gravel (6.7 – 19)	D	Dense
fGr	Fine Gravel (2.36 – 6.7)	VD	Very Dense
cSa	Coarse Sand (0.6 – 2.36)	CONSISTENCY (fine grained, cohesive soils)	
mSa	Medium Sand (0.21 – 0.6)	VS	Very Soft
fSa	Fine Sand (0.075 – 0.21)	S	Soft
Si	Silt (0.002 – 0.075)	F	Firm
Cly	Clay (< 0.002)	St	Stiff
MOISTURE CONDITION (coarse grained, non-cohesive)		VSt	Very Stiff
M	Moist	H	Hard
D	Dry	Fr	Friable
W	Wet	PLASTICITY (Silts) Liquid Limit Range	
MOISTURE CONDITION (fine grained, cohesive soils)		Low Plasticity Silts	≤ 50
(M), w < PL	Moist, dry of plastic limit	High Plasticity Silts	>50
(M), $w \approx$ PL	Moist, near plastic limit	PLASTICITY (Clays) Liquid Limit Range	
(M), w > PL	Moist, wet of plastic limit	Low Plasticity Clays	≤ 35
(W), $w \approx$ LL	Wet, near liquid limit	Medium Plasticity Clays	> 35 and ≤ 50
(W), w > LL	Wet, wet of liquid limit	High Plasticity Clays	> 50
SOIL GROUP SYMBOL (Coarse Grained Soils)		SOIL GROUP SYMBOL (Fine Grained Soils)	
GW	Clean Gravel, Well Graded	ML	Inorganic Low Plasticity Silt
GP	Clean Gravel, Poorly Graded	CL	Inorganic Low Plasticity Clay
GM	Silty, Sandy Gravel	CI	Inorganic Med Plasticity Clay
GC	Clayey, sandy Gravel	OL	Organic Silt
SW	Clean Sand, Well Graded	MH	Inorganic Silt
SP	Clean Sand, Poorly Graded	CH	Inorganic High Plasticity Clay
SM	Sand Silt Mixtures	OH	Organic High Plasticity Clay
SC	Sand Clay Mixtures	Pt	Peat

Modified Casagrande Chart for Classifying Silts and Clays



Abbreviation	Description	Abbreviation	Description
ROCK DRILLING PARAMETERS		ROCK GRAIN SIZE (mm)	
TCR	Total Core Recovery	Coarse	>2
RQD	Rock Quality Designation	Medium	0.06 to 2
RMU	Rock Mass Unit	Fine	<0.06
WEATHERING / ALTERATION GRADE		INTACT ROCK STRENGTH ($Is_{(50)}$) range (MPa)	
RS	Residual Soil	VL	0.03 to 0.1
XW / XA	Extremely Weathered	L	0.1 to 0.3
HW / HA	Highly Weathered /	M	0.3 to 1
MW / MA	Moderately Weathered /	H	1 to 3
SW / SA	Slightly Weathered /	VH	3 to 10
FR	Fresh	EH	> 10
ROCK FABRICS		ROCK FABRIC (BED) SPACING (mm)	
LAM	Lamination	Thinly LAM	<6
BED	Bedding	Thickly LAM	6 to 20
FOL	Foliation / Cleavage	Very Thinly BED	20 to 60
LN	Lineation	Thinly BED	60 to 200
FLB	Flow Banding	Medium BED	200 to 600
		Thickly BED	600 to 2000
		Very Thickly BED	> 2000

Abbreviation	Description	Abbreviation	Description
ROCK DEFECTS		DEFECT SPACING range (mm)	
J, Js	Joint, Joints	EC	Extremely Close (< 20)
SS	Sheared Surface	VC	Very Close (20 to 60)
SZ	Sheared Zone	C	Close (60 to 200)
Ss	Sheared Seam	M	Medium (200 to 600)
Cs	Crushed Seam	W	Wide (600 to 2000)
Is	Infilled Seam (Generally)	VW	Very Wide (> 2000)
Xs	Extremely Weathered	DEFECT SURFACE ROUGHNESS	
BP	Bedding Parting	Vro	Very rough
LP	Lamination Parting	Ro	Rough
FP	Foliation / Cleavage	Sm	Smooth
IF	Induced Fracture	Po	Polished
DEFECT APERTURE		Sl	Slickensided
OP	Open	DEFECT INFILL	
FL	Filled	Cn	Clean
TI	Tight	Std	Stained
HD	Healed (cemented)	Vr	Veneer
		Ct	Coating
ANGLE OF INCIDENCE (to the horizontal)		Vn	Vein
0° to 15°	Sub horizontal		
15° to 30°	Gentle	INSTRUMENTATION	
30° to 45°	Moderate	SPP	Standpipe Piezometer
45° to 60°	Steep	VWP	Vibrating Wire Piezometer
60° to 75°	Very Steep	INC	Inclinometer
75° to 90°	Sub vertical	EXT	Extensometer

BOREHOLE: BH01

SHEET: 1 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277300.0 m 6153667.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 17/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	EP	17/11/22 09:30	0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M		
								Cl	Sandy CLAY medium plasticity, orange red brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel	w < PL		0.20-3.00 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)
			1		ES 0.70-0.80 m SPT 1.00-1.45 m 1, 2, 3 N=5 PP 1.20 m =220 kPa ES 1.50-1.60 m					w ~ PL		
				1.70				CL	Sandy CLAY low plasticity, grey brown, fine to coarse grained sand, with lenses of clayey sand	w > PL	St	
			2		SPT 2.50-2.95 m 4, 5, 5 N=10 PP 2.70 m =225 kPa							
			3	3.00	PP 2.90 m =225 kPa			Cl	Gravelly CLAY medium plasticity, orange brown, fine to coarse grained, sub-rounded to sub-angular calcareous gravel, with fine to coarse grained sand			3.00-3.40 m: Glanville Formation
				3.40				CH	CLAY high plasticity, orange brown, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded, calcareous gravel			3.40-21.70 m: Hindmarsh Clay Formation
			4		PP 3.50 m =450 kPa PP 3.80 m =400 kPa SPT 4.00-4.45 m 5, 8, 9 N=17							
				4.50				CL	CLAY low plasticity, mottled orange-brown and grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel			
			5		PP 4.80 m =410 kPa PP 5.20 m =410 kPa PP 5.40 m =430 kPa SPT 5.50-5.95 m 3, 5, 8 N=13 PP 5.60 m =450 kPa					w < PL	VSt	
				6.00	PP 5.90 m =450 kPa			Cl-CH	Sandy CLAY medium to high plasticity, mottled orange-brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded, calcareous gravel			
	MP		6		PP 6.20 m =420 kPa PP 6.50 m =420 kPa							
			7		SPT 7.00-7.45 m 5, 6, 10 N=16 PP 7.00 m =400 kPa							
				7.80				SC	Clayey SAND fine to coarse grained, mottled orange-brown and grey, medium plasticity clay, trace fine to coarse grained, sub-rounded to sub-angular gravel	M	MD	
			8	8.50				Cl-CH	Sandy CLAY medium to high plasticity, orange brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel			
					SPT 8.50-8.95 m 6, 8, 9 N=17 PP 8.50 m =200 kPa					w < PL	VSt	
			9		PP 9.30 m =300 kPa PP 9.50 m =300 kPa							
			10	10.00	PP 9.80 m =200 kPa							

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

BOREHOLE: BH01

SHEET: 2 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277300.0 m 6153667.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 17/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP		10		SPT 10.00-10.45 m 8, 12, 18 N=30 PP 10.20 m =420 kPa PP 10.40 m =420 kPa			CH	CLAY high plasticity, orange brown and grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel			3.40-21.70 m: Hindmarsh Clay Formation
			11		PP 10.80 m =450 kPa PP 11.20 m =450 kPa PP 11.40 m =450 kPa SPT 11.50-11.95 m 7, 14, 14 N=28							
			12	12.00	PP 12.20 m =600 kPa PP 12.50 m =400 kPa PP 12.60 m =450 kPa PP 12.80 m =600 kPa			CI	Gravelly CLAY medium plasticity, mottled orange brown and pale grey, fine to coarse grained, sub-rounded to rounded calcareous gravel			
			13	12.90	PP 12.90 m =600 kPa SPT 13.50-13.95 m 9, 14, 16 N=30 PP 13.50 m =600 kPa			CH	CLAY high plasticity, mottled orange brown and pale grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded to rounded, calcareous gravel			
			14	14.00	PP 13.80 m =600 kPa U50 14.00-14.50 m SPT 14.50-14.95 m 9, 16, 26 N=42			CI-CH	Sandy CLAY medium to high plasticity, mottled orange brown and pale grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to rounded, calcareous gravel	w < PL	H	
			15									
			16	16.00	SPT 16.00-16.45 m 8, 15, 20 N=35			CH	CLAY high plasticity, mottled orange brown and pale grey, with fine to medium coarse sand			
				16.50				CH	Sandy CLAY high plasticity, mottled orange-brown and grey, fine to medium grained sand, with fine to coarse grained, sub-rounded to rounded gravel			
			17	17.50	SPT 17.50-17.95 m 10, 18, 22 N=40 PP 17.80 m =500 kPa PP 17.90 m =500 kPa			CH	CLAY high plasticity, orange brown and grey, trace fine to coarse grained sand			
			18	18.00				CI-CH	Sandy Gravelly CLAY medium to high plasticity, orange brown and grey, fine to coarse grained, sub-rounded to rounded gravel, fine to coarse grained sand			
			19	19.00	SPT 19.00-19.45 m 8, 14, 19 N=33 PP 19.30 m =500 kPa PP 19.40 m =500 kPa			CI-CH	Sandy CLAY medium to high plasticity, orange brown and grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to rounded gravel			
				19.45					No Recovery (19.45 - 20.50 m)			
			20									

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It has been prepared for geotechnical purposes only.

BOREHOLE: BH01

SHEET: 3 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277300.0 m 6153667.0 m MGA2020 Z54
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 17/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			20						No Recovery (19.45 - 20.50 m)			3.40-21.70 m: Hindmarsh Clay Formation
				20.50								
					SPT 20.50-20.95 m 6, 11, 17 N=28			CI	Sandy CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained sand	w < PL	H	
		▽	21									
				21.70				SC	Clayey SAND fine to coarse grained, orange brown and grey, low plasticity clay, trace fine to coarse grained, sub-rounded gravel			21.70-25.00 m: Carisbrooke Sand Formation
				22.00								
HSA	MP		22		SPT 22.00-22.45 m 4, 8, 18 N=26			SP	SAND fine to coarse grained, grey, with low plasticity clay			
			23							W	MD	
					SPT 23.50-23.95 m 7, 10, 12 N=22							
			24									
			25						END OF BOREHOLE @ 25.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 1.50 m DEPTH BACKFILLED			
			26									
			27									
			28									
			29									
			30									

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BOREHOLE: BH02

SHEET: 1 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277502.0 m 6153527.0 m MGA2020 Z54
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 23/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	EP		0	0.20				CI	TOPSOIL: Sandy CLAY medium plasticity, dark grey, fine to coarse grained sand, trace rootlets	M		
								CI	Gravelly Sandy CLAY medium plasticity, orange brown, fine to medium grained sand, fine to coarse grained, sub-rounded to sub-angular calcareous gravel, with fine to coarse grained, sub-rounded gravel		St	0.20-3.90 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)
			1	1.00	SPT 1.00-1.45 m 2, 3, 4 N=7 PP 1.40 m =280 kPa			CI	Sandy CLAY medium plasticity, mottled orange-brown, fine to medium grained sand	w < PL		
			2	2.20	BH02-E04 ES 2.10-2.20 m			CL-CI	Sandy CLAY low to medium plasticity, grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded, calcareous gravel	w ~ PL		
		21/11/22 09:30			SPT 2.50-2.95 m 3, 5, 6 N=11							
			3	3.00	PP 2.95 m =375 kPa				red brown, increased sand content		VSt	
				3.90								
			4		SPT 4.00-4.45 m 4, 6, 8 N=14 PP 4.45 m =375 kPa			CI-CH	CLAY medium to high plasticity, mottled orange, brown, grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel	w < PL		3.90-19.00 m: Hindmarsh Clay Formation
			5									
	MP			5.50	SPT 5.50-5.95 m 1, 7, 10 N=17			SP	SAND fine to coarse grained, pale grey orange brown, with low plasticity clay	M	MD	
			6	6.00				GP	Gravelly SAND fine to coarse grained, orange brown, fine to coarse grained, sub-rounded to sub-angular gravel, with low plasticity clay			
				6.40	PP 6.50 m >600 kPa PP 6.70 m >600 kPa			CH	CLAY high plasticity, mottled brown grey orange, trace fine to coarse grained, sub-rounded to sub-angular gravel, trace fine to coarse grained sand			
			7		SPT 7.00-7.45 m 4, 9, 12 N=21 PP 7.00 m >600 kPa							
			8	8.00					with fine to coarse grained, sub-rounded to sub-angular calcareous gravel	w < PL	H	
					SPT 8.50-8.95 m 5, 9, 12 N=21 PP 8.50 m =480 kPa							
			9	9.20				CI-CH	Sandy CLAY medium to high plasticity, orange, brown, grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel			
					PP 9.50 m =475 kPa							
			10									

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BOREHOLE: BH02

SHEET: 2 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277502.0 m 6153527.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 23/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP	▽	10		PP 10.00 m =475 kPa			CI-CH	Sandy CLAY medium to high plasticity, orange, brown, grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel			3.90-19.00 m: Hindmarsh Clay Formation
			11		SPT 11.00-11.45 m 5, 8, 13 N=21					w < PL	H	
				11.50	PP 11.40 m >600 kPa SPT 11.50-11.95 m 8, 15, 17 N=32 PP 11.50 m =480 kPa			CI	CLAY medium plasticity, orange, brown, grey, with fine to coarse grained sand, trace fine to medium grained, sub-rounded gravel			
			12	12.20				GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, red brown grey, low plasticity clay	M	MD	
				12.50				CI				
								CI-CH	Sandy Gravelly CLAY medium plasticity, orange mottled brown grey, fine to coarse grained, sub-rounded to sub-angular calcareous gravel, fine to coarse grained sand	w < PL	H	
			13		PP 12.90 m >600 kPa SPT 13.00-13.45 m 13, 14, 15 N=29				Sandy CLAY medium to high plasticity, orange mottled brown grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel			
				13.50	PP 13.30 m >600 kPa				No Recovery (13.50 - 14.50 m)			
			14	14.50	SPT 14.50-14.95 m 11, 22, 24 N=46			CH	Sandy CLAY high plasticity, mottled orange, brown, grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded calcareous gravel			
			15	15.20				CH	CLAY high plasticity, mottled orange, brown, grey, trace fine to coarse grained, sub-rounded calcareous gravel, with fine to coarse grained sand			
			16		SPT 16.00-16.45 m 7, 7, 12 N=19					w < PL	H	
			17	17.50	SPT 17.50-17.95 m 5, 9, 14 N=23			CH	Sandy CLAY high plasticity, mottled orange, brown, grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded calcareous gravel			
			18									
		▽	19	19.00	SPT 19.00-19.45 m 7, 12, 10 N=22			SC	Clayey SAND fine to coarse grained, grey, low plasticity clay	W	VSt	19.00-25.00 m: Carisbrooke Sand Formation
				19.20				CI	Sandy CLAY medium plasticity, mottled orange, brown, grey, fine to coarse grained sand	w ~ PL		
				19.45					No Recovery (19.45 - 20.50 m)			
			20									

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BOREHOLE: BH02

SHEET: 3 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277502.0 m 6153527.0 m MGA2020 Z54
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 23/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP		20						No Recovery (19.45 - 20.50 m)			19.00-25.00 m: Carisbrooke Sand Formation
				20.50	SPT 20.50-20.95 m 8, 12, 11 N=23			SP	SAND fine to coarse grained, brown grey, trace low plasticity clay			
			21	21.00					brown	M	MD	
			22	22.00					No Recovery (22.00 - 23.00 m)			
			23	23.00				SP	SAND fine to coarse grained, brown, with low plasticity clay			
				23.80	SPT 23.50-23.95 m 3, 14, 17 N=31				with fine to coarse grained, sub-rounded to sub-angular calcareous gravel	M	D	
			24	24.00					reduced gravel content			
			25						END OF BOREHOLE @ 25.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 2.50 m DEPTH BACKFILLED			
			26									
			27									
			28									
			29									
			30									

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BOREHOLE: BH03

SHEET: 1 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277157.0 m 6153547.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 15/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	EP	15/11/22 09:30	0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M		
								CI	Sandy CLAY medium plasticity, orange red brown, fine to coarse grained sand	w < PL	F	0.20-4.00 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)
			1		SPT 1.00-1.45 m 1, 2, 2 N=4 PP 1.20 m =50 kPa PP 1.50 m =75 kPa							
			2	2.10	PP 1.90 m =150 kPa					w ~ PL	St	
				2.30	PP 2.30 m =200 kPa			SC	Clayey SAND fine to coarse grained, red and brown, low plasticity clay, trace fine to coarse grained, sub-rounded gravel	W	MD	
					SPT 2.50-2.95 m 3, 3, 3 N=6			CI	Sandy CLAY medium plasticity, mottled orange brown, fine to coarse grained sand	w < PL	St - VS	
			3	3.00					No Recovery (3.00 - 4.00 m)			
				4.00								
			4		SPT 4.00-4.45 m 2, 3, 5 N=8			CI	Sandy Gravelly CLAY medium plasticity, orange brown, fine to coarse grained, rounded to sub-rounded gravel, fine to coarse grained sand	w < PL	VSt	4.00-25.00 m: Hindmarsh Clay Formation
			5	5.20				CI	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel			
					SPT 5.50-5.95 m 0(HW), 2, 5 N=7							
				5.90				SP	SAND fine to coarse grained, orange brown grey, trace fine to coarse grained, sub-rounded to sub-angular gravel, trace low plasticity clay	M	MD	
			6	6.30				SP	No Recovery (6.00 - 6.30 m)			
	MP								SAND fine to coarse grained, orange brown grey, with fine to coarse grained, sub- angular to sub-rounded gravel, with low plasticity clay	M	MD	
			7		SPT 7.00-7.45 m 8, 7, 10 N=17							
				7.45					No Recovery (7.45 - 8.50 m)			
			8	8.50								
					SPT 8.50-8.95 m 10, 17, 20 N=37			SP	Gravelly SAND fine to coarse grained, orange brown grey, fine to coarse grained, sub- angular to sub-rounded gravel, trace low plasticity clay	M	D	
			9	9.00					No Recovery (9.00 - 10.00 m)			
			10	10.00								

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BOREHOLE: BH03

SHEET: 2 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277157.0 m 6153547.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 15/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP	▽	10	10.45	SPT 10.00-10.45 m 13, 15, 20 N=35			SP	Gravelly SAND fine to coarse grained, orange brown grey, fine to coarse grained, sub- angular to sub-rounded gravel	M	D	4.00-25.00 m: Hindmarsh Clay Formation
			11	11.50					No Recovery (10.45 - 11.50 m)			
				12.00	SPT 11.50-11.95 m 12, 15, 20 N=35 PP 11.80 m =600 kPa			CH	CLAY high plasticity, mottled orange-brown and grey, trace fine to coarse grained, sub-angular to sub-rounded gravel, trace fine to coarse grained sand			
			12					CI-CH	CLAY medium to high plasticity, mottled red orange-brown and grey, with fine to coarse grained sand, with fine to coarse grained, sub-angular gravel			
			13		SPT 13.00-13.45 m 5, 5, 7 N=12 PP 13.20 m =300 kPa PP 13.40 m =300 kPa PP 13.60 m =300 kPa PP 13.80 m =450 kPa					w < PL	VSt - H	
			14		PP 14.00 m =450 kPa PP 14.10 m =300 kPa PP 14.40 m =250 kPa U50 14.50-15.00 m							
			15	15.20	SPT 15.00-15.45 m 22, 27, 29 N=56 PP 15.30 m =300 kPa PP 15.50 m =350 kPa			GC CI-CH	Clayey GRAVEL fine to medium grained, rounded, orange brown and grey, low plasticity clay, with fine to coarse grained sand CLAY medium to high plasticity, orange brown and grey, with fine to coarse grained sand, trace fine to coarse grained, rounded gravel	M	MD	
			16		PP 15.80 m =450 kPa PP 16.20 m =450 kPa							
				16.50	PP 16.50 m =350 kPa PP 16.80 m =350 kPa			CI-CH	Sandy CLAY medium to high plasticity, orange brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel		VSt - H	
			17	17.00	PP 17.10 m =450 kPa PP 17.40 m =400 kPa SPT 17.50-17.95 m 22, 32, 20 N=52 PP 17.60 m =450 kPa			CH	CLAY high plasticity, orange brown red, trace fine to coarse grained sand			
			18	18.00	PP 17.80 m =400 kPa			SC	Clayey SAND fine to coarse grained, orange brown, low plasticity clay, trace fine to coarse grained, sub-rounded gravel	M	MD	
				18.80				CH	CLAY high plasticity, orange brown grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel			
			19		SPT 19.00-19.45 m 7, 12, 18 N=30					w < PL	H	
			20									

