Geotechnical and Acid Sulfate Soil Assessment

Proposed Rezoning at 196 Old Main Road, 263, 269, 271, 273, 293 and 321 Gan Gan Road, Anna Bay, NSW

Final Report

P2208888JR07V01.docx
December 2024
Prepared for AB Rise Pty Ltd C/- DMPS

environmental science & engineering

Project Details

Report Title	Geotechnical and Acid Sulfate Soil Assessment: Proposed Rezoning at 196 Old Main Road, 263, 269, 271, 273, 293 and 321 Gan Gan Road, Anna Bay, NSW
Client	AB Rise Pty Ltd C/- DMPS
Document	P2208888JR07V01.docx
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Document History

Issue	Issue Date	Status	Description / Comment	Author	Reviewer	Approved
1.	13/12/2024	Final	For PP	WB	JF /RE / MS	MS

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Contents

Tables

1 Introduction & Background

1.1 Overview

The purpose of the geotechnical and acid sulfate soil (**ASS**) assessment is to support a Planning Proposal (**PP**) for the proposed land rezoning and future residential subdivision at 196 Old Main Road, 263, 269, 271, 273, 293 and 321 Gan Gan Road, Anna Bay, NSW (the **Site**).

The Site comprises a group of adjoining lots to the north of Gan Gan Road. The extent of the Site is shown on Map 01, Appendix A. The combined area of the Site is approximately 117.57 hectares. We note that there is an area in the southern portion of 293 and 321 Gan Gan Road which is subject to an existing development application (**DA**). This small portion of the Site is currently zoned residential and is not included as part of this PP.

1.2 Location and General Site Description Details

General location and general Site description details are summarised in Table 1 below.

Table 1: Summary of Site details.

Item	Description / Comment
Lot / DP, Site address, and approximate area	Lot 963 in DP 731955 - 196 Old Main Road, Anna Bay, NSW, 27.15 ha. Lot 21 in DP 590387 - 263 Gan Gan Road, Anna Bay, NSW, 28.58 ha. Lot 23 in DP 590387 - 269 Gan Gan Road, Anna Bay, NSW, 0.12 ha. Lot 1 in DP 536752 - 271 Gan Gan Road, Anna Bay, NSW, 19.20 ha. Lot 901 in DP 436550 - 273 Gan Gan Road, Anna Bay, NSW, 1.0 ha. Lot 902 in DP 634550 - 293 Gan Gan Road, Anna Bay, NSW, 31.38 ha. Lot 1 in DP 503876 - 321 Gan Gan Road, Anna Bay, NSW, 11.26 ha. Refer Map 01, Appendix A for the location of the Site.
LGA	Port Stephens Council ('Council').
Current zoning (ePLanning Spatial Viewer)	196 Old Main Road, Anna Bay, NSW • RU2 – Rural Landscape 263 and 271 Gan Gan Road, Anna Bay, NSW • RU2 – Rural Landscape 293 and 321 Gan Gan Road, Anna Bay, NSW • R2 – Low Density Residential • C3 – Environmental Management • RU2 – Rural Landscape

1.3 Proposed Development

The master plan of the development (BKA, 2024) indicates that the future development will involve:

- Subdivision of the Site into residential allotments.
- Construction of associated new internal access roads and stormwater drainage infrastructure (including stormwater treatment basins).

- Widening of an existing east-west aligned channel (i.e. Anna Bay main drain) in the central portion of the Site.

- Provision of public open / recreational and ecological spaces.

Based on the preliminary map set (P2208888MS16-R02, dated 13 December, 2024) prepared by MA (MA, 2024a), the following earthworks are anticipated to be undertaken at the Site:

- Filling of up to approximately 4.9 m above existing ground level within the proposed lots and roadways.

- No or little cutting is expected to be required across the majority of the Site where there lot development is proposed. A maximum cut of approximately 2.2 m is expected to be required across a small area in the south eastern portion of the Site.

- Excavation up to approximately 2.5 mbgl for the widening of the existing channel will be undertaken without altering the current base level (varies between -1.38 mAHD and -2.3 mAHD) of the channel. A total cut volume of approximately 25,000 m^3 is expected to be required as part of channel widening.

- Construction of several shallow unlined stormwater detention basins (the **basin(s))** across the site, with a base level of -0.1 mAHD. This will require excavation of up to approximately 2.0 mbgl in some basin locations.

An east-west aligned remnant sand dune is located in the southern portion of the Site. We understand that the future residential subdivision will not extend into the footprint of the sand dune (the **Sand Dune**).

1.4 Investigation Scope of Work

Field investigations were conducted on 13 to 16 September and 5 to 7 December 2022, 7 and 8 February 2023, 4 April 2023 and 11 April 2024. Works in relation to this assessment included:

1. Review of BYDA survey plans and buried services searches.

2. A walkover inspection of the Site to review local geology, surface hydrology and topography.

3. Drilling of thirty three boreholes (BH101 to BH107, BH110 to BH129 and BH133 to BH138) via solid flight auger up to a maximum depth of 6.0 metres below ground level (**mbgl**).

4. Ten cone penetration tests (**CPT**) (CPT101 to CPT110) to CPT refusal depth of up to 22.0 mbgl. We note that CPT102, CPT103 and CPT107 to CPT109 were undertaken near the crest of an east-west aligned Sand Dune through the southern portion of the Site.

5. Twenty three dynamic cone penetrometer (**DCP**) tests (DCP101 to DCP105 and DCP107 to DCP124) up to 4.4 mbgl.

6. Six standard penetration tests (**SPTs**), in BH105 and BH114.

7. Construction of ten groundwater monitoring wells (**MW**) (MW01 in BH101, MW02 in BH106, MW04 in BH110, MW05 in BH112, MW08 in BH116, MW09 in BH118, MW10 in BH121, MW11 in BH124, MW12 in BH126 and MW13 in BH129).

8. Collection of soil samples for future reference and laboratory testing.

Investigation locations are shown in Maps 05 – 09, Appendix A.

1.5 Previous MA Assessment

A geotechnical, groundwater and acid sulfate soil assessment was previously undertaken by Martens and Associates (MA) to support the development application (**DA**) for the proposed subdivision across the small portion of land across the southern portions of 263, 273, 293 and 321 Gan Gan Road, Anna Bay (refer Map 01 for the footprint area associated with the DA). The assessment involved drilling of fourteen boreholes (BH108, BH109 and BH201 to BH212), two CPTs (CPT111 and CPT112) and installation of three MWs (MW03 in BH109, MW06 in BH206 and MW07 in BH207) as shown in Maps 07 – 10, Attachment A. Results of this assessment are presented in MA's report referenced P2208888JR04V01, dated July 2023 (MA, 2023). Reference has been made to the findings of the geotechnical, groundwater and acid sulfate soil assessment, where necessary, however have not been reproduced as part of this report.

1.6 Other Assessments

A previous geotechnical investigation was conducted by Douglas Partners (DP, 2005) to support a development proposal for a residential subdivision and golf course at the Site (and surrounding land in close proximity to the Site). The proposal was ultimately unsuccessful, however DP (2005) included an assessment of the subsurface conditions and geotechnical constraints at the Site including a ground settlement analysis. The data and findings of the DP (2005) report have been considered but not reproduced in this report.

A summary of the field investigation undertaken by DP (2005) and relevant conclusions are presented below:

a) The geotechnical investigation included:

   i. Excavation of 129 test pits and drilling of thirteen boreholes.

   ii. Seventy CPTs.

   CPT locations within the Site are shown on Maps 07 – 10, Appendix A.

b) In general, the subsurface profile in the northern portion of the Site (to the north of the Sand Dune) comprised organic silty topsoil and very soft to firm silty clay to varying depths, overlying sand. The thickness of the clay typically ranged between 2 m and 4 m. The underlying sand was initially loose grading to medium dense or dense. The southern portion of the Site (to the south of the Sand Dune) typically comprised loose grading to dense sand.

c) Subsurface conditions were assessed to be susceptible to significant differential, total and likely creep settlements caused by consolidation of the underlying compressible very soft to firm clays. Careful treatment of these soils was recommended.

d) Where expected large settlements could not be tolerated, consideration was to be given to preloading to remove some settlements prior to building construction, or alternatively supporting the buildings on piled foundations. Settlements were recommended to be monitored during any period of preloading.

e) Consolidation settlement over 50 years was expected to be between approximately 20 mm and 130 mm. Differential settlement was expected to be around 30% to 40% of the total settlement.

f) Fill batters should not exceed 1V:3H.

2 Site Details and Subsurface Conditions

2.1 General Site Details

General Site details are summarised in Table 2.

Table 2: Summary of general Site details based on desktop reviews and field investigations.

Item	Description / Comment
Topography	The majority of the central and northern portion of the Site is near level and low-lying. The Sand Dune in the southern portion of the Site extends adjacent to and parallel with Gan Gan Road. A network of man-made east-west and north-south aligned drainage channels are located within the low-lying northern Site portion.
Typical slopes, aspect, elevation	The majority of the Site to the north of the Sand Dune is relatively flat with grades of less than 2 % and elevations between approximately 0.5 m to 3 mAHD (TSS, 2023a). A small area of the Site to the south of the Sand Dune, along Gan Gan Road, generally has a southerly aspect with an overall grade of less than 5 %. Areas immediately adjacent to the southern toe of the Sand Dune have grades of between approximately 10 % and 20 %. The elevations of this portion of the Site range between approximately 4.5 mAHD and 6 mAHD (TSS, 2023b). The Sand Dune has general grades of between approximately 20 % and 30 %, with some steeper grades of between approximately 40 % and 60 %. The ground elevation at the toe of the Sand Dune is approximately 6.0 mAHD increasing to approximately 23.0 mAHD at the crest (TSS, 2023b). Ground elevation contours for the Site are presented in Map 02, Appendix A.
Expected geology	Quaternary deposits comprising gravel, sand, silt, clay, Waterloo rock, marine and freshwater deposits (Site geology is shown in Map 03, Appendix A).
Soil landscape (refer Map 04, Appendix A)	The NSW Office of Environment and Heritage's (OEH) information system (eSPADE) indicates the majority of the Site to the north of the Sand Dune is underlain by the Bobs Farm (bf) soil landscape while the Sand Dune and portion of the Site to the south of the Sand Dune is underlain by the Shoal Bay (sb) soil landscape. They comprise the following: • The Bobs Farm soil landscape consists typically of flat, swampy, Holocene estuarine plains with slope gradients <1% and elevations between 1 and 3 mAHD. This soil landscape is often characterised by deep (> 300 cm) estuarine swamp deposits comprising slit and clay and is well known for flooding, foundation hazard and seasonal water logging, permanently high water tables and acid sulphate potential. • The Shoal Bay soil landscape consists typically of gently inclined, deep (> 300 cm) and well drained Pleistocene aeolian sand sheets to rolling very low dunes, with slope gradients generally <5 % (but on slopes of rolling dunes up to 15 %) and elevation <15 m. This soil landscape is often associated with wind erosion, ground water pollution and foundation (localised swamps) hazards, permanent high water tables (localised swampy depressions), seasonal waterlogging (localised low-lying swales) and acid soils. We note that the Sand Dune is underlain by Variant-a of the Shoal Bay soil landscape consisting of steeper slopes and higher relief, however, soils are similar to the Shoal Bay soil landscape.
Existing Site Features	Site mainly consists of: • Bushland / forest with some cleared grassed areas and market gardens in the northern and central portions of the Site. • Scattered infrastructure including residential dwellings, garages and sheds predominantly in the southern portion. • Cleared farm tracks for site access.
Drainage	The northern and central portion of the Site (to the north of the Sand Dune) drains via a network of man made drainage channels to the east-west aligned Anna Bay main drain.

Item	Description / Comment
	The portion of the Site to the south of the Sand Dune generally drains via overland flow to a trapped low point on 293 Gan Gan Road.
Neighbouring environment	The Site is bordered by Gan Gan Road and Old Main Road to the south, with rural land and low density residential developments to the east, north and west.

2.2 Subsurface Conditions

Based on the variations in subsurface conditions identified from the investigations, the Site has been divided into three generalised zones (refer to Map 06, Appendix A for zone extents), underlying by the following generalised subsurface units:

1. Zone A, the portion of the Site to the south of the Sand Dune:

   Unit A: Marine / aeolian sand / silty sand, generally loose to medium dense, encountered up to approximately 5.5 mbgl.

   Unit B: Marine sand / silty sand, typically medium dense grading to dense, encountered below Unit A up to investigation termination depth of 10.47 mbgl.

2. Zone B, the Sand Dune, underlain by well-drained Pleistocene aeolian sand:

   Marine / aeolian sand / silty sand, varying typically between very loose and medium dense, with some dense layers, encountered up to investigation termination depth of 22.0 mbgl.

3. Zone C, the majority of the Site, to the north of the Sand Dune, underlain by estuarine swamp deposits comprising silt and clay:

   Unit A: Marine silty clay / silt, typically organic and very soft to firm (with interbedded loose sand at some locations), encountered in places up to between approximately 2.0 mbgl and 4.75 mbgl. Where encountered, Unit A is typically 2 m to 4 m thick, though the soft clay layer thickness encountered across the southern portion (along the northern toe of the Sand Dune) as well as the far north eastern and north western portions of Zone C, is typically less than 2 m.

   Unit B: Marine sand / silty sand, typically medium dense grading to dense, encountered in some places beneath Unit A and to investigation termination depths of up to 15.95 mbgl.

We note that a thin (up to ≈ 0.2 m) topsoil layer comprising organic sand / silty sand overlies Unit A in some locations of the Site.

CPT refusal is inferred to have occurred due to the presence of dense cemented sand (i.e. Waterloo rock) at CPT termination depth.

Encountered conditions are described in more detail on the borehole logs in Appendix C. Associated explanatory notes are provided in Appendix J. For DCP and CPT test results refer to Appendix D and Appendix E, respectively. Geotechnical investigation locations are shown on Map 07 to Map 10, Attachment A.

2.3 Groundwater

2.3.1 Monitoring Well Installation

Thirteen groundwater monitoring wells (MWs) were installed across the Site. A summary of MW construction is documented in the Preliminary Hydrogeological Assessment report prepared by MA (P2208888JR10V01, dated December, 2024). Details of MW construction are provided on the borehole logs in Appendix C.

2.3.2 Borehole Observations

Groundwater inflow was encountered during drilling of all boreholes except BH101, BH102, BH104 to BH107, BH110 to BH114 and BH134. A summary of these groundwater inflow levels and levels identified in the CPT results is provided in Table 3.

Table 3: Summary of groundwater inflow levels in boreholes and groundwater levels identified in CPT results.

Location	Surface Level (mAHD)	Depth of Groundwater Inflow (mbgl)	Groundwater Inflow Level (mAHD)	Date
BH103	4.0 [1]	0.9	3.1	13/09/2022
BH115	1.2 [1]	1.0	0.2	07/02/2023
BH116	0.69 [1]	3.0	-2.31	07/02/2023
BH117	0.60 [1]	1.5	-0.9	07/02/2023
BH118	0.73 [1]	1.5	-0.77	07/02/2023
BH119	0.80 [1]	2.0	-1.2	07/02/2023
BH120	0.80 [1]	1.0	-0.2	07/02/2023
BH121	0.98 [1]	1.5	-0.52	08/02/2023
BH122	0.50 [1]	1.5	-1.0	08/02/2023
BH123	0.80 [1]	1.0	-0.2	08/02/2023
BH124	1.14 [1]	1.9	-0.76	08/02/2023
BH125	0.90 [1]	1.0	-0.1	08/02/2023
BH126	0.94 [1]	1.0	-0.06	08/02/2023
BH127	0.90 [1]	1.5	-0.60	08/02/2023
BH128	0.90 [1]	1.0	-0.1	08/02/2023
BH129	0.84 [1]	1.5	-0.66	08/02/2023
BH133	0.62 [1]	2.3	-1.68	12/04/2024
BH135	0.78 [1]	0.80	-0.02	12/04/2024
BH136	0.84 [1]	1.2	-0.36	12/04/2024
BH137	0.76 [1]	0.70	0.06	12/04/2024
BH138	0.78 [1]	0.80	-0.02	12/04/2024
CPT101	4.4 [1]	2.5	1.9	14/09/2022
CPT102	14.5 [1]	11.0	3.5	14/09/2022
CPT103	23.8 [2]	18.0	5.8	14/09/2022
CPT104	1.9 [1]	0.40	1.5	14/09/2022
CPT105	5.9 [1]	1.7	4.2	15/09/2022

Location	Surface Level (mAHD)	Depth of Groundwater Inflow (mbgl)	Groundwater Inflow Level (mAHD)	Date
CPT106	1.8 [1]	0.40	1.4	15/09/2022
CPT107	19.5 [2]	11.0	8.50	15/09/2022
CPT108	17.3 [1]	15.0	2.3	15/09/2022
CPT109	18.0 [2]	10.0	8.00	15/09/2022
CPT110	2.0 [1]	0.0	2.0	15/09/2022

Notes:

1. Surface level estimated from TSS (2023a).
2. Surface level estimated from TSS (2023b).
3. Surface level surveyed by TSS (2023c).
4. Surface level estimated from TSS (2024).

2.3.3 Monitoring Well Installation

Continuous monitoring of MWs was completed from 7 December 2022 to 27 November 2024. Details of the monitoring, monitoring results and assessment findings are provided in MA (MA, 2024b). However, for convenience, the continuous data logger statistics are summarised in Table 4.

Table 4: Summary of groundwater level statistics from continuous monitoring.

Location	Surface Level (mAHD) [1]	Groundwater Level (mbgl / mAHD)			Range (m)
		Minimum	Mean	Maximum	
MW01	4.31	4.00 / 0.31	3.30 / 1.01	2.21 / 2.10	1.79
MW02	1.74	1.57 / 0.17	0.93 / 0.81	0.42 / 1.32	1.15
MW04	2.17	1.90 / 0.27	1.16 / 1.01	0.54 / 1.63	1.36
MW05	1.85	1.80 / 0.05	1.00 / 0.85	0.18 / 1.67	1.62
MW08	0.69	1.01 / - 0.32	0.39 / 0.30	0.34 [2] / 1.03	1.35
MW09	0.73	0.78 / - 0.05	0.27 / 0.46	0.32 [2] / 1.05	1.10
MW10	0.98	0.99 / -0.01	0.45 / 0.53	0.14 [2] / 1.12	1.13
MW11	1.14	0.85 / 0.29	0.24 / 0.90	0.34 [2] / 1.48	1.19
MW12	0.94	1.18 / - 0.24	0.52 / 0.42	0.10 [2] / 1.04	1.28
MW13	0.84	1.02 / - 0.18	0.45 / 0.39	0.21 [2] / 1.05	1.23

Notes:

1. Surface level surveyed by TSS (2023c).
2. Water level above ground surface.

2.3.4 Comments

The groundwater monitoring results indicate the following:

1. Groundwater responds relatively rapidly to incident rainfall, which can cause groundwater to rise rapidly as water infiltrates the ground within the local area. We note that several significant rainfall events occurred over the monitoring period, particularly between mid March and mid April 2023 and 2024.

2. Mean groundwater levels were generally reflective of surface topography, tending to be shallow (≈ 0.3 mbgl) in low-lying areas to the north of the Sand Dune and deeper

in the southern portion of the Site (to the south of Sand Dune), ranging typically between 2.2 m to 4.0 mbgl (0.3 to 2.2 mAHD).

3. Proposed cut for lot development (in the southeastern portion of the Site) is unlikely to intercept the permanent groundwater table.

4. Proposed cut for the channel widening and basins will likely intercept the permanent groundwater table. However, channel widening and basin construction is expected to be undertaken without the need for mechanical dewatering (i.e. pumping to draw down water levels). As a result, the altered channel and the basin are note expected to adversely affect current groundwater levels.

5. The proposed residential subdivision is not expected to adversely impact (i.e. lower) the groundwater table on the Site or on adjacent land.

3 Acid Sulfate Soil (ASS) Assessment

3.1 Guidelines

This ASS assessment was undertaken in general accordance with the following guidelines:

1. Acid Sulfate Soil Management Advisory Committee (1998), Acid Sulfate Soil Manual, referred to as ASSMAC (1998).
2. Qld Natural Resources, Mines and Energy (2004) Acid Sulfate Soil Laboratory Methods Guidelines.

3.2 Acid Sulfate Soil Risk Map Classification

The Port Stephens Local Environmental Plan 2013 (Port Stephens LEP, 2013) ASS planning map indicates that the majority of the Site is Class 3 land, with a small portion in the south of the Site, along Gan Gan Road (including the Sand Dune), mapped as Class 4 land (refer to Map 05). ASSMAC (1998) indicates that works on Class 3 land have the potential to pose an environmental risk, if works extend 1 m below the natural ground surface and are likely to lower the water table more than 1 m below the natural ground surface. Therefore, a preliminary geomorphic ASS assessment was undertaken.

3.3 Geomorphic Setting

The likelihood of ASS occurrence at a site is a function of various geomorphic parameters, in particular those listed in Table 5 as derived from ASSMAC (1998). Each is an indicator that ASS may be present onsite.

Table 5: Site geomorphic features indicative of ASS.

Geomorphic Feature	Present On Site?
Holocene sediments.	Yes
Soil horizons less than 5 mAHD.	Yes
Marine / estuarine sediments or tidal lakes.	Yes
Coastal wetland; backwater swamps; waterlogged or scalded areas; inter-dune swales or coastal sand dunes (i.e. deep excavation is required).	Yes
Dominant vegetation is mangroves, reeds, rushes and other swamp or marine tolerant species.	No
Geologies containing sulfide bearing material / coal deposits or former marine shales / sediments.	Yes
Deep older (Holocene or Pleistocene) estuarine sediments > 10 mbgl (if deep excavation or drainage is proposed).	Likely

Most of the geomorphic features listed are present at the Site. Therefore, the geomorphic setting indicates that ASS is likely to be present and intrusive investigation, with laboratory testing of soils, should be carried out at the Site.

3.4 Field Testing and Action Criteria

A total of fifty one (51) soil samples were selected to assess the field pH (pH_F) and oxidised pH (pH_{OX}) of site soils. Seventy seven (77) soil samples were selected for ASS analysis using the chromium reducible sulfur (S_{CR}) method.

Field and oxidised pH results were assessed against the following criteria adopted from the ASSMAC (1998):

- pH_F < 4.0 is indicative of actual acid sulfate soils (AASS); and
- pH_{OX} < 3.5 is indicative of potential acid sulfate soils (PASS).

We understand that future development works will involve the disturbance of greater than 1,000 tonnes of soil material. Based on this, S_{CR} results were assessed against the following action criteria adopted from Table 4.4 of ASSMAC (1998):

- Net acidity (sulfur units) > 0.03%; and
- Net acidity (acid units) >18 mol H^+/tonne.

Exceedance of these criteria indicates that a further investigation and detailed ASS management plan may be required for the Site.

3.5 Soil Analytical Results

Samples were collected during the geotechnical investigations and groundwater installation works, from solid flight augers (generally for shallow boreholes) and from hollow flight augers and SPT sampling (for deeper boreholes).

A total of seventy seven soil samples taken from BH101 – BH107, BH110 – BH129 and BH133 – BH138 (excluding BH102, BH105, BH107 to BH109 and BH114) were submitted to Envirolab Services for pH screening (pHf and pHfox) and S_{CR} analysis. Samples were taken from fill and natural soil samples at various depths across the Site.

Field and oxidised pH results and S_{CR} results are summarised in Table 6 below. Bolded values indicate exceedances of ASSMAC (1998) action criteria. Detailed tabulated results are provided in Appendix E with the complete laboratory report provided as Appendix F.

Table 6: Laboratory field screening result summary.

Borehole ID	Sample Depth (mbgl)	Material type	pH_F	pH_{FOX}	Net Acidity (sulfur units, %S)	Net Acidity (acidity units, mol H^+/t)	Liming Rate (kg/t)
BH101	0.5	Sand and trace silt	5.3	**2.3**	<0.005	5.3	<0.75
	2.5	Sand and trace silt	5.4	**3.4**	<0.005	7.1	<0.75
BH103	0.5	Sand and trace silt	5.3	**2.2**	<0.005	**25**	2
	1.0	Sand and trace silt	4.6	**2.1**	<0.005	**63**	5
	2.5	Sand and trace silt	5.0	**2.0**	**0.05**	**46**	3
	4.0	Sand and trace silt	5.1	**2.7**	<0.005	14	1
BH104	0.5	Sand and trace silt	5.3	**2.5**	<0.005	5.8	<0.75
	1.5	Sand and trace silt	5.6	3.7	<0.005	13	1
	2.5	Sand and trace silt	5.7	3.8	<0.005	5.6	<0.75
	4.0	Sand and trace silt	5.8	3.9	<0.005	8.6	<0.75
BH106	0.2	Sand with silt	5.5	**2.9**	0.005	10	0.8
	1.2	Sandy Silt	5.5	**3.2**	0.005	15	1
BH110	0.5	Sand with silt	5.7	**3.3**	<0.005	7.1	<0.75
	1.5	Silt and trace sand	5.5	3.7	<0.005	**33**	2
BH111	0.5	Sand and trace silt	5.9	3.8	<0.005	<5	<0.75

Borehole ID	Sample Depth (mbgl)	Material type	pH_F	pH_{FOX}	Net Acidity (sulfur units, %S)	Net Acidity (acidity units, mol H^+/t)	Liming Rate (kg/t)
	1.5	Sand	6.4	3.6	<0.005	<5	<0.75
	2.8	Sand	6.6	**2.4**	<0.005	<5	<0.75
	4.4	Sand	6.6	**2.6**	<0.005	<5	<0.75
BH112	1.0	Sand with silt	5.5	3.7	<0.005	<5	1
	2.0	Sand with silt	4.9	**3.4**	**0.04**	**48**	4
BH113	0.3	Sand	6.1	4.7	0.005	5.6	<0.75
	1.0	Sand	6.1	4.8	<0.005	12	0.9
BH115	0.1	Silty Sand	4.7	**2.0**	**0.03**	**270**	20
	3.3	Clayey Sand	4.7	**1.9**	**0.08**	**76**	6
BH116	1.0	Sandy Clay	4.7	**1.8**	**0.07**	**82**	6
	2.5	Sandy Clay	5.5	**1.8**	**0.15**	**130**	9.6
BH117	0.5	Silty Clay	4.8	**1.9**	0.01	**180**	14
	1.5	Silty Clay	5.1	**1.6**	**0.14**	**160**	12
BH118	0.5	Silty Clay	4.6	**2.4**	**0.09**	**240**	18
	3.5	Clayey Sand	5.2	**2.5**	**0.30**	**220**	17
BH119	1.0	Silty Clay	4.5	**1.7**	**0.22**	**200**	15
	2.0	Silty Clay	7.0	**2.2**	**0.17**	<5	<0.75
BH120	0.5	Silty Clay	4.3	**1.9**	<0.005	**120**	9
	1.5	Silty Clay	4.7	**2.7**	**0.99**	**740**	56
BH121	0.2	Silty Clay	4.2	**1.8**	0.02	**260**	19
	1.5	Sandy Clay	4.4	**1.8**	**0.24**	**210**	16
BH122	1.0	Silty Clay	6.0	**1.9**	**0.59**	**490**	37
	3.5	Clayey Sand	6.2	**2.4**	**0.05**	**35**	3
BH123	0.5	Silty Clay	5.7	**2.0**	**0.54**	**370**	28
	1.5	Silty Clay	6.2	**1.9**	**0.30**	**200**	15
BH124	1.5	Silty Clay	4.9	**1.8**	**0.25**	**220**	16
	3.5	Clayey Sand	5.4	**3.2**	0.006	9.8	<0.75
BH125	0.2	Silty Clay	4.6	**2.2**	0.01	**72**	5
	1.5	Silty Sand	5.2	**1.9**	0.01	**29**	2
BH126	1.5	Silty Sand	4.5	**2.5**	**0.03**	**73**	5
	3.0	Silty Sand with clay	4.8	**2.1**	**0.06**	**52**	4
BH127	1.0	Sandy Clay	5.0	**2.3**	**0.04**	**59**	4
	2.5	Silty Sand	5.2	**1.9**	**0.06**	**48**	4
BH128	0.5	Silty Sand	5.1	**2.4**	0.007	**37**	3
	1.5	Clayey Sand	4.3	**2.6**	**0.15**	**140**	10
BH129	0.5	Silty Clay	4.5	**3.2**	**0.10**	**200**	15
BH133	0.4-0.5	Sandy Clay	-	-	**0.35**	**180**	14.00

Borehole ID	Sample Depth (mbgl)	Material type	pH_F	pH_{FOX}	Net Acidity (sulfur units, %S)	Net Acidity (acidity units, mol H^+/t)	Liming Rate (kg/t)
	1.4-1.5	Silty Sandy Clay	-	-	**0.37**	**220**	17.00
	2.5-2.6	Clayey Sand	-	-	**0.15**	**96**	7.20
	3.5-3.6	Clayey Sand	-	-	**0.11**	**71**	5.30
BH134	0.4-0.5	Sandy Clay	-	-	**0.21**	**110**	8.50
	0.9-1.0	Silty Clay	-	-	**0.27**	**160**	12.00
	2.0-2.1	Clayey Sand	-	-	**0.15**	**92**	6.90
	2.4-2.5	Silty Clay	-	-	<0.005	<5	17.00
	3.0-3.1	Silty Clay	-	-	**0.082**	**51**	17.00
BH135	0.4-0.5	Clayey Sand	-	-	**0.3**	**170**	13.00
	0.9-1.0	Sandy Silty Clay	-	-	**0.35**	**200**	15.00
	1.9-2.0	Sandy Silty Clay	-	-	**0.56**	**340**	25.00
	2.4-2.5	Clayey Sand	-	-	**0.32**	**200**	15.00
	3.4-3.5	Clayey Sand	-	-	**0.3**	**190**	14.00
BH136	0.9-1.0	Silty Sandy Clay	-	-	**0.21**	**120**	9.30
	1.5-1.6	Clayey Sand	-	-	**0.17**	**110**	7.90
	2.0-2.1	Clayey Sand	-	-	**0.18**	**110**	8.50
	3.0-3.1	Clayey Sand	-	-	0.016	10	0.75
BH137	0.4-0.5	Silty Clay	-	-	**0.2**	**120**	9.20
	1.5-1.6	Silty Clay	-	-	**0.55**	**340**	26.00
	2.5-2.6	Clayey Sand	-	-	**0.3**	**190**	14.00
	3.5-3.6	Clayey Sand	-	-	**0.39**	**250**	18.00
BH138	0.9-1.0	Silty Sandy Clay	-	-	**0.14**	**87**	6.50
	2.0-2.1	Clayey Sand	-	-	**0.036**	**22**	1.70
	3.0-3.1	Clayey Sand	-	-	**0.15**	**91**	6.90
	3.9-4.0	Clayey Sand	-	-	0.008	<5	<0.75

3.6 Results

The findings of this preliminary ASS assessment are summarised as follows:

- No samples returned pH_F values < 4.
- 42 out of 51 samples returned pH_{OX} values < 3.5, indicative of PASS.
- 57 out of 77 samples from 29 borehole locations exceeded the ASSMAC (1998) action criteria for either net acidity in sulfur units and in S_{CR} (% w/w) (all of these having pH_{OX} values < 3.5). These samples are considered to be potential acid sulfate soils (PASS) that have further acid generating potential associated with them.

- Samples considered PASS were from soils north of the Sand Dune and were at depths ranging from near surface to > 3.0 mbgl.
- Sand Dune soils and soils to the south of the Sand Dune are not considered PASS.
- Indicative liming rates, to neutralise potential acidity for samples exceeding action criteria, range between 0.75 kg/t and 37 kg/t.
- Laboratory results for all samples analysed, apart from 4 samples, indicate that the alluvial soil profile has a negligible natural acid neutralising capacity (ANC) (0.25% $CaCO_3$ – BH111/1.5; 0.75% $CaCO_3$ – BH119/2.0; 2.1% $CaCO_3$ – BH134/2.4-2.5 and 1.4% $CaCO_3$ – BH134/3.0-3.1).

3.7 Discussion / Conclusion

Based on laboratory testing, there is widespread PASS present across the areas of the Site to the north of the Sand Dune. The Sand Dune and area south of the Sand Dune does not contain PASS or AASS.

Additional soil sampling and laboratory testing may need to be completed at the development application (DA) stage to meet the requirements of ASSMAC (1998) in areas of proposed cut (or should any temporary dewatering be carried out). In addition to this, a detailed ASSMP will be required at the DA stage to support the management of ASS as part of any future development works.

The presence of PASS within the Site is expected to be appropriately managed during construction stage, subject to the above additional works being undertaken.

Proposed cut for the channel widening and basin(s) construction may intercept the permanent groundwater table at the Site. However, as excavation works are expected to be completed without mechanical dewatering, these works and the proposed residential subdivision in general are unlikely to adversely impact (i.e. lower) the groundwater table at the Site and neighbouring lands. If, however, any future dewatering works (either temporary or long term) are proposed as part of future development works, they will require a detailed assessment of the impact of dewatering on Site PASS soils and any neighbouring Class 1 – 4 mapped land.

4 ASS Hazards and Risk Assessment

4.1 Overview

Potential hazards associated with ASS and assessed risk as a result of the residential subdivision is discussed in the following sections.

4.2 Potential Hazards

The following potential hazards are noted with regards to ASS:

1. Unmanaged PASS material being exposed to air and acidifying following excavation works.
2. Groundwater level changes as a result of drainage modification works (basins and channel widening) potentially impacting groundwater and surface water quality.
3. Construction of dwelling footings being impacted by ASS.

These hazards shall be managed to result in a low risk via the mitigation measures provided in the following sections:

4.3 Risk Mitigation Measures

4.3.1 PASS Material Risk Management

The presence of excavated PASS materials within the Site shall be appropriately managed in accordance with ASSMAC (1998) during construction by implementing an ASSMP and the recommendations presented in this report. The ASSMP may comprise, but not be limited to, the following steps:

i. Undertake baseline water monitoring prior to works: this should include both surface and groundwater monitoring, upstream and downstream of potential impact areas. Monitoring should be completed a minimum 6 months prior to earthworks commencing.

ii. Setup of a treatment area for treatment of PASS. This area should be adequately barricaded and marked with appropriate signage and may include the following:

- An impermeable liner or pad (e.g. impervious clay or concrete pad) to prevent leachate contaminating underlying soil.
- Be surrounded by an earthen bund to redirect stormwater runoff around the material stockpile and retain leachate inside the bund.
- A leachate collection settlement sump to collect runoff and leachate.
- Be graded towards the leachate sump for efficient drainage.

iii. Stockpile excavated PASS material in the treatment area. The stockpiles are to be covered, with the cover extending over the bund crest to redirect rainwater runoff away from the stockpiles. Stockpiling may be completed in a staged manner.

iv. Treatment of PASS: All disturbed PASS material is to be treated with agricultural lime at appropriate liming rates based on laboratory test results. A lime register should be maintained by the contractor to record the amount of lime delivered to the Site.

v. Treatment of leachate or acidic groundwater (with PH < 6.5): Leachate or acidic groundwater collected from bunded stockpiles of untreated soil is to be neutralised with hydrated lime mixed into a slurry before adding water and tested to ensure suitability for disposal into the nearest receptor. Stringent containment measures and monitoring schedules shall be implemented to limit adverse impacts of the hydrated lime on health and safety and the environment.

vi. Validation: Validation of appropriate treatment is to be completed and documented, including:

- Excavated soil volume, including total material and acidic soil.
- Photographic evidence of lime treatment and soil stockpile bunding and cover.
- Details of leachate tests, test results and test certificates.
- Calculated liming rates for acidic soil and leachate treatment.
- Waste classifications for spoil removed from the Site.

Material can be reused for bulk filling works on the Site following validation.

vii. Certification: Following completion of the treatment process, a report is to be prepared by a suitably qualified person demonstrating that the requirements of this management plan have been met.

The application of an ASSMP shall result in a low risk to environmental receptors as a result of PASS disturbance during construction works.

4.3.2 Groundwater Risk Management

Proposed development activities as listed in Section **Error! Reference source not found.** (in particular shallow excavation for channel widening and basin construction) may intercept the groundwater tables.

