

31 January 2020

109 BEACHLANDS ROAD, BEACHLANDS

**PRELIMINARY GEOTECHNICAL INVESTIGATION
REPORT**

Neil Construction Limited
AKS2020-0001AB Rev.0

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the Official Information Act 1982

AKS2020-0001AB		
Date	Revision	Comments
24 January 2020	A	Initial draft for internal review
31 January 2020	0	Final report for client

	Name	Signature	Position
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EXECUTIVE SUMMARY

This report presents the results of a geotechnical investigation and geohazards assessment for the block of land at 109 Beachlands Road, Beachlands and is intended for due diligence purposes.

The approximately 16.3 hectares of land is characterised by an incised gully that originates beyond the north eastern corner and exits across the southern boundary. Several short tributaries extend into it from the north west and another in the south eastern corner. The majority of the gullies are covered in thick gorse and vegetation. The contour grades moderately gently from the north west and the eastern boundary down to gully flanks, from where it falls moderately steeply into the gullies. Along the eastern boundary between a farm fence and the site boundary is a strip of land with various small stockpiles and evidence from the aerial photographs of previous earthworks. An existing house, associated sheds and stock yards are located in the north-eastern corner.

- Based on the investigation results, the site is underlain by East Coast Bays Formation deposits, possibly overlain in places by Puketoka alluvium.
- In general, the site is considered suitable for the proposed residential sub-divisional development.
- Should purchase of the property proceed, additional site investigations should be undertaken, as part of detailed design.
- Review of historic photographs reveals previous activities on the site have included the formation and subsequent filling of a pond in the south-eastern corner, earthworks that include stockpiling and filling inside the eastern boundary and removal of a building adjacent to Beachlands Road;
- Boreholes encountered topsoil overlying stiff to very stiff natural clays silts and sands, including in the gully areas where no significant organic or soft deposits were identified. No significantly organic natural deposits were identified anywhere on the site and groundwater levels were found to be beyond 3m depth. Some of the soils were identified as being sensitive, particularly in the (anticipated) cut areas to the west of the gully system;
- Liquefaction is not expected to be a significant hazard on this site;
- Where gully areas are to remain, additional investigations and analyses will be required for the design of retaining walls or to assess the need for subsoil drains and/ or building line limitations to limit the proximity of development to the steep slopes. These issues are not expected to be difficult to address during earthworks development, although care will be needed to assess stability conditions in the south eastern corner where a pond has been backfilled in the past.
- The site soils are expected to be suitable for normal bulk earthworks operations, although the surface silt deposits over the western site areas should be expected to be sensitive to water content and therefore difficult to compact unless mixed with other clay soils.
- Aerial photographic evidence shows that earthworks have been undertaken along a strip approximately 30m wide inside the eastern boundary, including filling a gully feature that previously extended into the north eastern corner. The quality of any previous filling in this area will need to be assessed by review of any geotechnical reports relating to it and most likely by further investigations. Similarly, the backfilling of the pond in the south eastern corner may require further investigation, depending on the extent of development proposals for this area.
- It is expected that the sensitive nature of some of the soils on the site has contributed to the gully erosion / formation processes. These soils can be sensitive to tomo formation and may be more sensitive than many sites to erosion and sedimentation during earthworks. These soils may also be problematic for building excavations, losing significant strength when disturbed.
- The soils comprise a range of sand, silt and clay mixtures expected to provide a range of expansive soil conditions. Testing should be undertaken in the future to confirm the expansive Class(es).
- Groundwater levels were low where encountered and therefore groundwater is not expected to pose any uncommon issues at this site unless combined with sensitive soils in excavations.

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1 INTRODUCTION

1.1 Project Brief

CMW Geosciences (CMW) was engaged by Neil Construction Limited to carry out a preliminary geotechnical investigation at 109 Beachlands Road, Beachlands, which is being considered for the construction of a 141 lot residential subdivision.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced AKS2020-0001AA Rev.0 dated 9 January 2020.

We understand that this report will be used for due diligence purposes. The proposed scheme plan by Neil Construction Limited referenced Possible Subdivision – Rev3 (draft only) can be found in **Appendix A**.

1.2 Scope of Work

The purpose of this report is to describe the investigation completed, the ground conditions encountered and to provide recommendations with respect to geotechnical aspects of the proposed development.

2 SITE DESCRIPTION

2.1 Site Location

The site comprises an area of approximately 16.3 hectares and is located at 109 Beachlands Road, Beachlands legally described as Lot 1002 DP 512674 as show in Figure 1 below.