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BOREHOLE: BH03

SHEET: 3 OF 3

CLIENT: Renascor Resources
DRILL RIG: Investigator Mk5

PROJECT: BAM Project
COORDS: 277157.0 m 6153547.0 m MGA2020 Z54
CONTRACTOR: Beyond Drillling

LOCATION: Bolivar
INCLINATION: -90°
LOGGED: DP DATE: 15/11/22

JOB NO: 20651.000.001
HOLE DEPTH: 25.00 m
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP		20					CH	CLAY high plasticity, orange brown grey, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel			4.00-25.00 m: Hindmarsh Clay Formation
			21		SPT 20.50-20.95 m 6, 12, 15 N=27							
			22		SPT 22.00-22.45 m 8, 15, 17 N=32							
				22.50				CI-CH	Sandy CLAY medium to high plasticity, orange brown and grey, fine to coarse grained sand, trace fine to medium grained, sub-rounded to sub-angular gravel	w < PL	H	
			23									
			24									
			25						END OF BOREHOLE @ 25.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 2.20 m DEPTH BACKFILLED			
			26									
			27									
			28									
			29									
			30									

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BOREHOLE: BH04

SHEET: 1 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277417.0 m 6153430.0 m MGA2020 Z54
SURFACE RL: DATUM:
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 22/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
SSA			0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M		
								Cl	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded gravel	w < PL		0.20-4.00 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)
				0.80								
	EP		1		SPT 1.00-1.45 m 1, 2, 3 N=5			CL-Cl	Sandy CLAY low to medium plasticity, mottled orange-brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel	w ~ PL	St	
		22/11/22 09:30	2									
				2.50								
			3		SPT 2.50-2.95 m 3, 3, 3 N=6 PP 2.90 m =300 kPa			Cl	Sandy CLAY medium plasticity, brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel			
				4.00								
			4		SPT 4.00-4.45 m 5, 7, 7 N=14 PP 4.50 m =390 kPa BH04-E05 ES 4.80-4.90 m			Cl-CH	CLAY medium to high plasticity, mottled orange brown, with fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel		VSt	4.00-20.50 m: Hindmarsh Clay Formation
			5									
				5.50								
HSA	MP		6		SPT 5.50-5.95 m 4, 8, 11 N=19 PP 5.50 m >600 kPa			CH	CLAY high plasticity, mottled brown grey, trace fine to medium grained sand	w < PL		
				6.00				Cl	Sandy CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel			
				6.70				Cl	Gravelly CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained, sub-rounded to sub-angular calcareous gravel			
			7		PP 6.90 m =450 kPa SPT 7.00-7.45 m 4, 7, 8 N=15							
				7.50	PP 7.50 m =550 kPa			Cl	Sandy CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel		VSt - H	
			8	8.00					lens of Clayey GRAVEL			
								Cl	Sandy CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel			
					SPT 8.50-8.95 m 6, 9, 12 N=21							
			9									
			10									

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BOREHOLE: BH04

SHEET: 2 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277417.0 m 6153430.0 m MGA2020 Z54
SURFACE RL: DATUM:
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 22/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HSA	MP		10		PP 9.90 m =400 kPa SPT 10.00-10.45 m 9, 17, 22 N=39 PP 10.00 m =380 kPa			CI	Sandy CLAY medium plasticity, mottled orange-brown and grey, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel			4.00-20.50 m: Hindmarsh Clay Formation
			11	11.00				CH	CLAY high plasticity, mottled orange-brown and grey, with fine to coarse grained, sub-rounded to sub-angular calcareous gravel, with fine to coarse grained sand	w < PL	H	
					SPT 11.50-11.95 m 5, 9, 13 N=22							
				11.90	PP 11.80 m >600 kPa							
			12					GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, mottled orange-brown and grey black, low plasticity clay	M	D	
				12.50					No Recovery (12.00 - 12.50 m)			
				12.70				GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, orange brown and grey, low plasticity clay, trace fine to coarse grained sand	M	D	
				13.00				CI				
			13		SPT 13.00-13.45 m 8, 20, 25 N=45			CH	Gravelly CLAY medium plasticity, orange brown and grey, fine to coarse grained, sub-rounded to sub-angular calcareous gravel, with fine to coarse grained sand		H	
				13.50	PP 13.50 m >600 kPa			CI	CLAY high plasticity, orange brown and grey, trace fine to coarse grained sand		VSt	
				14.00				CH	Sandy CLAY medium plasticity, orange brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel	w < PL		
			14		SPT 14.50-14.95 m 5, 7, 11 N=18				CLAY high plasticity, orange brown and grey, trace fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel			
			15		PP 14.90 m >600 kPa						H	
				15.90				SC	Clayey SAND fine to coarse grained, orange brown and grey, medium plasticity clay	M	MD	
			16	16.20	SPT 16.00-16.45 m 4, 11, 15 N=26			CH	No Recovery (16.00 - 16.20 m)	w < PL	VSt	
				16.50				SC	Sandy CLAY high plasticity, orange brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular calcareous gravel, with calcareous nodules			
			17						Clayey SAND fine to coarse grained, orange brown and grey, medium plasticity clay	M	MD	
				17.50	SPT 17.50-17.95 m 5, 7, 10 N=17			CL	Sandy CLAY low plasticity, orange brown and grey, fine to coarse grained sand			
				18.00				CI	Sandy CLAY medium plasticity, orange brown and grey, fine to coarse grained sand			
			18		PP 18.10 m =450 kPa							
					PP 18.50 m =480 kPa					w < PL	VSt	
			19		PP 18.90 m =450 kPa SPT 19.00-19.45 m 7, 8, 11 N=19							
				19.50	PP 19.50 m =550 kPa				No Recovery (19.50 - 20.50 m)			
			20									

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BOREHOLE: BH04

SHEET: 3 OF 3

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277417.0 m 6153430.0 m MGA2020 Z54
SURFACE RL: DATUM:
INCLINATION: -90°
HOLE DEPTH: 25.00 m

DRILL RIG: Investigator Mk5
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 22/11/22
CHECKED: RAM DATE: 5/12/22

Drilling					Sampling		Field Material Description					
METHOD / SUPPORT	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			20						No Recovery (19.50 - 20.50 m)			4.00-20.50 m: Hindmarsh Clay Formation
		▽		20.50	SPT 20.50-20.95 m 4, 9, 15 N=24			SC	Clayey SAND fine to coarse grained, orange brown and grey, low plasticity clay	W	MD	20.50-25.00 m: Carisbrooke Sand Formation
			21	21.00					No Recovery (21.00 - 22.00 m)			
			22	22.00	SPT 22.00-22.45 m 5, 18, 26 N=44			SC	Clayey SAND fine to coarse grained, grey, low plasticity clay	W	D	
HSA	MP			22.40 22.50				SP	Gravelly SAND fine to coarse grained, pale orange grey, fine to coarse grained, sub-rounded to sub-angular gravel			
			23						No Recovery (22.50 - 23.50 m)			
				23.50	SPT 23.50-23.95 m 12, 20, 25 N=45			SP	SAND fine to coarse grained, brown, trace fine to coarse grained, sub-rounded gravel	W	D	
			24		SPT 24.50-24.95 m 14, 22, 24 N=46							
			25						END OF BOREHOLE @ 25.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 1.50 m DEPTH BACKFILLED			
			26									
			27									
			28									
			29									
			30									

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TEST PIT: TP01

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277208.2 m 6153660.2 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 09:30	0.0	0.15	TP01-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
			0.5					CL-CI	Sandy CLAY low to medium plasticity, red-orange brown, fine to coarse grained sand	w < PL	St	0.15-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0							w ~ PL			
			1.5	1.70	TP01-B02 1.70-1.90 m			CL	Sandy CLAY low plasticity, brown, fine to coarse grained sand, with lenses of clayey sand	w > PL	VSt		
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

Photographs

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TEST PIT: TP02

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277198.1 m 6153601.1 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 14:00	0.0	0.15	TP02-B01 0.20-0.50 m			SP	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	D			0 3 6 9 12 15
			0.5					Cl	Sandy CLAY medium plasticity, red and orange brown, fine to coarse grained sand	w < PL	St	0.15-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0							w ~ PL			
			1.5	1.60	TP02-B02 1.60-1.90 m			CL	Sandy CLAY low plasticity, grey- brown, fine to coarse grained sand, with lenses of sandy clay	w > PL			
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				
			2.5										
			3.0										

Photographs

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TEST PIT: TP03

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277199.0 m 6153520.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 14:30	0.0	0.15	TP03-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5					Cl-CH	Sandy CLAY medium to high plasticity, orange and red brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	F - St	0.15-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0								St		
			1.5	1.60						w ~ PL	St - VSt		Practical Refusal
					TP03-B02 1.70-1.90 m			CL	Gravelly CLAY low plasticity, pale grey brown, fine to coarse grained, rounded, calcareous gravel, with fine to coarse grained sand	w > PL	H	1.60-2.00 m: Glanville Formation	
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

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TEST PIT: TP04

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277289.2 m 6153475.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 15:45	0.0	0.20	TP04-ASS1 0.10-0.20 m TP04-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, tarce rootlets	M			
			0.5	0.80				CI	Sandy CLAY medium plasticity, red brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.20-0.80 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0		TP04-B02 0.80-1.10 m			GC / CL	Clayey GRAVEL / Gravelly CLAY fine to coarse grained, rounded, calcareous, low plasticity clay, trace fine to coarse grained sand	M	MD	0.80-2.00 m: Glanville Formation	
			1.5							W	D		Practical Refusal
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.20 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP05

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277304.8 m 6153591.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 13:30	0.0	0.15	TP05-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
								Cl	Sandy CLAY medium plasticity, orange brown to red, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.15-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			0.5										
			1.0							w ~ PL			
			1.5	1.70	TP05-B02 1.70-2.00 m			CL	Sandy CLAY low plasticity, grey brown, fine to coarse grained sand, trace lenses of clayey sand	w > PL	VSt		Practical Refusal
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				
			2.5										
			3.0										

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
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TEST PIT: TP06

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277298.5 m 6153528.8 m MGA2020 Z54
PIT DEPTH: 1.80 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 15:00	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
					TP06-B01 0.20-0.50 m			CI	Sandy CLAY medium plasticity, brown to red, fine to coarse grained sand, with fine to coarse grained, rounded gravel	w < PL	St	0.20-0.70 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			0.5	0.70	TP06-B02 0.70-1.00 m			GC / CL	Clayey GRAVEL / Gravelly CLAY fine to coarse grained, rounded, pale grey brown, low plasticity clay, with fine to coarse grained sand	W	D	0.70-1.80 m: Glanville Formation	Practical Refusal
			1.0										
			1.5										
			2.0						TEST PIT DISCONTINUED @ 1.80 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.20 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
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TEST PIT: TP07

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277392.8 m 6153539.8 m MGA2020 Z54
PIT DEPTH: 1.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 0800	0.0	0.20	TP07-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
			0.5	0.80				CI	Sandy CLAY medium plasticity, red brown, fine to coarse grained sand	w < PL	St	0.20-0.75 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	PR
					TP07-B02 0.75-1.00 m			GC / CL	Clayey GRAVEL / Gravelly CLAY fine to coarse grained, rounded, calcareous, red brown, low plasticity clay, with fine to coarse grained sand	W	D	0.75-1.00 m: Glanville Formation	
			1.0						TEST PIT DISCONTINUED @ 1.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.90 m DEPTH BACKFILLED				
			1.5										
			2.0										
			2.5										
			3.0										

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP08

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277397.0 m 6153489.0 m MGA2020 Z54
PIT DEPTH: 2.30 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 08:15	0.0					SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
				0.30	TP08-B01 0.30-0.60 m TP08-ASS2 0.40-0.50 m			CI	Sandy CLAY medium plasticity, red, brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded gravel	w < PL w ~ PL	St	0.30-0.90 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS) 0.30 m: Thermal Resistivity = 2.044 mK/W	
			0.5	0.90				CL-CI	Gravelly Sandy CLAY low to medium plasticity, orange brown mottled grey, fine to coarse grained sand, fine to coarse grained, sub-rounded gravel	w > PL	H	0.90-2.30 m: Glanville Formation	Practical Refusal
			1.0		TP08-B02 1.00-1.30 m								
			1.5										
			2.0										
			2.5						TEST PIT DISCONTINUED @ 2.30 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.90 m DEPTH BACKFILLED				
			3.0										

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
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TEST PIT: TP09

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277380.6 m 6153397.8 m MGA2020 Z54
PIT DEPTH: 3.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 08:30	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5		TP09-B01 0.20-0.60 m			CI	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded to rounded gravel	w < PL w ~ PL	St	0.20-0.80 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
				0.80									
			1.0		TP09-B02 0.80-1.20 m			GC / CL	Clayey GRAVEL / Gravelly CLAY fine to coarse grained, rounded, calcareous, red brown, low plasticity clay, with fine to coarse grained sand		MD	0.80-3.00 m: Glanville Formation	
			1.5										Practical Refusal
			2.0							W	D		
			2.5						TEST PIT DISCONTINUED @ 3.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.80 m DEPTH BACKFILLED				
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
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TEST PIT: TP10

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277436.0 m 6153378.0 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 08:45	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5					CI	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand	w < PL w ~ PL	St	0.20-1.50 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
			1.0	0.90	TP10-B01 0.90-1.20 m			CL-CI	Sandy CLAY low to medium plasticity, orange brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel	w > PL	VSt		
			1.5	1.50	TP10-B02 1.50-1.90 m			SP	Gravelly SAND fine to coarse grained, mottled pale brown orange and grey, fine to coarse grained, sub-rounded to sub-angular, calcareous gravel	W	D	1.50-2.00 m: Glanville Formation	Practical Refusal
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.70 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

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TEST PIT: TP11

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277480.1 m 6153407.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 09:00	0.0					SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
				0.30	TP11-B01 0.20-0.60 m HV 0.50 m s_v=130 kPa			CI	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded to sub-angular gravel	w < PL w ~ PL	St	0.30-2.00 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
			0.5	0.80	TP11-ASS5 0.80-0.90 m TP11-B02 0.90-1.10 m			CL-CI	Sandy CLAY low to medium plasticity, mottled orange grey and brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel	w > PL	VSt - H		Practical Refusal
			1.0										
			1.5										
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.70 m DEPTH BACKFILLED				
			2.5										
			3.0										

Photographs

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TEST PIT: TP12

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277489.0 m 6153457.0 m MGA2020 Z54
PIT DEPTH: 2.30 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 09:15	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5	0.60	TP12-B01 0.20-0.60 m			CI-CH	Sandy CLAY medium to high plasticity, orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded gravel	w < PL	St	0.20-1.80 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
					TP12-B02 0.60-0.90 m			CL-CI	Sandy CLAY low to medium plasticity, orange brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel	w ~ PL			
			1.0							w > PL			
			1.5	1.80							VSt		
			2.0		TP12-ASS4 1.80-1.90 m			SC	Clayey SAND fine to coarse grained, pale brown grey, low plasticity clay	M	D	1.80-2.30 m: Glanville Formation	
			2.5						TEST PIT DISCONTINUED @ 2.30 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.70 m DEPTH BACKFILLED				
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
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TEST PIT: TP13

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277592.0 m 6153295.0 m MGA2020 Z54
PIT DEPTH: 2.80 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 09:30	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5		TP013-B01 0.20-0.60 m			Cl	Gravelly CLAY medium plasticity, orange brown, fine to coarse grained, sub-rounded to rounded, calcareous gravel	w < PL w ~ PL	St VSt	0.20-2.80 m: Glanville Formation	
			1.0	0.90	TP13-B02 0.90-1.20 m			Cl	Sandy CLAY medium plasticity, grey brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel	w > PL	H		Practical Refusal
			1.5										
			2.0										
			2.5						TEST PIT DISCONTINUED @ 2.80 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.60 m DEPTH BACKFILLED				
			3.0										

0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP14

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277574.0 m 6153344.0 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 09:45	0.0	0.20	TP14-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
				0.50	TP14-B02 0.50-0.90 m			CI	Gravelly CLAY medium plasticity, orange brown, fine to coarse grained, sub-rounded to rounded gravel	w < PL	St	0.20-2.00 m: Glanville Formation	
			0.5					SP	Gravelly SAND fine to coarse grained, orange brown, fine to coarse grained, sub-rounded to rounded gravel	M	MD		
			1.0										Practical Refusal
			1.5							W	D		
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 0.7 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP15

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277581.4 m 6153399.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 10:00	0.0	0.20	TP15-B01 0.20-0.60 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5					CI	CLAY medium plasticity, pale brown, with fine to coarse grained sand, with fine to coarse grained, sub-rounded gravel	w < PL	St	0.20-2.00 m: Glanville Formation	
			1.0	1.20	TP15-B02 1.20-1.50 m			SC	Clayey SAND fine to coarse grained, mottled orange grey and brown, low plasticity clay	w ~ PL / W	D		Practical Refusal
			1.5										
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.20 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP16

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277640.3 m 6153204.8 m MGA2020 Z54
PIT DEPTH: 2.40 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 10:15	0.0	0.20	TP16-B01 0.20-0.60 m			SM	Silty SAND fine to coarse grained, brown, trace rootlets	M			
				0.50				CI	Sandy CLAY medium plasticity, red orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded to rounded gravel		St	0.20-2.40 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
			0.5						brown	w < PL			
			1.0										
			1.5	1.70						w ~ PL	H		
									mottled orange grey and brown	w > PL			
			2.0										
			2.5						TEST PIT DISCONTINUED @ 2.40 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Practical Refusal

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP17

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277248.8 m 6153682.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 10:15	0.0	0.10	TP17-B01 0.10-0.40 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
								CI	Sandy CLAY medium plasticity, red and orange brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.10-1.70 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			0.5										
			1.0										
			1.5							w ~ PL	VSt		
				1.70	TP17-B02 1.70-1.90 m			SC	Clayey SAND fine to coarse grained, brown, low plasticity clay	W	MD - D	1.70-2.00 m: Glanville Formation	
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP18

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277552.3 m 6153336.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 10:30	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5		TP18-B01 0.20-0.50 m			CI-CH	Sandy CLAY medium to high plasticity, orange brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.20-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0							w ~ PL			
			1.5	1.60							VSt		
					TP18-B02 1.60-1.90 m			CL	Sandy CLAY low plasticity, grey brown, fine to coasre grained sand, trace lenses of clayey sand	w > PL	H		
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.60 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP19

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277581.4 m 6153399.8 m MGA2020 Z54
PIT DEPTH: 2.10 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 13:00	0.0					SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			0 3 6 9 12 15
				0.20	TP19-B01 0.20-0.50 m			CI	Sandy CLAY medium plasticity, orange and red brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL w ~ PL	St VSt	0.20-2.10 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			0.5										
			1.0										
			1.5	1.70	TP19-B02 1.70-2.00 m			CL	Sandy CLAY low plasticity, grey brown, fine to coarse grained sand, with lenses of clayey sand	w > PL	VSt - H		
			2.0						TEST PIT DISCONTINUED @ 2.10 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.80 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP20

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277478.0 m 6153576.0 m MGA2020 Z54
PIT DEPTH: 1.90 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 10:30	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5		TP20-B01 0.20-0.60 m			Cl	Sandy Gravelly CLAY medium plasticity, orange brown, fine to coarse grained, sub-rounded to sub-angular gravel, fine to coarse grained sand	w < PL	St	0.20-1.90 m: Glanville Formation	
			1.0	1.00	TP20-B02 1.00-1.50 m			Cl	Sandy CLAY medium plasticity, mottled orange-brown, fine to coarse grained sand	w ~ PL	VSt		
			1.5		TP20-ASS3 1.50-1.60 m					w > PL	H		
			2.0						TEST PIT DISCONTINUED @ 1.90 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.00 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP21

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277369.0 m 6153712.8 m MGA2020 Z54
PIT DEPTH: 2.20 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 12:00	0.0					SM	TOPSOIL: Silty SAND fine to coarse grained, brown	D			
				0.20	TP21-B01 0.20-0.50 m			CI	Sandy CLAY medium plasticity, red and brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.20-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			0.5										
			1.0								VSt		
			1.5							w ~ PL	St - VSt		
				1.80	TP21-B02 1.80-2.00 m			CL	Sandy CLAY low plasticity, grey brown, fine to coarse grained sand, trace lenses of clayey sand	w > PL	VSt		
			2.0						TEST PIT DISCONTINUED @ 2.20 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.80 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP22

