Geotechnical & Acid Sulfate Soils Investigation Report

Proposed Multi-Storey Residential Development
Portion of Lot 5 on SP337697
280 MacArthur Avenue, Hamilton

Prepared for:
Ebonie Fox
McNab Developments Queensland Pty Ltd
PO Box 5054
WEST END QLD 4101

Email: Ebonie.Fox@mcnab.net.au

Report Number: J002479-001-R-Rev0

7 August 2024

Table of Contents

Appendices

Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
McNab	Ebonie Fox	Rev0	August 2024	Email (PDF)

1.0 INTRODUCTION

This report presents the results of a geotechnical and acid sulfate soils (ASS) investigation carried out by Core Consultants Pty Ltd (Core) for a proposed multi-storey residential development at 330 Macarthur Avenue, Hamilton. The site consists of a portion of Lot 5 on SP337697, currently in the process of subdivision approval.

The work was carried out for McNab Developments Queensland Pty Ltd (McNab) in accordance with our proposal Q005034-001-L-Rev0, dated 23 April 2024.

2.0 PROPOSED DEVELOPMENT

The proposed development includes a six-level building with at grade carparking; no basement is proposed. The site requires about 0.4 to 1 m of fill (locally 1.6 m in the drain) for a FFL of 4.5 over a plan area as shown in Image 1 below.

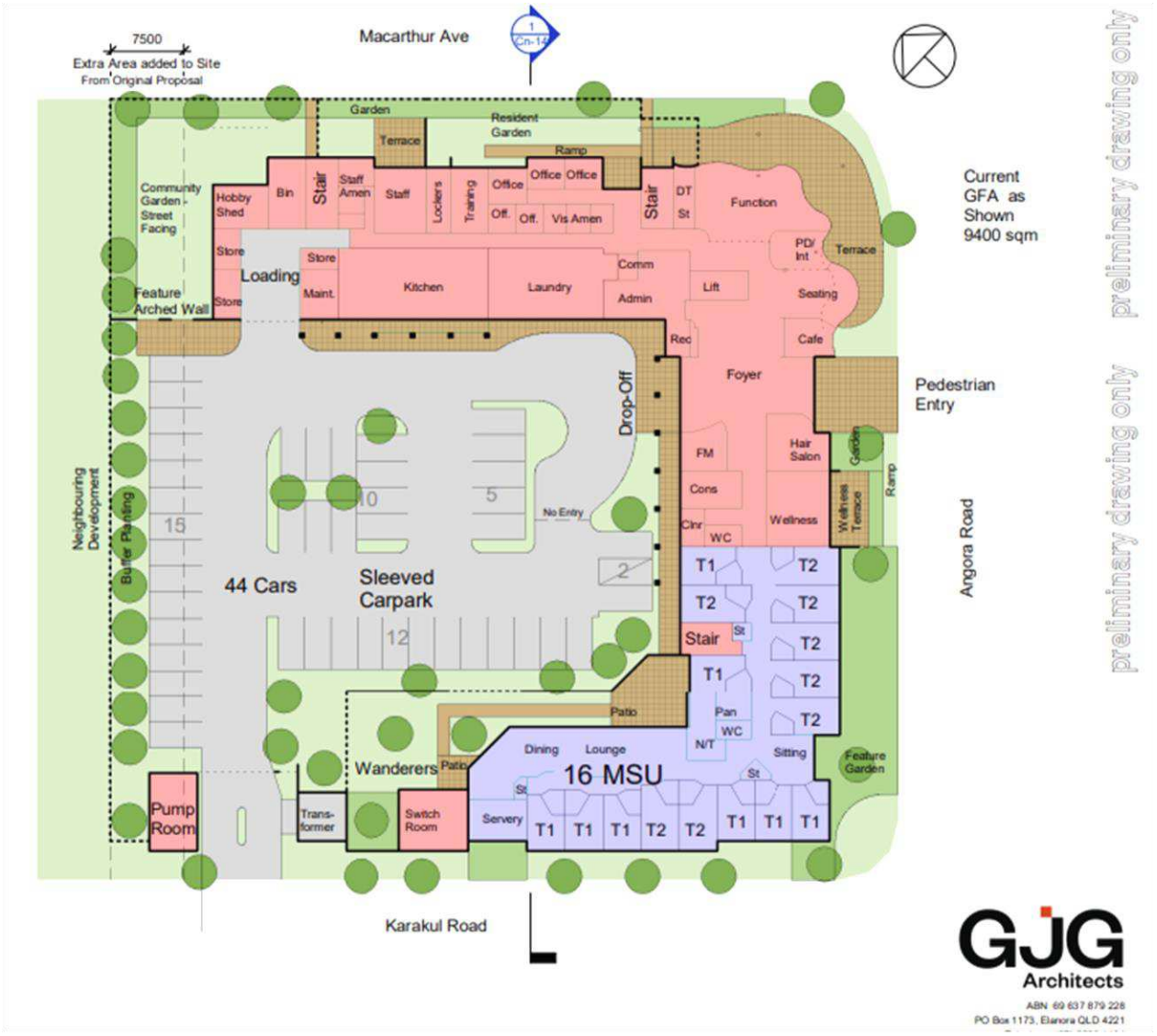


Image 1: Extract from proposed development plan at ground level.

3.0 SITE DESCRIPTION

The site is located at 11 Karakul Road, Hamilton. Lot 17 comprises a portion of Lot 5 on SP337697 (Preliminary subdivision to Lot 4 on SP346185) and covers an area of approximately 7466 m^2. Lot 18 (Lot 6 SP326594) comprises Lot 6 on SP326594 which covers 14,740 m^2. The site location is shown in Image 2 below.

Image 2: Site location (Aerial image sourced from Nearmap, Annotations by Core).

At the time of the investigation the eastern portion of Lot 5 SP326594 comprised a vacant lot covered with grass. The elevation of the site is mostly around RL 3.3 to 3.7 m Australian Height Datum (AHD), but ranges between about RL 2.7 m in a drain to RL 6.0 m in the western corner generally sloping down towards the north-eastern boundary. The central portion contains the lowest point with a drain moving in a southeast to northwest direction towards Macarthur Avenue. The roads bounding the north, east and southern boundaries have been constructed at a higher RL to the general Lot.

Macarthur Avenue bounds the site to the northeast, with medium density residential dwellings then drainage line, then followed by Royal Qld Golf Course beyond. To the southeast the site is bounded by Angora Road followed by high density residential dwellings (Riverlight Apartments). Karakul Road forms the southwest boundary followed by vacant land. The northwest area is the remaining portion of Lot 5 on SP326594 currently grassed land in the process of redevelopment.

Access is currently available off Karakul Road. The Brisbane River is located approximately 200 m to the south, with Northshore Riverside Park Beach directly south.

Site conditions at the time of our investigation are shown in Photograph 1 below.

Photograph 1: General site conditions at the time of fieldwork looking east towards Macarthur Ave & Angora Rd

Photograph 2: General site conditions looking north towards Macarthur Avenue

Photograph 3: Existing concrete slab observed within the western area of the site boundary

4.0 METHOD OF INVESTIGATION

4.1 Review of Available Information

To assess likely ground conditions a review of published geological maps, aerial images, acid sulfate soils (ASS) maps and available geotechnical information was undertaken (refer Section 5).

4.2 Boreholes

Four boreholes (designated BH201 to BH204) were drilled between 4 July 2024 in the presence of geotechnical personnel from Core, at the locations shown on the attached Figure 1 (Appendix A). Borehole positions were recorded in the field using a handheld GPS unit.

All boreholes were auger drilled using a 4WD mounted drill rig. Standard Penetration Testing (SPT) was conducted at regular intervals and vane shear tests were undertaken in the boreholes with disturbed and undisturbed samples collected. ASS samples were collected at 0.25 m intervals to 4 m BGL. Dynamic Cone Penetrometer (DCP) testing was conducted within the boreholes to 1 m BGL. Groundwater standpipes were installed in BH203 and BH204 (denoted MW01 and MW02) for groundwater level measurement and sampling; the other boreholes were backfilled with drill spoil.

4.3 Cone Penetration Testing (CPTs)

Three (3) cone penetration tests (CPT001 to CPT003) were pushed using a truck-mounted CPT truck on 4 July 2024 to supplement the borehole data and provide data on the compressible soils. These were pushed to refusal at depths of 29.4 to 26.6 m BGL. The CPT is a probe instrumented to measure resistance on the tip and a following sleeve and also to measure pore water pressure, with these readings captured at 10 mm intervals.

4.4 Geophysical Testing

Geophysical testing in the form of multi-channel analysis of surface waves (MASW) was undertaken on 10 July 2024 by a geotechnical engineer/engineering geophysicist from Core and comprised two survey alignments Line 1 and Line 2. MASW geophysical surveys use seismic surface (Rayleigh) wave phase and frequency data to estimate shear-wave velocities of the subsurface materials.

The MASW acquisition comprised the use of a 24-channel land streamer array with 4.5 Hz geophones spaced horizontally at 1 m. Each survey comprises a single 1-Dimensional vertical sounding recorded at the

centre of the geophone array; as shown on Image 3 below. Vertical soundings were carried out at approximately 10 m intervals along each survey line.

The array was connected to a Geometrics Geode, with data recorded using the Geometrics Seismodule Controller Software (SCS). A sampling rate of 0.5 ms and sample record length of 2 seconds was adopted. The seismic source was a 7 kg sledgehammer striking a polyethylene plate, with an offset of 6 m. Vertical stacking of the seismic source was carried out to minimise ambient noise (i.e., wind and traffic) and increase the signal to noise ratio.

Sounding co-ordinates (X-Y-Z) were recorded in the field with a Trimble GNSS device with typically ± 0.2 m accuracy. Co-ordinates were recorded using Map Grid of Australia (GDA2020) and height above mean sea level (AUSGeoid20).

The acquired data was processed using the *SurfSeis 6* software, by Kansas Geological Society. Dispersion images were generated, which show the frequency versus the percentage intensity of phase velocity, for each acquired field record. A dispersion curve was then produced by picking the maximum intensity velocities (of the fundamental mode) across the useful range of frequencies. The dispersion curves for each survey alignment were put through an 8-layer inversion algorithm to produce one-dimensional shear-wave velocity soundings.

The S-wave soundings were then gridded using Golden Software's *Surfer 22* to produce two-dimensional shear-wave velocity sections.

The quality of the produced MASW dispersion curves for each sounding was typically good, with high signal-to-noise (S/N) ratios for the fundamental-mode dispersion energy, for a frequency range between about 4 Hz and 20 Hz.

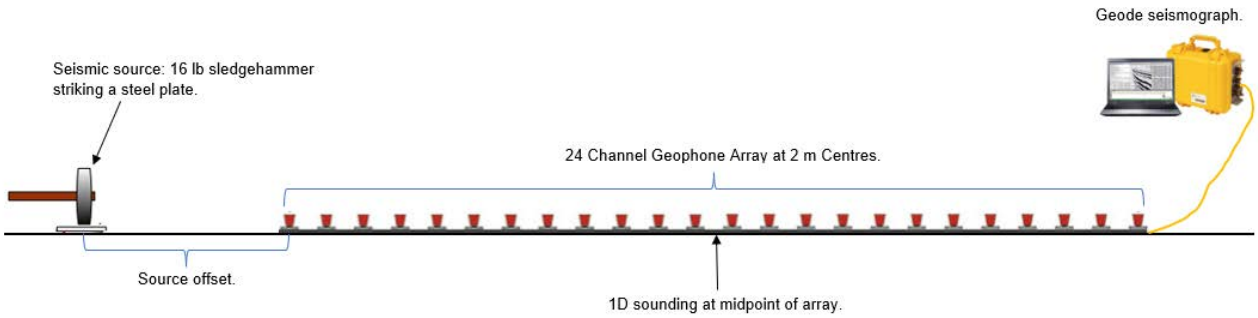


Image 3: Example MASW acquisition schematic.

4.5 Acid Sulfate Soils Sampling

The ASS component of the investigation was planned based on the findings of a desktop assessment (refer Section 7.0) and with reference to the following '*National Acid Sulfate Soils Guidance'* documents:

- National acid sulfate soils sampling and identification methods manual[1]
- National acid sulfate soils identification and laboratory methods manual[2]
- Guidance for the dewatering of acid sulfate soils in shallow groundwater requirements[3]
- Queensland State Planning Policy 2017 (SPP17)[4]

[1] Sullivan L, Ward N, Toppler N, Lancaster G, *National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual* (2018), Department of Agriculture and Water Resources, Canberra ACT.

[2] Sullivan L, Ward N, Toppler N, Lancaster G, *National Acid Sulfate Soils guidance: National acid sulfate soils identification and laboratory methods manual* (2018), Department of Agriculture and Water Resources, Canberra ACT.

[3] Sullivan L, Ward N, Toppler N, Lancaster G, *National Acid Sulfate Soils guidance: Guidance for the dewatering of acid sulfate soils in shallow groundwater environments* (2018), Department of Agriculture and Water Resources, Canberra ACT.

[4] State Planning Policy (2017), State of Queensland, Department of Infrastructure, Local Government and Planning.

For this assessment, samples were recovered from four boreholes (BH201 – BH204) at 0.25 m intervals to a depth of 4 m BGL. ASS sampling protocols in the field were conducted to minimise oxidation prior to laboratory testing and followed the above referenced guidelines.

4.6 Groundwater Sampling

Groundwater sampling was undertaken in accordance with the following:

- Department of Environment Science and Innovation (DESI) Monitoring and Sampling Manual 2018.
- Groundwater was assessed using the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 *Brisbane River Estuary Environmental Values and Water Quality Objectives Part of Basin 143*.

The site is located within the Brisbane River Estuary – middle estuary waters area with the water quality objectives adopted for the environmental Value Zone and water type.

For this assessment, samples were recovered from the two monitoring wells (MW01 & MW02), that were installed to a depth of about 4 m BGL. Samples were immediately placed in airtight containers supplied by the testing laboratory and then placed into a chilled insulated esky for transportation to the laboratory.

4.7 Laboratory Testing

4.7.1 Geotechnical Testing

Soil samples were forwarded to a NATA-accredited laboratory for geotechnical laboratory classification testing comprising Weighted Plasticity Index (WPI), Emerson class number (ECN), soil aggressivity and soaked California Bearing Ratio (CBR) testing.

4.7.2 Acid Sulfate Soil Testing

A total of 64 samples were screened to assess field pH (pH_F) and pH after oxidation (pH_{FOX}) using 30% hydrogen solution.

The pH_F/pH_{FOX} screening method consists of two steps. In the first step, the field pH of a 1:5 soil/water suspension is measured (pH_F). In the second step, a 30% Hydrogen Peroxide solution is added to a second sample of the same material which is then heated to accelerate the oxidation of the sample. The pH after oxidation (pH_{FOX}) is then measured. A significant difference between the pH_F and pH_{FOX} results is an indication of potential acid sulfate soils (PASS); however, test results may be affected by other inclusions such as shell material and organics.

Based on the results of pH screening tests, 8 samples were selected and dispatched to Eurofins to undergo quantitative analysis by the Chromium Reducible Sulfur (CRS) suite in accordance with ASS Method 23F and 22B laboratory procedures of Ahern et al (2004).

This CRS method includes analysis of ‘inherent buffering capacity’ from naturally occurring alkaline materials (i.e. calcite, coral debris, fine shell fragments) and 'retained acidity' which includes sulfur held in stable oxidation minerals such as 'jarosite' and allows for calculation of 'net acidity'. The CRS test method was selected in preference to the Suspension Peroxide Oxidation Combined Acidity & Sulfur (SPOCAS) method as is gives more accurate indications of pyrite content where significant amounts of organic matter (and organic derived acidity) are present in the soil samples. An overall acid-base accounting method was used to calculate a ‘net acidity’ value which is used to qualify analytical test results and calculate liming rates. This equation is:

Net Acidity = Actual Acidity (as TAA) + Retained Acidity (as S_{NAS}) + Potential Acidity (as S_{CR}) - insitu Acid Neutralising Capacity (ANC).

Groundwater samples were recovered from the standpipes (MW1 to MW2), after initial purging. The groundwater sample was then dispatched to Eurofins/MGT (Eurofins) to undergo further water quality analysis.

All sample collection, in-situ testing and dispatch were performed in accordance with Core procedures for water quality monitoring and the Department of Environment and Science (DES) Monitoring and Sampling Manual 2018.

Both groundwater samples were analysed for Total and dissolved Aluminium and Iron, Anions Cations, Chloride and Sulphides.

5.0 RESULTS

5.1 Published Geological Mapping

The Queensland Geotechnical Database (QGD) indicates that the site is located in an area of Quaternary age Anthropocene comprising "*Gravel, sand and silt; man-made deposits generally associated with land-fill or mining (tailings, dumps and rehabilitated areas*)". An extract of the relevant geological map is shown in Image 4 below.

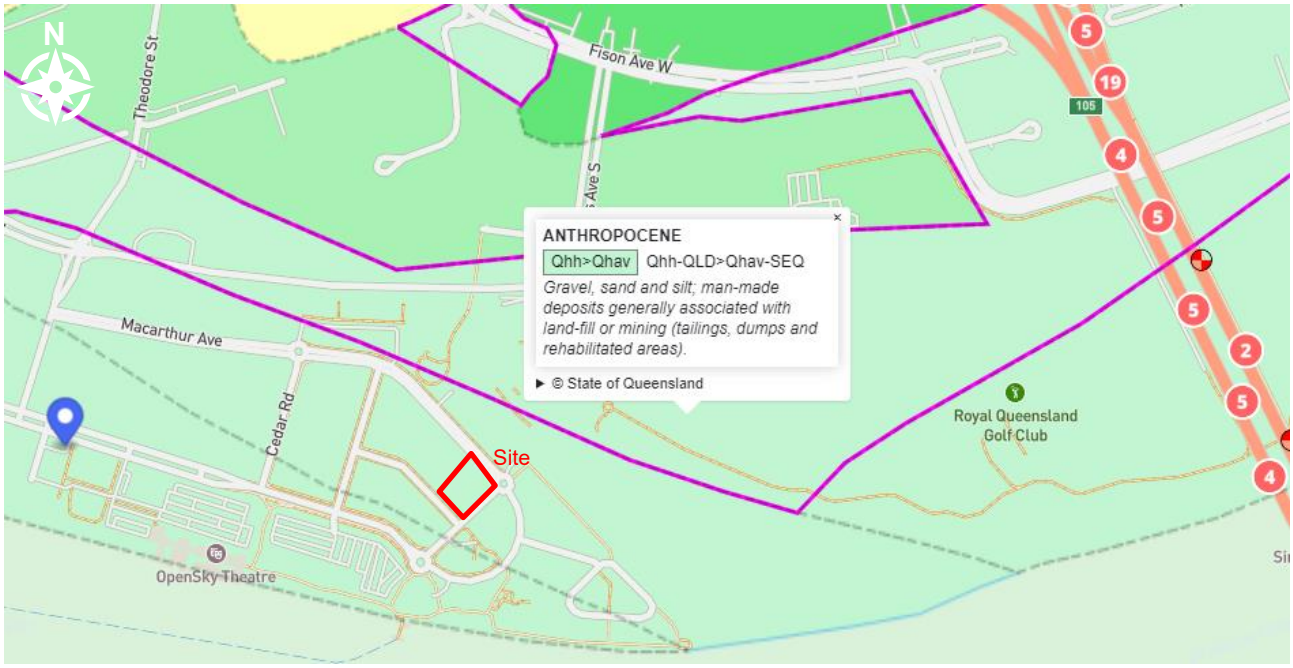


Image 4: Extract from QGD map showing regional geology (not to scale).

5.2 Historical Information & Aerial Images

The site history ('Northshore History') indicates that the site consisted of a river inlet until the early 1900's when the area of Hamilton was reclaimed as part of dredging of the Brisbane River to allow safer access for vessels, with the dredge spoil placed behind a 'training wall' across the inlet to create additional land. This dredging and filling process was conducted over decades of time. In 1999 the land was considered high enough to produce a Deed of Grant to the Port of Brisbane. The land was initially leased for shipping freight handling purposes until the 2010's when the land was redeveloped for future community development.

Historical aerial images (QImagery) indicate the following:

- In 1936 and up until 1963 the land was a back channel of the Brisbane River and grass paddocks (refer Image 6a).
- By 1967 (refer Image 6b) land development along the riverbank had started and the river channel was less evident.
- By 1972 (refer Image 6c) surrounding land was largely developed with buildings, although the site itself appeared undeveloped.
- In 1981 (refer Image 6d) there appears to be land reclamation at the site; after that the site appears grassed until the car storage was constructed sometime between 1994 and 1997.

- The site was used for shipping storage until 2009 at which time MacArthur Avenue was constructed and part of the site adjoining MacArthur Avenue became grassed whilst the remainder continued as vehicle storage.
- The vehicle storage was discontinued by late 2020 and construction of local roads had occurred.

Image 5a: 1936 aerial image (QImagery).

Image 5b: 1967 aerial image (QImagery).

Image 5c: 1972 aerial image (QImagery).

Image 5d: 1991 aerial image (QImagery).

5.3 Previous Geotechnical Investigations

A previous 'broad-scale' geotechnical investigation has been carried out in the area by Butler Partners, including the current site of interest (refer report *Preliminary Geotechnical Investigation, Proposed High Density Residential Development, 240A, 250 and 280 Macarthur Avenue, Hamilton'*, ref. 018-150J, dated October 2020; and Image 6 below).

The previous investigation included four deep boreholes (1 to 4), ten shallow boreholes (5 to 14) and eleven Cone Penetration Tests (CPT 1 to 11). The subsurface profile encountered in boreholes BH3 and BH4 and inferred in CPTs 1, 2 and 5 in the area of the current site of interest in summary comprised:

- Fill to 1 to 1.1 m BGL comprising silty sands with trace fine to medium gravels; SPT N value indicate this fill was mostly relatively medium dense at BH3 and BH4. No records to confirm the fill was placed in a controlled manner were seen (nor would be usually available for dredge spoil placement) and the fill would be considered uncontrolled.
- 'Upper alluvium' (possibly including some dredge spoil) comprising very soft to firm clay to about 9 m BGL, then very loose to loose clayey sand and sand (with a firm clay band in places) to about 15 m BGL.
- Lower alluvium comprising very loose and loose to medium dense clayey sand (with stiff clay bands in places) then medium dense with dense material encountered below about 31.5 to 33 m BGL.
- Dense sandy gravel was encountered at 27.3 to 31.5 m BGL which extended to the end of the boreholes at 32.1 to 34.95 m BGL.

Groundwater was encountered mostly at levels of RL 1.1 m to 2.5 m but locally down to RL 0.4 m and up to RL 3.3 m.

The previous investigation included geotechnical laboratory testing as follows:

- Emerson class tests with results of 4 to 5
- Particle size distribution tests with silt/clay fractions of 16% to 54% and sand fractions of 46% to 84%
- Plasticity tests with liquid limits of 55% to 78% and plasticity indexes of 2% to 47%
- Shrink swell tests with shrinkages of 4.5% to 10.1% and shrink swell indexes of 2.4% to 5.7%
- Standard compaction tests with a maximum dry density of 1.76 to 2.08 t/m^3 and optimum moisture contents of 9.3% to 14.5%
- Soaked CBR tests with CBR values of 4%, 15% and 25 %.

The previous ASS laboratory testing indicated that the sand and clay have potential acidity but also contained high levels of acid neutralising capacity (ANC) which appeared to be due to shells. Shells cannot not be relied upon for neutralising acidity and are not included in the assessment of nett acidity. The liming rates for the sand fill (in one sample only tested) were found to be 4 kg/t and for the underlying clays varying from 5kg/t to 6 kg/t (e.g. boreholes 1, 2, 7, 12 and 13 but 23 kg/t to 33 kg/t in others, e.g. boreholes 4, 5, 6, 7 and 10).

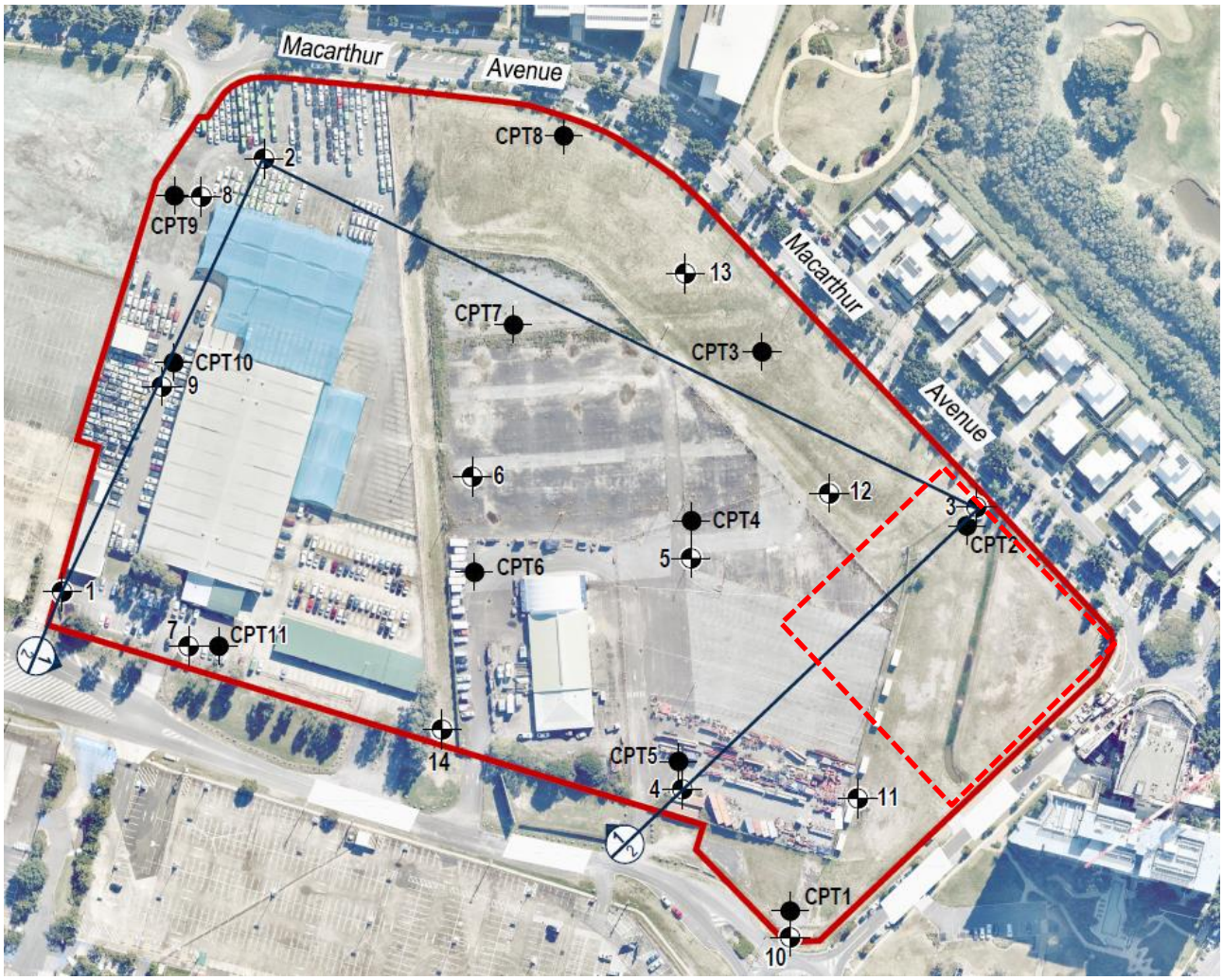


Image 6: Previous investigation locations (extract from Butler Partners report, site location by Core).

