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Geotechnical Investigation for Multi-Level Commercial Building at

538 Karangahape Road, Newton

Rev A **22 August 2023** **Job No. 20111**

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Appendix A: Drawings

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Report Summary

The following summarises the findings of this report however is not to be taken in isolation. It is a requirement that any user of this report review the document in its entirety, including all appendices.

Feature	Commentary
Proposed Development	Concept drawings prepared by Fearon Hay show the new building will be up to ten storeys high, with an additional two basement levels below.
RMA: Section106 Building Act: Section 71	No *geotechnical* natural hazards were identified (as listed in these Acts) that are considered an undue impediment to development/construction (respectively) or that cannot be reasonably addressed by typical engineering design and construction. Consent for Groundwater Take/Diversion will be required and detailed assessment and a GSMCP will be provided in a separate S&RC report.
Fill	Encountered to a maximum depth of 5.9m bpgl inferred to be associated with existing retaining. Elsewhere fill is generally less than 0.5m thick.
Natural Soils	Stiff to very stiff weathered Waitemata Group soils and sandstone/siltstone rock at depth.
Unduly Weak, Sensitive, or Compressible Soils	Not encountered.
Groundwater	Measured within the piezometers installed following drilling from depths ranging between 4.3m and 5.4m bpgl. The proposed development is considered outside of the ‘Permitted Activity’ criteria in terms of Sections E7.6.1.6 and E7.6.1.10 of the AUP.
Seismic Site Class	Site Class C.
Liquefaction	The site is considered to have a “Very Low Liquefaction Vulnerability”.
Expansive Soils	Classified as Highly Expansive in accordance with B1/AS1 or H1 per AS2870:2011.
Slope Stability	We consider the site to be suitable for the construction of the proposed development from a ‘global’ land stability perspective.
Settlement	We consider any potential total or differential settlement as a result of the proposed development to be within typical tolerable limits.
Foundations	Pile foundations will be required
Retaining	Retaining walls to a maximum height of approximately 8.0m are proposed. Geotechnical retaining wall design parameters are provided in Section 14.0 of this report.
Drawing Review prior to Consent Application	Required.
Construction Constraints	See Section 20.0 of this report.
Construction Observation	CM3 Level recommended.

1.0 Introduction

Soil & Rock Consultants (S&RC) were engaged by James Kirkpatrick Ltd to carry out a geotechnical investigation at 538 Karangahape Road, Newton regarding a proposed multi-level commercial building.

Our investigation has been informed by Section 106 of the Resource Management Act and Section 71 of the Building Act 2004 which lists 'Natural Hazards' that must be considered by Council when assessing a Resource or Building Consent application respectively.

Our report is intended to identify geotechnical constraints to development and provide associated remedial, mitigating, and design recommendations in order that Consent can be granted. Information and advice related to good construction practise are also provided.

1.1 Limitations

This report has been prepared by S&RC for the sole benefit of James Kirkpatrick Ltd (the client), their appointed consultants, and Council with respect to 538 Karangahape Road, Newton and the brief given to us. The data and/or opinions contained in this report may not be used in other contexts, for any other purpose or by any other party without our prior review and agreement. This report may only be read or transmitted in its entirety, including the appendices.

The recommendations given in this report are based on data obtained from discrete locations and soil conditions between locations are inferred only. Our geotechnical models are based on those actual and inferred conditions however variations between test locations may occur and S&RC should be contacted in this event. S&RC should also be contacted should the scope or scale of the development proposal vary from that currently indicated.

2.0 Site Description

The subject site, legally described as Lot 1 DP 570848, is irregular in shape and covers an area of 1,597m^2 (see Figure 1). The site is located towards the top of the crest of a ridge along Karangahape Road to the east-northeast and Great North Road to the southwest. The ground surface across the site slopes down gently to the south to southeast at inclinations of less than 10°.

The commercial building shown in Figure 1 has been demolished, and at the time of our investigation only the basement slab (66.13mRL) and retaining walls remained. Current retained heights extend to a maximum of approximately 5.0m in the northwestern corner of the basement (see Figure 1). The remainder of the site is covered in gravel or asphalt.

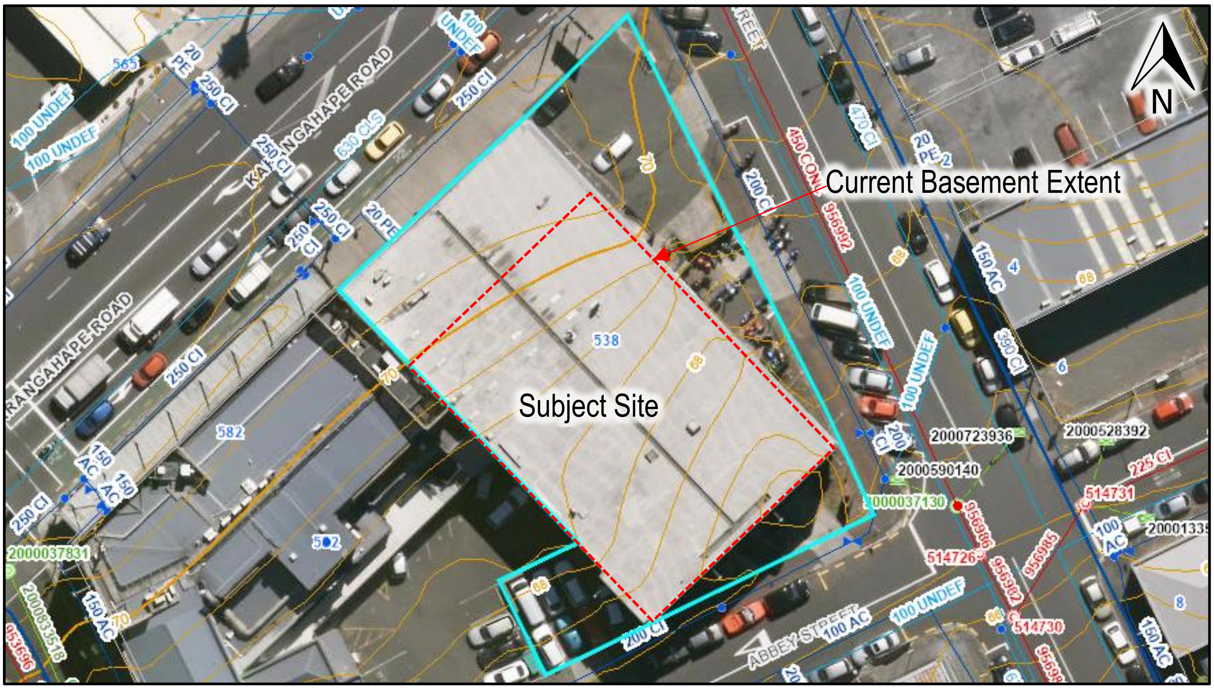


Figure 1: Aerial Image (Source: Auckland Council GeoMaps Website)

2.1 Proposed Development

Drawings prepared by Fearon Hay show the proposed development will comprise construction of a ten-level building, with two basement levels below as shown in Figure 2. Cuts to a maximum depth of 7.5m are required to form the basement levels. Minimal filling is expected to be required. The following (minimum) Final Floor Levels (FFL) have been adopted for our analyses:

Ground Floor: 70.5mRL **Basement 01: 67.0 - 66.6mRL** **Basement 02: 64.0 - 63.6mRL**

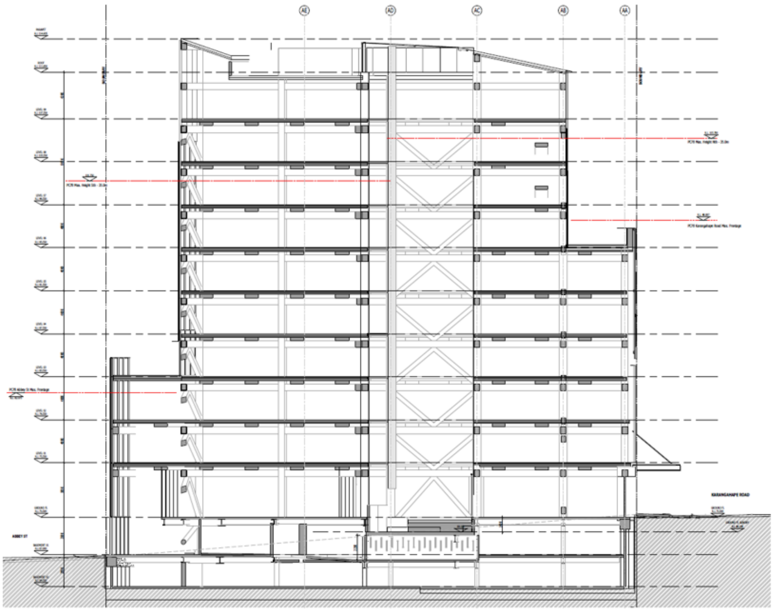


Figure 2: Proposed Development (Source: Basement 2 Reference Plan by Feron Hay Architects)

2.2 Previous Investigation

S&RC have previously conducted geotechnical investigations at the site for an alternate design proposal comprising the renovation and extension of the previous structure. The results of our investigations were presented in the following reports:

- ‘Geotechnical Investigation for Proposed Commercial Additions at 538 Karangahape Road, Auckland City’ Revision A, dated 15 April 2020, Job No. 20111
- ‘Addendum Geotechnical Investigation for Proposed Commercial Additions at 538 Karangahape Road, Auckland City’ Revision A, dated 31 March 2022, Job No. 20111

Reference has been made to the above reports in the preparation of this report and the data from those investigations included within this report.

3.0 Geology

Reference to the GNS New Zealand Geological Web Map 1:250,000 Geology map, indicates the site is underlain by soils and rocks of the Waitemata Group (see Figure 1Figure 3). Waitemata Group soils are derived from weathering of the parent sedimentary sandstones and siltstones to form a mantle of residual soils typically comprising firm to very stiff clays, silts, and sands of variable plasticity. These soils are prone to shrinking and swelling with variations in soil moisture content.

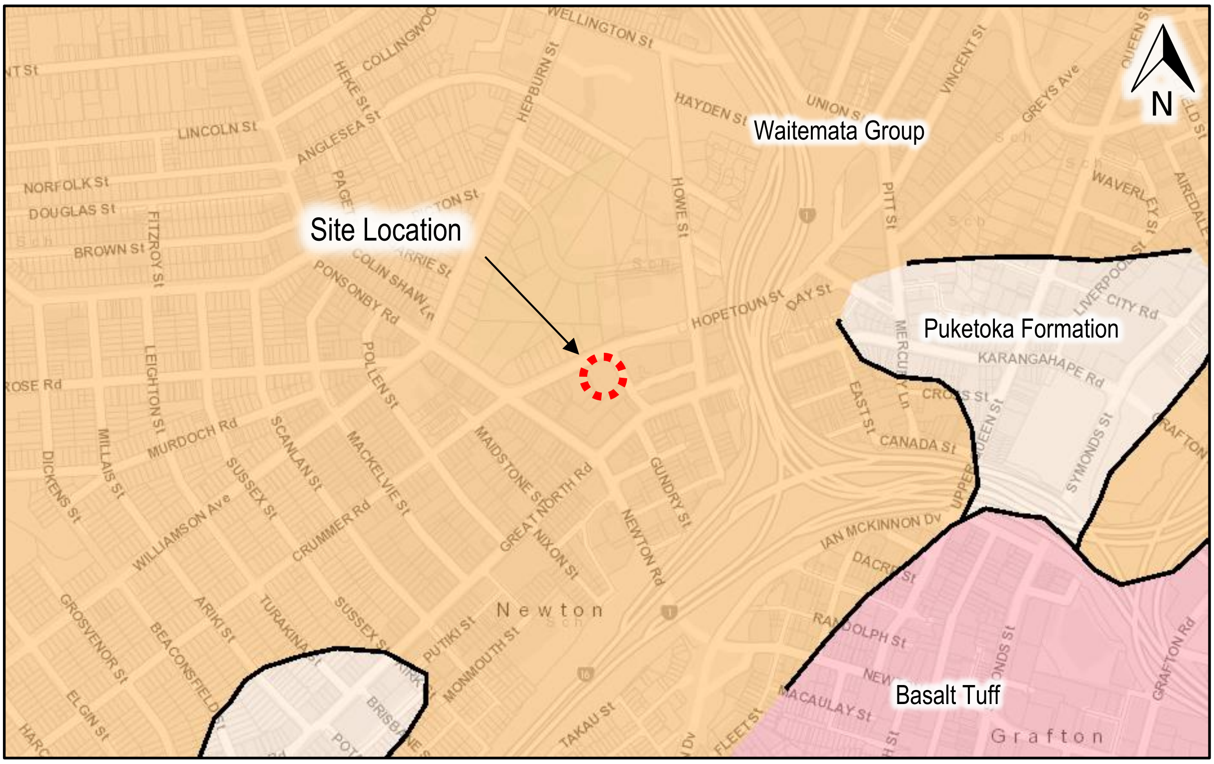


Figure 3: Geological Map (Source: GNS WebMaps Website)

4.0 Field Investigation

The field investigation carried out in March 2020 comprised a visual appraisal of the site and drilling of two machine boreholes outside of the existing building platform (MB01 and MB02). A third machine borehole (MB03) was carried out within the existing building platform in March 2022.

The field investigation carried out in July 2023 comprised:

- Visual appraisal of the site
- Drilling of three machine boreholes (MB04 – MB06 inclusive) – Appendix B
- Installation of three standpipe piezometers (PZ04 – PZ06 inclusive) – Appendix B
- Advancement of four Cone Penetration Tests (CPT01 – CPT04 inclusive) – Appendix C

The test locations are shown on the Site Plan, Drawing No 20111/NB1 (Appendix A). The locations were measured from existing site features using hand-held tape and are therefore approximate only.

Standard Penetration Testing (SPT) was carried out within the boreholes in accordance with NZS4402:1986 '*Methods of Testing Soils for Engineering Purposes*' at nominal 1.0m depth intervals in the boreholes for a maximum total advancement of 300mm per test. The SPT profile at each location is given on the log.

A visual-tactile field classification of the soils encountered during drilling was carried out in accordance with "*Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes*", issued by the New Zealand Geotechnical Society Inc. (2005).

CPT's were carried out on 03 July 2023 by ProDrill in accordance with NZS 4402.6.5.3:1988 and also in general accordance with ASTM D5778-07, DIN 4094-1 and ISSMFE Appendix A TC16. During the test, the CPT probe was pushed into the ground at a constant rate of 20mm/s ± 5mm/s. Sensors in the cone produced continuous analogue data of cone resistance (qc), sleeve friction (fs) and pore water pressure (u2) that was converted to digital form at intervals of depth. The CPT results are attached in Appendix C.

4.1 Ground Model

Subsurface conditions have been interpolated between the test locations and localised variations between and away from the test locations will exist. In general, the ground conditions encountered comprised asphalt and granular fill underlain by Waitemata Group soils and rock. An outline of the ground conditions and investigation results is given below and summarised in Table 1, and detailed descriptions of the soils are given on the attached logs (Appendix B).

- **Asphalt/Concrete.** A 15mm-35mm thick layer of asphalt was encountered in MB01, MB02, and MB05, and a 150mm thick concrete slab was encountered in MB03. The concrete slab has since been removed.

- **Fill.** Dense granular fill was encountered to a depth of 0.4m below present ground level (bpgl) in both MB01 and MB02 and depths of 0.3m in MB05 and MB06. Intermixed cohesive and granular fill was encountered to 0.3m in MB04. Granular fill was encountered in MB03 to a depth of 5.9m bpgl due to the test location being immediately upslope of the basement retaining wall.

  The depth, lateral extent, and composition of the fill material will vary across the site.

- **Weathered Waitemata Group Soils.** Weathered Waitemata Group soils were encountered underlying the fill to depths ranging between 6.0m and 13.6m bpgl. The weathered soils generally comprised silts, sandy silts, and clayey silts with occasional silty clays or thin zones of loose sand.

  SPT ‘N’ values recorded within the weathered Waitemata Group soils ranged between 3 and 29 blows for 300mm penetration.

- **Transition Zone.** A ‘Transition Zone’ is present between the weathered soils and underlying ‘competent’ rock. The Transition Zone material comprises intermixed and alternating zones of weathered soils and competent sandstone/siltstone rock and ranges in thickness between 1.6m and 8.9m thick and appears to decrease in thickness to the south. MB03 was terminated within the Transition Zone material without encountering ‘competent’ rock (i.e. rock not underlain by significant thicknesses of weathered soil).

  Generally, the weathered soil zones can be considered as extremely weak or partly cemented soil. SPT ‘N’ values recorded within the Transition Zone ranged from 10 blows for 300mm of penetration to greater than 50 blows for less than 300mm of penetration.

- **Waitemata Group Rock.** Competent Waitemata Group rock was encountered at each test location except MB03 from depths ranging between 11.7m and 16.3m bpgl. The depth to competent rock generally increases to the northwest.

  The rock extended to the termination depth of each borehole and comprised alternating layers of extremely to very weak sandstone and siltstone. SPT ‘N’ values recorded within the Waitemata Group rock were in excess of 50 blows for less than 300mm penetration.

- **Cone Penetration Tests.** Cone Penetration testing was carried out at four locations (CPT01-CPT04) to nominal depths of 20m bpgl, however testing encountered refusal due to the maximum pore pressure of the equipment being reached at depths ranging between 9.4m to 15.6m bpgl.

  The CPT refusal depths (see Table 2) approximately correlate with the upper portion of the Transition Zone material.

- **Groundwater.** Tactile descriptions of 'wet' soils are shown on the logs. These depths are shown in Table 1 as an 'inferred' groundwater level on the day of drilling. Groundwater measurements taken in machine boreholes on the day of drilling are not an accurate portrayal of the actual long-term groundwater table as groundwater levels take time to stabilise during drilling.

  Groundwater monitoring has been undertaken in standpipe piezometers installed in MB04 – MB06 (inclusive) following drilling. Reference should be made to Section 5.0 of this report in this regard.

Table 1 – Summary of Ground Conditions

Test ID	Termination Depth	Soil SPT 'N' Values	Depth to Transition Zone	Transition Zone SPT 'N' Values	Depth to (Competent) Sandstone	Inferred Groundwater Depth
All depths measured in (m) below present ground level. (Rounded to 1 DP)						
MB01	15.9	5 – 24	8.5	10 – 27	12.5	4.5
MB02	13.8	4 – 21	10.5	22	12.1	6.6
MB03	15.5	8 – 29	11.0	30 – 60+	>15.5	5.9
MB04	19.7	4 – 12	13.6	20 – 23	16.2	1.5
MB05	18.2	3 – 8	6.0	17 – 50+	14.9	1.5
MB06	13.7	3 – 19	9.8	50+	11.7	2.8

Table 2 – CPT Depths

ID	Termination Depth (m) bpgl
CPT01	15.6
CPT02	9.4
CPT03	11.6
CPT04	10.9

5.0 Groundwater Monitoring

Three standpipe piezometers (PZ04 – PZ06 inclusive) were installed in the respective machine boreholes at the completion of drilling (03 to 05 July 2023).

Groundwater level measurements were carried out within the installed standpipe piezometers on 06, 13, and 21 July 2023. Piezometer construction details are provided on the augerhole logs in Appendix B.

The piezometer locations are shown on the Site Plan, Drawing No 20111/GW1 (Appendix A). The locations were measured from existing site features using hand-held tape and are therefore approximate only.

Piezometer surface elevations have been estimated from contours available from the Auckland Council GeoMaps website. These elevations are compared to the relative measured groundwater elevations in **Table** 3.

Table 3 – Groundwater Elevations

Location	Ground Surface (mRL)	Groundwater Elevation (mRL)				Minimum Depth Below Ground Surface (m)
		06 July	13 July	21 July	Recorded Maximum	
PZ04	70.8	66.0	65.3	65.6	66.0	4.8
PZ05	69.8	63.4	62.9	64.4	64.4	5.4
PZ06	67.8	63.5	62.6	62.8	63.5	4.3

Maximum groundwater elevations observed during the monitoring period ranged from 63.5mRL (PZ06) to 66.0mRL (PZ04) across the site. The groundwater level appears to generally flow slightly across slope, dipping down to the east, where the ground surface slopes down to the south to southeast.

The measured groundwater elevations are shown in Figure 4 against local rainfall data recorded during the monitoring period at the Albert Park rainfall monitoring station. Throughout the monitoring period the response in groundwater levels to rainfall events was generally minimal with groundwater levels falling slightly in all three piezometers between 06 and 13 July despite frequent rainfall events.

Given groundwater levels measured within the piezometers fell between 06 and 13 July despite frequent rainfall events suggests the levels recorded on 06 July (24hrs to 72hrs following drilling) were still stabilising following drilling.

A significant rise (1.5m) was recorded in PZ05 between 13 and 21 July with rises of just 0.3m and 0.2m recorded in PZ04 and PZ06 respectively for the same period. No significant rainfall was recorded during this period, and we therefore infer these rises in groundwater levels are due to the significant rainfall event on the day of measurement (21 July).

The significant rise observed in PZ05 is therefore inferred to be the result of near-surface water ingress, and the groundwater level recorded in PZ05 on 21 July is therefore considered unrepresentative.