To minimise impacts on the groundwater level changes, we recommend the following:

i. Works should be completed using conventional earthmoving equipment (e.g., small-medium excavators with mud buckets).

ii. No mechanised dewatering (i.e. pumping) to be undertaken as part of the construction works.

iii. Where saturated material is excavated from below the groundwater table, soil is to be adequately drained of free water (into the channel / basins) prior to stockpiling for required treatment. Any residual leachate from stockpiled material will be appropriately collected, treated and validated prior to discharge back to the channel / basin. These works shall be documented in detail in the future ASSMP.

If the above works are implemented, risk associated with disturbance of the groundwater table is expected to be low and acceptable. This should be confirmed at DA stage through further groundwater monitoring and modelling as the development design is refined.

4.3.3 Dwelling Construction Risk Management

Risks to dwelling construction (footings / foundations) and buried concrete structures as a result of ASS on the Site shall be managed by:

1. Completing appropriate soil testing following subdivision completion to confirm soil aggressiveness in accordance with AS3600 and AS2159.

2. Design of footings to be completed by registered engineer with consideration of the soil testing noted above.

3. Provision of community education resources by the developer for new home purchasers at the point of contract for sale of the land.

4.4 Conclusion

The proposed residential subdivision is likely to result in negligible impacts on the existing groundwater system and pose minimal environmental risk as a result of ASS, subject to implementation of an ASSMP and recommendations presented in this report.

5 Geotechnical Assessment

5.1 Laboratory Testing

Laboratory testing carried out by Resource Laboratories, a NATA accredited laboratory, for the geotechnical assessment, included:

1. Particle size distribution (**PSD**) testing on sixteen soil samples.
2. Atterberg limits testing on five soil samples.

Laboratory test certificates are provided in Appendix G.

5.1.1 Particle Size Distribution (PSD) Results

Laboratory PSD test results are summarised in Table 7 (refer to Appendix G for PSD test certificate).

Table 7: Summary of laboratory PSD test results.

Sample ID	% Gravel [1]	% Sand	% Silt and Clay
BH101 / 1.0	0	93	7
BH102 / 1.0	0	98	2
BH114 / 1.0	0	98	2
BH119 / 2.1	0	96	4
BH124 / 1.6	0	97	3
BH126 / 1.4	0	97	3
BH127 / 1.6	0	96	4
BH128 / 0.5	0	92	8
BH130 / 0.4-0.8	9	72	19
BH131 / 0-0.5	0	94	6

Notes:

1. Borehole # / sample depth.
2. % Gravel summary includes all material greater than 2.36 mm sieve size.

5.1.2 Atterberg Limits Testing

Laboratory Atterberg limits test results are summarised in Table 8 (refer to Attachment D for test certificate).

Table 8: Summary of laboratory Atterberg limits test results.

Sample ID [1]	Material	Atterberg Limits (%)			Plasticity Classification	Potential Volume Change [3]
		LL [2]	PL [2]	PI [2]		
BH115 / 1.0	Silty CLAY	86	33	53	High	High
BH118 / 1.5	Silty CLAY	94	40	54	High	High
BH119 / 0.5	Silty CLAY, with sand	50	22	28	Medium to high	Medium
BH122 / 0.5	Silty CLAY	88	38	50	High	High

Sample ID [1]	Material	Atterberg Limits (%)			Plasticity Classification	Potential Volume Change [3]
		LL [2]	PL [2]	PI [2]		
BH122 / 1.5	Silty CLAY	88	33	55	High	High

Notes:

1. Borehole#/Depth (mbgl).
2. LL = Liquid limit, PL= Plastic limit, PI=Plasticity index.
3. Based on Hazelton and Murphy, 2016.

Laboratory test results indicate that the tested marine soil samples are generally of high plasticity, which may induce significant ground movements as a result of soil volume changes due to soil moisture variations.

5.2 Risk of Slope Instability

5.2.1 Site Observations

Observations during the various site inspections revealed:

1. The Site generally has grades of less than approximately 5 %. Some areas along the southeastern portion of the Site, immediately adjacent to the toe of the Sand Dune, have grades of between approximately 10 % and 20 %.
2. The south and north facing batters of the Sand Dune are estimated to have an average grade of between approximately 20 % and 30 % (i.e. < 18 °).
3. No evidence of former or current slope movement (landslip), e.g. soil creep, leaning trees and hummocky ground, was observed across the Site.
4. Shallow (1 m to 1.5 m high) toe cutting was observed at a number of locations along the alignment of the Sand Dune.

5.2.2 Sand Dune Stability

Three CPTs (CPT103, CPT107 and CPT109) were undertaken near the crest of the Sand Dune. CPT investigation revealed that the subsurface material underlying the Sand Dune generally comprised medium dense sand / silty sand grading to dense sand up to investigation termination depth of 20.04 mbgl. Based on the likely subsurface conditions, the natural angle of repose of the Sand Dune material is expected to be > 32°. However, loose sand with natural angle of repose as low as 28° may be encountered at some locations, particularly along the toe of the dune.

5.2.3 Preliminary Slope Instability Discussion

Considering the assessed geotechnical conditions at the Site, the risk of land-sliding as a result of the proposed development or risk of slope instability impacting the proposed development is expected to be low subject to the recommendations presented in this report and adoption of relevant Australian Standards and industry guidelines.

5.3 Geotechnical Constraints

The proposed development is inferred to be impacted by the following key geotechnical constraints:

- Loose aeolian sand encountered at some locations across Zone A may settle under loading, such as building loads or loads from plant and machinery during

construction. Loose aeolian sand is also susceptible to liquefaction, where below the water table, particularly during a significant seismic event.

- Thick (> 4 m) soft to firm clay, encountered in the upper soil profile across Zone C, is susceptible to consolidation settlement in the long term. This may result in damage of new structures / infrastructures as well as slope instability during construction (filling to earthworks platform level).
- Requirement for ground improvement across areas where structures and services will adversely be affected by settlement.
- Groundwater across Zone C is expected to be shallow and variable due to weather and seasonal changes, which may impact vehicle trafficability during construction.
- Presence of PASS within the subsurface profile and shallow groundwater levels in areas north of the Sand Dune may impact construction methodologies for the proposed residential subdivision, including a requirement for appropriate ASS management strategies, if disturbed during construction.

6 Geotechnical Recommendations

6.1 Overview

Preliminary geotechnical recommendations related to the future residential subdivision are provided below. General geotechnical recommendations are provided in Appendix H.

6.2 The Sand Dune

Consideration should be given to good hillslope engineering practices for future construction in close proximity of the steep batter of the Sand Dune (Zone B) to minimise risk of slope instability. A description of good hillslope engineering practices is provided as Attachment G.

6.3 Site Preparation and Earthworks

6.3.1 General Recommendations

All earthworks are to be undertaken in accordance with the guidelines for earthworks for commercial and residential developments as set out in AS 3798 (2007). In addition, we recommend carrying out the following site preparation and earthworks:

1. Prior to any filling works, remove any unsuitable materials such as topsoils and root affected soils and compact to achieve a suitable subgrade for fill placement and foundation for future structures / infrastructure.

2. All excavated material should be stockpiled and undergo formal waste classification and / or appropriate treatment in accordance with ASS management plan (where necessary). Any material that is to be taken off site should be classified in accordance with NSW EPA (2014) Waste Classification Guidelines prior to offsite disposal to a suitable location in accordance with NSW Waste Classification Guidelines.

3. Exposed subgrade is to be proof rolled using a suitable smooth drum roller with required passes to achieve required compaction. A qualified geotechnical engineer should inspect the condition of the exposed subgrade during proof roll, to assess suitability of the subgrade for fill placement or as foundation for new structures / infrastructure or to identify localised soft spots requiring ground improvement.

4. Fill material should be placed in horizontal layers, generally not less than 100 mm and not more than 300 mm in loose thickness, and compacted, in accordance with AS3798 (2007).

5. Fill material should comprise well graded granular material. Site won excavated marine and aeolian sands may be reused for filling, however, some treatment (e.g. mixing with cement or with coarser / finer sands) may be required to achieve material grading requirements typically associated with ‘engineered fill’ specifications. Alternatively, well graded granular fill may be imported, subject to approval by the project geotechnical engineer.

6. Fill batters should not exceed a grade of 1V:3H.

7. Fill is to be placed in maximum lifts of 1 m at each stage. Consideration should be given to minimise slope instability risk during filling.

8. Contractor should submit their earthworks construction methodology to a senior geotechnical engineer for review and approval.

9. All earthworks and compliance testing should be carried out under Level 1: Inspection and Testing as defined in Section 8 of AS3798 (2007) and in accordance with Council's requirements, under guidance of an experienced geotechnical engineer.

6.3.2 Ground Treatment for Filling over Soft Soils

In order to accelerate the primary consolidation settlement of the soft to firm alluvial clay within the soil profile across Zone C, the following ground treatment methods are recommended:

- Ground improvement by preloading: Surcharge in the form of a fill platform constructed over the area to accelerate the consolidation process.

- Ground improvement by installing prefabricated vertical drains (PVD): In areas underlain by deeper very soft to firm marine clays (> 2 m), we recommend installing prefabricated vertical drains (PVD). This may be carried out in conjunction with subsequent placement of surcharge over the area to accelerate the consolidation process. We note, however, that this would require deep excavations and management of excavated PASS.

Alternative ground improvement methods may be developed, subject to further guidance during development of such alternative methods and approval by an experienced geotechnical engineer.

We note that considerable consolidation settlement of very soft to soft marine clay is expected to occur where new fill thicknesses exceed 0.5 m . Depending on the soil properties, thickness of very soft to firm clay and drainage characteristics, the time taken to achieve required degree of consolidation may typically range between 3 and 6 months. Further field investigations and laboratory testing on collected soil samples should be undertaken to evaluate the time required for achieving a target degree of consolidation.

6.3.3 Settlement Monitoring

Monitoring of primary consolidation settlement behaviour is typically undertaken during construction to compare actual against predicted settlements. Monitoring may be carried out by site surveying, with settlement plates and ground settlement markers installed on the ground surface.

6.4 Long Term Settlement Management

Following completion of preloading, some long-term settlement will continue to occur due to recompression and creep. However this is expected to be of considerably lower magnitude and occur at slow rates. This long-term settlement will likely induce differential settlement beneath building foundations and services because of varying ground conditions, such as thickness of very soft to firm clay. Consideration should be given to potential differential ground settlements in design of residences in accordance with AS 2870 (2011), road pavements, road drainage and the connection of buried services to residences.

6.5 Drainage Requirements

Appropriate surface and subsurface drainage should be provided, as necessary, to divert overland flows and potential perched groundwater away from excavations, foundations, underside of floor slabs and behind all shoring / retaining walls, and to limit ponding of water in excavations and near footings in clay subsoils. All site discharges should be passed through a filter material prior to release into Council approved discharge points.

6.6 Soil Erosion Control

Removal of soil overburden should be performed in a manner that reduces the risk of sedimentation occurring in the Council stormwater system and on neighbouring lands. All spoil on Site should be properly controlled by erosion control measures to prevent transportation of sediments offsite. Appropriate soil erosion control methods in accordance with Landcom (2004) shall be required.

Channel widening design should include appropriate bank erosion controls.

6.7 Site Classification

Zone A is currently classified as a 'Class A' site in accordance with AS 2870 (2011), for design of lightly loaded shallow footings founding on at least medium dense marine sand at least 0.5 m above maximum permanent groundwater levels.

Zone B and Zone C are classified as a 'Class P' site in accordance with AS 2870 (2011) due to presence of steep slopes, unsuitable (loose and / or very soft to firm) foundation soil and shallow groundwater levels.

Future residential lots across Zone C may be reclassified following ground treatment and placement of engineered fill material.

These site classifications are subject to the recommendations presented in this report, design of footings in accordance with the relevant Australian Standards and industry guidelines and footings unlikely being impacted by the presence of environments that could lead to exceptional foundation material movements, such as existing or future trees, or surface / subsurface water accumulation / variations.

6.8 Construction Considerations

Owing to the presence of soft / loose surface materials across the Site, and shallow groundwater levels, ground improvement may be required to improve trafficability by construction plant and vehicles.

All excavations should be battered back at grades not exceeding 1V:2H for temporary batters and 1V:3H for permanent batters, or retained. Grades should be increased for batters below groundwater levels.

7 Proposed Additional Works

We recommend the following additional geotechnical assessments are carried out at the DA stage of development to further develop and support the final design:

1. Additional borehole investigations, soil sampling and laboratory testing, particularly across areas of the Site where a cutting is proposed, to better define ASS conditions and management requirements.
2. Preparation of a detailed ASSMP.
3. Laboratory testing of soft to firm clayey soil present within the soil profile across Zone C for more accurate prediction of ground settlements under loading and the rate of consolidation.
4. CBR testing in pavement areas following completion of bulk cut and fill works.
5. Additional geotechnical assessment, including laboratory testing, to better define geotechnical conditions and geotechnical hazards and provide appropriate advice with respect to final development proposals.
6. Review of final designs and construction methodologies by a senior geotechnical engineer to confirm adequate consideration of the geotechnical risks and adoption of the recommendations provided in this report.

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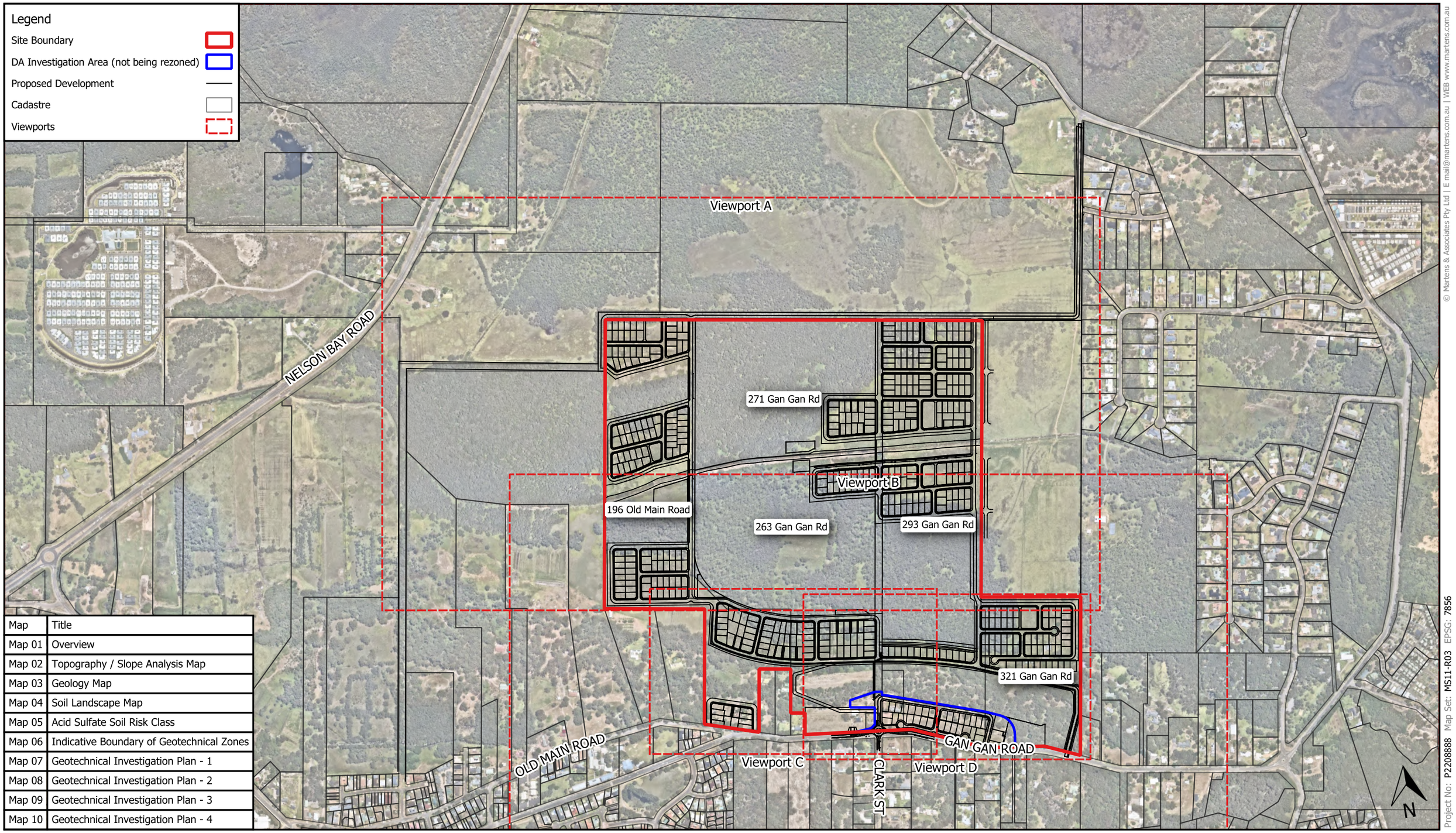
Appendix A – Maps



Map	Title
Map 01	Overview
Map 02	Topography / Slope Analysis Map
Map 03	Geology Map
Map 04	Soil Landscape Map
Map 05	Acid Sulfate Soil Risk Class
Map 06	Indicative Boundary of Geotechnical Zones
Map 07	Geotechnical Investigation Plan - 1
Map 08	Geotechnical Investigation Plan - 2
Map 09	Geotechnical Investigation Plan - 3
Map 10	Geotechnical Investigation Plan - 4

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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Map Title / Figure:
Overview

Map 01	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

Legend

Site Boundary

DA Investigation Area (not being rezoned)

1m Contours

Slope Analysis - Percent

<= 5

5 - 10

10 - 20

20 - 30

> 30

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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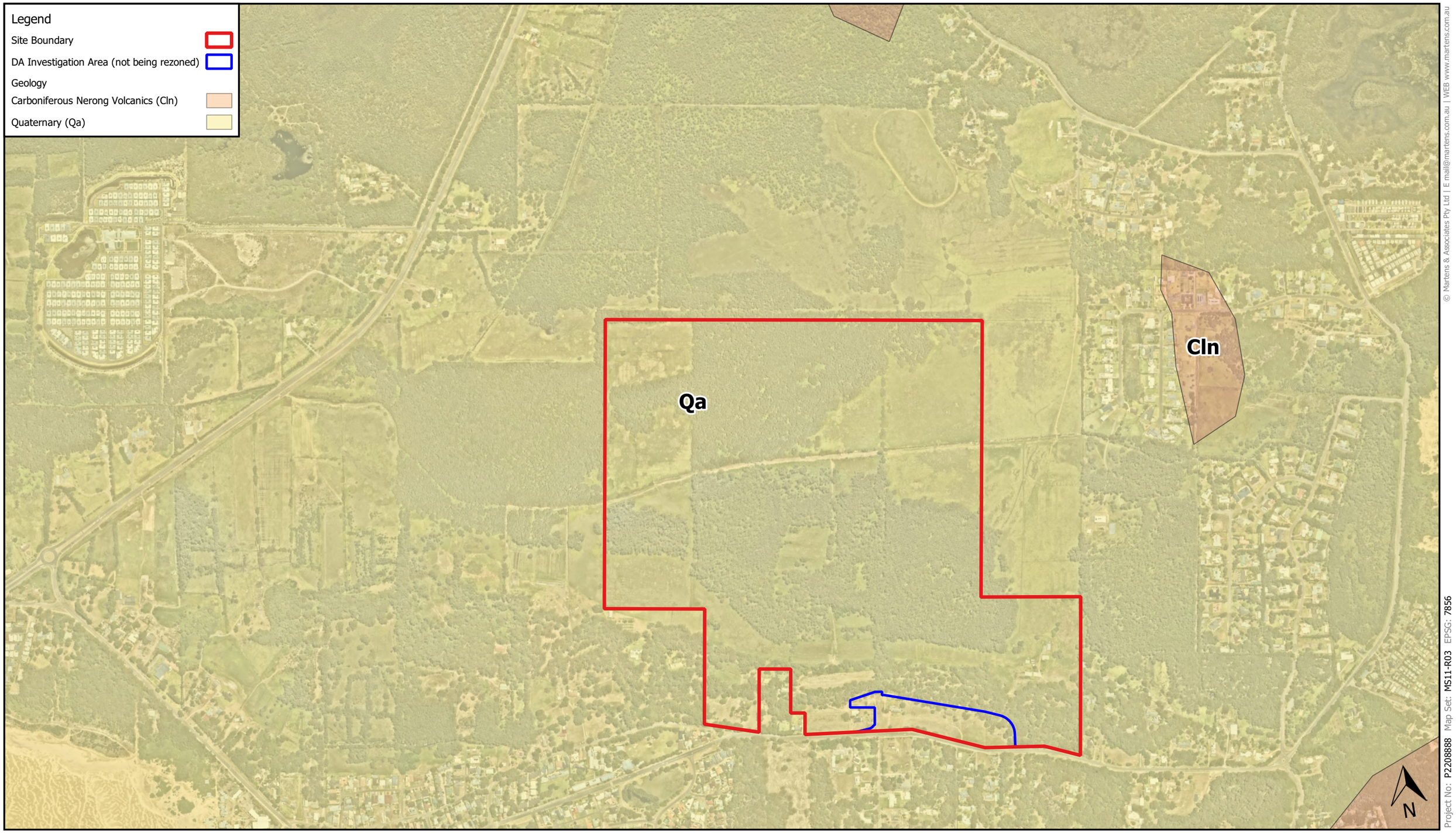
Map Title / Figure:

Topography / Slope Analysis Map

Map 02	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856



Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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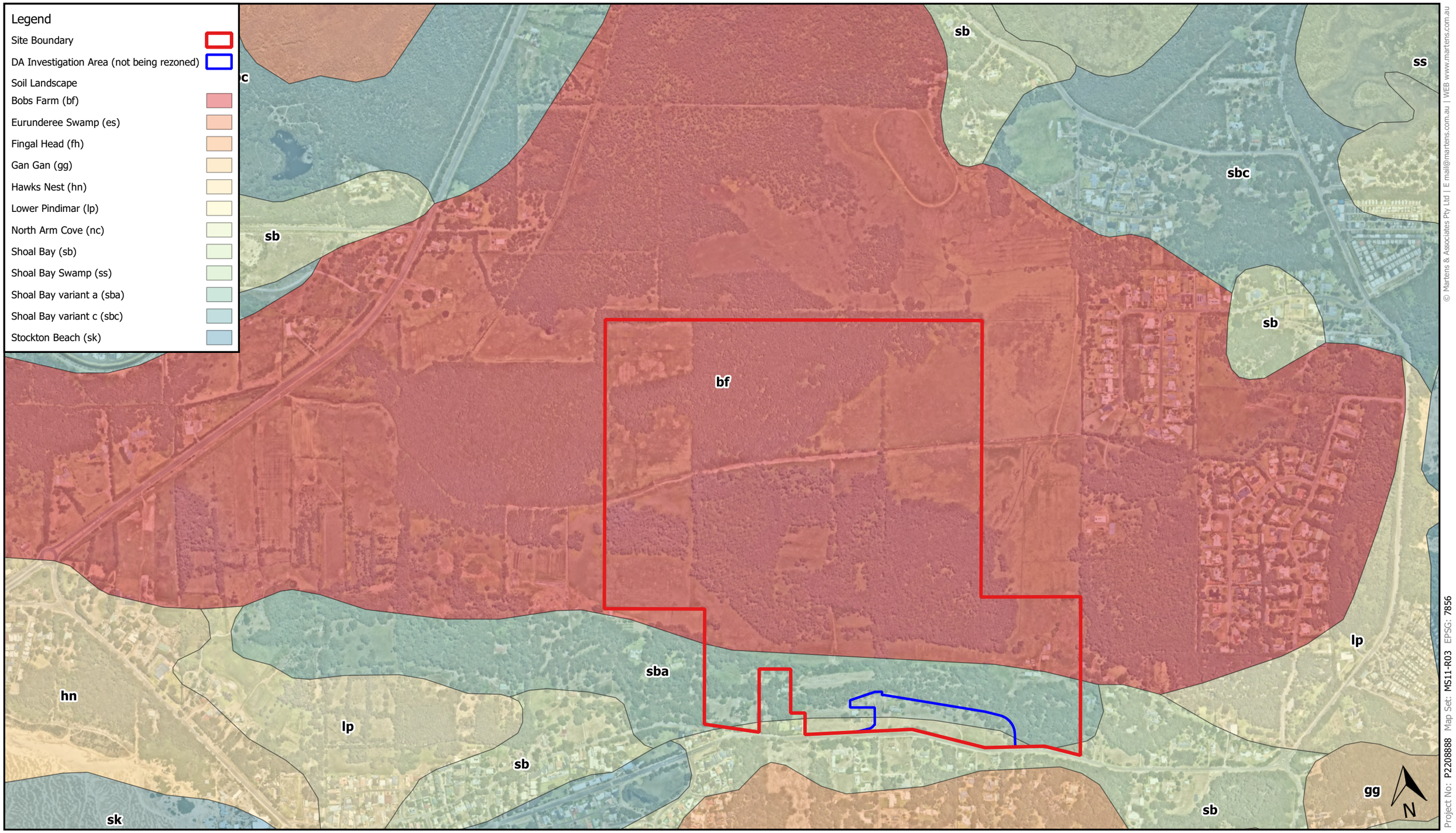
Map Title / Figure:
Geology Map

Map 03	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date



Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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Map Title / Figure:
Soil Landscape Map

Map 04	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Legend

Site Boundary

DA Investigation Area (not being rezoned)

Acid Sulfate Soils Risk

Class 3

Class 4

Class 5

Class 3

Class 4

Class 5

N

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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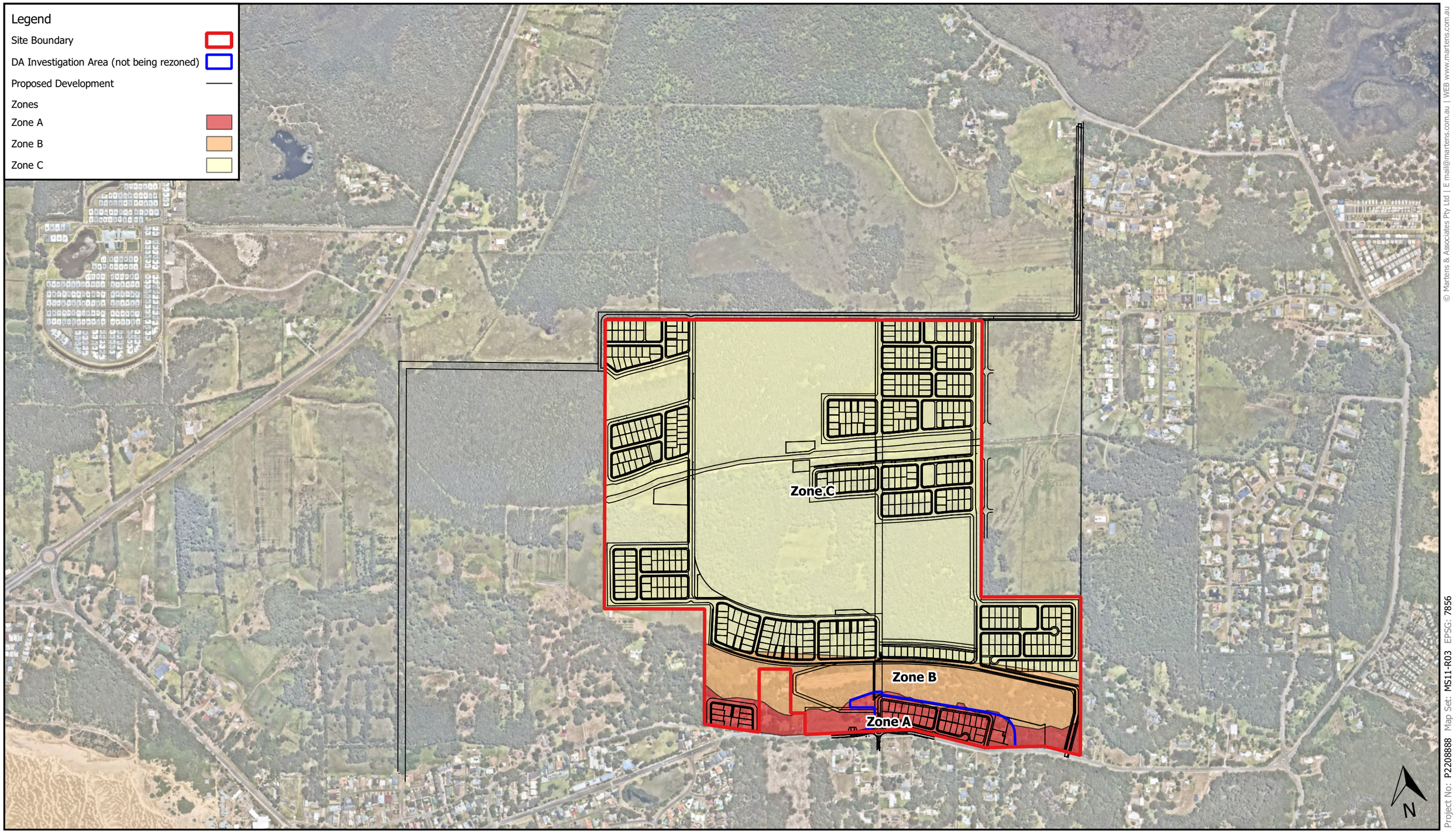
Map Title / Figure:
Acid Sulfate Soil Risk Class

Map 05	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856



0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Note:
- Aerial from Nearmap (2022).

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Map Title / Figure:

Indicative Boundary of Geotechnical Zones

Map 06	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

0 60 120 180 240 300 m

1:5000 @ A3

Viewport A

Note:
- Aerial from Nearmap (2022).

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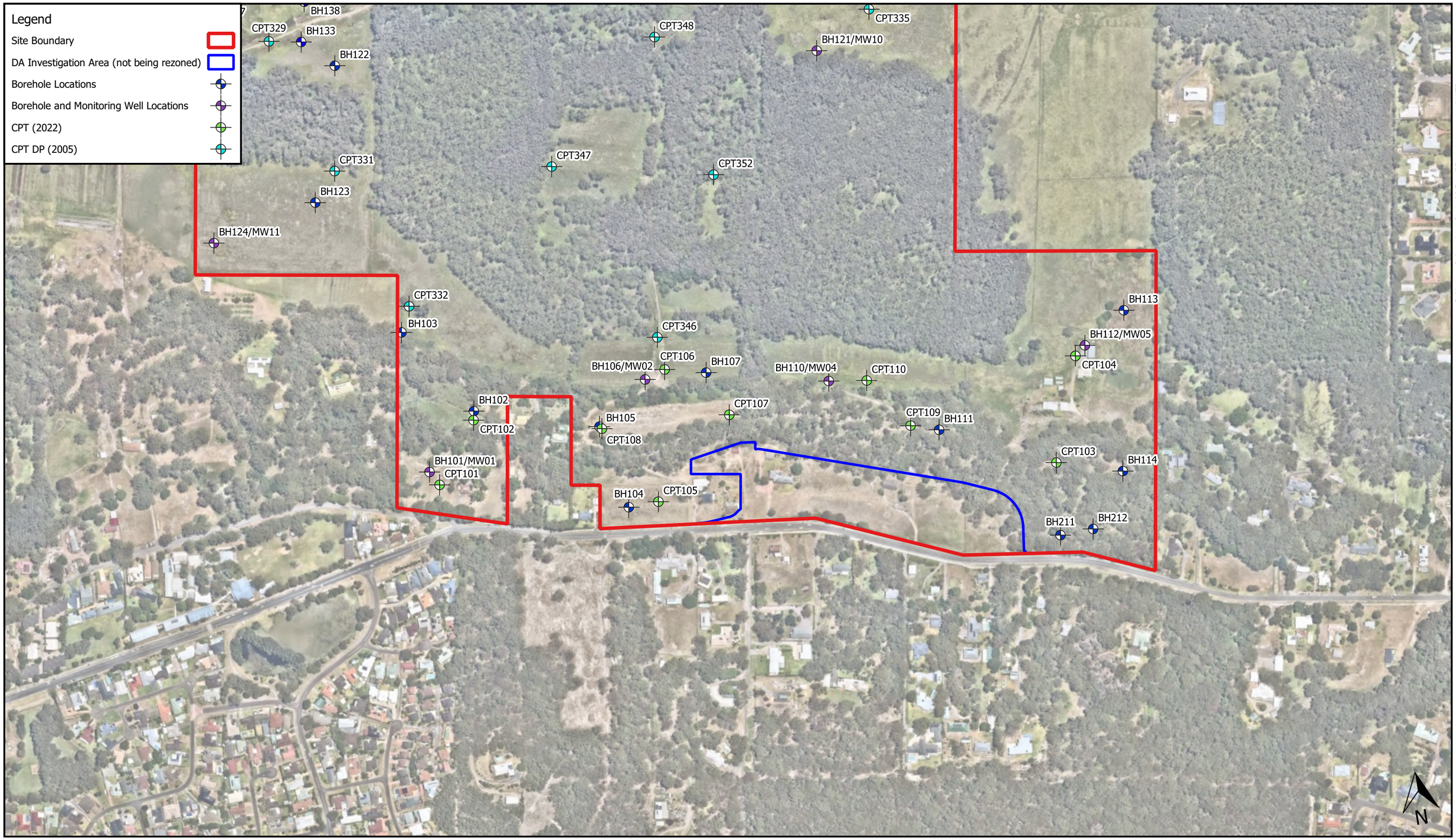
Map Title / Figure:

Geotechnical Investigation Plan - 1

Map 07	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856



0 60 120 180 240 300 m

1:5000 @ A3

Viewport B

Note:
- Aerial from Nearmap (2022).

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Map Title / Figure:

Geotechnical Investigation Plan - 2

Map 08	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

Legend

- Site Boundary
- DA Investigation Area (not being rezoned)
- Borehole Locations
- Borehole and Monitoring Well Locations
- CPT (2022)
- CPT DP (2005)

CPT332
BH103
CPT346
CPT106
BH107
BH106/MW02
BH110/MW04
BH102
CPT102
CPT107
BH105
CPT108
BH101/MW01
CPT101
BH104
CPT105
N

0 20 40 60 80 100 m

1:2000 @ A3

Viewport C

Note:
- Aerial from Nearmap (2022).

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

Map Title / Figure:

Geotechnical Investigation Plan - 3

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Map 09	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Legend

- Site Boundary
- DA Investigation Area (not being rezoned)
- Borehole Locations
- Borehole and Monitoring Well Locations
- CPT (2022)
- CPT DP (2005)

CPT106
BH107
BH106/MW02
BH110/MW04
CPT110
CPT107
CPT109
BH111
BH113
BH112/MW05
CPT104
CPT103
BH114
CPT105
BH211
BH212
N

0 20 40 60 80 100 m

1:2000 @ A3

Viewport D

Note:
- Aerial from Nearmap (2022).