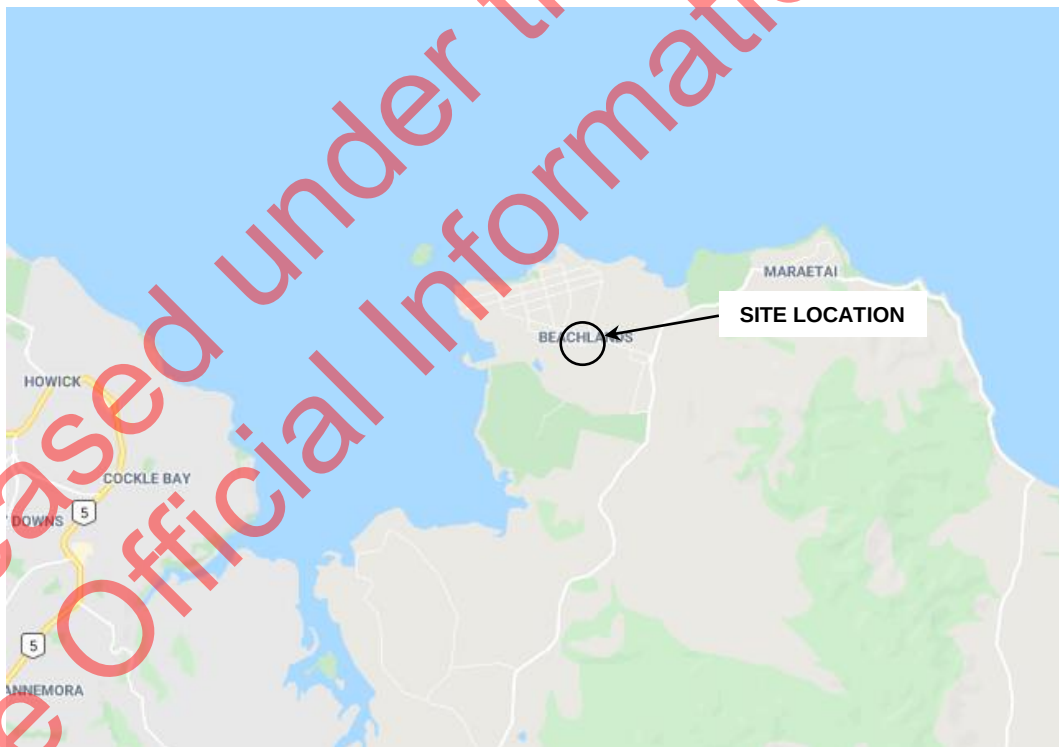


Figure 1: Site Location Plan (Google Maps)

2.2 Landform

The current general landform, together with associated features located within and adjacent to the site is presented on the attached Site Plan as **Drawing 01**.

The site is relatively square in shape with the majority of the land in open pasture. Historic aerial photographs illustrate that the site was historically and is currently used for agricultural purpose. The site is bound to the north by Beachlands Road, to the east and west by recent residential subdivisions and commercial lots and to the south by a gully and a partially developed subdivision. The approximately 16.3 hectares of land is characterised by an incised gully that originates beyond the north eastern corner and exits across the southern boundary. Several short tributaries extend into it from the north west and another in the south eastern corner. The majority of the gullies are covered in thick gorse and vegetation.

The site grades moderately gently from RL 45m in the north west and RL 36m on the eastern boundary down to gully flanks, from where it falls moderately steeply into the gullies, reaching the lowest point at approximately RL 22.5m in the gully in the centre of the southern boundary. Along the eastern boundary between a farm fence and the site boundary is a strip of land with various small stockpiles and evidence from the aerial photographs of previous earthworks. An existing house, associated sheds and stock yards are located in the north-eastern corner of the site.

3 PROPOSED DEVELOPMENT

The preliminary design scheme in **Appendix A** depicts the possible creation of 141 large residential lots and associated roading that would incorporate filling most of the gully features and would likely require retaining walls to support some portions of roads and lots.

4 INVESTIGATION SCOPE

4.1 Desktop Study

A desktop study was carried out before commencing fieldwork. This included online research through Auckland Council Geo Maps, Dial Before You Dig and aerial photographs.

A review of historic aerial photographs between 1996 and 2017 indicated the following activity:

- Formation of a pond in the south eastern corner between 1996 and 2010;
- Removal of a building adjacent to Beachlands Road between 2008 and 2010;
- Filling of the pond in the south eastern corner between 2010 and 2015;
- Filling of the gully in the north eastern corner between 2010 and 2015;
- Earthworks activities inside the eastern boundary since 2015.

4.2 Field Investigation

Following a Dial Before You Dig search the field investigation was undertaken on 23rd January 2020. All fieldwork was carried out under the direction of CMW Geosciences in general accordance with the NZGS guidance¹. The scope of fieldwork completed was as follows:

- Undertook a walkover survey of the site to assess the general landform, site conditions, geomorphology and adjacent structures/infrastructure;
- 12 hand auger boreholes, denoted HA01-20 to HA12-20, were drilled using a 50mm diameter auger to target depths of up to 4.0m below existing ground levels to visually observe the near surface soil profile and to facilitate in-situ vane shear strength testing. Engineering logs of the hand auger boreholes, together with peak and remoulded vane shear strengths are presented in **Appendix B**;

¹ NZ Geotechnical Society (2005), Field Description of Soil and Rock, Guideline for the field classification and description of soil and rock for engineering purposes.