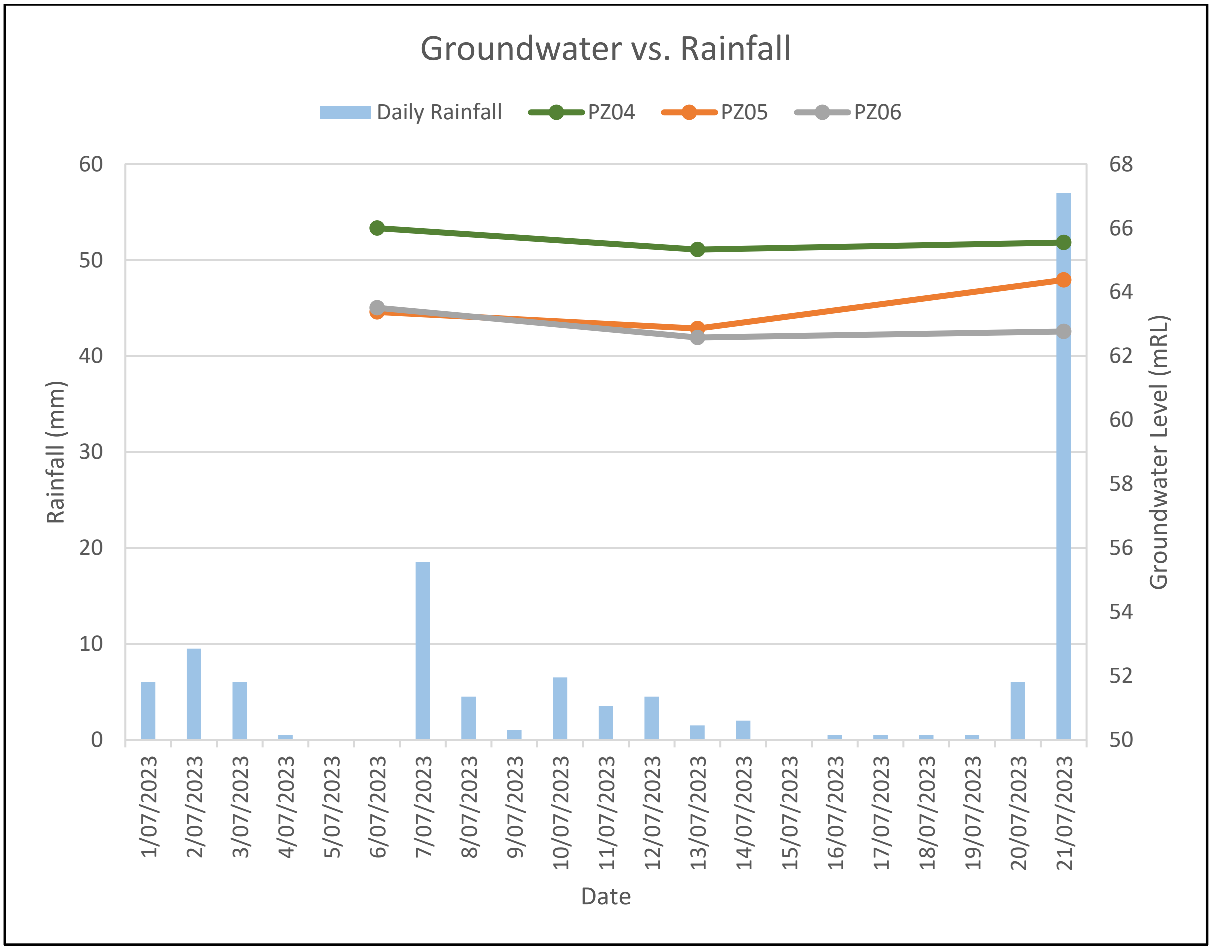


Figure 4: Hydrograph (Recorded Rainfall (Albert Park) and Groundwater Level)

Groundwater monitoring was carried out in winter, with frequent rainfall events occurring during the monitoring period, and immediately following significant rainfall events. We therefore infer groundwater conditions represent levels towards the upper limit of winter conditions.

The existing basement structure has a floor level of 66.13mRL with drainage material known to be present behind the walls. The maximum groundwater levels recorded during the monitoring period are close to the under-slab level of the existing basement. We therefore infer the existing drainage is acting to inhibit prolonged elevated groundwater levels above the existing basement level.

Further, the site is located towards the crest of the ridgeline along Great North and Karangahape Roads. Given the limited capacity for upslope groundwater recharge and the response to rainfall events outlined above, groundwater levels are inferred to be encountered at much lower elevations during summer, i.e. below the depth of excavation.

6.0 Groundwater Compliance Assessment

Groundwater levels have been modelled using the maximum groundwater elevations recorded during the monitoring period, exclusive of the anomalous result recorded in PZ05 on 21 July and the levels recorded on 06 July which are inferred to be still stabilising following drilling as outlined in Section 5.0 of this report. The PZ05 result recorded on 13 July has been elevated by 0.3m based on the similar rises recorded in PZ04 and PZ06 between 13 and 21 July.

The resulting contours in relation to the proposed development (Basement 02) are shown in Figure 4.

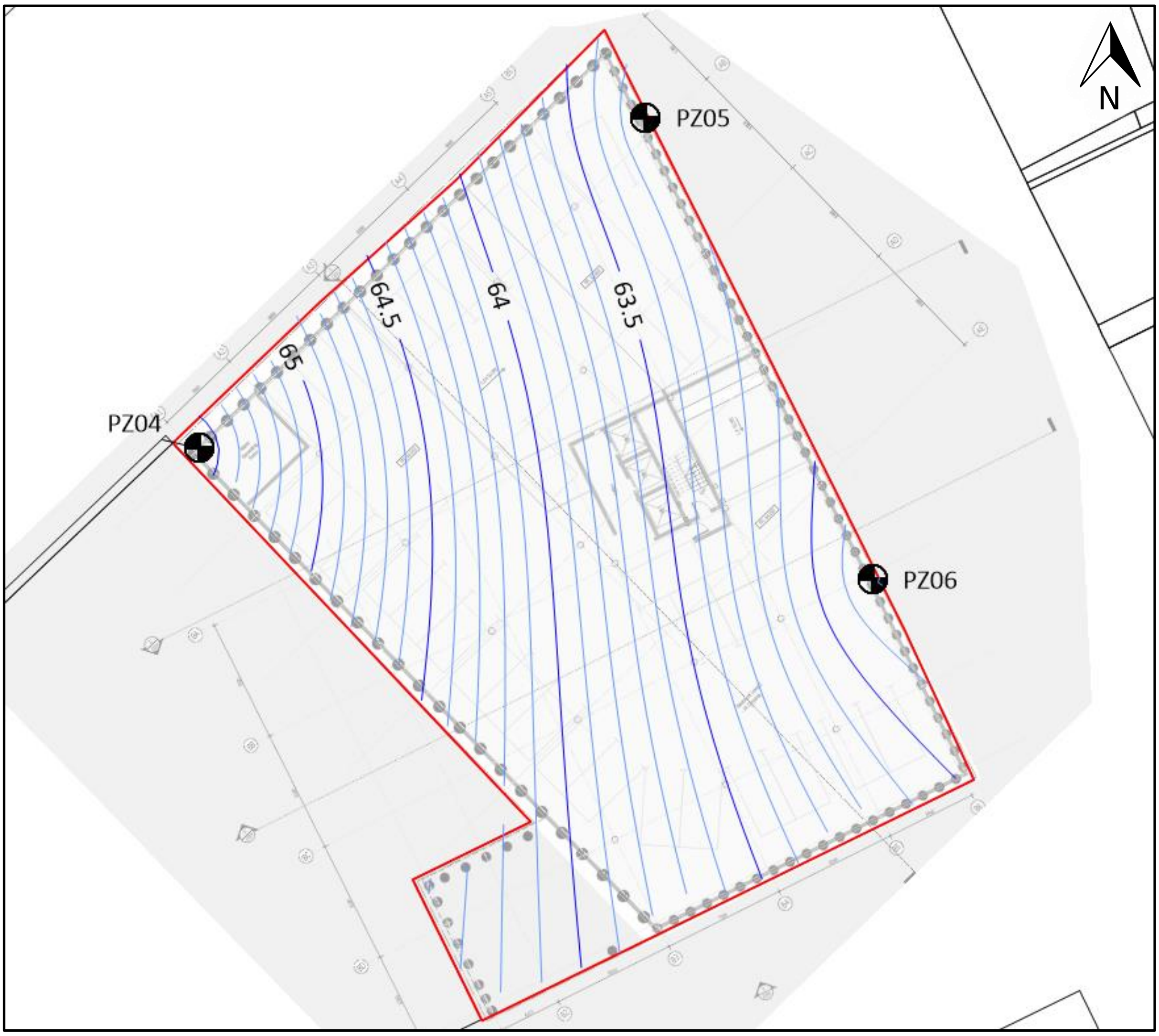


Figure 4: Groundwater Elevation vs. Proposed Basement 02

A temporary excavation level 0.5m below the FFL is inferred to be required for slab preparation. The modelled groundwater elevations are compared to the inferred temporary excavation levels for the proposed development in **Table** 4.

The floor level of the lower basement level (Basement 02) is slightly lower in the northern corner of the development, and this is accounted for in Table 4**.**

Table 4 – Groundwater Elevations, Finished Floor Levels and Estimated Excavation Levels

Piezometer Location	Modelled Groundwater Elevation (mRL)	Basement 02 Finished Floor Level (mRL)	Temporary Excavation Level (mRL)	Groundwater Depth Above Excavation (m)
PZ04	65.6	64.0	63.5	2.1
PZ05	63.2	63.6	63.1	0.1
PZ06	62.8	64.0	63.5	-0.7

Table 4 indicates groundwater will be encountered within the excavation for the proposed Basement 02 level by up to 2.1m in the northwest corner. However, this reduces to just 0.1m penetration in the northern corner and no penetration of groundwater in the southern to southeastern portions of the site.

Compliance criteria and assessment for a Permitted Activity under Sections E7.6.1.6 and E7.6.1.10 of the Auckland Unitary Plan (AUP) with reference to the proposed development are presented in Table 5.

Our assessment assumes the basement will not be 'tanked' with under-slab and retaining drainage installed. Whilst tanking of the basement may reduce the effects of groundwater drawdown on neighbouring properties, drawdown is still likely to occur during construction, and we understand tanking of the basement is not proposed at this time.

Table 5 – AUP Provision for Dewatering or Diversion of Groundwater

Rule	E7.6.1 Permitted Activity Criteria	Design Commentary
E7.6.1.6	Dewatering or groundwater level control associated with a groundwater diversion permitted under Standard E7.6.1.10 must ensure that: (1) The water take must not be geothermal water; (2) The water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soil or rock; and (3) The water take must only occur during construction.	**Meets Criteria** (1) Water taken is not geothermal. **Does Not Meet Criteria** (2/3) Excavation is likely to be open/drained for at least 30 days.

Rule	E7.6.1 Permitted Activity Criteria	Design Commentary
E7.6.1.10 (2)	Any excavation that extends below natural groundwater level must not exceed: (a) 1ha in total area; and (b) 6m depth below the natural ground level.	**Meets Criteria** The proposed excavations are less than 1ha in total area.
E7.6.1.10 (3)	The natural groundwater level must not be reduced by more than 2m on the boundary of any adjoining site.	**Does Not Meet Criteria** Penetration of the groundwater level by up to 2.1m is expected immediately adjacent to the boundary in the northwest corner. In the absence of basement tanking groundwater drawdown is expected to exceed 2m over the northern and western boundaries.
E7.6.1.10 (4)	Any structure that physically impedes the flow of groundwater through the site must not: (a) impede the flow of groundwater over a length of more than 20m; and (b) extend more than 2m below the natural groundwater level.	**Meets Criteria** The greatest length of the structure penetrating groundwater by more than 2.0m is less than 20m in length.
E7.6.1.10 (5)	Distance to any existing building or structure on an adjoining site from the edge of any: (a) trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation.	**Does Not Meet Criteria** Excavation to approximately 2.1m below groundwater level is proposed immediately adjacent to the neighbouring structure to the west.
E7.6.1.10 (6)	The distance from the edge of any excavation that extends below natural groundwater level, must not be less than: (a) 50m from the Wetland Management Areas (WMA) Overlay; (b) 10m from a Scheduled Historic Heritage (SHH) Overlay; or (c) 10m from a lawful groundwater take.	**Meets Criteria** (a) Not within 50m of a WMA Overlay (b) Not within 10m of an SHH Overlay (c) No known take within 10m

6.1 E7 Compliance Conclusions

Fundamentally the proposed development cannot be revised into compliance with the criteria for a Permitted Activity under Sections E7.6.1.6 and/or E7.6.1.10 of the AUP without removing the lower basement level. A detailed assessment of dewatering and settlement effects against the relevant criteria in Section E7.8.2 of the AUP is therefore required to support Resource Consent application.

A preliminary estimate of potential groundwater drawdown-related settlement has been undertaken using a change in effective vertical stress method and adopting the expected (winter-high) 2.1m of drawdown in the northwest corner of the site, i.e., in the worst-case area/scenario.

Our preliminary estimate indicates a maximum potential settlement of up to 8mm can be expected from groundwater drawdown related effects. This value is indicative only, subject to detailed analysis, and provided here for the purposes of informing preliminary/concept retaining design only.

If mechanical deflections associated with the proposed basement retaining wall(s) can be restricted to result in expected settlements of a similar magnitude, i.e., so a combined groundwater drawdown settlement and mechanical deflection settlement of less than approximately 15mm is expected, then tanking of the lower basement level may not be required in order to maintain the integrity of the neighbouring building.

Should mechanical deflection related settlements be expected to exceed 7-8mm then tanking of the lower basement level is likely to be required to ensure the total expected settlements do not result in damage to the neighbouring structure.

However, the above is subject to specific assessment of the susceptibility of the neighbouring building to settlement. Should the neighbouring building be supported by pile foundations with suspended floors, the building will have a far greater tolerance to groundwater drawdown related settlement effects than if it is supported by shallow foundations.

Review/Assessment of the neighbouring structures foundations is recommended in this regard.

Draft GSMCP

Following a detailed assessment as outlined above, a draft Groundwater and Settlement Monitoring and Contingency Plan (GSMCP) should be prepared, in addition to methods incorporated into engineering design, to mitigate (where appropriate) any groundwater drawdown related effects.

The purpose of the GSMCP is to outline the expected monitoring of groundwater levels, drawdown, and any related ground movements during and post construction and inform the Resource Consent requirements in this regard.

7.0 Expansive Soils

The results of our investigation, experience with these types of soils, and laboratory testing in the wider area indicate the soils lie in 'Expansive Soil Class H – Highly Expansive' with reference to B1/AS1, or Class H1 with reference to AS2870:2011.

8.0 UCS Testing

Two samples of intact Waitemata Group sandstone/siltstone were taken from MB01 and MB03 for the purposes of Unconfined Compressive Strength (UCS) tests.

Testing was completed by Babbage Geotechnical Laboratory (test method: NZS4402: 1986: Test 6.3.1) and the test results are presented in Table 6. The laboratory report sheets are provided in Appendix D.

Table 6 – Summary of UCS Laboratory Testing Results

Borehole ID	UCS Test Depth	UCS Maximum Stress (kPa)	Failure Mode	Strain at Failure (%)
MB01	19.1 – 19.4	2,100	Brittle	1.0
MB03	9.5 – 9.7	510	Brittle	0.87

9.0 Seismic Design Parameters

The site is considered a Class C – 'Shallow Soil Site' as defined by NZS 1170.5:2004.

9.1 Liquefaction Vulnerability

Reference to the Auckland Council GeoMaps 'Development Restrictions' layer, indicates the site has been subject to a Level B (Calibrated Assessment) as defined in MBIE's '*Planning and engineering guidance for potentially liquefaction-prone land Resource Management Act and Building Act aspects'* dated September 2017.

Auckland Council have zoned the site as 'Very Low Liquefaction Vulnerability' under their Level B assessment. This development is considered 'commercial development' and Table 3.7 of the above document indicates a Level B assessment is suitable to support a Building Consent application for the development. Based on the results of our investigation, we concur with the Council classification.

10.0 Static Settlement

Significant thicknesses of organic or otherwise compressible soils were not encountered during our investigation. Provided the recommendations of this report are adopted in design and construction we consider any potential total or differential (static) settlement as a result of the proposed development to be within typical tolerable limits.

11.0 Slope Stability

The ground surface descends gently to the south at inclinations of flatter than 10°. Combined with the proposed development comprising specifically designed retaining walls, and located near the ridgeline, the proposed development will mitigate any slope stability concerns and we consider the site to be suitable for the construction of the proposed building from a global land stability perspective.

12.0 Geotechnical Discussion

We consider the site to be geotechnically suitable for the proposed development provided the recommendations given in this report are observed.

Geotechnical constraints that will require particular consideration by the designer are outlined below and specific geotechnical recommendations and parameters to mitigate these constraints are provided in subsequent sections of this report.

We consider the primary geotechnical constraint to development of the site to be the maintenance of the stability of the neighbouring structure to the west, both in terms of localised excavation stability and short and long-term settlement effects associated with the proposed basement retaining.

The construction of temporary support will be required prior to any bulk excavations being carried out. A specific construction methodology is required in order to mitigate the potential for localised instability during construction of retaining.

13.0 Site Formation

All site formation works should be carried out to the requirements of NZS 4404:2010 '*Land Development and Subdivision Infrastructure*'. Prior to commencing excavations, a sediment control system must be constructed to ensure the Council requirements are met. Typical details can be found in Auckland Councils publication 'GD05' (June 2016).

Stripped material should be removed from site or stockpiled well clear of the works and in such a way that land stability and/or existing structures are not compromised. Any in-situ fill is considered unlikely to be suitable for re-use as engineered fill.

Any proposal to create cuts or fills greater than 1.0m in height other than those indicated/inferred at the time of preparation of this report should be the subject of specific design advice as temporary stability must be considered.

Cuts

Cuts along the property boundaries to a maximum depth of approximately 7.5m bpgl are required to form the lower basement level with the area of deepest cut in the northwestern corner. Cuts then progressively decrease in depth to the east and south of the site with a minimum excavation depth of approximately 2.5m bpgl in the southeast corner of the site.

Temporary support in the form of barrier pile or soldier pile walls will be required for the proposed bulk excavations and reference should be made to Section 13.1 of this report in this regard.

Battered cut slopes in lieu of built temporary support are not considered viable in this instance given the depth of excavation proposed, excavations being along the site boundaries, and the limited area available within the excavation for the extent of batters likely to be required.

Where temporary batters are proposed in addition to temporary support (i.e. in front of a barrier pile wall), batters should be no steeper than 1V:1H to a maximum height of 3.0m. The width of the batter (measured at the top) should be as wide as possible to reduce the temporary demands on the barrier pile wall, as a guide the batter width should be equal to (or greater than) the batter height wherever possible.

Where temporary batters are required for localised excavations within stiff natural ground within the building platform, excavations to a maximum depth of 1.0m may be cut near-vertical and battered no steeper than 1V:0.5H to a depth of 1.5m provided such excavations are a greater distance from the site boundaries or other structures than the depth of excavation.

All temporary cut batters must be protected from the elements with PVC sheeting. Reference should be made to Section 13.1 of this report in this regard.

Groundwater is expected to be encountered within the proposed bulk excavation for the lower basement level (Basement 02) and sumps/pumps will be required to remove groundwater from the excavation. The contractor must be vigilant in this respect and summertime construction is beneficial in this regard.

Similarly, any springs or seepage of water intercepted by stripping operations should be captured and taken in a sealed pipe via the shortest route to a safe discharge point as per S&RC advice.

Should a zone of ‘wet’ soil be encountered outside of the lower basement excavation this increases the potential for cut-face collapse and increased erosion where soils are exposed to the elements, and temporary face protection between barrier/soldier piles may be required (if not proposed). S&RC should be contacted for advice in this event.

Provided the excavations are undertaken in accordance with the recommendations of this report we consider the potential effects of those excavations on neighbouring land, structures, buildings, and any services to be negligible.

Fills

Filling is expected to be limited to minor backfilling to under-slab level. All fills, regardless of depth, must be placed in accordance with NZS 4431:2022 with respect to subgrade preparation and standard of compaction.

The exposed soils should be inspected by S&RC prior to placement of any fill. Weak, compressible or other unsuitable matter should be excavated and replaced with properly compacted granular fill.

Given the limited extent, we recommend any fill comprise quarry-sourced granular fill (GAP material). The granular fill should be compacted to design level in loose layers no more 150mm thick and to achieve 95% of the maximum dry density.

13.1 Temporary Stability and Support

Temporary support in the form of barrier pile or ‘palisade’ walls and/or top-down construction will be required for the proposed excavations. We understand the use of a secant wall may be considered in the northwest corner if required to limit settlement effects resulting from groundwater drawdown. This consideration is subject to detailed analysis of wall deflections and associated settlement effects on nearby structures.

The construction of temporary support is required prior to any bulk excavations being carried out. The designer should ensure that a satisfactory Factor of Safety against temporary instability is available at all stages of the development, i.e., temporary excavations, tiered retaining walls, final topography.

Typically, temporary support would comprise barrier piles and strip drainage with shotcrete then applied to provide the final retaining solution (potentially with an aesthetic facing) and this is considered appropriate in this instance. These piles could also be regarded as sacrificial ‘soldier’ piles and the permanent retaining solution constructed in front of the same if required/preferred.

Indicatively we consider 600mm diameter piles at a 3D (D = Pile Diameter) spacing likely to be suitable for retained heights of up to approximately 6.0m. Larger diameter piles and/or closer spacing are likely to be required for greater retained heights. Geotechnical retaining design parameters are provided in Section 14.0 of this report.

We recommend any consideration of alternative temporary support systems or construction methodologies other than those outlined in this report be discussed with S&RC at the design stage.

The existing basement level and associated retaining along the northwest boundary must be considered in the design and construction methodology of the temporary/permanent support for the proposed excavations to the north and west.

All temporary support structures must consider the potential for machinery working above the wall unless this is strictly removed by the construction methodology or otherwise accounted for in the design.

At all times the maintenance of temporary support and batter stability is the responsibility of the contractor. Efforts should be made during construction to complete the construction of retaining walls as soon as practicable following excavation and to carry out the work during, and following, dry weather.

We reiterate that provided the recommendations of this report regarding temporary stability of excavations are adhered to during design and construction we consider the potential effects of those excavations on neighbouring land, structures, buildings, and any services likely to be negligible.

A specific construction methodology of temporary support and earthworks is required to mitigate the potential for localised instability during construction. This should be prepared by the designer based on the specific requirements of the various walls and construction sequence assumed in the design.

However, from a geotechnical perspective the following general process should be followed, subject to specific design requirements arising during detailed design:

1. Site Clearing
2. Installation of any required monitoring stations/equipment/piezometers
3. Installation of temporary support structures
4. Bulk excavation (including temporary batters, benches, and drain installation)
5. Bulk filling
6. Construction of permanent support and installation of associated drainage (if required/proposed)
7. Building Construction

Cut Batter Stability

In addition to the recommendations herein, we recommend the "*Good Practice Guidelines – Excavation Safety*" by WorkSafe New Zealand (2016) be followed by the designer and the contractor and we recommend all excavations be subject to inspection by S&RC.

Any cut left exposed for greater than 24 hours should be covered with heavy PVC sheeting which is suitably battened and anchored to protect the exposed soils from the elements. In addition, surface runoff should be intercepted by means of shallow surface drains or small bunds to protect the excavation from saturation and erosion. Water collected in the interceptor drains should be diverted away from the excavation to a safe disposal point.

Care should also be taken with regard to the use and movement of machine plant above any cut faces during construction. The surcharge effect of heavy machinery could cause local instability and as such should be considered in the earthworks design.

14.0 Retaining Structures

Boundary retaining walls to a maximum height of approximately 8.0m are proposed. We recommend retaining systems be Engineer-designed and consider both the local and global stability of the site, and any surcharge applicable to the wall. Particular attention should be paid to the influence of building and/or traffic surcharges above any retaining wall.