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Map Title / Figure:
Geotechnical Investigation Plan - 4

Map 10	Map
Gan Gan Rd & Old Main Rd, Anna Bay, NSW	Site
Proposed Land Rezoning	Project
Geotechnical and Acid Sulfate Soil Assessment	Sub-Project
AB Rise Pty Ltd	Client
04/12/2024	Date

Project No: P2208888 Map Set: MS11-R03 EPSG: 7856

Appendix B – Borehole and Monitoring Well Logs

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH101**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.093458	RL SURFACE	4.31 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 6.00 m depth	LATITUDE	-32.775396	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered		4.31				SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.			TOPSOIL
				0.15	0.1/S/1 D 0.10 m							
				4.16				SP	SAND; fine to medium grained; dark grey; trace silt.			MARINE DEPOSITS
					0.5/S/Dupe02 D 0.50 m							
				0.60 3.71					Becoming grey.			
			1	*1.00* 3.31	1.0/S/Dupe02 D 1.00 m				Becoming brown.			
	L			*1.40* 2.91					Becoming orange - brown.		MD	
					1.5/S/1 D 1.50 m							
			2									
					2.5/S/Dupe02 D 2.50 m							
			3							M		
				3.50 0.81					Becoming pale brown; inferred dense.			
			4		4.0/S/Dupe02 D 4.00 m							
	M										MD - D	
			5	*5.00* -0.69					Pale brown - grey.			
					5.5/S/Dupe02 D 5.50 m							
			6	*6.00*								
									Hole Terminated at 6.00 m (Target depth reached)			

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH101/MW01**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.093458	RL SURFACE	4.31 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 6.00 m depth	LATITUDE	-32.775396	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW01 Static Water Level
AD/V				4.31				SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.			Concrete
				0.15	0.1/S/1 D 0.10 m							
				4.16				SP	SAND; fine to medium grained; dark grey; trace silt.			
				0.60	0.5/S/Dupe02 D 0.50 m							
				3.71					Becoming grey.			
			1	1.00								Casing. Cuttings
				3.31	1.0/S/Dupe02 D 1.00 m				Becoming brown.			
	L			1.40							MD	
				2.91	1.5/S/1 D 1.50 m				Becoming orange - brown.			
			2									Bentonite
					2.5/S/Dupe02 D 2.50 m							
		26/11/24	3							M		
				3.50								
				0.81					Becoming pale brown; inferred dense.			
			4		4.0/S/Dupe02 D 4.00 m							Sand
	M										MD - D	Screen.
			5	5.00								
				-0.69					Pale brown - grey.			
					5.5/S/Dupe02 D 5.50 m							
			6	6.00								
									Hole Terminated at 6.00 m (Target depth reached)			

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH102**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09425	RL SURFACE	17 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.774739	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered		17.00 ***0.15*** 16.85	0.1/S/1 D 0.10 m			SP	TOPSOIL: SAND; fine to medium grained; dark grey; trace silt.			TOPSOIL
	L		1		0.5/S/Dupe02 D 0.50 m 1.0/S/Dupe02 D 1.00 m			SP	SAND; fine to medium grained; grey; trace silt.	M	MD	AEOLIAN DEPOSITS
				1.30 15.70	1.5/S/1 D 1.50 m				Brown.			
			2		2.5/S/Dupe02 D 2.50 m							
			3	***3.50*** 13.50				SP	SAND; fine to medium grained; pale brown; trace silt; inferred dense.			
	M		4		4.0/S/Dupe02 D 4.00 m						D	
				4.50					Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH103**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.093387	RL SURFACE	4 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø4.5 mm x 4.50 m depth	LATITUDE	-32.773624	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	0	4.00				SP	TOPSOIL: SAND; fine to medium grained; dark grey; with silt.			TOPSOIL
				0.20	0.1/S/1 D 0.10 m							
				3.80				SM	Silty SAND; fine to medium grained; dark grey - black; with silt.			MARINE DEPOSITS
					0.5/S/Dupe02 D 0.50 m					M		
				0.90								
			1	3.10				SM	Silty SAND; fine to medium grained; black; mild organic odour.		L	
					1.0/S/Dupe02 D 1.00 m							
				1.40								
				2.60				SP	SAND; medium grained; dark grey; with silt; mild odour increasing with depth.			
					1.5/S/1 D 1.50 m							
			2									
					2.5/S/Dupe02 D 2.50 m					W		
			3								MD	
			4		4.0/S/Dupe02 D 4.00 m							
				4.50								
									Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH104**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.096274	RL SURFACE	5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.776235	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				5.00				SP	TOPSOIL: SAND; fine to medium grained; dark grey; trace silt.			TOPSOIL
				0.20	0.1/S/1 D 0.10 m							
				4.80				SP	SAND; fine to medium grained; grey; trace silt.		L	MARINE DEPOSITS
					0.5/S/Dupe02 D 0.50 m							
			1		1.0/S/Dupe02 D 1.00 m							
	L			*1.20*								
				3.80					Becoming brown.		MD	
					1.5/S/1 D 1.50 m							
		Not Encountered		*2.00*								
			2	3.00					Becoming orange brown.	M		
					2.5/S/Dupe02 D 2.50 m							
				3.00								
			3	2.00					Pale brown.			
	M										D	
					4.0/S/Dupe02 D 4.00 m							
			4									
				4.50								
									Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH105**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.096042	RL SURFACE	17 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.45 m depth	LATITUDE	-32.775185	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				17.00				SP	TOPSOIL: SAND; fine to medium grained; black - dark brown; with silt.			TOPSOIL
					0.2/S/Dupe02 D 0.20 m							
				0.40								
				16.60				SP	SAND; fine to medium grained; grey; trace silt.			AEOLIAN DEPOSITS
					0.8/S/1 D 0.80 m							
				1.00								
AD/V	L	Not Encountered	1	16.00	SPT 1.00-1.45 m 5, 4, 3 N = 7 1.0-1.45/S/1				Brown.			
				2.00								
			2	15.00	2.0/S/Dupe02 D 2.00 m				Yellowish brown.	M		
				2.30								
				14.70					Brown.		L - MD	
					SPT 2.50-2.95 m 2, 3, 4 N = 7							
				2.70								
				14.30	2.5-2.95/S/1				Pale yellowish brown.			
			3									
			4		SPT 4.00-4.45 m 4, 4, 5 N = 9 4.0-4.45/S/1							
				4.45								
									Hole Terminated at 4.45 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH106**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09682	RL SURFACE	1.74 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.20 m depth	LATITUDE	-32.774699	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				1.74				SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.			TOPSOIL
					0.2/S/Dupe02 D 0.20 m					M		
				0.40								
				1.34				ML	Sandy SILT; low plasticity; dark brown.			MARINE DEPOSITS
			1									
					1.2/S/Dupe02 D 1.20 m					M (<PL)	S - F	
	L				1.6/S/1 D 1.60 m							
AD/V		Not Encountered		*2.00*								
			2	-0.26				SW	SAND; medium to coarse grained; pale brown - grey; inferred medium dense to dense.			
					2.6/S/Dupe02 D 2.60 m						MD	
			3							M		
	M										MD - D	
					4.0/S/1 D 4.00 m							
			4	*4.20*								
									Hole Terminated at 4.20 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH106/MW02**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09682	RL SURFACE	1.74 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.20 m depth	LATITUDE	-32.774699	ASPECT	North	SLOPE <2%

Drilling | **Sampling** | **Field Material Description**

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS (ID / Static Water Level)
AD/V				1.74				SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.	M		MW02
				0.40	0.2/S/Dupe02 D 0.20 m							Concrete
				1.34				ML	Sandy SILT; low plasticity; dark brown.			Casing
		26/11/24	1									Bentonite
	L				1.2/S/Dupe02 D 1.20 m					M (<PL)	S - F	
					1.6/S/1 D 1.60 m							
			2	2.00								
				-0.26				SP	SAND; medium to coarse grained; pale brown - grey; inferred medium dense to dense.			Sand
					2.6/S/Dupe02 D 2.60 m						MD	
			3							M		
	M										MD - D	Screen.
			4		4.0/S/1 D 4.00 m							
				4.20					Hole Terminated at 4.20 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	13/09/2022	COMPLETED	13/09/2022	**REF BH107**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.097723	RL SURFACE	5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.90 m depth	LATITUDE	-32.774739	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	L	Not Encountered	1	5.00	0.2/S/1 D 0.20 m			ML	Sandy SILT; low plasticity; dark brown.	M (<PL)		MARINE DEPOSITS
				0.50								
				4.50	1.0/S/1 D 1.00 m			SP	SAND; fine to medium grained; pale brown - grey; trace silt; inferred loose to medium dense.	M	L - MD	
				1.90	1.7/S/1 D 1.70 m							
			2						Hole Terminated at 1.90 m (Target depth reached)			
			3									
			4									
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH110**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.099489	RL SURFACE	2.17 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.775092	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered		2.17								
					0.1/S/Dupe02 D 0.10 m			SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.		L	TOPSOIL
				0.20 1.97				SP	SAND; fine to medium grained; brown; with silt.	M	MD	MARINE DEPOSITS
					0.5/S/1 D 0.50 m							
	L			*0.80* 1.37				MH	SILT; medium plasticity; dark grey - black; trace fine grained sand.		F	
			1		1.0/S/Dupe02 D 1.00 m							
					1.5/S/1 D 1.50 m					M (<PL)	St	
			2	*2.00* 0.17				SP	SAND; fine to medium grained; grey; trace silt.			
					2.5/S/Dupe02 D 2.50 m							
	M		3	*3.20* -1.03				SW	SAND; medium to coarse grained; dark grey; trace shell fragments.	M	D	
					3.5/S/Dupe02 D 3.50 m							
			4	*4.00* -1.83					Pale brown - grey.			
					4.3/S/1 D 4.30 m							
				4.50					Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH110/MW04**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.099489	RL SURFACE	2.17 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.775092	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW04	
AD/V				2.17									
				0.20 1.97	0.1/S/Dupe02 D 0.10 m			SP	TOPSOIL: SAND; fine to medium grained; dark brown - black; with silt.		L		Concrete Casing.
					0.5/S/1 D 0.50 m			SP	SAND; fine to medium grained; brown; with silt.	M	MD	MW04	Bentonite
	L	26/11/24		*0.80* 1.37				MH	SILT; medium plasticity; dark grey - black; trace fine grained sand.		F		
			1		1.0/S/Dupe02 D 1.00 m					M (<PL)			
					1.5/S/1 D 1.50 m						St		
			2	*2.00* 0.17				SP	SAND; fine to medium grained; grey; trace silt.				Sand
					2.5/S/Dupe02 D 2.50 m								
	M		3	*3.20* -1.03				SW	SAND; medium to coarse grained; dark grey; trace shell fragments.	M	D		Screen.
					3.5/S/Dupe02 D 3.50 m								
			4	*4.00* -1.83					Pale brown - grey.				
				4.50	4.3/S/1 D 4.30 m								
									Hole Terminated at 4.50 m (Target depth reached)				
			5										
			6										

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH111**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.100977	RL SURFACE	20 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.775916	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		20.00				SP	SAND; fine to medium grained; black; trace silt.			AEOLIAN DEPOSITS
				0.15 19.85	0.1/S/1 D 0.10 m			SP	SAND; fine to medium grained; dark grey.		L	
					0.5/S/Dupe02 D 0.50 m						MD	
				0.80 19.20					Becoming pale brown.			
			1		1.0/S/Dupe02 D 1.00 m						L	
					1.5/S/1 D 1.50 m							
				1.80 18.20					Becoming brown.			
			2		2.0/S/Dupe02 D 2.00 m					M		
				2.50 17.50					Becoming yellow - brown.			
					2.8/S/1 D 2.80 m							
			3								MD	
				3.20 16.80					Becoming pale yellow - brown; inferred medium dense.			
					3.5/S/Dupe02 D 3.50 m							
			4									
				4.50	4.4/S/Dupe02 D 4.40 m				Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH112**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.103303	RL SURFACE	1.85 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.30 m depth	LATITUDE	-32.775175	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	1	1.85 *0.15* 1.70	0.1/S/Dupe02 D 0.10 m			SP	FILL: SAND; black; trace anthropogenic plastics; with silt; inferred poorly compacted.	M		FILL
								ML	SILT; low plasticity; black; mild organic odour.			MARINE DEPOSITS
					0.5/S/1 D 0.50 m					M (<PL)	S and F	
				0.80 1.05				SP	SAND; fine to medium grained; brown; with silt.			
			1		1.0/S/Dupe02 D 1.00 m						L - MD	
					1.5/S/1 D 1.50 m							
			2	*2.00* -0.15	2.0/S/1 D 2.00 m				Becoming dark grey - brown; trace silt.			
					2.5/S/Dupe02 D 2.50 m					M		
			3								MD	
				3.50 -1.65	3.5/S/1 D 3.50 m				Inferred medium dense.			
			4	*4.30*								
									Hole Terminated at 4.30 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH112/MW05**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.103303	RL SURFACE	1.85 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.30 m depth	LATITUDE	-32.775175	ASPECT	North	SLOPE <2%

Drilling | **Sampling** | **Field Material Description**

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS (ID: MW05; Static Water Level)
AD/V	L	27/11/24	0	1.85				SP	FILL: SAND; black; trace anthropogenic plastics; with silt; inferred poorly compacted.	M		Concrete Casing.
				0.15	0.1/S/Dupe02 D							
				1.70	0.10 m			ML	SILT; low plasticity; black; mild organic odour.			
					0.5/S/1 D 0.50 m					M (<PL)	S and F	Bentonite
				0.80								
				1.05				SP	SAND; fine to medium grained; brown; with silt.			
			1		1.0/S/Dupe02 D 1.00 m						L - MD	
					1.5/S/1 D 1.50 m							
			2	*2.00*								
				-0.15	2.0/S/1 D 2.00 m				Becoming dark grey - brown; trace silt.			
					2.5/S/Dupe02 D 2.50 m					M	MD	Sand
			3									Screen.
				3.50								
				-1.65	3.5/S/1 D 3.50 m				Inferred medium dense.			
			4	*4.30*								
									Hole Terminated at 4.30 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH113**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.103954	RL SURFACE	5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.80 m depth	LATITUDE	-32.774823	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT			1	*0.10* 4.90 *0.50* 4.50 *1.40* 3.60 *1.80*	0.05/S/1 D 0.05 m 0.3/S/1 D 0.30 m 1.0/S/1 D 1.00 m 1.7/S/1 D 1.70 m			SP SP	TOPSOIL: SAND; fine to medium grained; black; with silt and rootlets. SAND; fine to medium grained; grey - dark grey; inferred loose to medium dense. Grey - brown. Pale brown. Hole Terminated at 1.80 m (Target depth reached)	M	L - MD	TOPSOIL MARINE DEPOSITS
			2									
			3									
			4									
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	15/09/2022	COMPLETED	15/09/2022	**REF BH114**
PROJECT	Geotechnical and ASS Assessment		LOGGED	DS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.103552	RL SURFACE	15 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.50 m depth	LATITUDE	-32.776798	ASPECT	North	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	1	15.00				SP	TOPSOIL: SAND; fine to medium grained; black; with rootlets and silt.			TOPSOIL
				0.20 14.80	0.1/S/Dupe02 D 0.10 m			SP	SAND; fine to medium grained; black; trace silt.			AEOLIAN DEPOSITS
				0.50 14.50	0.5/S/1 D 0.50 m				Grey.			
					0.9/S/Dupe02 D 0.90 m							
				1.10 13.90	SPT 1.00-1.45 m 1, 1, 1 N = 2 1.0-1.45/S/1				Brown.		VL	
			2	*1.90* 13.10					Pale brown - yellow.			
					2.3/S/Dupe02 D 2.30 m							
					SPT 2.50-2.95 m 2, 3, 4 N = 7 2.5-2.95/S/1							
			3								L	
					3.9/S/Dupe02 D 3.90 m							
			4	*4.00* 11.00	SPT 4.00-4.45 m 4, 5, 5 N = 10 4.0-4.45/S/1				Orange - brown.		MD	
				4.50					Hole Terminated at 4.50 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH115**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.098308	RL SURFACE	1.2 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.770305	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflowb	1	1.20	0.1/S/1 D 0.10 m			SM	TOPSOIL: Silty SAND; brown, dark brown; with organics.	M	MD	TOPSOIL
				0.30								
				0.90	0.3/S/1 D 0.30 m			CH	Silty CLAY; high plasticity; grey, dark grey; with sand.	M (<PL)	VS	MARINE DEPOSITS
					1.0/S/1 D 1.00 m							
			2		1.5/S/1 D 1.50 m					M (=PL)	F	
					2.0/S/1 D 2.00 m							
				2.70								
				-1.50	2.7/S/1 D 2.70 m			SC	Clayey SAND; fine to medium grained; grey, dark brown.			
			3		3.3/S/1 D 3.30 m					W	L	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH116**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.097832	RL SURFACE	0.69 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.769259	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.69	0.1/S/1 D 0.10 m			ML	Clayey SILT; brown.	M (<<PL)	St	MARINE DEPOSITS
				0.50								
				0.19	0.5/S/1 D 0.50 m			CH	Sandy CLAY; high plasticity; grey.			
			1		1.0/S/1 D 1.00 m						VS	
				1.60	1.5/S/1 D 1.50 m							
				-0.91					Moisture increasing.	M (<PL)		
			2									
					2.5/S/1 D 2.50 m						F	
			3		3.0/S/1 D 3.00 m							
					3.5/S/1 D 3.50 m					M (>PL)	St	
				4.00								
			4		4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH116/MW08**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.097832	RL SURFACE	0.69 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.769259	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW08 Static Water Level
AD/V	L	26/11/24 ▽	0	0.69	0.1/S/1 D 0.10 m			ML	Clayey SILT; brown.	M (<<PL)	St	MW08
				0.50								Casing.
				0.19	0.5/S/1 D 0.50 m			CH	Sandy CLAY; high plasticity; grey.			Concrete
			1		1.0/S/1 D 1.00 m						VS	
				1.60	1.5/S/1 D 1.50 m							
				-0.91					Moisture increasing.	M (<PL)		
			2									
					2.5/S/1 D 2.50 m						F	Bentonite
			3		3.0/S/1 D 3.00 m							Screen.
												Sand
					3.5/S/1 D 3.50 m					M (>PL)	St	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH117**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.100284	RL SURFACE	0.6 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	LATITUDE	-32.768084	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	0	0.60				CI-CH	Silty CLAY; medium to high plasticity; trace gravels 2-10mm.	M (<<PL)	VS	MARINE DEPOSITS
					0.2/S/1 D 0.20 m							
					0.5/S/1 D 0.50 m							
				0.90								
			1	-0.30	1.0/S/1 D 1.00 m			CH	Silty CLAY; high plasticity; grey.	M (<PL)		
					1.5/S/1 D 1.50 m							
			2		2.0/S/1 D 2.00 m					M (>PL)		
					2.5/S/1 D 2.50 m						F	
				2.70								
				-2.10				CH	Sandy CLAY; high plasticity; grey.			
			3	*3.00*	3.0/S/1 D 3.00 m				Hole Terminated at 3.00 m (Target depth reached)			
			4									
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH118**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.101463	RL SURFACE	0.73 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.76705	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.73	0.2/S/1 D 0.20 m			CH	Silty CLAY; high plasticity; brown, grey; trace sand and organics.	M (<<PL)	VS	MARINE DEPOSITS
					0.5/S/1 D 0.50 m							
					1.0/S/1 D 1.00 m							
				1.20 -0.47				CH	Silty CLAY; high plasticity; pale grey.	M (<PL)		
			2		1.5/S/1 D 1.50 m							
					2.0/S/1 D 2.00 m					M (>PL)	F	
					2.5/S/1 D 2.50 m						St	
				3.00 -2.27	3.0/S/1 D 3.00 m			SC	Clayey SAND; fine to medium grained; pale grey.			
			3		3.5/S/1 D 3.50 m					W	L and MD	
			4	4.00	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH118/MW09**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.101463	RL SURFACE	0.73 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.76705	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW09 Static Water Level	
AD/V	L	26/11/24	0	0.73	0.2/S/1 D 0.20 m			CH	Silty CLAY; high plasticity; brown, grey; trace sand and organics.	M (<<PL)	VS	MW09	Casing. Concrete
					0.5/S/1 D 0.50 m								
			1		1.0/S/1 D 1.00 m								
				1.20 -0.47				CH	Silty CLAY; high plasticity; pale grey.	M (<PL)			
					1.5/S/1 D 1.50 m								
			2		2.0/S/1 D 2.00 m					M (>PL)	F		Bentonite
					2.5/S/1 D 2.50 m						St		
			3	3.00 -2.27	3.0/S/1 D 3.00 m			SC	Clayey SAND; fine to medium grained; pale grey.	W	L and MD		Screen. Sand
					3.5/S/1 D 3.50 m								
			4	4.00	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)				
			5										
			6										

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH119**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.10021	RL SURFACE	0.8 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	LATITUDE	-32.769245	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.80	0.2/S/1 D 0.20 m			CI-CH	TOPSOIL: Silty CLAY; medium to high plasticity; brown, dark grey; with organics.	M (<<PL)		TOPSOIL
				0.50								
				0.30	0.5/S/1 D 0.50 m			CI-CH	Silty CLAY; medium to high plasticity; grey; trace fine grained sand.		VS	MARINE DEPOSITS
			1		1.0/S/1 D 1.00 m					M (<PL)		
				1.50								
				-0.70	1.5/S/1 D 1.50 m				Sand increasing with depth.		St	
											F	
			2	*2.00*								
				-1.20	2.0/S/1 D 2.00 m			SP	SAND; fine grained; grey; trace silt.		VL - L	
					2.1/S/1 D 2.10 m					M		
				3.00							L - MD	
			3		3.0/S/1 D 3.00 m				Hole Terminated at 3.00 m (Target depth reached)			
			4									
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	07/02/2023	COMPLETED	07/02/2023	**REF BH120**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.101647	RL SURFACE	0.8 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.770316	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.80	0.2/S/1 D 0.20 m			CI-CH	Silty CLAY; medium to high plasticity; grey, brown; with organics.	M (<<PL)	VS	MARINE DEPOSITS
					0.5/S/1 D 0.50 m							
				1.00 -0.20	1.0/S/1 D 1.00 m			CH	Silty CLAY; high plasticity; grey.			
					1.5/S/1 D 1.50 m					M (<PL)	F	
			2	*2.00* -1.20	2.0/S/1 D 2.00 m			CH	Sandy CLAY; high plasticity; grey.		VS	
				2.50 -1.70	2.5/S/1 D 2.50 m			SC	Clayey SAND; fine to medium grained; grey.		F	
			3		3.0/S/1 D 3.00 m					W	L	
					3.5/S/1 D 3.50 m						L - MD	
			4	*4.00*	3.9/S/1 D 3.90 m							
					4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH121**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.100112	RL SURFACE	0.98 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.771047	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	0	0.98	0.2/S/1 D 0.20 m			CH	Silty CLAY; high plasticity; grey brown; with organics; trace sand.	M (<<PL)	St	MARINE DEPOSITS
				0.50								
				0.48	0.5/S/1 D 0.50 m			CH	Sandy CLAY; high plasticity; grey.			
			1		1.0/S/1 D 1.00 m					M (=PL)		
					1.50/S/1 D 1.50 m							
			2		2.0/S/1 D 2.00 m						VS	
					2.5/S/1 D 2.50 m					M (>PL)		
			3		3.0/S/1 D 3.00 m							
					3.5/S/1 D 3.50 m							
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH121/MW10**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.100112	RL SURFACE	0.98 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.771047	ASPECT	South	SLOPE <5%

Drilling | **Sampling** | **Field Material Description**

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS (ID: MW10; Static Water Level)
AD/V	L	26/11/24	0	0.98				CH	Silty CLAY; high plasticity; grey brown; with organics; trace sand.	M (<<PL)	St	MW10
				0.50	0.2/S/1 D 0.20 m							
				0.48	0.5/S/1 D 0.50 m			CH	Sandy CLAY; high plasticity; grey.			
			1		1.0/S/1 D 1.00 m					M (=PL)		Casing.
					1.50/S/1 D 1.50 m							Cuttings
			2		2.0/S/1 D 2.00 m						VS	
					2.5/S/1 D 2.50 m					M (>PL)		
			3		3.0/S/1 D 3.00 m							Sand.
					3.5/S/1 D 3.50 m							Sand
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH122**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09304	RL SURFACE	0.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.77021	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.50	0.2/S/1 D 0.20 m			CH	Silty CLAY; high plasticity; dark grey; with organics.	M (<<PL)	S	MARINE DEPOSITS
					0.5/S/1 D 0.50 m							
					1.0/S/1 D 1.00 m					M (<PL)		
			2		1.5/S/1 D 1.50 m						F	
					2.0/S/1 D 2.00 m					M (>PL)		
				2.50 -2.00	2.5/S/1 D 2.50 m				Trace sand.			
				2.70 -2.20				CH	Sandy CLAY; high plasticity; grey.		F - St	
			3		3.0/S/1 D 3.00 m							
				3.20 -2.70				SC	Clayey SAND; medium grained; brown; with silt.			
					3.5/S/1 D 3.50 m					W	MD	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH123**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.092433	RL SURFACE	0.8 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.77197	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.80	0.2/S/1 D 0.20 m			CI-CH	Silty CLAY; medium to high plasticity; dark grey; with organics.	M (<PL)	F	MARINE DEPOSITS
				0.5/S/1 D 0.50 m								
				1.00 -0.20	1.0/S/1 D 1.00 m			CI-CH	Silty CLAY; medium to high plasticity; dark grey; with fine to medium grained sand.			
			2	1.5/S/1 D 1.50 m								
				2.0/S/1 D 2.00 m						M (>PL)	St	
			3	*3.00* -2.20	3.0/S/1 D 3.00 m			SC	Clayey SAND; fine to medium grained; brown.		MD	
				3.50 -2.70	3.5/S/1 D 3.50 m				Becoming pale grey with depth.	W	D	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH124**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.090911	RL SURFACE	1.14 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.772146	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				1.14								MARINE DEPOSITS
					0.2/S/1 D 0.20 m			Cl	Silty CLAY; medium plasticity; grey.	M (<PL)		
				0.50								
	L			0.64	0.5/S/1 D 0.50 m			Cl	Sandy CLAY; medium plasticity; grey.		F	
			1		1.0/S/1 D 1.00 m					M (=PL)		
				1.50							F and St	
				-0.36	1.5/S/1 D 1.50 m			SP	SAND; fine to medium grained; pale grey; trace silt.			
					1.6/S/1 D 1.60 m							
		Inflow	2		2.0/S/1 D 2.00 m					M	MD	
					2.4/S/1 D 2.40 m							
	L-M				2.5/S/1 D 2.50 m							
				3.00								
			3	-1.86	3.0/S/1 D 3.00 m			SP	Clayey SAND; fine to medium grained; brown.			
											MD	
					3.5/S/1 D 3.50 m					W		
				4.00							MD - D	
			4		4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH124/MW11**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.090911	RL SURFACE	1.14 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.772146	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW11 Static Water Level
AD/V	L	26/11/24	1	1.14	0.2/S/1 D 0.20 m			CI	Silty CLAY; medium plasticity; grey.	M (<PL)	F	MW11
				0.50 0.64	0.5/S/1 D 0.50 m			SC	Sandy CLAY; medium plasticity; grey.			Cuttings
					1.0/S/1 D 1.00 m					M (=PL)	St	Casing.
			2	*1.50* -0.36	1.5/S/1 D 1.50 m			SP	SAND; fine to medium grained; pale grey; trace silt.			Bentonite
	L-M				1.6/S/1 D 1.60 m							
					2.0/S/1 D 2.00 m					M		
					2.4/S/1 D 2.40 m							
					2.5/S/1 D 2.50 m						MD	Sand
			3	*3.00* -1.86	3.0/S/1 D 3.00 m			SC	Clayey SAND; fine to medium grained; brown.			Screen.
					3.5/S/1 D 3.50 m					W		
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)		MD - D	
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH125**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09405	RL SURFACE	0.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.766501	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.90	0.2/S/1 D 0.20 m			CI	Silty CLAY; medium plasticity; dark grey; with organics and fine to medium grained sand.	M (<PL)		MARINE DEPOSITS
				0.50								
				0.40	0.5/S/1 D 0.50 m			SM	Silty SAND; fine to medium grained; pale grey.	M		
					0.9/S/1 D 0.90 m							
					1.0/S/1 D 1.00 m						VS - S	
			2		1.5/S/1 D 1.50 m					W		
					2.0/S/1 D 2.00 m							
					2.5/S/1 D 2.50 m							
				2.70								
				-1.80				SC	Clayey SAND; fine to medium grained; grey.		L	
			3		3.0/S/1 D 3.00 m					M (<PL)		
				3.50								
				-2.60	3.5/S/1 D 3.50 m			SM	Silty SAND; fine to medium grained; brown.		MD	
				4.00								
			4		4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH126**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.092219	RL SURFACE	0.94 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.765779	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.94	0.2/S/1 D 0.20 m			CI	Silty CLAY; medium plasticity; dark grey; with organics and fine to medium grained sand.	M (<<PL)	F	MARINE DEPOSITS
				0.50 0.44	0.5/S/1 D 0.50 m			SM	Silty SAND; fine to medium grained; pale grey.	M	L	
					1.0/S/1 D 1.00 m							
			2		1.4/S/1 D 1.40 m							
					1.5/S/1 D 1.50 m						MD	
					2.0/S/1 D 2.00 m					W		
					2.5/S/1 D 2.50 m						L	
			3	*3.00* -2.06	3.0/S/1 D 3.00 m				With clay.			
					3.5/S/1 D 3.50 m						MD	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH126/MW12**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.092219	RL SURFACE	0.94 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.765779	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
AD/V	L	26/11/24	1	0.94	0.2/S/1 D 0.20 m			CI	Silty CLAY; medium plasticity; dark grey; with organics and fine to medium grained sand.	M (<<PL)	F	MW12
				0.50								Cuttings
				0.44	0.5/S/1 D 0.50 m			SM	Silty SAND; fine to medium grained; pale grey.	M	L	Casing.
			1		1.0/S/1 D 1.00 m							Bentonite
					1.4/S/1 D 1.40 m							
					1.5/S/1 D 1.50 m							
			2		2.0/S/1 D 2.00 m						MD	Sand
					2.5/S/1 D 2.50 m					W		Screen.
											L	
			3	3.00								
				-2.06	3.0/S/1 D 3.00 m				With clay.			
					3.5/S/1 D 3.50 m						MD	
			4	4.00								
					4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH127**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.91572	RL SURFACE	0.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.76918	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.90	0.2/S/1 D 0.20 m			SC	Sandy CLAY; medium to high plasticity; dark grey; with organics.	M (<PL)	S	MARINE DEPOSITS
					0.5/S/1 D 0.50 m						VS	
					1.0/S/1 D 1.00 m						S	
				1.50	1.5/S/1 D 1.50 m							
			2	-0.60	1.6/S/1 D 1.60 m			SM	Silty SAND; fine to medium grained; grey, pale grey.			
					2.0/S/1 D 2.00 m							
					2.5/S/1 D 2.50 m					W	L - MD	
			3		3.0/S/1 D 3.00 m							
				3.50	3.5/S/1 D 3.50 m				Becoming pale grey and brown.			
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH128**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.092963	RL SURFACE	0.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.767996	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.90	0.2/S/1 D 0.20 m			SM	Silty SAND; fine to medium grained; dark grey and brown.	M	L	MARINE DEPOSITS
					0.5/S/1 D 0.50 m						VL	
				1.00 -0.10	1.0/S/1 D 1.00 m			SC	Clayey SAND; fine to medium grained; grey brown.			
			2		1.5/S/1 D 1.50 m							
				1.70 -0.80	2.0/S/1 D 2.00 m			SM	Silty SAND; fine to medium grained; pale grey.	W	L - MD	
					2.5/S/1 D 2.50 m							
			3		3.0/S/1 D 3.00 m							
				3.50 -2.60	3.5/S/1 D 3.50 m				Becoming pale brown.		L	
			4	*4.00*	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH129**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09346	RL SURFACE	0.84 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.768997	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.84	0.2/S/1 D 0.20 m			CI-CH	Silty CLAY; medium to high plasticity; pale grey, brown; with organics; trace sand.	M (<<PL)	F	MARINE DEPOSITS
					0.5/S/1 D 0.50 m						S	
				1.00 -0.16	1.0/S/1 D 1.00 m			SC	Sandy CLAY; medium to high plasticity; pale grey, brown.	M (<PL)	St	
			2	1.50 -0.66	1.5/S/1 D 1.50 m			SM	Silty SAND; fine to medium grained; pale grey.			
					2.0/S/1 D 2.00 m						MD	
					2.5/S/1 D 2.50 m					W		
			3	3.00 -2.16	3.0/S/1 D 3.00 m				Becoming dark grey.		L	
					3.5/S/1 D 3.50 m							
			4	4.00	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	08/02/2023	COMPLETED	08/02/2023	**REF BH129/MW13**
PROJECT	Geotechnical and ASS Assessment		LOGGED	AK / TR	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	152.09346	RL SURFACE	0.84 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-32.768997	ASPECT	South	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW13 Static Water Level
AD/V	L	26/11/24	0	0.84				CI-CH	Silty CLAY; medium to high plasticity; pale grey, brown; with organics; trace sand.			MW13
					0.2/S/1 D 0.20 m						F	
					0.5/S/1 D 0.50 m					M (<<PL)		
											S	
			1	1.00 -0.16	1.0/S/1 D 1.00 m			SC	Sandy CLAY; medium to high plasticity; pale grey, brown.	M (<PL)	St	Cuttings
				1.50 -0.66	1.5/S/1 D 1.50 m			SM	Silty SAND; fine to medium grained; pale grey.			Casing
			2		2.0/S/1 D 2.00 m						MD	
					2.5/S/1 D 2.50 m							Bentonite
										W		
			3	3.00 -2.16	3.0/S/1 D 3.00 m				Becoming dark grey.			Screen
					3.5/S/1 D 3.50 m						L	Sand
			4	4.00	4.0/S/1 D 4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH133**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.0926	RL SURFACE	0.62 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.76972	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow.	0	0.62				CL	Sandy CLAY; low plasticity; brown.			MARINE DEPOSITS
					0.4-0.5/S/1 D 0.40-0.50 m							
				0.80 -0.18				CI	Silty Sandy CLAY; medium plasticity; brown.	M (<PL)		
			1		0.9-1.0/S/1 D 0.90-1.00 m							
					1.4-1.5/S/1 D 1.40-1.50 m							
				1.90 -1.28				SP	Clayey SAND; fine grained; dark grey.			
			2		1.9-2.0/S/1 D 1.90-2.00 m					M		
					2.5-2.6/S/1 D 2.50-2.60 m							
			3		3.0-3.1/S/1 D 3.00-3.10 m					W		
					3.5-3.6/S/1 D 3.50-3.60 m							
			4	*4.00*	3.9-4.0/S/1 D 3.90-4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH134**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.09706	RL SURFACE	0.83 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.76961	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	0.83				CL	Sandy CLAY; low plasticity; brown; trace rootlets.			MARINE DEPOSITS
					0.4-0.5/S/1 D 0.40-0.50 m							
				0.70 0.13				CI	Silty CLAY; medium plasticity; brown.	M (<PL)		
			1		0.9-1.0/S/1 D 0.90-1.00 m							
				1.50 -0.67	1.4-1.5/S/1 D 1.40-1.50 m			SP	Clayey SAND; fine grained; brown; pale grey.			
			2		2.0-2.1/S/1 D 2.00-2.10 m					M		
				2.30 -1.47				CI	Silty CLAY; medium plasticity; dark grey.			
					2.4-2.5/S/1 D 2.40-2.50 m							
			3		3.0-3.1/S/1 D 3.00-3.10 m					M (<PL)		
					3.5-3.6/S/1 D 3.50-3.60 m							
				3.80 -2.97						M		
				4.00	3.9-4.0/S/1 D 3.90-4.00 m			SP	Clayey SAND; fine grained; dark grey; yellow brown.			
			4						Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH135**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.09481	RL SURFACE	0.78 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.76983	ASPECT	North	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow.	1	0.78	0.0-0.1/S/1 D 0.00-0.10 m			SP	Clayey SAND; fine grained; brown.	M		MARINE DEPOSITS
				0.50 0.28	0.4-0.5/S/1 D 0.40-0.50 m			CI	Sandy Silty CLAY; medium plasticity; dark grey.	M (<PL)		
					0.9-1.0/S/1 D 0.90-1.00 m							
			2		1.4-1.5/S/1 D 1.40-1.50 m					M (>PL)		
					1.9-2.0/S/1 D 1.90-2.00 m							
				2.30 -1.52				SP	Clayey SAND; fine grained; grey.			
					2.4-2.5/S/1 D 2.40-2.50 m							
			3		2.9-3.0/S/1 D 2.90-3.00 m					W		
					3.4-3.5/S/1 D 3.40-3.50 m							
			4	*4.00*	3.9-4.0/S/1 D 3.90-4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH136**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.0988	RL SURFACE	0.84 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.76976	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow.	1	0.84				CL	Silty CLAY; low plasticity; dark brown; trace rootlet.			MARINE DEPOSITS
				0.60	0.5-0.6/S/1 D 0.50-0.60 m					M		
				0.24				CI	Silty Sandy CLAY; medium plasticity; dark brown.	(<PL)		
					0.9-1.0S/1 D 0.90-1.00 m							
				1.20								
				-0.36				SP	Clayey SAND; fine grained; grey.			
			2		1.5-1.6/S/1 D 1.50-1.60 m							
					2.0-2.1/S/1 D 2.00-2.10 m					W		
			3		3.0-3.1/S/1 D 3.00-3.10 m							
					3.5-3.6/S/1 D 3.50-3.60 m							
			4	*4.00*	3.9-4.0/S/1 D 3.90-4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH137**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	263, 271, 293, 321 Gan Gan Rd, Anna Bay, NSW.		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.09964	RL SURFACE	0.76 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.7696	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow	1	0.76	0.4-0.5/S/1 D 0.40-0.50 m			CL	Silty CLAY; low plasticity; dark brown; trace rootlets.	M (<PL)		MARINE DEPOSITS
				0.70 0.06				CI	Silty CLAY; medium plasticity; dark brown.			
					0.9-1.0/S/1 D 0.90-1.00 m					M (>PL)		
			2		1.5-1.6/S/1 D 1.50-1.60 m							
				2.10 -1.34	2.0-2.1/S/1 D 2.00-2.10 m			SP	Clayey SAND; fine grained; dark grey.			
					2.5-2.6/S/1 D 2.50-2.60 m							
			3		3.0-3.1/S/1 D 3.00-3.10 m					W		
					3.5-3.6/S/1 D 3.50-3.60 m							
			4	*4.00*	3.9-4.0/S/1 D 3.90-4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - BOREHOLE

CLIENT	AB Rise Pty Ltd		COMMENCED	12/04/2024	COMPLETED	12/04/2024	**REF BH138**
PROJECT	Geotechnical and ASS Assessment		LOGGED	WS	CHECKED	RE	Sheet 1 OF 1
SITE	196 Old Main Rd, Anna Bay, NSW		GEOLOGY	Quaternary deposits	VEGETATION	Grass	PROJECT NO. P2208888
EQUIPMENT		4WD ute-mounted hydraulic drill rig	LONGITUDE	152.09224	RL SURFACE	0.78 m	DATUM AHD
EXCAVATION DIMENSIONS		4.00 m depth	LATITUDE	-32.76949	ASPECT	South	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow.	1	0.78	0.4-0.5/S/1 D 0.40-0.50 m			CL	Silty CLAY; low plasticity; dark grey; trace rootlets.	M (<PL)		MARINE DEPOSITS
				0.60 0.18				CI	Silty Sandy CLAY; medium plasticity; dark brown.			
					0.9-1.0/S/1 D 0.90-1.00 m					M (>PL)		
				1.50 -0.72	1.5-1.6/S/1 D 1.50-1.60 m			SP	Clayey SAND; fine grained; grey.			
			2		2.0-2.1/S/1 D 2.00-2.10 m							
					2.4-2.5/S/1 D 2.40-2.50 m					W		
			3		3.0-3.1/S/1 D 3.00-3.10 m							
					3.5-3.6/S/1 D 3.50-3.60 m							
			4	*4.00*	3.9-4.0/S/1 D 3.90-4.00 m				Hole Terminated at 4.00 m (Target depth reached)			
			5									
			6									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

Appendix C – DCP Test Results

Dynamic Cone Penetrometer Test Log Summary

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Site	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	**DCP Group Reference**	P2208888JS03V01
Client	AB Rise Pty Ltd C/- DMPS	**Log Date**	13.09.2022 - 15.09.2022
Logged by	DS	**Page**	1 of 5
Checked by	WB		
Comments	DCP commenced from 50 mm bgl.		