5.4 Published Acid Sulfate Soil Information

This site is mapped as a high probability (>70%) for the presence of ASS, likely due to the elevation of the site and proximity to the Brisbane River. An extract of the relevant ASS map is shown in Image 7.

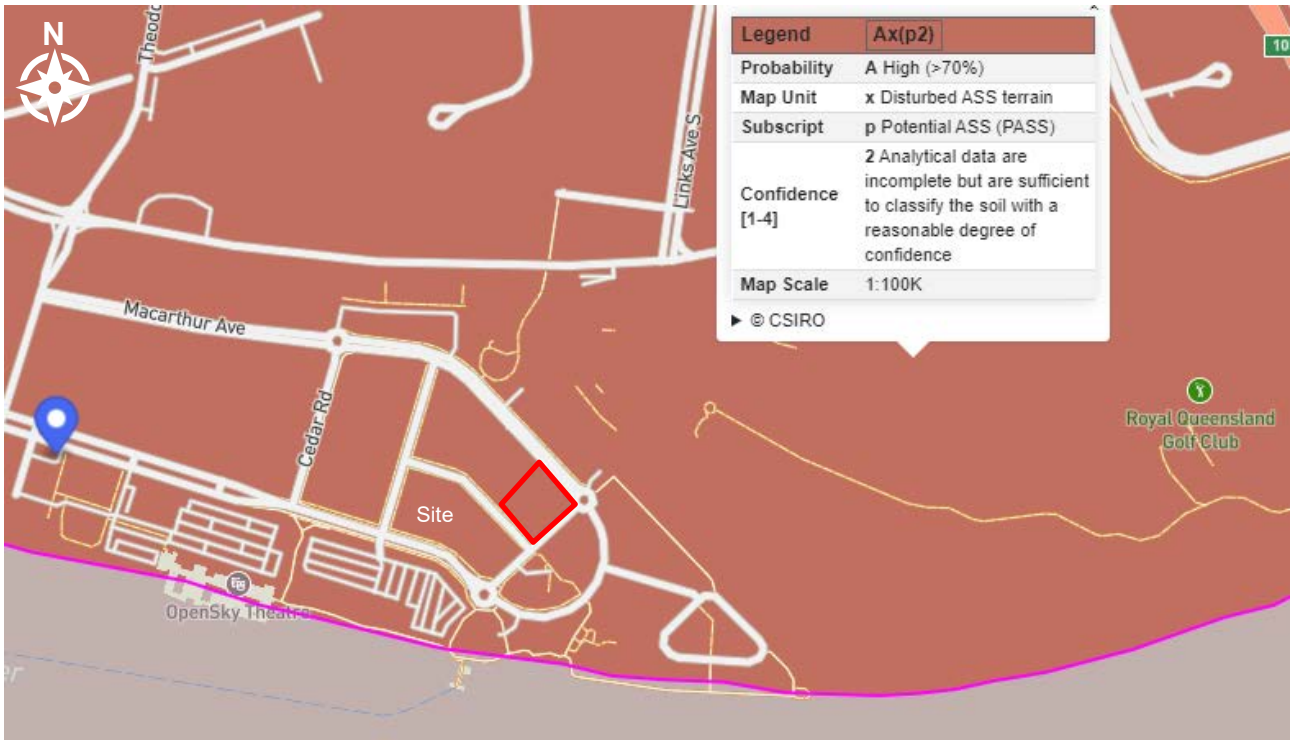


Image 7: Extract from QGD map showing ASS classification (not to scale).

5.5 Subsurface Conditions

The locations of boreholes and geophysical survey line locations are shown on Figure 1 in Appendix A. The Borehole logs are contained in Appendix B and the geophysical survey results are shown in Figure 2 in Appendix A.

The subsurface conditions encountered in the boreholes, MASW and interpreted from the site history, previous CPT results generally comprised the following:

- Fill, typically medium dense gravelly sand with clay, to about 1 to 1.2 m BGL, over
- Fill/dredge spoil comprising soft clay (material likely dredged from the adjacent Brisbane River channel), to depths of possibly about 5 m BGL, although very similar to and difficult to differentiate from the underlying alluvium,
- Upper alluvium, generally comprising interbedded loose sand and firm clay to about 15 m to 20 m BGL, over
- Lower alluvium, generally loose to medium dense sand and stiff clay, becoming medium dense or dense gravel from about 30 m BGL.

The upper fill and dredge spoil is considered ‘uncontrolled’ because of lack of geotechnical inspection and density testing records.

Groundwater seepage was encountered in the auger boreholes at about 1.2 m BGL. Groundwater levels in the standpipes at 1.12 m, 1.58 m BGL respectively were observed during the groundwater samplings. Ordinarily near the Brisbane River where sands are present, groundwater levels would be tidally dominated and occur at or around high tide level about RL 1 m to 1.5 m and rise temporarily and locally due to ingress after rainfall. It is understood the storm tide level for this site is about RL 3.1 m. Groundwater conditions can vary over distance and time and apart from tide and rainfall be influenced by changes to surface and subsurface drainage conditions and human influences.

5.6 In Situ Permeability Testing

Insitu falling head permeability testing was undertaken in monitoring wells on 10 July 2024. The test results provided the following indicative permeability (*k*) values:

- BH203/MW01: *k* value of 1.2 x 10^{-7} m/sec
- BH204/MW02: *k* value of 5.6 x 10^{-8} m/sec

5.7 Laboratory Testing

Geotechnical laboratory testing results are attached in Appendix D and summarised below in Tables 1 to 3.

Table 1: Summary Particle Size Distribution (PSD), Atterberg Limits and Emerson Class Number (ECN) Testing Results

Borehole (no.)	Depth (m)	Soil Description	Plasticity				LS (%)	ECN
			LL (%)	PL (%)	PI (%)	WPI (%)		
201	0.5-1.0	Gravelly sand	34	28	26	1222	9.0	4
202	0.5-1.0	Gravelly sand	-	-	-	-	-	4
203	1.0-1.45	Sandy clay	25	14	11	1023	5.5	4
204	1.0-1.45	Sandy clay	-	-	-	-	-	4

Notes: LL – Liquid Limit, PL – Plastic Limit, PI – Plastic Index, LS – linear shrinkage, WPI – weighted plasticity index (PI x %<0.425mm)

Table 2: Summary of Compaction and CBR results

Borehole (no.)	Depth (m)	Soil Description	Compaction and CBR			
			SMDD (t/m^3)	OMC (%)	CBR (%)	Swell (%)
201	0.5-1.0	Gravelly sand	1.86	15.0	5.0	1.0
202	0.5-1.0	Gravelly sand	1.83	14.0	6.0	-0.5

Notes: SMDD – standard maximum dry density, OMC - optimum moisture content

Table 3: Summary of Soil Aggressivity Testing Results

Borehole No./Depth	Soil Description	Chloride (mg/kg)	Conductivity (uS/cm)	pH	Resistivity (Ωm)	Sulphate (mg/kg)	% moisture
BH204 1.0-1.45 m	Sandy clay	1400	1100	8.8	9.5	260	39

6.0 GEOTECHNICAL COMMENTS & RECOMMENDATIONS

6.1 Excavations

Excavation for services and footings is anticipated to encounter predominantly sand or clay fill including dredge spoil. These materials are expected to be excavatable using conventional small sized earthmoving equipment such as excavators up to 8 t in size. A rock breaker could be required for the removal of concrete (i.e. pavements and building foundations) if encountered. The sand and the underlying clay should be separated during excavation as they are likely to require differing disposal and treatment requirements.

6.2 Temporary Batter Stability

Temporary batters in the sands and clays (up to 2 m deep) could probably be formed at 1V:1.5H, provided there are no surcharge loads, services or structures close to the excavation crest. Batter slopes will need to be confirmed by a geotechnical engineer at the time of construction. Flatter slopes or temporary support will be required in soft clays or if groundwater is present in the face or toe of the batter.

For excavations where space does not permit temporary batters (e.g. close to the site boundary), engineer-designed temporary support will be required. This could comprise temporary sheet piling, with possibly one or two rows of temporary anchors in the sand fill (due to poor toe support afforded by the soft clays) depending on wall height. Anchors extending beyond the site boundary would require permission from the adjacent landowner. Propping of sheet piles could be considered with angled prop to a block on the subgrade; cross excavation props will not be practical given the large excavation width.

6.3 Trafficability & Working Platforms

The existing clayey to gravelly sand subgrade should be trafficable for tracked machines but generally not trucks and other rubber-tyred machines. Most, it not all of this subgrade should be covered by new imported fill. If not, capping with 0.2 m to 0.3 m of granular fill (e.g. recycled ‘CBR45’) is expected to be required on sand subgrade. For a piling rig with bearing pressures of up to 250 kPa (e.g. driven pile rig), a working platform of 0.3 m to 0.5 m of CBR45 granular fill might be required for existing subgrade and possibly for fill areas but depending on imported fill quality.

Working platform design must be undertaken by suitably qualified RPEQ when the crane/rig load specifications are known.

6.4 Filling

Any localised new filling required to achieve design levels should be undertaken under ‘Level 1’ inspection and testing as detailed in Australian Standard AS3798-2007 *Guidelines on earthworks for residential and commercial developments*. A low plasticity granular fill (CBR 10 material) should preferably be used compacted to a minimum Dry Density ratio of 98 % (Standard) within 2 % of optimum moisture content.

6.5 Consolidation Settlement

Long term settlements of the land due to compression of the softer clays in the upper alluvium is anticipated (e.g. as evidenced in the road surface adjoining access shafts along Macarthur Avenue).

In order to assess the settlement characteristics of the weaker clay layers encountered in the CPTs, the tip resistance was compared to those expected for normally consolidated clays as well as those for lightly overconsolidated clays at differing overconsolidation margins (OCM). From this analysis, an OCM of 25 kPa was found to best represent the nature of the clays at CPT 1 and 2 at the nrothern end of the site, and 50 kPa at CPT 3 at the southern end (refer Image 9). This analysis indicates that the upper alluvial clay is lightly over-consolidated at the northern end and slightly more overconsolidated at the southern end. Consolidation settlement should therefore be anticipated under new loads (e.g. from fill or structure or pavements supported on ground and not piles).

Estimated primary consolidation settlement at the CPT locations range between about 60 mm at CPT 3 to 95 mm at CPT 1, for assumed new development loads not exceeding 20 kPa (i.e. 1m of fill). If larger loads are proposed then higher primary settlements can be expected as well as additional secondary settlements; further advice should be obtained if such higher loads are to be considered.

Differential settlement will be likely due to variation in clay thickness/extent as well as due to varying structural loads and supports (e.g. between piled and non-piled elements). This will need to be considered in the development design, e.g. detailing of gravity services and other entry points as well as other parts of the development, noting they will be remaining settlements in the existing roads and filled areas due to that fill.

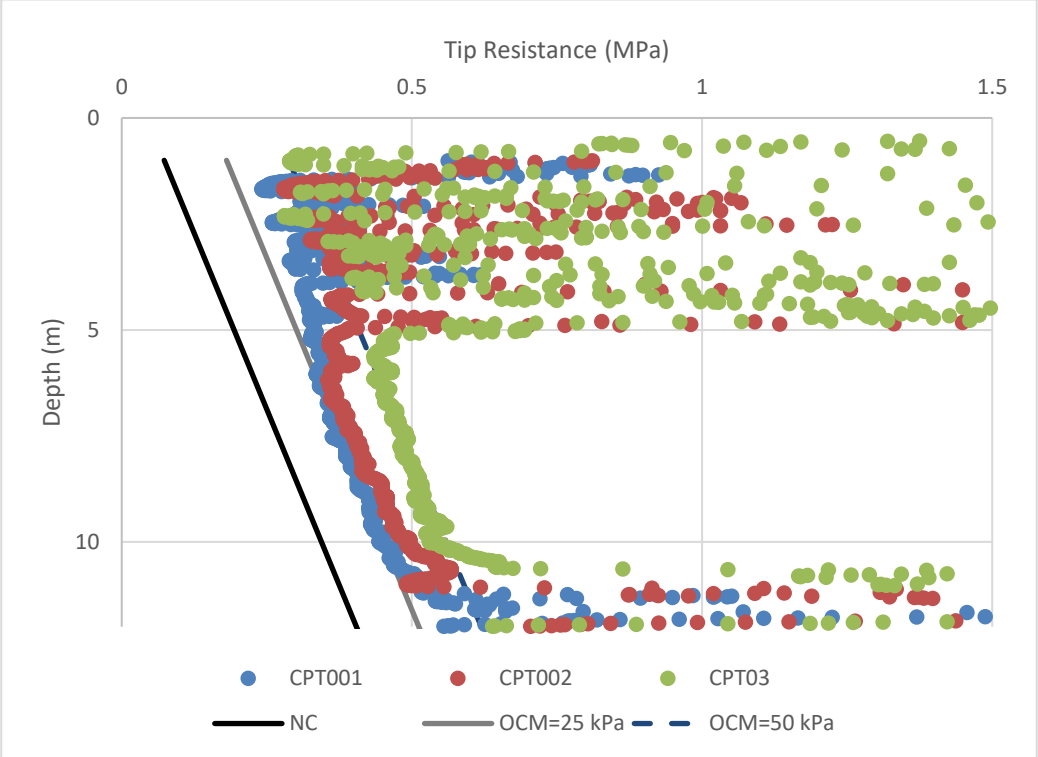


Image 8: Analysis of CPT tip resistance results.

6.6 Retaining Walls

Retaining walls that are free to rotate up to 1 5 of wall height can be designed using an active earth pressure coefficient of 0.4 for existing fill and a passive earth pressure coefficient of 2.0 with a base sliding friction of 20^{O} for cast insitu concrete footings. If a wall is propped or small movements are desired, then at rest pressure coefficient of 0.55 should be used for design. Walls should be designed for surcharge loads by multiplying the surcharge by the earth pressure coefficient. Unless walls are designed for surcharges from compaction equipment, only small hand guided equipment should be used behind walls.

Unless walls are designed for water pressures they should be full drained using 0.2 m width of drainage gravel with an ag-pipe that discharges freely to a legal point of discharge or weep holes.

6.7 Site Classification

This structure it outside the scope of Australian Standard AS 2870-2011 *Residential slabs and footings* but the site classification derived in accordance that standard can provide an indication of the likely magnitude of reactive (shrink and swell) movements associated with normal seasonal soil moisture variations and is required for hydraulic design.

Due to the presence of uncontrolled fill and potential consolidations settlements, the site would be classified *Class P* in accordance with AS 2870-2011. Ground surface movement due to seasonal moisture variation ('y_s' value) for at this site are likely to be negligible due to the presence of surface sands. However, consolidation settlement will be the main ground movement criteria for design (refer Section 6.5). Based on available information, provided there are no large development loads not supported on piles, *Class H1* could be adopted for plumbing design.

6.8 Foundations

Due to the compressible soils with settlement potential as well as the presence of very loose and loose silty sands which may be susceptible to liquefaction under earthquake conditions, the structure will need to be fully suspended on piles.

Driven precast concrete piles are considered suitable, founded in the dense gravel alluvium expected from approximately 32 m to 34 m BGL. Piles driven to set would achieve the full structural capacity of the piles. Driven piles generate vibrations, however as there are no structures close to the site the impacts are expected to be manageable by a competent piling contractor.

Alternatively, CFA piles could be considered, founding in the dense materials at depth. Bored piles are likely to encounter construction difficulty due to the loose/soft soils and groundwater and would be unsuitable. The ultimate geotechnical strengths ($R_{d,ug}$) given in Table 4 may be adopted for the design of CFA piles.

Table 4: Ultimate Geotechnical Strengths ($R_{d,ug}$) for CFA Pile Design.

Strata	Unfactored Ultimate Shaft Adhesion (kPa)	Unfactored Ultimate End Bearing (kPa)
Soft to Firm clays or Loose / Very Loose sands	-	-
Medium Dense sands and Stiff to Hard clays	25	-
Dense to Very Dense sandy gravel	100	1,800

The $R_{d,ug}$ values provided in Table 1 above will need to be multiplied by a suitable geotechnical strength reduction factor (Φ_{gb}) to obtain design geotechnical strength ($R_{d,g}$) of piles in compression and tension. Where no load testing is proposed, and after assessing the design average risk rating (ARR) in accordance with the guidelines presented in AS 2159, a Φ_{gb} value of 0.45 is suggested for preliminary design but higher values may be possible depending on verification testing undertaken.

Where piles are designed to carry tension loads, the shaft adhesion values provided above are to be used, multiplied by a suitable a Φ_{gb} value. Where pile load testing is undertaken on a sufficient number of piles for compression loads the use of higher Φ_{gb} values may be possible, in accordance with AS 2159.

If working stress methods are used in pile design, the $R_{d,ug}$ values should be divided by a factor of safety of 2.5 to calculate the maximum single pile working load.

Piles should be designed and installed by an appropriately experienced contractor and in accordance with AS 2159-2009 (Ref.5).

If any soil conditions encountered during footing construction are found to differ from those noted in the geotechnical investigation, Core should be notified immediately, and further assessment carried out to determine if changes to footing design are required.

All footings should found such that they are not adversely affected by any adjacent excavations batter slopes, trenches, or retaining walls that are not designed to support building loads. To minimise the potential for any adverse interaction effects, footings should found at least below a plane extending 1 m horizontally from the base of trenches/batter slopes/excavations/retaining walls, then rising up at 1V:1H. This requirement is illustrated in Diagram 1.

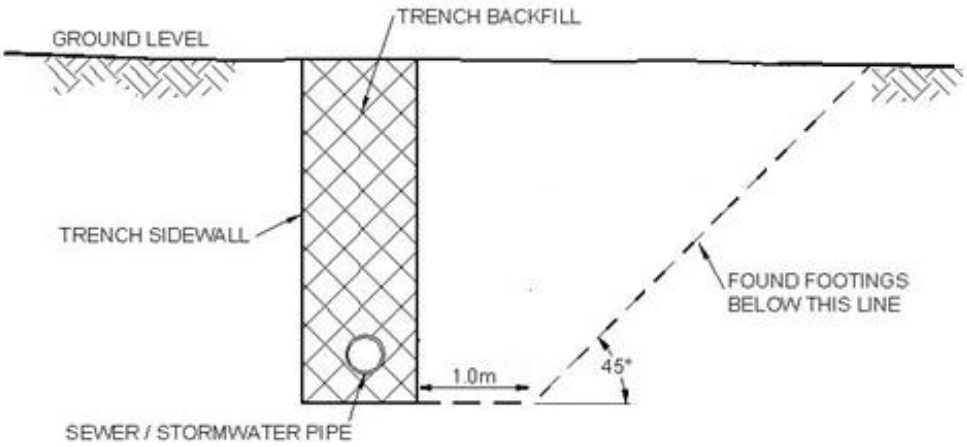


Diagram 1: Exclusion zone for base of footings.

6.9 Site Sub-soil Classification

The shear wave velocities indicated in the geophysical testing are very low, typically about 100 m/s in the upper 8 m then increasing to about 150 m/s; velocities of over 250 m/s were encountered about 16 m BGL. The AS1170.4-2007 *Structural design actions* site subsoil classification for earthquake actions design is considered to be *Class D_e – Deep or soft soil site*, due to the presence of very soft and very loose soils.

6.10 Aggressivity of Soils

Chemical analysis can provide an indication of the potential for long term damage to foundations, buried pipelines, in-ground structures, services and other infrastructure. Soil texture is also important in this regard, as granular soils allow oxygen exchange (oxidation) to occur more readily and are also more permeable.

Australian Standard AS 2159-2009 *Piling - Design and installation* provides the range of exposure classification of the surface of steel piles and concrete piles based on the range of chemical conditions in the soil and the possibility of changes in groundwater levels.

Exposure classifications will be provided on receipt of laboratory testing results, as follows:

- For concrete piles in soil, *Non-aggressive* in accordance with Table 6.4.2(C) of AS 2159-2009
- For steel piles in soil, *Non-aggressive* in accordance with Table 6.5.2(C) of AS 2159-2009.

6.11 Pavements

Design parameters for pavements will depend on the subgrade materials present after earthworks and the type, depth and quality of any fill used (if any) to bring the site to design levels. For the existing fill (e.g. where new fill depth is less than 0.5 m) a design CBR value of 5 % or a modulus of subgrade reaction of 30 kPa/mm could be used for design assuming the pavement subgrades are well drained; where pavements adjoin unsealed areas and landscaping in particular subsoil drains should be installed. If a fill of lower CBR is used then that lower value should be adopted for design. If fill is of higher CBR, then the weighted CBR could be assessed using the Japan Road Rule method; examples of the improvement using CBR 10 or CBR 15 imported fill are shown below in Image 9.

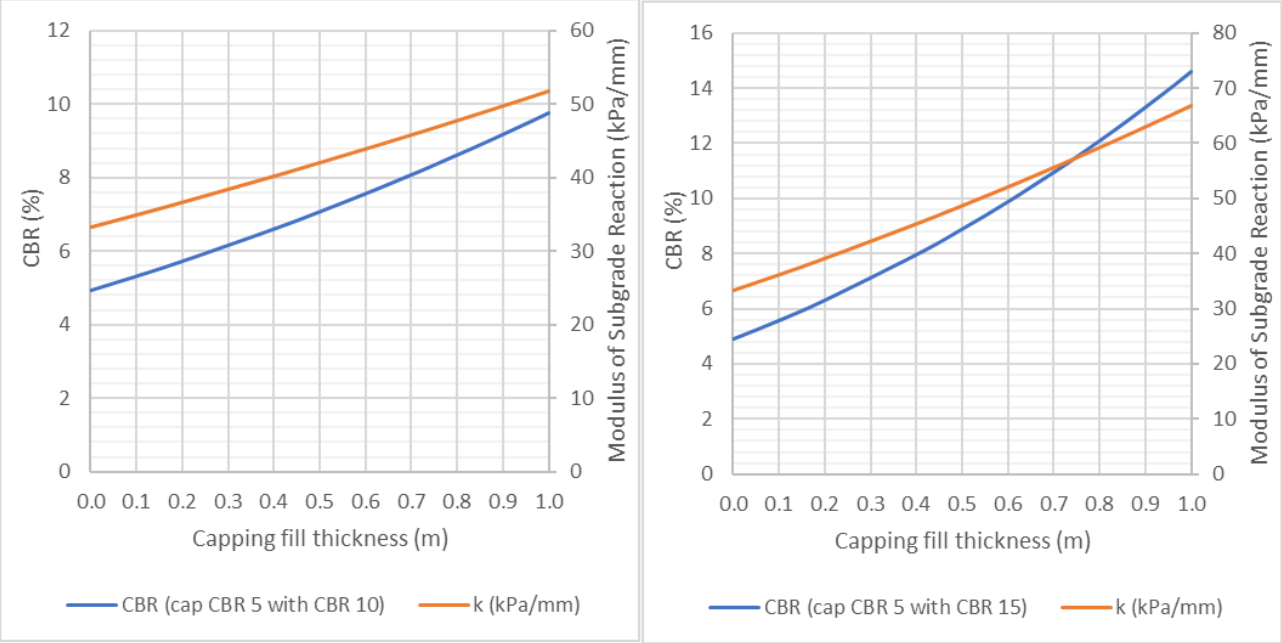


Image 9: Weighted Subgrade CBR values (cap fill of CBR 10 or CBR 15)

Further subgrade evaluation (including further testing) should be undertaken during the construction stage.

7.0 ACID SULFATE SOIL ASSESSMENT

The development of ASS is commonly the result of marine or estuarine deposition of sulfate and iron bearing sediments in the presence of an abundant source of readily decomposable organic matter resulting in the deposition of pyrite. This pyrite is stable within the soil so long as anoxic conditions prevail. Oxidation of this material produces acidic conditions and oxidation typically occurs as the material is exposed above the water table by excavation, and by lowering the water table during dewatering processes.

Previous experience and available guidelines indicate that ASS are normally restricted in extent to recent (Holocene to Pleistocene age) soil horizons deposited in a saline environment below RL 5 m. The National Acid Sulfate Soils sampling and identification methods manual indicates that sites should be investigated for ASS materials if there is any evidence that reasonably suggests that ASS materials may be present in the vicinity, and that these materials may be disturbed. Examples of such evidence may include the following:

- Soil materials disturbance of 100 m^3 or more located within an area mapped with at least a moderate risk of ASS materials occurring within 3 m of the natural soil surface.
- Soil materials disturbance of 100 m^3 or more, with excavation likely from below the natural water table, in an area with at least a moderate risk of ASS materials occurring within 3 m of the natural soil surface, or with at least a moderate risk of ASS materials occurring deeper than 3 m of the natural soil surface.
- Temporary or permanent lowering of the water table in areas mapped with a risk of ASS materials occurring within 3 m of the natural soil surface.

The topography of the site is consistent with the above criteria (i.e. surface elevation below RL 5 m AHD) and the proposed development involves excavations that will exceed the above trigger levels. Due to the proposed excavation works required, an assessment of potential disturbance of ASS is required.

7.1 Investigation Aims

The aims of this investigation were to:

- Conduct an ASS assessment in general accordance with the National Sampling Guidelines.
- Quantitatively identify the presence or absence of ASS across the site.
- If necessary, assess the likely impact of the proposed development on ASS and groundwater.
- If necessary, provide prudent management measures so that the release of acid leachate from disturbed soil and groundwater does not have significant adverse effects on the natural and built environment or human health.

The results of the ASS investigation are set out in the following sections.

7.2 Groundwater Conditions

A groundwater sample was collected from MW01 to MW02 to provide a baseline reading of the groundwater conditions. The following groundwater test results were obtained:

- Neutral conditions (pH 7.11 to 7.33).
- Electrical conductivity reported brackish to saline conditions.
- Alkalinity (Bicarbonate as $CaCO_3$) was reported in groundwater above 200mg/L.
- Chloride was reported in groundwater (MW2) with a concentration of 7,500 mg/L and sodium at 4,300 mg/L.
- Elevated heavy metals were reported including iron, magnesium and potassium. MW02 has moderate levels of magnesium and potassium. This is common in these groundwater environments and potentially due to the high turbidity observed in MW02.