Geotechnical retaining wall design parameters are provided in Table 7.

Table 7 – Retaining Wall Design Parameters

Stratum	Bulk Density (kN/m^3)	Cohesion c' (kN/m^2)	Internal Friction Angle (°)	Young's Modulus E (MN/m^2)	Shear Strength S_u (kN/m^2)
Non-Engineered Fill	18	0	26	-	-
Weathered Waitemata Group Soil	18	7	30	24	80
Transition Zone	19	12	32	45	150
Waitemata Group Rock	19	30	36	300	200

The cohesion provided in Table 7 is for in-ground barrier pile walls only. Any wall with drainage material installed behind the wall should assume zero cohesion. Soil pressures should be determined for 'at-rest' pressure conditions (K_o).

No passive resistance should be inferred until the horizontal buttress of stiff natural soil at the downslope side of the retaining pole is at least 4D in width, where 'D' is the diameter of the bored hole.

If the basement is to be constructed as fully tanked, permanent retaining must be designed to withstand the full build-up of the hydrostatic pressures behind the wall.

For barrier-pile walls all poles should be spaced no greater than 3D apart (D = Pile Diameter) with each pile able to resist lateral pressures over the retained height to a width of 3D centred on the pole. Structural design may require lesser spacing to account for applicable surcharge loads.

Factors of safety and surcharge loadings appropriate to the conditions should be in accordance with '*Limit State Design of Retaining Walls and Foundations for Geotechnical and Structural Engineers*' SESOC Seminar Series 2005 and/or '*Module 6: Earthquake resistant retaining wall design*' prepared by MBIE dated November 2021 as applicable.

Reference should be made to the Auckland Council Practice Note AC2231 Version 5 with regards to retaining walls near property boundaries.

15.0 Foundation Design Recommendations

S&RC should inspect all foundation excavations to determine whether the exposed soil and foundation conditions are consistent with those described in this report.

15.1 Pile Foundations

We recommend pile foundations take the form of bored steel-reinforced concrete piles embedded into very stiff natural ground or rock. Embedment must be a minimum of 3D into the founding stratum and 6D if required to resist uplift.

Pile excavations are expected to penetrate groundwater and will potentially be susceptible to collapse and casing may be required. Pumps capable of handling slurry-rich material will also be required during construction.

Bridging piles are required where foundations would otherwise embed above a plane inclined at 1V:1H rising from 500mm below the invert of any buried service. Bridging piles must be designed in accordance with Council guidelines.

Soil strength parameters applicable to Ultimate Limit State Design in accordance with AS/NZS 1170:2002 are given in Table 8. These parameters may only be adopted for piles with a length-to-diameter ratio greater than five (L/D > 5), and that are embedded a minimum of 3D into stiff natural ground.

A Strength Reduction Factor ($Ø_{pc}$) not greater than 0.5 should be applied to the Geotechnical Ultimate Capacity values to determine the Design (Dependable) Capacity values.

Table 8 – Ultimate Limit State Pile Design Parameters

Material	Ultimate End Bearing Capacity	Ultimate Skin Friction	
		Compression	Tension
Non-Engineered Fill	Nil	Nil	Nil
Weathered Waitemata Group Soils Indicative RL70 – RL64	450kPa	40kPa	10kPa
Weathered Waitemata Group Soils Indicative RL64 – RL60	900kPa	100kPa	30kPa
Waitemata Group Transition Zone Indicative RL60 – RL55	2MPa	200kPa	50kPa
Smooth Wall Piles in Waitemata Group Rock Indicative Below RL55	6MPa	500kPa	120kPa
Grooved Wall Piles in Waitemata Group Rock Indicative Below RL55	Nil	750kPa	500kPa

Skin friction should be ignored within non-engineered fill and/or the upper 0.8m of pile length (whichever is the deeper). Skin friction should also be ignored if the pile holes are permanently cased.

15.2 Grooved Pile Foundations

Should grooved piles be proposed/required, the grooved skin friction capacities provided in Table 8 may be used in design and apply to the portion of the pile shaft embedded below one pile diameter (1D) into N=60+ dense deposits for axial compression and three pile diameters into N=60+ dense deposits for axial tension (uplift).

For the above capacity to apply, the pile shaft must be grooved in accordance with Section 3.6 of the Auckland Structural Group Piling specifications, an excerpt of which is provided below:

> *Where specified on the Drawings, each pile bore shall be spirally grooved with a 50 x 50 mm finger withdrawn to achieve a pitch of 300mm, over the entire length of minimum embedment shown on the Drawings. If a temporary or permanent casing is used, the minimum length of embedment, as specified on the Drawings, shall be measured from below the bottom of the casing.*
>
> *A grooving trial shall be carried out on the first production pile. The Contractor shall allow for inspection of the grooved pile by the Engineer.*

We recommend the end-bearing component of theoretical pile capacity be discounted for piles that rely on a grooved shaft. This recommendation is a consequence of the full pile end bearing only becoming available once the pile has deflected beyond the allowable limit of the groove in which case the pile reverts to a smooth-shaft design.

For clarification - piles may only be designed as follows:

- Utilising both smooth shaft friction and end-bearing (aka 'total socket design') or
- Grooved shaft friction only i.e. no end-bearing

Grooved Pile Construction Challenges

Achieving adequate grooving of piles requires specialist equipment and a contractor experienced in constructing grooved piles. This must be considered during selection of the contractor.

During grooving, material may fall to the base of the pile, and must be removed in order for the wet concrete to be able to set without pre-stressing the grooves. Given the expected depth to the base of any pile hole, this is expected to be difficult.

Grooved Pile Inspection

Thorough inspection of pile grooving must be carried out to ensure the above specification is met. Inspection must comprise CCTV inspection over the full grooved depth of the pile and confirmation that the pile base has been fully cleaned.

Both construction and inspection will be difficult should casing and/or bentonite slurry be required to keep the pile bores open prior to concreting or groundwater be unable to be completely removed from the hole.

15.3 Shallow Foundations

The natural site soils are considered suitable for the use of shallow foundations which may comprise traditional strip/pad footings embedded a minimum of 600mm into stiff natural ground or engineered fill.

We infer any shallow foundations will be located greater than 2.0m below final ground level and therefore soil expansivity may be ignored. Any shallow foundation within 2.0m of final ground level must be embedded a minimum of 800mm into stiff natural ground or engineered fill and be designed to accommodate the expansivity characteristics of the soils, classified as 'Highly Expansive' as per Section 7.0 of this report.

A Design (Dependable) Bearing Capacity of 200kPa is available for Ultimate Limit State Design of shallow foundations carried out in accordance with B1/AS1, B1/VM4 and AS/NZS 1170:2002. A Strength Reduction Factor ($Ø_{bc}$) of 0.5 has been applied to the Geotechnical Ultimate Bearing Capacity value to determine the Design Bearing Capacity.

16.0 Floor Slabs and Pavements

All topsoil, non-engineered fill, vegetation, organic or otherwise unsuitable material should be removed from under floor slab and pavement areas prior to construction.

For preliminary design a CBR value of 3% or a modulus of subgrade reaction of 25kPa/mm are considered appropriate for flexible and rigid pavements respectively. These values should be confirmed by specific testing by S&RC following preparation of the subgrade.

Any concrete floor-slab or pavement should be underlain by a basecourse of clean, free-draining granular fill as specified by the designer and should be subjected to compaction by a device of appropriate weight and energy. Silty or sandy subgrades are generally sensitive to disturbance and ‘static’ rolling only (no vibration) is recommended.

Subgrade Protection

Any subgrade should be protected from desiccation, rain damage, and plant-trafficking immediately upon excavating or filling to grade following inspection by S&RC.

Protection may take the form of topsoil, mulching, or by placing a protective layer of granular fill. The granular fill can later be left in-situ as a construction sub-base or basecourse if managed well and protected from damage. We recommend watering expansive subgrades approximately 48 hours prior to concrete placement to return the subgrade to its inferred pre-excavation moisture content.

16.1 Under-Slab Drainage

The lower basement floor level is below the groundwater table. Installation of permanent under-slab drainage is recommended, however the effects of permanent drainage of neighbouring structures must be considered.

The drainage should comprise strip drains (nominally 300mm wide and 300mm deep with 100mm ID perforated drainage coil at no more than 5.0m spacing. The drainage system should be taken to an outfall that cannot discharge above floor level even if it becomes blocked or its capacity is exceeded.

In the absence of gravity-fall discharge (i.e. passive dewatering) a permanent sump and reliable pump system will be required. (i.e. active dewatering). Design for any pumped groundwater dewatering system should consider both back-up power-supply/pumping equipment and/or potential for temporary hydrostatic uplift on the basement floor slab, in the event of power/pump failure during significant storms.

Pumped dewatering systems require ongoing maintenance for the full lifespan of the structure and should therefore be incorporated into the considerations of end-user responsibilities and lifetime costs.

A geotextile should be laid both under and over the drainage blanket with a damp-proof membrane laid over the upper geotextile layer to prevent grout from concrete slab construction reaching the drainage blanket. If any area of the drainage blanket is isolated, e.g. by ground beams founded directly on the ground surface, provision must be made to drain the isolated area.

17.0 Stormwater

Concentrated stormwater flows must not be allowed to saturate the ground as this could adversely affect foundation conditions. Flows from all impermeable areas must be collected and carried in sealed pipes to a disposal point approved by Council.

18.0 Drawing Review

No finalised drawings of the proposed foundations/retaining were provided at the time of preparation of this report. We recommend once plans are available that they be submitted to S&RC so that the applicability and implementation of the recommendations made in this report can be confirmed prior to application for Building Consent.

We expect iterative design to take place (structural designer and S&RC) as assessment of basement retaining (temporary and permanent deflections) will be required.

We recommend S&RC review the draft Resource Consent conditions prior to final acceptance.

19.0 Underground Services

Underground stormwater/wastewater services are present within the site. Additional services, public or private, mapped or unmapped, of any type (gas, pipelines, fibre, electricity etc) could be present. A thorough service-search should be carried out prior to commencement of excavations.

20.0 Construction Constraints

Geotechnical aspects of construction that are anticipated to require special attention by the Contractor and inspecting Geotechnical Engineer include (but are not necessarily limited to) the following:

- Careful consideration of the excavation and construction methodology is required, and reference should be made to Section 13.1 of this report in this regard.
- Pile or bulk excavations that penetrate groundwater will potentially be susceptible to collapse and pile casing or temporary support may be required respectively. Pumps capable of handling slurry-rich material will also be required during construction.
- At all times the maintenance of temporary stability is the responsibility of the contractor.

21.0 Observation of Construction

The recommendations given in this report are based on limited site data from discrete locations and variations in ground conditions will exist. S&RC should be engaged to inspect excavations and foundation conditions exposed during construction so that ‘actual’ ground conditions can be compared with those assumed in formulating this report.

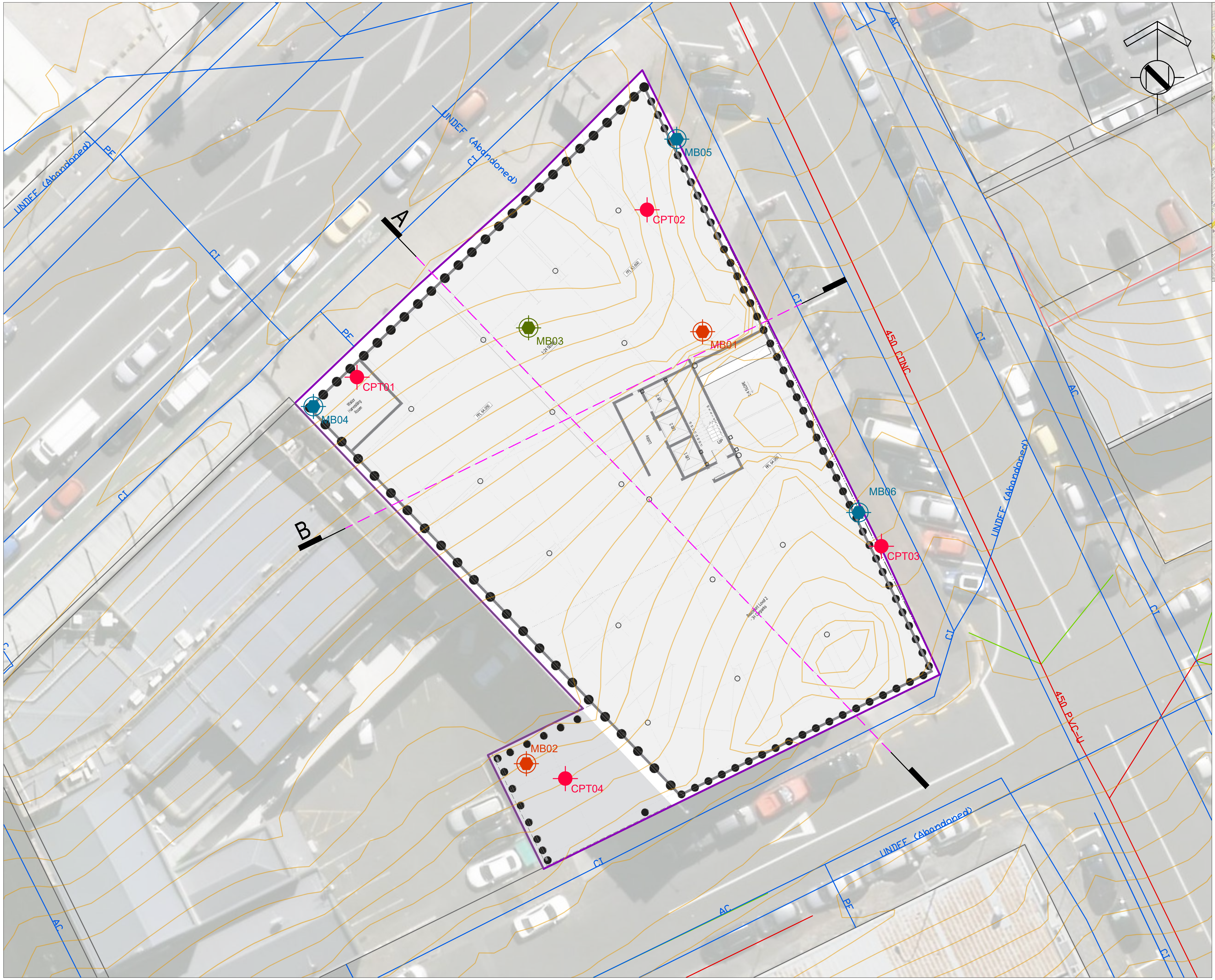
The aspects of the development that require geotechnical observation, testing, and final certification as determined by Council will be given in the conditions of the Consent. The Contractor should make themselves familiar with those conditions, in addition to the requirements of this report, and ensure adequate observations are carried out. Any ground covered by fill or concrete prior to geotechnical inspection will be specifically excluded from any Producer Statement – Construction Review (PS4).

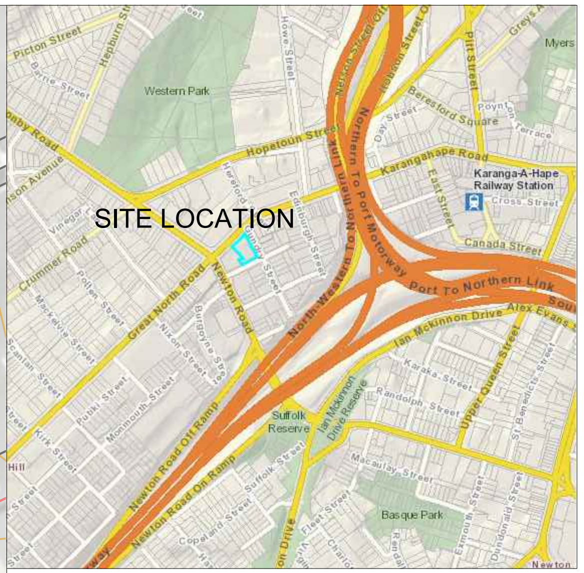
In any case, the contractor should notify S&RC should ground conditions encountered during construction vary from those described in this report.

End of Report Text – Appendices Follow

Appendix A

Drawings





LOCATION MAP

NOTES:

1. Locations of features approximate only.
2. Location of all buried services to be verified prior to construction.
3. Original sheet size A3.
4. Boundary information on this Site plan adapted from Auckland Council Aerial Photographs and/or GIS Data.

KEY:

—	Site Boundary
—	Watermain
—	Wastewater Line
—	Stormwater Line
CPT03	Approximate CPT Locations Soil & Rock Consultants, July 2023
MB01	Approximate Machine Borehole Locations Soil & Rock Consultants, Mar 2020
MB01	Approximate Machine Borehole Locations Soil & Rock Consultants, Mar 2022
MB01	Approximate Machine Borehole Locations Soil & Rock Consultants, July 2023
A	Approximate Cross Section Locations Soil & Rock Consultants

AMENDMENTS

DATE	REV	DESCRIPTION

Soil&Rock Consultants
Your responsive & cost-effective engineers

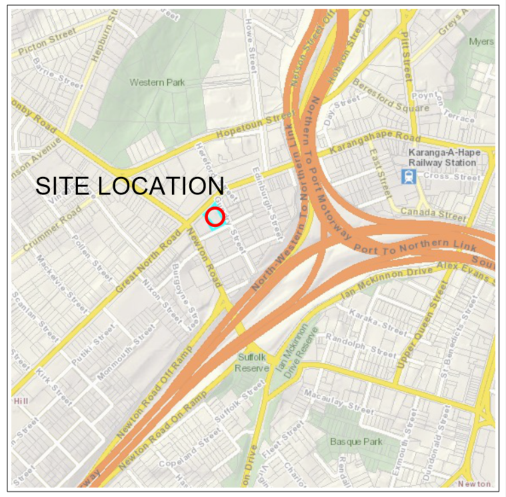
Level 1, 131 Lincoln Road, Waitakere
PO Box 21-424 Henderson, Waitakere 0650
Ph 09 835 1740 Fax 09 835 1847
www.soilandrock.co.nz

Check all dimensions and levels on site before commencing construction.
This drawing and design remains the property of Geotechnical Engineering Ltd. and may not be reproduced without the written permission of Geotechnical Engineering Ltd.

538 KARANGAHAPE ROAD
NEWTON

SITE PLAN

20111 / NB1
SCALES: 1: 300
AT A3
DRAWN: B.Smith
DATE: 11-Aug-23
CHECKED:
REV.
DESIGNED:
Filename: 20111 - plan -july2023.dwg



LOCATION MAP

NOTES:

1. Locations of features approximate only.
2. Original sheet size A3.
3. Soil & Rock Consultants drawing adapted from Auckland Council Aerial Photographs and/or GIS Data.

KEY:

🟥	Site Boundary
〰	Groundwater Contour
◐ PZ04	Approximate Piezometer Locations Soil & Rock Consultants, July 2023

AMENDMENTS

DATE	REV	DESCRIPTION

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538 KARANGAHAPE ROAD

NEWTON

GROUNDWATER
CONTOURS PLAN

20111 / GW1

SCALE: AT A3 1: 1250

DRAWN: B.Smith

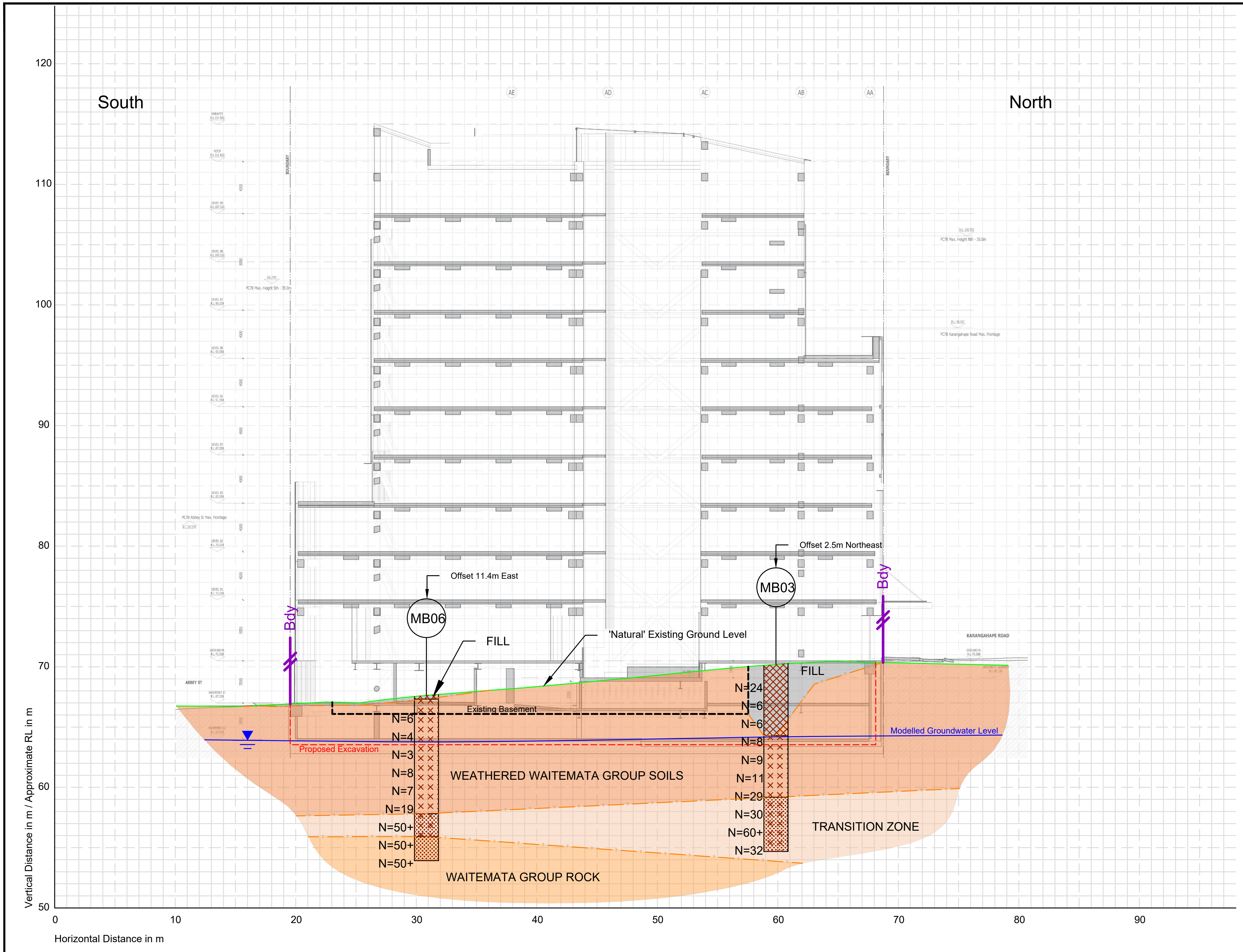
DATE: July 2023

CHECKED:

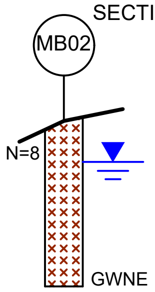
REV.