TEST DATA

Depth Interval (m)	DCP101 (BH101)	DCP102 (BH102)	DCP103 (BH103)	DCP104 (BH104)	DCP105 (BH106)	DCP107 (BH110)	
0.15	2	2	1	1	1	1	
0.30	4	2	4	1	2	3	
0.45	6	4	5	5	3	6	
0.60	7	2	4	6	3	6	
0.75	6	4	1	5	1	5	
0.90	5	3	2	3	1	2	
1.05	6	3	2	6	2	2	
1.20	5	3	2	6	1	3	
1.35	6	3	3	4	2	4	
1.50	4	5	2	5	1	6	
1.65	4	4	1	5	2	7	
1.80	5	5	3	4	8	8	
1.95	5	4	4	4	10	10	
2.10	4	4	3	4	9	15	
2.25	5	4	6	7	7	16	
2.40	4	6	7	10	7	15	
2.55	3	5	5	9	5	15	
2.70	5	7	5	10	7	16	
2.85	9	8	6	10	7	18	
3.00	9	7	5	9	7	18	
3.15	10	7	8	9	8	14	
3.30	10	10	7	8	10	12	
3.45	Terminated @ 3.35 m	Terminated @ 3.35 m	Terminated @ 3.35 m	Terminated @ 3.35 m	Terminated @ 3.35 m	Terminated @ 3.35 m	

Dynamic Cone Penetrometer Test Log Summary

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Site	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	**DCP Group Reference**	P2208888JS03V01
Client	AB Rise Pty Ltd C/- DMPS	**Log Date**	13.09.2022 - 15.09.2022 & 07.02.2023 - 08.02.2023
Logged by	DS/AK/TR	**Page**	2 of 5
Checked by	WB		
Comments	DCP commenced from 50 mm bgl.		

TEST DATA

Depth Interval (m)	DCP108 (BH111)	DCP109 (BH112)	DCP110 (BH115)	DCP111 (BH116)	DCP112 (BH117)	DCP113 (BH118)	DCP114 (BH119)	
0.15	1	Hammer weight	4	5	1	5	3	
0.30	1	1	3	4	Hammer weight	4	1	
0.45	3	4	Hammer weight	1	Hammer weight	3	Hammer weight	
0.60	3	3	Hammer weight	Hammer weight	Hammer weight	2	Hammer weight	
0.75	3	3	Hammer weight	Hammer weight	Hammer weight	Hammer weight	Hammer weight	
0.90	2	2	Hammer weight	Hammer weight	Hammer weight	1	Hammer weight	
1.05	3	3	Hammer weight	Hammer weight	Hammer weight	Hammer weight	Hammer weight	
1.20	4	3	Hammer weight	Hammer weight	Hammer weight	Hammer weight	Hammer weight	
1.35	3	4	Hammer weight	Hammer weight	Hammer weight	Hammer weight	Hammer weight	
1.50	2	6	Hammer weight	Hammer weight	Hammer weight	Hammer weight	1	
1.65	4	6	2	Hammer weight	Hammer weight	Hammer weight	4	
1.80	4	7	2	Hammer weight	Hammer weight	Hammer weight	4	
1.95	5	5	3	Hammer weight	Hammer weight	1	3	
2.10	5	4	3	3	Hammer weight	2	2	
2.25	6	5	2	3	1	2	1	
2.40	5	7	2	2	3	2	Hammer weight	
2.55	5	7	3	2	3	4	Hammer weight	
2.70	5	7	2	3	3	3	3	
2.85	5	7	3	3	3	6	4	
3.00	5	7	3	5	3	5	4	
3.15	6	6	3	4	4	4	4	
3.30	7	7	4	4	4	4	4	
3.45	Terminated @ 3.35 m	Terminated @ 3.35 m	3	4	4	5	3	
3.60			2	5	4	4	Terminated @ 3.5 m	
3.75			2	5	5	5		
3.90			3	5	6	3		
4.05			3	5	5	6		
4.20			2	5	6	4		
4.35			4	4	5	3		
4.50			Terminated @ 4.4 m	Terminated @ 4.4 m	Terminated @ 4.4 m	Terminated @ 4.4 m		
4.65								

Dynamic Cone Penetrometer Test Log Summary

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Site	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	**DCP Group Reference**	P2208888JS03V01
Client	AB Rise Pty Ltd C/- DMPS	**Log Date**	07.02.2023 - 08.02.2023
Logged by	AK/TR	**Page**	3 of 5
Checked by	WB		
Comments	DCP commenced from 50 mm bgl.		

TEST DATA

Depth Interval (m)	DCP115 (BH120)	DCP116 (BH121)	DCP117 (BH122)	DCP118 (BH123)	DCP119 (BH124)	DCP120 (BH125)	DCP121 (BH126)	
0.15	3	3	1	1	1	Hammer weight	1	
0.30	4	5	2	2	3	1	2	
0.45	Hammer weight	Hammer weight	1	2	2	Hammer weight	2	
0.60	Hammer weight	Hammer weight	1	2	4	1	1	
0.75	Hammer weight	Hammer weight	1	2	3	Hammer weight	Hammer weight	
0.90	Hammer weight	Hammer weight	1	3	2	1	1	
1.05	Hammer weight	Hammer weight	2	2	2	1	1	
1.20	Hammer weight	Hammer weight	2	2	4	1	1	
1.35	Hammer weight	Hammer weight	2	2	5	1	4	
1.50	Hammer weight	Hammer weight	2	3	7	2	5	
1.65	Hammer weight	Hammer weight	2	3	5	2	6	
1.80	2	Hammer weight	2	4	3	1	6	
1.95	2	Hammer weight	2	3	4	Hammer weight	6	
2.10	2	Hammer weight	2	4	5	Hammer weight	6	
2.25	Hammer weight	Hammer weight	3	3	4	2	6	
2.40	Hammer weight	Hammer weight	3	3	5	1	5	
2.55	2	Hammer weight	2	2	7	1	4	
2.70	2	Hammer weight	3	3	5	2	3	
2.85	3	Hammer weight	4	4	5	2	3	
3.00	4	Hammer weight	4	5	6	3	4	
3.15	3	Hammer weight	3	6	9	3	4	
3.30	3	Hammer weight	4	7	12	3	2	
3.45	6	Hammer weight	5	12	11	4	5	
3.60	5	Hammer weight	6	13	6	4	6	
3.75	4	Hammer weight	7	8	8	4	7	
3.90	4	Hammer weight	7	25	10	11	8	
4.05	5	Hammer weight	8	40+	12	9	7	
4.20	3	Hammer weight	8	Terminated @ 4.1 m due to high 'N' counts	12	9	4	
4.35	4	Hammer weight	7		18	8	4	
4.50	Terminated @ 4.4 m	Terminated @ 4.4 m	Terminated @ 4.4 m		Terminated @ 4.4 m	Terminated @ 4.4 m	Terminated @ 4.4 m	
4.65								

Dynamic Cone Penetrometer Test Log Summary

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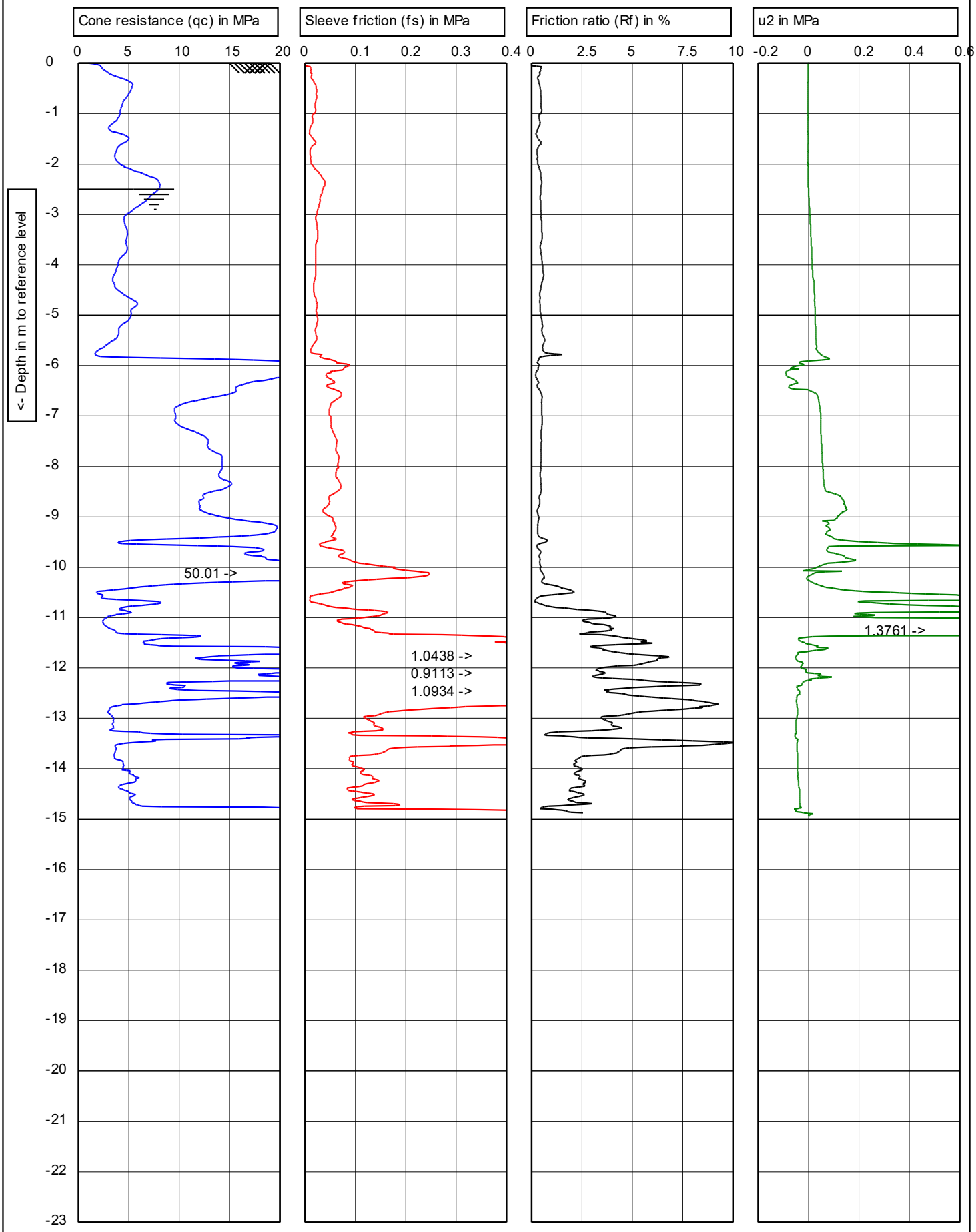
Site	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	**DCP Group Reference**	P2208888JS03V01
Client	AB Rise Pty Ltd C/- DMPS	**Log Date**	07.02.2023 - 08.02.2023
Logged by	AK/TR	**Page**	4 of 5
Checked by	WB		
Comments	DCP commenced from 50 mm bgl.		

TEST DATA

Depth Interval (m)	DCP122 (BH127)	DCP123 (BH128)	DCP124 (BH129)					
0.15	2	3	2					
0.30	1	2	6					
0.45	Hammer weight	2	3					
0.60	Hammer weight	Hammer weight	1					
0.75	Hammer weight	1	1					
0.90	Hammer weight	Hammer weight	1					
1.05	1	1	1					
1.20	1	Hammer weight	Hammer weight					
1.35	2	4	4					
1.50	5	4	5					
1.65	5	4	7					
1.80	6	4	6					
1.95	6	3	6					
2.10	7	3	7					
2.25	8	4	6					
2.40	4	6	8					
2.55	5	4	5					
2.70	2	5	4					
2.85	3	2	1					
3.00	4	4	3					
3.15	3	2	2					
3.30	4	2	2					
3.45	4	3	2					
3.60	4	4	2					
3.75	3	3	2					
3.90	4	4	2					
4.05	4	5	2					
4.20	5	4	2					
4.35	4	4	2					
4.50	Terminated @ 4.4 m	Terminated @ 4.4 m	Terminated @ 4.4 m					
4.65								

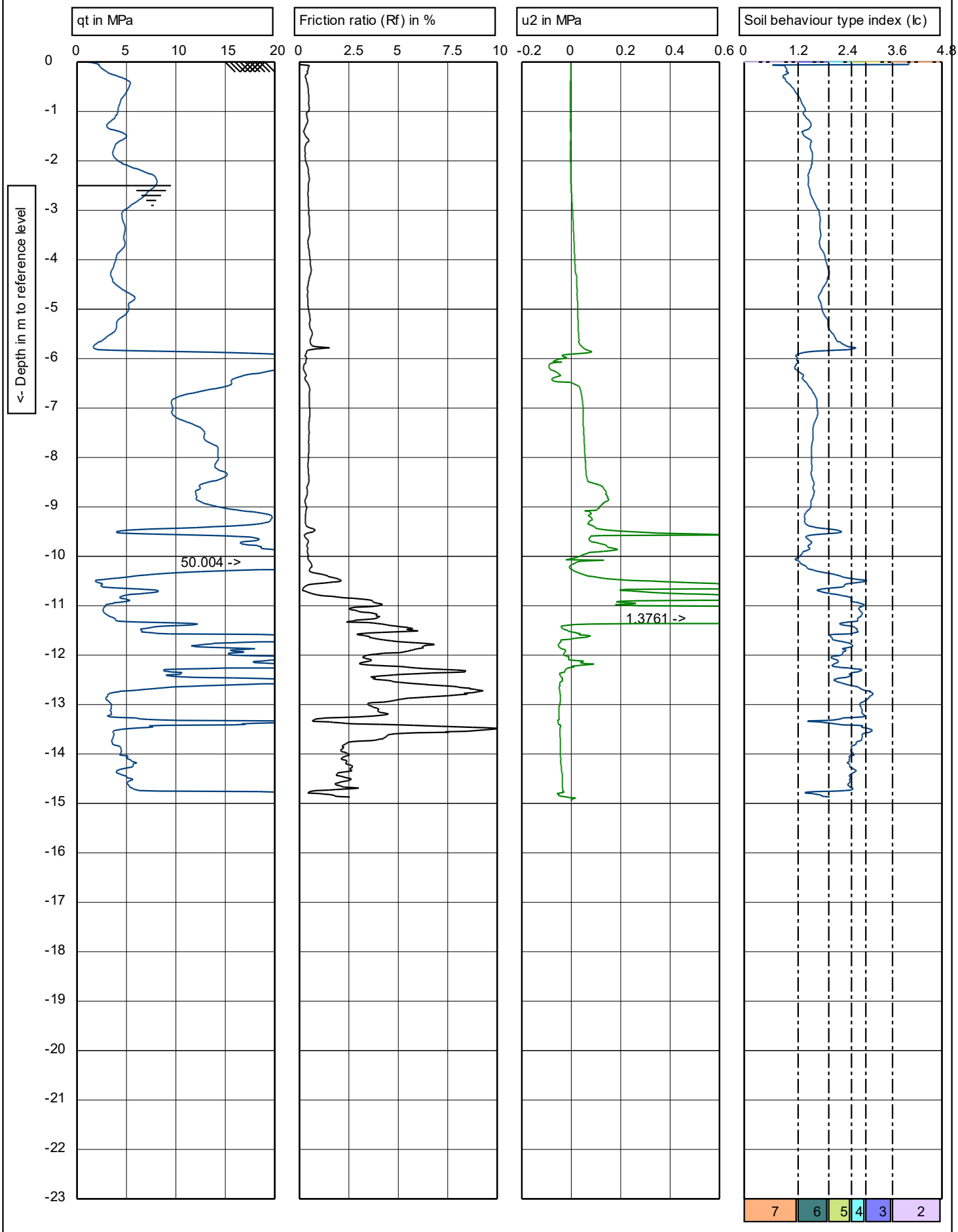
Appendix D – CPT Results



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

r u2 / L 150 cm² / 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill: **0.00 m Predrilled**
	G.L.: **0.00 m**	W.L.: **-2.50 m**	Date: **14/09/2022**
Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.: **C10CFIIP.C21089**
Location:	**196 OLD MAIN RD**		Project no.: **8888**
Position:	**0, 0**		CPT no.: **CPT-101** **1/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-2.50 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

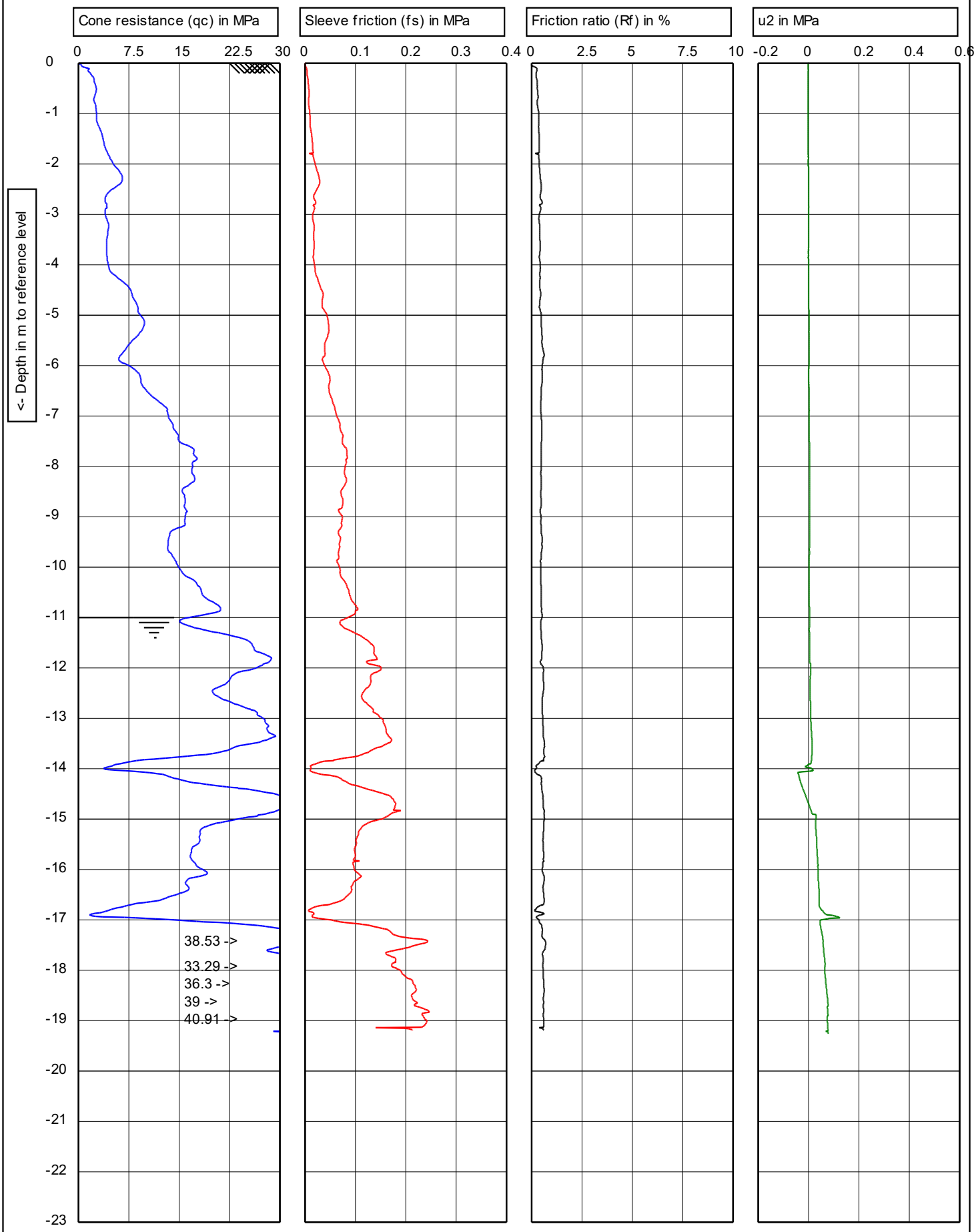
Predrill:	**0.00 m Predrilled**
Date:	**14/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-101** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-2.50 m**	Date:	**14/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT-101** **3/3**

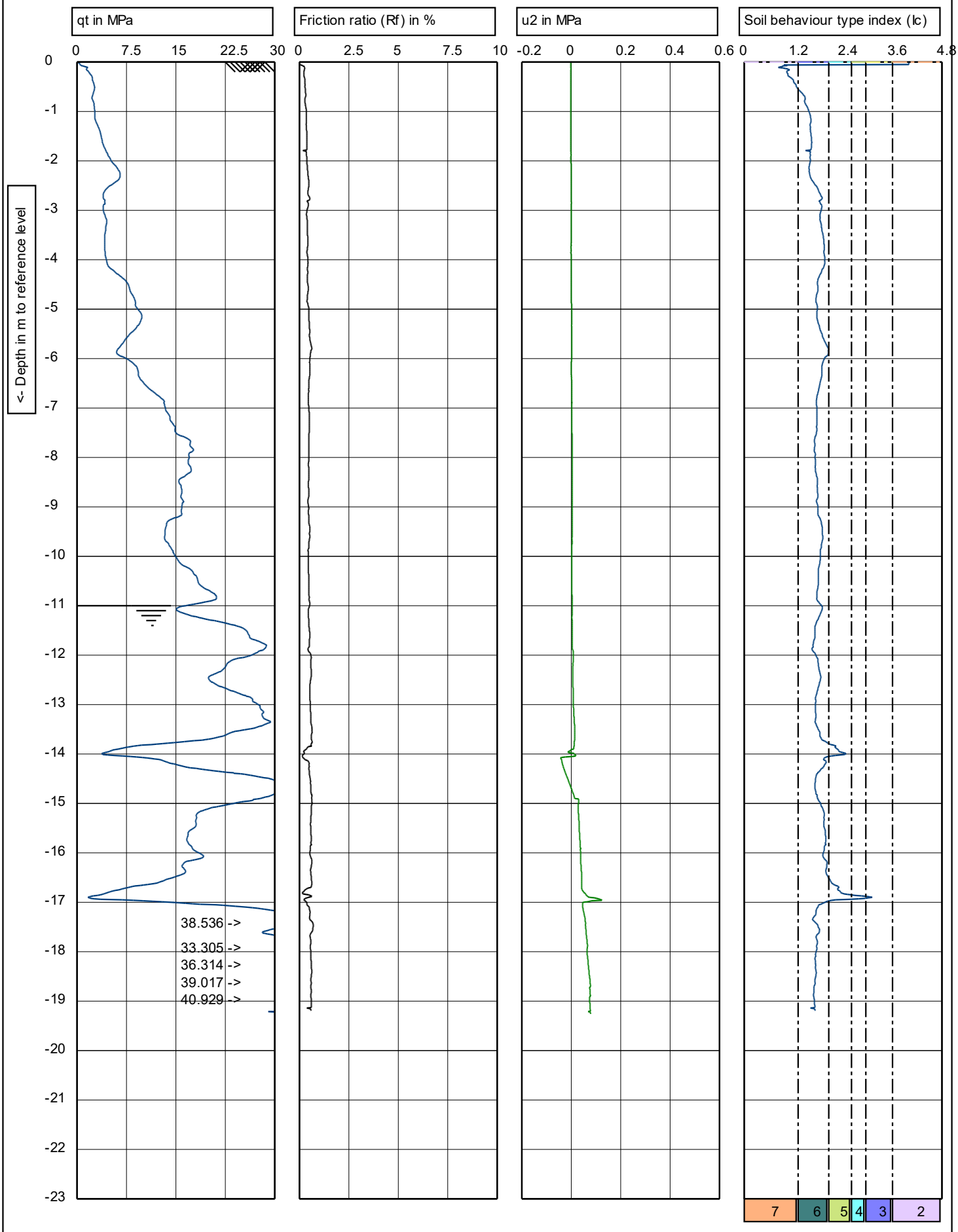
1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

u2 150 cm² / 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill: **0.00 m Predrilled**
	G.L.: **0.00 m NAP**	W.L.: **-11.00 m**	Date: **14/09/2022**
Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.: **C10CFIIP.C21089**
Location:	**196 OLD MAIN RD**		Project no.: **8888**
Position:	**0, 0 RD**		CPT no.: **CPT-102** **1/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m NAP** W.L.: **-11.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0 RD**

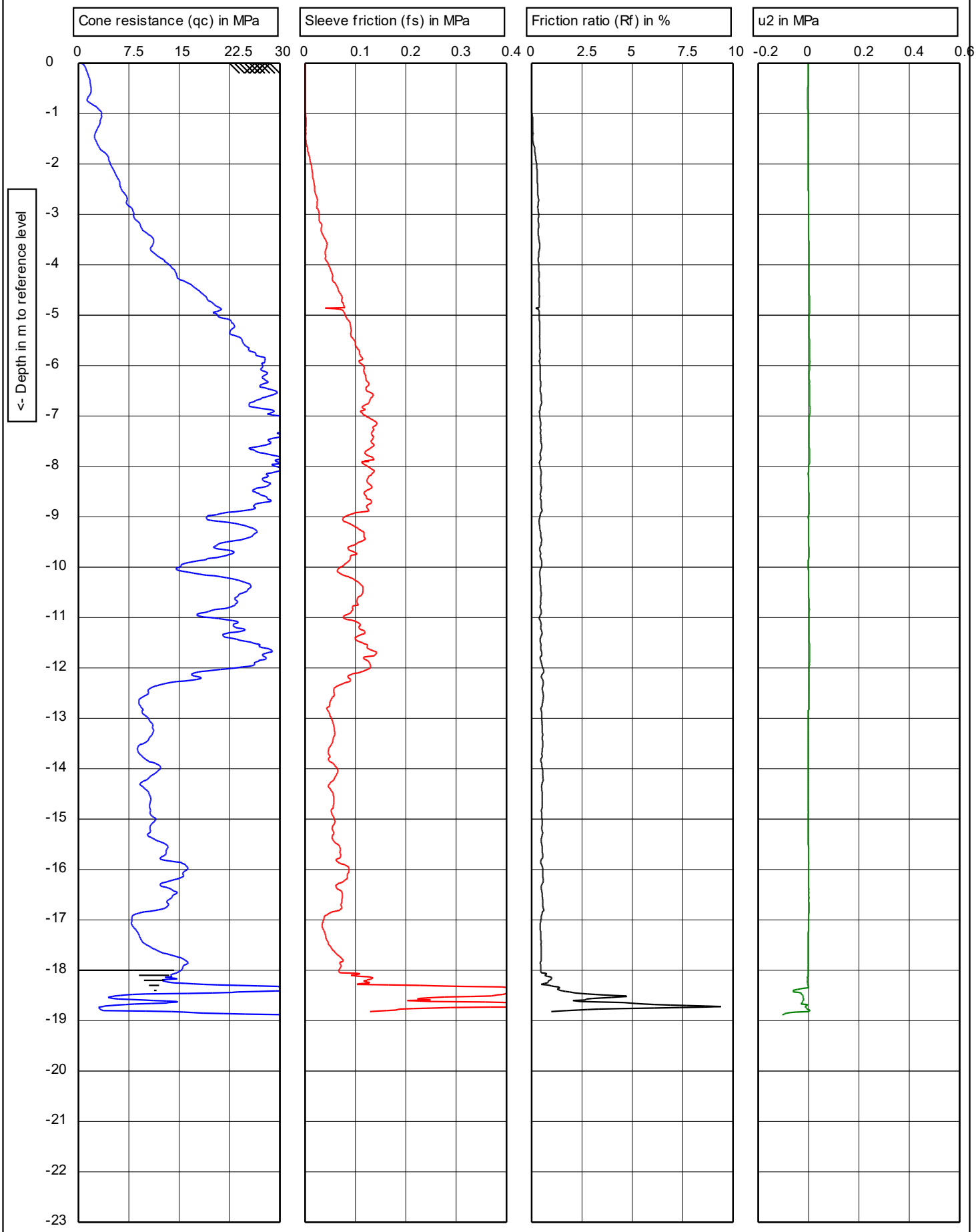
Predrill:	**0.00 m Predrilled**
Date:	**14/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-102** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

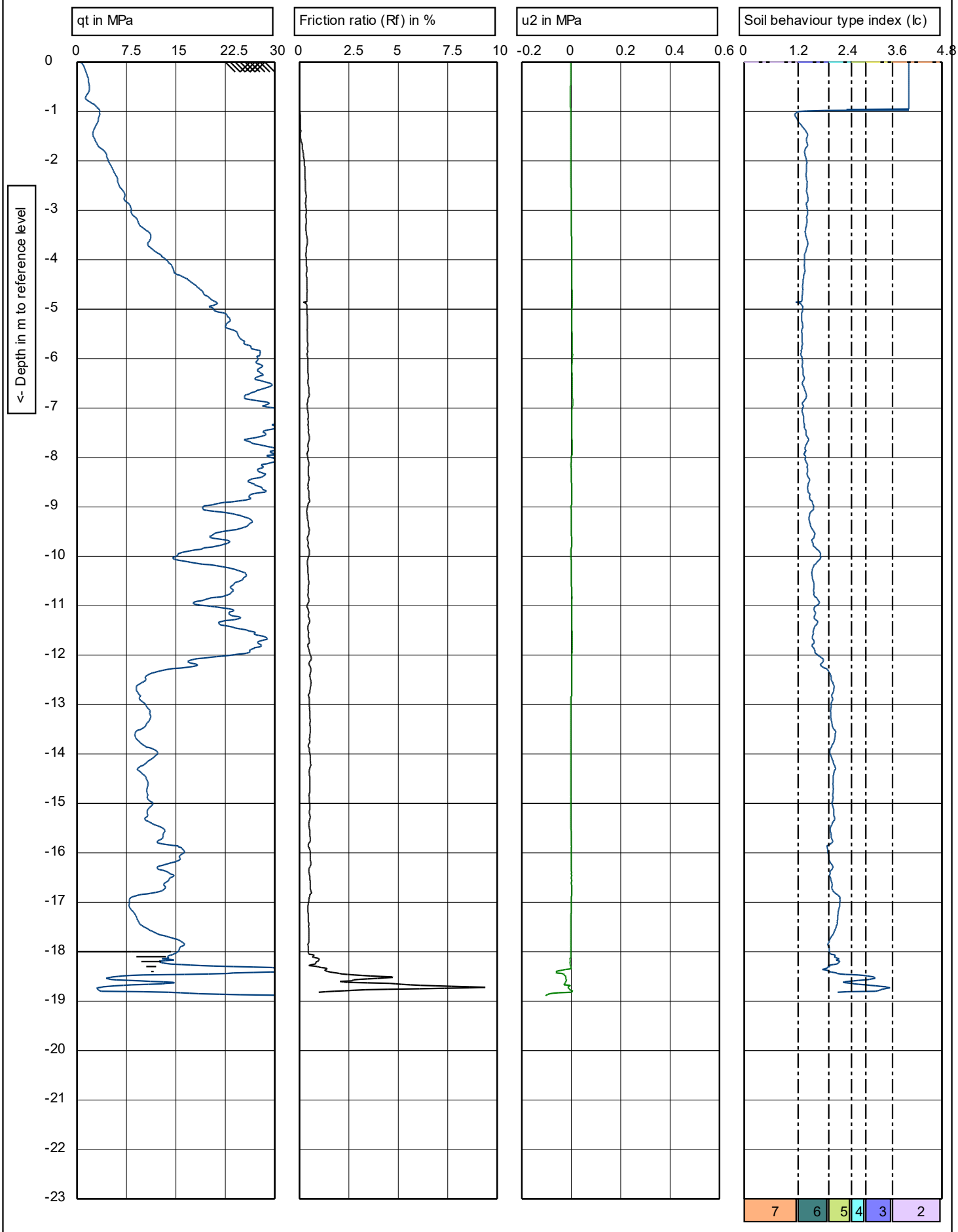
NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	⌜ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m NAP**	W.L.: **-11.00 m**	Date:	**14/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0 RD**		CPT no.:	**CPT-102** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING Ph. 0408 292638	ISO 22476-1:2012 Application class 1 Testtype TE1	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m** W.L.: **-18.00 m**	Date:	**14/09/2022**
Project: **GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
Location: **196 OLD MAIN RD**		Project no.:	**8888**
Position: **0, 0**		CPT no.:	**CPT-103** 1/3

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

u2
150 cm²
10 cm²

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-18.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