A copy of the groundwater results is provided in Appendix F.

7.3 Preliminary Screening

Results of preliminary screening are summarised in Table D1 (Appendix E).

The mean soil pH (represented by pH_F results) was 8.4, ranging from pH 5.4 to pH 9.3.

The preliminary screening results indicate a low probability of actual (existing) acid sulfate soils (AASS) and a low to moderate potential for potential acid sulfate soils (PASS).

7.4 Quantitative Soils Analysis

Table 5 below shows the ASS action levels adopted in Queensland. These categories are used to identify whether action / management of ASS spoil is required, based on ‘net acidity’. For minor fill works and disturbances of less than 1,000 tonnes, an action criterion of 0.06% S equivalents (36 moles / tonne) is adopted for medium texture soil types. We estimate less than 1000 tonnes of material will be excavated (e.g. stripping, footings, ground slabs, services), therefore, we have adopted < 1000 tonnes as the criteria for this investigation.

Table 5: ASS Action Criteria.

Type of Material		Action Criteria 1-1000 tonnes disturbed		Action Criteria > 1000 tonnes disturbed (and major fill projects)	
		Existing + Potential Acidity		Existing + Potential Acidity	
Texture range McDonald et al. (1990)	Approx clay content (%)	Equivalent sulfur %S oxidisable	Equivalent acid mol H^+/ tonne	Equivalent sulfur %S oxidisable (oven-dry basis)	Equivalent acid mol H^+/ tonne (oven-dry basis)
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 – 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥40	0.10	62	0.03	18

Results of quantitative analysis carried out are summarised in Table D1, attached. Laboratory test certificates are also included in Appendix E.

Results of the 8 samples analysed are summarised below:

- No samples returned Titratable Actual Acidity (TAA) results above the Action Criteria of 36 mol H+/ tonne with all samples provided concentrations ranging between of <2 mole H+/t and 28 mole H+/t.
- Four samples, returned Oxidisable Sulfur as Scr above the Action Criteria of 0.06%S ranging from 0.014 to 0.532%S.
- Seven samples returned pH KCl values exceeding pH 6.5 and as such, these samples were subjected to analysis for acid neutralising capacity (ANC) and reported concentrations ranging up to 498 mole H+/t.
- No samples returned pH KCl value of pH 4.5 and therefore were not tested for retained acidity (S_{NAS}).

Concentrations of acid neutralising capacity (ANC) were high in all seven samples analysed between 186 to 498 mole H+/t. ANC can be an indicator of a natural lime source (e.g. shells) or previous lime treatment. Shells were observed within the dredged spoil. White powder (possible lime) was evident within the test pits carried out on the neighbouring site at 0.3 m depth BGL. For six of the eight samples analysed, net acidity exceeded the relevant QASSIT 'Action Criteria' indicating that management and/or lime neutralisation treatment will be required if these soils are disturbed.

7.5 Extent and Severity

The results from this investigation indicate moderate levels of potential acidity are distributed throughout the soil profile (up to 3.0 m BGL).

The SPP14 Guidelines require that the level of treatment for management of ASS is based on treatment of all existing and potential acidity. The results of the laboratory testing have been accumulated in an Acid-Base Account to give the Net Acidity for each sample in units of mol H^+/tonne as presented in Table E1 (excluding ANC), attached. This value has been calculated from sulfur trail potential acidity (S_{Cr}) plus actual acidity (TAA).

A preliminary liming rate has been calculated in kg $CaCO_3$/t and kg $CaCO_3$/m^3 using a factor of safety (fineness factor) of 1.5 and an assumed bulk density of 1.8 tonne/m^3. Consideration of the tabulated laboratory results indicates that high levels of potential acidity are fairly uniformly distributed throughout the soil profile.

Due to the difficulty in mixing the soft silty clay material and the presence of lime within the dredge spoil fill, it is considered that adoption of a uniform liming rate, not exceeding the 90th percentile of relevant test results for 'net acidity', i.e., 40 kg $CaCO_3/m^3$, will be sufficiently conservative to limit the risk of environmental impact. Soils have been separated into two types the surface Gravelly clay/gravelly sand fill to 0.75m BGL and the lower alluvial Clays and dredging spoil from 0.75 m BGL. Table 6 below provides the recommended liming rates calculated for each soil type.

Table 6: Recommended Liming Rates

Soil Type	Colour	Bottom of Layer, Depth Range	Treatment Rate**
Gravelly Clay /gravelly sand (Fill)	Brown	0.0 – 0.75 m BGL	7 kg $CaCO_3/m^3$
Alluvial Clays / Fill Dredging Spoil	Grey, dark grey	0.75 – 3.0 m BGL*	40 kg $CaCO_3/m^3$ **

Note: * Maximum depth of ASS sampling and analysis
** Liming rate based on 90th percentile values.

7.6 Risk Assessment

As the proposed excavations will intersect soils with potential acidity, there will be a requirement for management of that acidity. Given the anticipated volume of soils that will be disturbed (calculated to be less than 1,000 tonnes) and required lime treatment, management of potential acidity at this site would be classified as H (High) treatment in accordance with Queensland Soil Management Guidelines V4.0 - Table 4.2.

Based on the results of the investigation and the currently proposed earthworks are in discussion to 3.5 m BGL (approximately 1.0m RL), the risk of impact to the surrounding environment is considered moderate. Provided that an ASS MP is prepared for the project and implemented, the environmental risk will be further reduced.

7.7 Recommendations

The results of this investigation indicate there is the likelihood of disturbance of high levels of potential acidity associated with the proposed development. Based on the net acidity values, lime treatment is considered necessary for the proposed excavation works. It is recommended that an ASS management plan (ASS MP) be developed and implemented.

8.0 LIMITATIONS

Should you require any further information please contact the undersigned. We draw your attention to the document, Limitations, which is included in Appendix G.

Core Consultants Pty Ltd

Endoo Anugoolprasert
BEng(Civil)&ESc(Environment) BE(Civil)
Graduate Geotechnical Engineer

Andrew Middleton
BE(Civil) FIEAust EngExec CPEng NER RPEQ 4366
Senior Principal Geotechnical Engineer

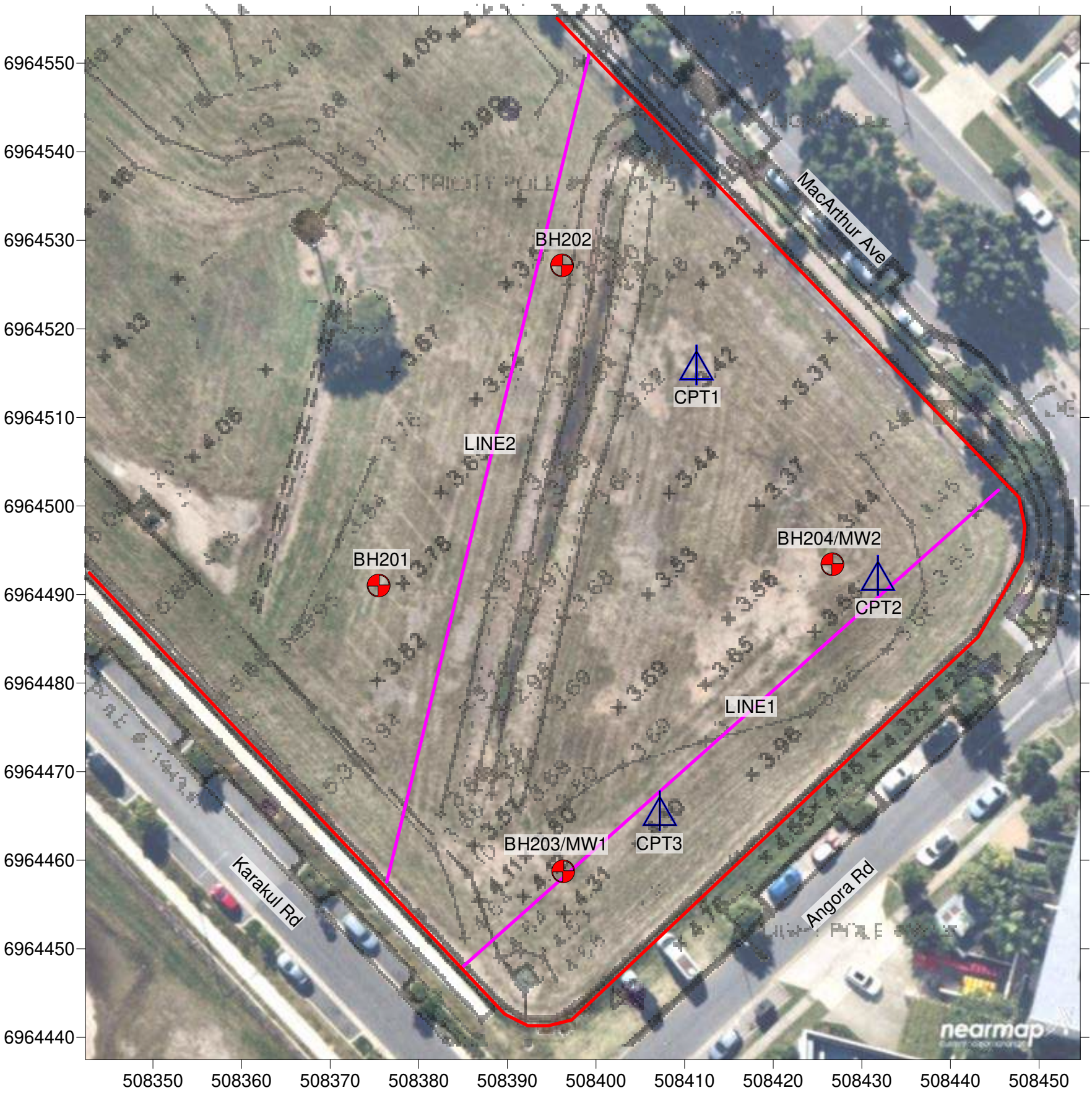
Christie Johnson BEng (Env) MIEAust
Environmental Engineer

Cameron Kay BSc (EnvScience) MEIANZ CEnvP
Director/Principal Environmental Consultant

EA/CJ/AM/CK/ea

A.B.N. 75 603 384 050

Appendix A
Figures



LEGEND

- Approximate borehole testing location
- Approximate property boundary
- Denotes seismic survey lines
- Denotes CPT testing locations

THIS DOCUMENT MUST BE READ IN CONJUCTION WITH CORE DOCUMENT J002479-001-L-Rev0.
BASE IMAGE MAP FROM NEARMAP.COM IMAGE DATED 3 JUNE 2024.

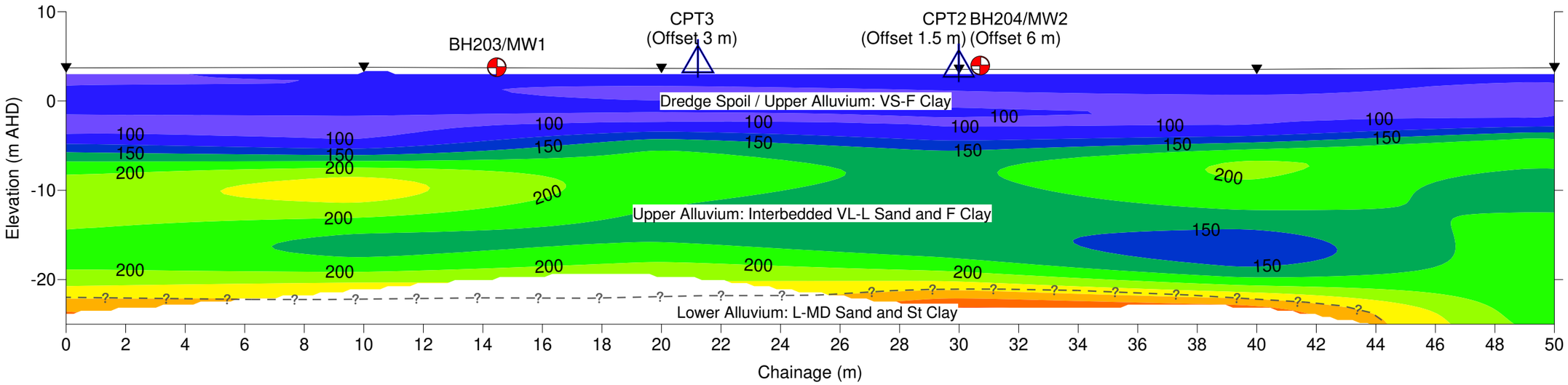
core consultants
clarity • commitment • passion

Scale Bar (m)
0 5 10 15 20

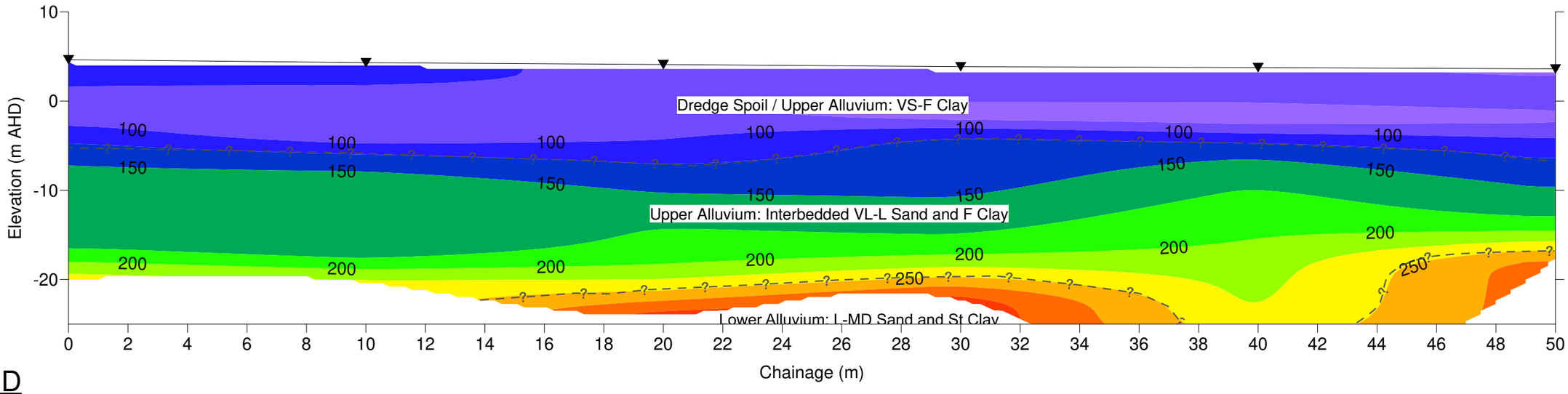
Projection: UTM
Datum: Australian GDA2020 - GRS 1980 / IUGG 1980

DRAWN	DS	CLIENT:	MCNAB BRISBANE PTY LTD
CHECKED		PROJECT:	PROPOSED MULTI-STOREY RESIDENTIAL UNIT DEVELOPMENT MACARTHUR AVENUE HAMILTON
DRAWN DATE	17/07/2024		
CHECKED DATE		TITLE:	SITE PLAN
ORIGINAL SIZE	A3	PROJECT NO.: J002479	FIGURE NO.: 001 REV 0

LINE 1



LINE 2



LEGEND

- APPROXIMATE LOCATION OF BOREHOLE TESTING
- APPROXIMATE LOCATION OF CPT TESTING
- APPROXIMATE CHAINAGE LOCATIONS FOR SEISMIC SURVEY
- DENOTES INFERRED UNIT CHANGE

REFER TO FIGURE 1 FOR SECTION LOCATION

THIS DOCUMENT MUST BE READ IN CONJUCTION WITH CORE DOCUMENT J002476-001-R-Rev0.

Core geophysical services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar circumstances and privy to not only the time limits but financial and physical constraints applicable to the services. MASW is a remote sensing geophysical method that may not detect all subsurface features and anomalies. The depth of the survey is largely dependent on the characteristics of the subsurface conditions, survey parameters and quality of data obtained. Interpreted features such as service utilities, hazards, rock-layer constraints or subsurface soil and/or geology, faults, voids, and other geological hazards have been and can be misinterpreted upon physical sampling. Inversion of MASW data has been implemented to model and characterise subsurface condition and geological structure.

core consultants pty ltd

clarity • commitment • passion

Scale Bar (m)

0 2 4 6

Projection: UTM
Datum: Australian GDA2020 - GRS 1980 / IUGG 1980

DRAWN	DS	CLIENT: MCNAB		
CHECKED	BH	PROJECT: PROPOSED MULTI-STOREY RESIDENTIAL UNIT DEVELOPMENT MACARTHUR AVENUE HAMILTON		
DATE	15/07/2024			
SCALE	AS SHOWN	TITLE: MASW SECTIONS: LINES 1 AND 2		
ORIGINAL SIZE	A3	PROJECT NO: J002479	FIGURE NO: 002	REV: 0

Appendix B
Reports of Boreholes
Explanatory Notes

REPORT OF BOREHOLE: BH201

Client	: McNab	East	: 508,369.05	Sheet	: 1 OF 1
Project	: Proposed Unit Development	North	: 6,964,499.04 56J	Logged	: Endoo Anugoolprasert
Location	: 280 MacArthur Avenue, Hamilton	Contractor	: All-Tech Drilling	Logged Date	04/07/2024
Job No	: J002479	Drill Rig	: 5.5T Excavator	Checked	:
		Inclination	:	Checked Date	: 31/07/2024

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (meters)	DEPTH RL	SAMPLE OR FIELD TEST	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE DESCRIPTION	CONSISTENCY DENSITY
ADT	L		0.25				CI	FILL Sandy to gravelly CLAY: fine sized gravel, fine to medium grained sand, medium plasticity, brown and dark brown.	w ≈ PL	F-St
			0.5				CI	Brown and orange-brown.		St
			0.75		BDS: 0.5-1.0		SC	FILL Clayey to gravelly SAND: fine grained, fine sized gravel, low plasticity clay, yellow-brown.	M	MD
			1				CL-CI	FILL Sandy to gravelly CLAY: fine sized gravel, fine to medium grained sand, low to medium plasticity, brown.	w ≈ PL	St
			1.1				CH	FILL Silty CLAY: trace fine grained sand, high plasticity, grey.		
		▶			SPT 2,2,1 (N=3)		CH	FILL Sandy CLAY: fine grained sand, high plasticity, grey.		S
			2				SM	FILL Silty SAND: fine to medium grained, with low plasticity clay, grey, trace shells.	W	L
			3		SPT 1,1,1 (N=2)					
			4		SPT 0,0,0 (N=0)					
					Shear Vane: 16 kPa			**BH201 Terminated at 4.45m**		

DCP TEST (Blows per 100 mm)

0 5 10 15 20 25 30

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF BOREHOLE: BH202

core consultants pty ltd

Client	: McNab	East	: 508,391.67	Sheet	: 1 OF 1
Project	: Proposed Unit Development	North	: 6,964,538.24 56J	Logged	: Endoo Anugoolprasert
Location	: 280 MacArthur Avenue, Hamilton	Contractor	: All-Tech Drilling	Logged Date	04/07/2024
Job No	: J002479	Drill Rig	: 4WD Mounted Auger Rig	Checked	:
		Inclination	:	Checked Date	: 31/07/2024

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (meters)	DEPTH RL	SAMPLE OR FIELD TEST	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE DESCRIPTION	CONSISTENCY DENSITY	DCP TEST (Blows per 100 mm)
ADT	L	▶	0.2				SC	FILL Clayey to gravelly SAND: fine to coarse grained, fine sized gravel, low to medium plasticity clay, brown and grey.	M	MD	
			0.6				CI-CH	FILL Sandy CLAY: fine to medium grained sand, medium to high plasticity, grey.	w ≈ PL	St	
			1		SPT 2,1,0 (N=1)		CH	Fine grained sand, high plasticity, grey with orange-brown.			
			2								
			2.5		Shear Vane: 37 kPa		SM	FILL Silty SAND: fine to medium grained, trace low to medium plasticity clay, grey.	W	VL-L	
			3		SPT 1,1,1 (N=2)		CH	FILL Silty CLAY: trace fine grained sand, high plasticity, grey and dark grey.	w ≈ PL	S-F	
			3		Shear Vane: 8 kPa						
			4		SPT 0,0,0 (N=0)						
					Shear Vane: 18 kPa						
								BH202 Terminated at 4.45m			

DCP TEST (Blows per 100 mm): 0 5 10 15 20 25 30

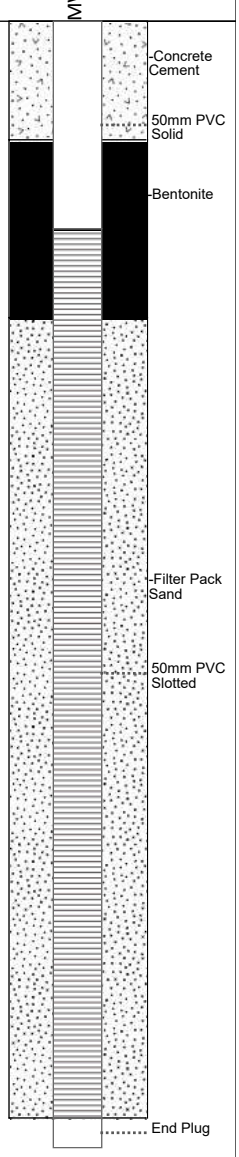
This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF BOREHOLE: BH203/MW1

Client	: McNab	East	: 508,391.78	Sheet	: 1 OF 1
Project	: Proposed Unit Development	North	: 6,964,464.16 56J	Logged	: Endoo Anugoolprasert
Location	: 280 MacArthur Avenue, Hamilton	Contractor	: All-Tech Drilling	Logged Date	04/07/2024
Job No	: J002479	Drill Rig	: 4WD Mounted Auger Rig	Checked	:
		Inclination	:	Checked Date	: 01/08/2024

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (meters)	DEPTH RL	SAMPLE OR FIELD TEST	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE DESCRIPTION	CONSISTENCY DENSITY
ADT	L	▼	0.25	3			SC	FILL Clayey to gravelly SAND: fine to coarse grained, fine sized gravel, low plasticity clay, brown.	M	MD
			0.5				CI	FILL Sandy CLAY: fine to coarse grained sand, with fine sized gravel, medium plasticity, brown and orange-brown.	w ≈ PL	St-VSt
			1				CI	FILL Silty to sandy CLAY: fine to coarse grained sand, with fine sized gravel, medium plasticity, yellow-brown.		St
			1		SPT 4,4,3 (N=7)		SC	FILL Clayey SAND: medium to coarse grained, low plasticity clay, brown.	M	MD
			1.2				CI	FILL Sandy CLAY: fine to medium grained sand, medium plasticity, brown.	w ≈ PL	St
			1.5	2			CI	Brown and orange-brown and black.	w > PL	
			2				CI	And grey, trace shells.		
			2.25				CI-CH	FILL Silty CLAY: with fine grained sand, medium to high plasticity, grey, trace shells.		S
			2.5	1	SPT 0,2,5 (N=7)		SM	FILL Silty SAND: fine to coarse grained, trace low plasticity clay, grey, trace shells.	W	L-MD
			3	0						
			4		SPT 1,0,1 (N=1)					
					Shear Vane: 20 kPa					
				-1				**BH203/MW1 Terminated at 4.45m**		

WELL DIAGRAM



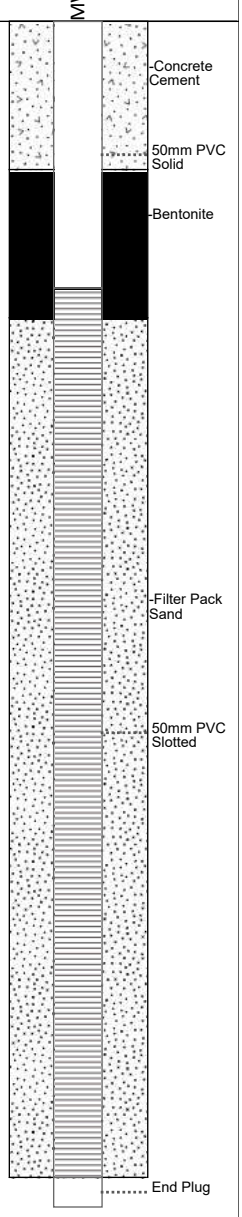
This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF BOREHOLE: BH204/MW2

Client	: McNab	East	: 508,424.94	Sheet	: 1 OF 1
Project	: Proposed Unit Development	North	: 6,964,501.85 56J	Logged	: Endoo Anugoolprasert
Location	: 280 MacArthur Avenue, Hamilton	Contractor	: All-Tech Drilling	Logged Date	04/07/2024
Job No	: J002479	Drill Rig	: 4WD Mounted Auger Rig	Checked	:
		Inclination	:	Checked Date	: 01/08/2024

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (meters)	DEPTH RL	SAMPLE OR FIELD TEST	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE DESCRIPTION	CONSISTENCY DENSITY
ADT	L	▶	0.75	3.45			SC	FILL Clayey to gravelly SAND: fine to medium grained, fine to medium sized gravel, low plasticity clay, brown.	M	D-VD
			1	3			CI-CH	FILL Silty to sandy CLAY: fine to medium grained sand, medium to high plasticity, brown and grey and orange-brown.	w ≈ PL	St
			1.25	2.75	SPT 0,1,2 (N=3)		CH	FILL Silty CLAY: trace fine grained sand, high plasticity, grey.		F-St
		▼	2.2	2			CL-CI	FILL Sandy CLAY: fine to medium grained sand, low to medium plasticity, grey.		S-F
			3	1	SPT 0,0,1 (N=1)		CI-CH	FILL Silty to sandy CLAY: fine grained sand, medium to high plasticity, grey, trace shells.		F-St
					Shear Vane: 15 kPa					
			4	0	SPT 0,1,2 (N=3)		CH	FILL Silty CLAY: trace fine grained sand, high plasticity, grey.		F
				-1	Shear Vane: 15 kPa			**BH204/MW2 Terminated at 4.45m**		

WELL DIAGRAM — MW2



This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V - Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
T	TC - Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatubre Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

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 equipment used

H **High resistance to penetration/excavation**. Further penetration is possible at a slow rate

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

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

WATER

▽	Water level shown at date	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	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.
GROUND WATER NOT ENCOUNTERED	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.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed Sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (sv = peak value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Dynamic cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

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 Quantity Designation (%)

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

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

FILL	CLAY (CL,CI, or CH)
GRAVEL (GP or SW)	ORGANIC SOILS (OL or OH or Pt)
SAND (SP or SW)	COBBLES or BOULDERS
SILT (ML or MH)	

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

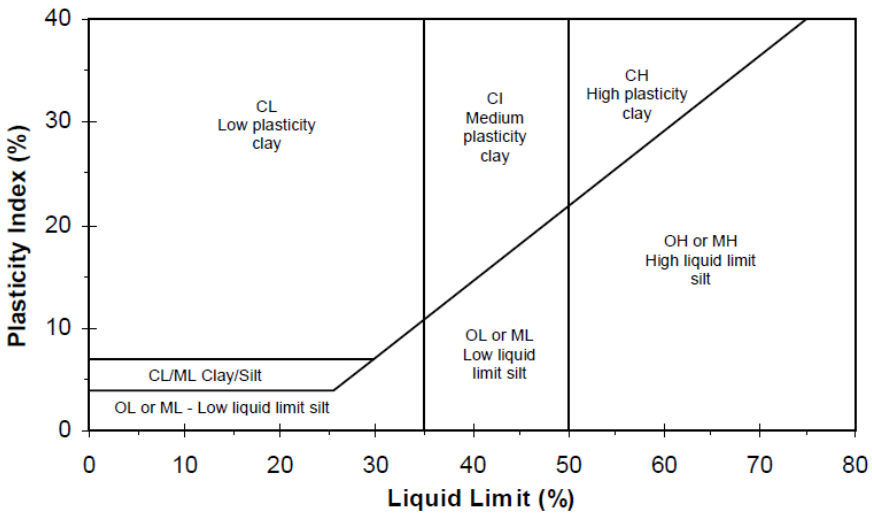
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS 1726 - 2017. The material properties are assessed in the field by visual/tactile methods.