DESIGNED:

Filename:



KEY TO CROSS SECTION SYMBOLS



Machine Drilled Borehole

SPT N value

Groundwater Level

Groundwater Not Encountered

KEY TO LITHOLOGY SHADES

Non-Engineered Fill	▨
Weathered Waitamata Group Soils	▨
Transition Zone	▨
Waitamata Group Rock	▨

KEY TO LITHOLOGY HATCHES

Fill	▨
Clay	▨
Silt	▨
Sand	▨
Gravel	▨
Sandstone	▨

NOTES:

1. Soil & Rock Consultants cross sections surveyed by tape and clinometer.
2. Soil descriptions shown approximate only, refer to borelogs for details.
3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater Level taken from modeled groundwater contours as per S&RC Groundwater Compliance Assessment
5. Locations of features approximate only.

AMENDMENTS		
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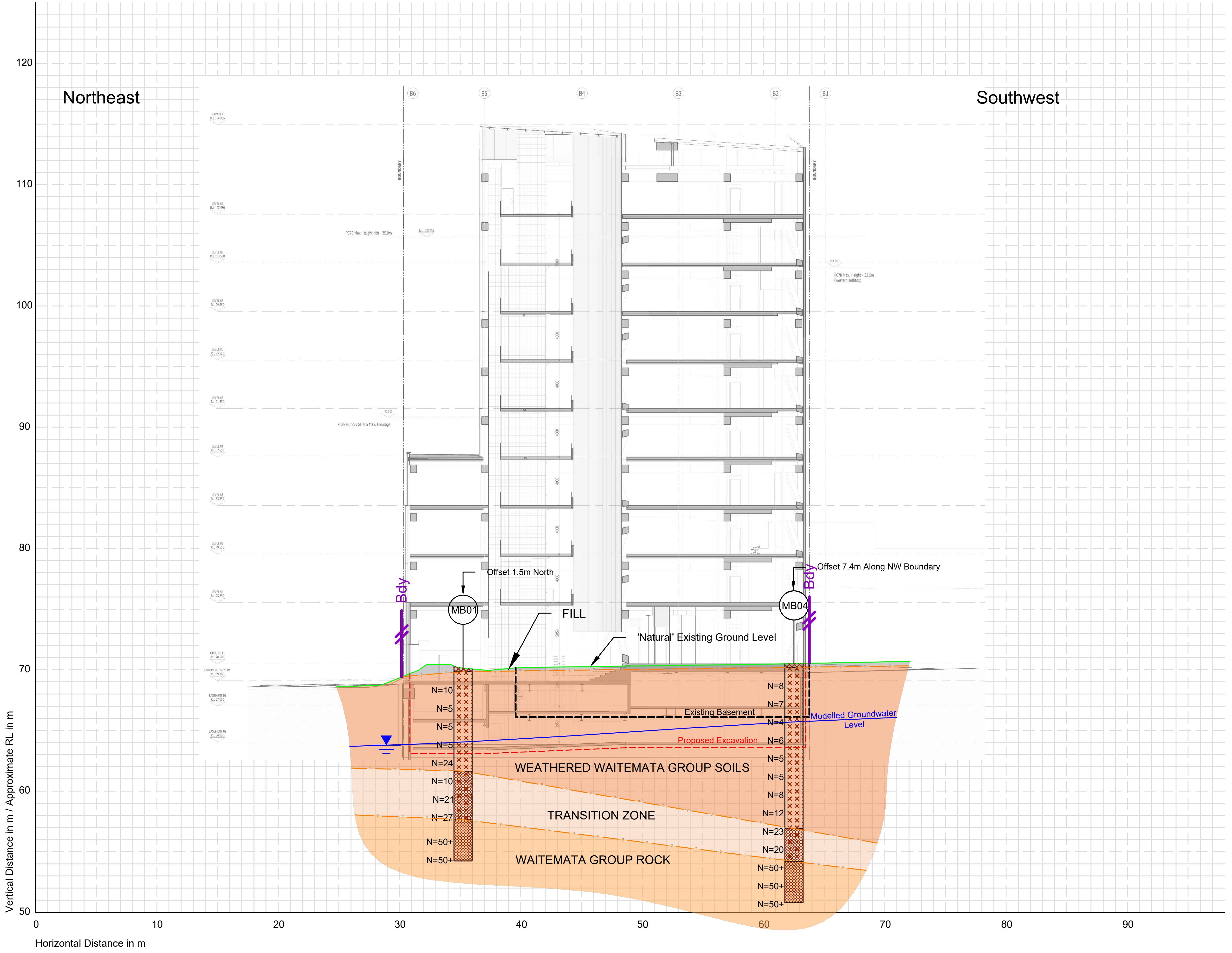
NEWTON

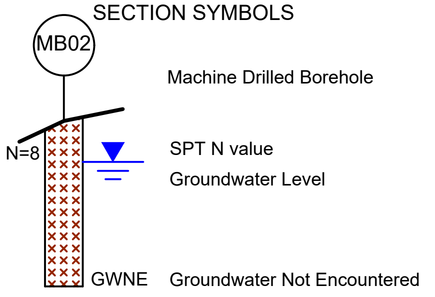
CROSS SECTION A

20111 /2A	DRAWN: B.Smith	DATE: 10-Aug-23
SCALES: 1: 300 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 20111 - section -july2023.dwg



KEY TO CROSS SECTION SYMBOLS



KEY TO LITHOLOGY SHADES

Non-Engineered Fill	■
Weathered Waitemata Group Soils	■
Transition Zone	■
Waitemata Group Rock	■

KEY TO LITHOLOGY HATCHES

Fill	▨
Clay	▨
Silt	▨
Sand	▨
Gravel	▨
Sandstone	▨

NOTES:

1. Soil & Rock Consultants cross sections surveyed by tape and clinometer.
2. Soil descriptions shown approximate only, refer to borelogs for details.
3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater Level taken from modeled groundwater contours as per S&RC Groundwater Compliance Assessment
5. Locations of features approximate only.

AMENDMENTS

DATE	REV	DESCRIPTION

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538 KARANGAHAPE ROAD
NEWTON

CROSS SECTION B

20111 /2B
DRAWN: B.Smith
DATE: 10-Aug-23
SCALES: 1: 300 AT A3
CHECKED:
REV.
DESIGNED:
Filename: 20111 - section -july2023.dwg

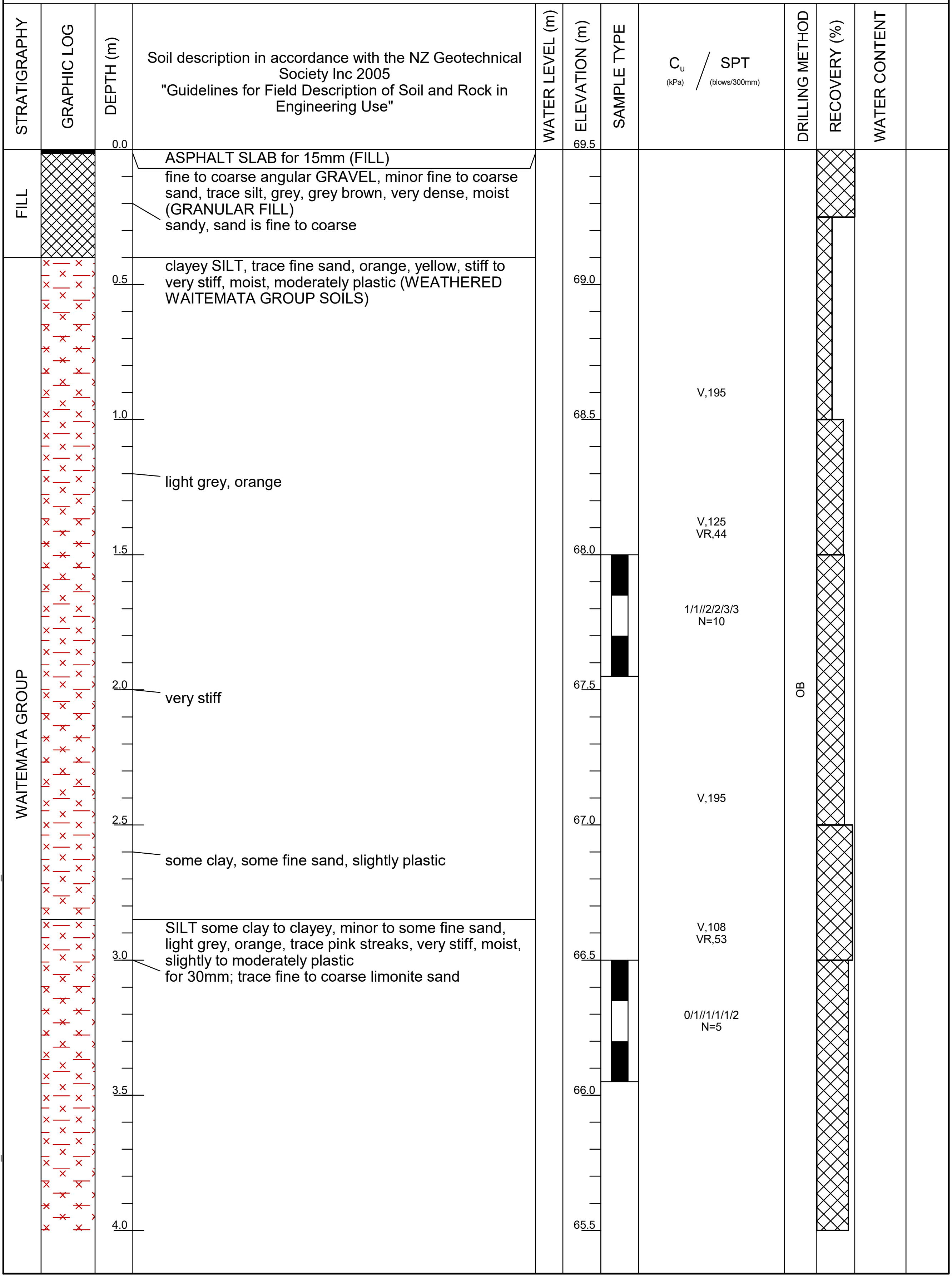
Appendix B

Investigation Logs and Machine Core Photos

Soil&Rock Consultants
For well-grounded solutions

CLIENT:	James Kirkpatrick Group Ltd	Machine Borehole No:	MB01
PROJECT:	538 Karangahape Road, Auckland City	Sheet	1 of 4

Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	DEG
Drilled By:	ProDrill Ltd	Coordinates:		Shear Vane No - Calibration Date:	GEO2425 - 18/10/2019
Date Started:	16/3/20	Ground Elevation:	69.5m	Surface Conditions:	Slight Slope, Asphlat
Date Finished:	16/3/20	Water Level:			



Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"

FILL

ASPHALT SLAB for 15mm (FILL)

fine to coarse angular GRAVEL, minor fine to coarse sand, trace silt, grey, grey brown, very dense, moist (GRANULAR FILL)

sandy, sand is fine to coarse

WAITEMATA GROUP

clayey SILT, trace fine sand, orange, yellow, stiff to very stiff, moist, moderately plastic (WEATHERED WAITEMATA GROUP SOILS)

light grey, orange

very stiff

some clay, some fine sand, slightly plastic

SILT some clay to clayey, minor to some fine sand, light grey, orange, trace pink streaks, very stiff, moist, slightly to moderately plastic

for 30mm; trace fine to coarse limonite sand

C

C_u (kPa) / SPT (blows/300mm)
V,195
V,125 VR,44
1/1//2/2/3/3 N=10
V,195
V,108 VR,53
0/1//1/1/1/2 N=5

CLIENT: James Kirkpatrick Group Ltd

PROJECT: 538 Karangahape Road, Auckland City

Machine Borehole No: MB01

Sheet 2 of 4

Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	DEG
Drilled By:	ProDrill Ltd	Coordinates:		Shear Vane No - Calibration Date:	GEO2425 - 18/10/2019
Date Started:	16/3/20	Ground Elevation:	69.5m	Surface Conditions:	Slight Slope, Asphlat
Date Finished:	16/3/20	Water Level:			

STRATIGRAPHY	DEPTH (m)	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	ELEVATION (m)	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	WATER CONTENT
WAITEMATA GROUP	4.0	SILT some clay to clayey, minor to some fine sand, light grey, orange, trace pink streaks, very stiff, moist, slightly to moderately plastic grey, firm to stiff		65.5	V,111 VR,35	OB		
	4.5	SILT some fine sand to sandy, minor clay, grey, firm to stiff, moist to wet, non to slightly plastic		65.0	0/1//1/1/1/2 N=5			
	5.0	for 80mm; some clay, some fine sand, slightly plastic		64.5				
	5.5			64.0				
		clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic			V,200+ UTP			
	6.0			63.5				
		SILT some fine sand to sandy, some clay, grey, very stiff, moist, slightly plastic			1/0//1/1/2/1 N=5			
	6.5			63.0				
		SILT some clay to clayey, minor fine sand, very stiff to hard, moist, slightly to moderately plastic clayey, trace fine sand, moderately plastic						
	7.0	some clay to clayey, slightly to moderately plastic		62.5				
		SILT some fine sand to sandy, trace lignite fragments to 2mm diameter, trace clay, grey speckled black, hard, moist, non plastic no lignite, grey			V,200+ UTP			
	7.5	for 60mm, trace lignite fragments to 1mm diameter		62.0				
		clayey SILT, trace fine sand, grey, hard, moist, moderately plastic some clay to clayey, slightly to moderately plastic some clay, slightly plastic			4/5//5/5/7/7 N=24			
		SILT some fine sand, minor clay, grey, hard, moist, non to slightly plastic						
	8.0			61.5				

MACHINE LOG-FULL_SPT-RL 20111 MB01 - MB02 19MAR2020.GPJ S+R_2013.GDT 1/4/20

Soil&Rock Consultants
For well-grounded solutions

CLIENT: James Kirkpatrick Group Ltd

PROJECT: 538 Karangahape Road, Auckland City

Machine Borehole No: MB01

Sheet 3 of 4

Drill Type: Rotary Machine Rig
Drilled By: ProDrill Ltd
Date Started: 16/3/20
Date Finished: 16/3/20
Project No: 20111
Coordinates:
Ground Elevation: 69.5m
Water Level:
Logged By: DEG
Shear Vane No - Calibration Date: GEO2425 - 18/10/2019
Surface Conditions: Slight Slope, Asphlat

STRATIGRAPHY	DEPTH (m)	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	ELEVATION (m)	SAMPLE TYPE	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	WATER CONTENT
WAITEMATA GROUP	8.0	SILT some fine sand, minor clay, grey, hard, moist, non to slightly plastic		61.5			OB		
		some clay, minor fine sand, slightly plastic							
		fine sandy SILT, trace clay, grey, hard, moist, non plastic							
	8.5	slightly to moderately weathered, grey, fine to medium SANDSTONE, very weak (WEATHERED WAITEMATA WAITEMATA GROUP SOIL AND ROCK) fine SANDSTONE silty, fine SANDSTONE		61.0					
						V,200+ UTP			
	9.0	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic some clay to clayey, slightly to moderately plastic		60.5		3/2//2/2/3/3 N=10			
		fine to medium SAND, some silt, grey, medium dense, moist							
	9.5	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic hard		60.0					
		some clay, minor fine sand, slightly plastic some clay to clayey, trace fine sand, slightly to moderately plastic							
	10.0			59.5					
		silty, fine SAND, grey, medium dense, moist							
		clayey SILT, trace fine sand, grey, hard, moist, moderately plastic							
	10.5			59.0		3/3//4/5/6/6 N=21			
		some clay to clayey, slightly to moderately plastic							
	11.0			58.5					
	11.5			58.0					
		slightly weathered, grey, fine to medium SANDSTONE, weak to very weak							
	12.0			57.5					

Soil&Rock Consultants For well-grounded solutions	CLIENT: James Kirkpatrick Group Ltd PROJECT: 538 Karangahape Road, Auckland City
Machine Borehole No: MB01	Sheet 4 of 4

Drill Type: Rotary Machine Rig
Drilled By: ProDrill Ltd
Date Started: 16/3/20
Date Finished: 16/3/20

Project No: 20111
Coordinates:
Ground Elevation: 69.5m
Water Level:

Logged By: DEG
Shear Vane No - Calibration Date: GEO2425 - 18/10/2019
Surface Conditions: Slight Slope, Asphlat

STRATIGRAPHY	DEPTH (m)	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	ELEVATION (m)	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	WATER CONTENT
WAITEMATA GROUP	12.0	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic		57.5	8/7//6/6/7/8 N=27	HQTT		
	12.5	slightly weathered, grey, SILTSTONE, weak		57.0				
		slightly weathered, grey, fine to medium SANDSTONE, weak						
		slightly to moderately weathered, grey, SILTSTONE, very weak						
	13.0	fine sandy SILTSTONE		56.5				
	13.5			56.0				
	14.0			55.5	11/11//14/13/11 for 40mm 60 blows for 340mm penetration			
		fine to medium SAND, some silt, grey, very dense / weakly cemented, wet						
	14.5			55.0				
		slightly weathered, grey, fine to medium SANDSTONE, weak fracture dipping 50°, rough, aperture <1mm, no discoloration, no infill fracture dipping 45°, rough, aperture <1mm, no discoloration, no infill						
	15.0	fracture dipping 45°, rough, aperture <1mm, no discoloration, no infill fractures dipping 35° and 70°, rough, aperture <1mm, no discoloration, no infill fracture dipping 65°, rough, aperture <1mm, no discoloration, no infill		54.5				
		clayey SILT, trace fine sand, grey, hard, moist, moderately plastic						
	15.5	slightly weathered, grey, SILTSTONE, grey, very weak (WAITEMATA GROUP ROCK)		54.0	8/8//11/13/14/6 for 45mm 60 blows for 420mm penetration			
	16.0	END OF BORE. 15.92 METRES. (TARGET DEPTH)		53.5				

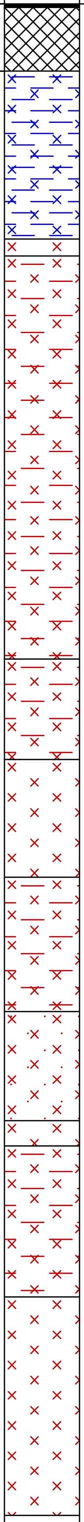
MACHINE LOG-FULL_SPT-RL 20111 MB01 - MB02 19MAR2020.GPJ S+R_2013.GDT 1/4/20

Soil&Rock Consultants
For well-grounded solutions

CLIENT: James Kirkpatrick Group Ltd
PROJECT: 538 Karangahape Road, Auckland City

Machine Borehole No: MB02
Sheet 1 of 2

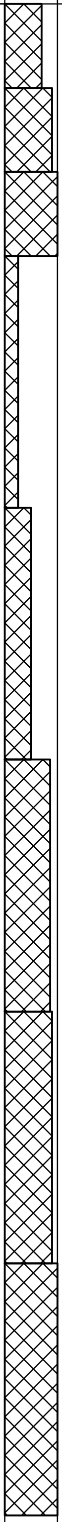
Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	STL
Drilled By:	ProDrill Ltd	Coordinates:		Shear Vane No - Calibration Date:	GEO2425 - 18/10/2019
Date Started:	16/3/20	Ground Elevation:	67.9m	Surface Conditions:	Slight Slope, Asphalt Carpark
Date Finished:	16/3/20	Water Level:			



STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	ELEVATION (m)	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
FILL	ASPHALT SLAB for 20mm (FILL)			
	fine to coarse angular GRAVEL, minor fine to coarse sand, grey, medium dense, moist (GRANULAR FILL)			
WAITEMATA GROUP	silty CLAY, trace fine sand, orange, grey, stiff, moist, highly plastic (WEATHERED WAITEMATA GROUP SOILS) core disturbed by drilling from 0.5m to 1.0m	67	V,72 VR,28	
	very stiff			
	light grey with orange streaks		V,200+ UTP	
	SILT some clay, minor fine sand, light grey, light yellow, very stiff, moist, slightly plastic		3/3//4/4/5/5 N=18	
	clayey SILT, trace fine sand, light grey, orange, very stiff to hard, moist, moderately plastic	66		
	light grey with orange and pink streaks, stiff	65	V,104 VR,44	
	minor fine sand		1/1//1/2/1/2 N=6	
	SILT some clay to clayey, minor fine sand, grey, orange, stiff to very stiff, moist, slightly to moderately plastic	64	V,83 VR,44	OB
	SILT some to minor fine sand, minor clay, grey, stiff to very stiff, moist, non to slightly plastic	63	1/0//1/1/1/2 N=5	
	clayey SILT, trace fine sand, grey, stiff, moist, moderately plastic			
	for 60mm; some brown, black speckles of lignite	62	V,72 VR,38	
	fine sandy SILT, trace clay, grey, stiff, moist, non plastic		0/1//1/1/1/1 N=4	
	SILT some fine to medium sand, some clay, grey, stiff, wet, slightly plastic	61		
	clayey SILT, trace fine sand, grey, stiff, wet, slightly plastic		V,150 VR,44	
	SILT some fine sand, some clay, grey, stiff, wet, slightly plastic	60	0/1//1/1/1/2 N=5	
		59	V,195	

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

WATER LEVEL (m) | SAMPLE TYPE | RECOVERY (%) | WATER CONTENT



MACHINE LOG-FULL_SPT-RL 20111 MB01 - MB02 19MAR2020.GPJ S+R_2013.GDT 1/4/20

Soil&Rock Consultants
For well-grounded solutions

CLIENT: James Kirkpatrick Group Ltd

PROJECT: 538 Karangahape Road, Auckland City

Machine Borehole No: MB02

Sheet 2 of 2

Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	STL
Drilled By:	ProDrill Ltd	Coordinates:		Shear Vane No - Calibration Date:	GEO2425 - 18/10/2019
Date Started:	16/3/20	Ground Elevation:	67.9m	Surface Conditions:	Slight Slope, Asphalt Carpark
Date Finished:	16/3/20	Water Level:			