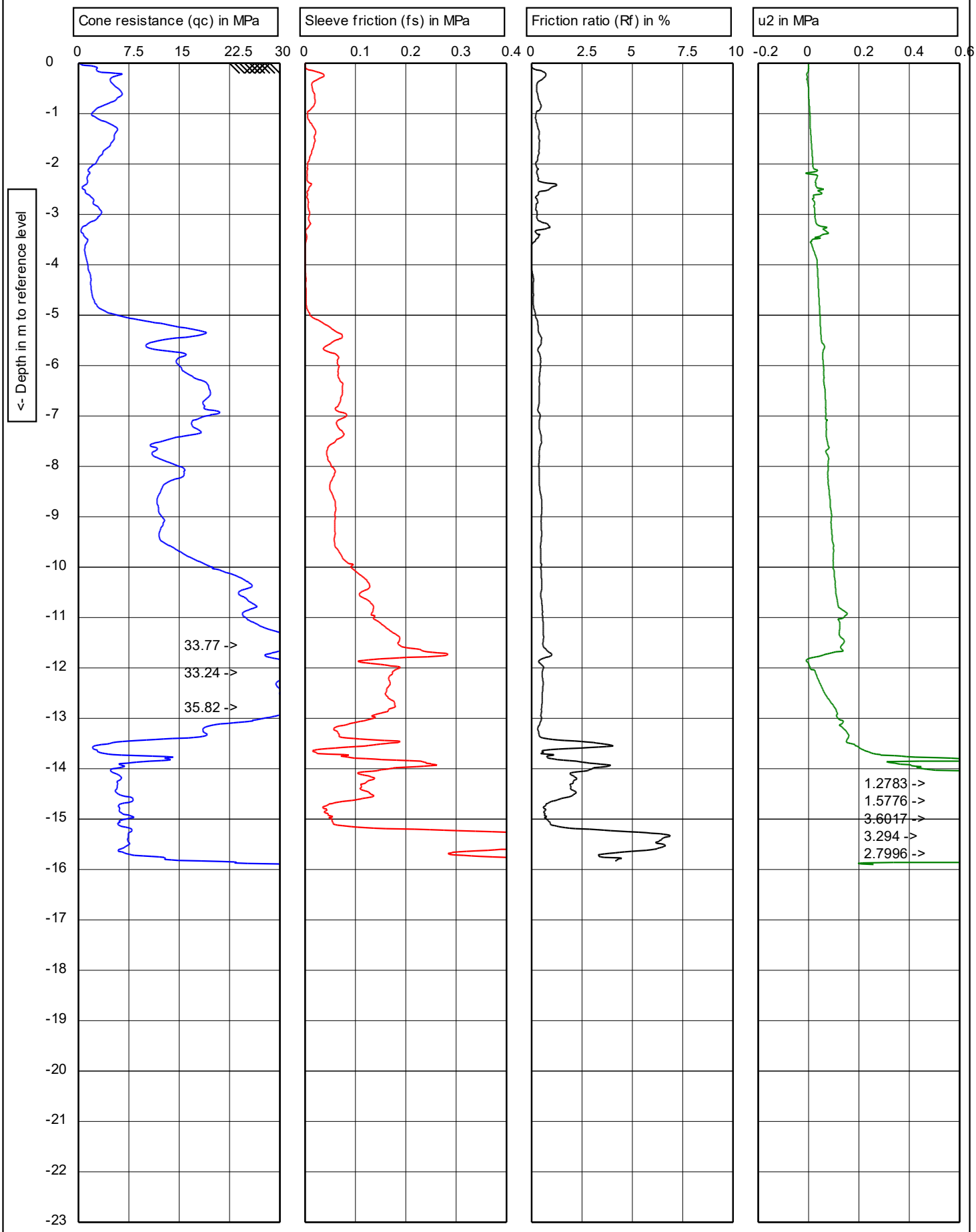
Predrill:	**0.00 m Predrilled**
Date:	**14/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-103** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-18.00 m**	Date:	**14/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT-103** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

u2
150 cm²
10 cm²

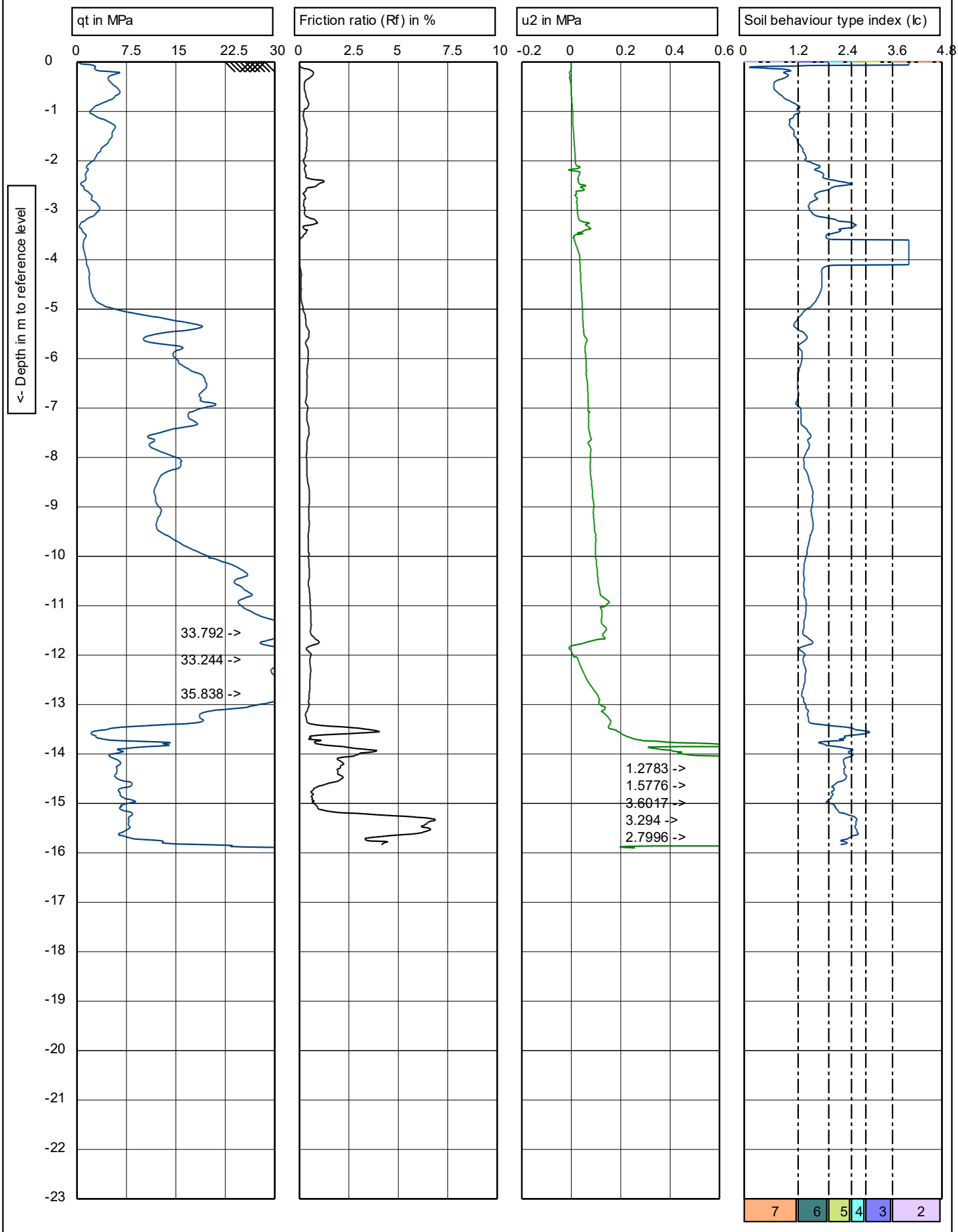
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **0.40 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**14/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-104** 1/3

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **0.40 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

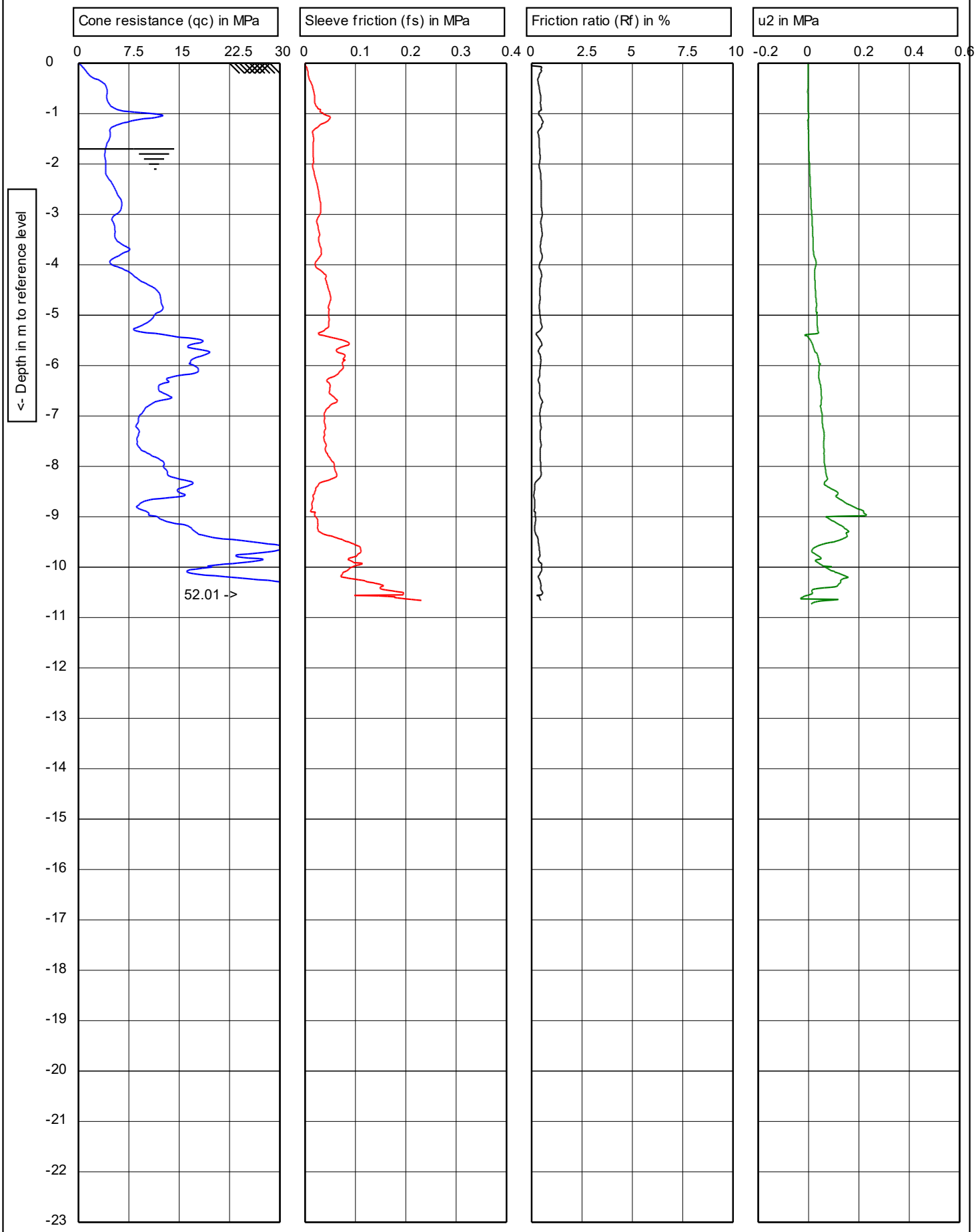
Predrill:	**0.00 m Predrilled**
Date:	**14/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-104** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **0.40 m**	Date:	**14/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT-104** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

u2
150 cm²
10 cm²

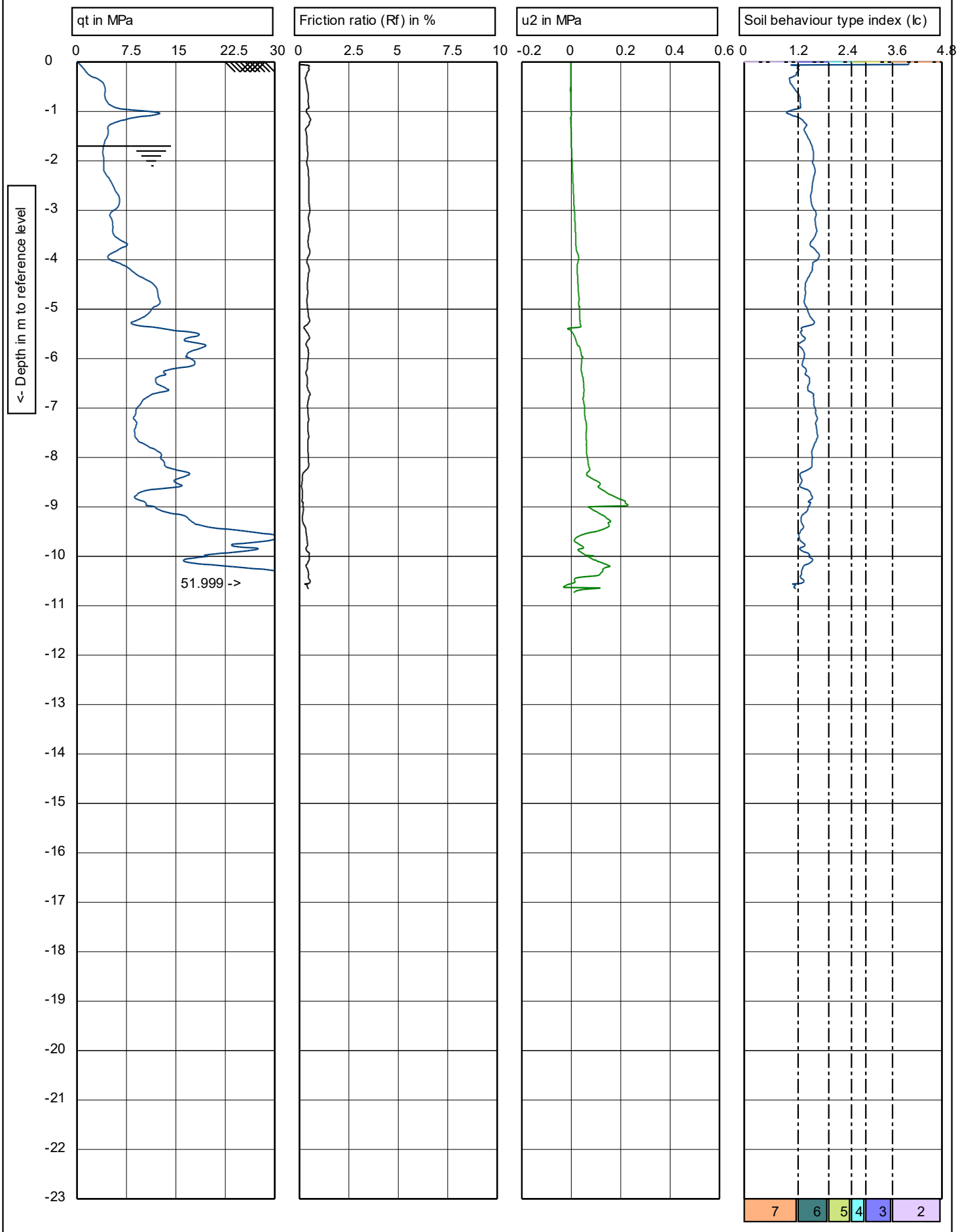
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-1.70 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT - 105** 1/3

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-1.70 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

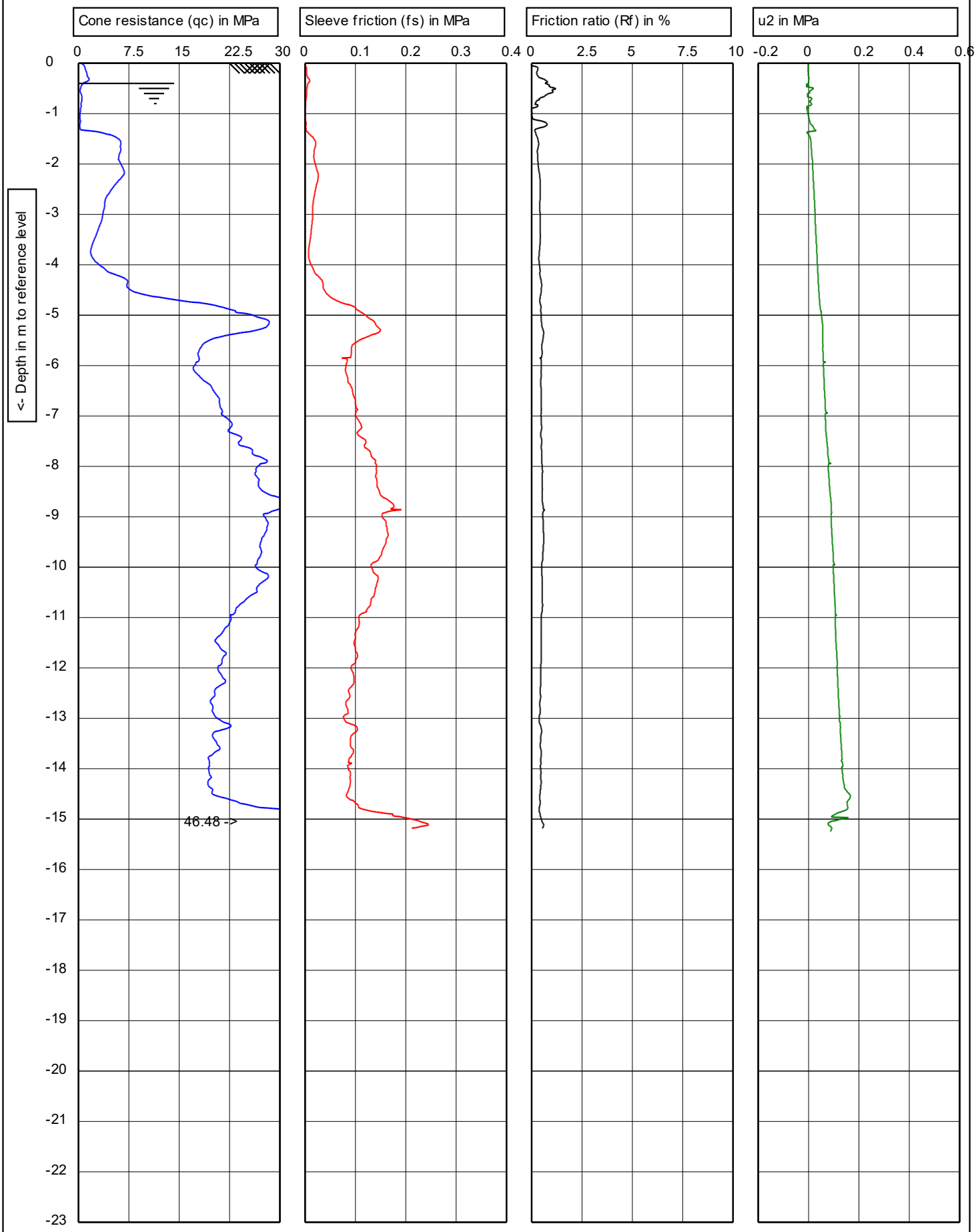
Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT - 105** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-1.70 m**	Date:	**15/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT - 105** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

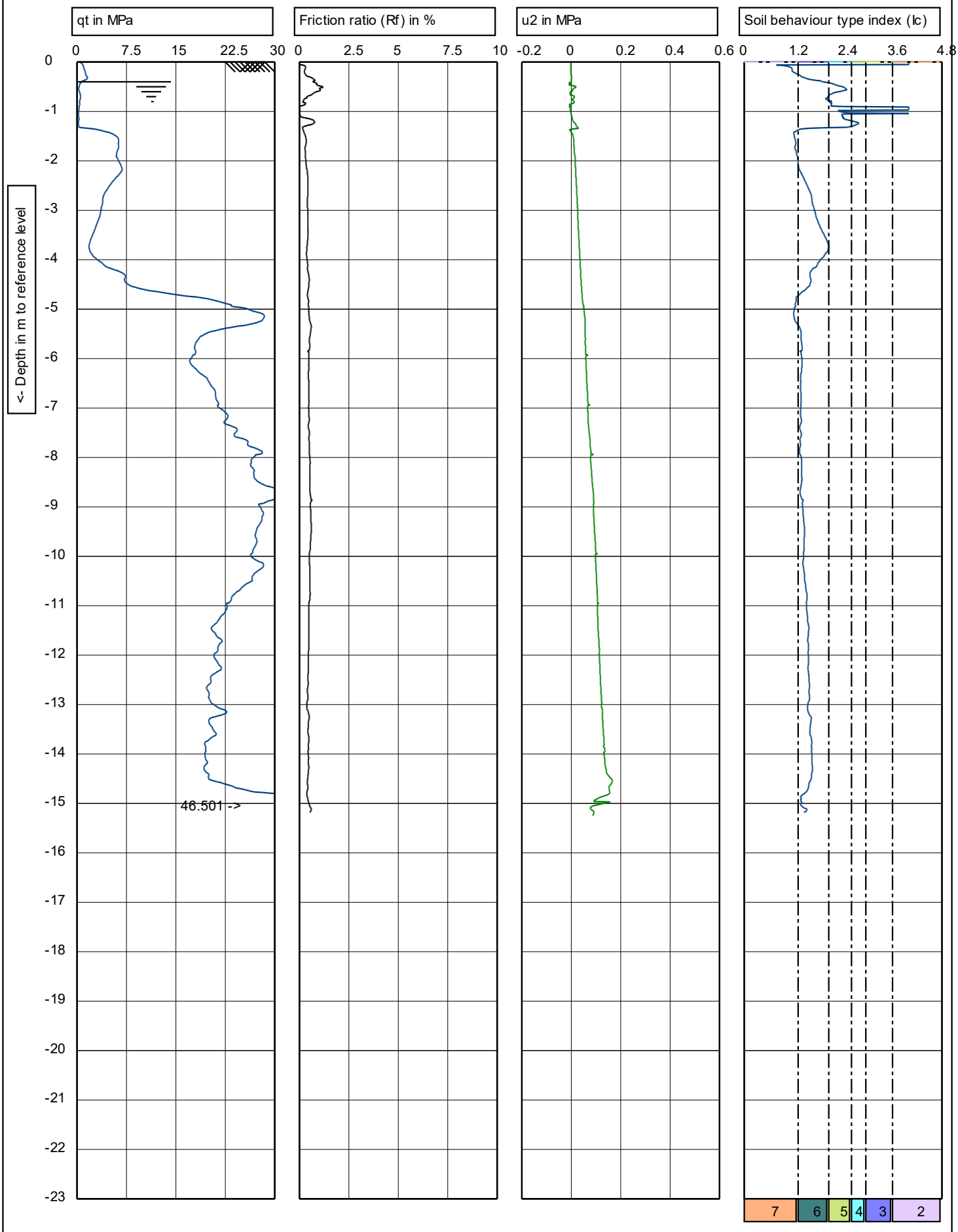
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-0.40 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT - 106** **1/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

r u2
L 150 cm²
10 cm²

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-0.40 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

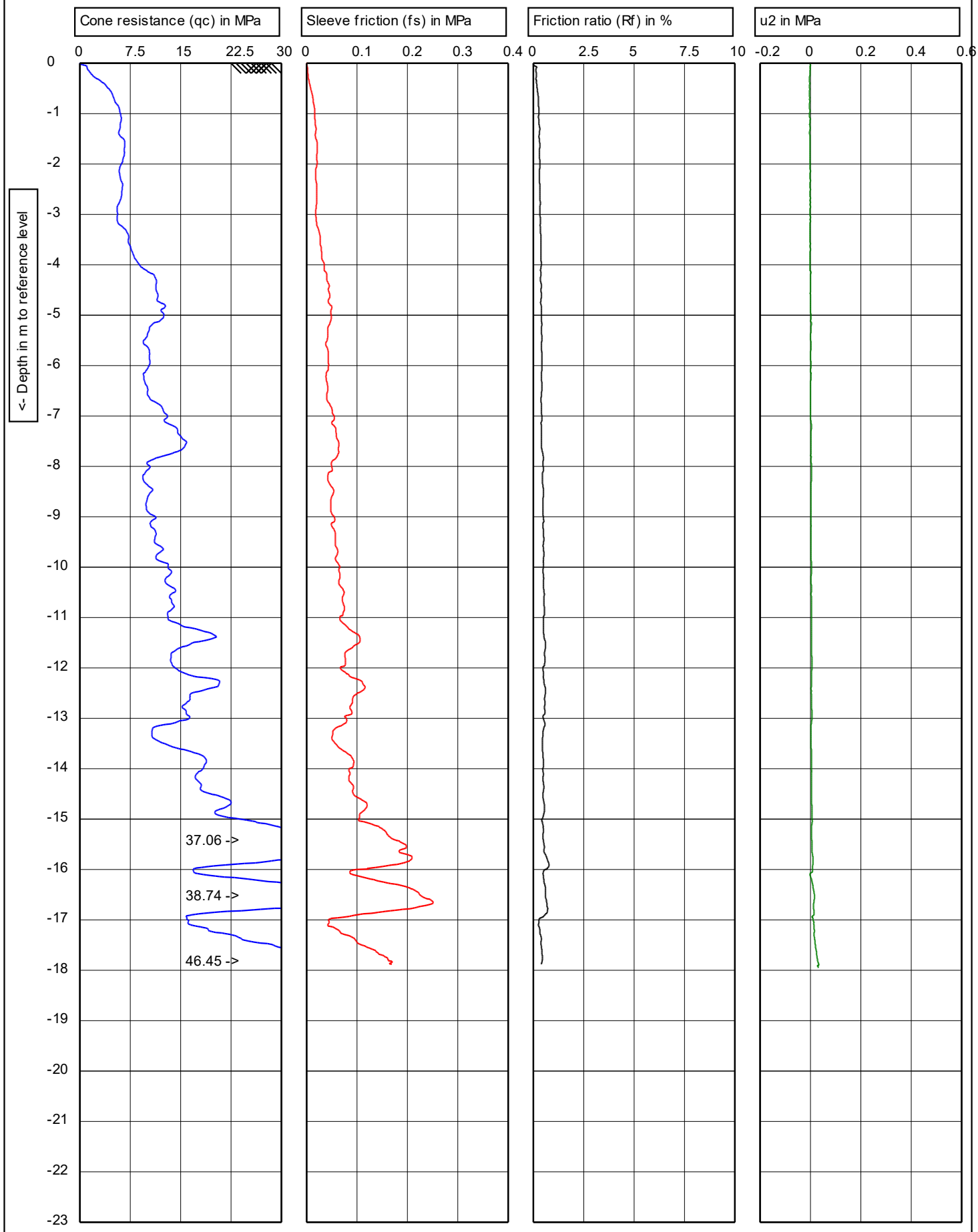
Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT - 106** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-0.40 m**	Date:	**15/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT - 106** **3/3**

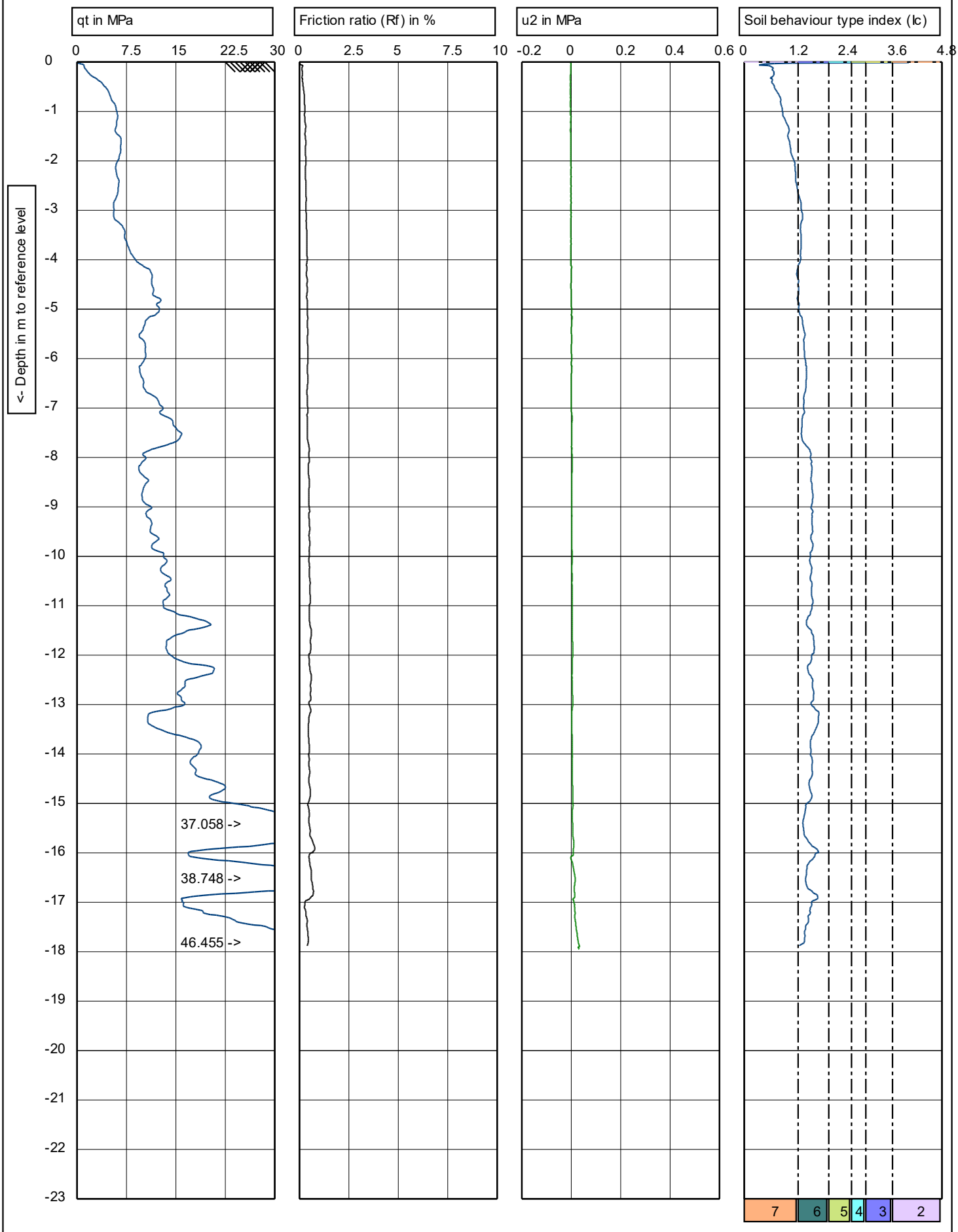
1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

r u2 / L 150 cm² / 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill: **0.00 m Predrilled**
	G.L.: **0.00 m**	W.L.: **11.00 m**	Date: **15/09/2022**
Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.: **C10CFIIP.C21089**
Location:	**196 OLD MAIN RD**		Project no.: **8888**
Position:	**0, 0**		CPT no.: **CPT - 107** **1/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **11.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

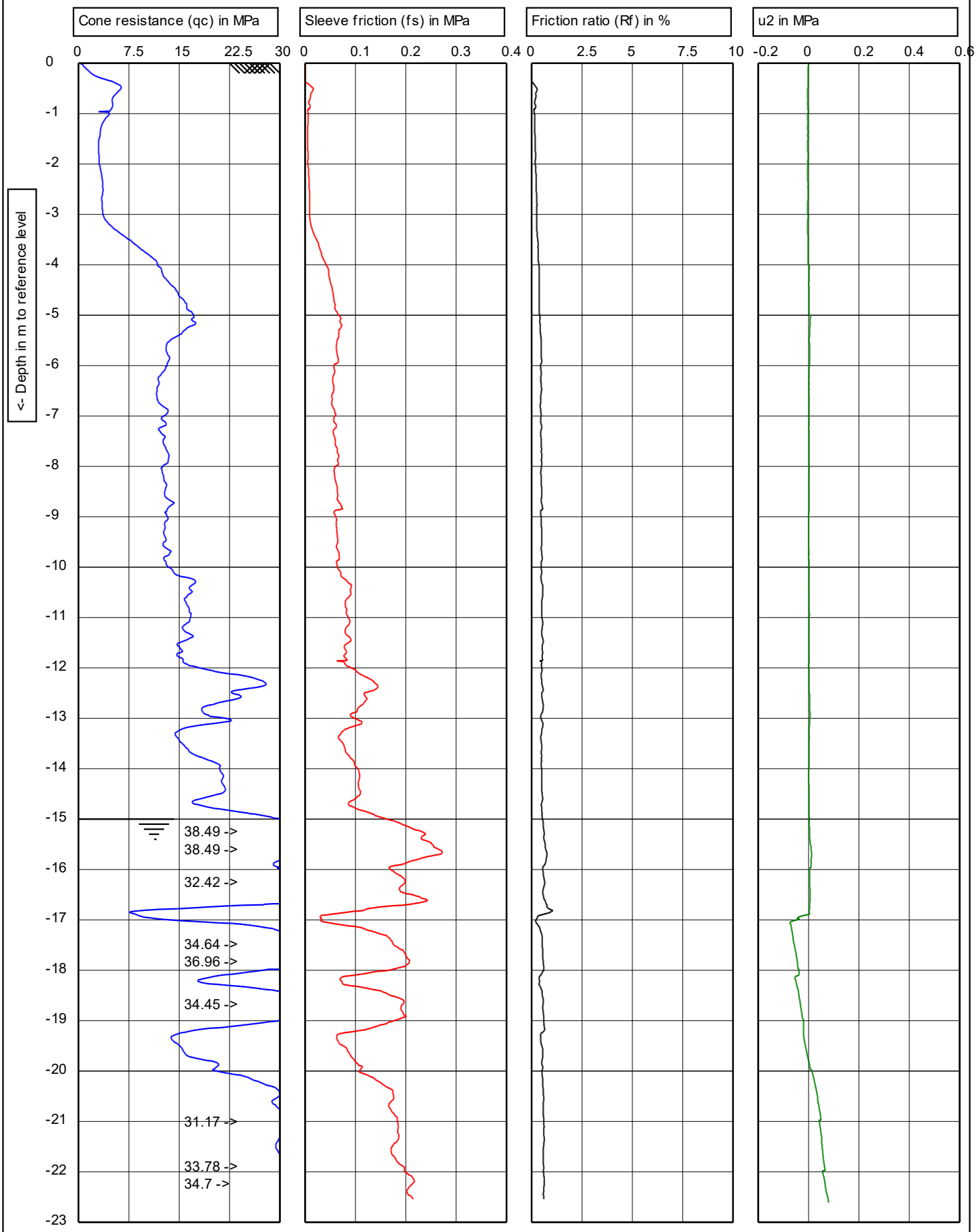
Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT - 107** **2/3**

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	⌜ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **11.00 m**	Date:	**15/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT - 107** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

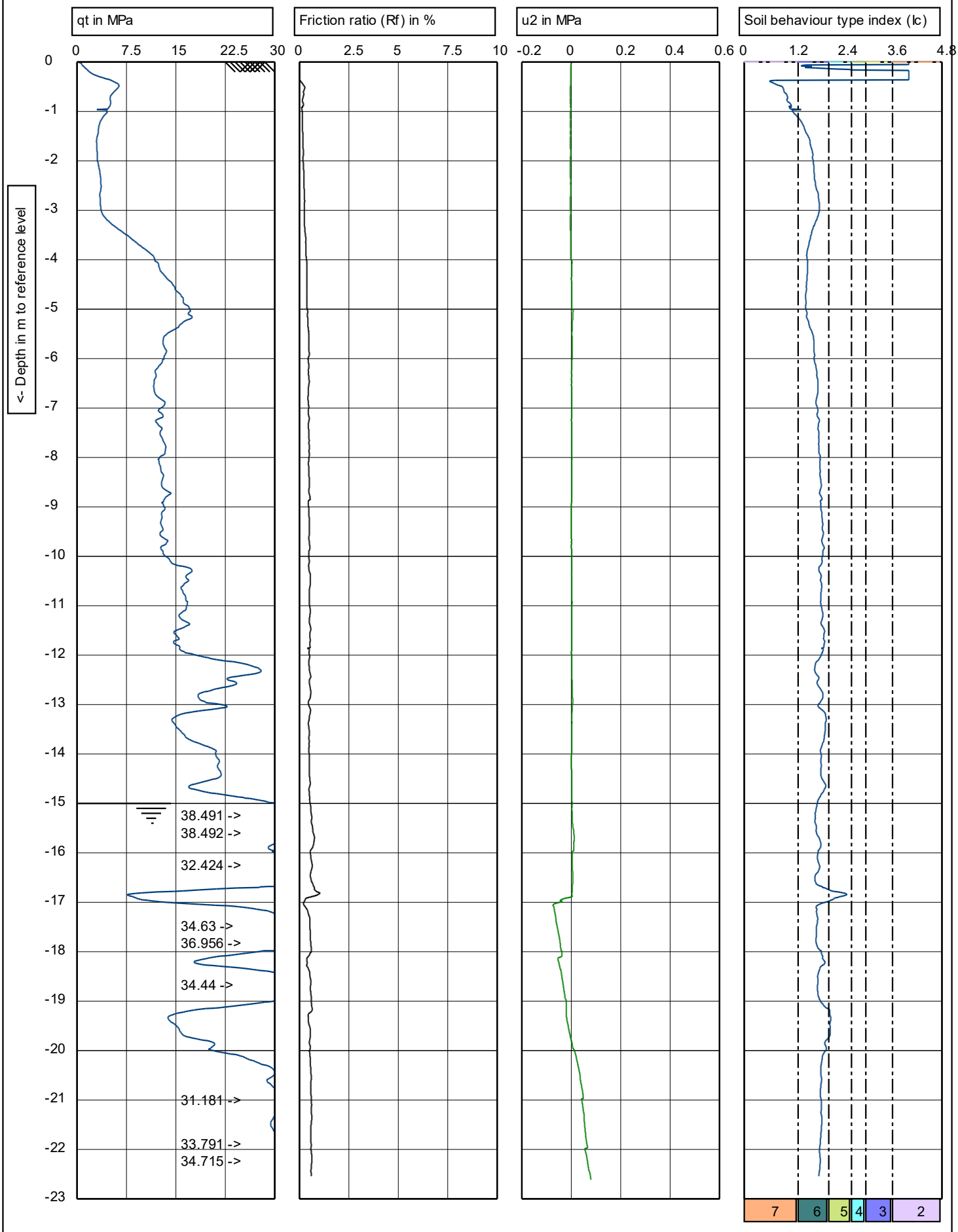
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-15.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-108** 1/3