The approximate locations of the respective investigation sites referred to above are shown on the Site Plan as **Drawing 01**. Test locations were measured using a hand-held GPS and elevations were taken from the current contours on Auckland Council GIS.

5 GROUND MODEL

5.1 Published Geology

Published geological maps² for the area depict the regional geology for the area as comprising mainly sedimentary rocks of the East Coast Bays Formation (ECBF) of the Warkworth Subgroup (Waitemata Group) as illustrated in Figure 2 below. The map also indicates the site sits just south of a boundary with Puketoka Formation alluvium and therefore alluvial deposits may overlies the ECBF in some areas of the site, particularly low-lying areas.

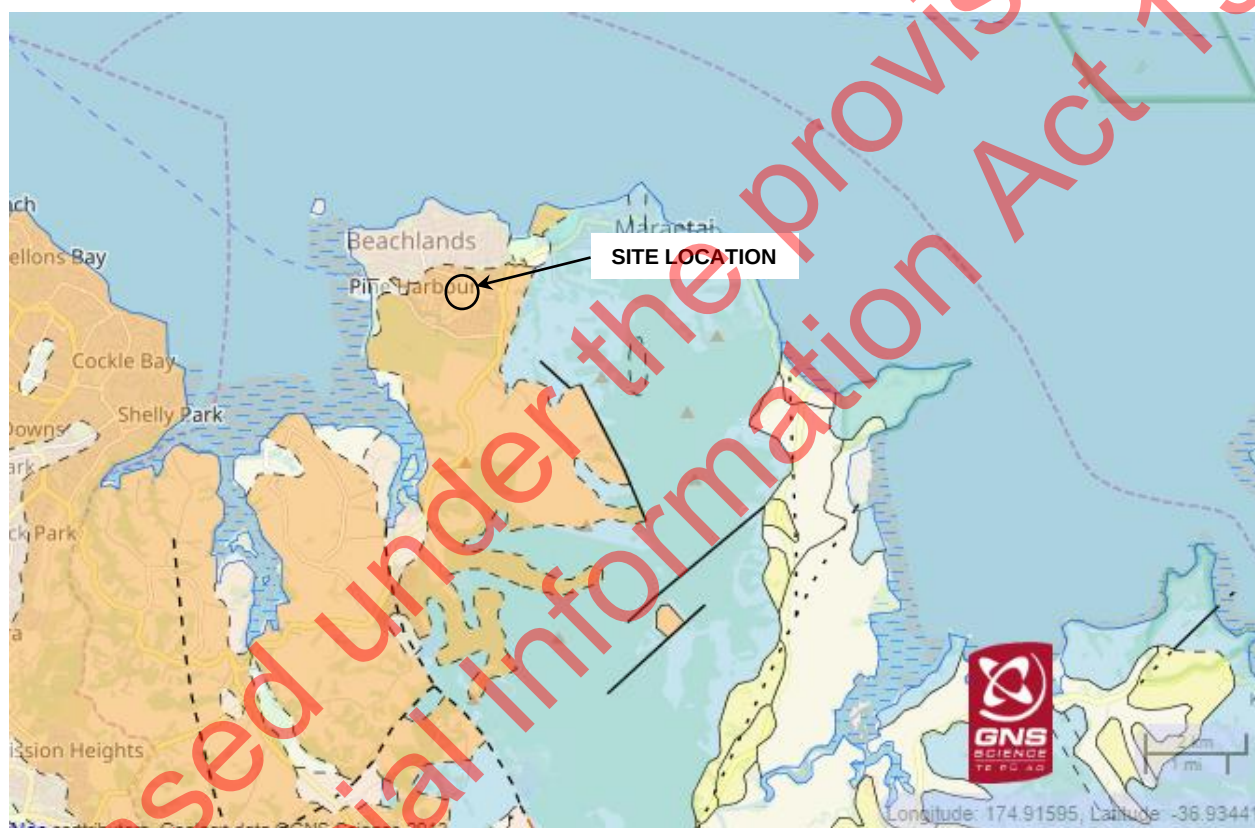


Figure 2: Regional Geology (Auckland Council GIS)

The historic turbidite flows of the ECBF consist of residual soils comprising stiff to very stiff clays and silty clays underlain by alternating sandstone and muddy siltstone with variable volcanic content.

Puketoka Formation alluvial deposits are characterised by pumiceous mud, sand and gravel with possible muddy peat and lignite.

5.2 Stratigraphic Units

The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area. Sand, silt and clay mixtures of alluvial and Waitemata Group origin can be difficult to distinguish in the absence of organic or pumiceous deposits so our appended borehole records have included geological units where we have been confident to make the distinction and

² Edbrooke, S.W. (compiler) 2001, Geology of the Auckland Area, 1:250,000 Geological Map 3, GNS Science

have not been labelled where uncertainty remains. In practice these units that are difficult to distinguish have very similar behaviour characteristics.