PARTICLE SIZE

Major Division	Sub Division	Particle Size
Boulders		>200 mm
Cobbles		63 - 200 mm
Gravel	Coarse	20 - 63 mm
Gravel	Medium	6.7 - 20 mm
Gravel	Fine	2.36 - 6.7 mm
Sand	Coarse	0.6 - 2.36 mm
Sand	Medium	0.21 - 0.6 mm
Sand	Fine	0.075 - 0.21 mm
Silt		0.002 - 0.075 mm
Clay		<0.002 mm

PLASTIC PROPERTIES



MOISTURE CONDITION FOR COARSE GRAINED SOIL — AS 1726 - 2017

Symbol	Term	Description
D	Dry	Non-cohesive and free running
M	Moist	Soil feels cool, darkened in colour, tends to stick together
W	Wet	Soil feels cool, darkened in colour, soil sticks together, free water forms when handling

MOISTURE CONDITION FOR FINE GRAINED SOIL — AS1726 - 2017

Symbol	Term	Description
W<PL	Moist dry of liquid limit	Hard and friable or powdery
W = PL	Moist near plastic limit	Soils can be molded at a moisture condition approximately equal to the plastic limit
W >PL	Moist, wet of plastic limit	Soils usually weakened and free water forms on hands when handling
W = LL	Wet near plastic limit	
W > LL	Wet, wet of liquid limit	

CONSISTENCY TERMS FOR COHESIVE SOILS — AS1726—2017

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

RELATIVE DENSITY OF COARSE GRAINED SOILS — AS1726—2017

Symbol	Term	Density Index %	SPT 'N' #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

ROCK MATERIAL STRENGTH CLASSIFICATION				AS1726—2017
Symbol	**Term**	**Uniaxial Compressive Strength (MPa)**	**Point Load Strength $I_{s\ (50)}$ (MPa)**	**Field Guide**
VL	Very Low Strength	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick. Pieces up to 30 mm thick can be broken with finger pressure.
L	Low Strength	2 to 6	0.1 to 0.3	Easily scored with knife. Indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point. A piece of core 150 mm by 50 mm may be broken by hand. Sharp edges of core are friable and break during handling.
M	Medium Strength	6 to 20	0.3 to 1	Readily scored with a knife. A piece of core 150 mm by 50 mm can be broken by hand with difficulty.
H	High Strength	20 to 60	1 to 3	A piece of core 150 mm by 50 mm cannot be broken by hand but can be broken by a pick with a single firm blow. Rock rings under hammer.
VH	Very High Strength	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow. Rock rings under hammer.
EH	Extremely High Strength	Above 200	Above 10	Specimen requires many blows with geological pick to break through intact material. Rock rings under hammer.

● = Diametral Point Load Test ▼ = Axial Point Load Test

CLASSIFICATION OF MATERIAL WEATHERING		AS1726—2017
Symbol	**Term**	**Field Guide**
RS	Residual Soil *(Note 1)*	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible but the soil has not been significantly transported.
XW	Extremely Weathered *(Note 1)*	Material is weathered to such an extent that is has soil properties. Mass structure and material texture and fabric of original rock are still visible.
HW	Highly Weathered *(Note 2)*	The whole rock mass is discoloured, usually by iron staining or beaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
MH	Moderately Weathered *(Note 2)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change in strength from fresh rock.
SW	Slightly Weathered	Pock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR	Fresh	Rock shows no signs of decomposition of individual minerals or colour change.
Note 1	The term 'Extremely Weathered rock' is misleading as the material has soil properties. The word 'rock' should be replaced with the name of the original rock of the word 'material', eg. Extremely Weathered granite or Extremely Weathered material.	
Note 2	Where it is not possible to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock the term 'Distinctly Weathered' may be used.	

DEFECT TYPE/DESCRIPTION			
B	Bedding Parting	V	Vein
J	Joint	HB/DB	Handling/Drilling Break
EW	Extremely Weathered Seam	C	Contact
FZ	Fracture Zone	L	Cleavage
CZ/S	Crushed Zone/Seam	X	Foliation
IS	Infilled Seam	S	Schistocity
SZ/S	Sheared Zone/Seam		

DEFECT PROFILE	
Symbol	**Description**
PL	Planar
St	Stepped
Un	Undulating

DEFECT INFILL DESCRIPTION	
Symbol	**Description**
Cn	Clean: No visible coating
Sn	Stain: Coated 1 to 3 mm
Vr	Veneer: < 1 mm
Ct	Coating: 1 to 3 mm

DEFECT ROUGHNESS DESCRIPTION	
Symbol	**Description**
Sl	Slickenside
Sm	Smooth
Ro	Rough

Vertical Boreholes - The dip (inclination from horizontal) for the defect is given.

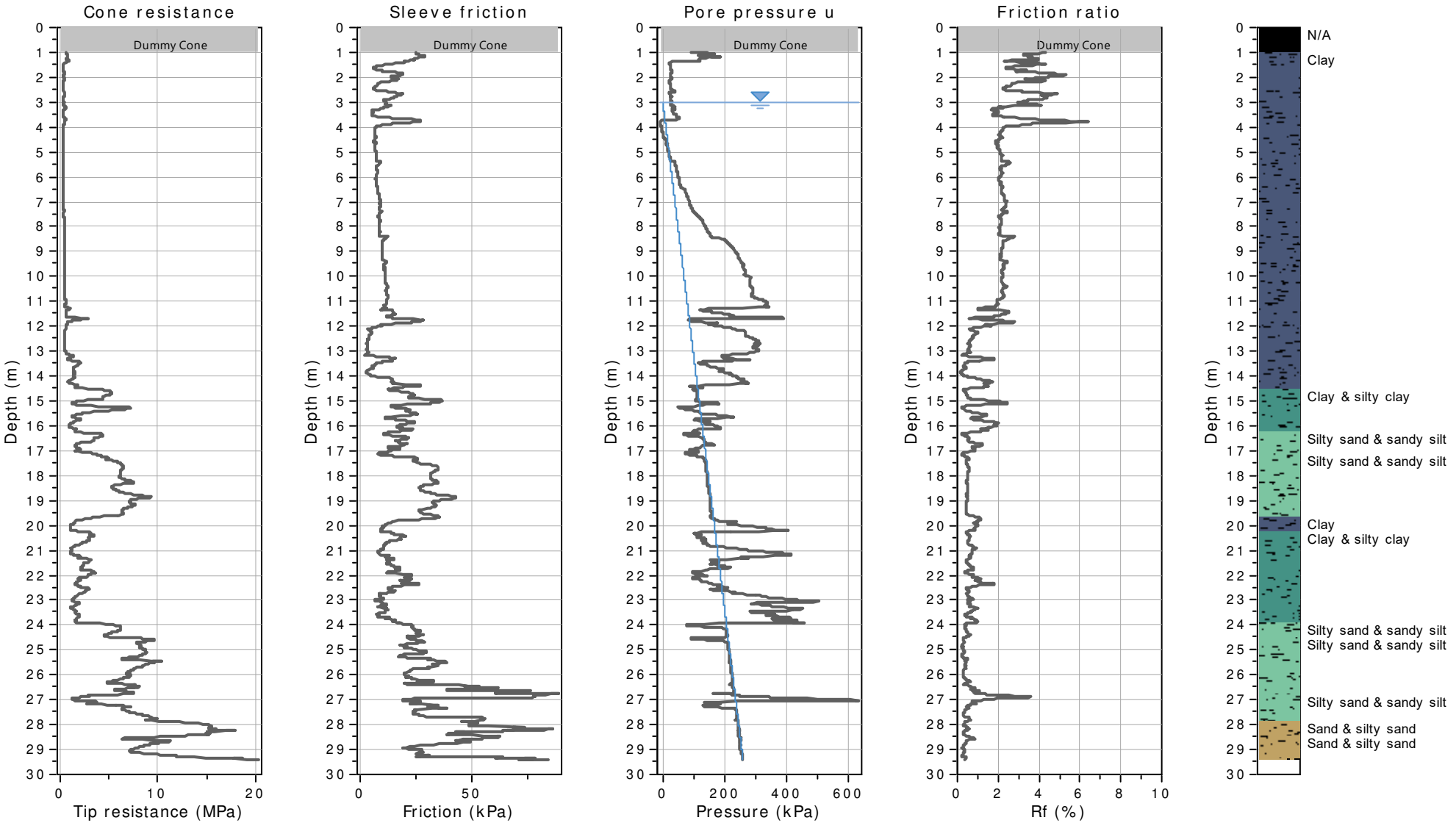
Inclined Boreholes - The inclination is measured as the acute angle to the core axis.

Appendix C
Cone Penetration Test Results

Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT01
Total depth: 29.41 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

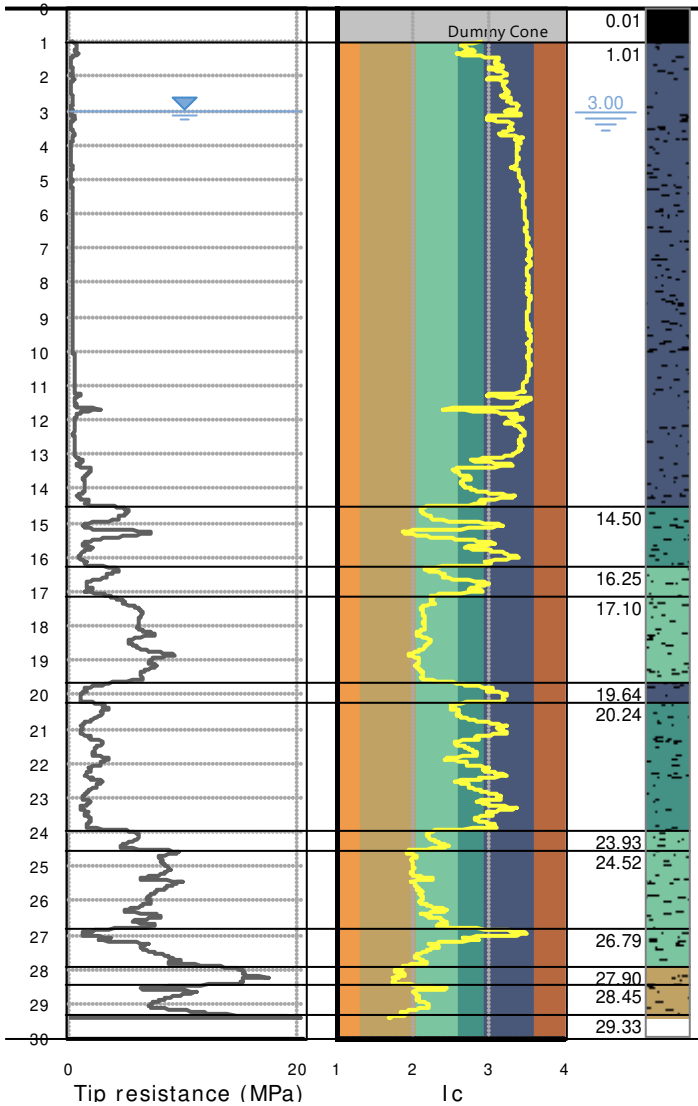
Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



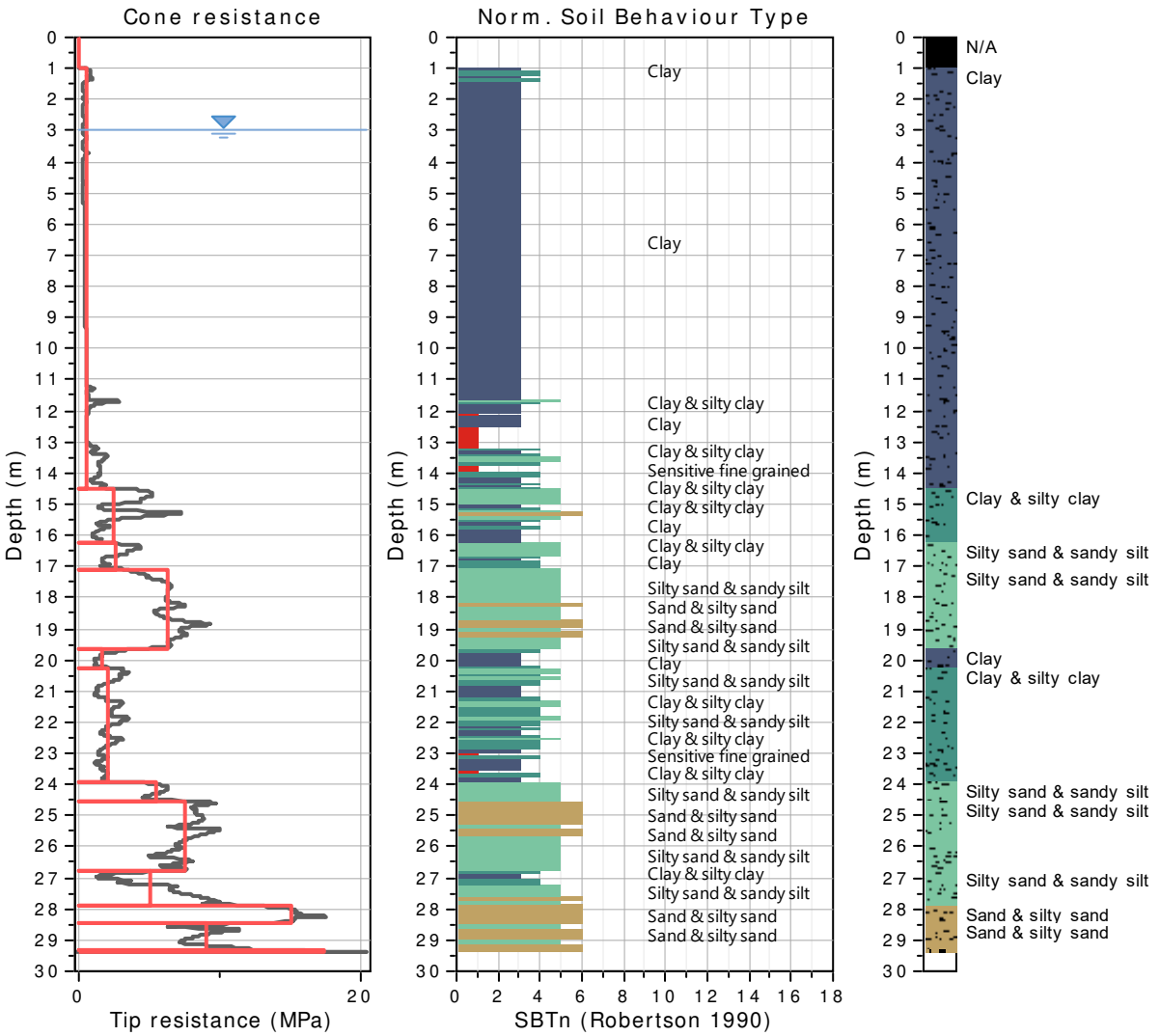
Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT01
Total depth: 29.41 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.01	N/A	-	1.43E-8	2.0	-	-	-	3.0	13.4	26.8	1.3	6.1	19.0
1.01	Clay	0.5	-	3.1	-	-	-	1.3	21.6	24.3	0.3	1.3	19.0
14.50	Clay & silty clay	2.5	7.94E-8	10.2	-	-	-	14.8	55.3	84.5	0.5	2.3	19.0
16.25	Silty sand & sandy silt	2.6	1.16E-7	10.2	46.1	35.1	32.0	17.3	54.4	-	-	-	19.0
17.10	Silty sand & sandy silt	6.2	2.87E-6	18.4	63.3	38.8	32.5	47.1	80.6	-	-	-	19.0
19.64	Clay	1.7	6.85E-9	8.6	-	-	-	6.4	50.8	83.9	0.4	1.8	19.0
20.24	Clay & silty clay	2.0	1.72E-8	9.6	-	-	-	9.6	54.6	101.2	0.4	2.0	19.0
23.93	Silty sand & sandy silt	5.4	9.09E-7	17.8	65.8	35.6	32.0	39.7	83.6	-	-	-	19.0
24.52	Silty sand & sandy silt	7.6	3.04E-6	22.2	75.5	38.0	32.4	56.8	96.2	-	-	-	19.0
26.79	Silty sand & sandy silt	5.1	2.62E-7	19.0	81.7	37.8	32.4	31.8	94.8	-	-	-	19.0
27.90	Sand & silty sand	15.0	2.75E-5	36.0	103.5	48.1	35.4	116.0	131.9	-	-	-	19.0
28.45	Sand & silty sand	9.0	3.93E-6	25.8	86.1	38.8	32.7	67.9	109.7	-	-	-	19.0
29.33	Sand & silty sand	17.4	3.32E-5	40.9	116.1	50.4	36.0	133.5	147.9	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Layer_1 Start depth: 0.01 (m), End depth: 1.01 (m)

Description: N/A

Basic results

Total cone resistance: 0.00 ±0.04 MPa

Sleeve friction: 9309.79 ±19208.24 kPa

Ic: 0.00 ±0.29

σ_v': 7.29 ±6.07 kPa

SBT_n: 0

SBT description: N/A

Schneider zone: N/A

Schneider desc.: N/A

Estimation results

Permeability: 1.43E-08 ±1.43E-08 m/s

N_{60}: 2.00 ±2.00 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 3.00 ±3.00 MPa

Go: 13.41 ±13.41 MPa

Su: 26.82 ±26.82 kPa

Su ratio: 1.32 ±1.32

O.C.R.: 6.08 ±6.08

.:: Layer No: 2 ::.

Code: Layer_2 Start depth: 1.01 (m), End depth: 14.50 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 0.49 ±0.38 MPa	Permeability: 0.00E+00 ±3.19E-08 m/s	Constrained Mod.: 1.29 ±3.09 MPa
Sleeve friction: 9.17 ±5.23 kPa	N_{60}: 3.10 ±1.54 blows	Go: 21.60 ±7.76 MPa
Ic: 3.31 ±0.26	Es: 0.00 ±0.00 MPa	Su: 24.32 ±19.64 kPa
σ_v': 90.02 ±39.30 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.27 ±0.33
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.26 ±1.51
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 3 ::.

Code: Layer_3 Start depth: 14.50 (m), End depth: 16.25 (m)

Description: Clay & silty clay

Basic results	Estimation results	
Total cone resistance: 2.47 ±1.90 MPa	Permeability: 7.94E-08 ±3.84E-06 m/s	Constrained Mod.: 14.77 ±16.52 MPa
Sleeve friction: 20.28 ±6.07 kPa	N_{60}: 10.18 ±3.61 blows	Go: 55.26 ±9.17 MPa
Ic: 2.61 ±0.46	Es: 0.00 ±0.00 MPa	Su: 84.51 ±30.30 kPa
σ_v': 170.57 ±4.68 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.49 ±0.19
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 2.26 ±0.86
SBTn description: Clay & silty clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 4 ::.

Code: Layer_4 Start depth: 16.25 (m), End depth: 17.10 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 2.57 ±1.03 MPa	Permeability: 1.16E-07 ±7.88E-07 m/s	Constrained Mod.: 17.30 ±8.64 MPa
Sleeve friction: 15.53 ±3.65 kPa	N_{60}: 10.18 ±2.10 blows	Go: 54.38 ±5.55 MPa
Ic: 2.58 ±0.28	Es: 46.06 ±3.23 MPa	Su: 0.00 ±0.00 kPa
σ_v': 182.57 ±2.29 kPa	Dr (%): 35.15 ±1.47	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.00 ±0.00 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 5 ::.

Code: Layer_5 Start depth: 17.10 (m), End depth: 19.64 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 6.25 ±1.13 MPa	Permeability: 2.87E-06 ±1.82E-06 m/s	Constrained Mod.: 47.14 ±8.97 MPa
Sleeve friction: 29.39 ±6.75 kPa	N_{60}: 18.42 ±2.49 blows	Go: 80.64 ±8.54 MPa
Ic: 2.13 ±0.08	Es: 63.28 ±6.70 MPa	Su: 0.00 ±0.00 kPa
σ_v': 198.05 ±6.78 kPa	Dr (%): 38.76 ±2.20	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.52 ±0.52 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 6 ::.

Code: Layer_6 Start depth: 19.64 (m), End depth: 20.24 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 1.66 ±0.92 MPa	Permeability: 6.85E-09 ±6.92E-08 m/s	Constrained Mod.: 6.44 ±9.03 MPa
Sleeve friction: 15.02 ±9.69 kPa	N_{60}: 8.64 ±2.69 blows	Go: 50.79 ±14.01 MPa
Ic: 2.99 ±0.23	Es: 0.00 ±0.00 MPa	Su: 83.89 ±53.54 kPa
σ_v': 212.58 ±1.63 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.40 ±0.26
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.83 ±1.22
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 7 ::.

Code: Layer_7 Start depth: 20.24 (m), End depth: 23.93 (m)

Description: Clay & silty clay

Basic results	Estimation results	
Total cone resistance: 2.03 ±0.66 MPa	Permeability: 1.72E-08 ±7.29E-08 m/s	Constrained Mod.: 9.64 ±7.18 MPa
Sleeve friction: 12.95 ±4.39 kPa	N_{60}: 9.60 ±1.76 blows	Go: 54.62 ±7.86 MPa
Ic: 2.86 ±0.22	Es: 0.00 ±0.00 MPa	Su: 101.24 ±37.25 kPa
σ_v': 232.10 ±9.83 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.43 ±0.17
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 2.01 ±0.79
SBTn description: Clay & silty clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 8 ::.

Code: Layer_8 Start depth: 23.93 (m), End depth: 24.52 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 5.43 ±0.76 MPa	Permeability: 9.09E-07 ±6.71E-07 m/s	Constrained Mod.: 39.69 ±6.05 MPa
Sleeve friction: 23.72 ±2.70 kPa	N_{60}: 17.76 ±1.43 blows	Go: 83.61 ±3.69 MPa
Ic: 2.30 ±0.11	Es: 65.82 ±2.50 MPa	Su: 0.00 ±0.00 kPa
σ_v': 251.97 ±1.61 kPa	Dr (%): 35.59 ±0.64	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.00 ±0.00 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 9 ::.

Code: Layer_9 Start depth: 24.52 (m), End depth: 26.79 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 7.59 ±1.14 MPa	Permeability: 3.04E-06 ±3.56E-06 m/s	Constrained Mod.: 56.79 ±9.18 MPa
Sleeve friction: 28.65 ±14.76 kPa	N_{60}: 22.25 ±2.07 blows	Go: 96.16 ±11.29 MPa
Ic: 2.12 ±0.15	Es: 75.46 ±8.86 MPa	Su: 0.00 ±0.00 kPa
σ_v': 265.04 ±6.06 kPa	Dr (%): 37.98 ±2.21	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.37 ±0.52 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 2		
Schneider desc.: Essentially drained sands		

.:: Layer No: 10 ::.

Code: Layer_10 Start depth: 26.79 (m), End depth: 27.90 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 5.13 ±3.05 MPa	Permeability: 2.62E-07 ±2.88E-06 m/s	Constrained Mod.: 31.77 ±26.95 MPa
Sleeve friction: 34.31 ±19.01 kPa	N_{60}: 18.97 ±6.07 blows	Go: 94.82 ±19.11 MPa
Ic: 2.45 ±0.47	Es: 81.73 ±9.30 MPa	Su: 0.00 ±0.00 kPa
σ_v': 280.63 ±2.98 kPa	Dr (%): 37.80 ±2.37	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.35 ±0.58 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 11 ::.

Code: Layer_11 Start depth: 27.90 (m), End depth: 28.45 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 15.04 ±1.13 MPa	Permeability: 2.75E-05 ±1.08E-05 m/s	Constrained Mod.: 115.99 ±9.00 MPa
Sleeve friction: 55.15 ±13.92 kPa	N_{60}: 35.96 ±2.31 blows	Go: 131.86 ±9.63 MPa
Ic: 1.81 ±0.06	Es: 103.47 ±7.56 MPa	Su: 0.00 ±0.00 kPa
σ_v': 288.27 ±1.50 kPa	Dr (%): 48.13 ±1.71	Su ratio: 0.00 ±0.00
SBT_n: 6	φ (degrees): 35.35 ±0.49 °	O.C.R.: 0.00 ±0.00
SBTn description: Sand & silty sand	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 12 ::.

Code: Layer_12 Start depth: 28.45 (m), End depth: 29.33 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 9.05 ±1.81 MPa	Permeability: 3.93E-06 ±5.37E-06 m/s	Constrained Mod.: 67.90 ±14.49 MPa
Sleeve friction: 34.64 ±13.81 kPa	N_{60}: 25.83 ±3.38 blows	Go: 109.72 ±11.60 MPa
Ic: 2.09 ±0.13	Es: 86.10 ±9.10 MPa	Su: 0.00 ±0.00 kPa
σ_v': 294.83 ±2.37 kPa	Dr (%): 38.78 ±2.91	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.65 ±0.73 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 13 ::.