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-15.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

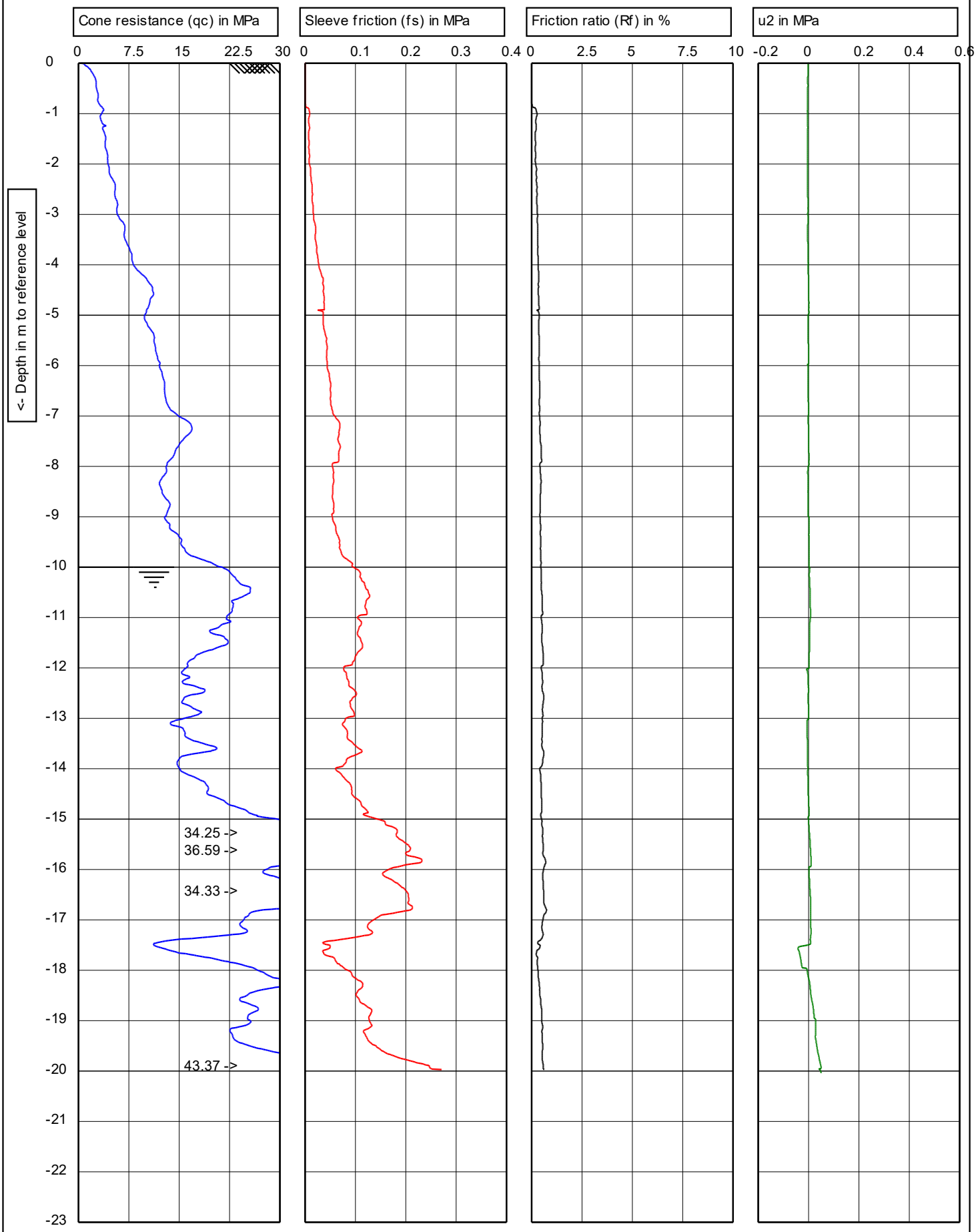
Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-108** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-15.00 m**	Date:	**15/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT-108** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

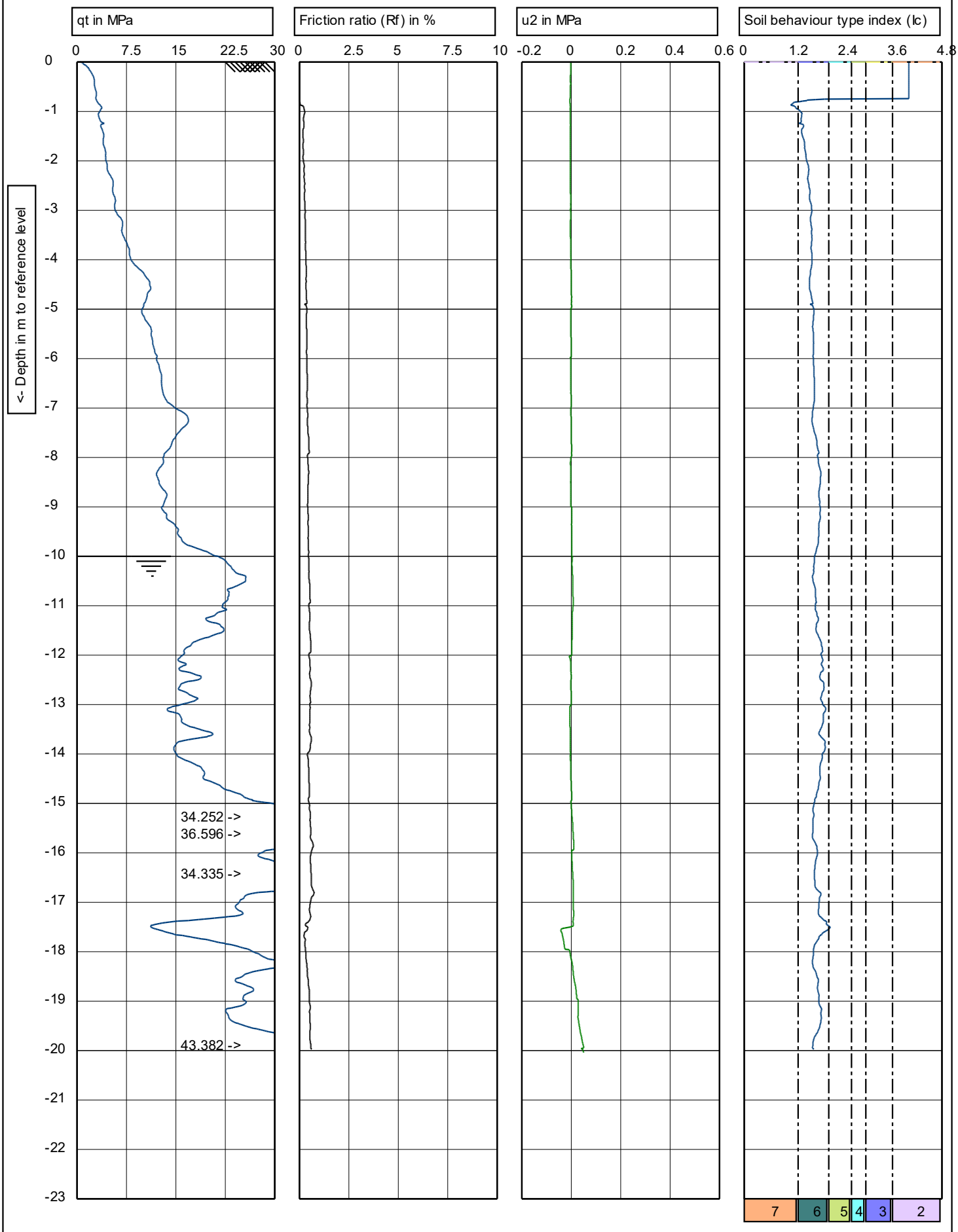
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-10.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-109C** **1/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **-10.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

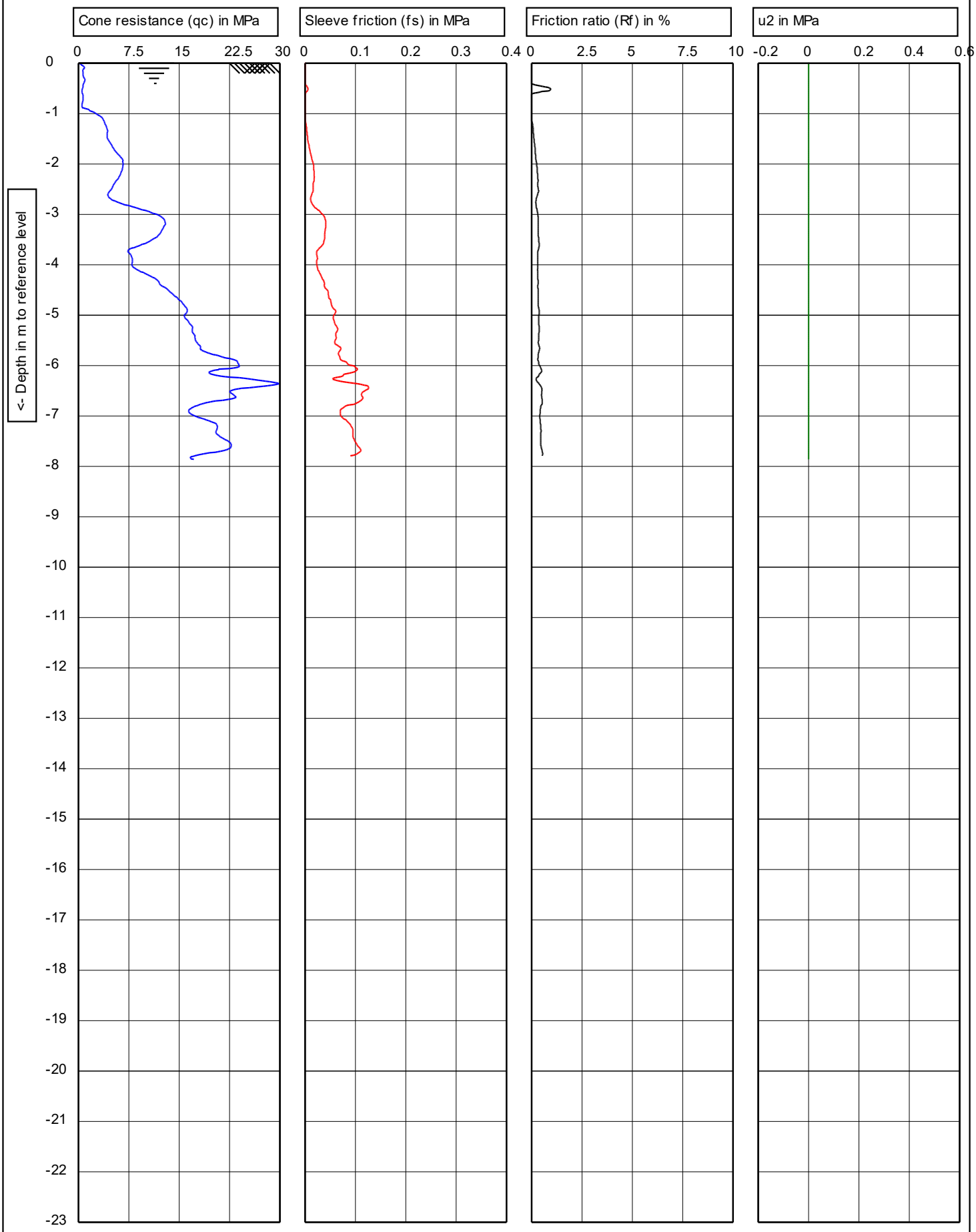
Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-109C** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

NEWSYD GEOTECHNICAL TESTING **Ph. 0408 292638**	┌ u2 └ 150 cm² 10 cm²	ISO 22476-1:2012 Application class 1 Testtype TE1		Predrill:	**0.00 m Predrilled**
		G.L.: **0.00 m**	W.L.: **-10.00 m**	Date:	**15/09/2022**
	Project:	**GEOTECHNICAL INVESTIGATION**		Cone no.:	**C10CFIIP.C21089**
	Location:	**196 OLD MAIN RD**		Project no.:	**8888**
	Position:	**0, 0**		CPT no.:	**CPT-109C** **3/3**

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

u2
150 cm²
10 cm²

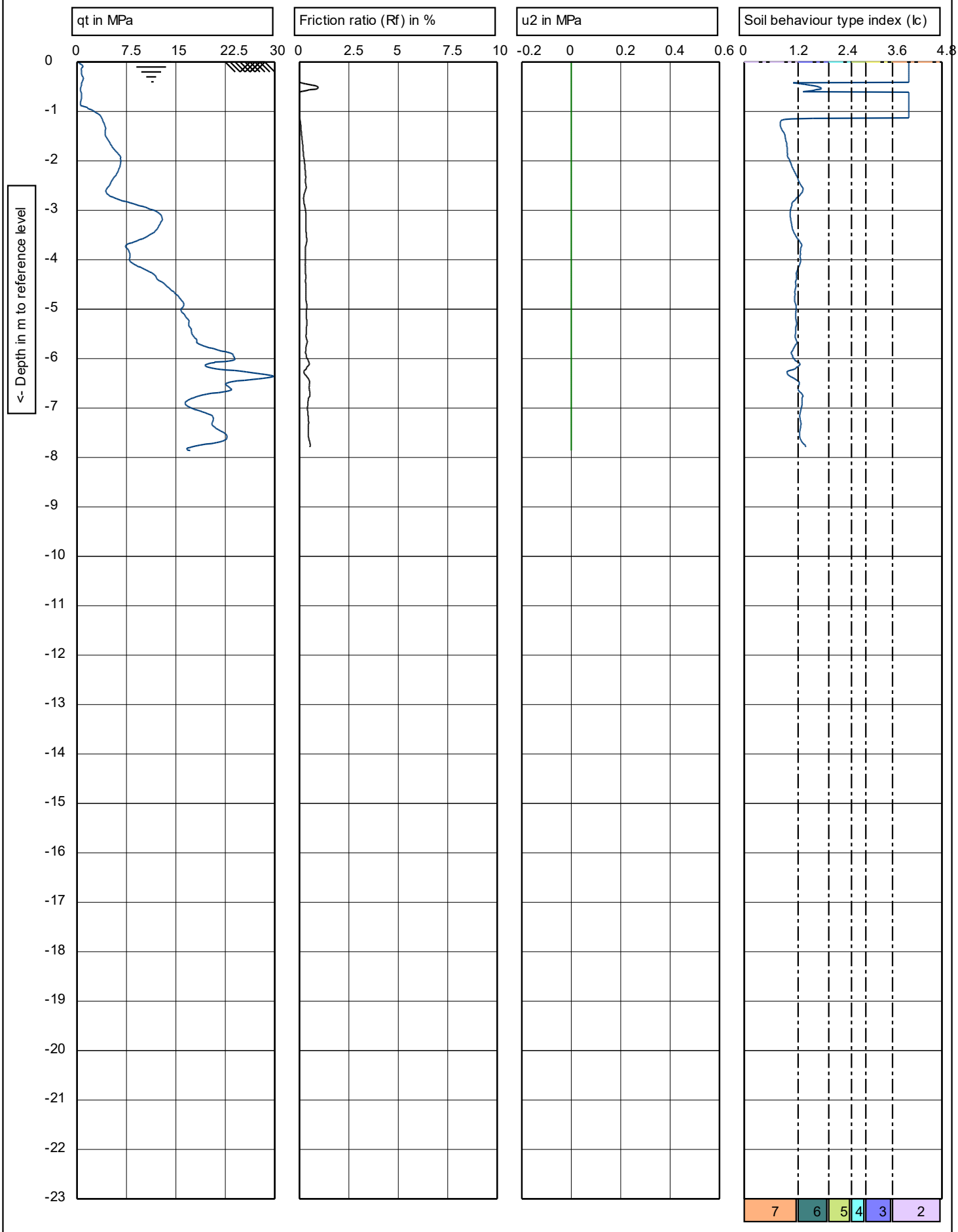
ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **0.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-110** 1/3

1.44



NEWSYD GEOTECHNICAL TESTING
Ph. 0408 292638

r u2
L 150 cm²
10 cm²

ISO 22476-1:2012 Application class 1 Testtype TE1

G.L.: **0.00 m** W.L.: **0.00 m**

Project: **GEOTECHNICAL INVESTIGATION**
Location: **196 OLD MAIN RD**
Position: **0, 0**

Predrill:	**0.00 m Predrilled**
Date:	**15/09/2022**
Cone no.:	**C10CFIIP.C21089**
Project no.:	**8888**
CPT no.:	**CPT-110** 2/3

1.44

(2) Organic soils
(3) Clay
(4) Silt mixture
(5) Sand mixture
(6) Sand clean to silty
(7) Gravelly sand

Appendix E – Chromium Suite Analytical Results

ASS Laboratory Test Results Interpretation

Method based on Acid Sulfate Soil Manual (ASSMAC, 1998)
Method ST-50 V05 Revised 30.04.2018

martens

Suite 201, 20 George Street, Hornsby, NSW 2077 Ph: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au, www.martens.co m.au

PROJECT DETAILS

Client:	AB Rise Pty Ltd C/- DMPS	Page:	1 of 5
Project:	Geotechnical and Acid Sulfate Soils Assessment	Assessment Date:	10/09/2024
Sampling Site:	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	Job Number:	P2208888
Sample Date:	14/09/2022	Sampled By:	DS

SAMPLE DETAILS / TEST RESULTS

Sample Location	Sample Depth (mbgl)	pH Measurements	Sulfur Trail		Acid Trail		ASS - Acid Base Accounting				Liming Rate ecluding ANC
		pH_{kcl}	Chromium Reducible Sulfur	Chromium Reducible Sulfur (acidity units)	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Net Acidity (acidity units)	Net Acidity (sulfur units)	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	
		pH Units	%S	mole H+/t	mole H+/t	%S	mole H+/t	%S	mole H+/t	%S	kg/t
ASSMAC Criteria >1000 t disturbance		**<3.5**	**0.03**	**18**	**18**	**0.03**	**18**	**0.03**	**18**	**0.03**	
BH101	0.50	4.8	<0.005	<3	<5	<0.01	5.3	0.009	5.3	0.009	<0.75
	2.50	5.2	<0.005	<3	6	0.01	7.1	0.011	7.1	0.011	<0.75
BH103	0.50	4.6	<0.005	<3	**22**	**0.04**	**25**	**0.04**	**25**	**0.04**	1.90
	1.00	3.7	<0.005	<3	**61**	**0.1**	**63**	**0.1**	**63**	**0.1**	4.70
	2.50	4.8	**0.05**	**30**	16	0.02	**46**	**0.073**	**46**	**0.073**	3.40
	4.00	5.2	<0.005	<3	11	0.02	14	0.022	14	0.022	1.00
BH104	0.50	5.3	<0.005	<3	<5	<0.01	5.8	0.009	5.8	0.009	<0.75
	1.50	4.9	<0.005	<3	11	0.02	13	0.021	13	0.021	0.99
	2.50	5.2	<0.005	<3	<5	<0.01	5.6	0.009	5.6	0.009	<0.75
	4.00	5.2	<0.005	<3	8	0.01	8.6	0.014	8.6	0.014	<0.75
BH106	0.20	5.1	0.005	3	7	0.01	10	0.017	10	0.017	0.78
	1.20	4.7	0.005	<3	12	0.02	15	0.024	15	0.024	1.10
BH110	0.50	5.2	<0.005	<3	6	<0.01	7.1	0.011	7.1	0.011	<0.75
	1.50	4.5	<0.005	<3	**31**	**0.05**	**33**	**0.052**	**33**	**0.052**	2.40
BH111	0.50	6.4	<0.005	<3	<5	<0.01	<5	<0.005	<5	<0.005	<0.75
	1.50	6.6	<0.005	<3	<5	<0.01	<5	<0.005	<5	<0.005	<0.75
	2.80	6.4	<0.005	<3	<5	<0.01	<5	<0.005	<5	<0.005	<0.75
	4.40	6.2	<0.005	<3	<5	<0.01	<5	0.007	<5	0.007	<0.75

Notes:

Highlighted values indicate exceedances of ASSMAC (1998) & WQA (2018) action critera.

Head Office
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www.martens.com.au

ASS Laboratory Test Results Interpretation

Method based on Acid Sulfate Soil Manual (ASSMAC, 1998)
Method ST-50 V05 Revised 30.04.2018

martens

Suite 201, 20 George Street, Hornsby, NSW 2077 Ph: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au, www.martens.co m.au

PROJECT DETAILS

Client:	AB Rise Pty Ltd C/- DMPS	Page:	2 of 5
Project:	Geotechnical and Acid Sulfate Soils Assessment	Assessment Date:	10/09/2024
Sampling Site:	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	Job Number:	P2208888
Sample Date:	14/09/2022	Sampled By:	DS

SAMPLE DETAILS / TEST RESULTS

Sample Location	Sample Depth (mbgl)	pH Measurements	Sulfur Trail		Acid Trail		ASS - Acid Base Accounting				Liming Rate ecluding ANC
		pH_{kcl}	Chromium Reducible Sulfur	Chromium Reducible Sulfur (acidity units)	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Net Acidity (acidity units)	Net Acidity (sulfur units)	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	
		pH Units	%S	mole H+/t	mole H+/t	%S	mole H+/t	%S	mole H+/t	%S	kg/t
ASSMAC Criteria >1000 t disturbance		**<3.5**	**0.03**	**18**	**18**	**0.03**	**18**	**0.03**	**18**	**0.03**	
BH112	1.00	4.9	<0.005	<3	15	0.02	17	0.027	17	0.027	1.20
	2.00	5.0	**0.04**	**26**	**23**	**0.04**	**48**	**0.078**	**48**	**0.078**	3.60
BH113	0.30	5.8	0.005	<3	<5	<0.01	5.6	0.009	5.6	0.009	<0.75
	1.00	5.3	<0.005	<3	11	0.02	12	0.019	12	0.019	0.87
BH115	0.10	3.8	0.03	18	**240**	**0.38**	**270**	**0.43**	**270**	**0.43**	20.00
	3.30	4.2	**0.08**	**52**	**24**	**0.04**	**76**	**0.12**	**76**	**0.12**	5.70
BH116	1.00	4.1	**0.07**	**44**	**39**	**0.06**	**82**	**0.13**	**82**	**0.13**	6.20
	2.50	4.2	**0.15**	**96**	**26**	**0.04**	**130**	**0.2**	**130**	**0.2**	9.60
BH117	0.50	3.9	0.01	7	**160**	**0.26**	**180**	**0.29**	**180**	**0.29**	14.00
	1.50	3.7	**0.14**	**88**	**74**	**0.12**	**160**	**0.26**	**160**	**0.26**	12.00
BH118	0.50	3.9	**0.09**	**56**	**170**	**0.28**	**240**	**0.38**	**240**	**0.38**	18.00
	3.50	4	**0.3**	**180**	**37**	**0.06**	**220**	**0.36**	**220**	**0.36**	17.00
BH119	1.00	3.9	**0.22**	**130**	**61**	**0.1**	**200**	**0.32**	**200**	**0.32**	15.00
	2.00	8.4	**0.17**	**100**	<5	>0.01	<5	0.006	**100**	**0.17**	7.80
BH120	0.50	3.9	<0.005	<3	**110**	**0.18**	**120**	**0.19**	**120**	**0.19**	9.00
	1.50	3.7	**0.99**	**620**	**120**	**0.2**	**740**	**1.2**	**740**	**1.2**	56.00
BH121	0.20	3.7	**16**	0.02	**220**	**0.36**	**260**	**0.41**	**260**	**0.41**	19.00
	1.50	4	**0.24**	**150**	**61**	**0.1**	**210**	**0.34**	**210**	**0.34**	16.00

Notes:

Highlighted values indicate exceedances of ASSMAC (1998) & WQA (2018) action critera.

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ASS Laboratory Test Results Interpretation

Method based on Acid Sulfate Soil Manual (ASSMAC, 1998)
Method ST-50 V05 Revised 30.04.2018

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PROJECT DETAILS

Client:	AB Rise Pty Ltd C/- DMPS	Page:	3 of 5
Project:	Geotechnical and Acid Sulfate Soils Assessment	Assessment Date:	10/09/2024
Sampling Site:	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	Job Number:	P2208888
Sample Date:	14/09/2022	Sampled By:	DS

SAMPLE DETAILS / TEST RESULTS

Sample Location	Sample Depth (mbgl)	pH Measurements	Sulfur Trail		Acid Trail		ASS - Acid Base Accounting				Liming Rate ecluding ANC
		pH_{kcl}	Chromium Reducible Sulfur	Chromium Reducible Sulfur (acidity units)	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Net Acidity (acidity units)	Net Acidity (sulfur units)	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	
		pH Units	%S	mole H+/t	mole H+/t	%S	mole H+/t	%S	mole H+/t	%S	kg/t
ASSMAC Criteria >1000 t disturbance		**<3.5**	**0.03**	**18**	**18**	**0.03**	**18**	**0.03**	**18**	**0.03**	
BH122	1.00	4	**0.59**	**370**	**86**	**0.14**	**490**	**0.78**	**490**	**0.78**	37.00
	3.50	5.3	**0.05**	**30**	<5	<0.01	**35**	**0.056**	**35**	**0.056**	2.60
BH123	0.50	4.4	**0.54**	**340**	**22**	**0.04**	**370**	**0.6**	**370**	**0.6**	28.00
	1.50	4.6	**0.3**	**190**	13	0.02	**200**	**0.32**	**200**	**0.32**	15.00
BH124	1.50	4.2	**0.25**	**160**	**220**	**0.35**	**220**	**0.35**	**220**	**0.35**	16.00
	3.50	5.1	0.006	4	6	0.01	9.8	0.016	9.8	0.016	<0.75
BH125	0.20	4.1	0.01	8	**58**	**0.09**	**72**	**0.12**	**72**	**0.12**	5.40
	1.50	5.1	0.01	7	**22**	0.03	**29**	**0.046**	**29**	**0.046**	2.20
BH126	1.50	4.2	0.03	16	**54**	**0.09**	**73**	**0.12**	**73**	**0.12**	5.50
	3.00	4.6	**0.06**	**39**	13	0.02	**52**	**0.083**	**52**	**0.083**	3.90
BH127	1.00	4.3	**0.04**	**28**	**30**	**0.05**	**59**	**0.094**	**59**	**0.094**	4.40
	2.50	4.7	**0.06**	**36**	12	0.02	**48**	**0.078**	**48**	**0.078**	3.60
BH128	0.50	4.3	0.007	4	**30**	**0.05**	**37**	**0.059**	**37**	**0.059**	2.80
	1.50	4	**0.15**	**91**	**47**	**0.08**	**140**	**0.22**	**140**	**0.22**	10.00
BH129	0.50	4	**0.1**	**60**	**130**	**0.21**	**200**	**0.32**	**200**	**0.32**	15.00

Notes:

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ASS Laboratory Test Results Interpretation

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Method ST-50 V05 Revised 30.04.2018

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PROJECT DETAILS

Client:	AB Rise Pty Ltd C/- DMPS	Page:	4 of 5
Project:	Geotechnical and Acid Sulfate Soils Assessment	Assessment Date:	10/09/2024
Sampling Site:	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	Job Number:	P2208888
Sample Date:	16/04/2024	Sampled By:	RIM

SAMPLE DETAILS / TEST RESULTS

Sample Location	Sample Depth (mbgl)	pH Measurements	Sulfur Trail		Acid Trail		ASS - Acid Base Accounting				Liming Rate ecluding ANC
		pH_{kcl}	Chromium Reducible Sulfur	Chromium Reducible Sulfur (acidity units)	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Net Acidity (acidity units)	Net Acidity (sulfur units)	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	
		pH Units	%S	mole H+/t	mole H+/t	%S	mole H+/t	%S	mole H+/t	%S	kg/t
ASSMAC Criteria >1000 t disturbance		**<3.5**	**0.03**	**18**	**18**	**0.03**	**18**	**0.03**	**18**	**0.03**	
BH133	0.4 - 0.5	3.7	**0.04**	**24**	**49**	**0.08**	**180**	**0.35**	**180**	**0.29**	14.00
	4.1 - 1.5	3.8	**0.21**	**130**	**61**	**0.1**	**220**	**0.37**	**220**	**0.36**	17.00
	2.5 - 2.6	4.4	**0.13**	**82**	14	0.02	**96**	**0.15**	**96**	**0.15**	7.20
	3.5 - 3.6	4.3	**0.09**	**58**	12	0.02	**71**	**0.11**	**71**	**0.11**	5.30
BH134	0.4 - 0.5	4.1	**0.04**	**24**	**33**	**0.05**	**110**	**0.21**	**110**	**0.18**	8.50
	0.9 - 1.0	3.6	0.01	8	**110**	**0.18**	**160**	**0.27**	**160**	**0.25**	12.00
	2.0 - 2.1	3.8	**0.07**	**45**	**36**	**0.06**	**92**	**0.15**	**92**	**0.15**	6.90
	2.4 - 2.5	7.6	**0.37**	**230**	<5	<0.01	<5	<0.005	**230**	**0.37**	17.00
	3.0 - 3.1	7.1	**0.37**	**230**	<5	<0.01	**51**	**0.082**	**230**	**0.37**	17.00
BH135	0.4 - 0.5	**3.5**	0.02	12	**99**	**0.16**	**170**	**0.3**	**170**	**0.27**	13.00
	0.9 - 1.0	3.6	0.03	17	**120**	**0.2**	**200**	**0.35**	**200**	**0.32**	15.00
	1.9 - 2.0	3.7	**0.41**	**260**	**49**	**0.08**	**340**	**0.56**	**340**	**0.54**	25.00
	2.4 - 2.5	4.0	**0.28**	**180**	**21**	0.03	**200**	**0.32**	**200**	**0.32**	15.00
	3.4 - 3.5	4.3	**0.28**	**180**	10	0.02	**190**	**0.3**	**190**	**0.3**	14.00
BH136	0.9 - 1.0	3.7	0.03	16	**86**	**0.14**	**120**	**0.21**	**120**	**0.2**	9.30
	1.5 - 1.6	4.1	**0.13**	**79**	**26**	**0.04**	**110**	**0.17**	**110**	**0.17**	7.90
	2.0 - 2.1	4.5	**0.17**	**110**	8	0.01	**110**	**0.18**	**110**	**0.18**	8.50
	3.0 - 3.1	4.2	<0.005	<3	10	0.02	10	0.016	10	0.016	0.75

Notes:

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PROJECT DETAILS

Client:	AB Rise Pty Ltd C/- DMPS	Page:	5 of 5
Project:	Geotechnical and Acid Sulfate Soils Assessment	Assessment Date:	10/09/2024
Sampling Site:	196 Old Main Road, 263, 271, 293 and 321 Gan Gan Road, Anna Bay, NSW	Job Number:	P2208888
Sample Date:	16/04/2024	Sampled By:	RIM

SAMPLE DETAILS / TEST RESULTS

Sample Location	Sample Depth (mbgl)	pH Measurements	Sulfur Trail		Acid Trail		ASS - Acid Base Accounting				Liming Rate ecluding ANC
		pH_{kcl}	Chromium Reducible Sulfur	Chromium Reducible Sulfur (acidity units)	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Net Acidity (acidity units)	Net Acidity (sulfur units)	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	
		pH Units	%S	mole H+/t	mole H+/t	%S	mole H+/t	%S	mole H+/t	%S	kg/t
ASSMAC Criteria >1000 t disturbance		**<3.5**	**0.03**	**18**	**18**	**0.03**	**18**	**0.03**	**18**	**0.03**	
BH137	0.4 - 0.5	3.8	**0.07**	**46**	**61**	**0.1**	**120**	**0.2**	**120**	**0.2**	9.20
	1.5 - 1.6	3.8	**0.44**	**280**	**61**	**0.1**	**340**	**0.55**	**340**	**0.55**	26.00
	2.5 - 2.6	4.3	**0.29**	**180**	7	0.01	**190**	**0.3**	**190**	**0.3**	14.00
	3.5 - 3.6	4.1	**0.37**	**230**	13	0.02	**250**	**0.39**	**250**	**0.39**	18.00
BH138	0.9 - 1.0	3.8	0.03	**19**	**61**	**0.1**	**87**	**0.14**	**87**	**0.14**	6.50
	2.0 - 2.1	4.4	0.02	12	10	0.02	**22**	**0.036**	**22**	**0.036**	1.70
	3.0 - 3.1	4.4	**0.13**	**82**	9	0.01	**91**	**0.15**	**91**	**0.15**	6.90
	3.9 - 4.0	5.0	<0.005	<3	<5	<0.01	<5	0.008	<5	0.008	<0.75

Notes:

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Appendix F – Laboratory Test Certificates

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: Martens & Associates Pty Ltd
Project: P2208888
Location: Gan Gan Road, Anna Bay NSW

Job number: 23-0067
Report number: 1
Page: 1 of 1

Soil Index Properties

Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1289.1.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1

	Results				
Laboratory sample no.	30652	30653	30654	30655	30656
Customer sample no.	8888/BH115/ S/1.0	8888/BH118/ S/1.5	8888/BH119/ S/0.5	8888/BH122/ S/0.5	8888/BH122/ S/1.5
Date sampled	07/02/2023	07/02/2023	07/02/2023	08/02/2023	08/02/2023
Material description	silty CLAY, trace of sand, grey/brown	silty CLAY, trace of sand, grey/brown	silty CLAY, with sand, grey/brown	silty CLAY, trace of sand, dark grey/dark brown	silty CLAY, trace of sand, grey/brown
Liquid limit (%)	86	94	50	88	88
Plastic limit (%)	33	40	22	38	33
Plasticity index (%)	53	54	28	50	55
Linear shrinkage (%)	-	-	-	-	-
Cracking / Curling / Crumbling	-	-	-	-	-
Sample history	Air dried	Air dried	Air dried	Air dried	Air dried
Preparation	Dry sieved	Dry sieved	Dry sieved	Dry sieved	Dry sieved

Approved Signatory: L. Coleman **Date:** 17/05/2023

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: Martens & Associates Pty Ltd
Project: P2208888
Location: Gan Gan Road, Anna Bay NSW