Our findings can be generalised according to the following subsurface sequences.

5.2.1 Topsoil

Topsoil was encountered in all hand auger boreholes from approximately 0.15m to 0.4m below current ground level and was generally dry.

5.2.2 Gully Deposits (HA02-20, HA03-20, HA04-20, HA06-20, HA09-20, HA10-20)

Other than topsoil deposits that were similar in depth to the boreholes drilled outside the gully areas, no specific soft or organic gully deposits that would require specific / additional undercutting were encountered in our borehole locations. Although allowance should be made for such deposits to be present in gully areas not investigated, this finding suggests that the gullies have been formed by erosion of the original ground surface.

Minor landslide movement was only identified in the gully head upslope of HA02-20.

5.2.3 Fill

No fill was identified in our site investigation, but it is evident that filling has taken place around the existing house site and during construction of the earth-worked strip along the eastern boundary.

5.2.4 Natural Soils

The natural soils encountered were typically stiff to very stiff, grey, orange and brown mixtures of clays silts and sands. Typically in the gully areas they became more consistently grey and higher strength (often unable to be penetrated) towards the bases of the boreholes, indicating less weathering. All boreholes extended to their target depth of 4m. No significant organic or pumiceous deposits were encountered.

Of note, a dry silt layer was encountered immediately beneath the topsoil horizon in nearly all the hand augers drilled to the north west of the gully system and extended to depths up to 1.6m below existing ground levels. This silt material is expected to be extensive in surface cuts taken from this area. Typically strengths were beyond the upper limit of our shear vanes and soil sensitivities were not able to be measured. However where it was able to be measured in elevated HA01-20, it was found to be sensitive. Measurements in this soil in the gully areas (HA02-20 and HA06-20) also showed it to be moderately sensitive to sensitive albeit that the dryness of the soils would also have affected the readings. Isolated readings of sensitive to extra sensitive buried clay soils in the gullies were also made in HA03-20 and HA09-20, again in dry soils.

5.2.5 Groundwater

Standing groundwater was only encountered in boreholes HA04-20, HA08-20 and HA10-20 drilled near the eastern boundary and located in a combination of elevated and gully areas. Depths ranged between 3.0m and 3.6m below the existing ground level. It should be noted that these levels are indicative only and may vary seasonally and with rain fall.

6 PRELIMINARY GEOTECHNICAL COMMENTS

6.1 Seismicity

Based on the findings of our preliminary investigations the seismic site subsoil class is provisionally assessed to be C (shallow soil) in accordance with NZS 1170.5 section 3.1.1

6.2 Liquefaction

On the basis of the geological age of the natural soils at this site, their composition that typically incorporates clay mineralogy, their high strength and the suppressed groundwater levels, our preliminary assessment is the soils at this site are not a significant liquefaction risk.

6.3 Slope Stability Assessment

Shallow, rotational type instability has been noted in some gully head areas, particularly upslope of HA02-20. Based on the scheme plan provided to us, we anticipate that any associated risks will be remediated during normal earthworks across most of the site. Where gully areas are to remain, additional investigations and analyses will be required for the design of retaining walls or to assess the need for subsoil drains and/or building line restrictions to limit the proximity of development to the steep slopes. Based on the high strengths of the soils, the low groundwater table and the relatively large lot sizes, these issues are not expected to be difficult to address during earthworks development, although care will be needed to assess stability conditions in the south eastern corner where a pond has been backfilled in the past.

6.4 Sensitive Soils

The sensitive surface silts mentioned above should be considered in terms of their performance in finished building excavations as they may prove difficult for foundation contractors to work, losing significant strength when disturbed or wet back from their current dry state. This can be addressed during earthworks if desired by over-excavation and mixing with other soils.

The sensitive clay soils encountered at depth in some of the gully boreholes are not expected to significantly impact on development works. Dryness of these soils during testing is expected to have impacted on the sensitivity results.

It is expected that the sensitive nature of some of the soils on the site has contributed to the gully erosion that has occurred here. These soils can be sensitive to tomo formation/ tunnel erosion

6.5 Earthworks

Evidence to date suggests that the gully features will be relatively straightforward to clean out and prepare for filling due to low volumes of organic deposits and the absence of soft soils.

The site soils are expected to be suitable for normal bulk earthworks operations, although the surface silt deposits over the western site areas described in Section 5.2.4 can be expected to be sensitive to water content and therefore difficult to compact unless mixed with other clay soils.

Aerial photographic evidence shows that earthworks have been undertaken along a strip approximately 30m wide inside the eastern boundary. Much of this work may have been surficial and/or stockpiling, but it is evident that a gully feature that previously extended into the north eastern corner has been filled. The quality of any previous filling in this area will need to be assessed by review of any geotechnical reports relating to it and most likely by further investigations. Similarly, the backfilling of the pond in the south eastern corner may require further investigation, depending on the extent of development proposals for this area.

It is expected that the sensitive nature of some of the soils on the site has contributed to the gully erosion / formation processes. These soils can be sensitive to tomo formation and may be more sensitive than many sites to erosion and sedimentation during earthworks.

6.6 Expansive Soils

The soils encountered in the investigations comprised a range of sand, silt and clay mixtures expected to provide a range of expansive soil conditions, depending on exposures at finished levels in cuts and the mix of soils achieved in fills. Testing should be undertaken in the future to confirm likely outcomes.

6.7 Groundwater

Groundwater levels were low where encountered, although it is noted that our fieldwork was undertaken during a dry summer period. Nevertheless, given these findings, groundwater is not expected to pose any uncommon issues at this site unless combined with sensitive soils in excavations.

USE OF THIS REPORT

Site subsurface conditions cause more construction problems than any other factor and therefore are generally the largest technical risk to a project. These notes have been prepared to help you understand the limitations of your geotechnical report.

Your geotechnical report is based on project specific criteria

Your geotechnical report has been developed on the basis of our understanding of your project specific requirements and applies only to the site area investigated. Project requirements could include the general nature of the project; its size and configuration; the location of any structures on or around the site; and the presence of underground utilities. If there are any subsequent changes to your project you should seek geotechnical advice as to how such changes affect your report's recommendations. Your geotechnical report should not be applied to a different project given the inherent differences between projects and sites.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface investigation, the conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation of factual data

Site investigations identify actual subsurface conditions at points where samples are taken. Additional geotechnical information (e.g. literature and external data source review, laboratory testing on samples, etc) are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can exactly predict what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

Your report's recommendations require confirmation during construction

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site. A geotechnical designer, who is fully familiar with the background information, is able to assess whether the report's recommendations are valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. Read all geotechnical documents closely and do not hesitate to ask any questions you may have. To help avoid misinterpretations, retain the assistance of geotechnical professionals familiar with the contents of the geotechnical report to work with other project design professionals who need to take account of the contents of the report. Have the report implications explained to design professionals who need to take account of them, and then have the design plans and specifications produced reviewed by a competent Geotechnical Engineer.

Drawings: Site Investigation Plan

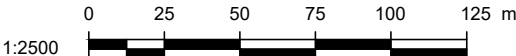


LEGEND:

- HA01-20 HAND AUGER (HA) LOCATION
- SITE BOUNDARY
- STORMWATER LINE
- WASTE WATER LINE

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS MAPS.



CLIENT:	NEIL CONSTRUCTION LIMITED		DRAWN:	FMS	PROJECT No:	AKS2020-0001
PROJECT:	109 BEACHLANDS ROAD, BEACHLANDS		CHECKED:	JW	DRAWING:	01
TITLE:	SITE INVESTIGATION PLAN		REVISION:	0	SCALE:	1:2500
			DATE:	28/01/2020	SHEET:	A3

Appendix A: Possible Scheme Plan (Neil Construction)

Appendix B: Hand Auger Borehole Logs

HAND AUGER BOREHOLE LOG - HA01-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: JW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778656.0mE; 5915312.0mN Projection: AUCKHT 1946

Elevation: 34.90m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			34.9			OL: TOPSOIL					
	0.4	Peak = >200kPa Residual = 45kPa				ML: SILT with trace fine grained sand and trace clay: orange brown, low plasticity. (Waitemata Group) ... at 0.40m, becoming grey streaked orange.	D				
	0.8	Peak = 160kPa Residual = 48kPa	34.2			CH: Silty CLAY: grey streaked orange, high plasticity. (Waitemata Group)					
	1.2	Peak = 224+ kPa		1							
	1.6	Peak = 224+ kPa	33.4			CH: CLAY with minor silt: grey streaked orange, high plasticity. (Waitemata Group)	VSt				
	2.0	Peak = 195kPa Residual = 157kPa		2							
	2.4	Peak = 141kPa Residual = 96kPa					M				
	2.8	Peak = 147kPa Residual = 96kPa									
	3.2	Peak = 147kPa Residual = 93kPa		3							
	3.6	Peak = 77kPa Residual = 48kPa	31.3			CH: Silty CLAY with some fine to medium grained sand: light grey streaked orange, high plasticity. (Waitemata Group)	St				
	4.0	Peak = 80kPa Residual = 51kPa		4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 2081

DCP No:

Remarks: No groundwater encountered.

HAND AUGER BOREHOLE LOG - HA02-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: JW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778740.0mE; 5915342.0mN Projection: AUCKHT 1946

Elevation: 32.40m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			32.4			OL: TOPSOIL					
	0.4	Peak = UTP				ML: SILT with minor clay: orange, low plasticity. (Waitemata Group)					
	0.8	Peak = 224+ kPa				... at 0.90m, with some clay.	D to M				
	1.2	Peak = 160kPa Residual = 45kPa		1							
	1.6	Peak = 163kPa Residual = 45kPa	30.8			CH: Silty CLAY with trace fine grained sand : orange streaked grey, high plasticity. (Waitemata Group)					
	2.0	Peak = 176kPa Residual = 45kPa		2		... at 2.00m, with trace limonite stained nodules.	VSt				
	2.4	Peak = 224+ kPa									
	2.8	Peak = 224+ kPa	29.8			ML: Clayey SILT: grey streaked orange, low plasticity. Trace blocky structure. (Waitemata Group)	M				
	3.2	Peak = 224+ kPa	29.4	3		CH: Sandy CLAY with some silt: grey, high plasticity. Sand fine to medium grained. (Waitemata Group)					
	3.6	Peak = UTP	29.0			ML: Sandy SILT with trace clay: grey, low plasticity. Sand fine to medium grained. (Waitemata Group)					
	4.0	Peak = UTP		4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 2081 DCP No:

Remarks: No groundwater encountered.

HAND AUGER BOREHOLE LOG - HA03-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: JW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778800.0mE; 5915316.0mN Projection: AUCKHT 1946

Elevation: 27.40m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			27.4			OL: TOPSOIL					
	0.4	Peak = UTP		27.2		ML: SILT with trace clay: light brown orangey grey, low plasticity. Friable.	D				
	0.8	Peak = UTP									
	1.2	Peak = 131kPa Residual = 58kPa		26.5		CH: Silty CLAY with trace fine to medium grained sand: grey streaked orange, high plasticity.					
	1.6	Peak = 128kPa Residual = 64kPa									
	2.0	Peak = 179kPa Residual = 45kPa		25.4		CH: CLAY with minor silt: grey streaked orange, high plasticity.	VSt				
	2.4	Peak = 157kPa Residual = 96kPa					M				
	2.8	Peak = 157kPa Residual = 99kPa				... at 2.70m, trace brown grey staining and organic inclusions.					
	3.2	Peak = 144kPa Residual = 64kPa		24.4		CH: CLAY with minor fine to coarse grained sand and trace silt: grey, high plasticity. Organic staining.					
	3.6	Peak = 157kPa Residual = 86kPa									
	4.0	Peak = 154kPa Residual = 58kPa									
				4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 2081 DCP No:

Remarks: No groundwater encountered.

HAND AUGER BOREHOLE LOG - HA04-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: JW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778870.0mE; 5915203.0mN Projection: AUCKHT 1946

Elevation: 25.10m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			25.1			OL: TOPSOIL					
	0.4	Peak = 109kPa Residual = 42kPa	24.7			CH: Silty CLAY with minor fine grained sand: grey mottled orange with black organic staining, high plasticity. (Waitemata Group)	VSt				
	0.8	Peak = 96kPa Residual = 32kPa		1			M				
	1.2	Peak = 93kPa Residual = 32kPa	23.8			CH: Sandy CLAY with minor silt: grey mottled orange, high plasticity. Trace limonite mottles, Sand is fine to medium grained. (Waitemata Group)	St				
	1.6	Peak = 67kPa Residual = 29kPa				... at 1.80m, seam of decomposed wood.					
	2.0	Peak = 192kPa Residual = 64kPa	23.1	2		CH: Sandy Silty CLAY: grey with trace black mottles and brown staining, high plasticity. Trace decomposed wood inclusions. (Waitemata Group)	M to W				
	2.4	Peak = 109kPa Residual = 35kPa									
	2.8	Peak = 115kPa Residual = 32kPa		3			VSt				
	3.2	Peak = UTP	21.8			... at 3.20m, 100mm layer of orange brown, limonite stained Silt nodules.	W				
	3.6	Peak = UTP				CH: Sandy CLAY with some silt: grey, high plasticity. Sand fine to medium grained. (Waitemata Group)	M to W				
	4.0	Peak = UTP		4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 2081

DCP No:

Remarks: Groundwater encountered at 3.0m.

HAND AUGER BOREHOLE LOG - HA05-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: LSW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778896.0mE; 5915256.0mN Projection: AUCKHT 1946

Elevation: 31.10m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			31.1			OL: TOPSOIL					
	0.4	Peak = 221+ kPa		30.9		CL: Silty CLAY: orange mottled brown, low plasticity. Friable. (Waitemata Group)	D				
	0.8	Peak = 221+ kPa				... at 0.80m, becoming light grey mottled orange.					
				1		... at 1.00m, becoming not friable,					
	1.2	Peak = 221+ kPa				... at 1.20m, with high plasticity, lack of sand.	VSt				
	1.6	Peak = 136kPa Residual = 85kPa				... at 1.80m, becoming orange mottled grey.	M				
	2.0	Peak = 126kPa Residual = 79kPa		2							
	2.4	Peak = 63kPa Residual = 44kPa				... at 2.60m, becoming orange.	W	St			
	2.8	Peak = 136kPa Residual = 60kPa				... at 3.00m, becoming sandy, fine to medium grained.					
	3.2	Peak = UTP		27.9		CL: Sandy Silty CLAY: grey brown mottled orange, low plasticity. Sand fine to medium grained. (Waitemata Group)	VSt				
	3.6	Peak = UTP				... at 3.60m, becoming bluey grey.	M				
	4.0	Peak = UTP		4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 1589 DCP No:

Remarks: No groundwater encountered.