Code: Layer_13 Start depth: 29.33 (m), End depth: 29.41 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 17.39 ±2.24 MPa	Permeability: 3.32E-05 ±1.94E-05 m/s	Constrained Mod.: 133.46 ±16.27 MPa
Sleeve friction: 72.46 ±6.27 kPa	N_{60}: 40.87 ±3.36 blows	Go: 147.93 ±6.06 MPa
Ic: 1.78 ±0.08	Es: 116.08 ±4.76 MPa	Su: 0.00 ±0.00 kPa
σ_v': 299.25 ±0.25 kPa	Dr (%): 50.42 ±2.18	Su ratio: 0.00 ±0.00
SBT_n: 6	φ (degrees): 35.99 ±0.61 °	O.C.R.: 0.00 ±0.00
SBTn description: Sand & silty sand	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_0 (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.01 1.01	1.00	1.43E-08 (±1.43E-08)	2.0 (±2.0)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	3.0 (±3.0)	13.4 (±13.4)	26.8 (±26.8)	1.3 (±1.3)	6.1 (±6.1)	19.0 (±0.0)
1.01 14.50	13.49	0.00E+00 (±3.19E-08)	3.1 (±1.5)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	1.3 (±3.1)	21.6 (±7.8)	24.3 (±19.6)	0.3 (±0.3)	1.3 (±1.5)	19.0 (±0.0)
14.50 16.25	1.75	7.94E-08 (±3.84E-06)	10.2 (±3.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	14.8 (±16.5)	55.3 (±9.2)	84.5 (±30.3)	0.5 (±0.2)	2.3 (±0.9)	19.0 (±0.0)
16.25 17.10	0.85	1.16E-07 (±7.88E-07)	10.2 (±2.1)	46.1 (±3.2)	35.1 (±1.5)	32.0 (±0.0)	17.3 (±8.6)	54.4 (±5.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
17.10 19.64	2.54	2.87E-06 (±1.82E-06)	18.4 (±2.5)	63.3 (±6.7)	38.8 (±2.2)	32.5 (±0.5)	47.1 (±9.0)	80.6 (±8.5)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
19.64 20.24	0.60	6.85E-09 (±6.92E-08)	8.6 (±2.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	6.4 (±9.0)	50.8 (±14.0)	83.9 (±53.5)	0.4 (±0.3)	1.8 (±1.2)	19.0 (±0.0)
20.24 23.93	3.69	1.72E-08 (±7.29E-08)	9.6 (±1.8)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	9.6 (±7.2)	54.6 (±7.9)	101.2 (±37.2)	0.4 (±0.2)	2.0 (±0.8)	19.0 (±0.0)
23.93 24.52	0.59	9.09E-07 (±6.71E-07)	17.8 (±1.4)	65.8 (±2.5)	35.6 (±0.6)	32.0 (±0.0)	39.7 (±6.0)	83.6 (±3.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
24.52 26.79	2.27	3.04E-06 (±3.56E-06)	22.2 (±2.1)	75.5 (±8.9)	38.0 (±2.2)	32.4 (±0.5)	56.8 (±9.2)	96.2 (±11.3)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
26.79 27.90	1.11	2.62E-07 (±2.88E-06)	19.0 (±6.1)	81.7 (±9.3)	37.8 (±2.4)	32.4 (±0.6)	31.8 (±26.9)	94.8 (±19.1)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
27.90 28.45	0.55	2.75E-05 (±1.08E-05)	36.0 (±2.3)	103.5 (±7.6)	48.1 (±1.7)	35.4 (±0.5)	116.0 (±9.0)	131.9 (±9.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
28.45 29.33	0.88	3.93E-06 (±5.37E-06)	25.8 (±3.4)	86.1 (±9.1)	38.8 (±2.9)	32.7 (±0.7)	67.9 (±14.5)	109.7 (±11.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)

Summary table of mean values

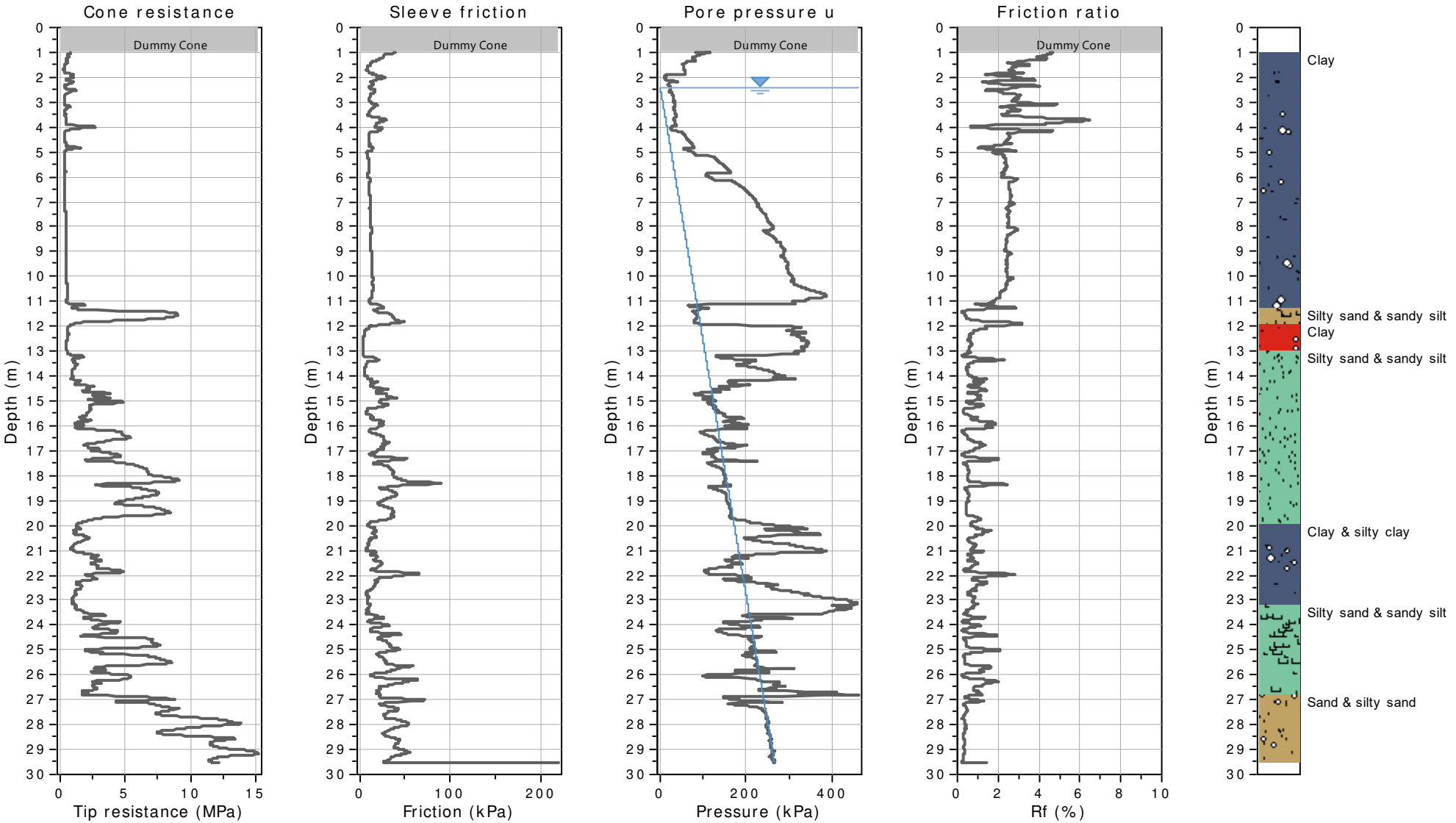
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_0 (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m^3)
29.33	0.08	3.32E-05	40.9	116.1	50.4	36.0	133.5	147.9	0.0	0.0	0.0	19.0
29.41		(±1.94E-05)	(±3.4)	(±4.8)	(±2.2)	(±0.6)	(±16.3)	(±6.1)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT02
Total depth: 29.54 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

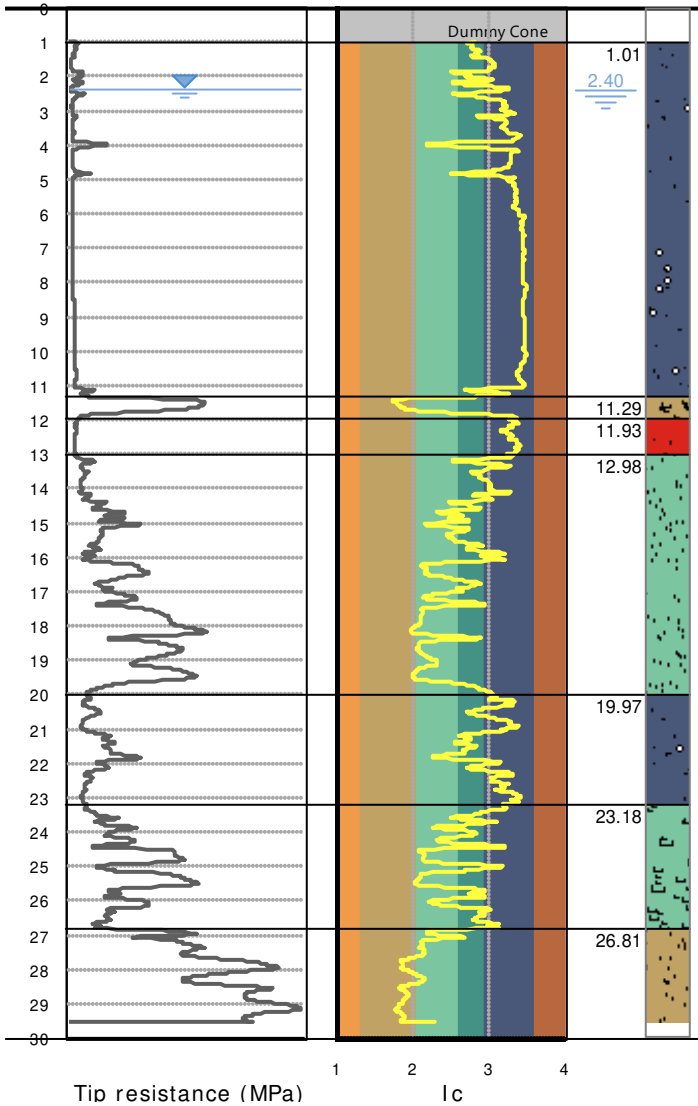
Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



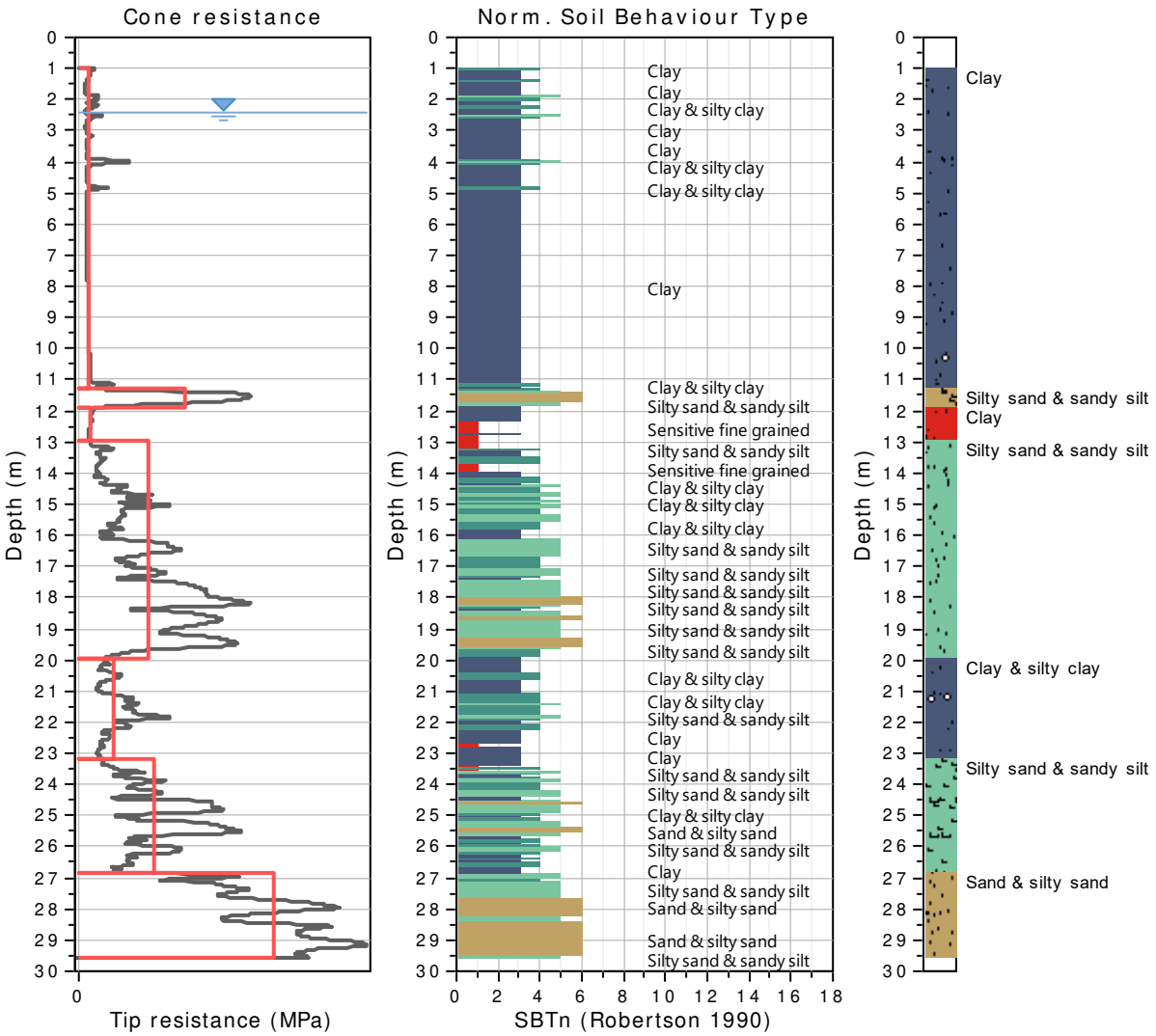
Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT02
Total depth: 29.54 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
1.01	Clay	0.5	2.23E-8	3.2	-	-	-	2.3	22.1	27.7	0.4	2.0	19.0
11.29	Silty sand & sandy silt	5.6	1.52E-5	15.2	56.6	46.3	34.8	43.3	65.3	-	-	-	19.0
11.93	Clay	0.6	9.40E-10	4.1	-	-	-	1.1	23.2	27.2	0.2	0.9	19.0
12.98	Silty sand & sandy silt	3.6	1.43E-6	12.3	57.0	38.4	32.6	26.1	60.7	-	-	-	19.0
19.97	Clay & silty clay	1.9	5.18E-8	9.1	-	-	-	9.7	52.6	93.4	0.4	2.0	19.0
23.18	Silty sand & sandy silt	3.9	9.15E-7	14.7	-	-	-	27.0	76.1	144.5	0.6	2.6	19.0
26.81	Sand & silty sand	10.3	1.16E-5	27.4	87.1	41.5	33.4	78.1	110.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: 1 Start depth: 1.01 (m), End depth: 11.29 (m)

Description: Clay

Basic results

Total cone resistance: 0.53 ±0.27 MPa

Sleeve friction: 13.00 ±4.51 kPa

Ic: 3.27 ±0.26

σ_v': 79.09 ±28.84 kPa

SBT_n: 3

SBTn description: Clay

Schneider zone: Zone 1a

Schneider desc.: Silts and low Ir clays

Estimation results

Permeability: 2.23E-08 ±1.57E-07 m/s

N_{60}: 3.18 ±0.99 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 2.28 ±2.55 MPa

Go: 22.06 ±5.11 MPa

Su: 27.74 ±13.06 kPa

Su ratio: 0.43 ±0.37

O.C.R.: 2.01 ±1.69

.:: Layer No: 2 ::.

Code: 2 Start depth: 11.29 (m), End depth: 11.93 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 5.65 ±3.13 MPa	Permeability: 1.52E-05 ±1.56E-05 m/s	Constrained Mod.: 43.31 ±25.26 MPa
Sleeve friction: 32.32 ±10.00 kPa	N_{60}: 15.23 ±5.76 blows	Go: 65.30 ±13.61 MPa
Ic: 2.24 ±0.53	Es: 56.59 ±6.48 MPa	Su: 0.00 ±0.00 kPa
σ_v': 130.15 ±1.74 kPa	Dr (%): 46.33 ±3.54	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 34.81 ±1.06 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 2		
Schneider desc.: Essentially drained sands		

.:: Layer No: 3 ::.

Code: 3 Start depth: 11.93 (m), End depth: 12.98 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 0.62 ±0.07 MPa	Permeability: 9.40E-10 ±3.81E-10 m/s	Constrained Mod.: 1.10 ±0.52 MPa
Sleeve friction: 5.69 ±4.65 kPa	N_{60}: 4.09 ±0.32 blows	Go: 23.19 ±4.32 MPa
Ic: 3.32 ±0.06	Es: 0.00 ±0.00 MPa	Su: 27.17 ±5.64 kPa
σ_v': 137.92 ±2.83 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.20 ±0.04
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 0.91 ±0.21
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

.:: Layer No: 4 ::.

Code: 4 Start depth: 12.98 (m), End depth: 19.97 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 3.63 ±2.33 MPa	Permeability: 1.43E-06 ±2.16E-06 m/s	Constrained Mod.: 26.11 ±18.92 MPa
Sleeve friction: 23.30 ±13.93 kPa	N_{60}: 12.30 ±5.49 blows	Go: 60.66 ±20.21 MPa
Ic: 2.54 ±0.38	Es: 57.03 ±12.61 MPa	Su: 0.00 ±0.00 kPa
σ_v': 174.86 ±18.58 kPa	Dr (%): 38.36 ±3.37	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.60 ±0.73 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 5 ::.

Code: 5 Start depth: 19.97 (m), End depth: 23.18 (m)

Description: Clay & silty clay

Basic results	Estimation results	
Total cone resistance: 1.87 ±0.88 MPa	Permeability: 5.18E-08 ±1.70E-07 m/s	Constrained Mod.: 9.66 ±8.45 MPa
Sleeve friction: 16.22 ±10.92 kPa	N_{60}: 9.14 ±2.50 blows	Go: 52.61 ±13.60 MPa
Ic: 3.01 ±0.28	Es: 0.00 ±0.00 MPa	Su: 93.36 ±48.41 kPa
σ_v': 221.73 ±8.56 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.42 ±0.22
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.96 ±1.03
SBTn description: Clay & silty clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 6 ::.

Code: 6 Start depth: 23.18 (m), End depth: 26.81 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 3.95 ±2.09 MPa	Permeability: 9.15E-07 ±1.55E-06 m/s	Constrained Mod.: 27.04 ±17.50 MPa
Sleeve friction: 25.27 ±12.46 kPa	N_{60}: 14.68 ±4.42 blows	Go: 76.13 ±15.70 MPa
Ic: 2.63 ±0.37	Es: 0.00 ±0.00 MPa	Su: 144.54 ±51.10 kPa
σ_v': 253.16 ±9.67 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.57 ±0.20
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 2.63 ±0.92
SBTn description: Clay & silty clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 7 ::.

Code: 7 Start depth: 26.81 (m), End depth: 29.54 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 10.30 ±2.88 MPa	Permeability: 1.16E-05 ±9.35E-06 m/s	Constrained Mod.: 78.12 ±23.04 MPa
Sleeve friction: 37.99 ±10.75 kPa	N_{60}: 27.41 ±5.05 blows	Go: 110.31 ±12.56 MPa
Ic: 2.02 ±0.21	Es: 87.09 ±9.24 MPa	Su: 0.00 ±0.00 kPa
σ_v': 282.39 ±7.28 kPa	Dr (%): 41.50 ±3.93	Su ratio: 0.00 ±0.00
SBT_n: 6	φ (degrees): 33.39 ±1.14 °	O.C.R.: 0.00 ±0.00
SBTn description: Sand & silty sand	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 2		
Schneider desc.: Essentially drained sands		

Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT02
Total depth: 29.54 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007

Summary table of mean values

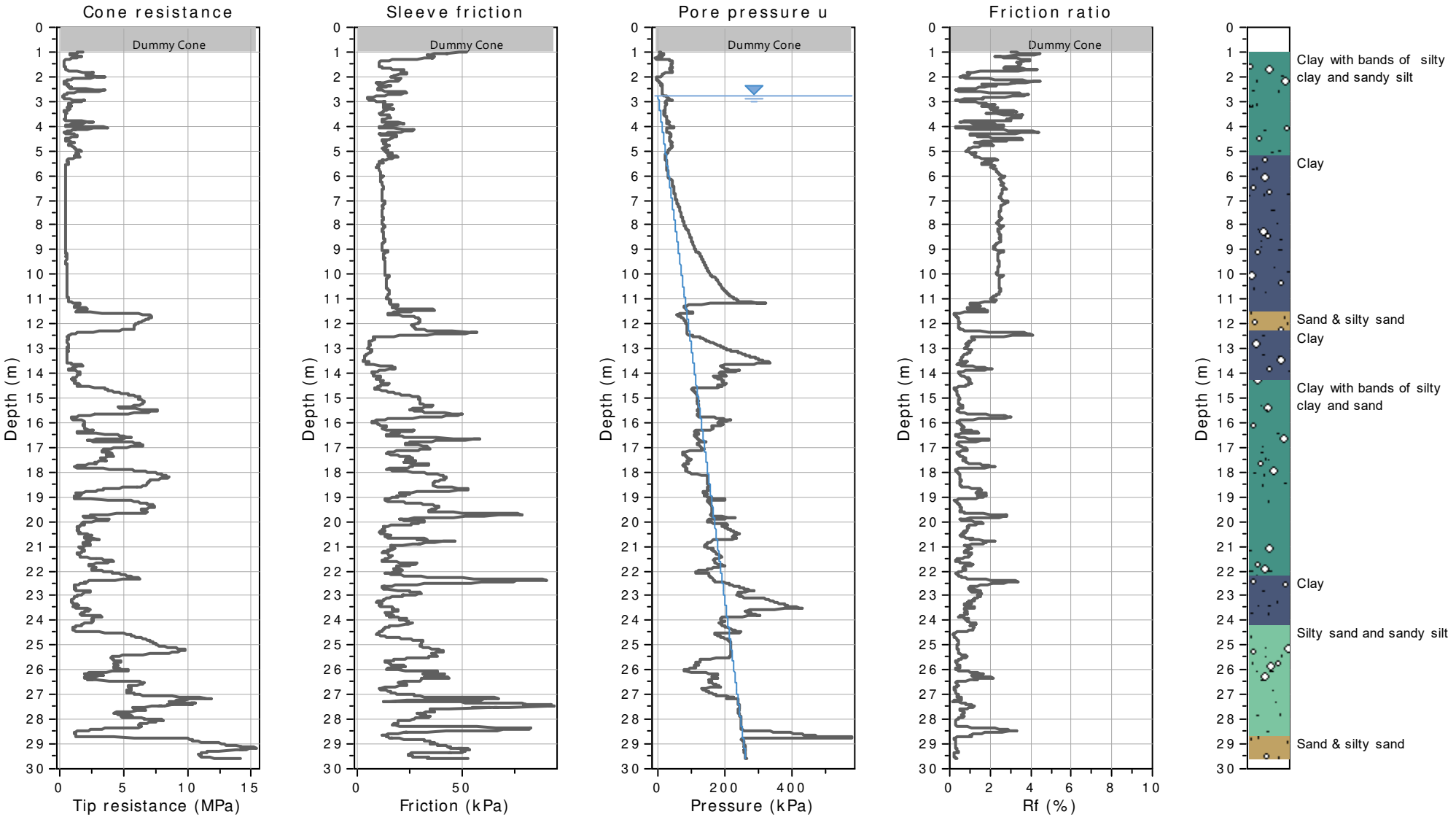
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_0 (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
1.01 11.29	10.28	2.23E-08 (±1.57E-07)	3.2 (±1.0)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	2.3 (±2.6)	22.1 (±5.1)	27.7 (±13.1)	0.4 (±0.4)	2.0 (±1.7)	19.0 (±0.0)
11.29 11.93	0.64	1.52E-05 (±1.56E-05)	15.2 (±5.8)	56.6 (±6.5)	46.3 (±3.5)	34.8 (±1.1)	43.3 (±25.3)	65.3 (±13.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
11.93 12.98	1.05	9.40E-10 (±3.81E-10)	4.1 (±0.3)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	1.1 (±0.5)	23.2 (±4.3)	27.2 (±5.6)	0.2 (±0.0)	0.9 (±0.2)	19.0 (±0.0)
12.98 19.97	6.99	1.43E-06 (±2.16E-06)	12.3 (±5.5)	57.0 (±12.6)	38.4 (±3.4)	32.6 (±0.7)	26.1 (±18.9)	60.7 (±20.2)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
19.97 23.18	3.21	5.18E-08 (±1.70E-07)	9.1 (±2.5)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	9.7 (±8.5)	52.6 (±13.6)	93.4 (±48.4)	0.4 (±0.2)	2.0 (±1.0)	19.0 (±0.0)
23.18 26.81	3.63	9.15E-07 (±1.55E-06)	14.7 (±4.4)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	27.0 (±17.5)	76.1 (±15.7)	144.5 (±51.1)	0.6 (±0.2)	2.6 (±0.9)	19.0 (±0.0)
26.81 29.54	2.73	1.16E-05 (±9.35E-06)	27.4 (±5.0)	87.1 (±9.2)	41.5 (±3.9)	33.4 (±1.1)	78.1 (±23.0)	110.3 (±12.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)

Depth values presented in this table are measured from free ground surface

Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT03
Total depth: 29.61 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

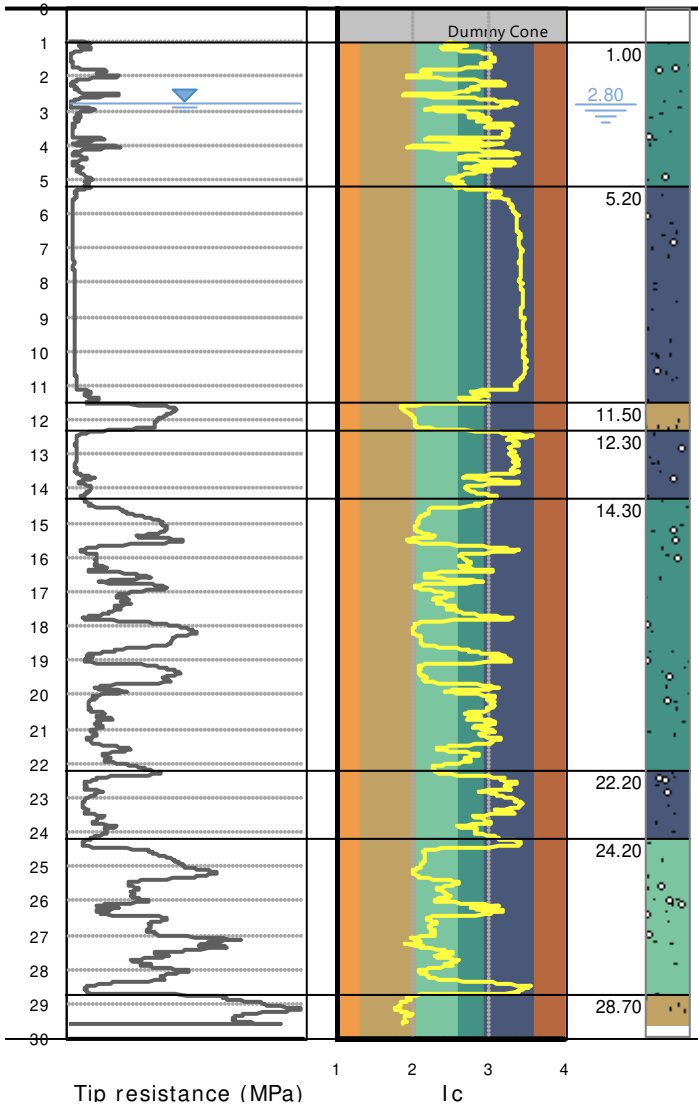
Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