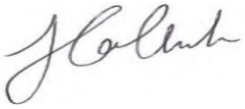
Job number: 23-0067
Report number: 1

Particle Size Distribution

Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1289.1.1, 3.6.1

	Results				
Laboratory sample no.	30607	30608	30609	30610	30611
Customer sample no.	8888/BH101/1.0	8888/BH102/1.0	8888/BH114/1.0	8888/BH119/2.1	8888/BH124/1.6
Date sampled	08/02/2023	08/02/2023	08/02/2023	07/02/2023	08/02/2023
Material description	SAND, trace of silt, dark brown	SAND, trace of silt, pale brown	SAND, trace of silt, brown	SAND, trace of silt, grey/dark brown	SAND, trace of silt, grey/brown
% Passing AS Sieve					
63.0mm					
53.0mm					
37.5mm					
26.5mm					
19.0mm					
13.2mm					
9.5mm					
6.7mm					
4.75mm					
2.36mm					
1.18mm	100			100	100
600µm	98	100		96	96
425µm	85	99	100	86	79
300µm	44	79	91	41	31
150µm	8	6	8	5	5
75µm	7	2	2	4	3

Approved Signatory:  L. Coleman **Date:** 11/05/2023

resource laboratories
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Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: Martens & Associates Pty Ltd
Project: P2208888
Location: Gan Gan Road, Anna Bay NSW

Job number: 23-0067
Report number: 1

Particle Size Distribution

Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1289.1.1, 3.6.1

	Results				
Laboratory sample no.	30612	30613	30614	30615	30616
Customer sample no.	8888/BH126/1.4	8888/BH127/1.6	8888/BH128/0.5	8888/BH130/ 0.4-0.8	8888/BH131/ 0-0.5
Date sampled	08/02/2023	08/02/2023	08/02/2023	04/04/2023	04/04/2023
Material description	SAND, trace of silt, grey/brown	SAND, trace of silt, grey/brown	SAND, trace of silt, dark brown	silty SAND, trace of gravel, dark brown	SAND, trace of silt, brown
% Passing AS Sieve					
63.0mm					
53.0mm					
37.5mm					
26.5mm				100	
19.0mm				98	
13.2mm				95	
9.5mm				95	
6.7mm				95	
4.75mm				93	
2.36mm			100	91	
1.18mm	100	100	99	89	100
600µm	96	97	94	86	99
425µm	80	82	76	81	91
300µm	36	36	33	56	56
150µm	5	5	11	22	8
75µm	3	4	8	19	6

Approved Signatory: L. Coleman **Date:** 11/05/2023

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
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CERTIFICATE OF ANALYSIS 306476

Client Details

Client	Martens & Associates Pty Ltd
Attention	Dean Shi
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2208888**
Number of Samples	28 Soil
Date samples received	23/09/2022
Date completed instructions received	23/09/2022

Analysis Details

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

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

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

Report Details

Date results requested by	30/09/2022
Date of Issue	30/09/2022

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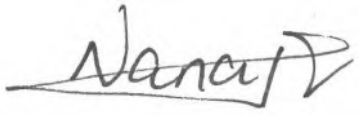
Results Approved By
Diego Bigolin, Inorganics Supervisor
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		306476-1	306476-2	306476-3	306476-4	306476-5
Your Reference	UNITS	BH101	BH101	BH103	BH103	BH103
Depth		0.5	2.5	0.5	1.0	2.5
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	5.3	5.4	5.3	4.6	5.0
pH_{FOX} (field peroxide test)	pH Units	2.3	3.4	2.2	2.1	2.0
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		306476-6	306476-7	306476-8	306476-9	306476-10
Your Reference	UNITS	BH103	BH104	BH104	BH104	BH104
Depth		4.0	0.5	1.5	2.5	4.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	5.1	5.3	5.6	5.7	5.8
pH_{FOX} (field peroxide test)	pH Units	2.7	2.5	3.7	3.8	3.9
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		306476-11	306476-12	306476-13	306476-14	306476-15
Your Reference	UNITS	BH106	BH106	BH108	BH108	BH109
Depth		0.2	1.2	1.0	2.0	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	5.5	5.5	5.3	5.5	5.0
pH_{FOX} (field peroxide test)	pH Units	2.9	3.2	3.5	3.7	3.3
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		306476-16	306476-17	306476-18	306476-19	306476-20
Your Reference	UNITS	BH109	BH109	BH109	BH110	BH110
Depth		1.9	2.5	5.2	0.5	1.5
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	5.2	5.4	5.3	5.7	5.5
pH_{FOX} (field peroxide test)	pH Units	3.7	3.8	3.6	2.4	2.6
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		306476-21	306476-22	306476-23	306476-24	306476-25
Your Reference	UNITS	BH111	BH111	BH111	BH111	BH112
Depth		0.5	1.5	2.8	4.4	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	5.9	6.4	6.6	6.6	5.5
pH_{FOX} (field peroxide test)	pH Units	3.7	3.4	4.7	4.8	3.5
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test				
Our Reference		306476-26	306476-27	306476-28
Your Reference	UNITS	BH112	BH113	BH113
Depth		2.0	0.3	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil
Date prepared	-	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022
pH_F (field pH test)	pH Units	4.9	6.1	6.1
pH_{FOX} (field peroxide test)	pH Units	2.0	3.1	3.5
Reaction Rate*	-	Medium reaction	Low reaction	Low reaction

Chromium Suite						
Our Reference		306476-1	306476-2	306476-3	306476-4	306476-5
Your Reference	UNITS	BH101	BH101	BH103	BH103	BH103
Depth		0.5	2.5	0.5	1.0	2.5
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	4.8	5.2	4.6	3.7	4.8
s-TAA pH 6.5	%w/w S	<0.01	0.01	0.04	0.1	0.02
TAA pH 6.5	moles H^+ /t	<5	6	22	61	16
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005	0.05
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3	<3	30
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	<0.005	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	<0.005	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	<0.005	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.0090	0.011	0.040	0.10	0.073
a-Net Acidity	moles H^+ /t	5.3	7.1	25	63	46
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	2	5	3
a-Net Acidity without ANCE	moles H^+ /t	5.3	7.1	25	63	46
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	1.9	4.7	3.4
s-Net Acidity without ANCE	%w/w S	0.0090	0.011	0.040	0.10	0.073

Chromium Suite						
Our Reference		306476-6	306476-7	306476-8	306476-9	306476-10
Your Reference	UNITS	BH103	BH104	BH104	BH104	BH104
Depth		4.0	0.5	1.5	2.5	4.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	5.2	5.3	4.9	5.2	5.2
s-TAA pH 6.5	%w/w S	0.02	<0.01	0.02	<0.01	0.01
TAA pH 6.5	moles H^+ /t	11	<5	11	<5	8
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.022	0.0090	0.021	0.0090	0.014
a-Net Acidity	moles H^+ /t	14	5.8	13	5.6	8.6
Liming rate	kg $CaCO_3$ /t	1	<0.75	1	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	14	5.8	13	5.6	8.6
Liming rate without ANCE	kg $CaCO_3$ /t	1.0	<0.75	0.99	<0.75	<0.75
s-Net Acidity without ANCE	%w/w S	0.022	0.0090	0.021	0.0090	0.014

Chromium Suite						
Our Reference		306476-11	306476-12	306476-13	306476-14	306476-15
Your Reference	UNITS	BH106	BH106	BH108	BH108	BH109
Depth		0.2	1.2	1.0	2.0	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	5.1	4.7	5.0	5.4	5.0
s-TAA pH 6.5	%w/w S	0.01	0.02	0.02	0.01	0.02
TAA pH 6.5	moles H^+ /t	7	12	15	8	14
Chromium Reducible Sulfur	%w/w	0.005	0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	3	<3	<3	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.017	0.024	0.027	0.012	0.022
a-Net Acidity	moles H^+ /t	10	15	17	7.5	14
Liming rate	kg $CaCO_3$ /t	0.8	1	1	<0.75	1
a-Net Acidity without ANCE	moles H^+ /t	10	15	17	7.5	14
Liming rate without ANCE	kg $CaCO_3$ /t	0.78	1.1	1.3	<0.75	1.0
s-Net Acidity without ANCE	%w/w S	0.017	0.024	0.027	0.012	0.022

Chromium Suite						
Our Reference		306476-16	306476-17	306476-18	306476-19	306476-20
Your Reference	UNITS	BH109	BH109	BH109	BH110	BH110
Depth		1.9	2.5	5.2	0.5	1.5
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	4.7	4.9	5.3	5.2	4.5
s-TAA pH 6.5	%w/w S	0.04	0.02	0.01	<0.01	0.05
TAA pH 6.5	moles H^+ /t	26	11	6	6	31
Chromium Reducible Sulfur	%w/w	<0.005	0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	<0.005
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	<0.005
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	<0.005
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.044	0.022	0.010	0.011	0.052
a-Net Acidity	moles H^+ /t	27	14	6.5	7.1	33
Liming rate	kg $CaCO_3$ /t	2	1	<0.75	<0.75	2
a-Net Acidity without ANCE	moles H^+ /t	27	14	6.5	7.1	33
Liming rate without ANCE	kg $CaCO_3$ /t	2.1	1.0	<0.75	<0.75	2.4
s-Net Acidity without ANCE	%w/w S	0.044	0.022	0.010	0.011	0.052

Chromium Suite						
Our Reference		306476-21	306476-22	306476-23	306476-24	306476-25
Your Reference	UNITS	BH111	BH111	BH111	BH111	BH112
Depth		0.5	1.5	2.8	4.4	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	6.4	6.6	6.4	6.2	4.9
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	0.02
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5	15
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	0.25	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	0.08	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	0.0070	0.027
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	17
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	1
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	<5	<5	17
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	1.2
s-Net Acidity without ANCE	%w/w S	<0.005	<0.005	<0.005	0.0070	0.027

Chromium Suite				
Our Reference		306476-26	306476-27	306476-28
Your Reference	UNITS	BH112	BH113	BH113
Depth		2.0	0.3	1.0
Date Sampled		13-16/09/2022	13-16/09/2022	13-16/09/2022
Type of sample		Soil	Soil	Soil
Date prepared	-	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022
pH $_{kcl}$	pH units	5.0	5.8	5.3
s-TAA pH 6.5	%w/w S	0.04	<0.01	0.02
TAA pH 6.5	moles H^+ /t	23	<5	11
Chromium Reducible Sulfur	%w/w	0.04	0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	26	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.078	0.0090	0.019
a-Net Acidity	moles H^+ /t	48	5.6	12
Liming rate	kg $CaCO_3$ /t	4	<0.75	0.9
a-Net Acidity without ANCE	moles H^+ /t	48	5.6	12
Liming rate without ANCE	kg $CaCO_3$ /t	3.6	<0.75	0.87
s-Net Acidity without ANCE	%w/w S	0.078	0.0090	0.019

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. Based on National acid sulfate soils identification and laboratory methods manual June 2018. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			28/09/2022	[NT]	[NT]	[NT]	[NT]	28/09/2022	[NT]
Date analysed	-			28/09/2022	[NT]	[NT]	[NT]	[NT]	28/09/2022	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	98	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	28/09/2022	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	28/09/2022	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			30/09/2022	1	30/09/2022	30/09/2022		30/09/2022	[NT]
Date analysed	-			30/09/2022	1	30/09/2022	30/09/2022		30/09/2022	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	4.8	4.8	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	115	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	82	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	<3	<3	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	[NT]	[NT]		[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	[NT]	[NT]		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	0.0090	0.0090	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	5.3	5.6	6	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	5.3	5.6	6	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.0090	0.0090	0	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	30/09/2022	30/09/2022		30/09/2022	[NT]
Date analysed	-			[NT]	11	30/09/2022	30/09/2022		30/09/2022	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	11	5.1	5.1	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	11	0.01	0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	11	7	8	13	115	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	11	0.005	<0.005	0	110	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	11	3	<3	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	11	0.017	0.016	6	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	11	10	9.9	1	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	0.8	<0.75	6	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	11	10	9.9	1	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	0.78	<0.75	4	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	11	0.017	0.016	6	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	30/09/2022	30/09/2022		[NT]	[NT]
Date analysed	-			[NT]	21	30/09/2022	30/09/2022		[NT]	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	21	6.4	6.3	2	[NT]	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	21	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	21	<5	<5	0	[NT]	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	21	<3	<3	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	21	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	21	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	21	<0.005	<0.005	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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CERTIFICATE OF ANALYSIS 316605

Client Details

Client	Martens & Associates Pty Ltd
Attention	Accounts Email, Ali Kandil
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2208888 - Gan Gan Anna Bay**
Number of Samples	31 Soil
Date samples received	15/02/2023
Date completed instructions received	15/02/2023

Analysis Details

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

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

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

Report Details

Date results requested by	23/02/2023
Date of Issue	23/02/2023

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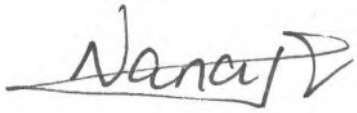
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Inorganics Supervisor
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		316605-1	316605-2	316605-3	316605-4	316605-5
Your Reference	UNITS	BH115	BH115	BH116	BH116	BH117
Depth		S/0.1	S/3.3	S/1.0	S/2.5	S/0.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	4.7	4.7	4.7	5.5	4.8
pH_{FOX} (field peroxide test)	pH Units	2.0	1.9	1.8	1.8	1.9
Reaction Rate*	-	Volcanic reaction	Volcanic reaction	Extreme reaction	Volcanic reaction	Medium reaction

sPOCAS field test						
Our Reference		316605-6	316605-7	316605-8	316605-9	316605-10
Your Reference	UNITS	BH117	BH118	BH118	BH119	BH119
Depth		S/1.5	S/0.5	S/3.5	S/1.0	S/2.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	5.1	4.6	5.2	4.5	7.0
pH_{FOX} (field peroxide test)	pH Units	1.6	2.4	2.5	1.7	2.2
Reaction Rate*	-	Volcanic reaction	Medium reaction	Volcanic reaction	Volcanic reaction	Medium reaction

sPOCAS field test						
Our Reference		316605-11	316605-12	316605-13	316605-14	316605-15
Your Reference	UNITS	BH120	BH120	BH121	BH121	BH122
Depth		S/0.5	S/1.5	S/0.2	S/1.5	S/1.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	4.3	4.7	4.2	4.4	6.0
pH_{FOX} (field peroxide test)	pH Units	1.9	2.7	1.8	1.8	1.9
Reaction Rate*	-	Volcanic reaction	Volcanic reaction	Low reaction	Volcanic reaction	Volcanic reaction

sPOCAS field test						
Our Reference		316605-16	316605-17	316605-18	316605-19	316605-20
Your Reference	UNITS	BH122	BH123	BH123	BH124	BH124
Depth		S/3.5	S/0.5	S/1.5	S/1.5	S/3.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	6.2	5.7	6.2	4.9	5.4
pH_{FOX} (field peroxide test)	pH Units	2.4	2.0	1.9	1.8	3.2
Reaction Rate*	-	Medium reaction	Volcanic reaction	Volcanic reaction	Volcanic reaction	Low reaction

sPOCAS field test						
Our Reference		316605-21	316605-22	316605-23	316605-24	316605-25
Your Reference	UNITS	BH125	BH125	BH126	BH126	BH127
Depth		S/0.2	S/1.5	S/1.5	S/3.0	S/1.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	4.6	5.2	4.5	4.8	5.0
pH_{FOX} (field peroxide test)	pH Units	2.2	1.9	2.5	2.1	2.3
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	Volcanic reaction	Low reaction

sPOCAS field test					
Our Reference		316605-26	316605-27	316605-28	316605-29
Your Reference	UNITS	BH127	BH128	BH128	BH129
Depth		S/2.5	S/0.5	S/1.5	S/0.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023
Date analysed	-	21/02/2023	21/02/2023	21/02/2023	21/02/2023
pH_F (field pH test)	pH Units	5.2	5.1	4.3	4.5
pH_{FOX} (field peroxide test)	pH Units	1.9	2.4	2.6	3.2
Reaction Rate*	-	Medium reaction	Medium reaction	High reaction	Medium reaction

Chromium Suite						
Our Reference		316605-1	316605-2	316605-3	316605-4	316605-5
Your Reference	UNITS	BH115	BH115	BH116	BH116	BH117
Depth		S/0.1	S/3.3	S/1.0	S/2.5	S/0.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	3.8	4.2	4.1	4.2	3.9
s-TAA pH 6.5	%w/w S	0.38	0.04	0.06	0.04	0.26
TAA pH 6.5	moles H^+ /t	240	24	39	26	160
Chromium Reducible Sulfur	%w/w	0.03	0.08	0.07	0.15	0.01
a-Chromium Reducible Sulfur	moles H^+ /t	18	52	44	96	7
S_{HCl}	%w/w S	0.043	0.047	0.036	0.068	0.047
S_{KCl}	%w/w S	0.019	0.048	0.036	0.059	0.028
S_{NAS}	%w/w S	0.024	<0.005	<0.005	0.010	0.019
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.43	0.12	0.13	0.20	0.29
a-Net Acidity	moles H^+ /t	270	76	82	130	180
Liming rate	kg $CaCO_3$ /t	20	6	6	9.6	14
a-Net Acidity without ANCE	moles H^+ /t	270	76	82	130	180
Liming rate without ANCE	kg $CaCO_3$ /t	20	5.7	6.2	9.6	14
s-Net Acidity without ANCE	%w/w S	0.43	0.12	0.13	0.20	0.29

Chromium Suite						
Our Reference		316605-6	316605-7	316605-8	316605-9	316605-10
Your Reference	UNITS	BH117	BH118	BH118	BH119	BH119
Depth		S/1.5	S/0.5	S/3.5	S/1.0	S/2.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	3.7	3.9	4.0	3.9	8.4
s-TAA pH 6.5	%w/w S	0.12	0.28	0.06	0.1	<0.01
TAA pH 6.5	moles H^+ /t	74	170	37	61	<5
Chromium Reducible Sulfur	%w/w	0.14	0.09	0.30	0.22	0.17
a-Chromium Reducible Sulfur	moles H^+ /t	88	56	180	130	100
S_{HCl}	%w/w S	0.24	0.072	0.11	0.11	<0.005
S_{KCl}	%w/w S	0.28	0.062	0.11	0.096	[NT]
S_{NAS}	%w/w S	<0.005	0.009	<0.005	0.009	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	0.75
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	0.24
s-Net Acidity	%w/w S	0.26	0.38	0.36	0.32	0.0060
a-Net Acidity	moles H^+ /t	160	240	220	200	<5
Liming rate	kg $CaCO_3$ /t	12	18	17	15	<0.75
a-Net Acidity without ANCE	moles H^+ /t	160	240	220	200	100
Liming rate without ANCE	kg $CaCO_3$ /t	12	18	17	15	7.8
s-Net Acidity without ANCE	%w/w S	0.26	0.38	0.36	0.32	0.17

Chromium Suite						
Our Reference		316605-11	316605-12	316605-13	316605-14	316605-15
Your Reference	UNITS	BH120	BH120	BH121	BH121	BH122
Depth		S/0.5	S/1.5	S/0.2	S/1.5	S/1.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	3.9	3.7	3.7	4.0	4.0
s-TAA pH 6.5	%w/w S	0.18	0.20	0.36	0.1	0.14
TAA pH 6.5	moles H^+ /t	110	120	220	61	86
Chromium Reducible Sulfur	%w/w	<0.005	0.99	0.02	0.24	0.59
a-Chromium Reducible Sulfur	moles H^+ /t	<3	620	16	150	370
S_{HCl}	%w/w S	0.040	0.31	0.061	0.075	0.16
S_{KCl}	%w/w S	0.026	0.43	0.035	0.094	0.10
S_{NAS}	%w/w S	0.013	<0.005	0.026	<0.005	0.056
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.19	1.2	0.41	0.34	0.78
a-Net Acidity	moles H^+ /t	120	740	260	210	490
Liming rate	kg $CaCO_3$ /t	9.0	56	19	16	37
a-Net Acidity without ANCE	moles H^+ /t	120	740	260	210	490
Liming rate without ANCE	kg $CaCO_3$ /t	9.0	56	19	16	37
s-Net Acidity without ANCE	%w/w S	0.19	1.2	0.41	0.34	0.78

Chromium Suite						
Our Reference		316605-16	316605-17	316605-18	316605-19	316605-20
Your Reference	UNITS	BH122	BH123	BH123	BH124	BH124
Depth		S/3.5	S/0.5	S/1.5	S/1.5	S/3.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	5.3	4.4	4.6	4.2	5.1
s-TAA pH 6.5	%w/w S	<0.01	0.04	0.02	0.09	0.01
TAA pH 6.5	moles H^+ /t	<5	22	13	58	6
Chromium Reducible Sulfur	%w/w	0.05	0.54	0.30	0.25	0.006
a-Chromium Reducible Sulfur	moles H^+ /t	30	340	190	160	4
S_{HCl}	%w/w S	[NT]	0.11	[NT]	0.037	[NT]
S_{KCl}	%w/w S	[NT]	0.090	[NT]	0.042	[NT]
S_{NAS}	%w/w S	[NT]	0.020	[NT]	<0.005	[NT]
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.056	0.60	0.32	0.35	0.016
a-Net Acidity	moles H^+ /t	35	370	200	220	9.8
Liming rate	kg $CaCO_3$ /t	3	28	15	16	<0.75
a-Net Acidity without ANCE	moles H^+ /t	35	370	200	220	9.8
Liming rate without ANCE	kg $CaCO_3$ /t	2.6	28	15	16	<0.75
s-Net Acidity without ANCE	%w/w S	0.056	0.60	0.32	0.35	0.016

Chromium Suite						
Our Reference		316605-21	316605-22	316605-23	316605-24	316605-25
Your Reference	UNITS	BH125	BH125	BH126	BH126	BH127
Depth		S/0.2	S/1.5	S/1.5	S/3.0	S/1.0
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	4.1	5.1	4.2	4.6	4.3
s-TAA pH 6.5	%w/w S	0.09	0.03	0.09	0.02	0.05
TAA pH 6.5	moles H^+ /t	58	22	54	13	30
Chromium Reducible Sulfur	%w/w	0.01	0.01	0.03	0.06	0.04
a-Chromium Reducible Sulfur	moles H^+ /t	8	7	16	39	28
S_{HCl}	%w/w S	0.017	[NT]	0.012	[NT]	0.012
S_{KCl}	%w/w S	0.009	[NT]	0.008	[NT]	0.011
S_{NAS}	%w/w S	0.008	[NT]	<0.005	[NT]	<0.005
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.12	0.046	0.12	0.083	0.094
a-Net Acidity	moles H^+ /t	72	29	73	52	59
Liming rate	kg $CaCO_3$ /t	5	2	5	4	4
a-Net Acidity without ANCE	moles H^+ /t	72	29	73	52	59
Liming rate without ANCE	kg $CaCO_3$ /t	5.4	2.2	5.5	3.9	4.4
s-Net Acidity without ANCE	%w/w S	0.12	0.046	0.12	0.083	0.094

Chromium Suite					
Our Reference		316605-26	316605-27	316605-28	316605-29
Your Reference	UNITS	BH127	BH128	BH128	BH129
Depth		S/2.5	S/0.5	S/1.5	S/0.5
Date Sampled		07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23	07/02/23-08/02/23
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023
Date analysed	-	23/02/2023	23/02/2023	23/02/2023	23/02/2023
pH $_{kcl}$	pH units	4.7	4.3	4.0	4.0
s-TAA pH 6.5	%w/w S	0.02	0.05	0.08	0.21
TAA pH 6.5	moles H^+ /t	12	30	47	130
Chromium Reducible Sulfur	%w/w	0.06	0.007	0.15	0.1
a-Chromium Reducible Sulfur	moles H^+ /t	36	4	91	60
S_{HCl}	%w/w S	[NT]	0.007	0.026	0.027
S_{KCl}	%w/w S	[NT]	<0.005	0.028	0.011
S_{NAS}	%w/w S	[NT]	<0.005	<0.005	0.016
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.078	0.059	0.22	0.32
a-Net Acidity	moles H^+ /t	48	37	140	200
Liming rate	kg $CaCO_3$ /t	4	3	10	15
a-Net Acidity without ANCE	moles H^+ /t	48	37	140	200
Liming rate without ANCE	kg $CaCO_3$ /t	3.6	2.8	10	15
s-Net Acidity without ANCE	%w/w S	0.078	0.059	0.22	0.32

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. Based on National acid sulfate soils identification and laboratory methods manual June 2018. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/02/2023	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
Date analysed	-			21/02/2023	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	21/02/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			23/02/2023	1	23/02/2023	23/02/2023		23/02/2023	[NT]
Date analysed	-			23/02/2023	1	23/02/2023	23/02/2023		23/02/2023	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	3.8	3.9	3	101	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	0.38	0.46	19	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	240	290	19	120	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.03	0.03	0	109	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	18	22	20	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.043	0.043	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.019	0.018	5	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	0.024	0.026	8	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	[NT]	[NT]		97	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	[NT]	[NT]		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	0.43	0.52	19	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	270	320	17	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	20	24	18	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	270	320	17	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	20	24	18	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.43	0.52	19	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	23/02/2023	23/02/2023		23/02/2023	[NT]
Date analysed	-			[NT]	11	23/02/2023	23/02/2023		23/02/2023	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	11	3.9	3.9	0	100	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	11	0.18	0.18	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	11	110	110	0	123	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	11	<0.005	<0.005	0	101	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	11	<3	<3	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	[NT]	11	0.040	0.040	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	[NT]	11	0.026	0.021	21	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	[NT]	11	0.013	0.018	32	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	[NT]	11	[NT]	[NT]		97	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	11	0.19	0.20	5	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	11	120	120	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	9.0	9.2	2	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	11	120	120	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	9.0	9.2	2	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	11	0.19	0.20	5	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	23/02/2023	23/02/2023		[NT]	[NT]
Date analysed	-			[NT]	21	23/02/2023	23/02/2023		[NT]	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	21	4.1	4.1	0	[NT]	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	21	0.09	0.08	12	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	21	58	49	17	[NT]	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	21	0.01	0.01	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	21	8	8	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	[NT]	21	0.017	0.017	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	[NT]	21	0.009	0.008	12	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	[NT]	21	0.008	0.009	12	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	21	0.12	0.10	18	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	21	72	62	15	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	5	5	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	21	72	62	15	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	5.4	4.7	14	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	21	0.12	0.10	18	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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CERTIFICATE OF ANALYSIS 349008

Client Details

Client	Martens & Associates Pty Ltd
Attention	Wailen Su
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2208888: Gan Gan Road, Anna Bay, NSW**
Number of Samples	26 Soil
Date samples received	16/04/2024
Date completed instructions received	16/04/2024

Analysis Details

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

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

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

Report Details

Date results requested by	23/04/2024
Date of Issue	23/04/2024

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Chromium Suite						
Our Reference		349008-1	349008-2	349008-3	349008-4	349008-5
Your Reference	UNITS	8888/BH133/0.4-0.5	8888/BH133/1.4-1.5	8888/BH133/2.5-2.6	8888/BH133/3.5-3.6	8888/BH134/0.4-0.5
Date Sampled		12/04/2024	12/04/2024	12/04/2024	12/04/2024	12/04/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/04/2024	16/04/2024	16/04/2024	16/04/2024	16/04/2024
Date analysed	-	17/04/2024	17/04/2024	17/04/2024	17/04/2024	17/04/2024
pH $_{kcl}$	pH units	3.7	3.8	4.4	4.3	4.1
s-TAA pH 6.5	%w/w S	0.08	0.1	0.02	0.02	0.05
TAA pH 6.5	moles H^+ /t	49	61	14	12	33
Chromium Reducible Sulfur	%w/w	0.04	0.21	0.13	0.09	0.04
a-Chromium Reducible Sulfur	moles H^+ /t	24	130	82	58	24
S_{HCl}	%w/w S	0.18	0.082	0.020	0.026	0.087
S_{KCl}	%w/w S	0.058	0.053	0.023	0.032	0.027
S_{NAS}	%w/w S	0.23	0.058	<0.005	<0.005	0.12
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.35	0.37	0.15	0.11	0.21
a-Net Acidity	moles H^+ /t	180	220	96	71	110
Liming rate	kg $CaCO_3$ /t	14	17	7	5	8.5
a-Net Acidity without ANCE	moles H^+ /t	180	220	96	71	110
Liming rate without ANCE	kg $CaCO_3$ /t	14	17	7.2	5.3	8.5
s-Net Acidity without ANCE	%w/w S	0.29	0.36	0.15	0.11	0.18

Chromium Suite						
Our Reference		349008-6	349008-7	349008-8	349008-9	349008-10
Your Reference	UNITS	8888/BH134/0.9-1.0	8888/BH134/2.0-2.1	8888/BH134/2.4-2.5	8888/BH134/3.0-3.1	8888/BH135/0.4-0.5
Date Sampled		12/04/2024	12/04/2024	12/04/2024	12/04/2024	12/04/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/04/2024	16/04/2024	16/04/2024	16/04/2024	16/04/2024
Date analysed	-	17/04/2024	17/04/2024	17/04/2024	17/04/2024	17/04/2024
pH $_{kcl}$	pH units	3.6	3.8	7.6	7.1	3.5
s-TAA pH 6.5	%w/w S	0.18	0.06	<0.01	<0.01	0.16
TAA pH 6.5	moles H^+ /t	110	36	<5	<5	99
Chromium Reducible Sulfur	%w/w	0.01	0.07	0.37	0.37	0.02
a-Chromium Reducible Sulfur	moles H^+ /t	8	45	230	230	12
S_{HCl}	%w/w S	0.069	0.043	[NT]	[NT]	0.084
S_{KCl}	%w/w S	0.028	0.031	[NT]	[NT]	0.025
S_{NAS}	%w/w S	0.081	0.022	[NT]	[NT]	0.12
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	2.1	1.4	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	0.67	0.43	[NT]
s-Net Acidity	%w/w S	0.27	0.15	<0.005	0.082	0.30
a-Net Acidity	moles H^+ /t	160	92	<5	51	170
Liming rate	kg $CaCO_3$ /t	12	7	<0.75	4	13
a-Net Acidity without ANCE	moles H^+ /t	160	92	230	230	170
Liming rate without ANCE	kg $CaCO_3$ /t	12	6.9	17	17	13
s-Net Acidity without ANCE	%w/w S	0.25	0.15	0.37	0.37	0.27

Chromium Suite						
Our Reference		349008-11	349008-12	349008-13	349008-14	349008-15
Your Reference	UNITS	8888/BH135/0.9-1.0	8888/BH135/1.9-2.0	8888/BH135/2.4-2.5	8888/BH135/3.4-3.5	8888/BH136/0.9-1.0
Date Sampled		12/04/2024	12/04/2024	12/04/2024	12/04/2024	12/04/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/04/2024	16/04/2024	16/04/2024	16/04/2024	16/04/2024
Date analysed	-	17/04/2024	17/04/2024	17/04/2024	17/04/2024	17/04/2024
pH $_{kcl}$	pH units	3.6	3.7	4.0	4.3	3.7
s-TAA pH 6.5	%w/w S	0.20	0.08	0.03	0.02	0.14
TAA pH 6.5	moles H^+ /t	120	49	21	10	86
Chromium Reducible Sulfur	%w/w	0.03	0.41	0.28	0.28	0.03
a-Chromium Reducible Sulfur	moles H^+ /t	17	260	180	180	16
S_{HCl}	%w/w S	0.12	0.13	0.053	0.037	0.049
S_{KCl}	%w/w S	0.056	0.10	0.055	0.041	0.026
S_{NAS}	%w/w S	0.13	0.064	<0.005	<0.005	0.046
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.35	0.56	0.32	0.30	0.21
a-Net Acidity	moles H^+ /t	200	340	200	190	120
Liming rate	kg $CaCO_3$ /t	15	25	15	14	9.3
a-Net Acidity without ANCE	moles H^+ /t	200	340	200	190	120
Liming rate without ANCE	kg $CaCO_3$ /t	15	25	15	14	9.3
s-Net Acidity without ANCE	%w/w S	0.32	0.54	0.32	0.30	0.20

Chromium Suite						
Our Reference		349008-16	349008-17	349008-18	349008-19	349008-20
Your Reference	UNITS	8888/BH136/1.5-1.6	8888/BH136/2.0-2.1	8888/BH136/3.0-3.1	8888/BH137/0.4-0.5	8888/BH137/1.5-1.6
Date Sampled		12/04/2024	12/04/2024	12/04/2024	12/04/2024	12/04/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/04/2024	16/04/2024	16/04/2024	16/04/2024	16/04/2024
Date analysed	-	17/04/2024	17/04/2024	17/04/2024	17/04/2024	17/04/2024
pH $_{kcl}$	pH units	4.1	4.5	4.2	3.8	3.8
s-TAA pH 6.5	%w/w S	0.04	0.01	0.02	0.1	0.1
TAA pH 6.5	moles H^+ /t	26	8	10	61	61
Chromium Reducible Sulfur	%w/w	0.13	0.17	<0.005	0.07	0.44
a-Chromium Reducible Sulfur	moles H^+ /t	79	110	<3	46	280
S_{HCl}	%w/w S	0.025	[NT]	0.031	0.048	0.11
S_{KCl}	%w/w S	0.026	[NT]	0.034	0.031	0.11
S_{NAS}	%w/w S	<0.005	[NT]	<0.005	0.033	0.009
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.17	0.18	0.016	0.20	0.55
a-Net Acidity	moles H^+ /t	110	110	10	120	340
Liming rate	kg $CaCO_3$ /t	7.9	8.5	0.8	9.2	26
a-Net Acidity without ANCE	moles H^+ /t	110	110	10	120	340
Liming rate without ANCE	kg $CaCO_3$ /t	7.9	8.5	0.75	9.2	26
s-Net Acidity without ANCE	%w/w S	0.17	0.18	0.016	0.20	0.55

Chromium Suite						
Our Reference		349008-21	349008-22	349008-23	349008-24	349008-25
Your Reference	UNITS	8888/BH137/2.5-2.6	8888/BH137/3.5-3.6	8888/BH138/0.9-1.0	8888/BH138/2.0-2.1	8888/BH138/3.0-3.1
Date Sampled		12/04/2024	12/04/2024	12/04/2024	12/04/2024	12/04/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/04/2024	16/04/2024	16/04/2024	16/04/2024	16/04/2024
Date analysed	-	17/04/2024	17/04/2024	17/04/2024	17/04/2024	17/04/2024
pH $_{kcl}$	pH units	4.3	4.1	3.8	4.4	4.4
s-TAA pH 6.5	%w/w S	0.01	0.02	0.1	0.02	0.01
TAA pH 6.5	moles H^+ /t	7	13	61	10	9
Chromium Reducible Sulfur	%w/w	0.29	0.37	0.03	0.02	0.13
a-Chromium Reducible Sulfur	moles H^+ /t	180	230	19	12	82
S_{HCl}	%w/w S	0.076	0.087	0.021	0.008	0.032
S_{KCl}	%w/w S	0.082	0.085	0.014	0.012	0.036
S_{NAS}	%w/w S	<0.005	<0.005	0.015	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.30	0.39	0.14	0.036	0.15
a-Net Acidity	moles H^+ /t	190	250	87	22	91
Liming rate	kg $CaCO_3$ /t	14	18	7	2	7
a-Net Acidity without ANCE	moles H^+ /t	190	250	87	22	91
Liming rate without ANCE	kg $CaCO_3$ /t	14	18	6.5	1.7	6.9
s-Net Acidity without ANCE	%w/w S	0.30	0.39	0.14	0.036	0.15

Chromium Suite		
Our Reference		349008-26
Your Reference	UNITS	8888/BH138/3.9-4.0
Date Sampled		12/04/2024
Type of sample		Soil
Date prepared	-	16/04/2024
Date analysed	-	17/04/2024
pH $_{kcl}$	pH units	5.0
s-TAA pH 6.5	%w/w S	<0.01
TAA pH 6.5	moles H^+ /t	<5
Chromium Reducible Sulfur	%w/w	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3
S_{HCl}	%w/w S	[NT]
S_{KCl}	%w/w S	[NT]
S_{NAS}	%w/w S	[NT]
ANC_{BT}	% $CaCO_3$	[NT]
s-ANC_{BT}	%w/w S	[NT]
s-Net Acidity	%w/w S	0.0080
a-Net Acidity	moles H^+ /t	<5
Liming rate	kg $CaCO_3$ /t	<0.75
a-Net Acidity without ANCE	moles H^+ /t	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75
s-Net Acidity without ANCE	%w/w S	0.0080

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL result. However, it has been applied in the SNAS calculation: SNAS % = (SHCL-SKCL)x2

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			16/04/2024	1	16/04/2024	16/04/2024		16/04/2024	[NT]
Date analysed	-			17/04/2024	1	17/04/2024	17/04/2024		17/04/2024	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	3.7	3.7	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	0.08	0.08	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	49	49	0	96	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.04	0.04	0	97	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	24	24	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.18	0.18	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.058	0.060	3	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	0.23	0.24	4	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	[NT]	[NT]		100	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	[NT]	[NT]		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	0.35	0.35	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	180	180	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	14	14	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	180	180	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	14	14	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.29	0.29	0	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	16/04/2024	16/04/2024		16/04/2024	[NT]
Date analysed	-			[NT]	11	17/04/2024	17/04/2024		17/04/2024	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	11	3.6	3.6	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	11	0.20	0.20	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	11	120	120	0	95	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	11	0.03	0.03	0	96	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	11	17	17	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	[NT]	11	0.12	0.12	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	[NT]	11	0.056	0.055	2	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	[NT]	11	0.13	0.13	0	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	[NT]	11	[NT]	[NT]		100	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	11	0.35	0.36	3	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	11	200	200	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	15	15	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	11	200	200	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	15	15	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	11	0.32	0.32	0	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	16/04/2024	16/04/2024		[NT]	[NT]
Date analysed	-			[NT]	21	17/04/2024	17/04/2024		[NT]	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	21	4.3	4.3	0	[NT]	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	21	0.01	0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	21	7	7	0	[NT]	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	21	0.29	0.29	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	21	180	180	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	[NT]	21	0.076	0.075	1	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	[NT]	21	0.082	0.078	5	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	21	0.30	0.30	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	21	190	190	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	14	14	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	21	190	190	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	21	14	14	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	21	0.30	0.30	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

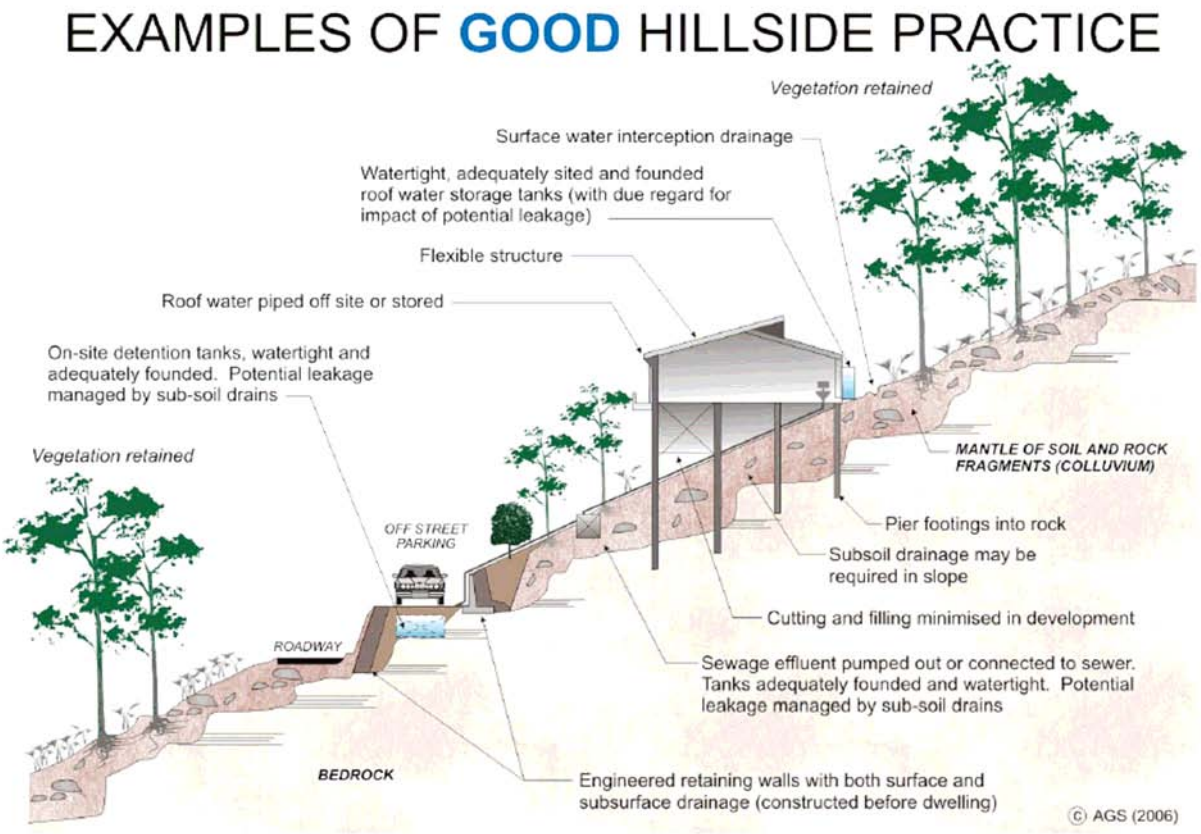
Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

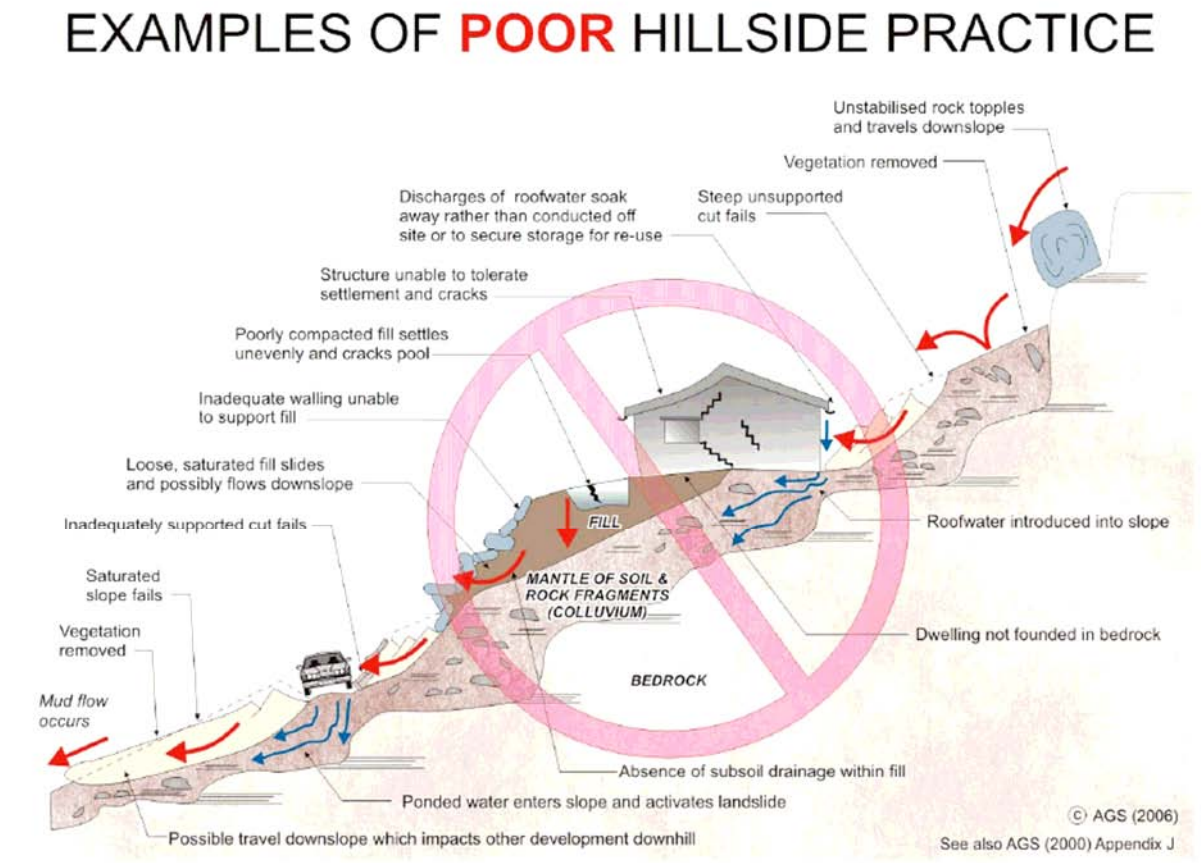
Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Appendix G – Hillside Construction Guidelines (AGS, 2007)

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	


EXAMPLES OF GOOD HILLSIDE PRACTICE
Vegetation retained
Surface water interception drainage
Watertight, adequately sited and founded roof water storage tanks (with due regard for impact of potential leakage)
Flexible structure
Roof water piped off site or stored
On-site detention tanks, watertight and adequately founded. Potential leakage managed by sub-soil drains
Vegetation retained
MANTLE OF SOIL AND ROCK FRAGMENTS (COLLUVIUM)
OFF STREET PARKING
Pier footings into rock
Subsoil drainage may be required in slope
Cutting and filling minimised in development
ROADWAY
Sewage effluent pumped out or connected to sewer. Tanks adequately founded and watertight. Potential leakage managed by sub-soil drains
BEDROCK
Engineered retaining walls with both surface and subsurface drainage (constructed before dwelling)
© AGS (2006)


EXAMPLES OF POOR HILLSIDE PRACTICE
Unstabilised rock topples and travels downslope
Vegetation removed
Discharges of roofwater soak away rather than conducted off site or to secure storage for re-use
Steep unsupported cut fails
Structure unable to tolerate settlement and cracks
Poorly compacted fill settles unevenly and cracks pool
Inadequate walling unable to support fill
Loose, saturated fill slides and possibly flows downslope
Inadequately supported cut fails
FILL
Roofwater introduced into slope
Saturated slope fails
MANTLE OF SOIL & ROCK FRAGMENTS (COLLUVIUM)
Vegetation removed
Dwelling not founded in bedrock
BEDROCK
Mud flow occurs
Absence of subsoil drainage within fill
Ponded water enters slope and activates landslide
© AGS (2006)
Possible travel downslope which impacts other development downhill
See also AGS (2000) Appendix J

Appendix H – General Geotechnical Recommendations

Geotechnical Recommendations

Important Recommendations About Your Site (1 of 2)

These general geotechnical recommendations have been prepared by Martens to help you deliver a safe work site, to comply with your obligations, and to deliver your project. Not all are necessarily relevant to this report but are included as general reference. Any specific recommendations made in the report will override these recommendations.

Batter Slopes

Excavations in soil and extremely low to very low strength rock exceeding 0.75 m depth should be battered back at grades of no greater than 1 Vertical (V) : 2 Horizontal (H) for temporary slopes (unsupported for less than 1 month) and 1 V : 3 H for longer term unsupported slopes.

Vertical excavation may be carried out in medium or higher strength rock, where encountered, subject to inspection and confirmation by a geotechnical engineer. Long term and short term unsupported batters should be protected against erosion and rock weathering due to, for example, stormwater run-off.

Batter angles may need to be revised depending on the presence of bedding partings or adversely oriented joints in the exposed rock, and are subject to on-site inspection and confirmation by a geotechnical engineer. Unsupported excavations deeper than 1.0 m should be assessed by a geotechnical engineer for slope instability risk.

Any excavated rock faces should be inspected during construction by a geotechnical engineer to determine whether any additional support, such as rock bolts or shotcrete, is required.

Earthworks

Earthworks should be carried out following removal of any unsuitable materials and in accordance with AS3798 (2007). A qualified geotechnical engineer should inspect the condition of prepared surfaces to assess suitability as foundation for future fill placement or load application.

Earthworks inspections and compliance testing should be carried out in accordance with Sections 5 and 8 of AS3798 (2007), with testing to be carried out by a National Association of Testing Authorities (NATA) accredited testing laboratory.

Excavations

All excavation work should be completed with reference to the *Work Health and Safety (Excavation Work) Code of Practice (2015)*, by Safe Work Australia. Excavations into rock may be undertaken as follows:

1. Extremely low to low strength rock - conventional hydraulic earthmoving equipment.

2. Medium strength or stronger rock - hydraulic earthmoving equipment with rock hammer or ripping tyne attachment.

Exposed rock faces and loose boulders should be monitored to assess risk of block / boulder movement, particularly as a result of excavation vibrations.

Fill

Subject to any specific recommendations provided in this report, any fill imported to site is to comprise approved material with maximum particle size of two thirds the final layer thickness. Fill should be placed in horizontal layers of not more than 300 mm loose thickness, however, the layer thickness should be appropriate for the adopted compaction plant.

Foundations

All exposed foundations should be inspected by a geotechnical engineer prior to footing construction to confirm encountered conditions satisfy design assumptions and that the base of all excavations is free from loose or softened material and water. Water that has ponded in the base of excavations and any resultant softened material is to be removed prior to footing construction.

Footings should be constructed with minimal delay following excavation. If a delay in construction is anticipated, we recommend placing a concrete blinding layer of at least 50 mm thickness in shallow footings or mass concrete in piers / piles to protect exposed foundations.

A geotechnical engineer should confirm any design bearing capacity values, by further assessment during construction, as necessary.

Shoring - Anchors

Where there is a requirement for either soil or rock anchors, or soil nailing, and these structures penetrate past a property boundary, appropriate permission from the adjoining land owner must be obtained prior to the installation of these structures.

Shoring - Permanent

Permanent shoring techniques may be used as an alternative to temporary shoring. The design of such structures should be in accordance with the findings of this report and any further testing recommended by this report. Permanent shoring may include [but not be limited to] reinforced block work walls, contiguous and semi contiguous pile walls, secant pile walls and soldier pile walls with or without reinforced shotcrete infill panels. The choice of shoring system will depend on the type of structure, project budget and site specific geotechnical conditions.

Permanent shoring systems are to be engineer designed and backfilled with suitable granular

material and free-draining drainage material. Backfill should be placed in maximum 100 mm thick layers compacted using a hand operated compactor. Care should be taken to ensure excessive compaction stresses are not transferred to retaining walls.

Shoring design should consider any surcharge loading from sloping / raised ground behind shoring structures, live loads, new structures, construction equipment, backfill compaction and static water pressures. All shoring systems shall be provided with adequate foundation designs.

Suitable drainage measures, such as geotextile enclosed 100 mm agricultural pipes embedded in free-draining gravel, should be included to redirect water that may collect behind the shoring structure to a suitable discharge point.

Shoring - Temporary

In the absence of providing acceptable excavation batters, excavations should be supported by suitably designed and installed temporary shoring / retaining structures to limit lateral deflection of excavation faces and associated ground surface settlements.

Soil Erosion Control

Removal of any soil overburden should be performed in a manner that reduces the risk of sedimentation occurring in any formal stormwater drainage system, on neighbouring land and in receiving waters. Where possible, this may be achieved by one or more of the following means:

1. Maintain vegetation where possible
2. Disturb minimal areas during excavation
3. Revegetate disturbed areas if possible

All spoil on site should be properly controlled by erosion control measures to prevent transportation of sediments off-site. Appropriate soil erosion control methods in accordance with Landcom (2004) shall be required.

Trafficability and Access

Consideration should be given to the impact of the proposed works and site subsurface conditions on trafficability within the site e.g. wet clay soils will lead to poor trafficability by tyred plant or vehicles.

Where site access is likely to be affected by any site works, construction staging should be organised such that any impacts on adequate access are minimised as best as possible.

Vibration Management

Where excavation is to be extended into medium or higher strength rock, care will be required when using a rock hammer to limit potential structural distress from excavation-induced vibrations where nearby structures may be affected by the works.

To limit vibrations, we recommend limiting rock hammer size and set frequency, and setting the hammer parallel to bedding planes and along defect planes, where possible, or as advised by a geotechnical engineer. We recommend limiting vibration peak particle velocities (PPV) caused by construction equipment or resulting from excavation at the site to 5 mm/s (AS 2187.2, 2006, Appendix J).

Waste – Spoil and Water

Soil to be disposed off-site should be classified in accordance with the relevant State Authority guidelines and requirements.

Any collected waste stormwater or groundwater should also be tested prior to discharge to ensure contaminant levels (where applicable) are appropriate for the nominated discharge location.

MA can complete the necessary classification and testing if required. Time allowance should be made for such testing in the construction program.

Water Management - Groundwater

If the proposed works are likely to intersect ephemeral or permanent groundwater levels, the management of any potential acid soil drainage should be considered. If groundwater tables are likely to be lowered, this should be further discussed with the relevant State Government Agency.

Water Management – Surface Water

All surface runoff should be diverted away from excavation areas during construction works and prevented from accumulating in areas surrounding any retaining structures, footings or the base of excavations.

Any collected surface water should be discharged into a suitable Council approved drainage system and not adversely impact downslope surface and subsurface conditions.

All site discharges should be passed through a filter material prior to release. Sump and pump methods will generally be suitable for collection and removal of accumulated surface water within any excavations.

Contingency Plan

In the event that proposed development works cause an adverse impact on geotechnical hazards, overall site stability or adjacent properties, the following actions are to be undertaken:

1. Works shall cease immediately.
2. The nature of the impact shall be documented and the reason(s) for the adverse impact investigated.
3. A qualified geotechnical engineer should be consulted to provide further advice in relation to the issue.

Appendix I – Notes about this Report

Information

Important Information About Your Report (1 of 2)

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

The recommendations presented in this report are based on limited investigations and include specific issues to be addressed during various phases of the project. If the recommendations presented in this report are not implemented in full, the general recommendations may become inapplicable and Martens & Associates accept no responsibility whatsoever for the performance of the works undertaken.

Occasionally, sub-surface conditions between and below the completed boreholes or other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact Martens & Associates.

Relative ground surface levels at borehole locations may not be accurate and should be verified by on-site survey.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings *etc* are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.

Important Information About Your Report (2 of 2)

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.
- The actions of contractors responding to commercial pressures.
- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

  The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

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

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those that were expected from the information contained in the report, Martens requests that it immediately be notified. Most problems are much more readily resolved at the time when conditions are exposed, rather than at some later stage well after the event.

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Soil Data

Explanation of Terms (1 of 3)

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water, it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are typically based on Australian Standard 1726 and the Unified Soil Classification System (USCS) – refer Soil Data Explanation of Terms (2 of 3). In general, descriptions cover the following properties: strength or density, colour, moisture, structure, soil or rock type and inclusions.

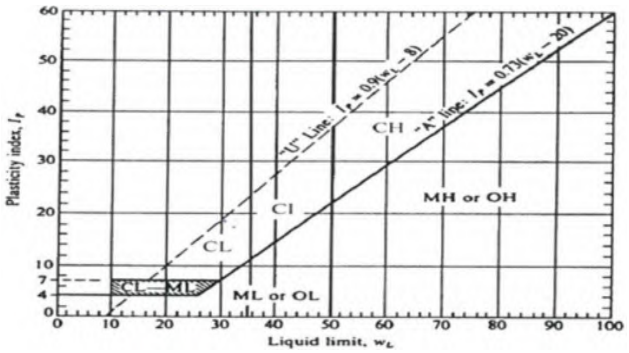
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy CLAY). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision		Particle Size (mm)
Oversized	BOULDERS		>200
	COBBLES		63 to 200
Coarse Grained Soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine Grained Soil	SILT		0.002 to 0.075
	CLAY		< 0.002

Plasticity Properties

Plasticity properties of cohesive soils can be assessed in the field by tactile properties or by laboratory procedures.



Soil Moisture Condition

Coarse Grained (Granular) Soil:

Dry (D):	Looks and feels dry. Cemented soils are hard, friable or powdery. Uncemented soils run freely through fingers.
Moist (M):	Feels cool and damp and is darkened in colour. Particles tend to cohere.
Wet (W):	As for moist but with free water forming on hands when handled.

Fine Grained (Cohesive) Soil:

Moist, dry of plastic limit[1] (w < PL):	Looks and feels dry. Hard, friable or powdery.
Moist, near plastic limit (w ≈ PL):	Can be moulded, feels cool and damp, is darkened in colour, at a moisture content approximately equal to the PL.
Moist, wet of plastic limit (w > PL):	Usually weakened and free water forms on hands when handled.
Wet, near liquid limit[2] (w ≈ LL)	
Wet, wet of liquid limit (w > LL)	

[1] Plastic Limit (PL): Moisture content at which soil becomes too dry to be in a plastic condition.

[2] Liquid Limit (LL): Moisture content at which soil passes from plastic to liquid state.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.
(Note: consistency is affected by soil moisture condition at time of measurement)

Term	C_u (kPa)	Field Guide
Very Soft (VS)	≤12	A finger can be pushed well into the soil with little effort. Sample exudes between fingers when squeezed in fist.
Soft (S)	>12 and ≤25	A finger can be pushed into the soil to about 25mm depth. Easily moulded by light finger pressures.
Firm (F)	>25 and ≤50	The soil can be indented about 5mm with the thumb, but not penetrated. Can be moulded by strong figure pressure.
Stiff (St)	>50 and ≤100	The surface of the soil can be indented with the thumb, but not penetrated. Cannot be moulded by fingers.
Very Stiff (VSt)	>100 and ≤200	The surface of the soil can be marked, but not indented with thumb pressure. Difficult to cut with a knife. Thumbnail can readily indent.
Hard (H)	> 200	The surface of the soil can only be marked with the thumbnail. Brittle. Tends to break into fragments.
Friable (Fr)	-	Crumbles or powders when scraped by thumbnail. Can easily be crumbled or broken into small pieces by hand.

Density of Granular Soils

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

Relative Density	%	SPT 'N' Value* (blows/300mm)	CPT Cone Value (q_c MPa)
Very loose	≤15	< 5	< 2
Loose	>15 and ≤35	5 - 10	2 - 5
Medium dense	>35 and ≤65	10 - 30	5 - 15
Dense	>65 and ≤85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

* Values may be subject to corrections for overburden pressures and equipment type and influenced by soil moisture condition at time of measurement.

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Description of components	Proportion of component in:					
	coarse grained soil				fine grained soil	
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand/ gravel	Terminology
Minor	≤5	Trace clay / silt, as applicable	≤15	Trace sand / gravel, as applicable	≤15	Trace sand / gravel, as applicable
	>5,≤12	With clay / silt, as applicable	>15,≤30	With sand / gravel, as applicable	>5,≤30	With sand / gravel, as applicable
Secondary	>12	Prefix soil name as 'silty' or 'clayey', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable

Soil Data

Explanation of Terms (2 of 3)

martens consulting engineers

Symbols for Soils and Other

SOILS


COBBLES/BOULDERS


GRAVEL (GP or GW)


Silty GRAVEL (GM)


Clayey GRAVEL (GC)


SAND (SP or SW)


Silty SAND (SM)


Clayey SAND (SC)


SILT (ML or MH)


ORGANIC SILT or CLAY (OH or OL)


CLAY (CL, CI or CH)


Silty CLAY


Sandy CLAY


PEAT (Pt)


Gravelly CLAY

OTHER


FILL


TALUS


ASPHALT


CONCRETE


TOPSOIL

Unified Soil Classification Scheme (USCS)

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)					USCS	Primary Name
COARSE GRAINED SOILS More than 65 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm.	GRAVEL and GRAVEL-SAND Mixtures (≤ 5% fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes; not enough fines to bind coarse grains; no dry strength	GW	GRAVEL
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	GP	GRAVEL
			GRAVEL-SILT and GRAVEL-SAND-SILT mixtures (≥ 12% fines) [1]	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength; may also contain sand	GM	Silty GRAVEL
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength; may also contain sand	GC	Clayey GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	SAND and GRAVEL-SAND mixtures (≤5% fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes; not enough fines to bind coarse grains; no dry strength.	SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	SP	SAND
			SAND-SILT and SAND-CLAY mixtures (≥ 12% fines) [1]	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength;	SM	Silty SAND
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength	SC	Clayey SAND

FINE GRAINED SOILS More than 35 % of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
	None to Low	Quick to Slow	Low	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or silt with low plasticity [2]	ML	SILT [3]
	Medium to High	None to Slow	Medium	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays	CL (or CI[4])	CLAY
	Low to Medium	Slow	Low	Organic slits and organic silty clays of low plasticity	OL	Organic SILT or CLAY
	Low to Medium	None to Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	SILT [3]
	High to Very High	None	High	Inorganic clays of high plasticity, fat clays	CH	CLAY
	Medium to High	None to Very Slow	Low to Medium	Organic clays of medium to high plasticity, organic silt of high plasticity	OH	Organic SILT or CLAY
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	PEAT

Notes:

1. Between 5% and 12% - dual classification, e.g. GP-GM.
2. Low Plasticity Clay – Liquid Limit W_L ≤35%; Medium Plasticity Clay – Liquid limit W_L >35%, ≤50%; High Plasticity Clay - Liquid limit W_L > 50%.
3. Low Plasticity Silt – Liquid Limit W_L ≤50%; High Plasticity Silt - Liquid limit W_L > 50%.
4. CI may be adopted for clay of medium plasticity to distinguish from clay of low plasticity.

Soil Data

Explanation of Terms (3 of 3)

Soil Agricultural Classification Scheme

In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL-	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

Rock Data

Explanation of Terms (1 of 2)

Symbols for Rock

SEDIMENTARY ROCK


BRECCIA


CONGLOMERATE


CONGLOMERATIC SANDSTONE


SANDSTONE/QUARTZITE


SILTSTONE


MUDSTONE/CLAYSTONE


SHALE


COAL


LIMESTONE


LITHIC TUFF

IGNEOUS ROCK


GRANITE


DOLERITE/BASALT

METAMORPHIC ROCK


SLATE, PHYLLITE, SCHIST


GNEISS


METASANDSTONE


METASILTSTONE


METAMUDSTONE

Definitions

Descriptive terms used for Rock by Martens are based on AS1726 and encompass rock substance, defects and mass.

Rock Material	The intact rock that is bounded by defects.
Rock Defect	Discontinuity, fracture, break or void in the material or minerals across which there is little or no tensile strength.
Rock Structure	The nature and configuration of the different defects within the rock mass and their relationship to each other.
Rock Mass	The entirety of the system formed by all of the rock material and all of the defects that are present.

Degree of Weathering

Rock weathering is defined as the degree of decline in rock structure and grain property and can be determined in the field.

Term	Symbol	Definition
Residual soil[1]	RS	Material is weathered to such an extent that it has soil properties. Mass structure, material texture, and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered[1]	XW	Material is weathered to such an extent that it has soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered[2]	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the original colour of the rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered[2]	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the rock is not recognisable. Rock strength shows little or no change from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	Rock substance unaffected by weathering. No sign of decomposition of individual materials or colour changes.

Notes:
1 RS and EW material is described using soil descriptive terms.
2. The term "Distinctly Weathered" (DW) may be used to cover the range of substance weathering between EW and SW

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the loading. The test procedure is described by the International Society of Rock Mechanics.

Term (Strength)	I_s (50) MPa	Uniaxial Compressive Strength MPa	Field Guide	Symbol
Very low	>0.03 ≤0.1	0.6 – 2	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VL
Low	>0.1 ≤0.3	2 – 6	Core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	L
Medium	>0.3 ≤1.0	6 – 20	Core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	M
High	>1 ≤3	20 – 60	Core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife. Breaks with single blow from pick.	H
Very high	>3 ≤10	60 – 200	Core 150mm long x 50mm diameter, broken readily with hand held hammer. Cannot be scratched with knife. Breaks after more than one pick strike.	VH
Extremely high	>10	>200	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	EH

Rock Data

Explanation of Terms (2 of 2)

Degree of Fracturing

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude fractures such as drilling breaks (DB) or handling breaks (HB).

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments.
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300 mm to 1000 mm, with occasional longer sections and sections of 100 mm to 300 mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\,\%$$

SCR = Solid Core Recovery

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\,\%$$

RQD = Rock Quality Designation

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm long}}{\text{Length of core run}} \times 100\,\%$$

Rock Strength Tests

- ▼ Point load strength Index (Is50) - axial test (MPa)
- ▶ Point load strength Index (Is50) - diametral test (MPa)
- ● Uniaxial compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)

BP	Bedding plane parting
FL	Foliation
CL	Cleavage
JT	Joint
FC	Fracture
SZ/SS	Sheared zone/ seam (Fault)
CZ/CS	Crushed zone/ seam
DZ/DS	Decomposed zone/ seam
FZ	Fractured Zone
IS	Infilled seam
VN	Vein
CO	Contact
HB	Handling break
DB	Drilling break

Planarity

Pl	Planar
Cu	Curved
Un	Undulating
St	Stepped
Ir	Irregular
Dis	Discontinuous

Roughness

Pol	Polished
Sl	Slickensided
Sm	Smooth
Ro	Rough
VR	Very rough

Thickness

Zone	> 100 mm
Seam	> 2 mm < 100 mm
Plane	< 2 mm

Coating or Filling

Cn	Clean
Sn	Stain
Ct	Coating
Vnr	Veneer
Fe	Iron Oxide
X	Carbonaceous
Qz	Quartzite
MU	Unidentified mineral

Inclination

Inclination of defect is measured from perpendicular to and down the core axis.
Direction of defect is measured clockwise (looking down core) from magnetic north.

Test, Drill and Excavation Methods

Explanation of Terms (1 of 3)

Sampling

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

Disturbed samples taken during drilling or excavation provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples may be taken by pushing a thin-walled sampling tube, e.g. U_{50} (50 mm internal diameter thin walled tube), into soils and withdrawing a soil sample in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling / Excavation Methods

The following is a brief summary of drilling and excavation methods currently adopted by the Company and some comments on their use and application.

Hand Excavation - in some situations, excavation using hand tools, such as mattock and spade, may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger, generally 75-100 mm in diameter, into the ground. The penetration depth is usually limited to the length of the auger pole; however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils and, if it is safe to descend into the pit, collection of bulk disturbed samples. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling (Push Tube) - the hole is advanced by pushing a 50 - 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength *etc.* is only marginally affected.

Continuous Spiral Flight Augers - the hole is advanced using 90 - 115 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel of usually 50 mm internal diameter. Provided full core recovery is achieved (not always possible in very weak or fractured rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

In-situ Testing and Interpretation

Cone Penetrometer Testing (CPT)

Cone penetrometer testing (sometimes referred to as Dutch Cone) described in this report has been carried out using an electrical friction cone penetrometer.

The test is described in AS 1289.6.5.1-1999 (R2013). In the test, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system.

Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the push rod centre to an amplifier and recorder unit mounted on the control truck. As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

(i) Cone resistance (q_c) - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa.

(ii) Sleeve friction (q_f) - the frictional force of the sleeve divided by the surface area, expressed in kPa.

(iii) Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

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

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

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

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

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

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

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes *etc.* This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Standard Penetration Testing (SPT)

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample.

The test procedure is described in AS 1289.6.3.1-2004. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm penetration depth increments and the 'N' value is taken as the number of blows for the last two 150 mm depth increments (300 mm total penetration). In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued. The test results are reported in the following form:

(i) Where full 450 mm penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows:

as 4, 6, 7
N = 13

(ii) Where the test is discontinued, short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm

as 15, 30/40 mm.

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

Dynamic Cone (Hand) Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer (PSP) - a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm. The test, described in AS 1289.6.3.3-1997 (R2013), was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

Cone penetrometer (DCP) - sometimes known as the Scala Penetrometer, a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm. The test, described in AS 1289.6.3.2-1997 (R2013), was developed initially for pavement sub-grade investigations, with correlations of the test results with California Bearing Ratio published by various Road Authorities.

Pocket Penetrometers

The pocket (hand) penetrometer (PP) is typically a light weight spring hand operated device with a stainless steel loading piston, used to estimate unconfined compressive strength, q_u, (UCS in kPa) of a fine grained soil in field conditions. In use, the free end of the piston is pressed into the soil at a uniform penetration rate until a line, engraved near the piston tip, reaches the soil surface level. The reading is taken from a gradation scale, which is attached to the piston via a built-in spring mechanism and calibrated to kilograms per square centimetre (kPa) UCS. The UCS measurements are used to evaluate consistency of the soil in the field moisture condition. The results may be used to assess the undrained shear strength, C_u, of fine grained soil using the approximate relationship:

$$q_u = 2 \times C_u.$$

It should be noted that accuracy of the results may be influenced by condition variations at selected test surfaces. Also, the readings obtained from the PP test are based on a small area of penetration and could give misleading results. They should not replace laboratory test results. The use of the results from this test is typically limited to an assessment of consistency of the soil in the field and not used directly for design of foundations.

Test Pit / Borehole Logs

Test pit / borehole log(s) presented herein are an engineering and / or geological interpretation of the subsurface conditions. Their reliability will depend to some extent on frequency of sampling and methods of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / core drilling will provide the most reliable assessment but this is not always practicable, or possible to justify on economic grounds. In any case, the test pit / borehole logs represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of test pits / boreholes, the frequency of sampling and the possibility of other than 'straight line' variation between the test pits / boreholes.

Laboratory Testing

Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent prior weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

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

Test, Drill and Excavation Methods

Explanation of Terms (3 of 3)

DRILLING / EXCAVATION METHOD

HA	Hand Auger	RD	Rotary Blade or Drag Bit	NQ	Diamond Core - 47 mm
AD/V	Auger Drilling with V-bit	RT	Rotary Tricone bit	NMLC	Diamond Core – 51.9 mm
AD/T	Auger Drilling with TC-Bit	RAB	Rotary Air Blast	HQ	Diamond Core – 63.5 mm
AS	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core – 63.5 mm
HSA	Hollow Stem Auger	CT	Cable Tool Rig	DT	Diatube Coring
S	Excavated by Hand Spade	PT	Push Tube	NDD	Non-destructive digging
BH	Tractor Mounted Backhoe	PC	Percussion	PQ	Diamond Core - 83 mm
JET	Jetting	E	Tracked Hydraulic Excavator	X	Existing Excavation

SUPPORT

Nil	No support	S	Shotcrete	RB	Rock Bolt
C	Casing	Sh	Shoring	SN	Soil Nail
WB	Wash bore with Blade or Bailer	WR	Wash bore with Roller	T	Timbering

WATER

▽ Water level at date shown

▷ Water inflow

◁ Partial water loss

◀ Complete water loss

GROUNDWATER NOT OBSERVED (NO)	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED (NX)	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

PENETRATION / EXCAVATION RESISTANCE

L	Low resistance: Rapid penetration possible with little effort from the equipment used.
M	Medium resistance: Excavation possible at an acceptable rate with moderate effort from the equipment used.
H	High resistance: Further penetration possible at slow rate & requires significant effort equipment.
R	Refusal/ Practical Refusal. No further progress possible without risk of damage/ unacceptable wear to digging implement / machine.

These assessments are subjective and dependent on many factors, including equipment power, weight, condition of excavation or drilling tools, and operator experience.

SAMPLING

D	Small disturbed sample	W	Water Sample	C	Core sample
B	Bulk disturbed sample	G	Gas Sample	CONC	Concrete Core

U63 Thin walled tube sample - number indicates nominal undisturbed sample diameter in millimetres

TESTING

SPT 4,7,11 N=18	Standard Penetration Test to AS1289.6.3.1-2004 4,7,11 = Blows per 150mm. 'N' = Recorded blows per 300mm penetration following 150mm seating
DCP	Dynamic Cone Penetration test to AS1289.6.3.2-1997. 'n' = Recorded blows per 150mm penetration

Notes:

RW	Penetration occurred under rod weight only
HW	Penetration occurred under hammer and rod weight only
20/100mm	Where practical refusal or hammer double bouncing occurred, blows and penetration for that interval are reported (e.g. 20 blows for 100 mm penetration)

CPT	Static cone penetration test
CPTu	CPT with pore pressure (u) measurement
PP	Pocket penetrometer test expressed as instrument reading (kPa)
FP	Field permeability test over section noted
VS	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PM	Pressuremeter test over section noted
PID	Photoionisation Detector reading in ppm
WPT	Water pressure tests

SOIL DESCRIPTION

Density		Consistency		Moisture	
VL	Very loose	VS	Very soft	D	Dry
L	Loose	S	Soft	M	Moist
MD	Medium dense	F	Firm	W	Wet
D	Dense	St	Stiff	Wp	Plastic limit
VD	Very dense	VSt	Very stiff	Wl	Liquid limit
		H	Hard		

ROCK DESCRIPTION

Strength		Weathering	
VL	Very low	EW	Extremely weathered
L	Low	HW	Highly weathered
M	Medium	MW	Moderately weathered
H	High	SW	Slightly weathered
VH	Very high	FR	Fresh
EH	Extremely high		