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	Cu (kPa) / SPT (blows/300mm)	DRILLING METHOD
WAITEMATA GROUP	SILT some fine sand to sandy, trace clay, grey, very stiff to hard, moist, non plastic	3/3//4/5/5/7 N=21	OB
	SILT minor fine sand, trace clay, grey, very stiff to hard, moist, non plastic		
	SILT trace fine sand, trace clay, grey, very stiff to hard, moist, non plastic		
	SILT some fine sand to sandy, minor clay, grey, hard, moist, non to slightly plastic	V,200+ UTP	
	moderately weathered, grey, fine SANDSTONE, extremely weak, remoulds to fine SAND some silt (WAITEMATA GROUP ROCK)	2/3//4/5/6/7 N=22	
	SILT some fine sand, minor clay, grey, hard, moist, non to slightly plastic (WEATHERED WAITEMATA GROUP SOILS)		
	moderately weathered, blue grey, fine to medium SANDSTONE, extremely weak to very weak (WAITEMATA GROUP ROCK)	9/12//9/10/10/10 for 70mm 60 blows for 445mm penetration	
	slightly to moderately weathered, grey, SILTSTONE, extremely weak to very weak	10/11//17/22 for 60mm 60 blows for 285mm penetration	SPT
	END OF BORE. 13.80 METRES. (TARGET DEPTH)		

GRAPHIC LOG | DEPTH (m) | WATER LEVEL (m) | ELEVATION (m) | SAMPLE TYPE | RECOVERY (%) | WATER CONTENT

DEPTH (m): 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

ELEVATION (m): 58, 57, 56, 55, 54, 53, 52, 51, 50

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CLIENT: James Kirkpatrick Group

PROJECT: Lift Pit Investigation, 538 Karangahape Road, Auckland City

Machine Borehole No: MB03

Sheet 1 of 2

Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO361 - 12/08/2021
Date Started:	22/3/22	Ground Elevation:		Surface Conditions:	Level, Concrete
Date Finished:	22/3/22	Water Level:			

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	DEPTH (m)	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
FILL	CONCRETE SLAB for 150mm (FILL)	0		OB
	fine to coarse angular GRAVEL, some fine to coarse sand, trace silt, brown, red brown, dense, moist (GRANULAR FILL)		V,200+ UTP	
	silty, fine to coarse SAND, minor fine to coarse angular gravel, minor brick fragments to 16mm diameter, brown grey, brown, medium dense, moist trace fine to coarse angular gravel, no brick fragments some fine to medium angular gravel, dark brown grey	1	V,200+ UTP	
	fine to medium angular GRAVEL, some coarse gravel, minor fine to coarse sand, dark grey, brown, medium dense, moist		V,200+ UTP	
	silty, fine to medium angular GRAVEL, some fine to coarse sand, grey brown, medium dense, moist		5/5//7/8/5/4 N=24	
	fine to coarse SAND, some silt, minor fine to medium angular gravel, trace brick fragments to 20mm diameter, brown grey, orange, dark grey, medium dense, moist no brick fragments some coarse angular gravel	2	V,200+ UTP	
	fine to medium angular GRAVEL, minor fine to coarse sand, brown, loose, moist	3	3/2//2/1/2/1 N=6	
		4	V,200+ UTP	
	minor coarse angular gravel, dark grey, water loss		3/2//2/1/2/1 N=6	
		5		
WAITEMATA GROUP	SILT some clay, some fine sand, grey, stiff, wet, slightly plastic (WEATHERED WAITEMATA GROUP SOILS)	6	V,153 VR,33	
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic		1/1//2/1/2/3 N=8	
	SILT some clay, some fine sand, grey, stiff, moist, slightly plastic	7		
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic stiff to very stiff		V,128 VR,33 2/1//2/3/1/3 N=9	
		8		

GRAPHIC LOG | WATER LEVEL (m) | SAMPLE TYPE | RECOVERY (%) | WATER CONTENT | FRACTURE DESCRIPTION

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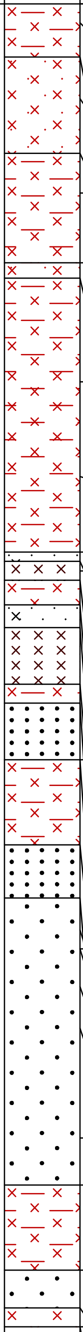
CLIENT: James Kirkpatrick Group
PROJECT: Lift Pit Investigation, 538 Karangahape Road, Auckland City

Machine Borehole No: MB03
Sheet 2 of 2

Drill Type:	Rotary Machine Rig	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO361 - 12/08/2021
Date Started:	22/3/22	Ground Elevation:		Surface Conditions:	Level, Concrete
Date Finished:	22/3/22	Water Level:			



STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	C_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	WATER CONTENT	FRACTURE DESCRIPTION
WAITEMATA GROUP	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic		8		OB			
	some clay to clayey, minor fine sand, slightly to moderately plastic							
	fine sandy SILT, minor clay, grey, very stiff to hard, moist, non to slightly plastic							
	hard							
	clayey SILT, trace fine sand, grey, very stiff to hard, moderately plastic		9	V,200+ UTP 2/2//3/2/3/3 N=11				
	fine sandy SILT, some clay, blue grey, very stiff to hard, wet, slightly plastic							
	clayey SILT, trace fine sand, hard, grey, moist, moderately plastic		10					
	some clay to clayey, minor fine sand, slightly to moderately plastic			5/5//5/5/9/10 N=29				
	silty, fine SAND, grey, medium dense, moist		11					
	slightly to moderately weathered, grey, SILTSTONE, very weak, bedding visible dipping 25° (WAITEMATA GROUP SOIL AND ROCK)							
	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic				HQTT			
	silty, fine SAND, grey, medium dense, moist							
	slightly to moderately weathered, grey, SILTSTONE, very weak		12					
	clayey SILT, trace fine sand, grey, very stiff to hard, moist, moderately plastic			3/6//5/9/7/9 N=30				
	slightly to moderately weathered, grey, fine SANDSTONE, very weak							
	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic							
	slightly to moderately weathered, grey, fine SANDSTONE, extremely weak, remoulds to fine SAND		13					
	fine to medium SAND, some silt, grey, very dense / weakly cemented, moist			8/15//17/20/13 for 50mm 73 blows for 350mm penetration				
	dense / not cemented							
	no medium sand							
	for 60mm; slightly weathered, grey, SILTSTONE, weak to very weak							
	very dense / weakly cemented		14					
	clayey SILT, minor fine sand, grey, hard, moist, moderately plastic							
	fine to medium SAND, some silt, grey, very dense, moist							
	SILT some clay, minor fine sand, grey, hard, moist, slightly plastic		15	6/8//8/8/8/8 N=32				
	END OF BORE. 15.45 METRES. (TARGET DEPTH)		16					

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CLIENT: James Kirkpatrick Ltd
PROJECT: 538 Karangahape Road, Newton, Auckland

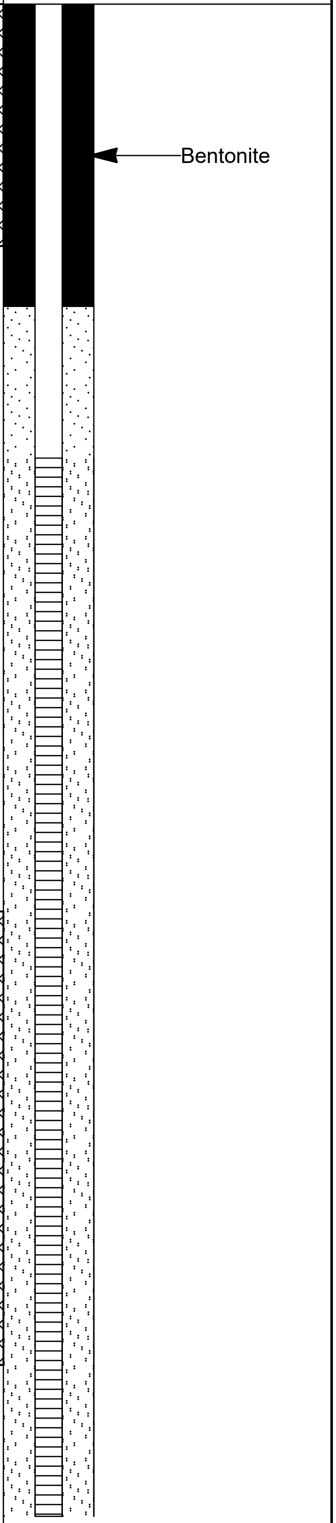
Machine Borehole No: MB/PZ04
Sheet 1 of 4

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	4/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Gravel
Date Finished:	4/7/23	Water Level:			

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
FILL	SILT, some fine to coarse gravel, some fine to coarse sand, grey, brown, stiff, wet, slightly plastic (FILL)
WAITEMATA GROUP	SILT, some clay, minor fine sand, orange brown, orange, yellowish brown, stiff, moist, slightly plastic (WEATHERED WAITEMATA GROUP SOILS)
	clayey SILT, trace fine sand, orange, yellowish orange, stiff, moist, moderately plastic
	silty CLAY, trace fine sand, orange, yellowish grey, stiff, moist, highly plastic
	clayey SILT, trace fine sand, orange, stiff, moist, moderately plastic
	silty CLAY, trace fine sand, orange, yellow, stiff, wet, highly plastic
	light grey with orange mottles, very stiff
	light grey, orange
	orange with grey and pink mottles
	pink, orange
	clayey SILT, trace fine sand, light grey, pink, very stiff, wet, moderately plastic
	SILT, some clay, minor fine sand, light grey with pink streaks, very stiff, wet, slightly plastic
	clayey SILT, trace fine sand, light grey, pink, stiff, wet, moderately plastic light grey with orange and pink streaks
	orange, light orange
	SILT, some clay, minor fine sand, grey, stiff, wet, slightly plastic

DEPTH (m)	cu (kPa) / SPT (blows/300mm)	DRILLING METHOD
0.0		Flight Auger
0.5		
1.0		Open Barrel
1.5	V,67 VR,30 1 1 2 2 2 2 N=8	
2.0		
2.5		
3.0	V,140 VR,67 1 1 1 2 2 2 N=7	
3.5		
4.0		
4.5	V,76 VR,32 1 0 1 1 1 1 N=4	
5.0		

STANDPIPE PIEZOMETER
Ø32mm



MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
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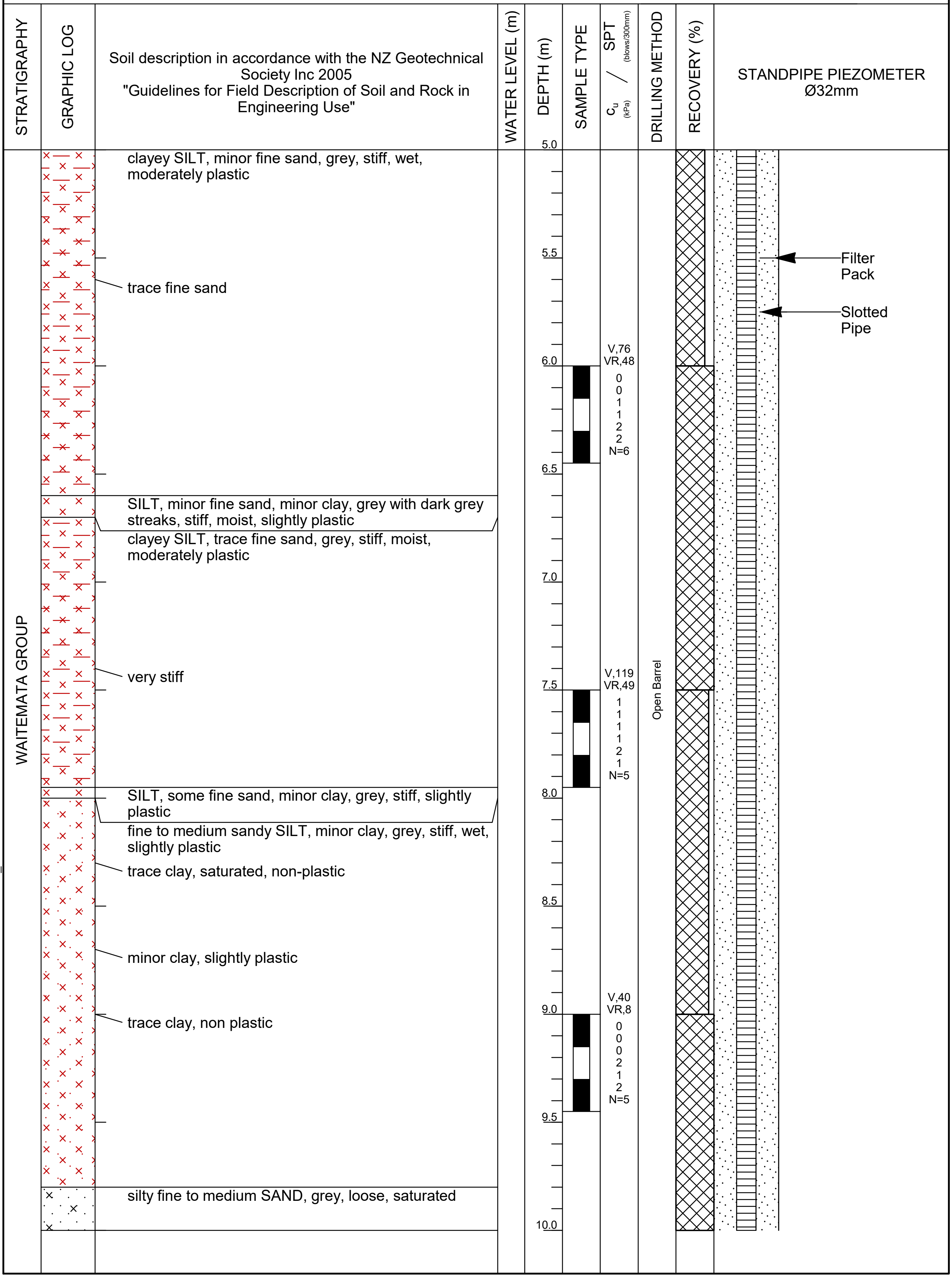
CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ04

Sheet 2 of 4

Drill Type: Machine Bore
Drilled By: PRO DRILL LTD
Date Started: 4/7/23
Date Finished: 4/7/23
Project No: 20111
Coordinates:
Ground Elevation:
Water Level:
Logged By: DEG
Shear Vane No - Calibration Date: GEO3564 - 2/05/2023
Surface Conditions: Slight Sloping, Gravel



Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"

DEPTH (m)	Soil description	c_u / SPT
5.0	clayey SILT, minor fine sand, grey, stiff, wet, moderately plastic	
	trace fine sand	
6.0		V,76 VR,48 0 0 1 1 2 2 N=6
	SILT, minor fine sand, minor clay, grey with dark grey streaks, stiff, moist, slightly plastic	
	clayey SILT, trace fine sand, grey, stiff, moist, moderately plastic	
	very stiff	
7.5		V,119 VR,49 1 1 1 1 2 1 N=5
8.0	SILT, some fine sand, minor clay, grey, stiff, slightly plastic	
	fine to medium sandy SILT, minor clay, grey, stiff, wet, slightly plastic	
	trace clay, saturated, non-plastic	
	minor clay, slightly plastic	
9.0	trace clay, non plastic	V,40 VR,8 0 0 0 2 1 2 N=5
	silty fine to medium SAND, grey, loose, saturated	
10.0		

MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ04

Sheet 3 of 4

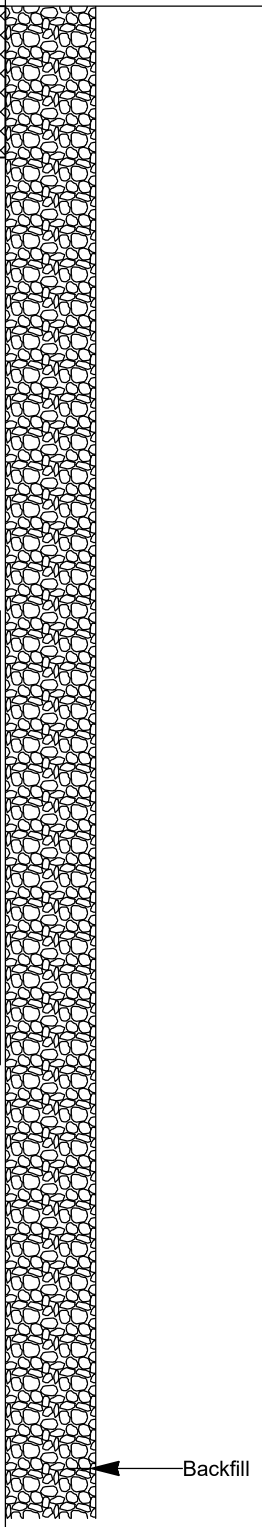
Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	4/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Gravel
Date Finished:	4/7/23	Water Level:			

STRATIGRAPHY | GRAPHIC LOG | Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use" | WATER LEVEL (m) | DEPTH (m) | SAMPLE TYPE | c_u (kPa) / SPT (blows/300mm) | DRILLING METHOD | RECOVERY (%) | STANDPIPE PIEZOMETER Ø32mm

STRATIGRAPHY: WAITEMATA GROUP

- clayey SILT, trace fine sand, grey, stiff, saturated, moderately plastic
- SILT, some fine to medium sand, some clay, grey, stiff, saturated, slightly plastic
- clayey SILT, trace fine sand, grey, stiff, saturated, moderately plastic
- SILT, some fine to medium sand, some clay, grey, stiff, saturated, slightly plastic
- clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic
  - hard
- SILT, some fine sand, minor clay, grey, hard, saturated, slightly plastic
- clayey SILT, trace fine sand, grey, hard, saturated, moderately plastic
- fine sandy SILT, trace clay, grey, hard, saturated non plastic

DEPTH (m)	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
10.0		Open Barrel
10.5	V,80 VR,24 1 1 2 2 2 2 N=8	
11.0		
11.5		
12.0	V,200+ UTP 2 2 2 3 3 4 N=12	HQTT
12.5		
13.0		
13.5	V,200+ UTP 5 5 5 6 6 6 N=23	
14.0		
14.5		
15.0		



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CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ04

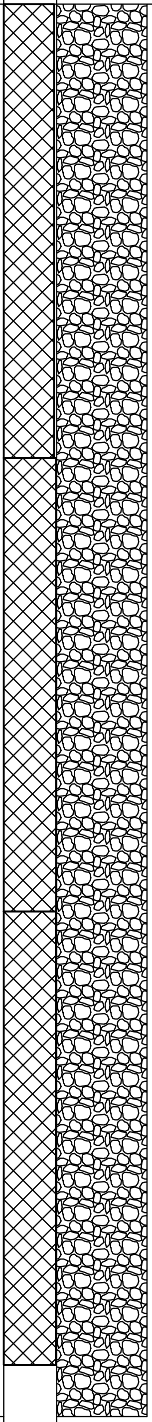
Sheet 4 of 4

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	4/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Gravel
Date Finished:	4/7/23	Water Level:			

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
WAITEMATA GROUP	SILT, some fine sand, some clay, grey, hard, saturated, non plastic		15.0	4 4 4 5 5 6 N=20	HQTT
	silty fine to medium sand, grey, medium dense, saturated dense / weakly cemented		15.5 16.0		
	slightly weathered, grey, SILTSTONE, weak to very weak (WAITEMATA GROUP SOIL AND ROCK)				
	moderately weathered, grey, fine to medium SANDSTONE, extremely weak, remoulds to fine to medium SAND		16.5	10 24 26 for 45mm N=50+	
	slightly weathered, grey, SILTSTONE, weak		17.0		
	moderately weathered, grey, fine to medium SANDSTONE, extremely weak, remoulds to fine to medium sand		17.5		
	slightly weathered, grey, SILTSTONE, weak				
	fine to medium SAND, some silt, grey, very dense / weakly cemented, saturated				
	slightly weathered, grey, SILTSTONE, weak (WAITEMATA GROUP ROCK) trace lignite fragments as brown streaks		18.0	15 32 13 for 20mm N=50+	
	slightly weathered, grey, fine SANDSTONE, weak fracture dipping 45°, rough, aperture <1mm, no infill, no discoloration		18.5 19.0 19.5	58 for 95mm N=50+	
	END OF BORE. 19.67 METRES. (TARGET DEPTH)		20.0		

RECOVERY (%)

STANDPIPE PIEZOMETER Ø32mm



MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ05

Sheet 1 of 4

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	3/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Asphalt
Date Finished:	3/7/23	Water Level:			

Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"

STRATIGRAPHY	Soil description
FILL	ASPHALT SLAB for 35mm (FILL)
	fine to coarse angular GRAVEL, grey, dense, moist (GRAVEL FILL)
WAITEMATA GROUP	silty CLAY, trace fine sand, light grey with orange mottles, very stiff, moist, highly plastic (WEATHERED WAITEMATA GROUP SOILS)
	clayey SILT, trace fine sand, light grey with some orange streaks, very stiff, moist, moderately plastic orange, light grey, pink minor fine sand
	SILT, minor fine sand, some clay, light grey with orange and pink streaks, stiff, wet, slightly plastic
	clayey SILT, trace fine sand, pink and light grey streaks, stiff, wet, moderately plastic yellow, orange, light grey
	SILT, some fine sand, some clay, grey, orange, dark orange, stiff, wet, slightly plastic
	clayey SILT, trace fine sand, orange, dark grey, stiff, wet, moderately plastic
	SILT, some fine sand, minor clay, grey, stiff, wet, slightly plastic
	fine to medium sandy SILT, minor clay, grey, stiff, wet, slightly plastic
	SILT, some fine to medium sand, some clay, grey, stiff, wet, slightly plastic
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic
	fine to medium sandy SILT, minor clay, grey, stiff, wet, slightly plastic
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic
	SILT, some clay, minor fine sand, trace lignite fragments, grey with black speckles, very stiff, wet, slightly plastic
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic

DEPTH (m)	c_u (kPa) / SPT (blows/300mm)
0.0	
0.5	V,119 VR,60
1.0	V,99 VR,48
1.5	V,95 VR,29 0 1 0 1 1 1 N=3
2.0	
2.5	
3.0	V,51 VR,19 0 1 0 1 1 1 N=3
3.5	
4.0	
4.5	V,118 VR,54 1 1 1 2 2 3 N=8
5.0	