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Sheet 1 of 1

Survey Source: Hand Held GPS

Depth (m)	Soil Description	Soil Type	Notes
0.0	OL: TOPSOIL		
0.4	Peak = 129kPa Residual = 28kPa	D	
0.8	Peak = 129kPa Residual = 38kPa	VSt	
1.2	Peak = 107kPa Residual = 57kPa		... at 0.60m, becoming grey mottled orange.
1.6	Peak = 95kPa Residual = 28kPa	M	
2.0	Peak = 107kPa Residual = 66kPa	St	
2.4	Peak = 129kPa Residual = 66kPa	VSt	
2.8	Peak = 98kPa Residual = 44kPa		... at 2.90m, with minor fine grained sand.
3.2	Peak = 79kPa Residual = 35kPa	St	
3.6	Peak = 104kPa Residual = 88kPa	W	
4.0	Peak = 50kPa Residual = 44kPa	VSt	
4.0	Borehole terminated at 4.0 m		

Remarks: No groundwater encountered.

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Sheet 1 of 1

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			33.5			OL: TOPSOIL					
	0.4	Peak = UTP	33.2			ML: SILT with trace clay: orangey grey, low plasticity.	D				
	0.8	Peak = UTP									
			32.5	1		CH: Silty CLAY: grey streaked, high plasticity.					
	1.2	Peak = 224+ kPa									
	1.6	Peak = 224+ kPa				... at 1.60m, with minor fine to medium sand.					
						... at 1.90m, becoming brownish grey with trace organic inclusions.					
	2.0	Peak = >200kPa Residual = 115kPa	31.5	2		CH: CLAY with trace fine to medium grained sand and trace silt: grey streaked orange with trace brown staining, high plasticity. Trace organic inclusions.	VSt				
	2.4	Peak = 195kPa Residual = 128kPa					M				
	2.8	Peak = 224+ kPa									
			30.6	3		ML: Sandy SILT with minor clay: grey mottled orange, low plasticity. Sand is fine grained. ... at 3.00m, becoming orange streaked grey.					
	3.2	Peak = 115kPa Residual = 99kPa	30.3			CH: CLAY with trace fine grained sand and trace silt: grey streaked orange, high plasticity.					
	3.6	Peak = 144kPa Residual = 83kPa									
	4.0	Peak = 141kPa Residual = 70kPa		4		Borehole terminated at 4.0 m					
				5							

Remarks: No groundwater encountered.

HAND AUGER BOREHOLE LOG - HA08-20

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: LSW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1778973.0mE; 5915332.0mN Projection: AUCKHT 1946

Elevation: 34.50m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
			34.5			OL: TOPSOIL					
	0.4	Peak = 221+ kPa		34.3		CL: Silty Sandy CLAY: orange mottled brown grey, low plasticity. Friable.	D				
	0.8	Peak = 221+ kPa				... at 0.80m, becoming grey mottled orange. Not friable.					
	1.2	Peak = 136kPa Residual = 66kPa		1		... at 1.00m, lack of sand.					
	1.6	Peak = 189kPa Residual = 95kPa				... at 1.40m, becoming orange mottled grey, minor fine grained sand.	VSt				
	2.0	Peak = 167kPa Residual = 73kPa		2		... at 2.20m, becoming light grey.	M				
	2.4	Peak = 85kPa Residual = 50kPa		32.1		CH: Silty CLAY: orange, high plasticity.	M to W	St			
	2.8	Peak = 110kPa Residual = 63kPa									
	3.2	Peak = 107kPa Residual = 73kPa		31.5	3	CH: Silty Sandy CLAY: orange, high plasticity. Sand is fine grained.		VSt			
	3.6	Peak = 50kPa Residual = 41kPa				... at 3.40m, becoming pinkish orange. Lack of clay.	W				
	4.0	Peak = 95kPa Residual = 47kPa		4		... at 3.90m, becoming light grey.		St			
						Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 1589 DCP No:

Remarks: Groundwater encountered at 3.6m.