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277282.1 m 6153703.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: RAM DATE: 10/8/22
CHECKED: SFF DATE: 22/8/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	10/08/22 11:00	0.0	0.15	TP22-B01 0.20-0.50 m			SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5					CI	Sandy CLAY medium plasticity, pale orange brown and red brown, fine to coarse grained sand, trace fine to coarse grained, rounded gravel	w < PL	St	0.15-2.00 m: Undifferentiated Quaternary Sediments (Qa), developed in estuarine deposits (EMS)	
			1.0							w ~ PL	VSt		
			1.5	1.70	TP22-B02 1.70-2.00 m			CL	Sandy CLAY low plasticity, brown and grey, fine to coarse grained sand, with lenses of clayey sand	w > PL			
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.70 m DEPTH BACKFILLED				Practical Refusal
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP23

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277520.1 m 6153614.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22 11:00	0.0	0.20				SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
			0.5		TP23-B01 0.20-0.50 m			CL	Sandy CLAY low plasticity, orange brown, fine to coarse grained sand, trace fine to coarse grained, sub-rounded gravel	w < PL	St	0.20-2.00 m: Glanville Formation	
			1.0	1.10						w ~ PL			Practical Refusal
			1.5		TP23-B02 1.10-1.40 m			Cl	Sandy CLAY medium plasticity, mottled orange brown and grey, fine to coarse grained sand, trace fine to coarse grained, sub-rounded to sub-angular gravel	w > PL	H		
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.10 m DEPTH BACKFILLED				
			2.5										
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

TEST PIT: TP25

SHEET: 1 OF 1

CLIENT: Renascor Resources
PROJECT: BAM Project
LOCATION: Bolivar
JOB NO: 20651.000.001

COORDS: 277525.2 m 6153520.8 m MGA2020 Z54
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Toothed

MACHINE: 8t Excavator
CONTRACTOR: Beyond Drillling
LOGGED: DP DATE: 28/11/22
CHECKED: RAM DATE: 5/12/22

Excavation					Sampling		Field Material Description						
METHOD / SUPPORT	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
TB	EP	28/11/22	0.0					SM	TOPSOIL: Silty SAND fine to coarse grained, brown, trace rootlets	M			
				0.25	TP25-B01 0.25-0.50 m			CI	Sandy CLAY medium plasticity, orange brown, fine to coarse grained sand, with fine to coarse grained, sub-rounded gravel	w < PL	St	0.25-2.00 m: Undifferentiated Quaternary Sediments(Qa), developed in estuarine deposits (EMS)	
			0.5										
			1.0	1.00					mottled orange brown and grey, trace fine to coarse grained, sub-rounded gravel	w ~ PL			
			1.5							w > PL	VSt - H		Practical Refusal
			2.0						TEST PIT DISCONTINUED @ 2.00 m PRACTICAL REFUSAL GROUNDWATER ENCOUNTERED @ 1.50 m DEPTH BACKFILLED				
			2.5										
			3.0										

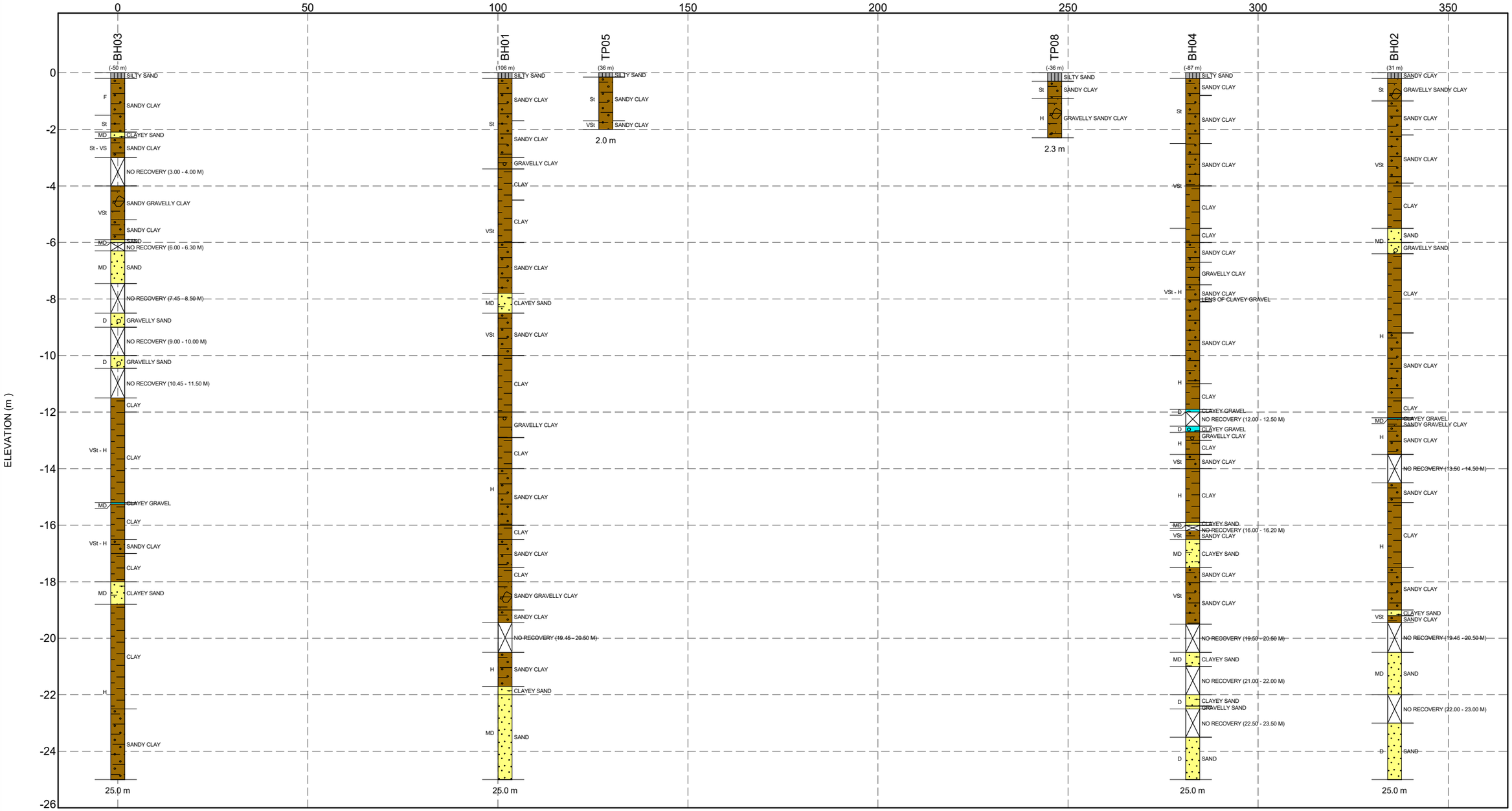
DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 3 6 9 12 15

Photographs

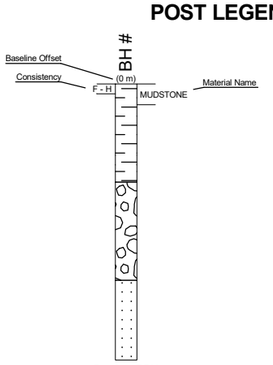
This log must be read in conjuction with accompanying symbols and abbreviations used on Geotechnical Logs.
It has been prepared for geotechnical purposes only.

APPENDIX 3:

Soil Profile Cross Section



POST LEGEND



MATERIAL GRAPHIC

TOPSOIL
CLAY
VOID
Clayey GRAVEL
Sandy CLAY
Clayey SAND
SAND
Gravelly CLAY
Sandy Gravelly CLAY
Gravelly SAND

H 1:1045
0 10 20 30 40 50m
V 1:141
0 1 2 3 4 5m
Coord.System: Zone MGA2020 Z54 Height Datum:

CLIENT	Renascor Resources
CONSULTANT	ENGEO
YYYY-MM-DD	2023-01-23
PREPARED	HS
DESIGN	
REVIEW	CL
APPROVED	CL

PROJECT
BAM Project
Bolivar

TITLE
Inferred Subsurface Section A-A'

PROJECT No.	CONTROL	Rev.	FIGURE
20651.000.001			1

APPENDIX 4:

Laboratory Test Certificates - Geotechnical

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229489
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229489'.

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

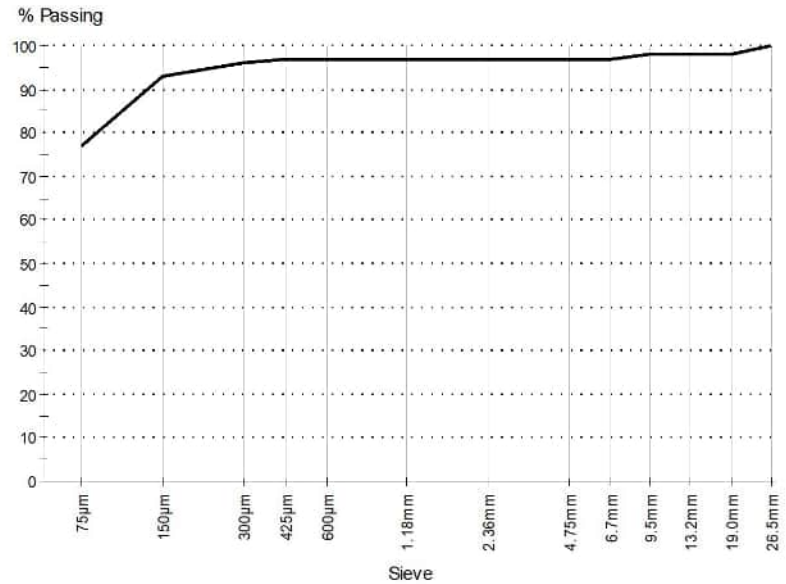
Sample ID	1-2229489
Sample Location	BH01
Depth	5.50 - 5.95m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) CLAY, low plasticity, brown/grey, with fine to coarse sand, trace of fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	15.4	
Date Tested		7/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 8/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	98	
13.2mm	98	
9.5mm	98	
6.7mm	97	
4.75mm	97	
2.36mm	97	
1.18mm	97	
600µm	97	
425µm	97	
300µm	96	
150µm	93	
75µm	77	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229489
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229489'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	32	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	14	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229490
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229490'.

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

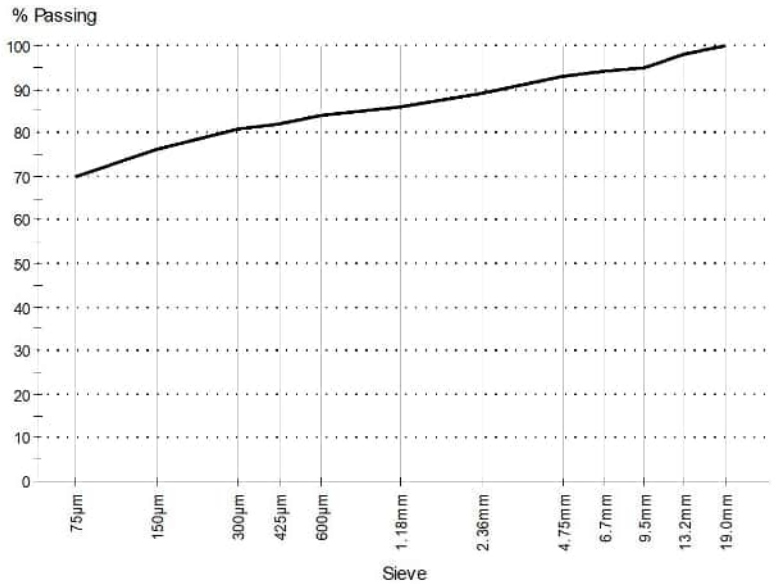
Sample ID	1-2229490
Sample Location	BH02
Depth	11.50 - 11.95m
Sampling Method	Submitted by client
Specification	-
Material Description	(CI) CLAY, medium plasticity, brown, with fine to coarse sand, trace of fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	16.8	
Date Tested		7/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.5	
Mould Length (mm)		250	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 8/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	98	
9.5mm	95	
6.7mm	94	
4.75mm	93	
2.36mm	89	
1.18mm	86	
600µm	84	
425µm	82	
300µm	81	
150µm	76	
75µm	70	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Material Test Report

Report No: MAT:1-2229490
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229490'.

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	45	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	27	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229487
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229487'.

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

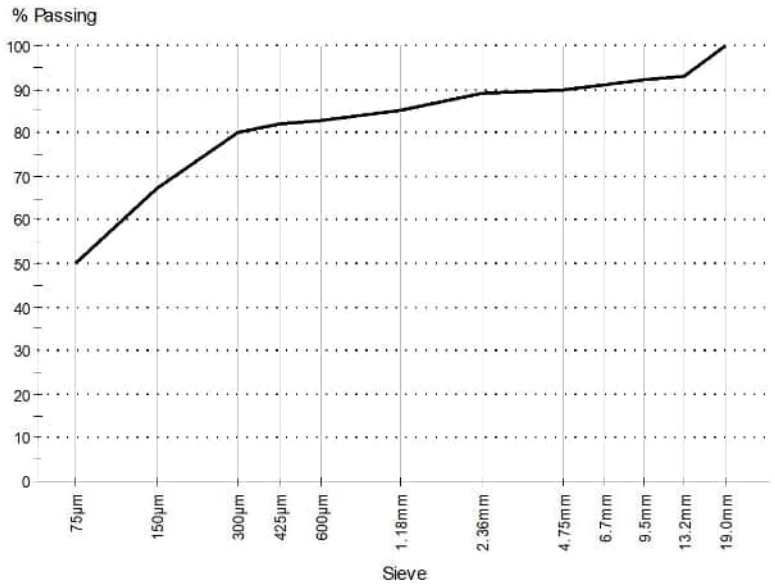
Sample ID	1-2229487
Sample Location	BH03
Depth	2.50 - 2.95m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Sandy CLAY, low plasticity, pale brown, approx. 50% fine to coarse sand, with fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.6	
Date Tested		6/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	6.0	
Mould Length (mm)		150	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 8/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	93	
9.5mm	92	
6.7mm	91	
4.75mm	90	
2.36mm	89	
1.18mm	85	
600µm	83	
425µm	82	
300µm	80	
150µm	67	
75µm	50	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
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Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229487
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229487'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	26	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	11	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

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Report No: MAT:1-2229488
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229488'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

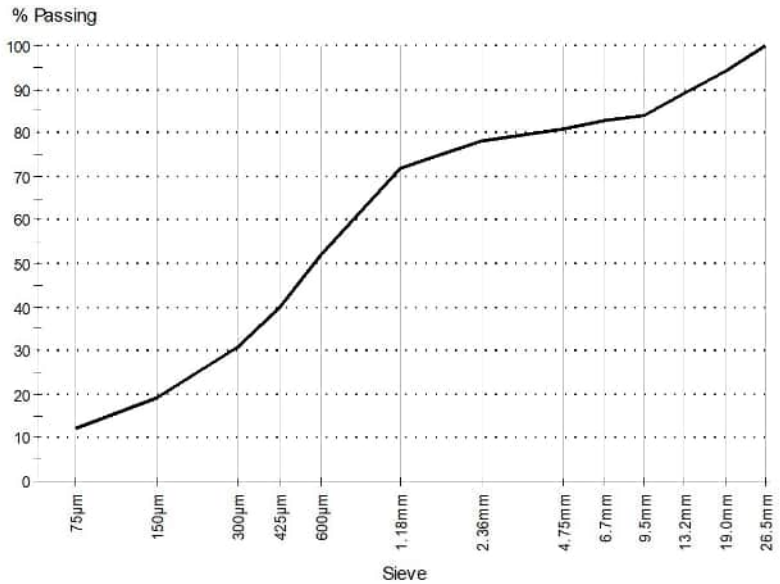
Sample ID	1-2229488
Sample Location	BH03
Depth	7.00 - 7.45m
Sampling Method	Submitted by client
Specification	-
Material Description	(SP) SAND, fine to coarse grained, pale brown, with low plasticity fines, with fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	13.3	
Date Tested		7/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	2.5	
Mould Length (mm)		250	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 8/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	94	
13.2mm	89	
9.5mm	84	
6.7mm	83	
4.75mm	81	
2.36mm	78	
1.18mm	72	
600µm	52	
425µm	40	
300µm	31	
150µm	19	
75µm	12	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2229488
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229488'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	22	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	5	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

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Report No: MAT:1-2229491
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229491'.

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

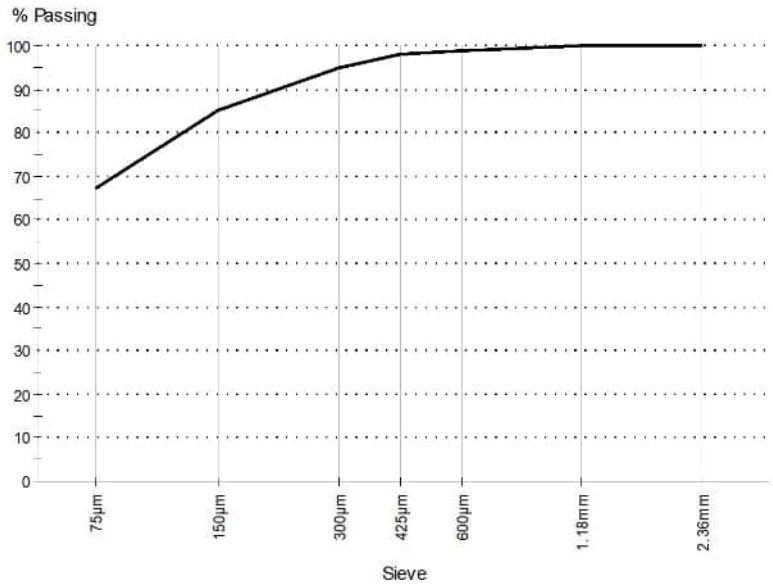
Sample ID	1-2229491
Sample Location	BH04
Depth	17.50 - 17.95m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Sandy CLAY, low plasticity, brown, approx. 35% fine to coarse sand

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	16.5	
Date Tested		7/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		250	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 7/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
2.36mm	100	
1.18mm	100	
600µm	99	
425µm	98	
300µm	95	
150µm	85	
75µm	67	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

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Report No: MAT:1-2229491
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229491'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	31	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	14	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content added

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Report No: MAT:1-2220454
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220454'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

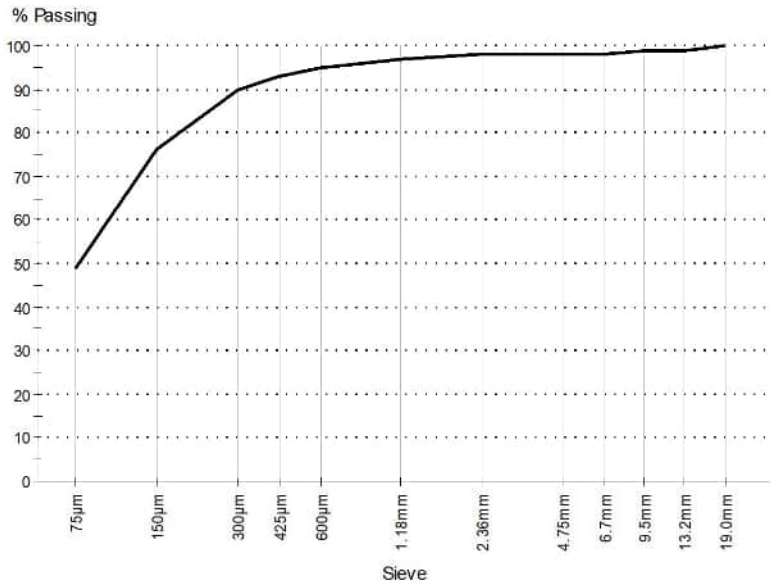
Sample ID	1-2220454
Sample Location	TP#01 - B02
Depth	1.70m - 1.90m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Sandy CLAY, low plasticity, brown, approx. 50% fine to coarse sand, trace of fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	22.5	
Date Tested		13/09/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	1.0	
Mould Length (mm)		250	
Crumbling		No	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 25/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	99	
9.5mm	99	
6.7mm	98	
4.75mm	98	
2.36mm	98	
1.18mm	97	
600µm	95	
425µm	93	
300µm	90	
150µm	76	
75µm	49	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

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Material Test Report

Report No: MAT:1-2220454
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220454'.

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Other Test Results

Description	Method	Result	Limits
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	23	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	8	
Date Tested		26/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

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Report No: MAT:1-2220456
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 8/09/2022

Sample Details

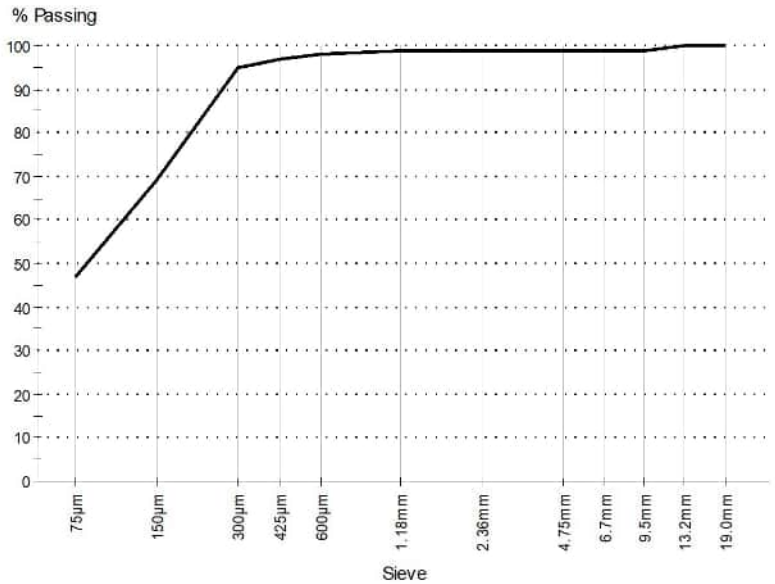
Sample ID	1-2220456
Sample Location	TP#02 - B02
Depth	1.60m - 1.90m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Sandy CLAY, low plasticity, brown, approx. 50% fine to coarse sand, trace of fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 25/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	100	
9.5mm	99	
6.7mm	99	
4.75mm	99	
2.36mm	99	
1.18mm	99	
600µm	98	
425µm	97	
300µm	95	
150µm	69	
75µm	47	

Comments

N/A

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Report No: MAT:1-2220456
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 8/09/2022

Other Test Results

Description	Method	Result	Limits
Liquid Limit (%)	AS 1289.3.1.2	25	
Plastic Limit (%)	AS 1289.3.2.1	13	
Plasticity Index (%)	AS 1289.3.3.1	12	
Date Tested		26/08/2022	

Comments

N/A

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Report No: MAT:1-2220475
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220475'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

NATA Accredited Laboratory Number:19225

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

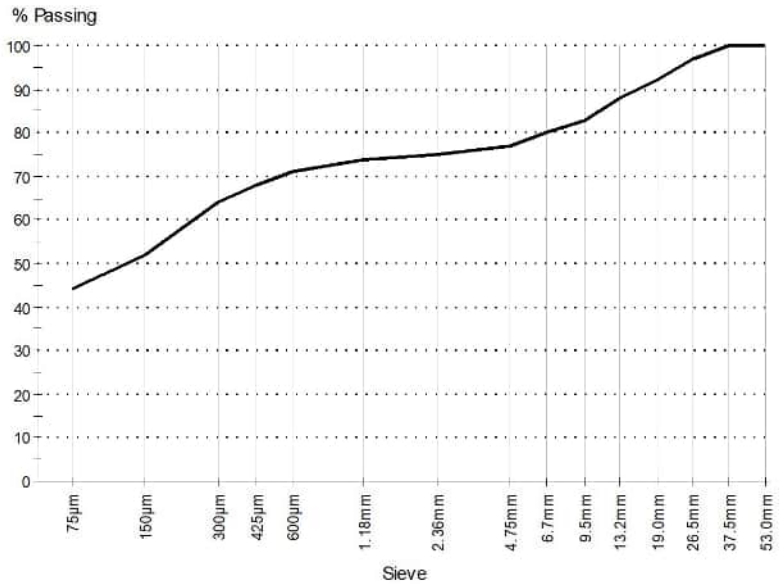
Sample ID	1-2220475
Sample Location	TP#06 - B01
Depth	0.20m - 0.50m
Sampling Method	Submitted by client
Specification	-
Material Description	(CI) Sandy CLAY, medium plasticity, red/brown, approx. 30% fine to coarse sand, with fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	21.3	
Date Tested		19/08/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.0	
Mould Length (mm)		250	
Crumbling		No	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 25/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
53.0mm	100	
37.5mm	100	
26.5mm	97	
19.0mm	92	
13.2mm	88	
9.5mm	83	
6.7mm	80	
4.75mm	77	
2.36mm	75	
1.18mm	74	
600µm	71	
425µm	68	
300µm	64	
150µm	52	
75µm	44	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220475
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220475'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Other Test Results

Description	Method	Result	Limits
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	36	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	18	
Date Tested		29/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220476
Issue No: 3
This report replaces all previous issues of report no 'MAT:1-2220476'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

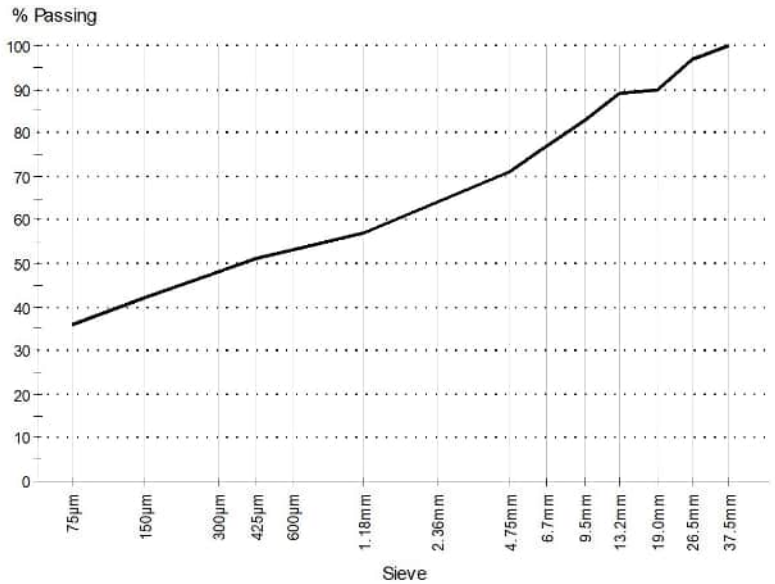
Sample ID	1-2220476
Sample Location	TP#06 - B02
Depth	0.70m - 1.00m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Gravelly CLAY, low plasticity, brown, approx. 35% fine to coarse gravel, with fine to coarse sand

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	19.8	
Date Tested		19/08/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		251	
Crumbling		No	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 25/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
37.5mm	100	
26.5mm	97	
19.0mm	90	
13.2mm	89	
9.5mm	83	
6.7mm	77	
4.75mm	71	
2.36mm	64	
1.18mm	57	
600µm	53	
425µm	51	
300µm	48	
150µm	42	
75µm	36	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

SMS Geotechnical Pty. Ltd.
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Material Test Report

Report No: MAT:1-2220476
Issue No: 3
This report replaces all previous issues of report no 'MAT:1-2220476'.

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Other Test Results

Description	Method	Result	Limits
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	30	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	16	
Date Tested		29/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.83**	
Standard OMC (%)		**15.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		52	
LL Method		AS 1289.3.1.2	
Date Tested		26/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

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Report No: MAT:1-2229495
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 12/12/2022

Sample Details

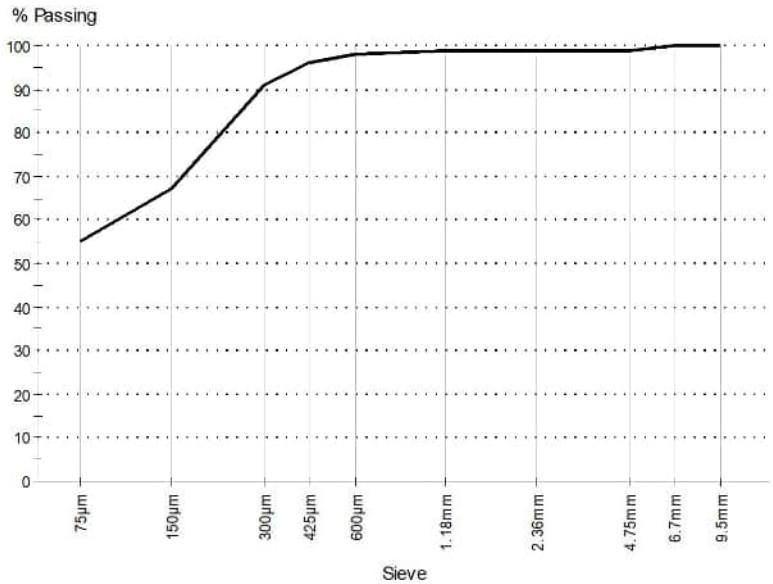
Sample ID	1-2229495
Sample Location	TP#12-B02
Depth	0.60 - 0.90m
Sampling Method	Submitted by client
Specification	-
Material Description	(CI) Sandy CLAY, medium plasticity, brown, approx. 45% fine to coarse sand, trace of fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.5	
Mould Length (mm)		150	
Crumbling		No	
Curling		Yes	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 5/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	99	
2.36mm	99	
1.18mm	99	
600µm	98	
425µm	96	
300µm	91	
150µm	67	
75µm	55	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
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www.smsgeotechnical.com.au

Report No: MAT:1-2229495
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 12/12/2022

Other Test Results

Description	Method	Result	Limits
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	36	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	21	
Date Tested		1/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229492
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229492'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

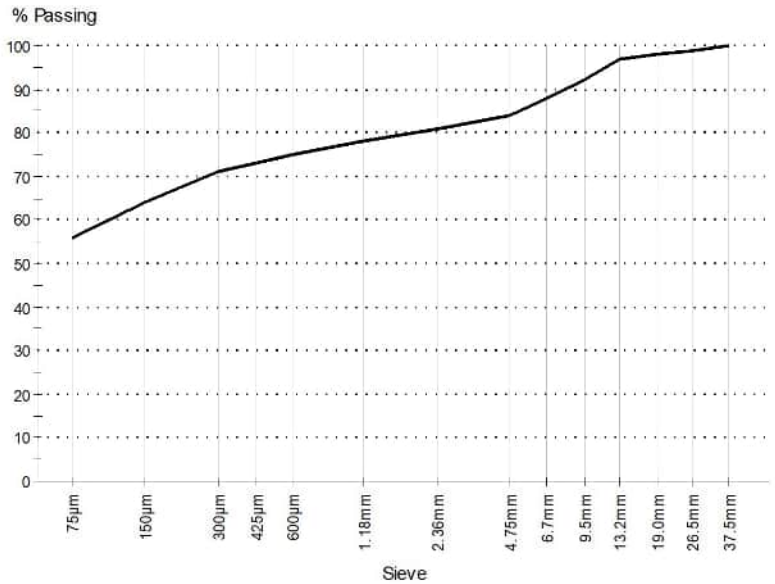
Sample ID	1-2229492
Sample Location	TP#15-B01
Depth	0.20 - 0.60m
Sampling Method	Submitted by client
Specification	-
Material Description	(CI) CLAY, medium plasticity, pale brown, with fine to coarse sand, with fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	23.6	
Date Tested		1/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.0	
Mould Length (mm)		251	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 8/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
37.5mm	100	
26.5mm	99	
19.0mm	98	
13.2mm	97	
9.5mm	92	
6.7mm	88	
4.75mm	84	
2.36mm	81	
1.18mm	78	
600µm	75	
425µm	73	
300µm	71	
150µm	64	
75µm	56	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content corrected

SMS Geotechnical Pty. Ltd.
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Material Test Report

Report No: MAT:1-2229492
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229492'.

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	37	
Plastic Limit (%)	AS 1289.3.2.1	16	
Plasticity Index (%)	AS 1289.3.3.1	21	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content corrected

SMS Geotechnical Pty. Ltd.
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Ph. (08) 8258 7498
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Report No: MAT:1-2220478
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220478'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

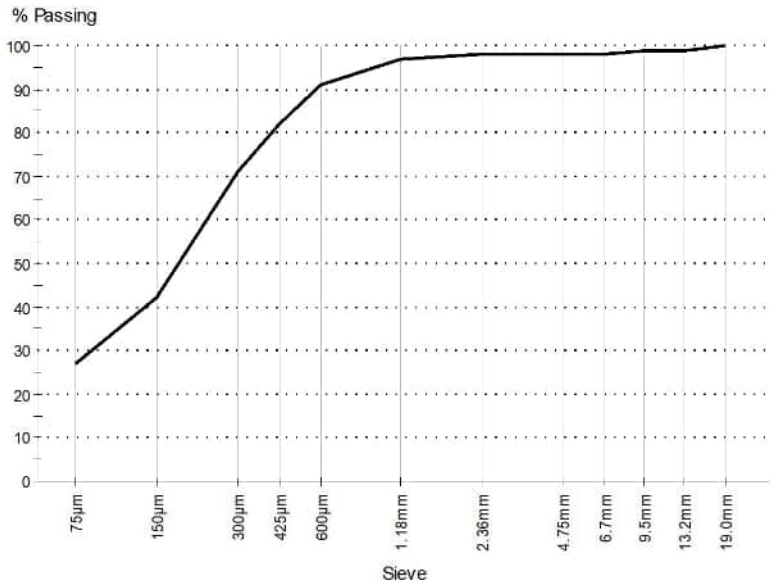
Sample ID	1-2220478
Sample Location	TP#17 - B02
Depth	1.70m - 1.90m
Sampling Method	Submitted by client
Specification	-
Material Description	(SC) Clayey SAND, fine to coarse grained, brown, approx. 25% low plasticity fines, trace of fine to medium gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.8	
Date Tested		24/08/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	0.5	
Mould Length (mm)		250	
Crumbling		No	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 25/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	99	
9.5mm	99	
6.7mm	98	
4.75mm	98	
2.36mm	98	
1.18mm	97	
600µm	91	
425µm	82	
300µm	71	
150µm	42	
75µm	27	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220478
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220478'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Other Test Results

Description	Method	Result	Limits
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	20	
Plastic Limit (%)	AS 1289.3.2.1	16	
Plasticity Index (%)	AS 1289.3.3.1	4	
Date Tested		26/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report as requested by client

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220490
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 15/09/2022

Sample Details

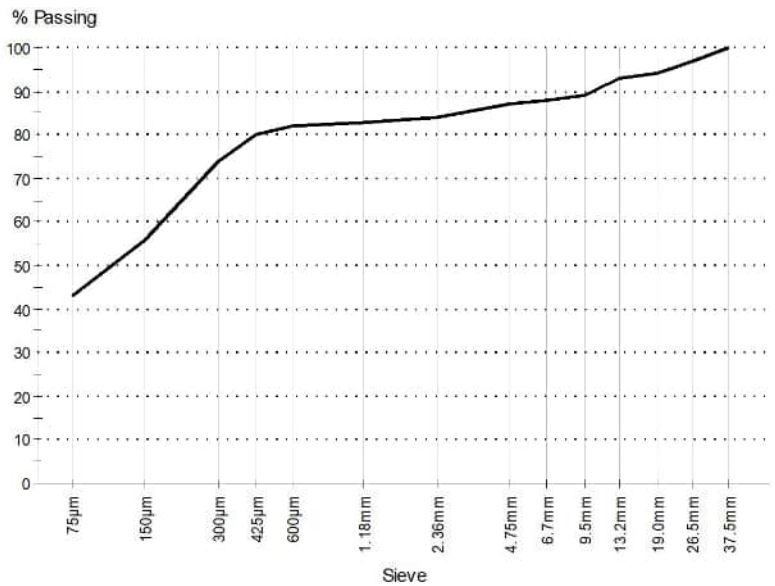
Sample ID	1-2220490
Sample Location	TP#21 - B01
Sampling Method	Submitted by client
Specification	-
Material Description	(CI) Sandy CLAY, medium plasticity, brown, approx. 40% fine to coarse sand, with fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.5	
Date Tested		23/08/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.0	
Mould Length (mm)		124	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 30/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
37.5mm	100	
26.5mm	97	
19.0mm	94	
13.2mm	93	
9.5mm	89	
6.7mm	88	
4.75mm	87	
2.36mm	84	
1.18mm	83	
600µm	82	
425µm	80	
300µm	74	
150µm	56	
75µm	43	

Comments

N/A

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220490
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

NATA Accredited Laboratory Number:19225

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 15/09/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	35	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	21	
Date Tested		31/08/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2229493
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229493'.

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Sample Details

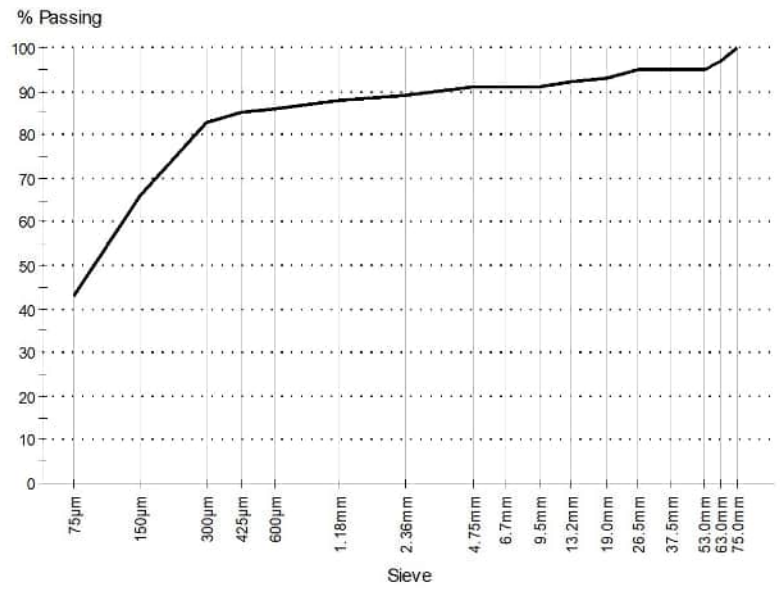
Sample ID	1-2229493
Sample Location	TP#23-B01
Depth	0.20 - 0.50m
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) Sandy CLAY, low plasticity, brown, approx. 55% fine to coarse sand, trace of fine to coarse gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	21.8	
Date Tested		1/12/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		251	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 9/12/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
75.0mm	100	
63.0mm	97	
53.0mm	95	
37.5mm	95	
26.5mm	95	
19.0mm	93	
13.2mm	92	
9.5mm	91	
6.7mm	91	
4.75mm	91	
2.36mm	89	
1.18mm	88	
600µm	86	
425µm	85	
300µm	83	
150µm	66	
75µm	43	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content corrected

SMS Geotechnical Pty. Ltd.
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Material Test Report

Report No: MAT:1-2229493
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2229493'.

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 20/12/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	27	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	12	
Date Tested		10/12/2022	

Comments

REASON FOR AMENDMENT: Typographical error amended - moisture content corrected

SMS Geotechnical Pty. Ltd.
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Report No: MAT:1-2220493
Issue No: 1

Material Test Report

Client: ENGEO
PO Box 79, Mitcham SA 5062

Project No: SMS1.22067

Project: Submitted Samples

Location: BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 15/09/2022

Sample Details

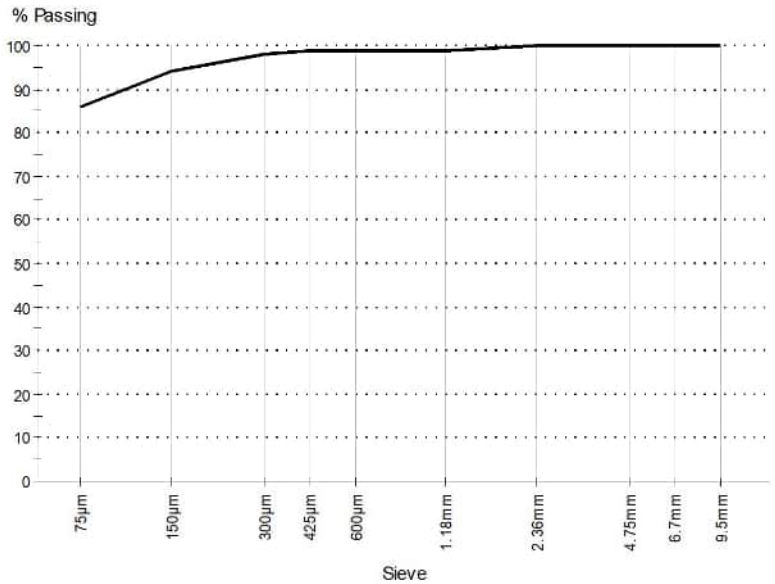
Sample ID	1-2220493
Sample Location	TP#21 - B02
Sampling Method	Submitted by client
Specification	-
Material Description	(CL) CLAY, low plasticity, brown, with fine to coarse sand

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	28.6	
Date Tested		20/08/2022	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.5	
Mould Length (mm)		150	

Particle Size Distribution

AS 1289.3.6.1



Date Tested: 30/08/2022

Note: Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	100	
1.18mm	99	
600µm	99	
425µm	99	
300µm	98	
150µm	94	
75µm	84	

Comments

N/A

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Report No: MAT:1-2220493
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 15/09/2022

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	34	
Plastic Limit (%)	AS 1289.3.2.1	16	
Plasticity Index (%)	AS 1289.3.3.1	18	
Date Tested		31/08/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
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Ph. (08) 8258 7498
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Report No: MAT:1-2220455
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

Sample ID	1-2220455
Sample Location	TP#02 - B01
Depth	0.20m - 0.50m
Sampling Method	Submitted by client
Specification	-
Material Description	Silty Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	20.3	
Date Tested		29/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.68**	
Standard OMC (%)		**19.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		72	
Date Tested		29/08/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2220457
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 8/09/2022

Sample Details

Sample ID	1-2220457
Sample Location	TP#03 - B01
Depth	0.20m - 0.50m
Sampling Method	Submitted by client
Specification	-
Material Description	Silty Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	23.1	
Date Tested		29/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.68**	
Standard OMC (%)		**20.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		72	
Date Tested		29/08/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
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Report No: MAT:1-2220473
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

Sample ID	1-2220473
Sample Location	TP#05 - B01
Depth	0.20m - 0.50m
Sampling Method	Submitted by client
Specification	-
Material Description	

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	21.8	
Date Tested		30/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.76**	
Standard OMC (%)		**17.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		1	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		30/08/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
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Report No: MAT:1-2220474
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220474'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

Sample ID	1-2220474
Sample Location	TP#05 - B02
Depth	1.70m - 2.00m
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown, with Gravel

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	26.3	
Date Tested		23/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.85**	
Standard OMC (%)		**14.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		6	

Particle Size Distribution

Comments

REASON FOR AMENDMENT: Additional test added to report

SMS Geotechnical Pty. Ltd.
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Para Hills West, South Australia 5096
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Report No: MAT:1-2220474
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220474'.

Material Test Report

Client:	ENGEO PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Other Test Results

Description	Method	Result	Limits
Curing Time (h)		192	
LL Method		Visual / Tactile Assessment	
Date Tested		31/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
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Report No: MAT:1-2229496
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 7/12/2022

Sample Details

Sample ID	1-2229496
Sample Location	TP#08-B01
Depth	0.30 - 0.60m
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.65**	
Standard OMC (%)		**18.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		100	
LL Method		Visual / Tactile Assessment	
Date Tested		5/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
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Material Test Report

Report No: MAT:1-2229497
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 7/12/2022

Sample Details

Sample ID	1-2229497
Sample Location	TP#09-B02
Depth	0.80 - 1.20m
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown, with gravel

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.72**	
Standard OMC (%)		**18.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		120	
LL Method		Visual / Tactile Assessment	
Date Tested		6/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229498
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 7/12/2022

Sample Details

Sample ID	1-2229498
Sample Location	TP#13-B01
Depth	0.20 - 0.60m
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.64**	
Standard OMC (%)		**21.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		1	
Curing Time (h)		124	
LL Method		Visual / Tactile Assessment	
Date Tested		5/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229499
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 12/12/2022

Sample Details

Sample ID	1-2229499
Sample Location	TP#16-B01
Depth	0.20 - 0.60m
Sampling Method	Submitted by client
Specification	-
Material Description	Silty Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.65**	
Standard OMC (%)		**21.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		95	
LL Method		Visual / Tactile Assessment	
Date Tested		5/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2220477
Issue No: 2
This report replaces all previous issues of report no 'MAT:1-2220477'.

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 13/09/2022

Sample Details

Sample ID	1-2220477
Sample Location	TP#17 - B01
Depth	0.10m - 0.40m
Sampling Method	Submitted by client
Specification	-
Material Description	Silty Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	17.5	
Date Tested		23/08/2022	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.82**	
Standard OMC (%)		**13.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		3	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		23/08/2022	

Comments

REASON FOR AMENDMENT: Additional test added to report

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2229502
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 7/12/2022

Sample Details

Sample ID	1-2229502
Sample Location	TP#20-B02
Depth	1.00 - 1.50m
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.71**	
Standard OMC (%)		**18.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		10	
Curing Time (h)		94	
LL Method		Visual / Tactile Assessment	
Date Tested		5/12/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No: MAT:1-2220492
Issue No: 1

Material Test Report

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

NATA Accredited Laboratory Number:19225

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 14/09/2022

Sample Details

Sample ID	1-2220492
Sample Location	TP#21 - B01
Sampling Method	Submitted by client
Specification	-
Material Description	Sandy CLAY, brown

Test Results

Description	Method	Result	Limits
Standard MDD (t/m³)	AS 1289.5.1.1	**1.75**	
Standard OMC (%)		**14.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		74	
LL Method		Visual / Tactile Assessment	
Date Tested		14/09/2022	

Comments

N/A

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

California Bearing Ratio Test Report

Report No: CBR:1-2220453
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

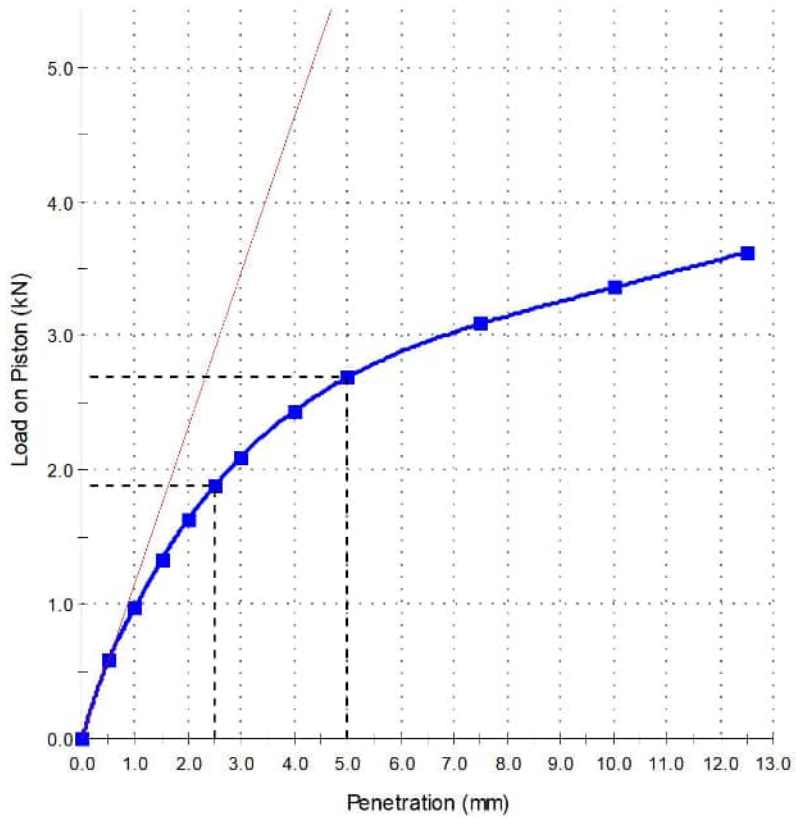
NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 13/09/2022

Sample Details

Sample ID:	1-2220453		
Sample Location:	TP#01 - B01		
Depth:	0.20m - 0.50m		
Material Description:	Sandy CLAY, brown		
Sampling Method:	Submitted by client	**Date Tested:**	12/09/2022

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**14**
Dry Density before Soaking (t/m³):	1.76
Density Ratio before Soaking (%):	95.0
Moisture Content before Soaking (%):	13.3
Moisture Ratio before Soaking (%):	102.0
Dry Density after Soaking (t/m³):	1.74
Density Ratio after Soaking (%):	93.5
Swell (%):	1.5
Moisture Content of Top 30mm (%):	19.8
Compaction Hammer Used:	Modified
	AS 1289.5.2.1
MDD (t/m³):	1.86
OMC (%):	13.0
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	220
Plasticity Determination Method:	Visual/Tactile

Comments

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
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www.smsgeotechnical.com.au

California Bearing Ratio Test Report

Report No: CBR:1-2220472
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

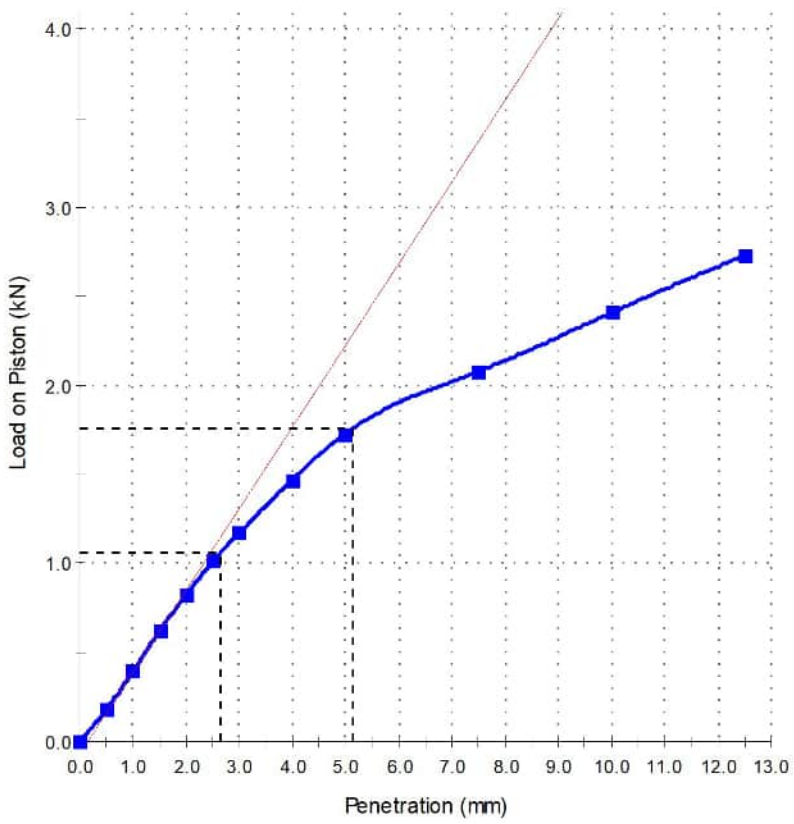
NATA Accredited Laboratory Number:19225

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 13/09/2022

Sample Details

Sample ID:	1-2220472		
Sample Location:	TP#04 - B02		
Depth:	0.80m - 1.10m		
Material Description:	Silty Sandy CLAY, brown		
Sampling Method:	Submitted by client	**Date Tested:**	12/09/2022

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 5.0mm (%):	**9**
Dry Density before Soaking (t/m³):	1.73
Density Ratio before Soaking (%):	95.5
Moisture Content before Soaking (%):	12.8
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.69
Density Ratio after Soaking (%):	93.0
Swell (%):	2.0
Moisture Content of Top 30mm (%):	23.4
Compaction Hammer Used:	Modified
	AS 1289.5.2.1
MDD (t/m³):	1.82
OMC (%):	13.0
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	144
Plasticity Determination Method:	Visual/Tactile

Comments

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

California Bearing Ratio Test Report

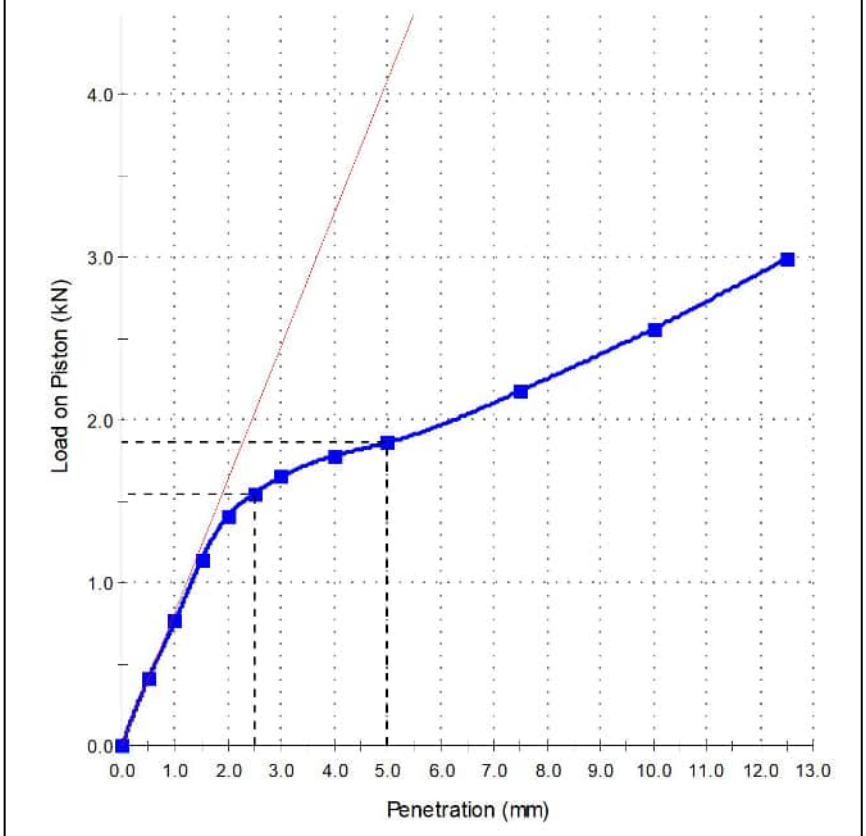
Report No: CBR:1-2220486
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

Sample Details

Sample ID: 1-2220486
Sample Location: TP#18 - B01
Material Description: Sandy CLAY, brown
Sampling Method: Submitted by client
Date Tested: 14/09/2022

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**12**
Dry Density before Soaking (t/m³):	1.83
Density Ratio before Soaking (%):	97.5
Moisture Content before Soaking (%):	14.6
Moisture Ratio before Soaking (%):	103.5
Dry Density after Soaking (t/m³):	1.82
Density Ratio after Soaking (%):	97.0
Swell (%):	0.5
Moisture Content of Top 30mm (%):	21.8
Compaction Hammer Used:	Modified AS 1289.5.2.1
MDD (t/m³):	1.87
OMC (%):	14.0
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	66
Plasticity Determination Method:	Visual/Tactile

Comments

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
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www.smsgeotechnical.com.au

California Bearing Ratio Test Report

Report No: CBR:1-2229492
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

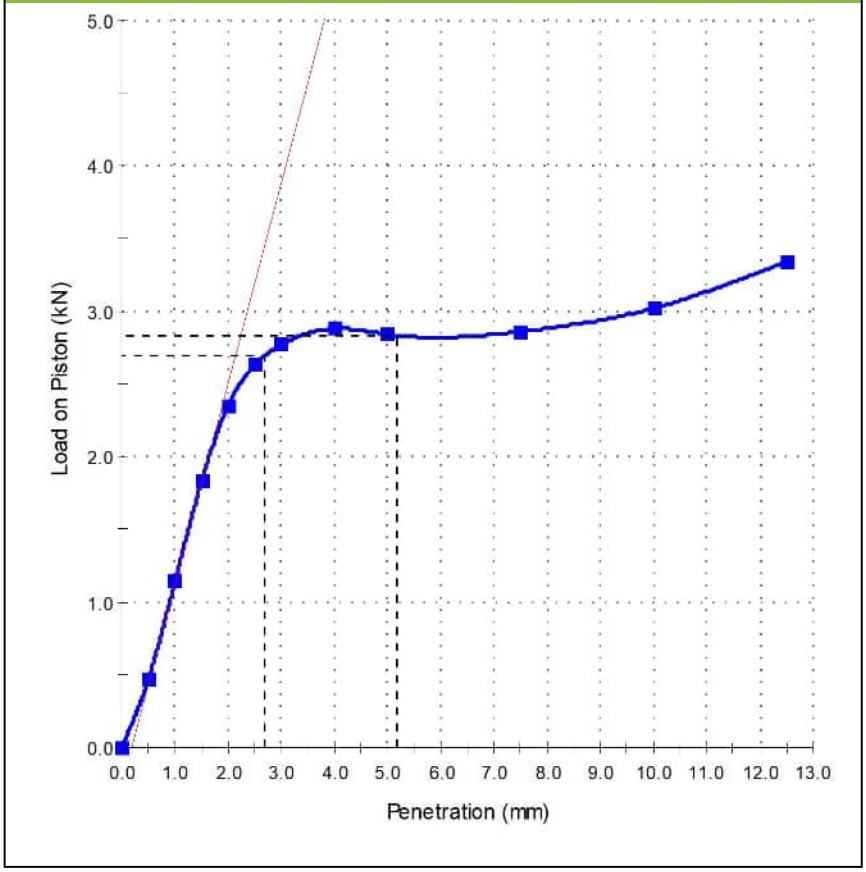
NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 14/12/2022

Sample Details

Sample ID: 1-2229492
Sample Location: TP#15-B01
Depth: 0.20 - 0.60m
Material Description: (CI) CLAY, medium plasticity, pale brown, with fine to coarse sand, with fine to coarse gravel
Sampling Method: Submitted by client **Date Tested:** 13/12/2022

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**20**
Dry Density before Soaking (t/m³):	1.80
Density Ratio before Soaking (%):	94.5
Moisture Content before Soaking (%):	12.3
Moisture Ratio before Soaking (%):	103.5
Dry Density after Soaking (t/m³):	1.77
Density Ratio after Soaking (%):	93.5
Swell (%):	1.0
Moisture Content of Top 30mm (%):	19.0
Compaction Hammer Used:	Modified
	AS 1289.5.2.1
MDD (t/m³):	1.90
OMC (%):	12.0
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	29
Plasticity Determination Method:	Visual/Tactile

Comments

SMS Geotechnical Pty. Ltd.
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Para Hills West, South Australia 5096
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California Bearing Ratio Test Report

Report No: CBR:1-2229493
Issue No: 1

Client:	ENGEO
	PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project, Boliver - 20651.000.001 - TR002

Accredited for compliance with ISO/IEC 17025-Testing
The results in this report relate only to the items/samples that were tested.

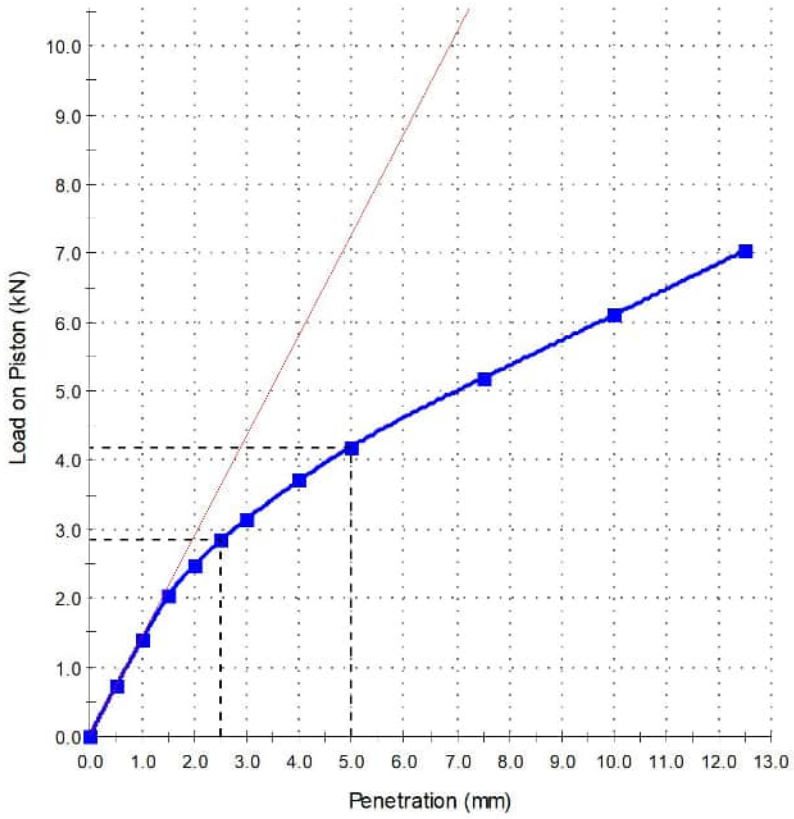
NATA Accredited Laboratory Number:19225

Approved Signatory: Michael Sella-Gianot
(Specialty Testing Coordinator)
Date of Issue: 15/12/2022

Sample Details

Sample ID: 1-2229493
Sample Location: TP#23-B01
Depth: 0.20 - 0.50m
Material Description: (CL) Sandy CLAY, low plasticity, brown, approx. 55% fine to coarse sand, trace of fine to coarse gravel
Sampling Method: Submitted by client **Date Tested:** 13/12/2022

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**20**
Dry Density before Soaking (t/m³):	1.90
Density Ratio before Soaking (%):	95.0
Moisture Content before Soaking (%):	10.6
Moisture Ratio before Soaking (%):	100.0
Dry Density after Soaking (t/m³):	1.88
Density Ratio after Soaking (%):	94.0
Swell (%):	1.0
Moisture Content of Top 30mm (%):	15.5
Compaction Hammer Used:	Modified
	AS 1289.5.2.1
MDD (t/m³):	2.00
OMC (%):	10.5
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	5
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	45
Plasticity Determination Method:	Visual/Tactile

Comments

SMS Geotechnical Pty. Ltd.
Unit 9/21 Beafield Road
Para Hills West, South Australia 5096
Ph. (08) 8258 7498
www.smsgeotechnical.com.au

Report No.: TH:1-2220473
Issue No.: 1

Thermal Resistivity Report ASTM D5334

Client:	ENGEO PO Box 79, Mitcham SA 5062
Project No:	SMS1.22067
Project:	Submitted Samples
Location:	BAM Project - Bolivar - 20651.000.001

NATA Accredited Laboratory Number: 19225

Accredited for compliance with ISO/IEC 17025-Testing

The results in this report relate only to the items/samples that were tested.

Approved Signatory: Simon Nelson
(Specialty Testing Manager)
Date of Issue: 15/09/2022

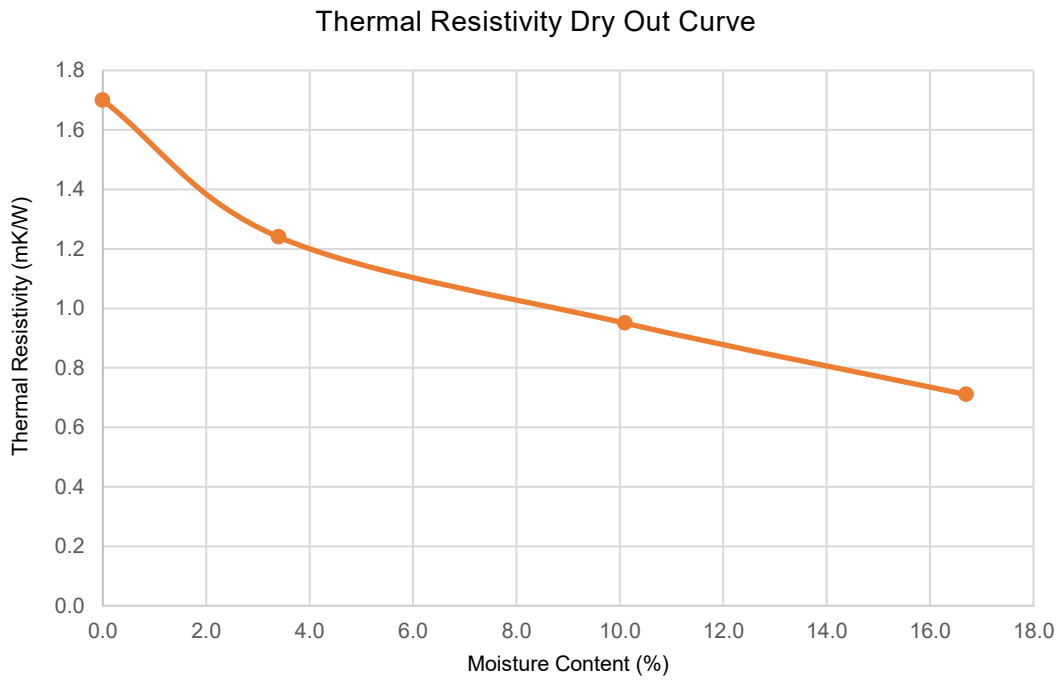
Sample Details

Sample ID:	1-2220473	**Material:**	Sandy CLAY
Location:	TP#05 - B01	**Material Description:**	brown
Depth:	0.20m - 0.50m	**Sampling Method:**	Submitted by client
Date Sampled:		**Date Moulded:**	5/09/2022

Test Results

Compaction Method (AS1289):	5.1.1
Maximum Dry Density (t/m^3):	1.76
Optimum Moisture Content (%):	16.8

Moisture Content (%)	Compacted Dry Density (t/m^3)	Thermal Conductivity (W/mK)	Thermal Resistivity (mK/W)
0.0	1.73	0.58	1.70
3.4	1.73	0.81	1.24
10.1	1.73	1.05	0.95
16.7	1.73	1.42	0.71



Resistivity Meter:	TLS-100	**Needle ID:**	810	**Needle Insertion:**	Pre-drilled

Remarks

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 Email reception@groundscience.com.au

PERMEABILITY - CONSTANT HEAD (Triaxial method) AS1289 6.7.3

Client :	SMS GEOTECHNICAL (SOUTH AUSTRALIA)	Job No.	GS6592/1
Project:	GEOTECHNICAL TESTING	Report No.	BF
Location:	-	Test date:	23-Dec-22

Sample number		#S26
Borehole / test pit		TP #12-BH02
Depth, m		0.6 - 0.9 m
Sample diameter	mm	63.26
Sample height	mm	62.84
Specimen wet density	t/m3	2.010
Specimen dry density	t/m3	1.71
Moisture content	%	17.5
Cell pressure	kPa	560
Inlet pressure	kPa	520
Outlet pressure	kPa	500
Mean effective stress	kPa	50
Hydraulic head	kPa	20
Saturation	%	96
PERMEABILITY	m/sec	3.E-10
Water type		de-aired - filtered
Specimen description		CLAY, medium plasticity, brown, with gravel, trace sand
Notes:		Sample remoulded to a target of 98% SMDD @ OMC
		MDD = 1.73 t/m3
		OMC = 18 %
		Density Ratio = 99 %

Comments: Sampled by client, tested as received
MDD and OMC Supllied by client

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Date of issue
12/01/2023

Aaron Stuart
Approved Signatory

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 Email reception@groundscience.com.au

PERMEABILITY - CONSTANT HEAD (Triaxial method) AS1289 6.7.3

Client :	SMS GEOTECHNICAL (SOUTH AUSTRALIA)	Job No.	GS6592/1
Project:	GEOTECHNICAL TESTING	Report No.	BG
Location:	-	Test date:	22-Dec-22

Sample number		#S27
Borehole / test pit		TP #09-BH02
Depth, m		0.8 - 1.2 m
Sample diameter	mm	63.26
Sample height	mm	62.48
Specimen wet density	t/m3	2.020
Specimen dry density	t/m3	1.70
Moisture content	%	19.1
Cell pressure	kPa	560
Inlet pressure	kPa	520
Outlet pressure	kPa	500
Mean effective stress	kPa	50
Hydraulic head	kPa	20
Saturation	%	98
PERMEABILITY	m/sec	1.E-10
Water type		de-aired - filtered
Specimen description		CLAY, medium plasticity, brown, trace gravel
Notes:		Sample remoulded to a target of 98% SMDD @ OMC MDD = 1.72 t/m3 OMC = 18.5 % Density Ratio = 99 %
Comments		Sampled by client, tested as received MDD and OMC Supllied by client

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Date of issue
11/01/2023

Aaron Stuart
Approved Signatory

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 Email reception@groundscience.com.au

PERMEABILITY - CONSTANT HEAD (Triaxial method) AS1289 6.7.3

Client :	SMS GEOTECHNICAL (SOUTH AUSTRALIA)	Job No.	GS6592/1
Project:	GEOTECHNICAL TESTING	Report No.	BH
Location:	-	Test date:	23-Dec-22

Sample number		#S28
Borehole / test pit		TP #13-BH01
Depth, m		0.2 - 0.6 m
Sample diameter	mm	50.64
Sample height	mm	50.78
Specimen wet density	t/m3	1.941
Specimen dry density	t/m3	1.61
Moisture content	%	20.6
Cell pressure	kPa	560
Inlet pressure	kPa	520
Outlet pressure	kPa	500
Mean effective stress	kPa	50
Hydraulic head	kPa	20
Saturation	%	100
PERMEABILITY	m/sec	7.E-10
Water type		de-aired - filtered
Specimen description		silty CLAY, medium plasticity, brown, with gravel
Notes:		Sample remoulded to a target of 98% SMDD @ OMC
		MDD = 1.64 t/m3
		OMC = 21.2 %
		Density Ratio = 98 %

Comments: Sampled by client, tested as received
MDD and OMC Supllied by client

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Date of issue
12/01/2023

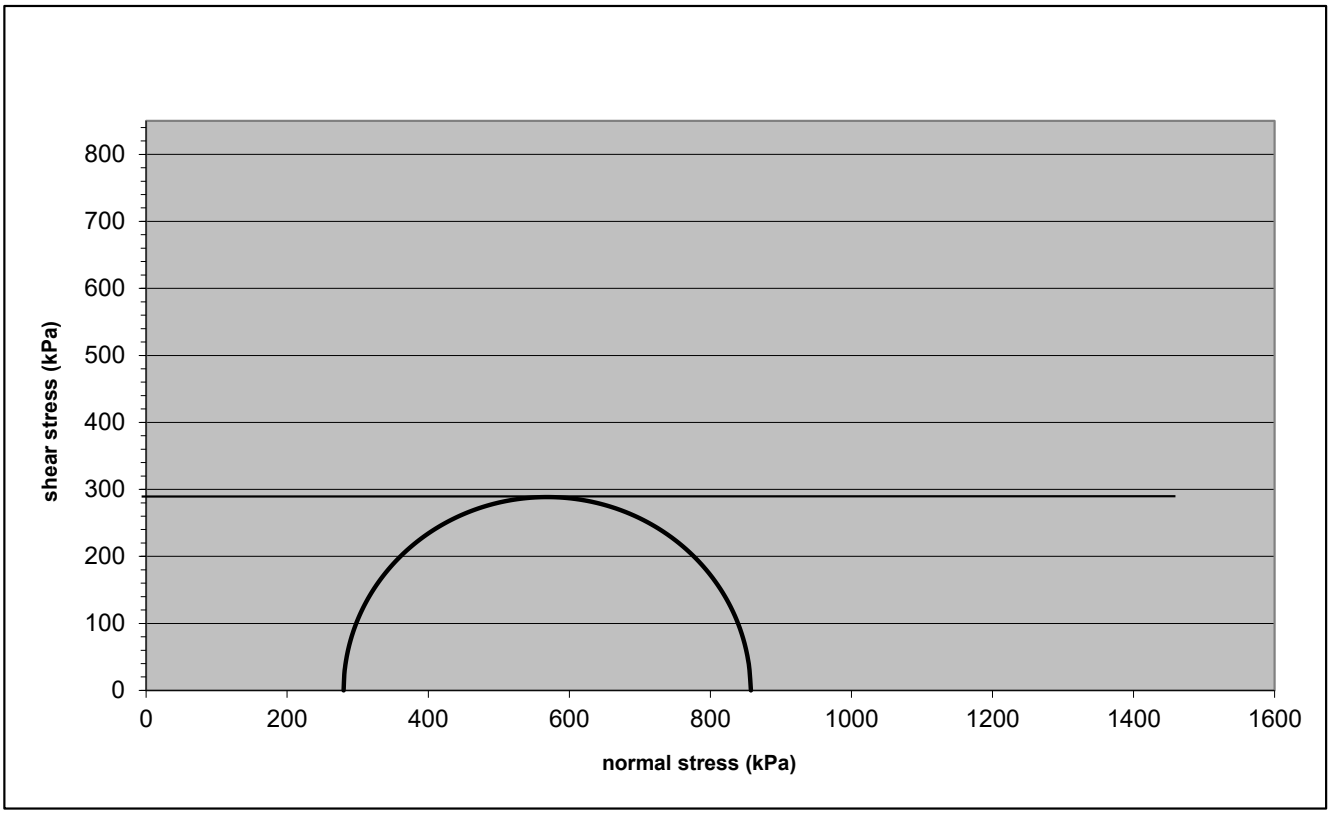
Aaron Stuart
Approved Signatory

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 F 03 9464 4618

UU TRIAXIAL - Unconsolidated Undrained Single Stage

client :	**SMS GEOTECHNICAL**	job No. :	**GS6592/1**
principal :	**-**	report No :	**AU**
project :	**GEOTECHNICAL TESTING**	test date :	**13/12/2022**
location :	**-**	Page :	**1 of 2**

borehole:	BH1	sample type:	Undisturbed	test type:	**UU**	test procedure:	AS 1289 6.4.1
sample No.	#S29	client ref:	1-2229500	normal stress:	**280**		
depth (m):	13.0-13.5	sample size (mm):	101.1	x	**50**	date of sampling:	**Sampled by client**



Stage	Deviator Stress kPa (σ1-σ3)	Peak lateral stress kPa (σ3)	Peak axial stress kPa (σ1)	Strain @ failure %
1	577	280	857	15.8

Undrained cohesion: **289 kPa**

failure criteria: maximum deviator stress

failure mode : Shear failure

sample description : silty CLAY, medium plasticity, mottled grey/brown

Notes :
1. Mohrs circles are a graphical presentation of the results and are not to scale
2. Tested as received

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Pelin Atas Erden
Approved Signatory

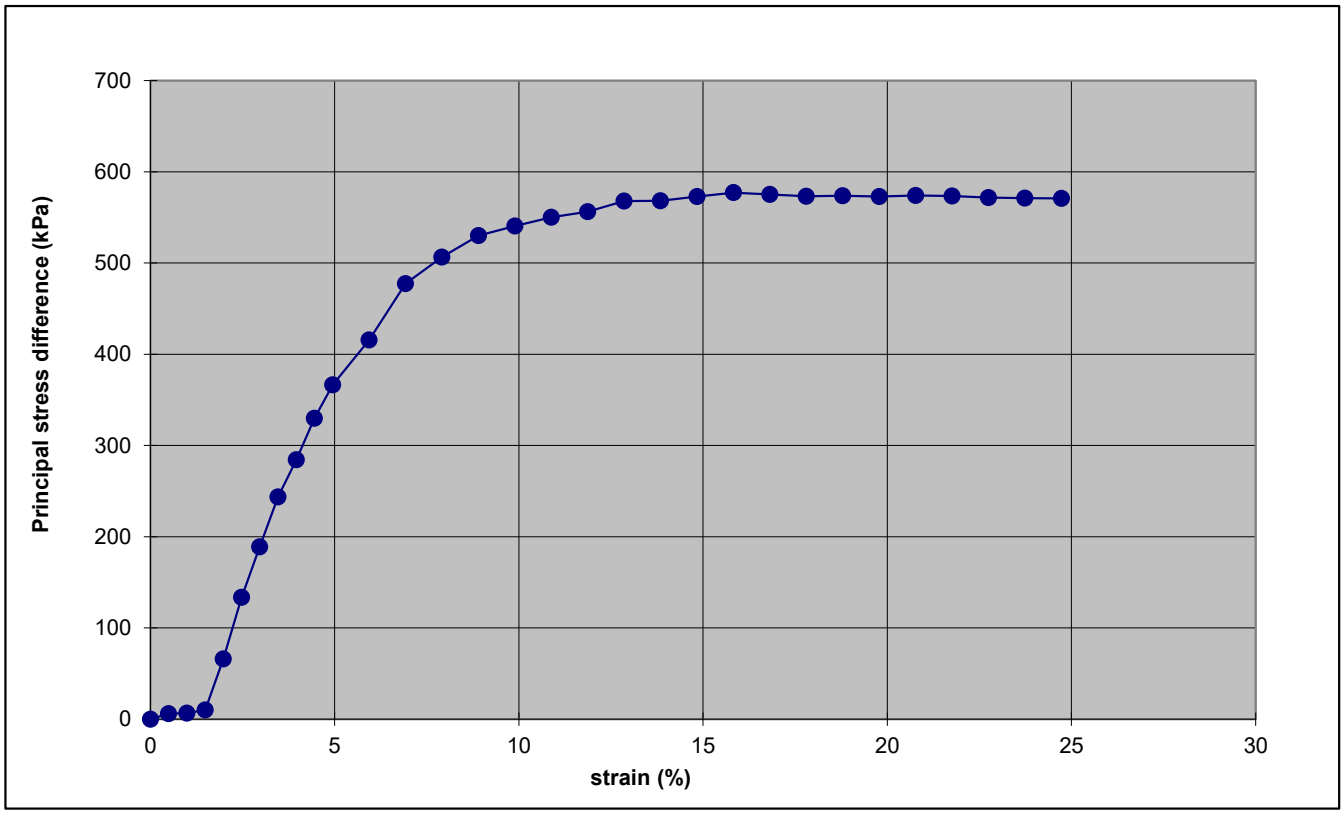
Date: 14-Dec-22

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 F 03 9464 4618

UU TRIAXIAL - Unconsolidated Undrained Single Stage

client :	**SMS GEOTECHNICAL**	job No. :	**GS6592/1**
principal :	**-**	report No :	**AU**
project :	**GEOTECHNICAL TESTING**	test date :	**13/12/2022**
location :	**-**	page :	**2 of 2**

borehole:	BH1	sample type:	Undisturbed	test type:	**UU**	test procedure:	AS 1289 6.4.1
sample No.	#S29	client ref:	1-2229500	normal stress:	**280**		
depth (m):	13.0-13.5	sample size (mm):	101.1	x	50	date of sampling:	**Sampled by client**



Stage	Strain rate %/min
1	1.000

Speciman after test

		Specific gravity	2.65 (assumed)
initial dry density :	1.81 t/m^3	**Degree of Saturation**	97.1 %
mositure content :	17.1 % (before test)	20.7 % (after test)	

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Date: 14-Dec-22

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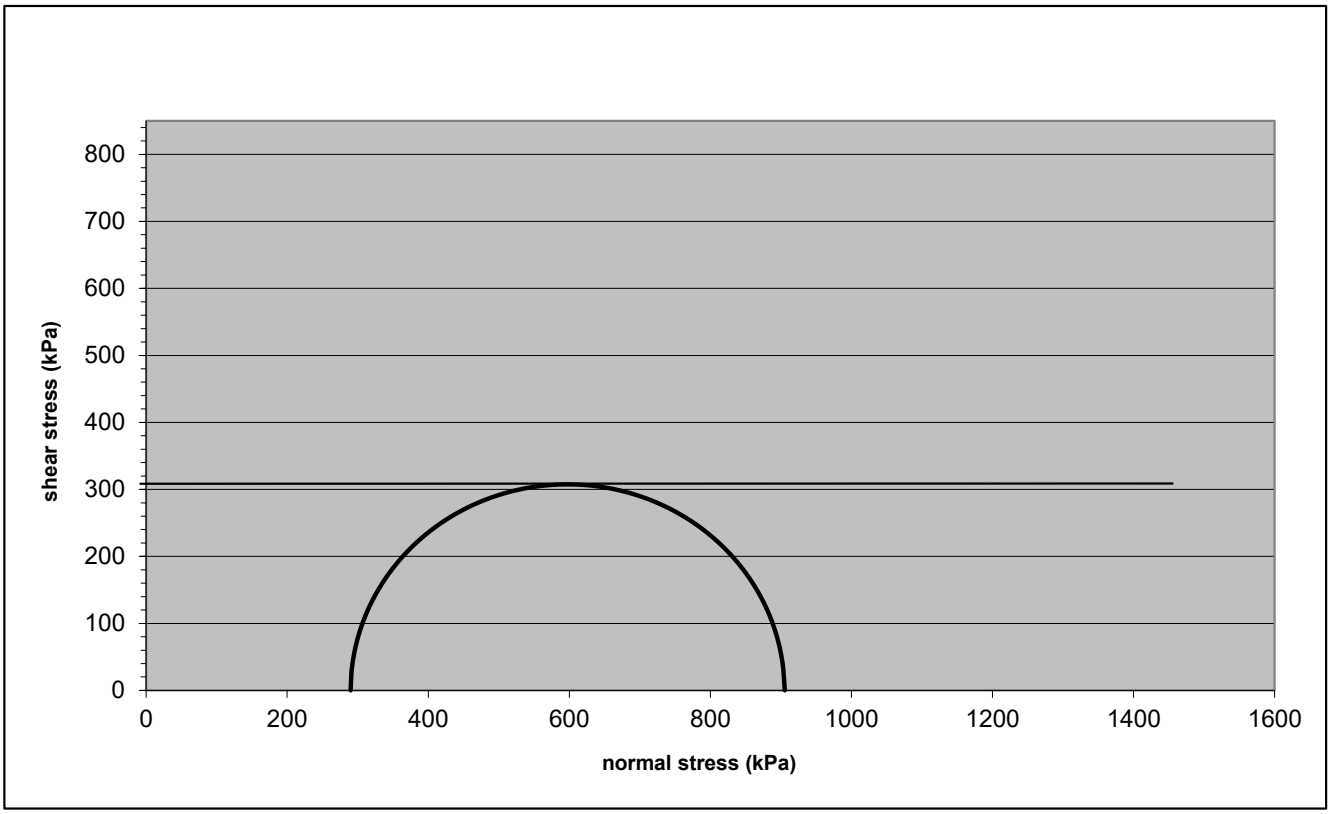
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 F 03 9464 4618

UU TRIAXIAL - Unconsolidated Undrained Single Stage

client :	**SMS GEOTECHNICAL**	job No. :	**GS6592/1**
principal :	**-**	report No :	**AV**
project :	**GEOTECHNICAL TESTING**	test date :	**13/12/2022**
location :	**-**	Page :	**1 of 2**

borehole:	BH03	sample type:	Undisturbed	test type:	**UU**	test procedure:	AS 1289 6.4.1
sample No.	#S30	client ref:	1-2229501	normal stress:	**290**		
depth (m):	14.5-15.0	sample size (mm):	101.6	x	**50.8**	date of sampling:	**Sampled by client**



Stage	Deviator Stress kPa (σ1-σ3)	Peak lateral stress kPa (σ3)	Peak axial stress kPa (σ1)	Strain @ failure %
1	615	290	905	8.9

Undrained cohesion: **308 kPa**

failure criteria: maximum deviator stress

failure mode : Shear failure

sample description : silty CLAY, medium plasticity, mottled grey/brown

Notes :
1. Mohrs circles are a graphical presentation of the results and are not to scale
2. Tested as received

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Pelin Atas Erden
Approved Signatory

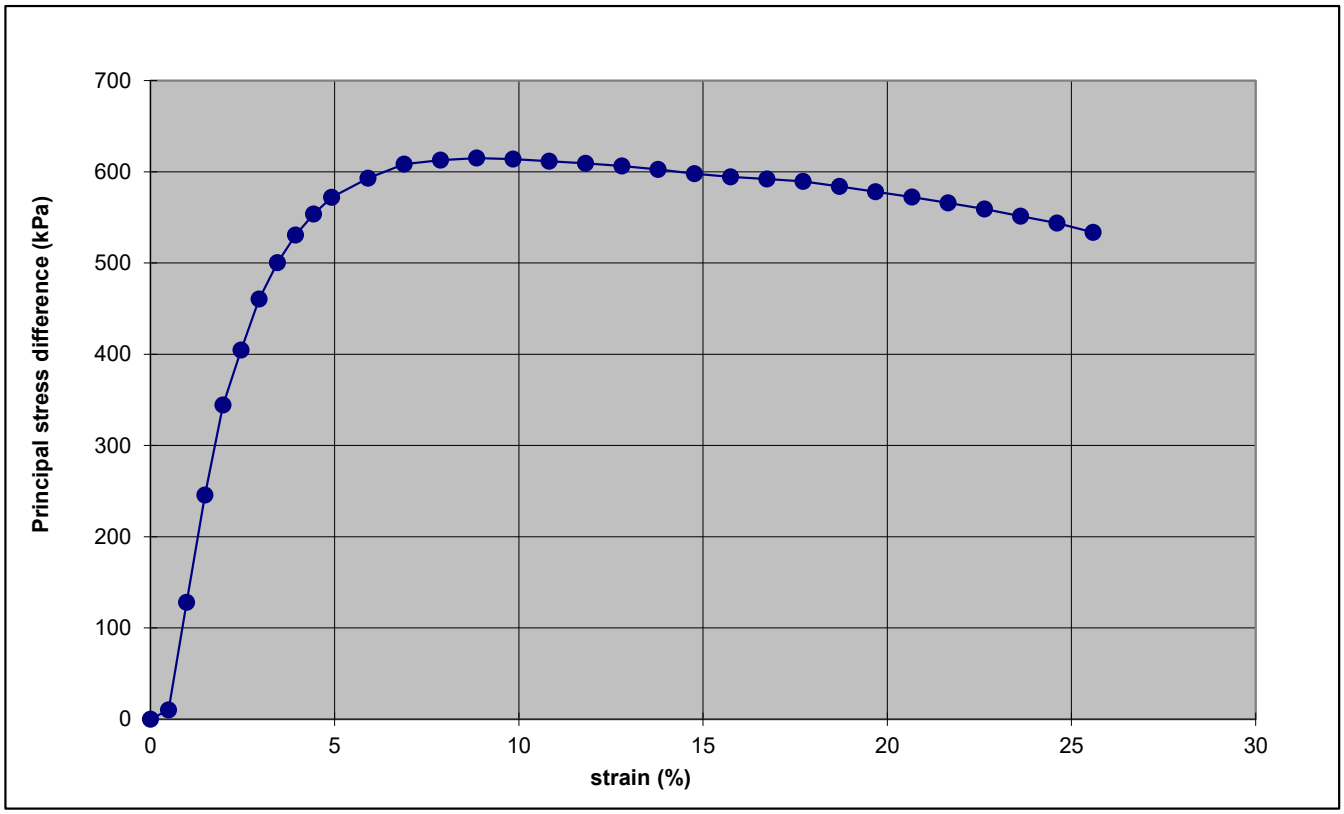
Date: 14-Dec-22

GroundScience
A C N 105 704 078
13 Brock Street Thomastown VIC, P 03 9464 4617 F 03 9464 4618

UU TRIAXIAL - Unconsolidated Undrained Single Stage

client :	**SMS GEOTECHNICAL**	job No. :	**GS6592/1**
principal :	**-**	report No :	**AV**
project :	**GEOTECHNICAL TESTING**	test date :	**13/12/2022**
location :	**-**	page :	**2 of 2**

borehole:	BH03	sample type:	Undisturbed	test type:	**UU**	test procedure:	AS 1289 6.4.1
sample No.	#S30	client ref:	1-2229501	normal stress:	**290**		
depth (m):	14.5-15.0	sample size (mm):	101.6	x	50.8	date of sampling:	**Sampled by client**



Stage	Strain rate %/min
1	1.000

Speciman after test

Specific gravity 2.65 (assumed)

initial dry density : 1.64 t/m^3 **Degree of Saturation** 93.9 %

mositure content : 21.8 % (before test) 23.8 % (after test)

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing

Pelin Atas Erden
Approved Signatory

Date: 14-Dec-22

APPENDIX 5:

Laboratory Test Certificates - Geochemical

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory — Unit E3 Bld F 16 Mars Road Lane Cove West NSW 2066 — 02 9900 8400 — EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory — Unit 1 21 Smallwood Place Murarrie QLD 4172 — 07 3902 4600 — EnviroSampleQLD@eurofins.com

☐ Perth Laboratory — Unit 2 91 Leach Highway Kewdale WA 6105 — 08 9251 9600 — EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory — 6 Monterey Road Dandenong South VIC 3175 — 03 8564 5000 — EnviroSampleVic@eurofins.com

Company	ENGEO	Project №	20651	Project Manager	Rhys Mathews
Address	170 Greenhill Rd	Project Name	BAM Bolivar	EDD Format (ESdat, EQuIS etc)	
Contact Name	Rhys Mathews			Sampler(s)	Harjeet Singh
Phone №	0457 562 109			Handed over by	
Special Directions				Email for Invoice	
Purchase Order				Email for Results	
Quote ID №					

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Acid sulphate soils

Containers — Change container type & size if necessary.

Required Turnaround Time (TAT) — Default will be 5 days if not ticked.

♦Surcharge will apply

☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☐ 5 days (Standard)
☐ Other(

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Acid sulphate soils	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	TP04 - Ass 1	24/11		X									
2	TP08 - ASS 2	24/11		X									
3	TP20 - Ass 3	24/11		X									#944513 Received
4	TP12 - ASS4	24/11		X									
5	TP11 - ASS 5	25/11		X									4.4°C −1.2°C 3.2°C on ice.
6													
7													
8													
9													
10													
	Total Counts												

Method of Shipment: ☐ Courier (#) ☐ Hand Delivered ☐ Postal — Name — Signature — Date — Time

Laboratory Use Only

Received By	Received	SYD | BNE | MEL | PER (ADL) | NTL | DRW	Signature	Date 25/11	Time 10 am	Temperature
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Report №

Parimal Acharya

From: Rhys Mathews <RMathews@engeo.com.au>
Sent: Friday, 25 November 2022 1:48 PM
To: Enquiries Adelaide
Subject: RE: Eurofins Sample Receipt Advice - Report 944513 : Site BAM BOLIVAR (20651)

Hi Parimal,

Thanks for sorting these out for us.
Can we please undertake the Chromium Reducible Sulfur Suite and pH field screen on the five (5) samples that I dropped off today?
Is a pH field screen required if we do the CRSS?

	ACID SULFATE SOIL ASSESSMENT	METHOD REFERENCE	LIMIT OF R / STANDARD
	pH - Field Screen (pH_F and pH_{fox})	ASSL Methods Guidelines Version 2.1	0.1 pH units
	Net Acid Generation (NAG) & Net Acid Production Potential (NAPP)	ASSL Methods Guidelines Version 2.1	NA
	SPOCAS /Acid Sulfate Soil Assessment - constituents reported as below	ASSL Methods Guidelines Version 2.1	See Below
	pH_{KCl} TAA		0.1 pH units, 2m H+/tonne
	pH_{OX} TPA		0.1 pH units, 2m H+/tonne
	KCl Extractable Sulfur		0.02%S
	Peroxide Extractable Sulfur		0.02%S
	ANC_E Acid Neutralizing Capacity		0.02%CaCO
	S_{NAS} Nett Acid Soluble Sulfur		0.02%S
	Chromium Reducible Sulfur Suite - constituents reported as below	ASSL Methods Guidelines Version 2.1	See Below
	Chromium Reducible Sulfur (S_{CR})		0.005%S
	pH_{KCl} TAA		0.1 pH units, 2m H+/tonne
	ANC_E Acid Neutralizing Capacity		0.02%CaCO
	S_{NAS} Nett Acid Soluble Sulfur		0.02%S

Thanks very much,
Rhys

#944513
Parimal

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521
Phone: +61 3 8564 5000
e.mail: EnviroRemittances@eurofins.com

Tax Invoice

ENGEO Australia Pty Ltd
PO Box 79
Mitcham
SA 5062

Purchase Order #:	Not provided
Invoice #:	738301
Date:	Dec 06, 2022
Report #:	944513
Project Name:	BAM BOLIVAR
Project ID:	20651
Contact:	Rhys Matthews

Description	Quantity	Price	Total	Notes
Solid Samples				
Acid Sulfate Soils Field pH Test	5	$5.00	$25.00	
Chromium Reducible Sulfur Suite	5	$70.00	$350.00	
Handling Charge	1	$30.00	$30.00	

	Nett Total	$405.00
	GST	$40.50
	Total Inc GST	$445.50

This invoice is subject to Eurofins General Terms of Sales. Copies available on request or at http://environment.eurofins.com.au

Please detach and return with payment to:
Postal:
Eurofins Environment Testing
6 Monterey Road
Dandenong South
Victoria, 3175

Please EFT Payments to:
Eurofins Environment Testing
BSB 063-498
Acct No: 10057019
e.mail Remittances:
EnviroRemittances@eurofins.com

Invoice Number : 738301
Amount Inc GST : $445.50

TERMS STRICTLY 30 DAYS

eurofins | Environment Testing

www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	4/52 Industrial Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield East NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	PO Box 60 Wickham 2293
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	Tel: +61 2 4968 8448
NATA# 1261 Site# 1254	NATA# 1261 Site# 1254	NATA# 1261 Site# 18217		NATA# 1261 Site# 20794	NATA# 1261 Site# 25079

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NATA# 2377 Site# 2370

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

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35 O'Rorke Road	43 Detroit Drive
Penrose,	Rolleston,
Auckland 1061	Christchurch 7675
Tel: +64 9 526 45 51	Tel: 0800 856 450
IANZ# 1327	IANZ# 1290

Sample Receipt Advice

Company name:	ENGEO Australia Pty Ltd
Contact name:	Rhys Matthews
Project name:	BAM BOLIVAR
Project ID:	20651
Turnaround time:	5 Day
Date/Time received	Nov 25, 2022 10:00 AM
Eurofins reference	944513

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Michael Cassidy on phone : +61 3 8564 5000 or by email: MichaelCassidy@eurofins.com

Results will be delivered electronically via email to Rhys Matthews - RMathews@engeo.com.au.

Note: A copy of these results will also be delivered to the general ENGEO Australia Pty Ltd email address.

eurofins

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

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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NATA# 1261 Site# 1254

Sydney
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NATA# 1261 Site# 18217

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Murarrie
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Tel: +61 7 3902 4600
NATA# 1261 Site# 20794

Newcastle
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PO Box 60 Wickham 2293
Tel: +61 2 4968 8448
NATA# 1261 Site# 25079

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NZBN: 9429046024954

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Tel: +64 9 526 45 51
IANZ# 1327

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: 0800 856 450
IANZ# 1290

Company Name: ENGEO Australia Pty Ltd
Address: Level 7, 19 Grenfell Street
Adelaide
SA 5000

Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944513
Phone: 1800 136 436
Fax:

Received: Nov 25, 2022 10:00 AM
Due: Dec 2, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Acid Sulfate Soils Field pH Test	Chromium Reducible Sulfur Suite	Moisture Set
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X	X
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP04-ASS 1	Nov 24, 2022		Soil	M22-No0061400	X	X	X
2	TP08-ASS 2	Nov 24, 2022		Soil	M22-No0061401	X	X	X
3	TP20-ASS 3	Nov 24, 2022		Soil	M22-No0061402	X	X	X
4	TP12-ASS 4	Nov 24, 2022		Soil	M22-No0061403	X	X	X
5	TP11-ASS 5	Nov 25, 2022		Soil	M22-No0061404	X	X	X
Test Counts						5	5	5

ENGEO Australia Pty Ltd
Level 7, 19 Grenfell Street
Adelaide
SA 5000

NATA Accredited
Accreditation Number 1261
Site Number 20794

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

Attention: **Rhys Matthews**

Report **944513-S**
Project name BAM BOLIVAR
Project ID 20651
Received Date Nov 25, 2022

Client Sample ID			**TP04-ASS 1**	**TP08-ASS 2**	**TP20-ASS 3**	**TP12-ASS 4**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M22-No0061400**	**M22-No0061401**	**M22-No0061402**	**M22-No0061403**
Date Sampled			**Nov 24, 2022**	**Nov 24, 2022**	**Nov 24, 2022**	**Nov 24, 2022**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.1	9.2	9.2	8.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.7	9.3	9.5	8.8
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	4.0
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	6.1	9.3	9.0	8.0
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	2.3	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.004	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	38	4.1	0.45
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	12	1.3	0.14
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	7700	810	89
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Extraneous Material						
<2mm Fraction	0.005	g	220	130	80	280
>2mm Fraction	0.005	g	< 0.005	87	120	< 0.005
Analysed Material	0.1	%	100	60	40	100
Extraneous Material	0.1	%	< 0.1	40	60	< 0.1
% Moisture	1	%	11	20	25	17

Client Sample ID			TP11-ASS 5
Sample Matrix			Soil
Eurofins Sample No.			M22-No0061404
Date Sampled			Nov 25, 2022
Test/Reference	LOR	Unit	
Acid Sulfate Soils Field pH Test			
pH-F (Field pH test)*	0.1	pH Units	9.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	9.9
Reaction Ratings*[S05]	0	-	4.0
Actual Acidity (NLM-3.2)			
pH-KCL (NLM-3.1)	0.1	pH Units	9.3
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003
Potential Acidity - Chromium Reducible Sulfur			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3
Extractable Sulfur			
Sulfur - KCl Extractable	0.005	% S	N/A
HCl Extractable Sulfur	0.005	% S	N/A
Retained Acidity (S-NAS)			
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0
Acid Neutralising Capacity (ANCbt)			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	18
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	5.8
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	3600
ANC Fineness Factor		factor	1.5
Net Acidity (Including ANC)			
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1
Extraneous Material			
<2mm Fraction	0.005	g	130
>2mm Fraction	0.005	g	90
Analysed Material	0.1	%	58
Extraneous Material	0.1	%	42
% Moisture	1	%	19

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Brisbane	Nov 30, 2022	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Nov 30, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Nov 30, 2022	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Nov 25, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins

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

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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NATA# 1261 Site# 1254

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NATA# 1261 Site# 1254

Sydney
179 Magowar Road
Girraween
NSW 2145
Tel: +61 2 9900 8400
NATA# 1261 Site# 18217

Canberra
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Mitchell
ACT 2911
Tel: +61 2 6113 8091

Brisbane
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Murarrie
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NATA# 1261 Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

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NATA# 2377 Site# 2370

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IANZ# 1327

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: 0800 856 450
IANZ# 1290

Company Name: ENGEO Australia Pty Ltd
Address: Level 7, 19 Grenfell Street
Adelaide
SA 5000

Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944513
Phone: 1800 136 436
Fax:

Received: Nov 25, 2022 10:00 AM
Due: Dec 2, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Acid Sulfate Soils Field pH Test	Chromium Reducible Sulfur Suite	Moisture Set
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X	X
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP04-ASS 1	Nov 24, 2022		Soil	M22-No0061400	X	X	X
2	TP08-ASS 2	Nov 24, 2022		Soil	M22-No0061401	X	X	X
3	TP20-ASS 3	Nov 24, 2022		Soil	M22-No0061402	X	X	X
4	TP12-ASS 4	Nov 24, 2022		Soil	M22-No0061403	X	X	X
5	TP11-ASS 5	Nov 25, 2022		Soil	M22-No0061404	X	X	X
Test Counts						5	5	5

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Actual Acidity (NLM-3.2)							
pH-KCL (NLM-3.1)	%	103			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)	%	104			80-120	Pass	
LCS - % Recovery							
Potential Acidity - Chromium Reducible Sulfur							
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	%	105			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	L22-No0066115	NCP	pH Units	9.4	9.4	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-No0066115	NCP	mol H+/t	< 2	< 2	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-No0066115	NCP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	L22-No0066115	NCP	% S	0.013	0.012	4.9	20%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	L22-No0066115	NCP	mol H+/t	7.8	7.4	4.9	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L22-No0066115	NCP	% S	N/A	N/A	N/A	20%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L22-No0066115	NCP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L22-No0066115	NCP	% CaCO3	1.6	1.6	1.9	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L22-No0066115	NCP	% S	0.52	0.53	1.9	30%	Pass	
ANC Fineness Factor	L22-No0066115	NCP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-No0066115	NCP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-No0066115	NCP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L22-No0066115	NCP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M22-No0058258	NCP	%	29	28	3.7	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	M22-No0061404	CP	pH Units	9.7	9.5	pass	20%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Harry Bacalis	Analytical Services Manager
Jonathon Angell	Senior Analyst-Sample Properties
Jonathon Angell	Senior Analyst-SPOCAS
Myles Clark	Senior Analyst-SPOCAS

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory — Unit F3, Bld F, 16 Mars Road, Lane Cove West NSW 2066 — 02 9900 8400 — EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory — Unit 1, 21 Smallwood Place, Murarrie QLD 4172 — 07 3902 4600 — EnviroSampleQLD@eurofins.com

☐ Perth Laboratory — Unit 2, 91 Leach Highway, Kewdale WA 6105 — 08 9251 9600 — EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory — 6 Monterey Road, Dandenong South VIC 3175 — 03 8564 5000 — EnviroSampleVic@eurofins.com

Company	ENGEO	Project №	20651	Project Manager	Rhys
Address		Project Name	BAM, BOLIVAR	EDD Format (ESdat, EQuIS etc)	
Contact Name	HARVI SINGH / Rhys				
Phone №	0421247594				
Special Directions					
Purchase Order					
Quote ID №					

Sampler(s)	H.S
Handed over by	Harvi.
Email for Invoice	Rhys
Email for Results	Rhys & Harvi

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing: pH, Chloride, Sodium sulfate, Resistivity

Containers — Change container type & size if necessary.

Required Turnaround Time (TAT) — Default will be 5 days if not ticked. ♦Surcharge will apply

- ☐ Overnight (reporting by 9am)♦
- ☐ Same day♦ ☐ 1 day♦
- ☐ 2 days♦ ☐ 3 days♦
- ☐ 5 days (Standard)
- ☐ Other(

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	pH	Chloride	Sodium sulfate	Resistivity	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	BH03 | E1 (11.6-11.7)	15/11/22		4												
2	BH01 | E2 (0.7-0.8)	18/11		4												
3	BH01 | E3 (1.5-1.6)	18/11		4												
4	BH02 | E4 (2.1-2.2)	21/11		4												#944863
5	BH04 | E5 (4.8-4.9)	22/11		4												Parkerat
6																
7																
8																17.9°C
9																- 1.2°C
10																16.7°C
	Total Counts															

Method of Shipment: ☐ Courier (#) ☐ Hand Delivered ☐ Postal — Name — Signature — Date — Time

Laboratory Use Only							
Received By	Parkerat	SYD | BNE | MEL | PER | (ADL) | NTL | DRW	Signature	Date 28/11	Time 10 am	Temperature	
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Report №	

Eurofins Environment Testing Australia Pty Ltd

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | Environment Testing Standard Terms and Conditions unless agreed otherwise. A copy is available on request.

Parimal Acharya

From: Harjeet Singh <hsingh@engeo.com.au>
Sent: Monday, 28 November 2022 10:49 AM
To: Enquiries Adelaide; Rhys Mathews
Subject: RE: Eurofins Sample Receipt Advice - Report 944863 : Site BAM BOLIVAR (20651)

Hi Primal,

Can you remove Sodium testing for all Jars please?

Thank you

From: EnquiriesAdelaide@eurofins.com <EnquiriesAdelaide@eurofins.com>
Sent: Monday, 28 November 2022 10:19 am
To: Rhys Mathews <RMathews@engeo.com.au>
Cc: Harjeet Singh <hsingh@engeo.com.au>
Subject: Eurofins Sample Receipt Advice - Report 944863 : Site BAM BOLIVAR (20651)

Dear Valued Client,

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins Analytical Services Manager as soon as possible to make certain that they get changed.

#.944863
Parimal

Regards

Parimal Acharya
Sample Receipt

Eurofins Environment Testing
9 Main Tce
Richmond SA 5033
AUSTRALIA
Phone: +61 884 434 430
Email: ParimalAcharya@eurofins.com
Website:environment.eurofins.com.au
View our latest EnviroNotes
How did we do? Provide your feedback here

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521
Phone: +61 3 8564 5000
e.mail: EnviroRemittances@eurofins.com

Tax Invoice

ENGEO Australia Pty Ltd
PO Box 79
Mitcham
SA 5062

Purchase Order #:	Not provided
Invoice #:	738938
Date:	Dec 1, 2022
Report #:	944863
Project Name:	BAM BOLIVAR
Project ID:	20651
Contact:	Rhys Matthews

Description	Quantity	Price	Total	Notes
Solid Samples				
Chloride	5	$11.00	$55.00	
pH (1:5 Aqueous extract at 25 °C as rec.)	5	$5.00	$25.00	
Resistivity*	5	$5.00	$25.00	
Sulphate (as SO4)	5	$11.00	$55.00	
Handling Charge	1	$30.00	$30.00	

Nett Total	$190.00
GST	$19.00
Total Inc GST	$209.00

This invoice is subject to Eurofins General Terms of Sales. Copies available on request or at http://environment.eurofins.com.au

Please detach and return with payment to:
Postal:
Eurofins Environment Testing
6 Monterey Road
Dandenong South
Victoria, 3175

Please EFT Payments to:
Eurofins Environment Testing
BSB 063-498
Acct No: 10057019
e.mail Remittances:
EnviroRemittances@eurofins.com

Invoice Number : 738938
Amount Inc GST : $209.00

TERMS STRICTLY 30 DAYS

eurofins | Environment Testing

www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd

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Rolleston,
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IANZ# 1290

Sample Receipt Advice

Company name:	ENGEO Australia Pty Ltd
Contact name:	Rhys Matthews
Project name:	BAM BOLIVAR
Project ID:	20651
Turnaround time:	5 Day
Date/Time received	Nov 28, 2022 10:46 AM
Eurofins reference	944863

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Michael Cassidy on phone : +61 3 8564 5000 or by email: MichaelCassidy@eurofins.com

Results will be delivered electronically via email to Rhys Matthews - RMathews@engeo.com.au.

Note: A copy of these results will also be delivered to the general ENGEO Australia Pty Ltd email address.

eurofins

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

Eurofins Environment Testing Australia Pty Ltd
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NATA# 1261 Site# 25079

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Tel: 0800 856 450
IANZ# 1290

Company Name: ENGEO Australia Pty Ltd
Address: Level 7, 19 Grenfell Street
Adelaide
SA 5000

Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944863
Phone: 1800 136 436
Fax:

Received: Nov 28, 2022 10:46 AM
Due: Dec 5, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Chloride	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	BH03/E1 (11.6-11.7)	Nov 15, 2022		Soil	M22-No0064784	X	X	X	X	X
2	BH01/E2 (0.7-0.8)	Nov 18, 2022		Soil	M22-No0064785	X	X	X	X	X
3	BH01/E3 (1.5-1.6)	Nov 18, 2022		Soil	M22-No0064786	X	X	X	X	X
4	BH02/E4 (2.1-2.2)	Nov 21, 2022		Soil	M22-No0064787	X	X	X	X	X
5	BH04/E5 (4.8-4.9)	Nov 22, 2022		Soil	M22-No0064788	X	X	X	X	X
Test Counts						5	5	5	5	5

ENGEO Australia Pty Ltd
Level 7, 19 Grenfell Street
Adelaide
SA 5000

Attention: **Rhys Matthews**

Report **944863-S**
Project name BAM BOLIVAR
Project ID 20651
Received Date Nov 28, 2022

Client Sample ID			**BH03/E1 (11.6-11.7)**	**BH01/E2 (0.7-0.8)**	**BH01/E3 (1.5-1.6)**	**BH02/E4 (2.1-2.2)**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M22-No0064784**	**M22-No0064785**	**M22-No0064786**	**M22-No0064787**
Date Sampled			**Nov 15, 2022**	**Nov 18, 2022**	**Nov 18, 2022**	**Nov 21, 2022**
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	1200	1100	2100	4600
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.5	8.1	7.3	8.0
Resistivity*	0.5	ohm.m	16	3.8	8.7	4.8
Sulphate (as SO4)	30	mg/kg	640	420	720	1600
% Moisture	1	%	21	17	19	21

Client Sample ID			**BH04/E5 (4.8-4.9)**
Sample Matrix			**Soil**
Eurofins Sample No.			**M22-No0064788**
Date Sampled			**Nov 22, 2022**
Test/Reference	LOR	Unit	
Chloride	5	mg/kg	1600
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	8.6
Resistivity*	0.5	ohm.m	12
Sulphate (as SO4)	30	mg/kg	680
% Moisture	1	%	17

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Chloride	Melbourne	Nov 29, 2022	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
pH (1:5 Aqueous extract at 25 °C as rec.)	Melbourne	Nov 29, 2022	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO4)	Melbourne	Nov 29, 2022	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
% Moisture	Melbourne	Nov 28, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

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Company Name: ENGEO Australia Pty Ltd
Address: Level 7, 19 Grenfell Street
Adelaide
SA 5000

Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944863
Phone: 1800 136 436
Fax:

Received: Nov 28, 2022 10:46 AM
Due: Dec 5, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Chloride	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	BH03/E1 (11.6-11.7)	Nov 15, 2022		Soil	M22-No0064784	X	X	X	X	X
2	BH01/E2 (0.7-0.8)	Nov 18, 2022		Soil	M22-No0064785	X	X	X	X	X
3	BH01/E3 (1.5-1.6)	Nov 18, 2022		Soil	M22-No0064786	X	X	X	X	X
4	BH02/E4 (2.1-2.2)	Nov 21, 2022		Soil	M22-No0064787	X	X	X	X	X
5	BH04/E5 (4.8-4.9)	Nov 22, 2022		Soil	M22-No0064788	X	X	X	X	X
Test Counts						5	5	5	5	5

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Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Sulphate (as SO4)			mg/kg	< 30			30	Pass	
LCS - % Recovery									
Chloride			%	107			70-130	Pass	
Sulphate (as SO4)			%	100			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Sulphate (as SO4)	M22-No0066703	NCP	%	94			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chloride	B22-No0064432	NCP	mg/kg	RR	RR	<1	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	M22-No0064784	CP	pH Units	7.5	7.5	pass	30%	Pass	
Resistivity*	M22-No0064784	CP	ohm.m	16	17	4.7	30%	Pass	
Sulphate (as SO4)	B22-No0064432	NCP	mg/kg	< 30	< 30	<1	30%	Pass	
% Moisture	B22-No0064460	NCP	%	3.0	2.6	14	30%	Pass	

Comments

Sample Integrity

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

Authorised by:

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

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

Glossary of Terms Specific to this Report

Term (Abbreviation)	Definition
Acid Sulfate Soil (ASS)	Soil or sediment distinguished from other soil materials by having properties and behaviour that have either been affected considerably by the oxidation of Reduced Inorganic Sulfur (RIS), or the capacity to be affected considerably by the oxidation of their RIS constituents. ASS materials include Potential acid sulfate soils (PASS or sulfidic soil materials) and Actual Acid Sulfate Soils (AASS or sulfuric soil materials). These are often found in the same profile, with AASS overlying PASS.
Actual Acid Sulfate Soils (AASS)	Soils containing highly acidic soil horizons resulting from the oxidation of soil materials are rich in RIS, primarily pyrite. When this oxidation of RIS produces acidity in excess of the soil material's capacity to neutralise this acidity, the soil material will often acidify to a pH 4 or less, forming an Actual ASS. The recognition of Actual ASS materials can be confirmed by the presence of jarosite in these materials, or the location of other Actual ASS or PASS materials within or in the nearby vicinity to the sampling location.
Potential Acid Sulfate Soils (PASS)	Soils that contain appreciable RIS that have not oxidised but will acidify to a pH of less than 4.0 after oxidation. The soils are also known as hypersulfidic soil materials. The field pH of these soils in their undisturbed state is pH 4 or more, and may be neutral or slightly alkaline. Potential ASS pose an environmental hazard if disturbed, as they can generate considerable acidity if mismanaged.
pH_F	Field pH. Field determination of pH in a soil:water paste or equivalent.
pH_{FOX}	Field peroxide pH. Field determination of pH in a soil: conc. H2O2 mixture after the complete reaction between 30% H2O2 and RIS has taken place.
Δ pH	$(pH_F) - (pH_{FOX})$
RIS	Reduced Inorganic Sulfur; including iron disulfides (FeS_2), most commonly pyrite but also marcasite, and lower amounts of other compounds such as monosulfides (for example FeS) and elemental sulfur (S_8).

Source: Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, *National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual*, Department of Agriculture and Water Resources, Canberra ACT. CC BY 4.0.

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

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☐ Brisbane Laboratory — Unit 1 21 Smallwood Place Murarrie QLD 4172 — 07 3902 4600 — EnviroSampleQLD@eurofins.com

☐ Perth Laboratory — Unit 2 91 Leach Highway Kewdale WA 6105 — 08 9251 9600 — EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory — 6 Monterey Road Dandenong South VIC 3175 — 03 8564 5000 — EnviroSampleVic@eurofins.com

Company	ENGEO	Project №	20651	Project Manager	Rhys Mathews
Address	170 Greenhill Rd	Project Name	BAM Bolivar	EDD Format (ESdat, EQuIS etc)	
Contact Name	Rhys Mathews			Sampler(s)	Harjeet Singh
Phone №	0457 562 109			Handed over by	
Special Directions				Email for Invoice	
Purchase Order				Email for Results	
Quote ID №					

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Acid sulphate soils

Containers — Change container type & size if necessary.

Required Turnaround Time (TAT) — Default will be 5 days if not ticked.

♦Surcharge will apply

☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☐ 5 days (Standard)
☐ Other(

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Acid sulphate soils	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	TP04 - Ass 1	24/11		X									
2	TP08 - ASS 2	24/11		X									
3	TP20 - Ass 3	24/11		X									#944513 Received
4	TP12 - ASS4	24/11		X									
5	TP11 - ASS 5	25/11		X									4.4°C −1.2°C 3.2°C on ice.
6													
7													
8													
9													
10													
	Total Counts												

Method of Shipment: ☐ Courier (#) ☐ Hand Delivered ☐ Postal — Name — Signature — Date — Time

Laboratory Use Only

Received By	Received	SYD | BNE | MEL | PER (ADL) | NTL | DRW	Signature	Date 25/11	Time 10 am	Temperature
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Report №

Parimal Acharya

From: Rhys Mathews <RMathews@engeo.com.au>
Sent: Friday, 25 November 2022 1:48 PM
To: Enquiries Adelaide
Subject: RE: Eurofins Sample Receipt Advice - Report 944513 : Site BAM BOLIVAR (20651)

Hi Parimal,

Thanks for sorting these out for us.
Can we please undertake the Chromium Reducible Sulfur Suite and pH field screen on the five (5) samples that I dropped off today?
Is a pH field screen required if we do the CRSS?

	ACID SULFATE SOIL ASSESSMENT	METHOD REFERENCE	LIMIT OF R / STANDARD
	pH - Field Screen (pH_F and pH_{fox})	ASSL Methods Guidelines Version 2.1	0.1 pH units
	Net Acid Generation (NAG) & Net Acid Production Potential (NAPP)	ASSL Methods Guidelines Version 2.1	NA
	SPOCAS /Acid Sulfate Soil Assessment - constituents reported as below	ASSL Methods Guidelines Version 2.1	See Below
	pH_{KCl} TAA		0.1 pH units, 2m H+/tonne
	pH_{OX} TPA		0.1 pH units, 2m H+/tonne
	KCl Extractable Sulfur		0.02%S
	Peroxide Extractable Sulfur		0.02%S
	ANC_E Acid Neutralizing Capacity		0.02%CaCO
	S_{NAS} Nett Acid Soluble Sulfur		0.02%S
	Chromium Reducible Sulfur Suite - constituents reported as below	ASSL Methods Guidelines Version 2.1	See Below
	Chromium Reducible Sulfur (S_{CR})		0.005%S
	pH_{KCl} TAA		0.1 pH units, 2m H+/tonne
	ANC_E Acid Neutralizing Capacity		0.02%CaCO
	S_{NAS} Nett Acid Soluble Sulfur		0.02%S

Thanks very much,
Rhys

#944513
Parimal

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NATA# 1261 Site# 1254	NATA# 1261 Site# 1254	NATA# 1261 Site# 18217		NATA# 1261 Site# 20794	NATA# 1261 Site# 25079

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Sample Receipt Advice

Company name:	ENGEO Australia Pty Ltd
Contact name:	Rhys Matthews
Project name:	BAM BOLIVAR
Project ID:	20651
Turnaround time:	5 Day
Date/Time received	Nov 25, 2022 10:00 AM
Eurofins reference	944513

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Michael Cassidy on phone : +61 3 8564 5000 or by email: MichaelCassidy@eurofins.com

Results will be delivered electronically via email to Rhys Matthews - RMathews@engeo.com.au.

Note: A copy of these results will also be delivered to the general ENGEO Australia Pty Ltd email address.

eurofins

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

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Company Name: ENGEO Australia Pty Ltd
Address: Level 7, 19 Grenfell Street
Adelaide
SA 5000

Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944513
Phone: 1800 136 436
Fax:

Received: Nov 25, 2022 10:00 AM
Due: Dec 2, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Acid Sulfate Soils Field pH Test	Chromium Reducible Sulfur Suite	Moisture Set
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X	X
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP04-ASS 1	Nov 24, 2022		Soil	M22-No0061400	X	X	X
2	TP08-ASS 2	Nov 24, 2022		Soil	M22-No0061401	X	X	X
3	TP20-ASS 3	Nov 24, 2022		Soil	M22-No0061402	X	X	X
4	TP12-ASS 4	Nov 24, 2022		Soil	M22-No0061403	X	X	X
5	TP11-ASS 5	Nov 25, 2022		Soil	M22-No0061404	X	X	X
Test Counts						5	5	5

ENGEO Australia Pty Ltd
Level 7, 19 Grenfell Street
Adelaide
SA 5000

NATA Accredited
Accreditation Number 1261
Site Number 20794

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

Attention: **Rhys Matthews**

Report **944513-S**
Project name BAM BOLIVAR
Project ID 20651
Received Date Nov 25, 2022

Client Sample ID			**TP04-ASS 1**	**TP08-ASS 2**	**TP20-ASS 3**	**TP12-ASS 4**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M22-No0061400**	**M22-No0061401**	**M22-No0061402**	**M22-No0061403**
Date Sampled			**Nov 24, 2022**	**Nov 24, 2022**	**Nov 24, 2022**	**Nov 24, 2022**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.1	9.2	9.2	8.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.7	9.3	9.5	8.8
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	4.0
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	6.1	9.3	9.0	8.0
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	2.3	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.004	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	38	4.1	0.45
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	12	1.3	0.14
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	7700	810	89
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Extraneous Material						
<2mm Fraction	0.005	g	220	130	80	280
>2mm Fraction	0.005	g	< 0.005	87	120	< 0.005
Analysed Material	0.1	%	100	60	40	100
Extraneous Material	0.1	%	< 0.1	40	60	< 0.1
% Moisture	1	%	11	20	25	17

Client Sample ID			TP11-ASS 5
Sample Matrix			Soil
Eurofins Sample No.			M22-No0061404
Date Sampled			Nov 25, 2022
Test/Reference	LOR	Unit	
Acid Sulfate Soils Field pH Test			
pH-F (Field pH test)*	0.1	pH Units	9.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	9.9
Reaction Ratings*[S05]	0	-	4.0
Actual Acidity (NLM-3.2)			
pH-KCL (NLM-3.1)	0.1	pH Units	9.3
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003
Potential Acidity - Chromium Reducible Sulfur			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3
Extractable Sulfur			
Sulfur - KCl Extractable	0.005	% S	N/A
HCl Extractable Sulfur	0.005	% S	N/A
Retained Acidity (S-NAS)			
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0
Acid Neutralising Capacity (ANCbt)			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	18
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	5.8
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	3600
ANC Fineness Factor		factor	1.5
Net Acidity (Including ANC)			
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1
Extraneous Material			
<2mm Fraction	0.005	g	130
>2mm Fraction	0.005	g	90
Analysed Material	0.1	%	58
Extraneous Material	0.1	%	42
% Moisture	1	%	19

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Brisbane	Nov 30, 2022	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Nov 30, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Nov 30, 2022	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Nov 25, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

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Project Name: BAM BOLIVAR
Project ID: 20651

Order No.:
Report #: 944513
Phone: 1800 136 436
Fax:

Received: Nov 25, 2022 10:00 AM
Due: Dec 2, 2022
Priority: 5 Day
Contact Name: Rhys Matthews

Eurofins Analytical Services Manager : Michael Cassidy

Sample Detail						Acid Sulfate Soils Field pH Test	Chromium Reducible Sulfur Suite	Moisture Set
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X	X
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP04-ASS 1	Nov 24, 2022		Soil	M22-No0061400	X	X	X
2	TP08-ASS 2	Nov 24, 2022		Soil	M22-No0061401	X	X	X
3	TP20-ASS 3	Nov 24, 2022		Soil	M22-No0061402	X	X	X
4	TP12-ASS 4	Nov 24, 2022		Soil	M22-No0061403	X	X	X
5	TP11-ASS 5	Nov 25, 2022		Soil	M22-No0061404	X	X	X
Test Counts						5	5	5

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Actual Acidity (NLM-3.2)							
pH-KCL (NLM-3.1)	%	103			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)	%	104			80-120	Pass	
LCS - % Recovery							
Potential Acidity - Chromium Reducible Sulfur							
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	%	105			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	L22-No0066115	NCP	pH Units	9.4	9.4	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-No0066115	NCP	mol H+/t	< 2	< 2	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-No0066115	NCP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	L22-No0066115	NCP	% S	0.013	0.012	4.9	20%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	L22-No0066115	NCP	mol H+/t	7.8	7.4	4.9	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L22-No0066115	NCP	% S	N/A	N/A	N/A	20%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L22-No0066115	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L22-No0066115	NCP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L22-No0066115	NCP	% CaCO3	1.6	1.6	1.9	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L22-No0066115	NCP	% S	0.52	0.53	1.9	30%	Pass	
ANC Fineness Factor	L22-No0066115	NCP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-No0066115	NCP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-No0066115	NCP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L22-No0066115	NCP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M22-No0058258	NCP	%	29	28	3.7	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	M22-No0061404	CP	pH Units	9.7	9.5	pass	20%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Harry Bacalis	Analytical Services Manager
Jonathon Angell	Senior Analyst-Sample Properties
Jonathon Angell	Senior Analyst-SPOCAS
Myles Clark	Senior Analyst-SPOCAS

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.