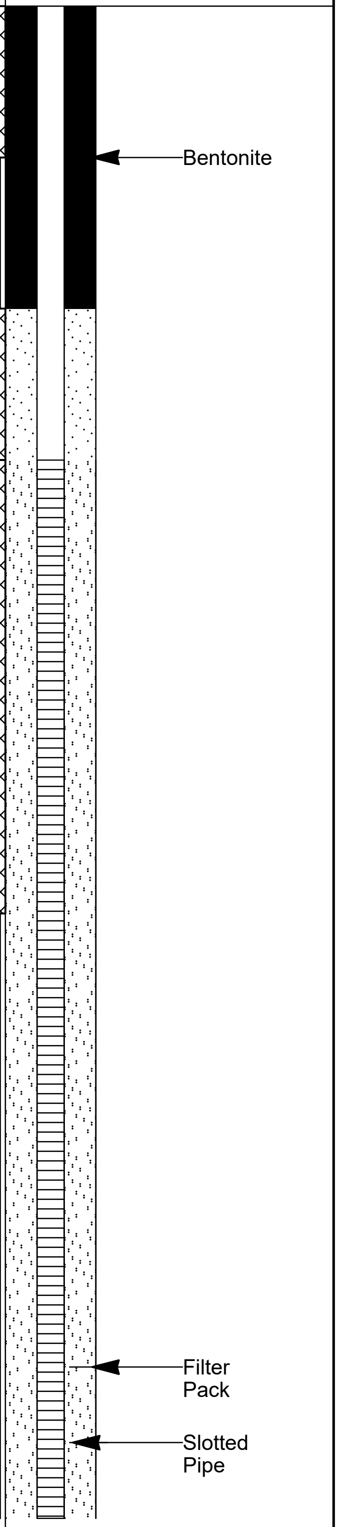
WATER LEVEL (m)

SAMPLE TYPE

DRILLING METHOD: OB

RECOVERY (%)

STANDPIPE PIEZOMETER
Ø32mm



MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ05

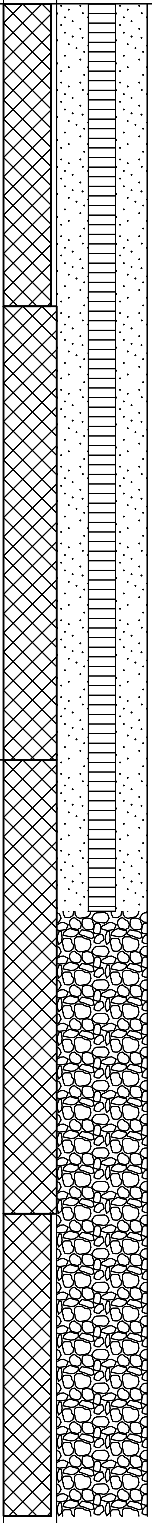
Sheet 2 of 4

Drill Type: Machine Bore
Drilled By: PRO DRILL LTD
Date Started: 3/7/23
Date Finished: 3/7/23
Project No: 20111
Coordinates:
Ground Elevation:
Water Level:
Logged By: DEG
Shear Vane No - Calibration Date: GEO3564 - 2/05/2023
Surface Conditions: Slight Sloping, Asphalt

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
WAITEMATA GROUP	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic hard		5.0 5.5			OB
	SILT, some fine sand, minor clay, grey, hard, moist, slightly plastic		6.0		V,200+ UTP 1 2 5	
	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic				5 5 6 N=21	
	moderately weathered, grey, fine to medium SANDSTONE, very weak (WAITEMATA GROUP SOIL AND ROCK)		6.5			
	fine to medium SAND, grey, very dense/weakly cemented					
	SILT, some clay, trace fine sand, grey, hard, moist, slightly plastic		7.0			
	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic		7.5		V,200+ UTP	
	fine to medium SAND, minor silt, grey, dense / weakly cemented, saturated trace lignite as black speckles				3 7 9 11 10 10 N=40	HQTT
	SILT, some fine sand, some clay, grey, hard, moist, slightly plastic trace fine to medium sand		8.0			
	moderately weathered, grey, fine to medium SANDSTONE, very weak		8.5			
	moderately weathered, grey, SILTSTONE, extremely weak, remoulds to SILT some clay					
	SILT, some clay, minor fine to medium sand, grey, hard, moist, slightly plastic		9.0		2 2 2 4 5 6 N=17	
	clayey SILT, trace fine sand, grey, hard, moist, moderately plastic		9.5			
			10.0			

RECOVERY (%)

STANDPIPE PIEZOMETER Ø32mm



Soil&Rock Consultants
Your responsive & cost-effective engineers

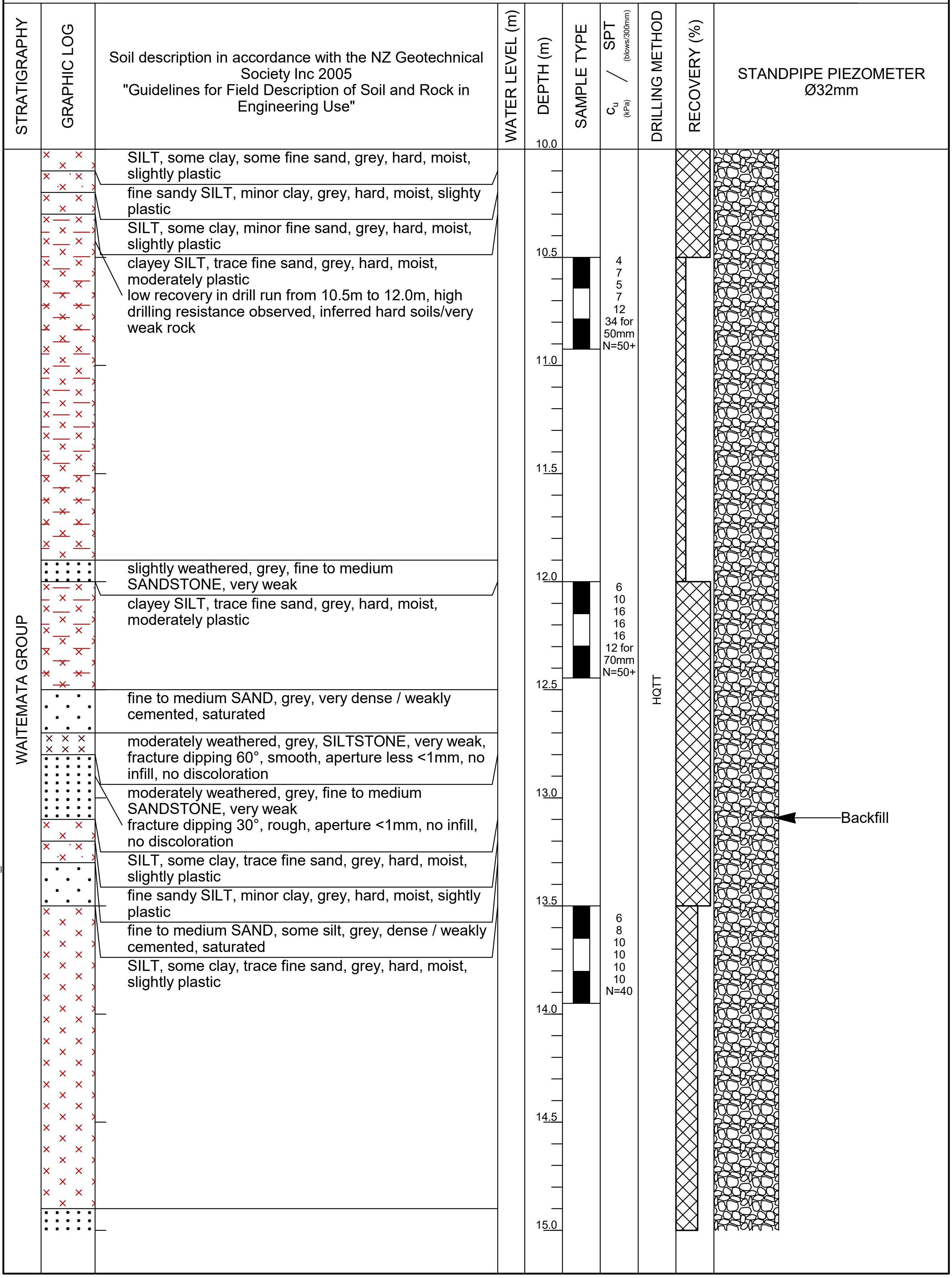
CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ05

Sheet 3 of 4

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	3/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Asphalt
Date Finished:	3/7/23	Water Level:			



Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"

SILT, some clay, some fine sand, grey, hard, moist, slightly plastic

fine sandy SILT, minor clay, grey, hard, moist, slighty plastic

SILT, some clay, minor fine sand, grey, hard, moist, slightly plastic

clayey SILT, trace fine sand, grey, hard, moist, moderately plastic
low recovery in drill run from 10.5m to 12.0m, high drilling resistance observed, inferred hard soils/very weak rock

slightly weathered, grey, fine to medium SANDSTONE, very weak

clayey SILT, trace fine sand, grey, hard, moist, moderately plastic

fine to medium SAND, grey, very dense / weakly cemented, saturated

moderately weathered, grey, SILTSTONE, very weak, fracture dipping 60°, smooth, aperture less <1mm, no infill, no discoloration

moderately weathered, grey, fine to medium SANDSTONE, very weak
fracture dipping 30°, rough, aperture <1mm, no infill, no discoloration

SILT, some clay, trace fine sand, grey, hard, moist, slightly plastic

fine sandy SILT, minor clay, grey, hard, moist, sightly plastic

fine to medium SAND, some silt, grey, dense / weakly cemented, saturated

SILT, some clay, trace fine sand, grey, hard, moist, slightly plastic

Depth (m)	SPT (blows/300mm)
10.5	4 7 5 7 12 34 for 50mm N=50+
12.0	6 10 16 16 16 12 for 70mm N=50+
13.5	6 8 10 10 10 10 N=40

Soil&Rock Consultants
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CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

Machine Borehole No: MB/PZ05

Sheet 4 of 4

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	3/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Asphalt
Date Finished:	3/7/23	Water Level:			

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
WAITEMATA GROUP		slightly weathered, grey, fine to medium SANDSTONE, very weak (WAITEMATA GROUP ROCK) fracture dipping 75°, rough, aperture <1mm, no infill, no discoloration		15.0		16 25 25 for 70mm N=50+	HQTT		
		slightly weathered, grey, SILTSTONE, weak fracture dipping 60°, smooth, aperture <1mm, no infill, no discoloration		15.5					
		slightly weathered, grey, fine to medium SANDSTONE, weak to very weak		16.0					
				16.5		10 20 30 for 5mm N=50+			
				17.0					
				17.5					
				18.0		15 26 19 for 35mm N=50+			
		END OF BORE. 18.19 METRES. (TARGET DEPTH)		18.5					
				19.0					
				19.5					
				20.0					

MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
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CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

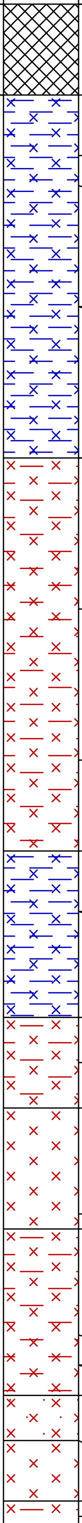
Machine Borehole No: MB/PZ06

Sheet 1 of 3

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	5/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Gravel
Date Finished:	5/7/23	Water Level:			

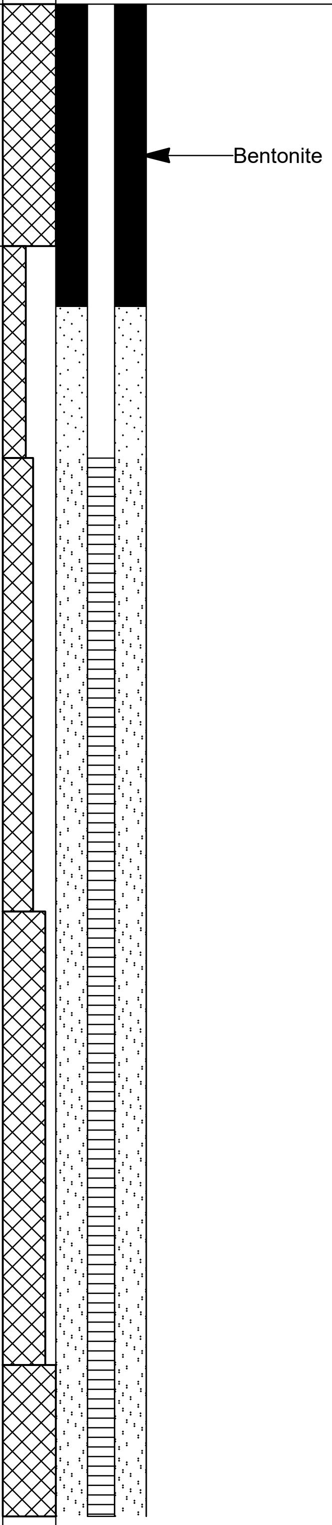
STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	DEPTH (m)	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
FILL	fine to coarse angular GRAVEL, some fine to coarse sand, some silt, light grey, brown, grey, loose, wet (GRANULAR FILL)	0.0		Flight Auger
WAITEMATA GROUP	silty CLAY, trace fine sand, orange, stiff, moist, highly plastic (WEATHERED WAITEMATA GROUP SOILS) orange, orange grey yellow, orange, light orange, light grey	0.5 1.0	V,95 VR,48 V,83 VR,32	
	clayey SILT, trace fine to medium sand, light grey, orange, yellow, stiff, moist, moderately plastic	1.5 2.0 2.5	1 1 2 1 1 2 N=6	OB
	silty CLAY, trace fine sand, orange, yellow, yellow grey, stiff, wet, highly plastic blue grey, grey	3.0	V,62 VR,43 1 1 1 1 1 1 N=4	
	clayey SILT, trace fine sand, grey, stiff, moist, moderately plastic	3.5		
	SILT some fine sand, some clay, orange, dark orange, firm, wet, slightly plastic	4.0		
	clayey SILT, trace fine sand, grey, firm, wet, moderately plastic stiff firm	4.5	V,64 VR,48	
	fine to medium sandy SILT, trace clay, grey, firm, wet, non plastic		0 0 0 0 1 2 N=3	
	SILT some clay, trace fine sand, grey, stiff, wet, slightly plastic	5.0		

GRAPHIC LOG



WATER LEVEL (m) | SAMPLE TYPE | RECOVERY (%)

STANDPIPE PIEZOMETER
Ø32mm

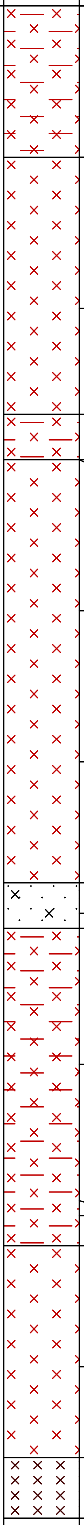


CLIENT: James Kirkpatrick Ltd
PROJECT: 538 Karangahape Road, Newton, Auckland

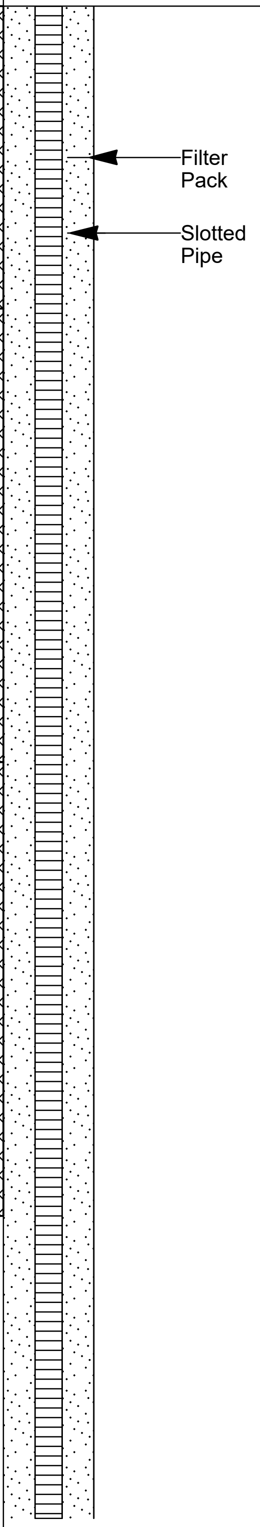
Machine Borehole No: MB/PZ06
Sheet 2 of 3

Drill Type: Machine Bore
Drilled By: PRO DRILL LTD
Date Started: 5/7/23
Date Finished: 5/7/23
Project No: 20111
Coordinates:
Ground Elevation:
Water Level:
Logged By: DEG
Shear Vane No - Calibration Date: GEO3564 - 2/05/2023
Surface Conditions: Slight Sloping, Gravel

STRATIGRAPHY	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	DEPTH (m)	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD
WAITEMATA GROUP	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic	5.0		
	SILT some fine sand, some clay, grey, stiff, wet, slightly plastic	5.5		
		6.0	V,83 VR,29 1 1 1 2 3 2 N=8	
	clayey SILT, trace fine sand, grey, very stiff, moist, moderately plastic			
	SILT some fine sand, some clay, grey, very stiff, wet, slightly plastic	6.5		
		7.0		OB
		7.5	V,151 VR,64 2 1 1 2 2 2 N=7	
	silty, fine to medium SAND, grey, loose, saturated	8.0		
	clayey SILT, trace fine sand, grey, hard, wet, moderately plastic			
		8.5		
	minor fine sand	9.0	V,200+ UTP 2 3 3 4 5 7 N=19	
	SILT some clay, trace fine sand, grey, hard, moist, slightly plastic			
		9.5		HQTT
	moderately weathered, grey, SILTSTONE, extremely weak, remoulds to SILT some clay (WAITEMATA	10.0		



STANDPIPE PIEZOMETER Ø32mm



MACHINE BORES WITH PIEZO 20111 MB04 - MB06 - 04JUL2023.GPJ S+R_2013.GDT 28/7/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

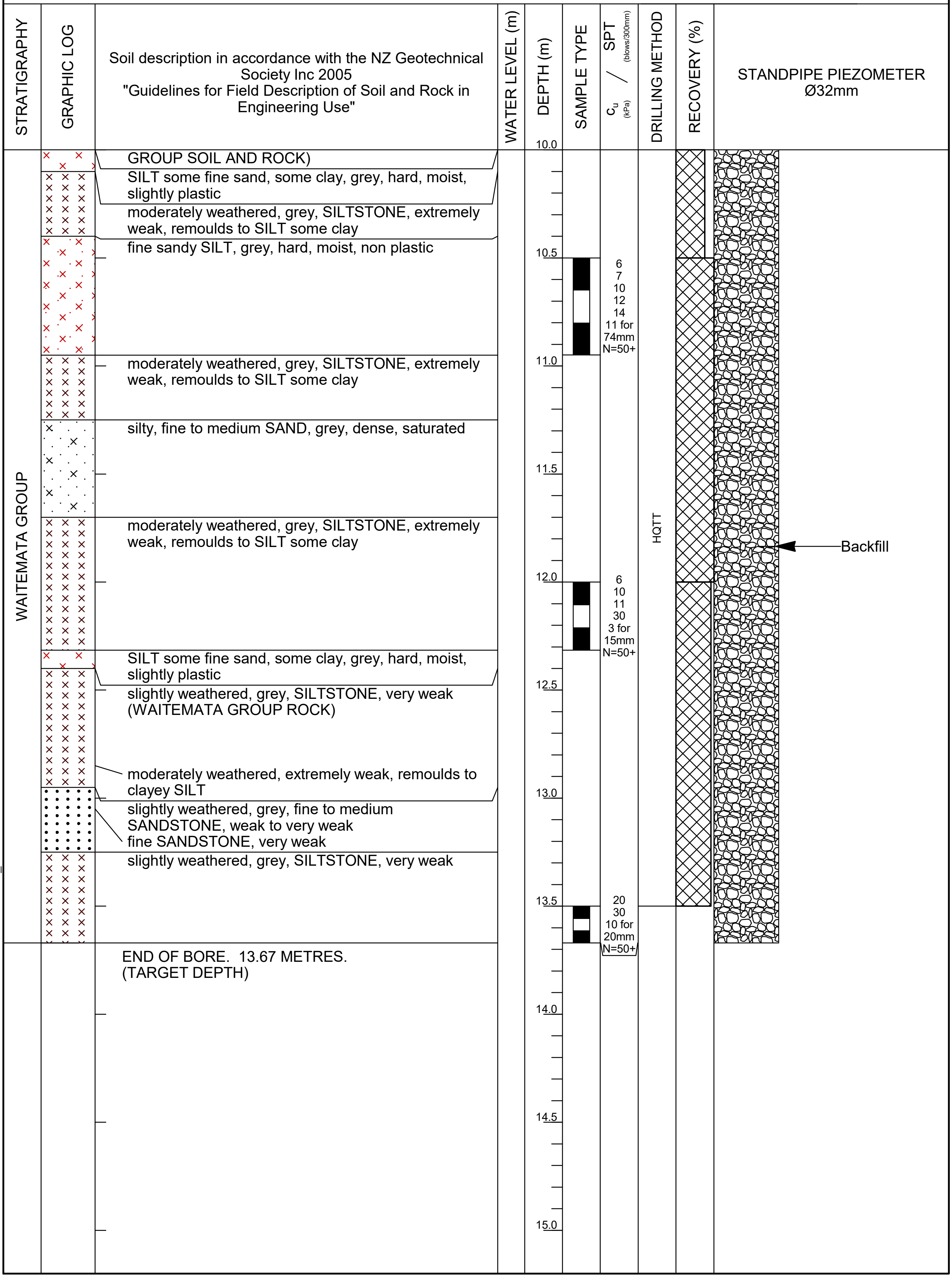
CLIENT: James Kirkpatrick Ltd

PROJECT: 538 Karangahape Road, Newton, Auckland

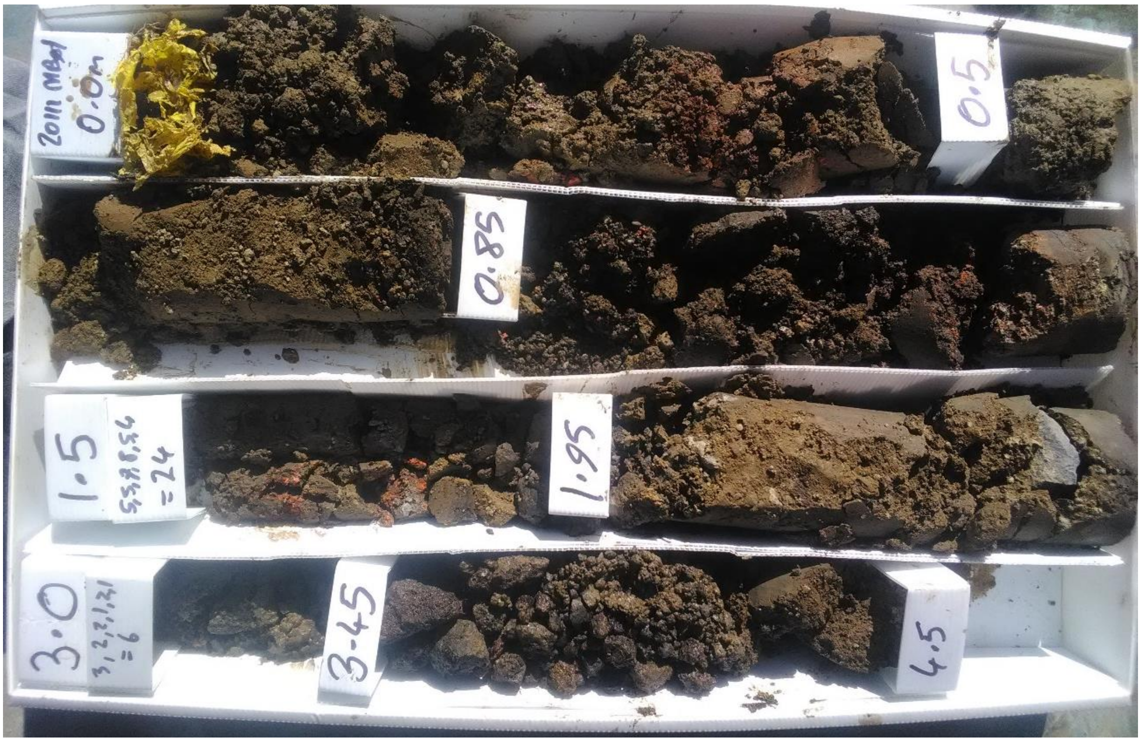
Machine Borehole No: MB/PZ06

Sheet 3 of 3

Drill Type:	Machine Bore	Project No:	20111	Logged By:	DEG
Drilled By:	PRO DRILL LTD	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	5/7/23	Ground Elevation:		Surface Conditions:	Slight Sloping, Gravel
Date Finished:	5/7/23	Water Level:			



STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	c_u (kPa) / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
WAITEMATA GROUP		GROUP SOIL AND ROCK)		10.0			HQTT		Backfill
		SILT some fine sand, some clay, grey, hard, moist, slightly plastic							
		moderately weathered, grey, SILTSTONE, extremely weak, remoulds to SILT some clay							
		fine sandy SILT, grey, hard, moist, non plastic		10.5		6 7 10 12 14 11 for 74mm N=50+			
		moderately weathered, grey, SILTSTONE, extremely weak, remoulds to SILT some clay		11.0					
		silty, fine to medium SAND, grey, dense, saturated		11.5					
		moderately weathered, grey, SILTSTONE, extremely weak, remoulds to SILT some clay		12.0		6 10 11 30 3 for 15mm N=50+			
		SILT some fine sand, some clay, grey, hard, moist, slightly plastic							
		slightly weathered, grey, SILTSTONE, very weak (WAITEMATA GROUP ROCK)		12.5					
		moderately weathered, extremely weak, remoulds to clayey SILT		13.0					
		slightly weathered, grey, fine to medium SANDSTONE, weak to very weak							
		fine SANDSTONE, very weak							
		slightly weathered, grey, SILTSTONE, very weak		13.5		20 30 10 for 20mm N=50+			
		END OF BORE. 13.67 METRES. (TARGET DEPTH)		14.0 14.5 15.0					



MB03 from 0.0m to 4.5m, Box 1 of 5

MB03 from 4.5m to 8.1m, Box 2 of 5

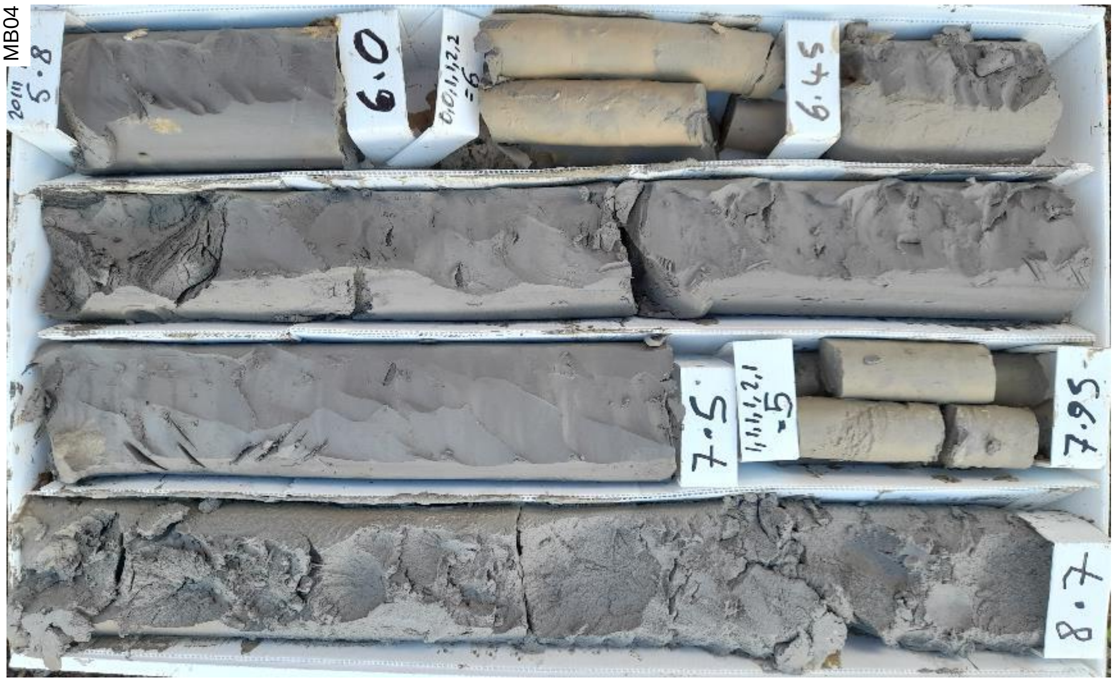
MB03 from 8.1m to 10.95m, Box 3 of 5

MB03 from 10.95m to 13m, Box 4 of 5

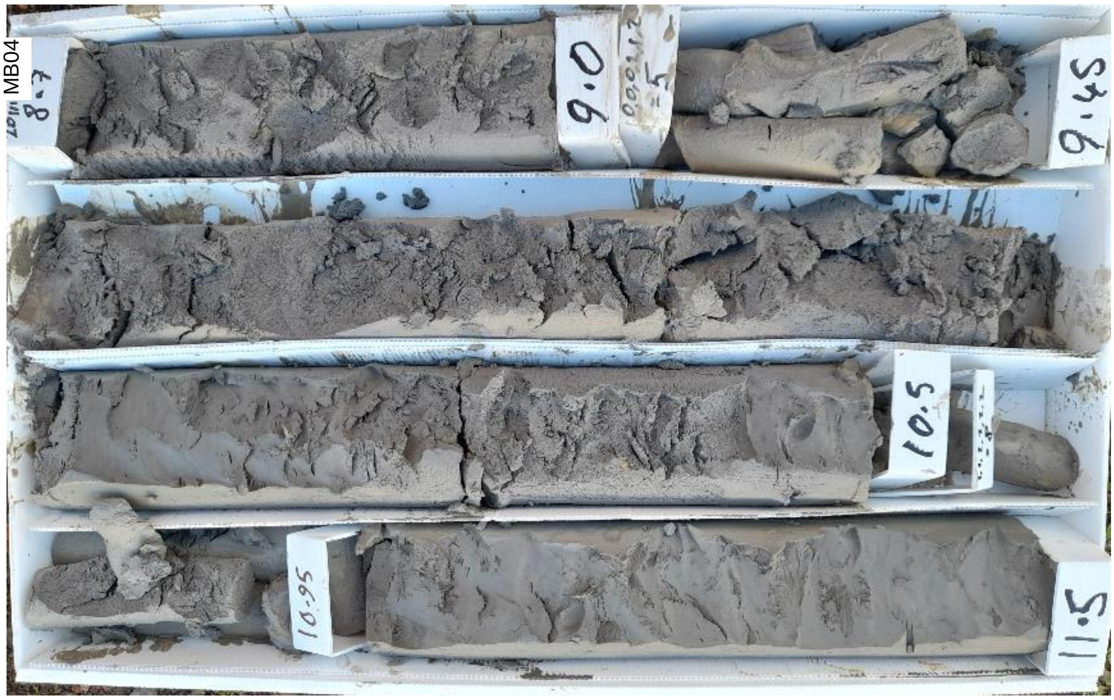
MB03 from 13m to 15.45m (EOH), Box 5 of 5

MB04 from 0.0m to 2.8m, Box 1 of 7

MB04 from 2.8m to 5.8m, Box 2 of 7

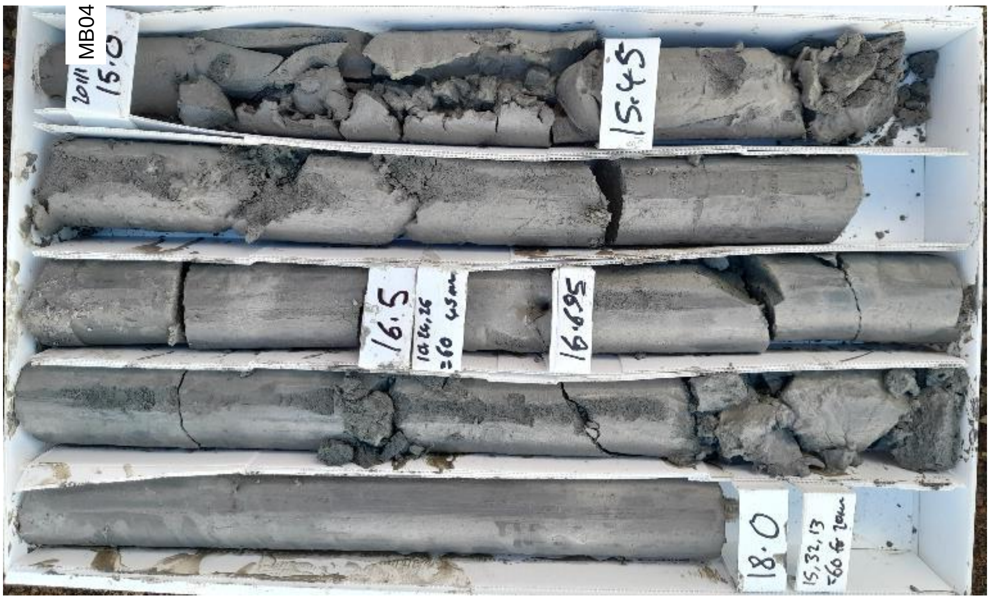


MB04 from 5.8m to 8.7m, Box 3 of 7

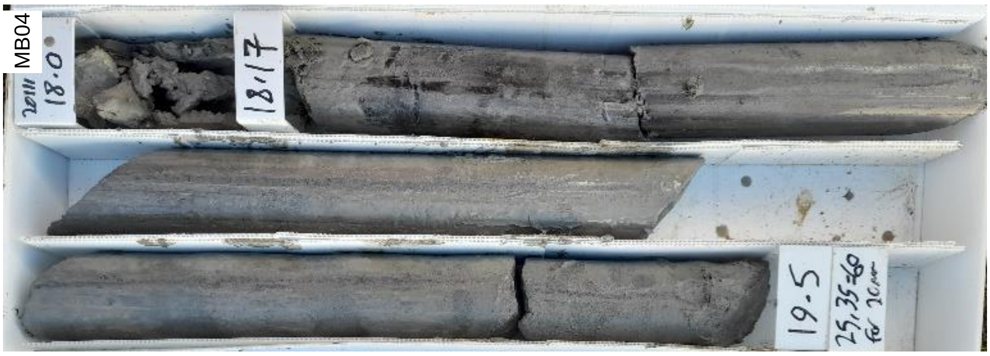


MB04 from 8.7m to 11.5m, Box 4 of 7

MB04 from 11.5m to 15.0m, Box 5 of 7



MB04 from 15.0m to 18.0m, Box 6 of 7



MB04 from 18.0m to 19.5m (EOH), Box 7 of 7

MB05 from 0.0m to 2.5m, Box 1 of 6

MB05 from 2.5m to 5.2m, Box 2 of 6

MB05 from 5.2m to 8.1m, Box 3 of 6

MB05 from 8.1m to 12.8m, Box 4 of 6

MB05 from 12.8m to 16.5m, Box 5 of 6

MB05 from 16.5m to 18.0m (EOH), Box 6 of 6

MB06 from 0.0m to 3.6m, Box 1 of 5

MB06 from 3.6m to 6.4m, Box 2 of 5

MB06 from 6.4m to 9.0m, Box 3 of 5

MB06 from 9.0m to 12.5m, Box 4 of 5

MB06 from 12.5m to 13.5m, Box 5 of 5

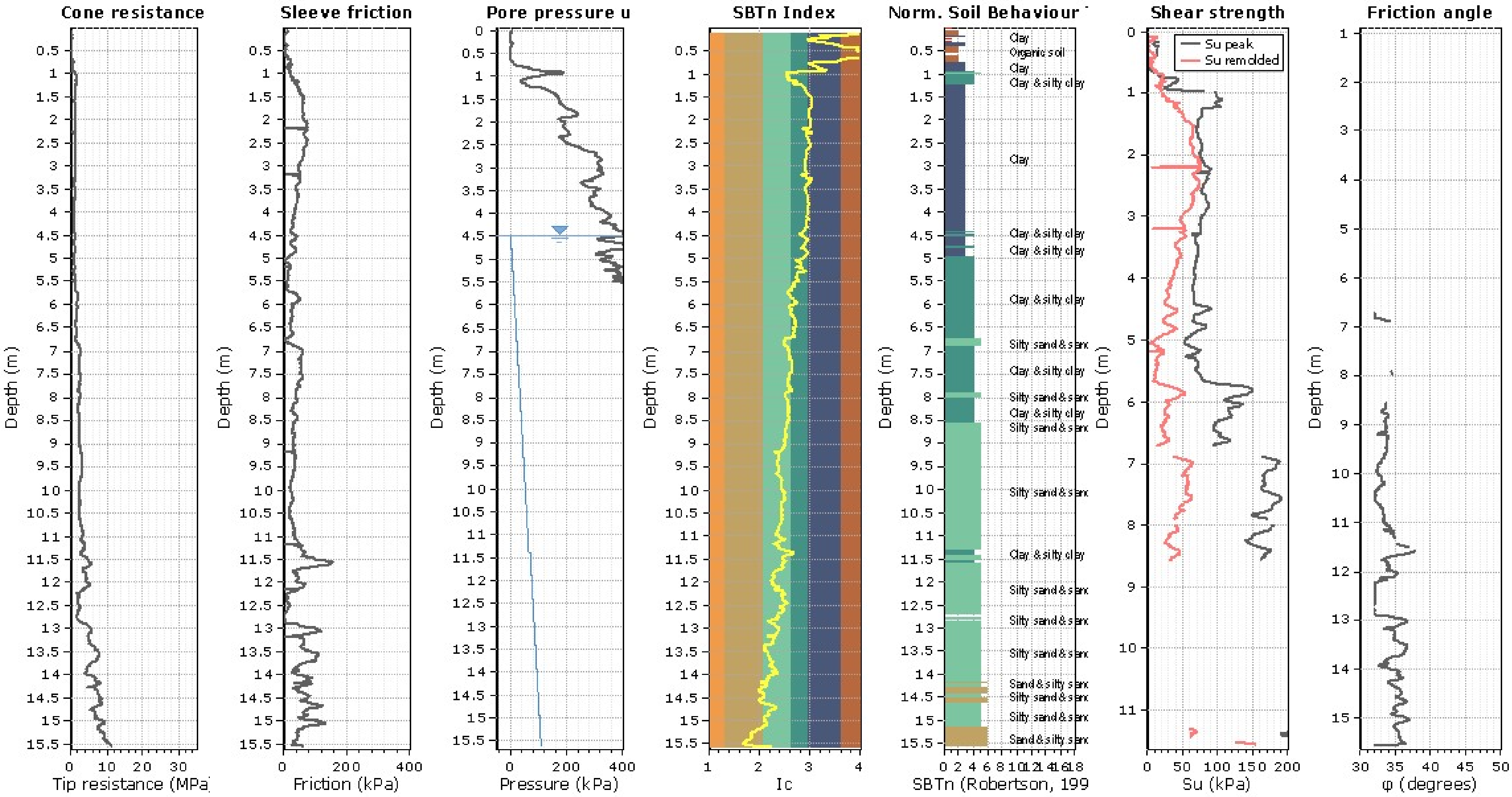
Appendix C

Cone Penetration Test (CPT) Results

Soil & Rock Consultants
289 Lincoln Road, Henderson
PO Box 21-424, Henderson
http://www.soilandrock.co.nz

CPT: Soil&Rock20111_CPT01
Total depth: 15.62 m, Date: 11/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator: ProDrill

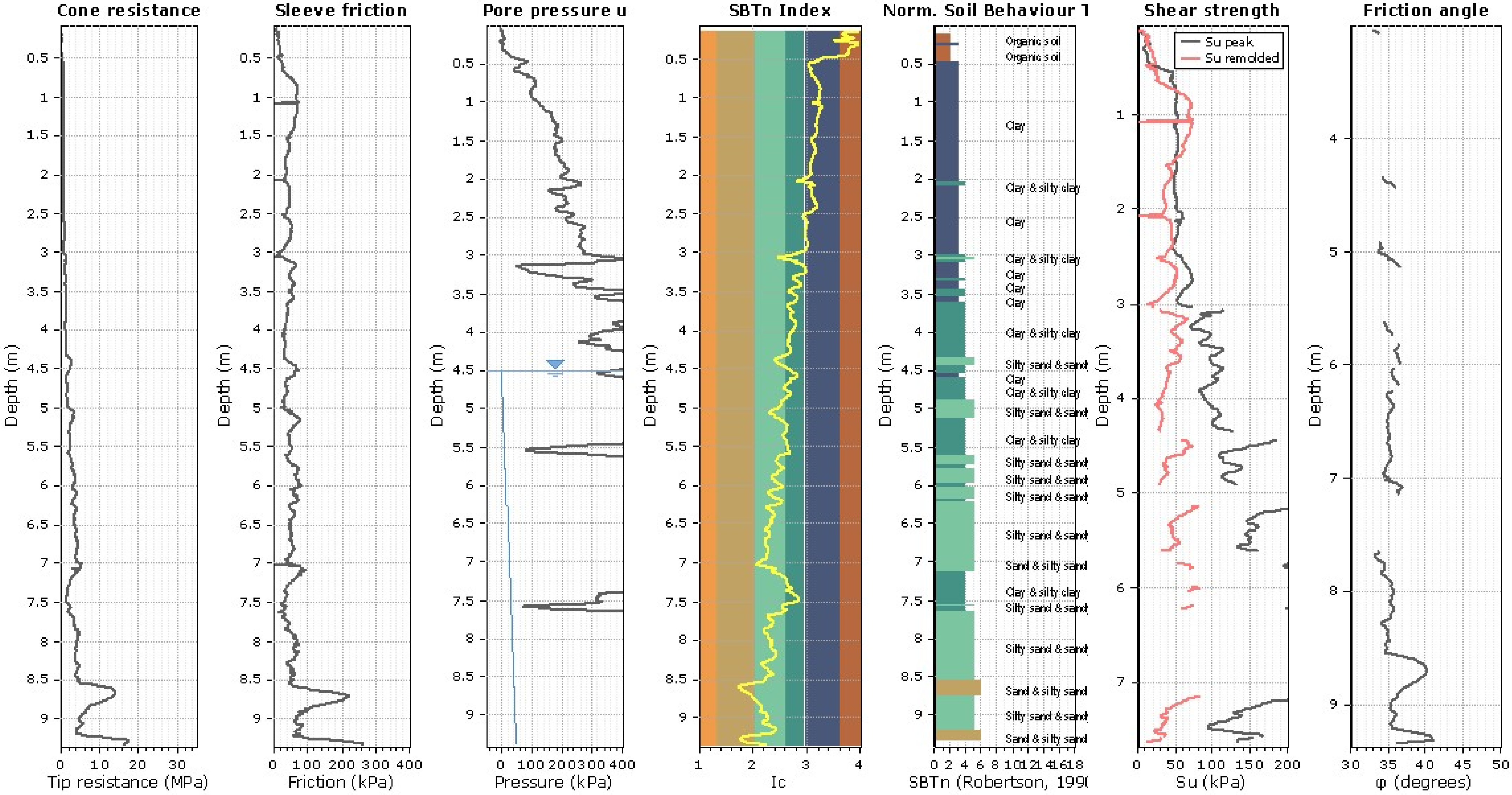
Project: **20111**
Location: **538 Karangahape Road, Newton**



Soil & Rock Consultants
289 Lincoln Road, Henderson
PO Box 21-424, Henderson
http://www.soilandrock.co.nz

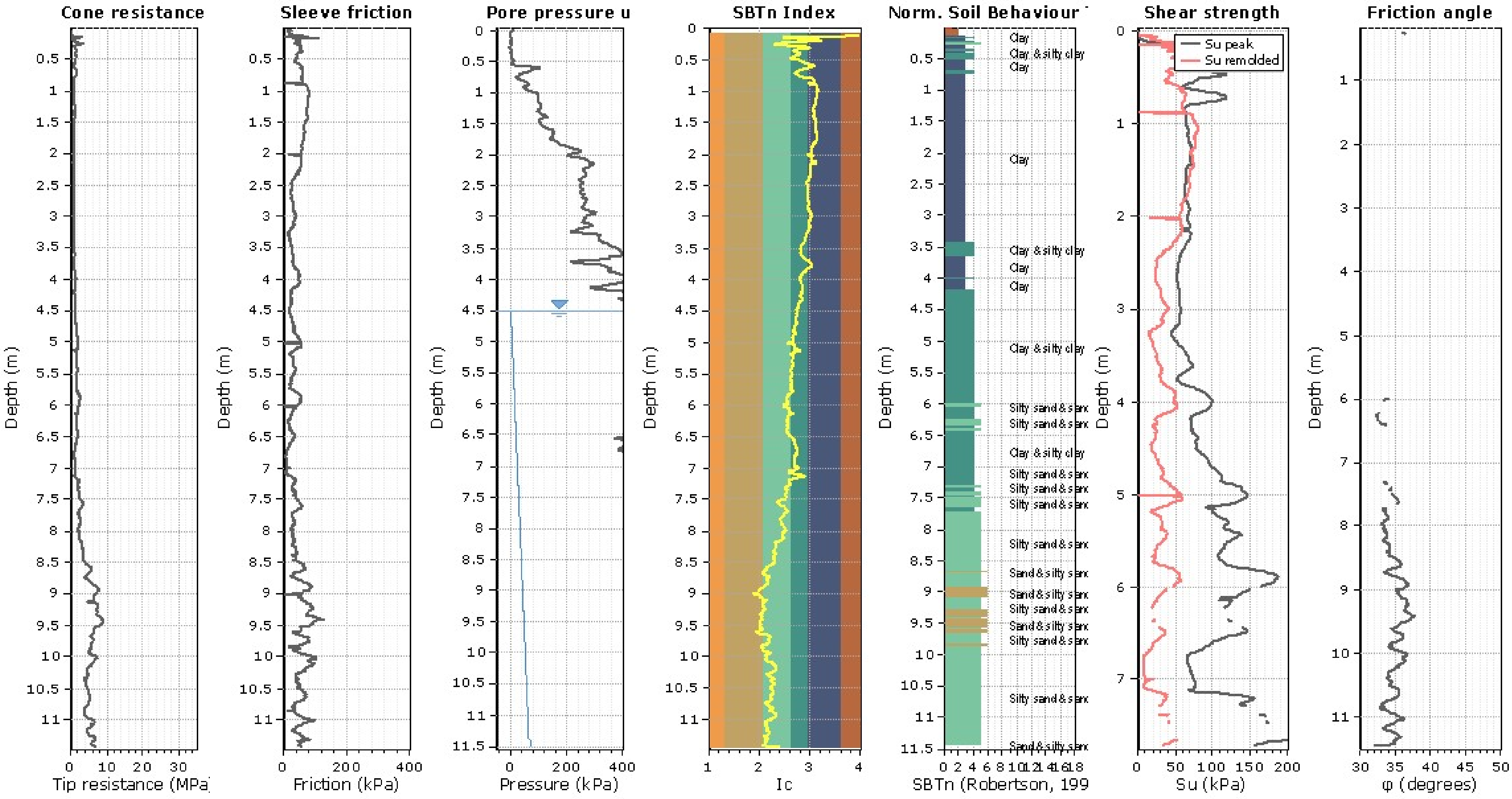
CPT: Soil&Rock20111_CPT02
Total depth: 9.38 m, Date: 11/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator: ProDrill