CMW Geosciences

Sheet 1 of 1

Survey Source: Hand Held GPS

Depth (m)	Soil Description	Soil Type	Notes
29.5	OL: TOPSOIL		
29.4	CL: Silty CLAY with some fine grained sand: orange mottled light grey, low plasticity.	D	
0.4	Peak = 186kPa Residual = 19kPa	VSt	
0.8	Peak = 180kPa Residual = 38kPa		
1			
1.2	Peak = 98kPa Residual = 54kPa ... at 1.20m, becoming light grey mottled orange, high plasticity,	M	
1.6	Peak = 69kPa Residual = 47kPa	St	
2	Peak = 107kPa Residual = 63kPa ... at 1.80m, lack of sand.		
2.4	Peak = 76kPa Residual = 63kPa	VSt	
26.9	CH: CLAY: brown black, high plasticity. Organic staining, some small organic inclusions.	W	
26.7	CH: Silty Sandy CLAY: blue grey, high plasticity. Sand is fine grained.	St	
26.5	CL: Silty CLAY: blue grey, low plasticity.	M to W	
3.2	Peak = 221+ kPa ... at 3.20m, with fine grained sand.	VSt	
3.6	Peak = UTP	M	
4.0	Peak = UTP Borehole terminated at 4.0 m		

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA10-20

Client: Neil Construction Limited
 Project: 109 Beachlands Road, Beachlands
 Site Location: Beachlands
 Project No.: AKS2020-0001
 Date: 21/01/2020



Borehole Location: Refer to site plan Logged by: LSW Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1779003.0mE; 5915449.0mN Projection: AUCKHT 1946

Elevation: 31.50m

Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
21-01-2020			31.5			OL: TOPSOIL					
			31.4			CL: Silty CLAY: yellow mottled grey brown, low plasticity. Friable.					
	0.4	Peak = 180kPa Residual = 54kPa									
	0.8	Peak = 221+ kPa				... at 0.80m, becoming light grey mottled orange	D				
	1.2	Peak = 101kPa Residual = 79kPa		1				VSt			
	1.6	Peak = 123kPa Residual = 63kPa				... at 1.40m, becoming grey					
	2.0	Peak = 95kPa Residual = 54kPa		2		... at 2.00m, with black inclusions.	W	St			
	2.4	Peak = 107kPa Residual = 66kPa				... at 2.30m, becoming dark grey.					
	2.8	Peak = 114kPa Residual = 50kPa	28.7	3		CH: Silty CLAY some fine grained sand: blue grey some orange mottles, high plasticity.	M	VSt			
	3.2	Peak = 123kPa Residual = 73kPa				... at 3.40m, becoming orange.	W to S				
	3.6	Peak = 76kPa Residual = 57kPa						St			
				4		Borehole terminated at 4.0 m					
				5							

Termination Reason: Target Depth Reached

Shear Vane No: 1589 DCP No:

Remarks: Groundwater encountered at 3.0m.

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Sheet 1 of 1

Survey Source: Hand Held GPS

Depth (m)	Soil Description	Soil Type	Notes
0.0 - 0.4	OL: TOPSOIL	D	
0.4 - 0.8	CL: Silty CLAY: orange mottled brown, low plasticity. Friable.	M	
0.8 - 1.2	Peak = 221+ kPa		
1.2 - 1.6	Peak = >200kPa Residual = 41kPa		
1.6 - 2.0	Peak = UTP		... at 1.20m, becoming high plasticity.
2.0 - 2.4	Peak = 142kPa Residual = 73kPa		... at 1.80m, becoming orange.
2.4 - 2.8	Peak = 155kPa Residual = 60kPa	VSt	
2.8 - 3.2	Peak = 170kPa Residual = 60kPa	M to W	
3.2 - 3.6	Peak = 221+ kPa		
3.6 - 3.8	Peak = UTP		CL: Silty Sandy CLAY: light grey, low plasticity. Sand is fine to medium grained.
3.8 - 4.0	Peak = UTP	M	... at 3.60m, becoming brownish grey. ... at 3.80m, becoming bluish grey.
4.0	Borehole terminated at 4.0 m		

Remarks: No groundwater encountered.

Client: Neil Construction Limited
Project: 109 Beachlands Road, Beachlands
Site Location: Beachlands
Project No.: AKS2020-0001
Date: 21/01/2020



Position: 1778757.0mE; 5915574.0mN Projection: AUCKHT 1946
Elevation: 47.30m Datum: NZTM

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency	Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
	Depth	Type & Results								
			47.3			OL: TOPSOIL				
	0.4	Peak = UTP	47.1			ML: SILT with minor clay: orangey brown, low plasticity.				
						... at 0.50m, becoming orange streaked yellow brown and friable.	D			
	0.8	Peak = UTP	46.4			ML: SILT with minor fine to coarse grained sand and trace clay: yellow brown orange, low plasticity.				
	1.2	Peak = UTP	45.9			CH: Silty CLAY with some fine to medium grained sand: grey streaked orange, high plasticity.				
	1.6	Peak = 224+ kPa								
	2.0	Peak = UTP	45.2			... at 2.00m, with red pink streaks.	VSt			
						CH: Silty CLAY with trace fine grained sand: grey streaked yellow orange and red pink, high plasticity.				
	2.4	Peak = 176kPa Residual = 96kPa					M			
	2.8	Peak = 163kPa Residual = 96kPa								
	3.2	Peak = 179kPa Residual = 99kPa								
	3.6	Peak = 115kPa Residual = 77kPa								
	4.0	Peak = 122kPa Residual = 80kPa				Borehole terminated at 4.0 m				

Remarks: No groundwater encountered.