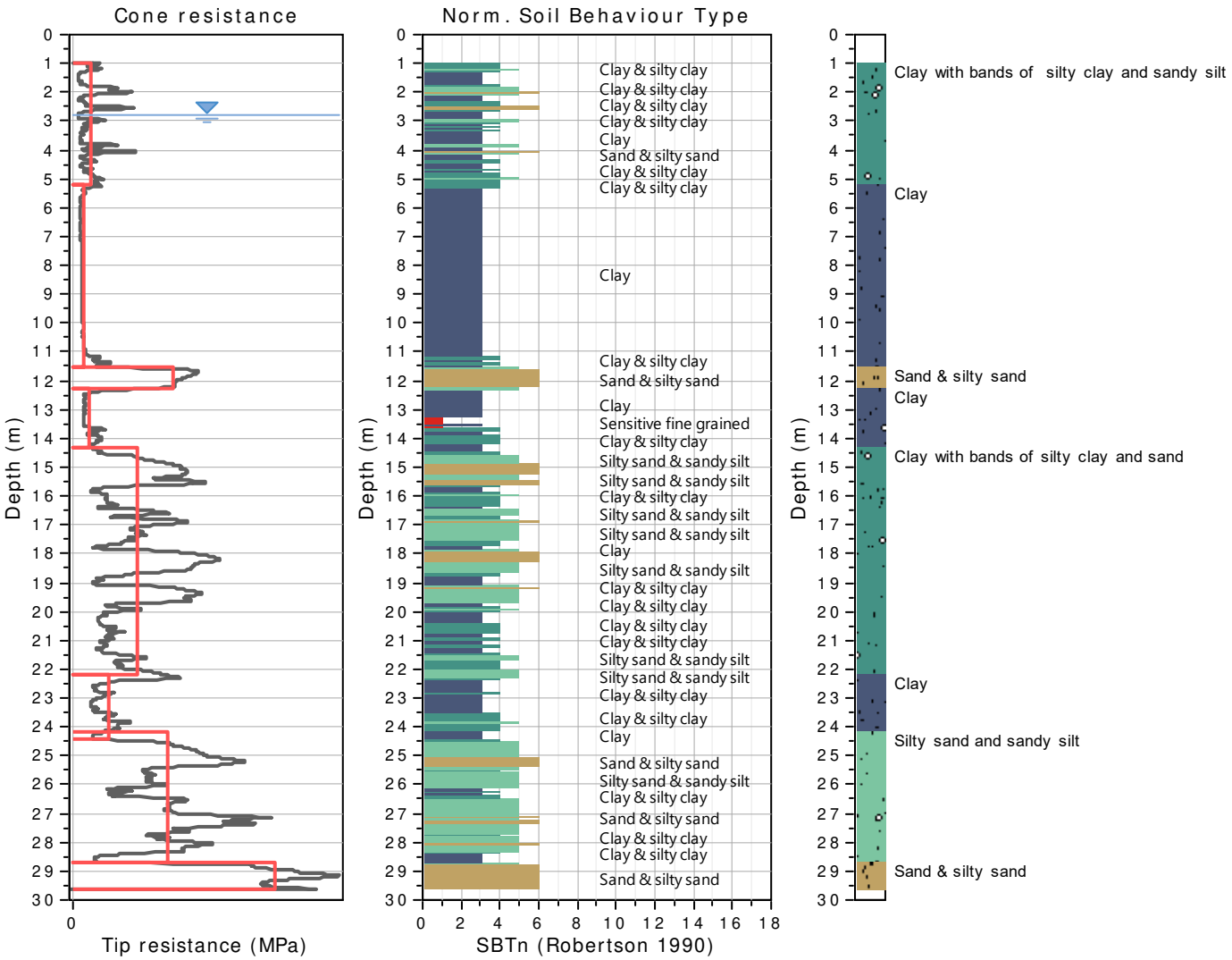
Core Consultants
Unit 1/ 18 Lysaght Street
Coolume Beach, QLD
https://www.coreconsultants.com.au/

CPT: CPT03
Total depth: 29.61 m, Date: 30/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: Proposed Unit Development
Location: 280 MacArthur Ave, Hamilton QLD 4007



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
1.00	Clay with bands of silty clay and sandy silt	1.0	7.28E-7	4.0	-	-	-	7.5	23.9	45.4	0.9	4.2	19.0
5.20	Clay	0.6	4.33E-9	3.8	-	-	-	2.1	26.3	31.8	0.3	1.4	19.0
11.50	Sand & silty sand	5.8	8.57E-6	15.7	52.7	42.3	33.6	44.5	65.7	-	-	-	19.0
12.30	Clay	1.0	1.30E-8	5.3	-	-	-	4.1	32.2	49.6	0.3	1.5	19.0
14.30	Clay with bands of silty clay and sand	3.8	1.49E-6	13.1	58.3	38.4	32.6	26.8	66.1	-	-	-	19.0
22.20	Clay	2.1	6.59E-8	10.3	-	-	-	10.8	61.2	96.0	0.4	1.8	19.0
24.20	Silty sand and sandy silt	5.5	1.70E-6	18.4	73.2	36.6	32.3	39.5	88.2	-	-	-	19.0
28.70	Sand & silty sand	11.7	1.70E-5	29.4	89.7	42.8	33.8	88.9	112.7	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: 1 Start depth: 1.00 (m), End depth: 5.20 (m)

Description: Clay with bands of silty clay and sandy silt

Basic results

Total cone resistance: 1.01 ±0.75 MPa
Sleeve friction: -7.45 ±482.74 kPa
Ic: 2.78 ±0.39
σ_v': 52.11 ±16.12 kPa
SBT_n: 4
SBTn description: Clay & silty clay
Schneider zone: Zone 3
Schneider desc.: Transitional soils

Estimation results

Permeability: 7.28E-07 ±2.38E-06 m/s
N_{60}: 4.05 ±1.78 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 7.47 ±6.10 MPa
Go: 23.95 ±6.52 MPa
Su: 45.41 ±22.91 kPa
Su ratio: 0.91 ±0.60
O.C.R.: 4.21 ±2.76

.:: Layer No: 2 ::.

Code: 2 Start depth: 5.20 (m), End depth: 11.50 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 0.60 ±0.29 MPa	Permeability: 4.33E-09 ±1.66E-08 m/s	Constrained Mod.: 2.10 ±2.67 MPa
Sleeve friction: 13.25 ±2.91 kPa	N_{60}: 3.76 ±1.10 blows	Go: 26.34 ±5.54 MPa
Ic: 3.36 ±0.19	Es: 0.00 ±0.00 MPa	Su: 31.79 ±20.16 kPa
σ_v': 104.11 ±16.75 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.31 ±0.18
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.42 ±0.84
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 3 ::.

Code: 3 Start depth: 11.50 (m), End depth: 12.30 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 5.79 ±1.45 MPa	Permeability: 8.57E-06 ±5.91E-06 m/s	Constrained Mod.: 44.50 ±11.56 MPa
Sleeve friction: 26.28 ±5.34 kPa	N_{60}: 15.73 ±2.74 blows	Go: 65.72 ±7.17 MPa
Ic: 2.06 ±0.25	Es: 52.67 ±3.71 MPa	Su: 0.00 ±0.00 kPa
σ_v': 136.74 ±2.16 kPa	Dr (%): 42.33 ±1.89	Su ratio: 0.00 ±0.00
SBT_n: 6	φ (degrees): 33.59 ±0.59 °	O.C.R.: 0.00 ±0.00
SBTn description: Sand & silty sand	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 2		
Schneider desc.: Essentially drained sands		

.:: Layer No: 4 ::.

Code: 4 Start depth: 12.30 (m), End depth: 14.30 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 0.97 ±0.51 MPa	Permeability: 1.30E-08 ±3.78E-08 m/s	Constrained Mod.: 4.09 ±4.79 MPa
Sleeve friction: 11.12 ±11.79 kPa	N_{60}: 5.27 ±1.77 blows	Go: 32.20 ±10.75 MPa
Ic: 3.17 ±0.25	Es: 0.00 ±0.00 MPa	Su: 49.58 ±31.21 kPa
σ_v': 149.61 ±5.35 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.33 ±0.21
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.53 ±0.98
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 5 ::.

Code: 5 Start depth: 14.30 (m), End depth: 22.20 (m)

Description: Clay with bands of silty clay and sand

Basic results	Estimation results	
Total cone resistance: 3.76 ±2.09 MPa	Permeability: 1.49E-06 ±2.26E-06 m/s	Constrained Mod.: 26.76 ±17.42 MPa
Sleeve friction: 25.34 ±12.32 kPa	N_{60}: 13.09 ±4.46 blows	Go: 66.15 ±14.57 MPa
Ic: 2.56 ±0.40	Es: 58.29 ±9.09 MPa	Su: 0.00 ±0.00 kPa
σ_v': 195.10 ±21.00 kPa	Dr (%): 38.43 ±2.95	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.59 ±0.60 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 6 ::.

Code: 6 Start depth: 22.20 (m), End depth: 24.40 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 2.08 ±1.23 MPa	Permeability: 6.59E-08 ±2.16E-07 m/s	Constrained Mod.: 10.81 ±11.12 MPa
Sleeve friction: 23.55 ±17.48 kPa	N_{60}: 10.30 ±3.38 blows	Go: 61.21 ±17.42 MPa
Ic: 3.06 ±0.30	Es: 0.00 ±0.00 MPa	Su: 96.05 ±50.02 kPa
σ_v': 241.51 ±5.88 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.40 ±0.21
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 1.84 ±0.98
SBTn description: Clay	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 7 ::.

Code: 7 Start depth: 24.20 (m), End depth: 28.70 (m)

Description: Silty sand and sandy silt

Basic results	Estimation results	
Total cone resistance: 5.51 ±2.48 MPa	Permeability: 1.70E-06 ±2.25E-06 m/s	Constrained Mod.: 39.48 ±20.75 MPa
Sleeve friction: 30.13 ±17.93 kPa	N_{60}: 18.36 ±5.39 blows	Go: 88.17 ±19.99 MPa
Ic: 2.46 ±0.42	Es: 73.20 ±12.87 MPa	Su: 0.00 ±0.00 kPa
σ_v': 270.46 ±11.98 kPa	Dr (%): 36.60 ±3.23	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 32.30 ±0.59 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 3		
Schneider desc.: Transitional soils		

.:: Layer No: 8 ::.

Code: 8 Start depth: 28.70 (m), End depth: 29.61 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 11.67 ±2.65 MPa	Permeability: 1.70E-05 ±8.88E-06 m/s	Constrained Mod.: 88.87 ±21.51 MPa
Sleeve friction: 35.27 ±11.08 kPa	N_{60}: 29.43 ±5.07 blows	Go: 112.67 ±14.46 MPa
Ic: 1.93 ±0.21	Es: 89.70 ±9.00 MPa	Su: 0.00 ±0.00 kPa
σ_v': 295.32 ±2.45 kPa	Dr (%): 42.81 ±3.29	Su ratio: 0.00 ±0.00
SBT_n: 6	φ (degrees): 33.78 ±0.91 °	O.C.R.: 0.00 ±0.00
SBTn description: Sand & silty sand	Unit weight: 19.00 ±0.00 kN/m³	
Schneider zone: Zone 2		
Schneider desc.: Essentially drained sands		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_0 (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
1.00 5.20	4.20	7.28E-07 (±2.38E-06)	4.0 (±1.8)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	7.5 (±6.1)	23.9 (±6.5)	45.4 (±22.9)	0.9 (±0.6)	4.2 (±2.8)	19.0 (±0.0)
5.20 11.50	6.30	4.33E-09 (±1.66E-08)	3.8 (±1.1)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	2.1 (±2.7)	26.3 (±5.5)	31.8 (±20.2)	0.3 (±0.2)	1.4 (±0.8)	19.0 (±0.0)
11.50 12.30	0.80	8.57E-06 (±5.91E-06)	15.7 (±2.7)	52.7 (±3.7)	42.3 (±1.9)	33.6 (±0.6)	44.5 (±11.6)	65.7 (±7.2)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
12.30 14.30	2.00	1.30E-08 (±3.78E-08)	5.3 (±1.8)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	4.1 (±4.8)	32.2 (±10.8)	49.6 (±31.2)	0.3 (±0.2)	1.5 (±1.0)	19.0 (±0.0)
14.30 22.20	7.90	1.49E-06 (±2.26E-06)	13.1 (±4.5)	58.3 (±9.1)	38.4 (±2.9)	32.6 (±0.6)	26.8 (±17.4)	66.1 (±14.6)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
22.20 24.40	2.20	6.59E-08 (±2.16E-07)	10.3 (±3.4)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	10.8 (±11.1)	61.2 (±17.4)	96.0 (±50.0)	0.4 (±0.2)	1.8 (±1.0)	19.0 (±0.0)
24.20 28.70	4.50	1.70E-06 (±2.25E-06)	18.4 (±5.4)	73.2 (±12.9)	36.6 (±3.2)	32.3 (±0.6)	39.5 (±20.8)	88.2 (±20.0)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)
28.70 29.61	0.91	1.70E-05 (±8.88E-06)	29.4 (±5.1)	89.7 (±9.0)	42.8 (±3.3)	33.8 (±0.9)	88.9 (±21.5)	112.7 (±14.5)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.0)

Depth values presented in this table are measured from free ground surface

Appendix D
Geotechnical Laboratory Test Certificates

Material Test Report

SQS www.sqs.net.au
SOIL QUALITY SERVICES
AMB Geotech SQS Pty Ltd
ABN 36 631 788 620

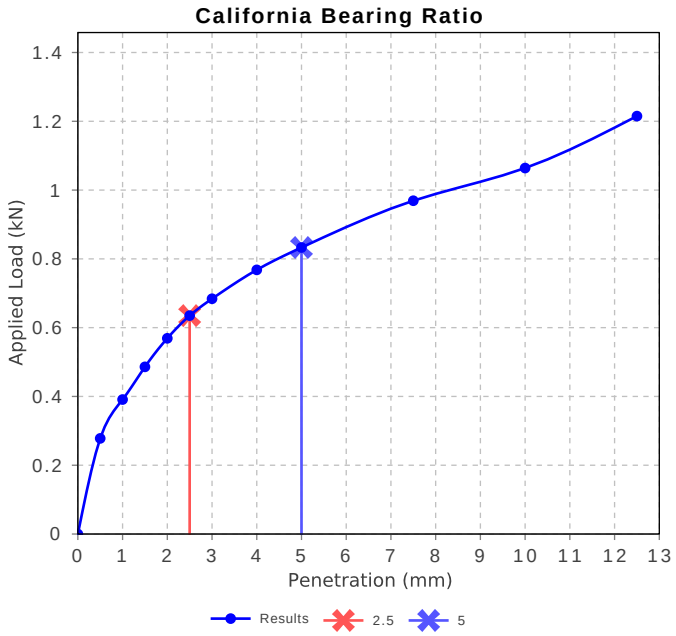
SQS
Brisbane Laboratory
105 Granite Street Geebung QLD 4034
Phone: (07) 3284 8766
Email: michael.mauff@sqs.net.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Mauff
Laboratory Manager
NATA Accredited Laboratory Number: 2911

Report Number:	**B-24-599-3**
Issue Number:	1
Date Issued:	26/07/2024
Client:	Core Consultants Pty Ltd
	Unit 3/31 Londor Close, Hemmant Qld 4174
Contact:	Andrew Middleton
Project Number:	B-24-599
Project Name:	Proposed Unit Development
Project Location:	MacArthur Ave, Hamilton
Client Reference:	J2466 - J2479
Work Request:	15737
Sample Number:	B-15737A
Date Sampled:	16/07/2024
Dates Tested:	16/07/2024 - 24/07/2024
Sample Location:	**BH201 BDS , Depth: 0.5m-1.0 m**
Material:	Silty Clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**5.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual		
Maximum Dry Density (t/m^3)	1.86		
Optimum Moisture Content (%)	15.0		
Laboratory Density Ratio (%)	98.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.81		
Field Moisture Content (%)	13.0		
Moisture Content at Placement (%)	15.1		
Moisture Content Top 30mm (%)	17.7		
Moisture Content Rest of Sample (%)	17.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	72.2		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	1.7		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Silty Clay		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	21		
* Mineral Present	Carbonate		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	34		
Plastic Limit (%)	18		
Plasticity Index (%)	**16**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**9.0**		
Cracking Crumbling Curling	Curling		

Material Test Report

SQS www.sqs.net.au
SOIL QUALITY SERVICES
AMB Geotech SQS Pty Ltd
ABN 36 631 788 620

SQS
Brisbane Laboratory
105 Granite Street Geebung QLD 4034
Phone: (07) 3284 8766
Email: michael.mauff@sqs.net.au

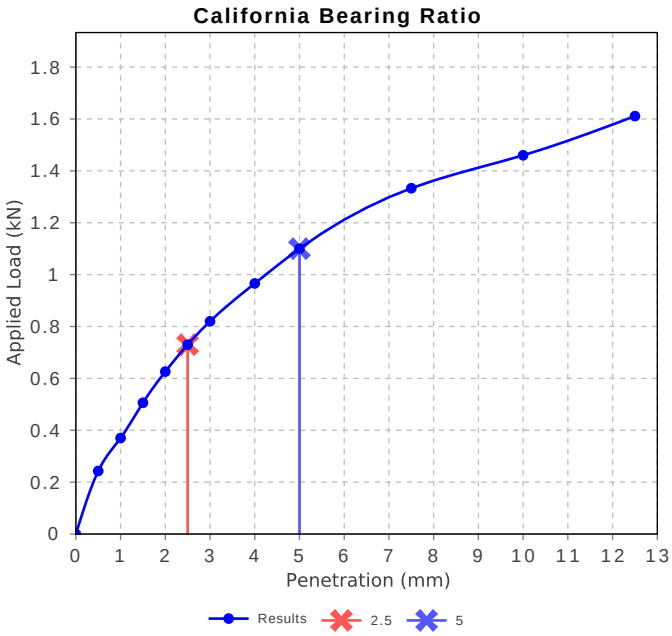
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Mauff
Laboratory Manager
NATA Accredited Laboratory Number: 2911

Report Number:	**B-24-599-3**
Issue Number:	1
Date Issued:	26/07/2024
Client:	Core Consultants Pty Ltd
	Unit 3/31 Londor Close, Hemmant Qld 4174
Contact:	Andrew Middleton
Project Number:	B-24-599
Project Name:	Proposed Unit Development
Project Location:	MacArthur Ave, Hamilton
Client Reference:	J2466 - J2479
Work Request:	15737
Sample Number:	B-15737B
Date Sampled:	16/07/2024
Dates Tested:	16/07/2024 - 19/07/2024
Sample Location:	**BH202 BDS, Depth: 0.5m-1.0 m**
Material:	Gravelly Clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**6**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual		
Maximum Dry Density (t/m^3)	1.83		
Optimum Moisture Content (%)	14.0		
Laboratory Density Ratio (%)	98.5		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.82		
Field Moisture Content (%)	19.2		
Moisture Content at Placement (%)	14.0		
Moisture Content Top 30mm (%)	17.7		
Moisture Content Rest of Sample (%)	16.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	68.1		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Gravelly Clay		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	21		
* Mineral Present	Carbonate		



Material Test Report

SQS www.sqs.net.au
SOIL QUALITY SERVICES
AMB Geotech SQS Pty Ltd
ABN 36 631 788 620

SQS
Brisbane Laboratory
105 Granite Street Geebung QLD 4034
Phone: (07) 3284 8766
Email: michael.mauff@sqs.net.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Mauff
Laboratory Manager
NATA Accredited Laboratory Number: 2911

Report Number: **B-24-599-3**
Issue Number: 1
Date Issued: 26/07/2024
Client: Core Consultants Pty Ltd
Unit 3/31 Londor Close, Hemmant Qld 4174
Contact: Andrew Middleton
Project Number: B-24-599
Project Name: Proposed Unit Development
Project Location: MacArthur Ave, Hamilton
Client Reference: J2466 - J2479
Work Request: 15737
Sample Number: B-15737C
Date Sampled: 16/07/2024
Dates Tested: 16/07/2024 - 24/07/2024
Sample Location: **BH203 DS, Depth: 1.0m-1.45m**
Material: Sandy Clay

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Sandy Clay		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	21		
* Mineral Present	Carbonate		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	25		
Plastic Limit (%)	14		
Plasticity Index (%)	**11**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**5.5**		
Cracking Crumbling Curling	Cracking		

Material Test Report

SQS www.sqs.net.au
SOIL QUALITY SERVICES
AMB Geotech SQS Pty Ltd
ABN 36 631 788 620

SQS
Brisbane Laboratory
105 Granite Street Geebung QLD 4034
Phone: (07) 3284 8766
Email: michael.mauff@sqs.net.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Mauff
Laboratory Manager
NATA Accredited Laboratory Number: 2911

Report Number: **B-24-599-3**
Issue Number: 1
Date Issued: 26/07/2024
Client: Core Consultants Pty Ltd
Unit 3/31 Londor Close, Hemmant Qld 4174
Contact: Andrew Middleton
Project Number: B-24-599
Project Name: Proposed Unit Development
Project Location: MacArthur Ave, Hamilton
Client Reference: J2466 - J2479
Work Request: 15737
Sample Number: B-15737D
Date Sampled: 16/07/2024
Dates Tested: 16/07/2024 - 18/07/2024
Sample Location: **BH204 DS, Depth: 1.0m-1.45m**
Material: Clay

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Clay		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	21		
* Mineral Present	Carbonate		

AMB Geotech SQS Pty Ltd
15 Malduf Street
Chinchilla
Qld 4413

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **Michael Mauff**

Report **1118414-S**
Project name MACARTHUR AVE HAMILTON
Project ID B-24-599
Received Date Jul 16, 2024

Client Sample ID			**B-15737D_BH204 1.0-1.45**
Sample Matrix			**Soil**
Eurofins Sample No.			**B24-JI0039545**
Date Sampled			**Jul 16, 2024**
Test/Reference	LOR	Unit	
Chloride	5	mg/kg	1400
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	1100
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	8.8
Resistivity*	0.5	ohm.m	9.5
Sulphate (as SO4)	30	mg/kg	260
Sample Properties			
% Moisture	1	%	39

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Chloride	Melbourne	Jul 18, 2024	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Jul 18, 2024	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25 °C as rec.)	Melbourne	Jul 18, 2024	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO4)	Melbourne	Jul 18, 2024	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
% Moisture	Melbourne	Jul 16, 2024	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins

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

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

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins ProMicro Pty Ltd
ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2561
Site# 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name: AMB Geotech SQS Pty Ltd
Address: 15 Malduf Street
Chinchilla
Qld 4413

Project Name: MACARTHUR AVE HAMILTON
Project ID: B-24-599

Order No.: AMB2862
Report #: 1118414
Phone: 07 4668 9716
Fax:

Received: Jul 16, 2024 5:42 PM
Due: Jul 19, 2024
Priority: 2 Day
Contact Name: Michael Mauff

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	B-15737D_BH204 1.0-1.45	Jul 16, 2024		Soil	B24-Jl0039545	X	X
Test Counts						1	1

eurofins | Environment Testing

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Chloride			mg/kg	< 5			5	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)			uS/cm	< 10			10	Pass	
Sulphate (as SO4)			mg/kg	< 30			30	Pass	
LCS - % Recovery									
Chloride			%	102			70-130	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)			%	124			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chloride	B24-JI0039577	NCP	mg/kg	260	200	23	30%	Pass	
Sulphate (as SO4)	B24-JI0039577	NCP	mg/kg	56	48	15	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	M24-JI0034314	NCP	%	12	12	4.9	30%	Pass	

Comments

Sample Integrity

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

Authorised by:

Ryan Gilbert	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

Appendix E
Acid Sulfate Soil Laboratory Test Certificates

BH ID	Depth (m)	Description	Quick Screening Test					Remark	Existing Acidity		Potential Acidity		Acid Neutralising Capacity			Retained Acidity					Acid Base Accounting			Required Lime Rate	
			pH_F	AASS likelihood[1]	pH_{FOX}	PASS likelihood [2]	Reaction		pH KCl	Titratable Actual Acidity	Chromium Reducible Sulfur	acidity - Chromium Reducible Sulfur	Acid Neutralising Capacity	acidity - Acid Neutralising Capacity	sulfidic - Acid Neutralising Capacity	Net Acid Soluble Sulfur	acidity - Net Acid Soluble Sulfur	sulfidic - Net Acid Soluble Sulfur	KCl Extractable Sulfur	HCl Extractable Sulfur	ANC Fineness Factor	Net Acidity (sulfur units)	Net Acidity (acidity units)		
			pH Unit		pH Unit				pH Unit	mole H+ / t	% S	mole H+ / t	% CaCO3	mole H+ / t	% pyrite S	% S	mole H+ / t	% pyrite S	% S	% S		% S	mole H+ / t	kg CaCO3/t	kg $CaCO3/m^3$
BH201	0.0-0.25	Fill: sandy to gravelly clay	7.2	L	5.3	L	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.25-0.5		5.4	L	4.2	L	1	x	5.4	28.0	0.014	<10	-	-	-	-	-	-	-	-	1.5	0.06	36	3	5
	0.5-0.75	Fill: clayey to gravelly sand	6.2	L	5.1	L	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.75-1.0	Fill: sandy to gravelly clay	6.7	L	5.2	L	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.0-1.25	Fill: sandy clay	6.4	L	4.5	L	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.25-1.5		7.3	L	5.1	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.5-1.75		8.0	L	4.4	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.75-2.0		8.8	L	4.2	M	3	x	8	<2	0.532	332	2.5	498.0	0.80	-	-	-	-	-	1.5	0.53	332	25	45
	2.0-2.25	Fill: silty clay trace shells	8.8	L	4.9	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.25-2.5		8.5	L	6.0	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.5-2.75		8.7	L	6.4	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.75-3.0		9.0	L	5.6	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.0-3.25		8.9	L	4.5	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.25-3.5		8.8	L	5.7	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.5-3.75		8.8	L	6.3	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.75-4.0		8.5	L	6.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH202	0.0-0.25	Fill: clayey to gravelly sand	7.6	L	4.4	M	1	x	8.8	<2	0.09	56	1.4	286.0	0.46	-	-	-	-	-	1.5	0.09	56	4	7
	0.25-0.5	Fill: sandy clay	8.6	L	5.9	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.5-0.75		9.3	L	6.8	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.75-1.0		9.2	L	7.3	L	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.0-1.25		9.1	L	5.9	M	1	x	9.0	<2	0.096	60	1.6	313.0	0.50	-	-	-	-	-	1.5	0.1	60	4	7
	1.25-1.5		9.1	L	6.4	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.5-1.75		8.8	L	5.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.75-2.0		9.1	L	5.1	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.0-2.25		9.0	L	6.5	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.25-2.5		8.8	L	5.8	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.5-2.75	Fill: silty sand	8.7	L	5.8	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.75-3.0		8.8	L	6.8	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.0-3.25	Fill silty clay	8.8	L	7.2	L	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.25-3.5		9.0	L	5.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.5-3.75		8.8	L	6.6	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.75-4.0		8.7	L	6.8	L	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH203	0.0-0.25	Fill: sandy to gravelly clay	8.1	L	2.4	M	4	x	7.5	<2	0.04	26.0	1.24	247	0.40	-	-	-	-	-	1.5	0.04	26	2	4
	0.25-0.5	Fill: sandy clay	7.6	L	4.9	M	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.5-0.75	Fill: silty to sandy clay	6.9	L	5.1	L	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.75-1.0		7.0	L	5.0	M	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.0-1.25	Fill: clayey sand	8.0	L	4.3	M	2	x	8.6	<2	0.024	15	1.20	241	0.38	-	-	-	-	-	1.5	0.02	15	1	2
	1.25-1.5	Fill: sandy clay	8.6	L	5.8	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.5-1.75		8.7	L	4.8	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.75-2.0		8.6	L	6.4	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.0-2.25		8.8	L	4.3	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.25-2.5	Fill: silty clay trace shells	8.7	L	5.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.5-2.75		8.9	L	6.3	M	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.75-3.0		9.0	L	7.0	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.0-3.25		8.9	L	3.8	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.25-3.5		8.8	L	6.7	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.5-3.75		9.0	L	6.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.75-4.0		8.7	L	6.5	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH204	0.0-0.25	Fill: clayey to gravelly sand	8.3	L	3.9	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.25-0.5		7.2	L	4.8	M	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.5-0.75		7.3	L	3.9	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.75-1.0	Fill: silty to sandy clay	7.6	L	3.0	M	4	x	8.2	<2	0.441	275	2.17	434	0.70	-	-	-	-	-	1.5	0.44	275	21	38
	1.0-1.25	Fill silty clay	8.6	L	4.7	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.25-1.5	Fill: sandy clay	8.8	L	6.7	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1.5-1.75		7.2	L	4.3	M	4	x	6.7	<2	0.057	35	0.93	186	0.30	-	-	-	-	-	1.5	0.06	35	3	5
	1.75-2.0		8.9	L	6.9	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.0-2.25		9.0	L	6.2	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.25-2.5	Fill: silty to sandy clay trace shell	9.0	L	7.2	L	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.5-2.75		8.8	L	5.5	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.75-3.0		8.6	L	5.0	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.0-3.25	Fill: silty clay trace shells	8.9	L	5.0	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.25-3.5		9.0	L	5.0	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.5-3.75		8.7	L	6.5	M	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.75-4.0		8.8	L	6.6	M	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

1. Actual Acid Sulfate Soil (AASS) likelihood is indicated by Low (L & no shade)(pH_F > 5), Medium (M & yellow shade)(pH_F 5 ≤ pH_F < 4) and High (H & red shade)(pH_F ≤ 4).
2. Potential Acid Sulfate Soil (PASS) likelihood is indicated by Low (L & no shade)(Δ pH from pH_F to pH_{FOX} is < 2 pH units), Medium (M & yellow shade)(Δ pH from pHF to pH_{FOX} is ≥ 2 pH units OR pHFOX is <3)) and High (H & red shade)(Δ pH from pHF to pH_{FOX} is ≥ 2 pH units AND pHFOX is <3)
3. Reaction L = Low strength, M = Medium strength, H = High strength, X = Extreme strength.
4. The letter in the remark column indicates the presence of the following. O - Organic; S - Shells;iron- Iron/Iron Oxide; P - Pyrite; and C - Coral.
5. Shaded TAA & S_{CR} results are those exceeding the QASSIT action levels of 18 mol H^+/t or 0.03 %S.
6. Acid-Base Account = Total Acidity (i.e., Potential + Actual + Retained) - Total ANC
7. Shaded Net Acidity (sulfur units) %S and Net Acidity (acidity units) /t results are those exceeding the QASSIT action levels of 0.03 %S or 18 mol H+/t
8. Required Lime Rate is calculated from the net Acid-Base Account with a factor of safety = 1.5 and bulk density of 1.8 t/m³

TEST REQUEST FORM

core consultants
clarity • commitment • passion
52 Second Avenue
Maroochydore QLD 4558
Phone: 5475 5900
Email: accounts@coreconsultants.com.au

Order No.: EB2423021
Job No.: J002479
Job Name: Proposed Unit Development
C.O.C. No.: TR01 Quotation No.
Sampled By: EA Contact Name: Endoo Anugoolprasert/Christie Jo
Email Report to: eanugoolprasert@coreconsultants.com.au/cjonson@coreconsultants.com.au
Prior Storage: Iced Esky

Environmental Division
Brisbane
Work Order Reference
EB2424426
Telephone : +61-7-3243 7222

SAMPLE ID	Sample Depth (m)	Media	No. of sample bags	SAMPLE DATE	pH f and pH fox [EA037] PREVIOUSLY TESTED	Chromium Suite (Include and Exclude ANC)	Remarks and or Other Details
BH201	0.0-0.25		1	4/07/2024			
	0.25-0.5	2	1	4/07/2024		x	
	0.5-0.75		1	4/07/2024			
	0.75-1.0		1	4/07/2024			
	1.0-1.25		1	4/07/2024			
	1.25-1.5		1	4/07/2024			
	1.5-1.75		1	4/07/2024			
	1.75-2.0	8	1	4/07/2024		x	
	2.0-2.25		1	4/07/2024			
	2.25-2.5		1	4/07/2024			
	2.5-2.75		1	4/07/2024			
	2.75-3.0		1	4/07/2024			
	3.0-3.25		1	4/07/2024			
	3.25-3.5		1	4/07/2024			
	3.5-3.75		1	4/07/2024			
	3.75-4.0		1	4/07/2024			
BH202	0.0-0.25	33	1	4/07/2024		x	
	0.25-0.5		1	4/07/2024			
	0.5-0.75		1	4/07/2024			
	0.75-1.0		1	4/07/2024			
	1.0-1.25	37	1	4/07/2024		x	
	1.25-1.5		1	4/07/2024			
	1.5-1.75		1	4/07/2024			
	1.75-2.0		1	4/07/2024			
	2.0-2.25		1	4/07/2024			
	2.25-2.5		1	4/07/2024			
	2.5-2.75		1	4/07/2024			
	2.75-3.0		1	4/07/2024			
	3.0-3.25		1	4/07/2024			
	3.25-3.5		1	4/07/2024			
	3.5-3.75		1	4/07/2024			
	3.75-4.0		1	4/07/2024			

Checked by:
Date Sent:

[1] Date Received By ALS: 16/7/24 10:42

Date: 12/07/2018
Ver. 1.02

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2424426**

Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: eanugoolprasert@coreconsultants.com.au	E-mail	: carsten.emrich@alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8616
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: J002479 Proposed Unit Development	Page	: 1 of 2
Order number	: ----	Quote number	: EP2023CORECON0001 (EN/222)
C-O-C number	: TR01	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Endoo Anugoolprasert		

Dates

Date Samples Received	: 16-Jul-2024 10:42	Issue Date	: 18-Jul-2024
Client Requested Due Date	: 26-Jul-2024	Scheduled Reporting Date	: **26-Jul-2024**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	: Re-batch	No. of samples received / analysed	: 4 / 4

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **This work order has been created to rebatch samples from: EB2423021.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB2424426-001	04-Jul-2024 00:00	BH201 0.25-0.5	✓
EB2424426-002	04-Jul-2024 00:00	BH201 1.75-2.0	✓
EB2424426-003	04-Jul-2024 00:00	BH202 0.0-0.25	✓
EB2424426-004	04-Jul-2024 00:00	BH202 1.0-1.25	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS DEPARTMENT		
- A4 - AU Tax Invoice (INV)	Email	accounts@coreconsultants.com.au
Christie Johnson		
- *AU Certificate of Analysis - NATA (COA)	Email	cjohnson@coreconsultants.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	cjohnson@coreconsultants.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	cjohnson@coreconsultants.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	cjohnson@coreconsultants.com.au
- Chain of Custody (CoC) (COC)	Email	cjohnson@coreconsultants.com.au
- EDI Format - XTab (XTAB)	Email	cjohnson@coreconsultants.com.au
Endoo Anugoolprasert		
- *AU Certificate of Analysis - NATA (COA)	Email	eanugoolprasert@coreconsultants.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	eanugoolprasert@coreconsultants.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	eanugoolprasert@coreconsultants.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	eanugoolprasert@coreconsultants.com.au
- Chain of Custody (CoC) (COC)	Email	eanugoolprasert@coreconsultants.com.au
- EDI Format - XTab (XTAB)	Email	eanugoolprasert@coreconsultants.com.au

CERTIFICATE OF ANALYSIS

Work Order	: **EB2423021**	Page	: 1 of 15
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 05-Jul-2024 13:45
Order number	: ----	Date Analysis Commenced	: 11-Jul-2024
C-O-C number	: TR01	Issue Date	: 11-Jul-2024 14:49
Sampler	: EA		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 64		
No. of samples analysed	: 64		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
~ = Indicates an estimated value.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH201 0.0-0.25	BH201 0.25-0.5	BH201 0.5-0.75	BH201 0.75-1.0	BH201 1.0-1.25
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-001	EB2423021-002	EB2423021-003	EB2423021-004	EB2423021-005
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**7.2**	**5.4**	**6.2**	**6.7**	**6.4**
pH (Fox)	----	0.1	pH Unit	**5.3**	**4.2**	**5.1**	**5.2**	**4.5**
Reaction Rate	----	1	-	**3**	**1**	**1**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH201 1.25-1.5	BH201 1.5-1.75	BH201 1.75-2.0	BH201 2.0-2.25	BH201 2.25-2.5
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-006	EB2423021-007	EB2423021-008	EB2423021-009	EB2423021-010
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**7.3**	**8.0**	**8.8**	**8.8**	**8.5**
pH (Fox)	----	0.1	pH Unit	**5.1**	**4.4**	**4.2**	**4.9**	**6.0**
Reaction Rate	----	1	-	**4**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH201 2.5-2.75	BH201 2.75-3.0	BH201 3.0-3.25	BH201 3.25-3.5	BH201 3.5-3.75
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-011	EB2423021-012	EB2423021-013	EB2423021-014	EB2423021-015
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.7**	**9.0**	**8.9**	**8.8**	**8.8**
pH (Fox)	----	0.1	pH Unit	**6.4**	**5.6**	**4.5**	**5.7**	**6.3**
Reaction Rate	----	1	-	**3**	**2**	**2**	**3**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH201 3.75-4.0	BH202 0.0-0.25	BH202 0.25-0.5	BH202 0.5-0.75	BH202 0.75-1.0
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-016	EB2423021-017	EB2423021-018	EB2423021-019	EB2423021-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.5**	**7.6**	**8.6**	**9.3**	**9.2**
pH (Fox)	----	0.1	pH Unit	**6.2**	**4.4**	**5.9**	**6.8**	**7.3**
Reaction Rate	----	1	-	**4**	**1**	**3**	**2**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH202 1.0-1.25	BH202 1.25-1.5	BH202 1.5-1.75	BH202 1.75-2.0	BH202 2.0-2.25
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-021	EB2423021-022	EB2423021-023	EB2423021-024	EB2423021-025
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**9.1**	**9.1**	**8.8**	**9.1**	**9.0**
pH (Fox)	----	0.1	pH Unit	**5.9**	**6.4**	**5.2**	**5.1**	**6.5**
Reaction Rate	----	1	-	**1**	**2**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH202 2.25-2.5	BH202 2.5-2.75	BH202 2.75-3.0	BH202 3.0-3.25	BH202 3.25-3.5
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-026	EB2423021-027	EB2423021-028	EB2423021-029	EB2423021-030
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.8**	**8.7**	**8.8**	**8.8**	**9.0**
pH (Fox)	----	0.1	pH Unit	**5.8**	**5.8**	**6.8**	**7.2**	**5.2**
Reaction Rate	----	1	-	**3**	**2**	**2**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH202 3.5-3.75	BH202 3.75-4.0	BH203 0.0-0.25	BH203 0.25-0.5	BH203 0.5-0.75
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-031	EB2423021-032	EB2423021-033	EB2423021-034	EB2423021-035
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.8**	**8.7**	**8.1**	**7.6**	**6.9**
pH (Fox)	----	0.1	pH Unit	**6.6**	**6.8**	**2.4**	**4.9**	**5.1**
Reaction Rate	----	1	-	**4**	**4**	**4**	**1**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH203 0.75-1.0	BH203 1.0-1.25	BH203 1.25-1.5	BH203 1.5-1.75	BH203 1.75-2.0
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-036	EB2423021-037	EB2423021-038	EB2423021-039	EB2423021-040
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**7.0**	**8.0**	**8.6**	**8.7**	**8.6**
pH (Fox)	----	0.1	pH Unit	**5.0**	**4.3**	**5.8**	**4.8**	**6.4**
Reaction Rate	----	1	-	**1**	**2**	**4**	**3**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH203 2.0-2.25	BH203 2.25-2.5	BH203 2.5-2.75	BH203 2.75-3.0	BH203 3.0-3.25
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-041	EB2423021-042	EB2423021-043	EB2423021-044	EB2423021-045
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.8**	**8.7**	**8.9**	**9.0**	**8.9**
pH (Fox)	----	0.1	pH Unit	**4.3**	**5.2**	**6.3**	**7.0**	**3.8**
Reaction Rate	----	1	-	**4**	**4**	**2**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH203 3.25-3.5	BH203 3.5-3.75	BH203 3.75-4.0	BH204 0.0-0.25	BH204 0.25-0.5
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-046	EB2423021-047	EB2423021-048	EB2423021-049	EB2423021-050
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.8**	**9.0**	**8.7**	**8.3**	**7.2**
pH (Fox)	----	0.1	pH Unit	**6.7**	**6.2**	**6.5**	**3.9**	**4.8**
Reaction Rate	----	1	-	**4**	**4**	**4**	**4**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH204 0.5-0.75	BH204 0.75-1.0	BH204 1.0-1.25	BH204 1.25-1.5	BH204 1.5-1.75
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-051	EB2423021-052	EB2423021-053	EB2423021-054	EB2423021-055
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**7.3**	**7.6**	**8.6**	**8.8**	**7.2**
pH (Fox)	----	0.1	pH Unit	**3.9**	**3.0**	**4.7**	**6.7**	**4.3**
Reaction Rate	----	1	-	**3**	**4**	**4**	**3**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH204 1.75-2.0	BH204 2.0-2.25	BH204 2.25-2.5	BH204 2.5-2.75	BH204 2.75-3.0
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00
Compound	CAS Number	LOR	Unit	EB2423021-056	EB2423021-057	EB2423021-058	EB2423021-059	EB2423021-060
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.9**	**9.0**	**9.0**	**8.8**	**8.6**
pH (Fox)	----	0.1	pH Unit	**6.9**	**6.2**	**7.2**	**5.5**	**5.0**
Reaction Rate	----	1	-	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH204 3.0-3.25	BH204 3.25-3.5	BH204 3.5-3.75	BH204 3.75-4.0	----
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2423021-061	EB2423021-062	EB2423021-063	EB2423021-064	--------
				Result	Result	Result	Result	----
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	**8.9**	**9.0**	**8.7**	**8.8**	**----**
pH (Fox)	----	0.1	pH Unit	**5.0**	**5.0**	**6.5**	**6.6**	**----**
Reaction Rate	----	1	-	**4**	**4**	**4**	**3**	**----**

QUALITY CONTROL REPORT

Work Order	: **EB2423021**	Page	: 1 of 3
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 05-Jul-2024
Order number	: ----	Date Analysis Commenced	: 11-Jul-2024
C-O-C number	: TR01	Issue Date	: 11-Jul-2024
Sampler	: EA		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 64		
No. of samples analysed	: 64		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA037: Ass Field Screening Analysis (QC Lot: 5915135)									
EB2423021-001	BH201 0.0-0.25	EA037: pH (F)	----	0.1	pH Unit	7.2	7.2	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.3	5.3	0.0	0% - 20%
EB2423021-011	BH201 2.5-2.75	EA037: pH (F)	----	0.1	pH Unit	8.7	8.7	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.4	6.4	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 5915136)									
EB2423021-021	BH202 1.0-1.25	EA037: pH (F)	----	0.1	pH Unit	9.1	9.1	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
EB2423021-031	BH202 3.5-3.75	EA037: pH (F)	----	0.1	pH Unit	8.8	8.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.6	6.6	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 5915137)									
EB2423021-041	BH203 2.0-2.25	EA037: pH (F)	----	0.1	pH Unit	8.8	8.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.3	4.3	0.0	0% - 20%
EB2423021-051	BH204 0.5-0.75	EA037: pH (F)	----	0.1	pH Unit	7.3	7.3	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.9	3.8	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 5915138)									
EB2423021-061	BH204 3.0-3.25	EA037: pH (F)	----	0.1	pH Unit	8.9	8.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.0	5.0	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2423021**	Page	: 1 of 5
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 05-Jul-2024
Site	: ----	Issue Date	: 11-Jul-2024
Sampler	: EA	No. of samples received	: 64
Order number	: ----	No. of samples analysed	: 64

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis							
Snap Lock Bag - frozen (EA037)							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis - Continued								
BH201 0.0-0.25,	BH201 0.25-0.5,	**04-Jul-2024**	**11-Jul-2024**	31-Dec-2024	✓	**11-Jul-2024**	31-Dec-2024	✓
BH201 0.5-0.75,	BH201 0.75-1.0,							
BH201 1.0-1.25,	BH201 1.25-1.5,							
BH201 1.5-1.75,	BH201 1.75-2.0,							
BH201 2.0-2.25,	BH201 2.25-2.5,							
BH201 2.5-2.75,	BH201 2.75-3.0,							
BH201 3.0-3.25,	BH201 3.25-3.5,							
BH201 3.5-3.75,	BH201 3.75-4.0,							
BH202 0.0-0.25,	BH202 0.25-0.5,							
BH202 0.5-0.75,	BH202 0.75-1.0,							
BH202 1.0-1.25,	BH202 1.25-1.5,							
BH202 1.5-1.75,	BH202 1.75-2.0,							
BH202 2.0-2.25,	BH202 2.25-2.5,							
BH202 2.5-2.75,	BH202 2.75-3.0,							
BH202 3.0-3.25,	BH202 3.25-3.5,							
BH202 3.5-3.75,	BH202 3.75-4.0,							
BH203 0.0-0.25,	BH203 0.25-0.5,							
BH203 0.5-0.75,	BH203 0.75-1.0,							
BH203 1.0-1.25,	BH203 1.25-1.5,							
BH203 1.5-1.75,	BH203 1.75-2.0,							
BH203 2.0-2.25,	BH203 2.25-2.5,							
BH203 2.5-2.75,	BH203 2.75-3.0,							
BH203 3.0-3.25,	BH203 3.25-3.5,							
BH203 3.5-3.75,	BH203 3.75-4.0,							
BH204 0.0-0.25,	BH204 0.25-0.5,							
BH204 0.5-0.75,	BH204 0.75-1.0,							
BH204 1.0-1.25,	BH204 1.25-1.5,							
BH204 1.5-1.75,	BH204 1.75-2.0,							
BH204 2.0-2.25,	BH204 2.25-2.5,							
BH204 2.5-2.75,	BH204 2.75-3.0,							
BH204 3.0-3.25,	BH204 3.25-3.5,							
BH204 3.5-3.75,	BH204 3.75-4.0							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	7	64	**10.94**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
ASS Field Screening Analysis	* EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house

CERTIFICATE OF ANALYSIS

Work Order	: **EB2424426**	Page	: 1 of 3
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 16-Jul-2024 10:42
Order number	: ----	Date Analysis Commenced	: 24-Jul-2024
C-O-C number	: TR01	Issue Date	: 24-Jul-2024 14:35
Sampler	: Endoo Anugoolprasert		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	BH201 0.25-0.5	BH201 1.75-2.0	BH202 0.0-0.25	BH202 1.0-1.25	----
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2424426-001	EB2424426-002	EB2424426-003	EB2424426-004	--------
				Result	Result	Result	Result	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.4**	**8.0**	**8.8**	**9.0**	**----**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**28**	<2	<2	<2	**----**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.04**	<0.02	<0.02	<0.02	**----**
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.014**	**0.532**	**0.090**	**0.096**	**----**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	**332**	**56**	**60**	**----**
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**----**	**2.49**	**1.43**	**1.57**	**----**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**----**	**498**	**286**	**313**	**----**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**----**	**0.80**	**0.46**	**0.50**	**----**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**----**
Net Acidity (sulfur units)	----	0.02	% S	**0.06**	<0.02	<0.02	<0.02	**----**
Net Acidity (acidity units)	----	10	mole H+ / t	**36**	<10	<10	<10	**----**
Liming Rate	----	1	kg CaCO3/t	**3**	<1	<1	<1	**----**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.06**	**0.53**	**0.09**	**0.10**	**----**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**36**	**332**	**56**	**60**	**----**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**3**	**25**	**4**	**4**	**----**

QUALITY CONTROL REPORT

Work Order	: **EB2424426**	Page	: 1 of 3
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 16-Jul-2024
Order number	: ----	Date Analysis Commenced	: 24-Jul-2024
C-O-C number	: TR01	Issue Date	: 24-Jul-2024
Sampler	: Endoo Anugoolprasert		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2424426**	Page	: 1 of 4
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 16-Jul-2024
Site	: ----	Issue Date	: 24-Jul-2024
Sampler	: Endoo Anugoolprasert	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
Pulp Bag (EA033)							
BH201 0.25-0.5, BH201 1.75-2.0, BH202 0.0-0.25, BH202 1.0-1.25	**04-Jul-2024**	**24-Jul-2024**	04-Jul-2025	✓	**24-Jul-2024**	22-Oct-2024	✓
EA033-B: Potential Acidity							
Pulp Bag (EA033)							
BH201 0.25-0.5, BH201 1.75-2.0, BH202 0.0-0.25, BH202 1.0-1.25	**04-Jul-2024**	**24-Jul-2024**	04-Jul-2025	✓	**24-Jul-2024**	22-Oct-2024	✓
EA033-C: Acid Neutralising Capacity							
Pulp Bag (EA033)							
BH201 0.25-0.5, BH201 1.75-2.0, BH202 0.0-0.25, BH202 1.0-1.25	**04-Jul-2024**	**24-Jul-2024**	04-Jul-2025	✓	**24-Jul-2024**	22-Oct-2024	✓
EA033-D: Retained Acidity							
Pulp Bag (EA033)							
BH201 0.25-0.5, BH201 1.75-2.0, BH202 0.0-0.25, BH202 1.0-1.25	**04-Jul-2024**	**24-Jul-2024**	04-Jul-2025	✓	**24-Jul-2024**	22-Oct-2024	✓
EA033-E: Acid Base Accounting							
Pulp Bag (EA033)							
BH201 0.25-0.5, BH201 1.75-2.0, BH202 0.0-0.25, BH202 1.0-1.25	**04-Jul-2024**	**24-Jul-2024**	04-Jul-2025	✓	**24-Jul-2024**	22-Oct-2024	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 5942492)									
EB2424416-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.04	0.04	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	23	24	0.0	0% - 50%
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.1	5.0	0.0	0% - 20%
EB2424426-003	BH202 0.0-0.25	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.8	8.9	1.4	0% - 20%
EA033-B: Potential Acidity (QC Lot: 5942492)									
EB2424416-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.009	0.010	16.3	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EB2424426-003	BH202 0.0-0.25	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.090	0.089	1.3	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	56	55	0.0	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 5942492)									
EB2424426-003	BH202 0.0-0.25	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	1.43	1.40	1.9	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.46	0.45	0.0	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	286	281	1.9	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 5942492)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.7 pH Unit	102	80.0	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	100	80.0	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 5942492)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.283 % S	100	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 5942492)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	104	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

TEST REQUEST FORM

core consultants
clarity • commitment • passion
52 Second Avenue
Maroochydore QLD 4558
Phone: 5475 5900
Email: accounts@coreconsultants.com.au

Order No.: EB2423021
Job No.: J002479
Job Name: Proposed Unit Development
C.O.C. No.: TR01 Quotation No.
Sampled By: EA Contact Name: Endoo Anugoolprasert/Christie Jo
Email Report to: eanugoolprasert@coreconsultants.com.au/cjonson@coreconsultants.com.au
Prior Storage: Iced Esky

Environmental Division
Brisbane
Work Order Reference
EB2424426
Telephone : +61-7-3243 7222

SAMPLE ID	Sample Depth (m)	Media	No. of sample bags	SAMPLE DATE	pH f and pH fox [EA037] PREVIOUSLY TESTED	Chromium Suite (Include and Exclude ANC)	Remarks and or Other Details
BH201	0.0-0.25		1	4/07/2024			
	0.25-0.5	2	1	4/07/2024		x	
	0.5-0.75		1	4/07/2024			
	0.75-1.0		1	4/07/2024			
	1.0-1.25		1	4/07/2024			
	1.25-1.5		1	4/07/2024			
	1.5-1.75		1	4/07/2024			
	1.75-2.0	8	1	4/07/2024		x	
	2.0-2.25		1	4/07/2024			
	2.25-2.5		1	4/07/2024			
	2.5-2.75		1	4/07/2024			
	2.75-3.0		1	4/07/2024			
	3.0-3.25		1	4/07/2024			
	3.25-3.5		1	4/07/2024			
	3.5-3.75		1	4/07/2024			
	3.75-4.0		1	4/07/2024			
BH202	0.0-0.25	33	1	4/07/2024		x	
	0.25-0.5		1	4/07/2024			
	0.5-0.75		1	4/07/2024			
	0.75-1.0		1	4/07/2024			
	1.0-1.25	37	1	4/07/2024		x	
	1.25-1.5		1	4/07/2024			
	1.5-1.75		1	4/07/2024			
	1.75-2.0		1	4/07/2024			
	2.0-2.25		1	4/07/2024			
	2.25-2.5		1	4/07/2024			
	2.5-2.75		1	4/07/2024			
	2.75-3.0		1	4/07/2024			
	3.0-3.25		1	4/07/2024			
	3.25-3.5		1	4/07/2024			
	3.5-3.75		1	4/07/2024			
	3.75-4.0		1	4/07/2024			

Checked by:
Date Sent:

[1] Date Received By ALS: 16/7/24 10:42

Date: 12/07/2018
Ver. 1.02

core consultants
clarity • commitment • passion
52 Second Avenue
Maroochydore QLD 4558
Phone: 5475 5900
Email: accounts@coreconsultants.com.au

Order No.: EB2423021
Job No.: J002479
Job Name: Proposed Unit Development
C.O.C. No.: TR01 Quotation No.:
Sampled By: EA Contact Name: Endoo Anugoolprasert/Christie Je
Email Report to: anugoolprasert@coreconsultants.com.au;cjackson@coreconsultants.com.au
Prior Storage: Iced Esky

SAMPLE ID	Sample Depth (m)	Media	No. of sample bags	SAMPLE DATE	pH f and pH fox [EA037]	Chromium Suite (Include and Exclude ANC)																Remarks and or Other Details
BH203	0.0-0.25	47	1	4/07/2024		x																
	0.25-0.5		1	4/07/2024																		
	0.5-0.75		1	4/07/2024																		
	0.75-1.0		1	4/07/2024																		
	1.0-1.25	53	1	4/07/2024		x																
	1.25-1.5		1	4/07/2024																		
	1.5-1.75		1	4/07/2024																		
	1.75-2.0		1	4/07/2024																		
	2.0-2.25		1	4/07/2024																		
	2.25-2.5		1	4/07/2024																		
	2.5-2.75		1	4/07/2024																		
	2.75-3.0		1	4/07/2024																		
	3.0-3.25		1	4/07/2024																		
	3.25-3.5		1	4/07/2024																		
	3.5-3.75		1	4/07/2024																		
	3.75-4.0		1	4/07/2024																		
BH204	0.0-0.25		1	4/07/2024																		
	0.25-0.5		1	4/07/2024																		
	0.5-0.75		1	4/07/2024																		
	0.75-1.0		1	4/07/2024		x																
	1.0-1.25		1	4/07/2024																		
	1.25-1.5		1	4/07/2024																		
	1.5-1.75		1	4/07/2024		x																
	1.75-2.0		1	4/07/2024																		
	2.0-2.25		1	4/07/2024																		
	2.25-2.5		1	4/07/2024																		
	2.5-2.75		1	4/07/2024																		
	2.75-3.0		1	4/07/2024																		
	3.0-3.25		1	4/07/2024																		
	3.25-3.5		1	4/07/2024																		
	3.5-3.75		1	4/07/2024																		
	3.75-4.0		1	4/07/2024																		

Checked by:
Date Sent:

Date Received By ALS:

Environmental Division
Brisbane
Work Order Reference
EB2425521

Telephone : + 61-7-3243 7222

CERTIFICATE OF ANALYSIS

Work Order	: **EB2425521**	Page	: 1 of 3
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 25-Jul-2024 13:33
Order number	: ----	Date Analysis Commenced	: 29-Jul-2024
C-O-C number	: TR01	Issue Date	: 29-Jul-2024 15:16
Sampler	: EA		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH203 0.0-0.25 EB2423021-033	BH203 1.0-1.25 EB2423021-037	BH204 0.75-1.0 EB2423021-052	BH204 1.5-1.75 EB2423021-055	----
			Sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	04-Jul-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2425521-001	EB2425521-002	EB2425521-003	EB2425521-004	--------
				Result	Result	Result	Result	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**7.5**	**8.6**	**8.2**	**6.7**	**----**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	**----**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	**----**
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.042**	**0.024**	**0.441**	**0.057**	**----**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**26**	**15**	**275**	**35**	**----**
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**1.24**	**1.20**	**2.17**	**0.93**	**----**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**247**	**241**	**434**	**186**	**----**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.40**	**0.38**	**0.70**	**0.30**	**----**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**----**
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	**----**
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	**----**
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	**----**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.04**	**0.02**	**0.44**	**0.06**	**----**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**26**	**15**	**275**	**35**	**----**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**2**	**1**	**21**	**3**	**----**

QUALITY CONTROL REPORT

Work Order	: **EB2425521**	Page	: 1 of 4
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Contact	: Carsten Emrich
Address	: 55 KINGSFORD SMITH PARADE MAROOCHYDORE 4558	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 25-Jul-2024
Order number	: ----	Date Analysis Commenced	: 29-Jul-2024
C-O-C number	: TR01	Issue Date	: 29-Jul-2024
Sampler	: EA		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 5951376)									
EB2425451-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.4	8.4	0.0	0% - 20%
EM2412502-005	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	10.0	10.0	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 5951376)									
EB2425451-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	1.06	1.08	2.2	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	659	674	2.2	0% - 20%
EM2412502-005	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.007	0.008	18.4	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 5951376)									
EB2425451-001	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	20.5	20.5	0.1	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	6.57	6.57	0.0	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	4100	4100	0.1	0% - 20%
EM2412502-005	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	4.24	4.24	0.0	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.36	1.36	0.0	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA033-C: Acid Neutralising Capacity (QC Lot: 5951376) - continued									
EM2412502-005	Anonymous	EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	847	847	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 5951376)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.7 pH Unit	99.2	80.0	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	112	80.0	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 5951376)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.283 % S	101	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 5951376)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	106	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2425521**	Page	: 1 of 4
Client	: **CORE CONSULTANTS**	Laboratory	: Environmental Division Brisbane
Contact	: Endoo Anugoolprasert	Telephone	: +61 7 3552 8616
Project	: J002479 Proposed Unit Development	Date Samples Received	: 25-Jul-2024
Site	: ----	Issue Date	: 29-Jul-2024
Sampler	: EA	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
80* dried soil (EA033)							
BH203 0.0-0.25 - EB2423021-033, BH203 1.0-1.25 - EB2423021-037, BH204 0.75-1.0 - EB2423021-052, BH204 1.5-1.75 - EB2423021-055	**04-Jul-2024**	**29-Jul-2024**	04-Jul-2025	✓	**29-Jul-2024**	27-Oct-2024	✓
EA033-B: Potential Acidity							
80* dried soil (EA033)							
BH203 0.0-0.25 - EB2423021-033, BH203 1.0-1.25 - EB2423021-037, BH204 0.75-1.0 - EB2423021-052, BH204 1.5-1.75 - EB2423021-055	**04-Jul-2024**	**29-Jul-2024**	04-Jul-2025	✓	**29-Jul-2024**	27-Oct-2024	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033)							
BH203 0.0-0.25 - EB2423021-033, BH203 1.0-1.25 - EB2423021-037, BH204 0.75-1.0 - EB2423021-052, BH204 1.5-1.75 - EB2423021-055	**04-Jul-2024**	**29-Jul-2024**	04-Jul-2025	✓	**29-Jul-2024**	27-Oct-2024	✓
EA033-D: Retained Acidity							
80* dried soil (EA033)							
BH203 0.0-0.25 - EB2423021-033, BH203 1.0-1.25 - EB2423021-037, BH204 0.75-1.0 - EB2423021-052, BH204 1.5-1.75 - EB2423021-055	**04-Jul-2024**	**29-Jul-2024**	04-Jul-2025	✓	**29-Jul-2024**	27-Oct-2024	✓
EA033-E: Acid Base Accounting							
80* dried soil (EA033)							
BH203 0.0-0.25 - EB2423021-033, BH203 1.0-1.25 - EB2423021-037, BH204 0.75-1.0 - EB2423021-052, BH204 1.5-1.75 - EB2423021-055	**04-Jul-2024**	**29-Jul-2024**	04-Jul-2025	✓	**29-Jul-2024**	27-Oct-2024	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Appendix F
Groundwater Analytical Results

			Lab Report Number	1117219	1117219
			Field ID	MW1	MW2
			Sample Type	Primary	Primary
			Date	07 Oct 2024	07 Oct 2024
	Unit	Brisbane River WQOs (Middle Esturine Waters)	EQL		
Field					
Temperature	**◦C**	NA		24.4	24.3
pH	**unit**	7.0-8.4		7.33	7.11
DO	**ppm**			3.4	0.76
Conductivity	**us/cm**	NA		8474	23371
Redox	**mV**	NA		-58.8	-95.4
Odour	**Observation**			Nil	Nil
Turbidity	**Observation**			Moderate	High
Inorganics					
Alkalinity (Bicarbonate as CaCO3)	**mg/L**		20	910	2600
Alkalinity (Carbonate as CaCO3)	**mg/L**		20	<20	<20
Alkalinity (Hydroxide as CaCO3)	**mg/L**		20	<20	<20
Alkalinity (total) as CaCO3	**mg/L**		20	910	2600
Chloride	**mg/L**		1	2200	7500
Sodium	**mg/L**		0.5	1500	4300
Sulphate	**mg/L**		5	380	460
Metals					
Aluminium (Total)	**mg/L**		0.05	3.2	100
Aluminium (dissolved)	**mg/L**		0.05	<0.05	<0.05
Calcium	**mg/L**		0.5	110	280
Iron (Total)	**mg/L**		0.05	14	120
Iron (dissolved)	**mg/L**		0.05	0.12	0.17
Magnesium	**mg/L**		0.5	110	310
Potassium	**mg/L**		0.5	47	120

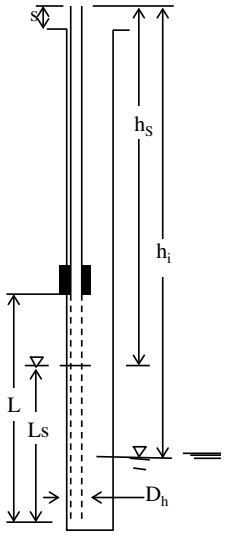
Notes: Environmental Protection (Water and Wetland Biodiversity) Policy 2019, *Brisbane River Estuary Environmental Values and Water Quality Objectives - Part of Basin 143* .

core consultants

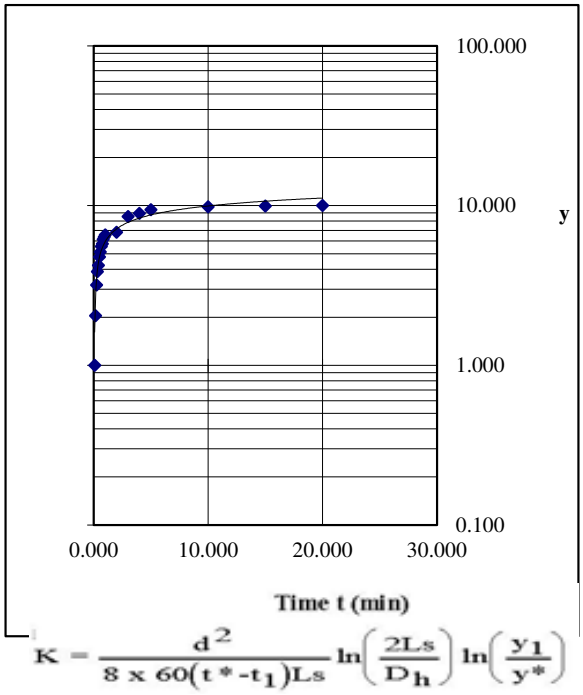
clarity • commitment • passion

FALLING HEAD PERMEABILITY TEST

Client	McNab	**Bore No**	**BH203/MW1**
Project	Proposed unit development	**Test Date**	July 10, 2024
Location	280 MacArthur Ave, Hamilton	**Project No.**	J002479
Tested by	AD	**Checked**	
Remarks			



Depth of borehole (H)	3.80	m	(measured from ground surface)
Depth to bottom of seal (Hb)	3.80	m	(measured from ground surface)
Test section length (L)	3.0	m	
Diameter of pipe (D_p)	0.05	m	Note **:
Diameter of test section (D_h)	0.10	m	1. d = D_p or D_h if no gravel pack
Dia. of water surface (d)**	0.069	m	
Static depth to gw (h_s) (tos)	0.00	m	
Depth of water in screen (Ls)	3.00	m	if water surface is within gravel pack
Bore inclination	0	°	
Stickup of pipe (s)	0.70	m	



$$K = \frac{d^2}{8 \times 60(t^* - t_1)Ls} \ln\left(\frac{2Ls}{D_h}\right) \ln\left(\frac{y_1}{y^*}\right)$$

where
t^*, y^*, $t_1 = 0$, $y_1 = 1$ define slope of a straight line fitted to the observations

t_1(min) =	3.00	t*(min) =	20.00
y_1(m) =	8.55	y*(m) =	10.000
K =	1.2E-07 m/sec		

i = 1, 2, 3, ...n

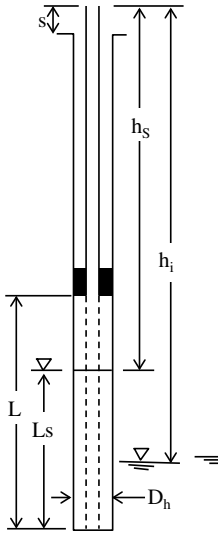
i	Time t (min)	Depth to water h_i (m)	Diff. in water levels $h_S - h_i$ (m)	$y = \frac{h_S - h_i}{h_S - h_1}$
1	0.083	0.022	0.022	1.000
2	0.17	0.045	0.045	2.045
3	0.25	0.070	0.070	3.182
4	0.33	0.085	0.085	3.864
5	0.42	0.093	0.093	4.227
6	0.50	0.105	0.105	4.773
7	0.58	0.113	0.113	5.136
8	0.67	0.122	0.122	5.545
9	0.75	0.127	0.127	5.773
10	0.83	0.135	0.135	6.136
11	0.92	0.140	0.140	6.364
12	1.00	0.144	0.144	6.545
13	2.00	0.150	0.150	6.818
14	3.00	0.188	0.188	8.545
15	4.00	0.197	0.197	8.955
16	5.00	0.207	0.207	9.409
17	10.00	0.216	0.216	9.818
18	15.00	0.219	0.219	9.955
19	20.00	0.220	0.220	10.000
20				
21				
22				
23				
24				
25				
26				
27				

core consultants

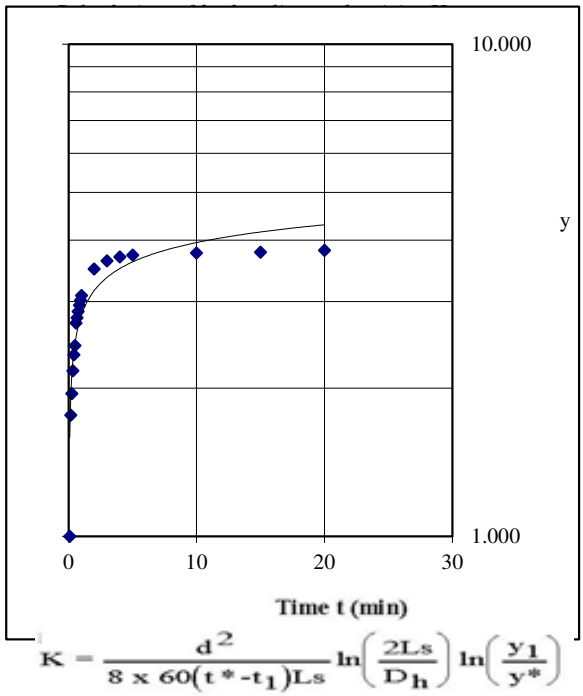
clarity • commitment • passion

FALLING HEAD PERMEABILITY TEST

Client	McNab	Bore No	BH204/MW2
Project	Proposed unit development	Test Date	July 10, 2024
Location	280 MacArthur Ave, Hamilton	Project No.	J002479
Tested by	AD	Checked	
Remarks			



Depth of borehole (H)	3.80	m	(measured from ground surface)
Depth to bottom of seal (Hb)	3.80	m	(measured from ground surface)
Test section length (L)	3.0	m	
Diameter of pipe (D_p)	0.05	m	Note **:
Diameter of test section (D_h)	0.10	m	1. d = D_p or D_h if no gravel pack
Dia. of water surface (d)**	0.069	m	
Static depth to gw (h_s) (tos)	0.00	m	
Depth of water in screen (Ls)	3.00	m	if water surface is within gravel pack
Bore inclination	0	°	
Stickup of pipe (s)	0.60	m	



$$K = \frac{d^2}{8 \times 60(t^* - t_1)Ls} \ln\left(\frac{2Ls}{D_h}\right) \ln\left(\frac{y_1}{y^*}\right)$$

where
t*, y*, t_1 = 0, y_1 = 1 define slope of a straight line fitted to the observations

t_1(min) =	3.00	t*(min) =	15.00
y_1(m) =	3.63	y*(m) =	3.814
K =	5.6E-08 m/sec		

i = 1, 2, 3, ...n

i	Time t (min)	Depth to water h_i (m)	Diff. in water levels $h_S - h_i$ (m)	$y = \frac{h_S - h_i}{h_S - h_1}$
1	0.08333	0.059	0.059	1.000
2	0.17	0.104	0.104	1.763
3	0.25	0.115	0.115	1.949
4	0.33	0.128	0.128	2.169
5	0.42	0.138	0.138	2.339
6	0.50	0.144	0.144	2.441
7	0.58	0.160	0.160	2.712
8	0.67	0.164	0.164	2.780
9	0.75	0.169	0.169	2.864
10	0.83	0.174	0.174	2.949
11	0.92	0.178	0.178	3.017
12	1.00	0.182	0.182	3.085
13	2.00	0.206	0.206	3.492
14	3.00	0.214	0.214	3.627
15	4.00	0.218	0.218	3.695
16	5.00	0.220	0.220	3.729
17	10.00	0.222	0.222	3.763
18	15.00	0.223	0.223	3.780
19	20.00	0.225	0.225	3.814
20				
21				
22				
23				
24				
25				
26				
27				

Order No.:	**TR02**											
Job No.:	**J002479**											
Job Name:	**MacNab- Macarthur Av, Hamilton**											
C.O.C. No.:	**TR02**	**Quotation No.**										
Sampled By:	**Albert**	**Contact Name:**	**Christie Johnson - 0411094288**									
Email Report to:	ckay@coreconsultants.com.au ; cjohnson@coreconsultants.com.au											
	eanugoolprasert@coreconsultants.com.au; coreconsultants@esdat.com.au,											
Prior Storage:	Fridge											

SAMPLE ID	Sample Depth (m)	Media	Bottles/vials	SAMPLE DATE	Alkalinity	Total and Dissolved Alluminium and Iron	Total Anions and Cations, Chloride/Sulphine Ratio				Hold
MW1		Water	3	7/10/2024	x	x	x				
MW2		Water	3	7/10/2024	x	x	x				

***** 5 DAY TAT**

Checked by: CJ
Date Sent: 7/10/2024

Date Received By Eurofins: _____

#1117219

Date/Time: 10/07/24. 6:25 pm
Chilled: (Yes) / No
Temp: 16.6°C
Correction: Elena Hoyos
Final Temp:

eurofins | Environment Testing

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

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins ProMicro Pty Ltd

ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2561
Site# 2554

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name: Core Consultants Pty Ltd
Contact name: Christie Johnson
Project name: MACNAB- MACARTHUR AV HAMILTON
Project ID: J002479
Turnaround time: 5 Day
Date/Time received Jul 10, 2024 6:25 PM
Eurofins reference 1117219

Sample Information

✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

✓ All samples have been received as described on the above COC.

✓ COC has been completed correctly.

✓ Attempt to chill was evident.

✓ Appropriately preserved sample containers have been used.

✓ All samples were received in good condition.

✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

✓ Appropriate sample containers have been used.

✓ Sample containers for volatile analysis received with zero headspace.

X Split sample sent to requested external lab.

X Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

Samples received by the laboratory after 5.30pm are deemed to have been received the following working day.

Contact

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

James McCann on phone : 0499 810 009 or by email: JamesMcCann@eurofins.com

Results will be delivered electronically via email to Christie Johnson - cjohnson@coreconsultants.com.au.

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

Global Leader - Results you can trust

eurofins

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

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

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins ProMicro Pty Ltd
ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2561
Site# 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name: Core Consultants Pty Ltd
Address: 18 Lysaght St
Coolum Beach
QLD 4573

Project Name: MACNAB- MACARTHUR AV HAMILTON
Project ID: J002479

Order No.: TR02
Report #: 1117219
Phone: 07 5475 5900
Fax:

Received: Jul 10, 2024 6:25 PM
Due: Jul 18, 2024
Priority: 5 Day
Contact Name: Christie Johnson

Eurofins Analytical Services Manager : James McCann

Sample Detail						Aluminium	Aluminium (filtered)	Iron	Iron (filtered)	Sulphate : Chloride Ratio*	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254										X		
Brisbane Laboratory - NATA # 1261 Site # 20794 & 2780						X	X	X	X		X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	MW1	Jul 10, 2024		Water	B24-Jl0030979	X	X	X	X	X	X	X
2	MW2	Jul 10, 2024		Water	B24-Jl0030980	X	X	X	X	X	X	X
Test Counts						2	2	2	2	2	2	2

Core Consultants Pty Ltd
18 Lysaght St
Coolum Beach
QLD 4573

NATA Accredited
Accreditation Number 1261
Site Number 20794 & 2780

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

Attention: **Christie Johnson**

Report **1117219-W**
Project name MACNAB- MACARTHUR AV HAMILTON
Project ID J002479
Received Date Jul 10, 2024

Client Sample ID			**MW1**	**MW2**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**B24-JI0030979**	**B24-JI0030980**
Date Sampled			**Jul 10, 2024**	**Jul 10, 2024**
Test/Reference	LOR	Unit		
Chloride	1	mg/L	2200	7500
Sulphate (as SO4)	5	mg/L	380	460
Sulphate : Chloride Ratio*		%	17	6
Alkalinity (speciated)				
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	910	2600
Carbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	910	2600
Heavy Metals				
Aluminium	0.05	mg/L	3.2	100
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05
Iron	0.05	mg/L	14	120
Iron (filtered)	0.05	mg/L	0.12	0.17
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	110	280
Magnesium	0.5	mg/L	110	310
Potassium	0.5	mg/L	47	120
Sodium	0.5	mg/L	1500	4300

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride	Brisbane	Jul 16, 2024	28 Day
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as SO4)	Brisbane	Jul 16, 2024	28 Day
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Brisbane	Jul 18, 2024	14 Day
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Heavy Metals	Brisbane	Jul 16, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Brisbane	Jul 16, 2024	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Brisbane	Jul 16, 2024	180 Day
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

eurofins

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

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

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins ProMicro Pty Ltd
ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2561
Site# 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name: Core Consultants Pty Ltd
Address: 18 Lysaght St
Coolum Beach
QLD 4573

Project Name: MACNAB- MACARTHUR AV HAMILTON
Project ID: J002479

Order No.: TR02
Report #: 1117219
Phone: 07 5475 5900
Fax:

Received: Jul 10, 2024 6:25 PM
Due: Jul 18, 2024
Priority: 5 Day
Contact Name: Christie Johnson

Eurofins Analytical Services Manager : James McCann

Sample Detail						Aluminium	Aluminium (filtered)	Iron	Iron (filtered)	Sulphate : Chloride Ratio*	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254										X		
Brisbane Laboratory - NATA # 1261 Site # 20794 & 2780						X	X	X	X		X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	MW1	Jul 10, 2024		Water	B24-Jl0030979	X	X	X	X	X	X	X
2	MW2	Jul 10, 2024		Water	B24-Jl0030980	X	X	X	X	X	X	X
Test Counts						2	2	2	2	2	2	2

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	-			20	N/A	
Carbonate Alkalinity (as CaCO3)	mg/L	-			20	N/A	
Hydroxide Alkalinity (as CaCO3)	mg/L	-			20	N/A	
Total Alkalinity (as CaCO3)	mg/L	< 20			20	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Chloride	%	105			70-130	Pass	
Sulphate (as SO4)	%	113			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Total Alkalinity (as CaCO3)	%	113			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	106			80-120	Pass	
Aluminium (filtered)	%	95			80-120	Pass	
Iron	%	103			80-120	Pass	
Iron (filtered)	%	96			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	107			80-120	Pass	
Magnesium	%	107			80-120	Pass	
Potassium	%	104			80-120	Pass	
Sodium	%	111			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Sulphate (as SO4)	B24-JI0016058	NCP	%	77			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	B24-JI0037536	NCP	%	103			75-125	Pass	
Aluminium (filtered)	TW24-JI0027967	NCP	%	94			75-125	Pass	
Iron	B24-JI0037536	NCP	%	83			75-125	Pass	
Iron (filtered)	B24-JI0039520	NCP	%	76			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Magnesium	B24-JI0037349	NCP	%	89			75-125	Pass	
Potassium	B24-JI0037536	NCP	%	109			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chloride	B24-Jl0015878	NCP	mg/L	2300	2300	<1	30%	Pass	
Sulphate (as SO4)	B24-Jl0015878	NCP	mg/L	410	410	<1	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	B24-Jl0030979	CP	mg/L	910	910	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	B24-Jl0030979	CP	mg/L	< 20	< 20	<1	30%	Pass	
Hydroxide Alkalinity (as CaCO3)	B24-Jl0030979	CP	mg/L	< 20	< 20	<1	30%	Pass	
Total Alkalinity (as CaCO3)	B24-Jl0030979	CP	mg/L	910	910	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	B24-Jl0038155	NCP	mg/L	3.5	3.5	1.6	30%	Pass	
Aluminium (filtered)	TW24-Jl0027966	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Iron	B24-Jl0035419	NCP	mg/L	28	32	13	30%	Pass	
Iron (filtered)	TW24-Jl0027966	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	B24-Jl0038155	NCP	mg/L	70	70	<1	30%	Pass	
Magnesium	B24-Jl0038155	NCP	mg/L	110	120	2.4	30%	Pass	
Potassium	B24-Jl0038155	NCP	mg/L	3.4	3.5	2.6	30%	Pass	
Sodium	B24-Jl0038155	NCP	mg/L	2000	2100	2.4	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference

Authorised by:

James McCann	Analytical Services Manager
Jonathon Angell	Senior Analyst-Inorganic
Jonathon Angell	Senior Analyst-Metal

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

Appendix G
Limitations

LIMITATIONS

This Document has been provided by Core Consultants Pty Ltd ("Core") subject to the following limitations:

This Document has been prepared for the particular purpose outlined in Core's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of Core's Services are as described in Core's proposal, and are subject to restrictions and limitations. Core did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Core in regards to it.

Conditions may exist which were undetectable given the limited nature of the enquiry Core was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Core's opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Core to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Core for incomplete or inaccurate data supplied by others.

Core may have retained subconsultants affiliated with Core to provide Services for the benefit of Core. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Core's affiliated companies, and their employees, officers and directors.

This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Core accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

core
consultants pty ltd

Head Office | **Sunshine Coast**
Unit 1 / 2 Neumann Court
Kunda Park Qld 4556

T 07 5475 5900

Brisbane
Suite 3.16, 433 Logan Road
Stones Corner Qld 4120

T 07 3394 8331

E info@coreconsultants.com.au

www.coreconsultants.com.au