Project: **20111**
Location: **538 Karangahape Road, Newton**



CPT: Soil&Rock20111_CPT03
Total depth: 11.51 m, Date: 11/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator: ProDrill

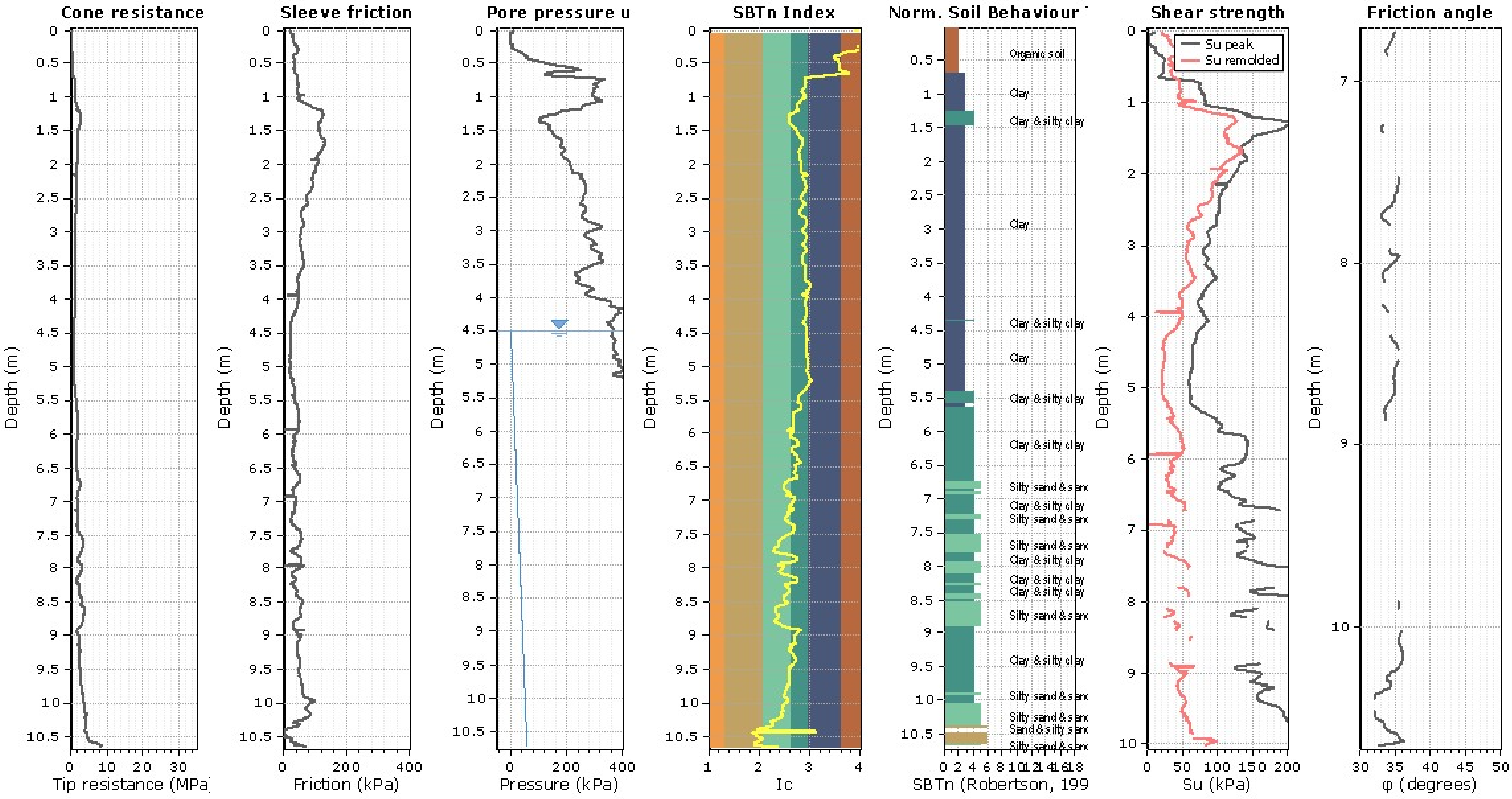
Project: **20111**
Location: **538 Karangahape Road, Newton**



Soil & Rock Consultants
289 Lincoln Road, Henderson
PO Box 21-424, Henderson
http://www.soilandrock.co.nz

CPT: Soil&Rock20111_CPT04
Total depth: 10.72 m, Date: 11/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator: ProDrill

Project: **20111**
Location: **538 Karangahape Road, Newton**



Appendix D

Laboratory Test Results

Babbage Geotechnical Laboratory

Babbage Geotechnical Laboratory
Level 4
68 Beach Road
Auckland 1010
Telephone
E-mail

P O Box 2027
New Zealand
64-9-367 4954
wec@babbage.co.nz

Please reply to: W.E. Campton

Geotechnical Engineering Ltd.
PO Box 21 424
Henderson
Auckland 0650

Attention: **GREG HILL**

Job Number: 63555#L
BGL Registration Number: 2809
Checked by: WEC

17th July 2023

UNCONFINED COMPRESSIVE STRENGTH (UCS) TESTING

Dear Raymond,

Re: 538 KARANGAHAPE ROAD
Your Reference: 20111
Report Number: 63555#L/UCS 538 Karangahape

The following report presents the results of Uniaxial Unconfined Compressive Strength Testing at BGL of rock core samples delivered to this laboratory on the 7th of July 2023. These samples were tested in accordance with the following standards:

Water Content:	NZS4402:1986:Test 2.1
Unconfined Compressive Strength Test:	NZS4402:1986:Test 6.3.1

The table below summarises the test results, with the following pages presenting sample measurements and test data.

Borehole Number	Sample Number	Depth (m)	FAILURE CONDITIONS			
			Unconfined Compressive Strength (kPa)	Strain at Failure		Failure Mode
				%	mm	
MB01	**CORE**	**19.10 – 19.40**	**2,100**	**1.0**	**1.3**	**brittle**
MB03	**CORE**	**9.50 – 9.70**	**510**	**0.87**	**1.0**	**brittle**

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. As per the reporting requirements of NZS4402: 1986: Test 6.3.1: UCS, dry density is reported to the nearest 0.05t/m^3, the unconfined compressive strength is reported to two significant figures, and the strain & rate of axial compression at failure is reported to two significant figures.

[redacted]

Please note that the test results relate only to the samples as-received, and relate only to the samples under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory

№ 126

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

[redacted]

BGL
Babbage Geotechnical Laboratory

Job No:	Reg. No:	Report No:	Page 3 of 8
63555#L	2809	63555#L/UCS 538 Karangahape	Version 3, July 2022

PROJECT:
538 KARANGAHAPE ROAD

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	11-Jul-23
Compiled By:	WEC	12-Jul-23
Checked By:	JF	17-Jul-23

Borehole: MB01 **Sample Number:** CORE **Depth:** 19.10 - 19.40m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm^2)	Axial Stress (kPa)
0.00	5.277	0.000	0.000	7.715	0.0	2981.5	0
0.38	5.338	0.062	0.001	7.755	201.4	2983.0	68
0.75	5.384	0.107	0.001	7.801	432.6	2984.1	145
1.12	5.442	0.165	0.001	7.838	619.1	2985.6	207
1.50	5.513	0.236	0.002	7.883	845.2	2987.3	283
1.87	5.581	0.304	0.003	7.932	1089.3	2989.0	364
2.25	5.636	0.359	0.003	7.984	1354.1	2990.4	453
2.62	5.686	0.409	0.003	8.041	1639.8	2991.7	548
2.98	5.730	0.454	0.004	8.102	1943.6	2992.8	649
3.37	5.775	0.498	0.004	8.164	2254.2	2993.9	753
3.73	5.818	0.541	0.005	8.226	2570.1	2994.9	858
4.10	5.859	0.583	0.005	8.290	2889.2	2996.0	964
4.48	5.901	0.624	0.005	8.354	3212.2	2997.0	1072
4.85	5.942	0.666	0.006	8.419	3536.1	2998.1	1179
5.22	5.984	0.707	0.006	8.484	3861.7	2999.1	1288
5.60	6.025	0.749	0.006	8.548	4186.7	3000.2	1396
5.97	6.069	0.793	0.007	8.612	4504.3	3001.3	1501
6.35	6.114	0.838	0.007	8.674	4818.9	3002.4	1605
6.72	6.162	0.886	0.007	8.736	5128.6	3003.6	1707
7.08	6.214	0.938	0.008	8.795	5423.0	3004.9	1805
7.47	6.270	0.993	0.008	8.852	5711.3	3006.3	1900
7.83	6.328	1.052	0.009	8.906	5980.6	3007.8	1988
8.20	6.395	1.119	0.009	8.955	6229.9	3009.5	2070
8.48	6.463	1.186	0.010	8.982	6361.2	3011.2	2112
8.73	**6.537**	**1.261**	**0.010**	**8.988**	**6395.6**	**3013.1**	**2123**
8.97	6.644	1.367	0.011	8.960	6255.1	3015.8	2074
9.20	8.108	2.831	0.024	7.777	315.6	3053.4	103

Unconfined Compressive Strength: 2,100 kPa

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	63555#L	2809	63555#L/UCS 538 Karangahape	Version 3, July 2022
	PROJECT:	**538 KARANGAHAPE ROAD**		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	11-Jul-23
Compiled By:	WEC	12-Jul-23
Checked By:	JF	17-Jul-23

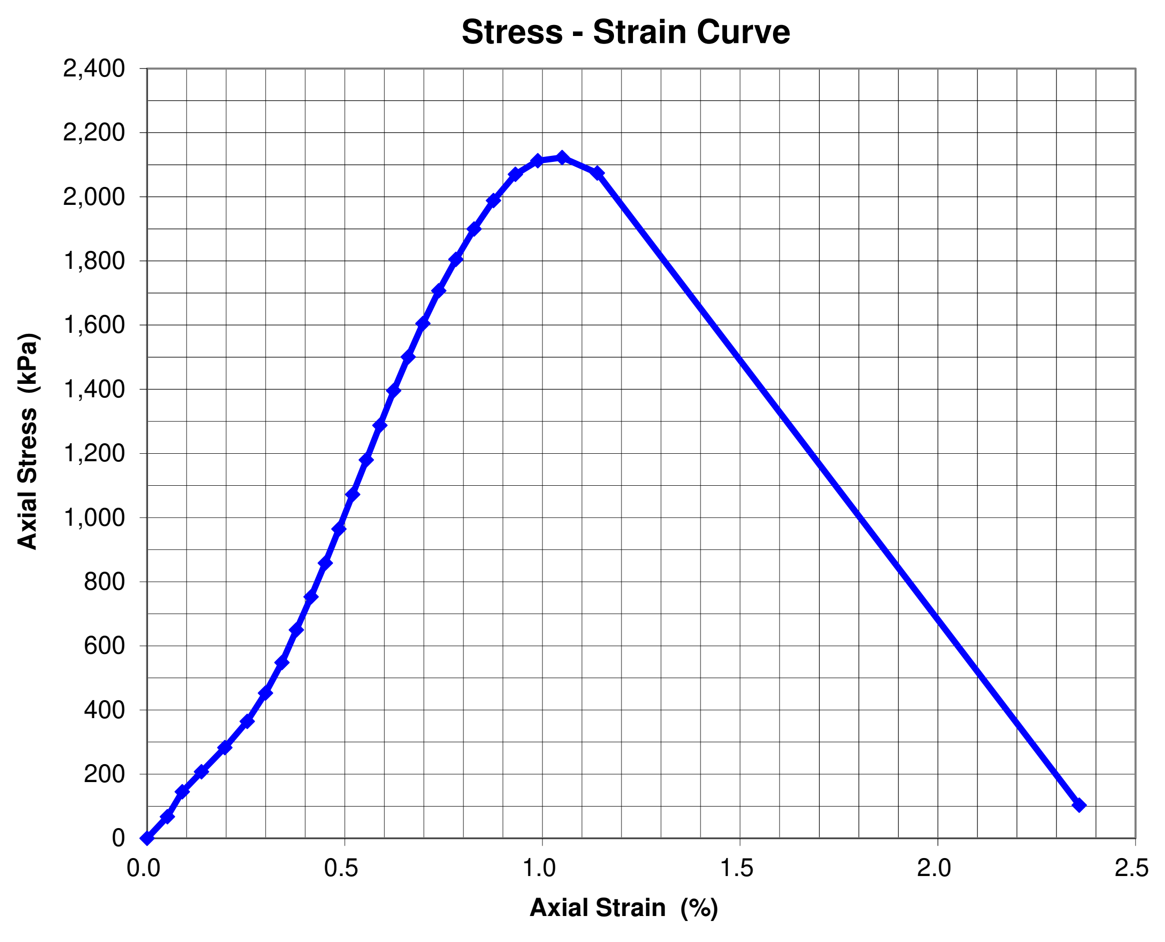
Borehole: MB01 **Sample Number:** CORE **Depth:** 19.10 - 19.40m

Test Performed on: rock / ~~whole soil~~
Sample History: ~~disturbed~~ / undisturbed / ~~remoulded / recompacted / unknown~~
Sample Method & Type: from core sample / ~~from tube sample~~

Initial Diameter: 61.61 mm
Initial Length: 120.08 mm
Initial Mass: 711.80 g
Initial Bulk Density: 1.99 t/m^3
Initial Dry Density: 1.60 t/m^3
Water Content After Test: 23.0 %

Failure Conditions:

Strain at failure: 1.0 %
Compression at failure: 1.3 mm
Rate of Compression: 0.14 mm / minute
Mode of Failure: brittle



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	63555#L	2809	63555#L/UCS 538 Karangahape	Version 3, July 2022
	PROJECT:	**538 KARANGAHAPE ROAD**		

Unconfined Compressive Strength of Cohesive Soils	**Tested By:**	WEC	11-Jul-23
	Compiled By:	WEC	12-Jul-23
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	**Checked By:**	JF	17-Jul-23

Borehole: **MB01** **Sample Number:** **CORE** **Depth:** **19.10 - 19.40m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to medium, very weak, grey, weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST

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Job No:	Reg. No:	Report No:	Page 6 of 8
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PROJECT: **538 KARANGAHAPE ROAD**

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	11-Jul-23
Compiled By:	WEC	12-Jul-23
Checked By:	JF	17-Jul-23

Borehole: **MB03** **Sample Number:** **CORE** **Depth:** **9.50 - 9.70m**

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm^2)	Axial Stress (kPa)
0.00	5.418	0.000	0.000	7.708	0.0	2981.9	0
0.37	5.513	0.095	0.001	7.721	66.2	2984.3	22
0.75	5.593	0.176	0.001	7.740	161.5	2986.3	54
1.12	5.669	0.251	0.002	7.764	284.5	2988.2	95
1.48	5.742	0.324	0.003	7.792	422.7	2990.0	141
1.87	5.806	0.388	0.003	7.811	519.6	2991.6	174
2.23	5.884	0.466	0.004	7.838	655.2	2993.6	219
2.60	5.970	0.552	0.005	7.864	783.6	2995.7	262
2.98	6.048	0.630	0.005	7.892	926.2	2997.7	309
3.35	6.130	0.713	0.006	7.919	1061.6	2999.7	354
3.73	6.210	0.792	0.007	7.947	1200.6	3001.7	400
4.10	6.287	0.869	0.007	7.974	1335.6	3003.7	445
4.47	6.370	0.952	0.008	7.996	1447.0	3005.8	481
4.85	**6.462**	**1.044**	**0.009**	**8.013**	**1532.6**	**3008.1**	**510**
5.08	6.596	1.178	0.010	7.933	1129.5	3011.5	375
5.32	6.686	1.268	0.011	7.910	1017.0	3013.8	337
5.57	6.754	1.336	0.011	7.909	1011.2	3015.5	335
5.80	6.825	1.407	0.012	7.906	996.5	3017.3	330

Unconfined Compressive Strength: 510 kPa

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PROJECT:

538 KARANGAHAPE ROAD

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	11-Jul-23
Compiled By:	WEC	12-Jul-23
Checked By:	JF	17-Jul-23

Borehole: **MB03** **Sample Number:** **CORE** **Depth:** **9.50 - 9.70m**

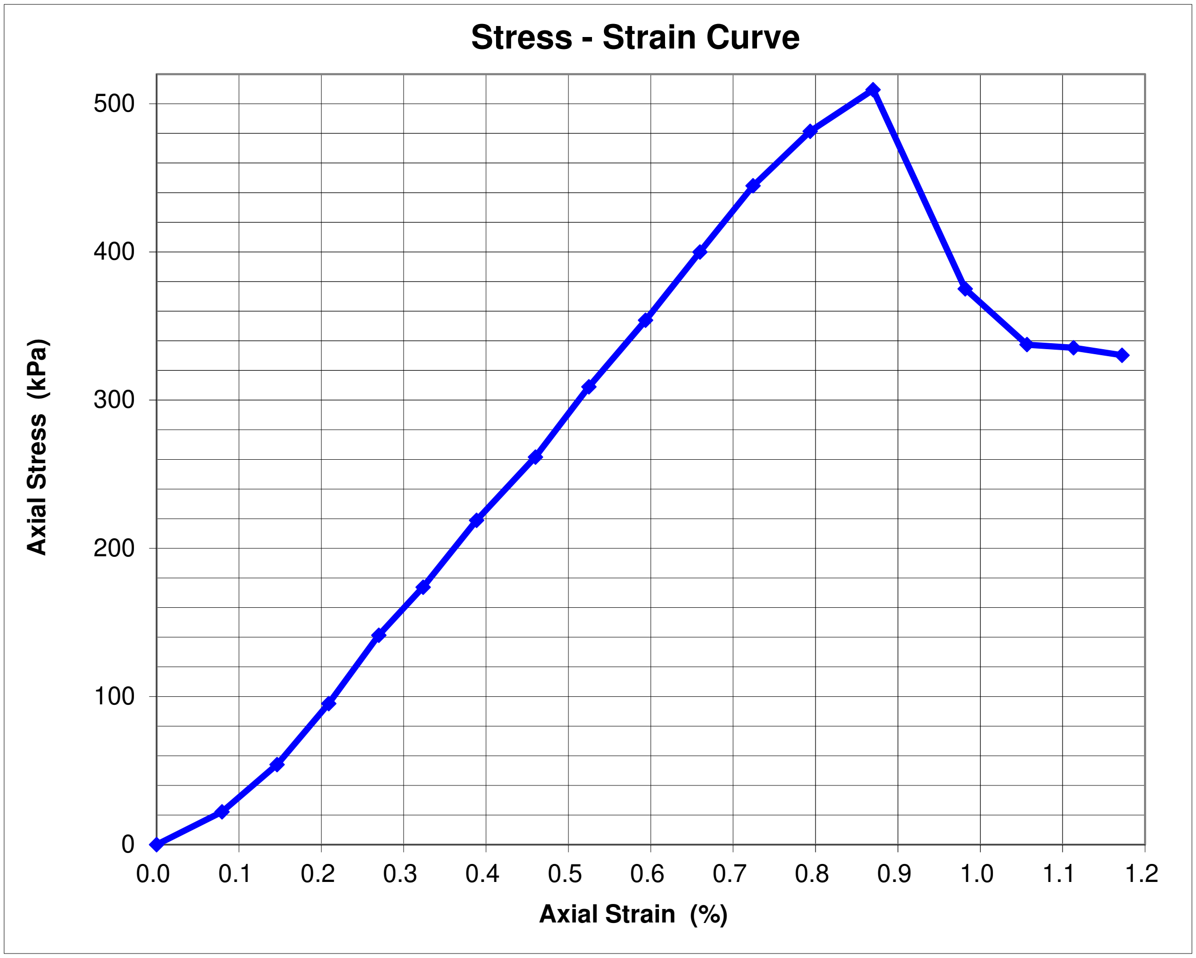
Test Performed on:	rock / ~~whole soil~~
Sample History:	~~disturbed~~ / undisturbed / ~~remoulded / recompacted / unknown~~
Sample Method & Type:	from core sample / ~~from tube sample~~

Initial Diameter:	61.62	mm
Initial Length:	120.03	mm
Initial Mass:	695.92	g
Initial Bulk Density:	1.94	t/m^3
Initial Dry Density:	1.50	t/m^3
Water Content After Test:	29.1	%

Failure Conditions:

Strain at failure:	0.87	%
Compression at failure:	1.0	mm
Rate of Compression:	0.22	mm / minute

Mode of Failure: **brittle**



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	PROJECT:	538 KARANGAHAPE ROAD		

Unconfined Compressive Strength of Cohesive Soils	**Tested By:**	WEC	11-Jul-23
	Compiled By:	WEC	12-Jul-23
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	**Checked By:**	JF	17-Jul-23

Borehole: **MB03** **Sample Number:** **CORE** **Depth:** **9.50 - 9.70m**

Sample Description (*not part of BGL IANZ Accreditation*):

SILTSTONE, extremely weak, grey.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST