HAWKE'S BAY GEOTECH

Ed Sundstrum C/o Vermont Street Partners No. 4 Limited

GEOTECHNICAL ASSESSMENT REPORT

PROPOSED RESIDENTIAL SUBDIVISION

174 & 176 Brookvale Road, Havelock North

Prepared & authorized by:

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Client:	*Ed Sundstrum C/o Vermont Street Partners No. 4 Limited*
Project Address:	*174 & 176 Brookvale Road, Havelock North*
Site Legal Description:	*Lot 2 DP 529421, Lot 2 DP 7771, and Lots 1 & 2 DP 16311*

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1 INTRODUCTION

Hawke's Bay Geotech Limited (HB Geotech) were engaged by Ed Sundstrum C/o Vermont Street Partners No. 4 Limited to undertake geotechnical investigations and assessment for a proposed residential subdivision of the parcels of land located at 174 & 176 Brookvale Road, Havelock North (legally described as Lot 2 DP 529421, Lot 2 DP 7771, and Lots 1 & 2 DP 16311). The site location is shown in a local site setting in Figure 1 and in a site-specific setting in Figure 2.

The purpose of this report is to summarise the ground conditions beneath the site, assess the geotechnical risks present and provide engineering recommendations pertaining to the proposed subdivision. This report is intended to accompany a subdivision consent application to the relevant council. Any environmental assessment of the site is outside of the commission of this report.

Figure 1: Site location in a local setting (HDC Intramaps)

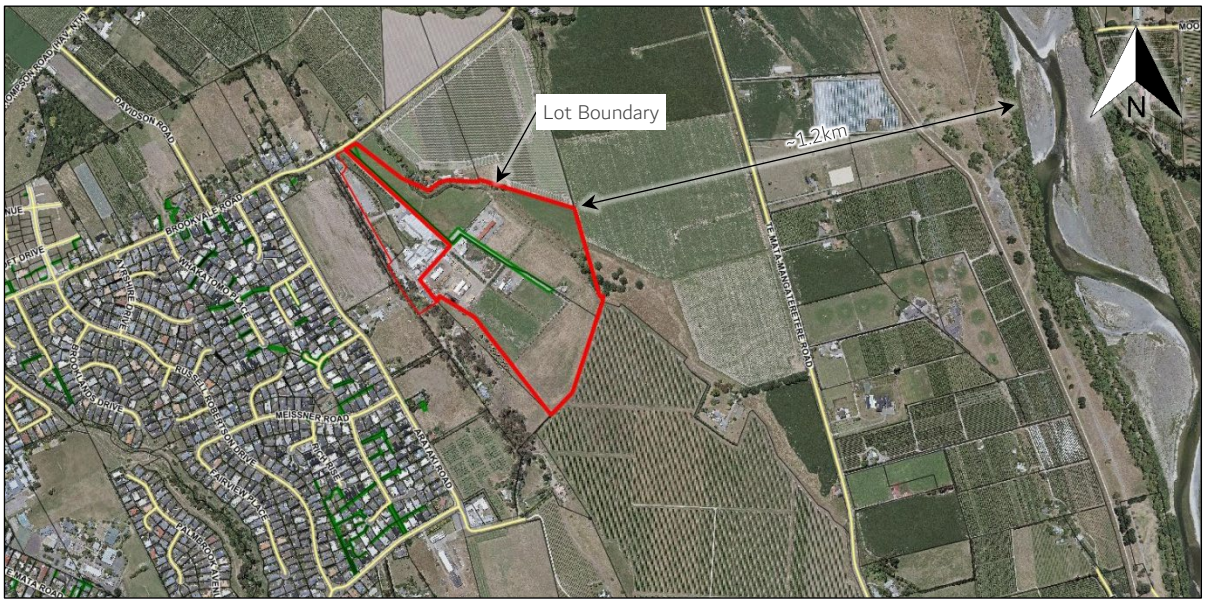

Figure 2: Site location in a site-specific setting (HDC Intramaps)

2 Proposed Development

Based on our review of the Maven Associates Limited (Maven) Draft Proposed Earthworks Plans ref. Project No. 135041, Drawings N0. C220 - Rev A, dated June 2026 (Appendix A & excerpt included in Figure 3) we understand that the proposed development involves:

- Development of up to 203 residential building lots and associated services.
- Re-alignment of an existing ephemeral stream in the north-eastern portion of the site involving cut/fill earthworks in the order of 3.0m
- Cut earthworks & retaining walls proposed in areas along the western site boundary & cut earthworks to form the proposed stormwater detention basin. Approximately 69,000m^3 of in-situ cut material.
- Fill earthworks typically ranging between 0.2m to 2.0m but locally up to 3m where the old channel with be infilled and 3-4m near the western boundary as part of proposed cut/fill earthworks. Approximately 95,000m^3 of fill is proposed.

Figure 3: Excerpt from Maven Associates – Proposed Cut/Fill Plan

3 Site Study

3.1 Site Setting

The site is located within Havelock on relatively flat ground which has formed from the deposition of river transported materials, predominantly from the Tukituki River which is located about 1.2km east of the site.

The ground level generally rises gently across the site from ~RL10 (NZVD 2016) in north to around RL15 in the south-east of the site. Along the western site boundary there is significant sloping ground which leads up to the higher elevated alluvial terrace to the west. Some of the slopes have been cut back at steep angles (i.e. >35°) and the natural slopes are typically moderate (i.e. around 25° to 35°). There is an ephemeral stream which runs through the north-eastern portion of the site and the invert of the channel is approximately 2-3m below the surrounding land. The land to the east of the site has similar or slightly lower ground levels and is located on a younger river terrace.

The site is currently used for commercial and agricultural purposes with several businesses operating out of the existing buildings on site. The undeveloped land had been used as a tree nursery until recently and most of this area is now grass and bare. Within the developed area there is significant existing infrastructure including:

- Multiple large sheds and many smaller commercial sheds.
- Existing treatment ponds,
- A residential dwelling / office,
- Several overland stormwater drains.

Figure 4 includes recent aerial imagery of the site indicating the existing infrastructure.

Figure 4: Aerial Imagery acquired April 2023 indicating the current commercial infrastructure & trees on site.

3.2 Previous Reports

As part of our assessment, we have reviewed the following reports which should be read in conjunction with this report.

- Hawke's Bay Geotech – Plan Change Geotechnical Investigation Report ref. 25030-0, dated 07 June 2025.
- Tonkin & Taylor (T&T) Geotechnical Investigation Reports for Commercial Developments at Te Mata Mushroom Farm, Havelock North, dated June 2013 & July 2020, referenced 29272 & 1014649.V1 respectively.
- Land Water People (LWP) Site Investigation Report ref. HBT021, dated 10 November 2022 which refers to the investigations and assessment for an application for earthworks consent with respect to a now infilled stormwater pond.

The T&T & LWP referenced reports are included with the HB Geotech – Geotechnical Investigation Report for the Proposed Plan Change (on the Council files). They have not been included with the attachments to this report however, the T&T geotechnical investigation data has been included in the project Test Location Plan & Site Investigations Logs (Appendix A). The information included in the above reports has been used to assist in the assessment of the site.

3.3 Published Geology and Geotechnical Hazards

The Hawke's Bay Regional Council Hazards Portal, GNS Active Faults Database and GNS Geological Maps were reviewed as a part of this desktop study.

The hazard portal indicates that the primary geological hazard associated with the site is liquefaction, with the site mapped within a 'medium' vulnerability zone.

The GNS online maps vary:

- The 1:250,000 scale online web maps indicate the southern half of the site is underlain by Middle Pleistocene to Late Pleistocene River deposits (comprising of moderately weathered undifferentiated poorly sorted loess-covered alluvial gravel deposits), and the north of the site by more recent Holocene River deposits comprising predominantly of poorly consolidated alluvial gravel, sand, and mud.
- The most recent (2020) geological maps (1:75,000, GNS Science geological map[1]) indicates that the site is entirely within the Middle to Late Pleistocene River deposits (am) comprising of gravel, sand, and silt.

Given the scale of the mapping and our site observations, we consider that the more recent (1:75,000 scale) maps are likely more accurate as to the deposits in the area.

No active faults are mapped within or close to the site.

[1] Lee, JM, Begg JG, Bland KJ 2020. Geological map of the Napier-Hastings urban area: scale 1:75,000, GNS Science geological map 7a.

3.4 Historical Aerial Imagery

A review of the Crown Historical aerial imagery archive was undertaken through the HDC Intramaps and Retrolens along with more recent imagery via Google Earth Pro and Land Information NZ (LINZ).

The earliest available imagery from Retrolens was acquired in 1950 (Figure 5) and indicates that the site was used for predominantly pastural purposes at this time. The north-western and south-western elevated platforms appear to have not been constructed at this stage. Cut and fill earthworks were likely undertaken at later stages in this area.

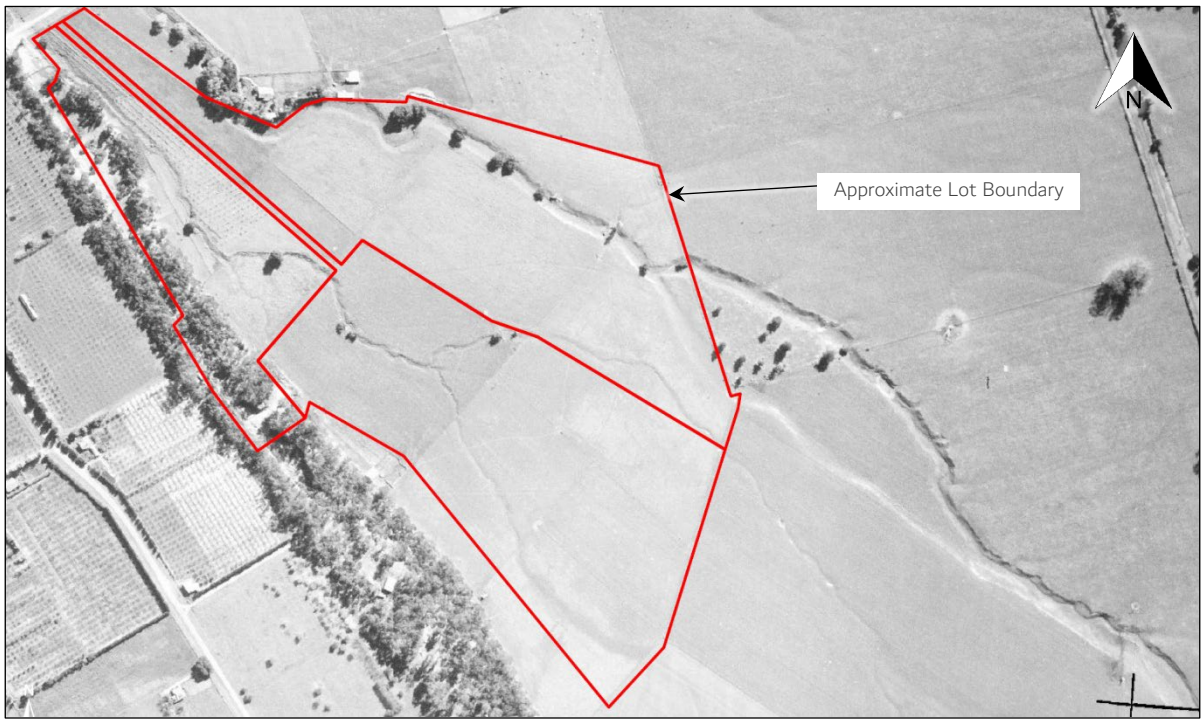

Figure 5: Historical aerial image of the site (1950) – Maven Associates (Preliminary Infrastructure Report)

No significant changes were noted until around 1980 when development of commercial buildings began, and a small dam was constructed on one of the contributing overland flow paths which leads to the north-eastern ephemeral stream (Figure 6).

Figure 6: Historical aerial image of the site (1980) – Maven Associates (Preliminary Infrastructure Report)

Further commercial development occurred within 174 Brookvale Road over the 1980's and much of the pastural land, predominantly 176 Brookvale Road, was converted to horticultural use.

A review of more recent aerial imagery (post 2009) via Google Earth Pro has identified the following features which are indicated in Figure 7 and in further detail in Figures 8 & 9.

- North-eastern elevated platform - There has been some cut and fill earthworks in this area to form the current platform.
- Central Commercial Area – Infilling of the old stream channel (as indicated in Figure 25).
- Central North – Potential for shallow fill in this area from stockpiles laid out over the area.
- Central North / Historical Stormwater Pond Fill – Up to ~2.3m deep of uncertified fill placed.
- North-eastern Fill – Infilling of the old ephemeral eastern stream channel where and oxbow had formed (refer to Figure 26).
- Some ponding of water (in image post Cyclone Gabrielle) in the south-west of the site where an old channel is located.

Figure 7: Recent aerial imagery with the locations of historical filling or potential filling, and ponding.

Figure 8: Recent aerial imagery indicating historical infilling of the channel in the centre of the site.

Figure 9: Recent aerial imagery indicating historical infilling of an old oxbow in the eastern ephemeral stream.

4 Site Investigations

4.1 Available Well Drilling Information

There are a significant number of Wells across, and close to, the site which have been logged during drilling. The logs are typically suitable to identify fine-grained soils, sand and gravels at approximate depths. The well logs have been reviewed and interpreted in order to gain an understanding of the deeper soil profile and to supplement the two 10m deep boreholes, CPT tests, and the 6m deep test pit which have been undertaken on the site.

The well log locations are indicated in Figure 10 and include a brief summary of the soils logged. The complete Well Logs are included in Appendix A along with all other site investigation data.

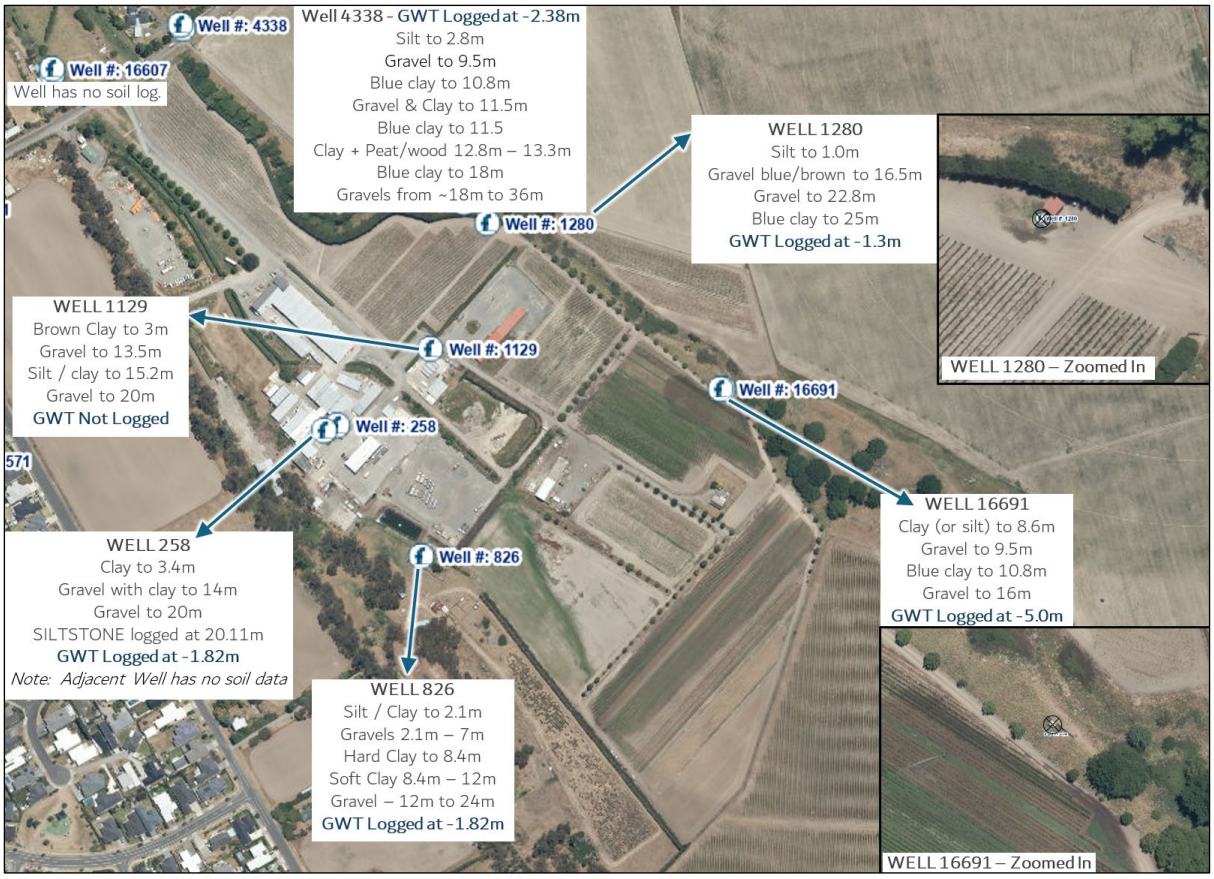

Figure 10: Recent Well Log Locations and Log Summaries.

4.2 Previous Site Investigations

Previous site investigations have been undertaken by T&T and are indicated alongside our testing in the Test Location Plan (Figure 11). T&T Site investigations were undertaken in June 2013 & July 2020, and included:

- 2 Machine Boreholes (BH) undertaken to depths of ~9.2m with SPT tests at 1.5m intervals.
- 4 Cone Penetration Tests (CPT) undertaken to depths of between 2.4m to 4.6m due to refusal in dense gravel units.
- 8 Test Pits (TP) to between 3.8 to 4.0 m below ground level.
- 6 Scala Penetrometer Test (S), undertaken to depths of between 1.7m to 4.4m below the current ground level, typically refusing in very dense soils.

In addition to the above, nearby test information for the Arataki Residential Project (86, 108 & 122 Arataki Road, Havelock North) was reviewed. The test logs are included in the CMW Geosciences Geotechnical Investigation Report (Job No. NAP2024-0007AC | Version 0, dated 30 June 2025). The investigation data in this report was used to assist in the slope stability analyses of this site, with respect to the proposed Western Slope & Retaining Wall configurations. Investigations included:

- 2 Machine Boreholes (BH) undertaken to depths of ~8m with SPT tests at 1.5m intervals.
- 4 Test Pits (TP) to between 2.5m to 4.0 m below ground level.

The site investigation logs for the T&T investigations are included alongside the HB Geotech Investigation Logs in Appendix A.

4.3 Recent Site Investigations

Recent site investigations were undertaken by HB Geotech in 2025 & 2026.

2025 investigations were undertaken between the 21st to the 27th of May 2025 in typically overcast conditions following ~42mm of rain in the weeks prior. (based on the Awanui Stream Rainfall Monitoring Station).

2026 investigations were undertaken between:

- March 2nd & 3rd in typically overcast / wet conditions with ~9.5mm of rain falling on the 2nd. The previous month saw ~59mm of rainfall (based on the Awanui Stream Rainfall Monitoring Station)
- April 1st – One Hand Auger Borehole (HA16) and installation of a standpipe piezometer.
- April 10th – Test Pit 31 (to collect samples for laboratory analysis).
- April 17th – Test Pits 16 & 30.
- April 23rd – Hand Augers 10-18. Undertaken following significant rainfall in the previous 3 days (~90mm) based on the Awanui Stream Rainfall Monitoring Station).
- June 3rd - Hand Auger & Face Logs 19 & 20.

Field investigations included:

- A site walkover assessment of the immediate surrounding area and setting out of the test locations using approximately georeferenced plans and a hand-held GPS.
- 14 Cone Penetration Tests (CPT) were undertaken to a maximum depth of 13.1m or refusal. A Dynamic Super Heavy Penetrometer (DPSH) tests was undertaken in CPTs 9, 10 & 11 which refused at shallow depths (i.e. < 5.5m). The DPSH test typically refused within 1.0m of the depth at which the CPTs refused.
- 20 Hand Augered boreholes (HA), undertaken using a 50mm hand auger. HA08 comprises of a combination of face logs and sampling with the hand auger. HA02 - HA06 also had Scala Penetrometers tests undertaken either adjacent to, or in the base, of the hand augers.
- 22 Test pits were undertaken typically to depths of between 3.2 to 5.0m, however at TP12 a deep pit was attempted which achieved a depth of 6.0m.
- Laboratory testing of samples collected from TP31 for particle size distribution and Atterberg limits. Results of the lab testing are included in Appendix A following the TP31 soil log.

The test locations are indicated in Figure 11 along with the locations of our cross-sections. The site investigation & CPT logs are included in Appendix A along with other relevant nearby investigation data.

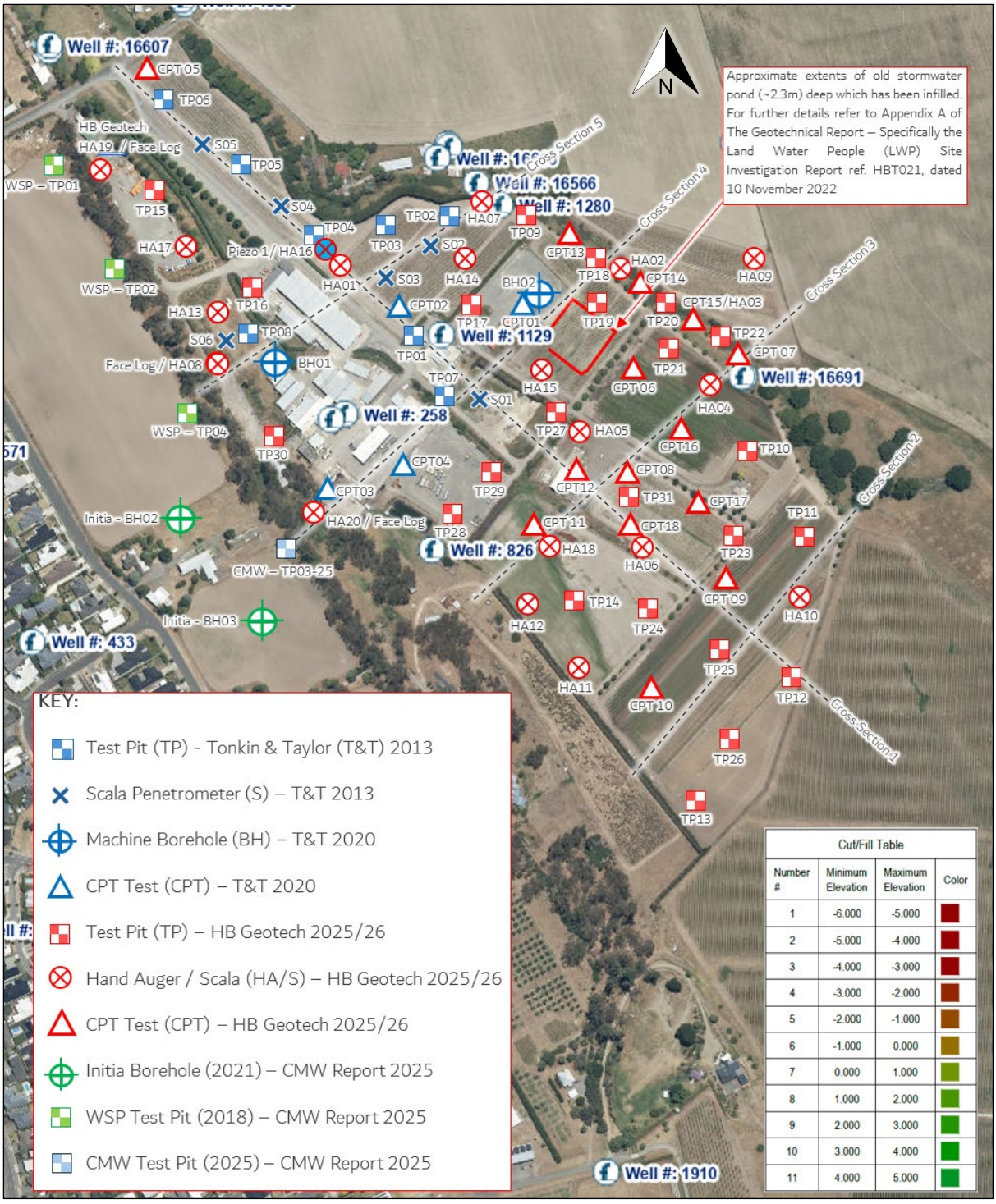

Figure 11: Site Test Location Plan

5 Ground Conditions

Our interpretation of the ground conditions beneath the site are summarised in this section. The ground model has been based on available information and subsurface data obtained at discrete locations at a particular time. It should be noted that due to the often complex and variable nature of the ground and groundwater, conditions between the investigation points may vary from those inferred in this report. All depths are below the current site level at the time of investigations unless otherwise stated.

5.1 GROUNDWATER

Groundwater levels varied across the site and over time. Slightly higher levels were encountered during the most recent investigations undertaken in March & April 2026 in typically overcast / wet conditions, typically following significant rainfall events in the weeks prior. The highest levels recorded for the areas have generally been adopted.

Based on test pit observations and the soils encountered, we anticipate that many of the groundwater levels recorded may be from perched or transient groundwater levels, where water is becoming trapped near the boundary of less permeable soils below. This was particularly noted in shallow gravel deposits which were underlain by much less permeable silts. In general, groundwater, or seepage within units, was encountered at the following depths:

- Entrance / north-west of the site to the centre (just past the existing buildings): Groundwater is typically between ~3.5-4.0m below ground near the entrance from Brookvale Road (Land RL ~9.75-10.5).
- Centre of the site to the south-east (Land RL typically between ~11.25-13.5): Groundwater seepage into test pits varied significantly and ranges from ~2.0m to ~4.0m. Groundwater seepage was typically higher in the lower lying areas, particularly those close to the current overland drains.
- South-west portion of the site (Land RL typically between ~13.5-15): Groundwater seepage into test pits varied significantly and ranges from ~2.0m to ~4.0m.
- Existing Eastern Ephemeral Stream: Groundwater was typically encountered between 1.0m to 2.0m below the base of the channel however, in localised areas was up to ~3.0m deep.
- Investigations undertaken within the proposed stormwater detention basin (northwest of the site encountered groundwater at depths between 3.8m (TP04 - 29th April 2013) and 3.7m (HA01 - 26th May 2025). A second Hand Auger HA16 was drilled in the area on the 1st of April 2026 (between TP04 & HA01) to investigate the water level and install a standpipe piezometer to allow ongoing recordings. The groundwater level was recorded at ~3.55m below ground level after drilling and a water level logger was installed at 3.6m below ground level. The highest recorded level was 3.15m on the 22nd of April following 3 days of significant rainfall.

Based on the investigations undertaken, the proposed earthworks are unlikely to encounter groundwater under typical conditions with the exception of:

- The proposed channel realignment which may encounter some groundwater in wet conditions.
- The clearing out of organic soils in and around over land drain areas and historical channels.

The base of the proposed stormwater detention basin is expected to be above the prevailing groundwater level and is likely also above typical winter levels however, to confirm this we have installed a standpipe piezometer and groundwater level logger to measure levels over the winter period. The Logger was set 3.6m below ground level, ~50mm below the groundwater level encountered, as gravels below 3.7m made it too difficult to auger deeper. Recording intervals were set to 12-hour intervals. The logger was able to capture data during the recent ex-tropical Cyclone Vaianu as well as during a much more significant, long duration rain-fall event which occurred over the 20th to 22nd of April. A graph of recorded levels is included below, and the data has been passed on to the client to provide to the stormwater design engineers.

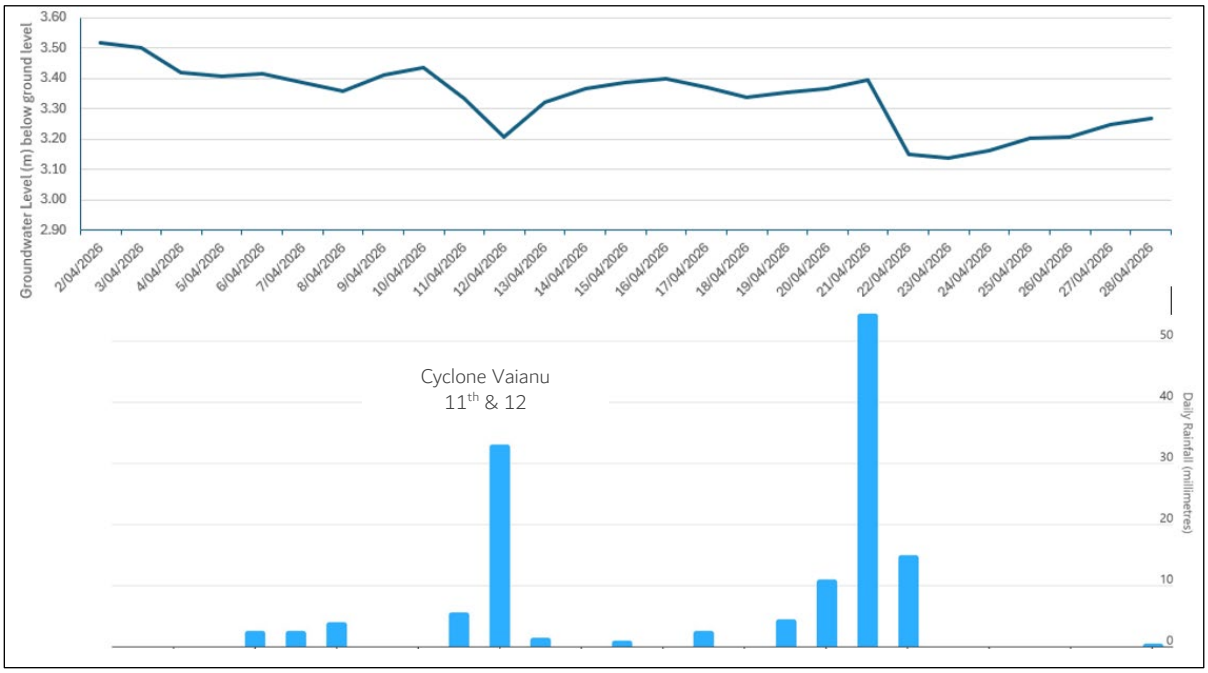

Figure 12: Piezometer 1 (HA16) groundwater levels compared with rainfall records from the Awanui Stream Station.

5.2 Site Stratigraphy

Ground models have been developed for the site based on the available information and are included in Appendix B of this report. The soils encountered across the site are discussed in detail below. We recommend the reader refer to the ground models and site investigation logs to get an understanding of the depth and distribution of the units. For areas of known uncertified fill, we recommend the reader refer to Section 3.4, particularly Figures 7-9 as well as Section 7.2

Topsoil, Fill & Shallow Organic Soils:

Topsoil

Topsoil was encountered across the majority of the undeveloped portion of the site and is typically 0.2m to 0.3m thick. In the more developed areas, topsoil has typically been replaced with gravel fills and hardstand areas.

Uncertified Fill

Uncertified fills, including organic fill, was encountered in several areas across the site and are discussed briefly below.

- North-eastern elevated platform – Cut and fill earthworks have been undertaken within the eastern portion of the platform. TP15 (Appendix A) was undertaken in this location and encountered poorly compacted fill and organics to ~3.0m depth. The fill depth is likely to vary in depth and composition across the area. Fill image included in Figure 13.
- Central Commercial Area – Infilling of the old stream channel (as indicated in Figure 8 – Section 3.4).
- Central North – Potential for shallow fill in this area from stockpiles laid out over the area based on historical imagery (refer to Section 3.4 for indicative locations).

- Central North / Historical Stormwater Pond Fill – Up to ~2.3m deep of uncertified fill placed.
- North-eastern Fill – Infilling of the old Ephemeral eastern stream channel where an oxbow had formed (refer to Figure 9 – Section 3.4). HA07 (Appendix A) was undertaken in this location and encountered very weak organic fill to around 2.4m which was underlain by firm organic silty soils to ~3.0m where gravels caused refusal of the test. Fill image included in Figure 14.

Figure 13: Site photo of uncertified fill – TP15 - North-eastern elevated platform.

Figure 14: Site photo of uncertified fill – HA07 – In-filled Old Eastern Stream Channel.

Natural Soils:

The natural soils covering the site comprise of alluvial deposits which tend to vary in thickness across the site. The units appear to generally be continuous although some fine-grained units were encountered in the south-central portion of the site (CPTs 07, 08 & 09) and these deposits appear to be more localized. The Alluvial soils encountered typically comprise of the following:

Shallow Organic Soils

Natural organic soils were typically only encountered in the base of the ephemeral stream but may still be present elsewhere on site, particularly where old channels were present or have been infilled.

The organic soils are typically blackish brown to dark grey and generally comprise of silts which have an organic odour (but little observable plant matter). The organic soils were present to depths of between 0.6m to 1.3m in the base of the ephemeral stream but there were also some shallow weak gravel layers with trace organic silts present.

Very Stiff to Hard Fine-grained Units – Typically Sandy SILT to Clayey SILT.

This unit is generally encountered across the site beneath any topsoil, fill or shallow organics. The unit is typically thickest in the centre of the site (up to 4.0m) and is thinner towards the north (near Brookvale Road) where it was around 1.5m-2.0m. This unit becomes very thin in the southern third of the site (Test Pits 11-14) where it was typically less than 1.0m thick. The thickness of the unit is more consistent across the site (west to east). This unit is typically yellowish brown to light greyish brown and often has minor to slight orangish brown mottling. Undrained shear strengths in this unit were consistently in excess of 100kPa, generally 150kPa or more, and often greater than 200kPa.

GRAVEL Units

This unit is generally encountered below the fine-grained units discussed above at depths ranging from ~0.5m to just over 4.0m. The upper 1-2 meters of the gravels tend to comprise of a Sandy GRAVEL with minor silt and trace clay. With depth the gravels typically become coarser and have minor sand, silt and sometimes trace clay.

The logs indicate that the GRAVELs extend for a significant depth below the site and typically make up the majority of the soil profile. At depth they are typically interrupted by 1-2 relatively thin, finer-grained units (silt and/or clay), however in the south-centre of the site (Cross Section 03) finer-grained units such as Sandy SILT or Silty SAND are much more prevalent (making up the majority of the upper 10m of the soil profile). The gravel units in this location are thinner and more interbedded with the finer units. We recommend that the reader refer to the ground models included in Appendix C for further detail.

Saturated, Finer-Grained Soils

As discussed briefly above, several significantly thick layers of finer-grained soils were encountered in CPTs 07, 08, 09, 16, 17 & 18 and have been interpreted by engineering correlations to be predominantly Silty SAND and Sandy SILT. We note that these soils may also be present below the base of CPTs 11, 13, 14, 15, 16 & 19 as these CPTs generally refused at shallow depths within overlying gravel units. In general, we consider that these soils are typically present across the site below the overlying gravel units.

Test pits (TP) were undertaken close to CPTs 07, 08, 09, 17 & 18 (TP22, 23 & 31) to investigate these soils given the effect they have on the liquefaction potential of the site. The results of the test pitting and cross-checks with nearby CPT testing indicates that the CPT interpretations may underestimate the plasticity / fines content of the soils. A more detailed list is provided for the comparison of CPT interpretations and Test Pit investigations below:

- CPT07 interprets the soils from 2.0m to beyond 4.0m to comprise predominantly of silty sand & sandy silt. The nearby Test Pit identified these soils as very stiff to hard, low plasticity silts with some sand and clay. In our opinion, these soils can be considered 'moderately plastic' soils but are not high plasticity. From 3.5m to 4.0m the interpreted sandy silt soils match with observations in the nearby test pit.
- CPT09 & 17 interpret the soils from ~2.4m to ~3.2m as silty sand and sandy silts, whereas nearby test pit TP23 encountered a very stiff to hard Clayey SILT with high plasticity between these depths. Below 3.2m the CPT interpretation better matched the soils observed.
- CPT08 indicates the presence of silty sand to sands (with some sandy silt lenses) at between 2.2m to 5.0m, however the nearby test pit (TP31) indicates that these units comprise of very stiff to hard units which exhibit engineering properties of silts.
- Of the silts encountered, those in TP31 were considered the most marginal and therefore samples were collected at depths of 2.5m, 3.6m & 4.5m, then Particle Size Distribution (PSD)

and Atterberg limits testing were undertaken. The results are included in Appendix A (alongside the Test Pit Log) and indicate the following:

- The soils between 2.2m to 3.5m have a Plasticity Index (PI) of 13 and are expected to behave as silts. The fines content was 80%.
- The soils between 3.5m to 4.2m have a Plasticity Index (PI) of 11 and are expected to behave as silts (based on the higher PI value recorded and site observations). The fines content was 30% making it marginal as to whether it is a Sandy SILT or Silty SAND. The high undrained shear strengths measured in this unit may be due to cementation (given the age of the soils).
- The soils between 4.2m to 5.0m have a fines content of 43% and are expected to behave as silts. From site observations, this unit is expected to have a plasticity index above 12.

Comparing our field observations and laboratory analyses with the CPT soil interpretations, we consider that the CPT correlations may be over predicting the sand-like behavior of the fine-grained soils. We anticipate that the over interpretation is likely due to the age of the deposits (mid-late Pleistocene) which fall outside of the calibration dataset. Pleistocene silts often exhibit higher cone resistance than Holocene aged silts, and therefore lower friction ratios. This can create bias towards 'sand-like' behaviour using standard CPT interpretations.

Deep Fine-grained Soils

The deep fine-grained soils, typically present below 10m, are expected to comprise of clay and/or silt deposits which may be interbedded with deeper gravel units. The soils types are based primarily on the Well Logs and a small number of CPT tests that extended to depths of up to 15m. Due to this caution is advised with respect to interpretation of the soil type, but we consider it safe to assume that these soils are fine grained and have good strengths (based on CPT data).

5.3 Site Soil Class

Based on available information and the geological setting of the site, we consider the site is most appropriately designated a Class D "Deep Soil" site as defined by NZS 1170.5 (2004) "Structural Design Actions: Part 5: Earthquake actions – New Zealand".

5.4 Geotechnical Ground Model

An interpreted geotechnical ground model is included in Table 2 and is based on available investigation data and engineering correlations.

The indicative minimum and maximum depths provided are intended to be used as a rough guide, for better detail we recommend the reader refer to the geological cross sections which are included in Appendix B along with the site investigation logs & test location plan included in Appendix A.

Table 1: Interpreted Geotechnical Ground Model

Soil Unit(s)	General Location	Indicative Depth to Top of Unit (m) min – max	Indicative Depth to Base of Unit (m) min – max	Typical CPT Cone Resistance (q_c) MPa	Undrained Shear Strength (S_u) kPa	Strength / Density
Gravel Fill (to be removed)	Industrial areas, roads and carparks	surface	0.3 – 0.5m	-	N/A	Medium dense to dense
Weak & Organic Fill (to be removed)	Old channel infills and some fill earthworks in the north-west of the site. Potential for other localised areas on site (refer to Sections 3.4 & 7.3)	Below topsoil	1.0 – 3.0m	-	-	Weak / compressible
Natural Organic & Weak Soils (to be removed)	Primarily within the base of the Eastern Ephemeral Stream Channel. Likely within other stream channels.	Below topsoil	0.6 – 1.2m (potentially deeper in localised areas)	<0.5	-	Weak / compressible
Sandy SILT to Clayey SILT	Site Wide (main unit encountered below topsoil or existing fill)	0.3 – 3.0m	0.8 - 4.0m	2 - 4	100 - 150	Very Stiff to hard Low-Moderate Plasticity
Sandy GRAVELs	Site Wide (main unit encountered below the above Sandy to Clayey SILTs)	0.8m – 4.0m	2.5m – >10m	20 - 50	-	Very dense
Deeper Fine-Grained Units / SILTs (clayey – sandy)	Site Wide (main deeper unit along with sandy gravels – Sometimes interbedded).	2.5 – >10m	9.0 – >10m	3 - 5	100 - 150	Very Stiff to hard Low-Moderate Plasticity
Deeper Gravel Units	Site Wide (main deeper unit along with very stiff fine-grained units. Sometimes interbedded)	10m - >15m	Unknown – CPT testing typically refused in this unit.	40 - 50	-	Very dense

6 Hazard Assessment

The following section summarises our assessment of the geotechnical hazards considered to be affecting the subject site and the potential risk that these present to the proposed development with respect to ground deformation and land stability.

6.1 Seismicity

The Ministry of Business Innovation & Environment (MBIE) Guidelines for Earthquake Geotechnical Engineering Practice in New Zealand Module 1, November 2021, provides guidance on estimating magnitudes and peak ground acceleration (PGA) in accordance with the Building Act.

For seismic analysis in this report, we have adopted Method 1 from the MBIE Module 1, which recommends the use of estimated parameters from the National Seismic Hazard Model (NZHM). The ground motion values adopted are provided in Table 2 and are based on the return periods provided in Table 3.3 of 1170.0:2002 (Structural Design Actions) assuming an Importance Level 2 (IL2) structure with a 50-year design life. An Intermediate Limit State (ILS) corresponding to a return period of 1/100-years has also been included to assist in understanding the potential effects of liquefaction for lower magnitude but higher probability events.

Table 2: Adopted Ground Motion Parameters for Liquefaction Analysis

Limit State	Return Period	Annual Exceedance Probability	Peak Ground Acceleration (PGA)	Magnitude
Serviceability Limit State 1 (SLS1)	1/25 year	4%	0.12g	6.4
Intermediate Limit State (ILS)	1/100 year	1%	0.26g	6.7
Ultimate Limit State (ULS)	1/500 year	0.2%	0.58g	7.1

6.2 Liquefaction

6.2.1 General

The assessment of the sites' expected performance under seismic conditions has been undertaken based on analyses of the CPT data collected by HB Geotech, review of the CPT data recorded as part of previous Tonkin & Taylor (T&T) investigations (CPT logs included in Appendix A), and test pit observations along with laboratory testing of soils identified as being susceptible to liquefaction based on CPT Testing.

Comparing our field observations and laboratory analyses with the CPT soil interpretations, we consider that the CPT correlations may be over predicting the sand-like behavior of the fine-grained soils. We anticipate that the over interpretation is likely due to the age of the deposits (mid-late Pleistocene) which fall outside of the calibration dataset for CPT tests (Holocene). Pleistocene silts often exhibit higher cone resistance than Holocene aged silts, and therefore lower friction ratios than Holocene aged silt deposits. This can create bias towards 'sand-like' behaviour using standard CPT interpretations.

It is generally accepted that ageing improves liquefaction resistance of soils. To account for this, the analyses have applied a conservative aging factor of 1.2 to the Pleistocene aged soils.

Current MBIE Guidance notes that "Liquefaction has been reported in late Pleistocene sediments (Youd et al., 2003), though such episodes are rare and comprise a small part in the total body of liquefaction case histories". The guidance suggests that liquefaction in Pleistocene sediments should generally be checked including potential consequences of liquefaction.

6.2.2 Adjustment for Soil Behaviour Type

An initial assessment was undertaken based on the CPT data, in accordance with the recommendations set out in the MBIE Earthquake Geotechnical Engineering Practice – Module 3, November 2021. No aging effects or corrects to the Ic cut-off were applied.

The initial assessment indicated significant liquefaction within the silt units encountered during site investigations. However, we note that many of these units (based on nearby test pits) comprise of very stiff to hard silt units which would typically not be expected to liquefy.

Of the silts encountered, those in TP31 were considered the most marginal (with respect to being potentially liquefiable) and therefore samples were collected at depths of 2.5m, 3.6m & 4.5m. Particle Size Distribution (PSD) and Atterberg limits testing were undertaken, and the results are included in Appendix A (alongside the Test Pit Log). Results indicated the following:

- The soils between 2.2m to 3.5m have a Plasticity Index (PI) of 13 and are expected to behave as silts. The fines content was 80%. Based on the age and PI index of the soil, this unit is not considered at significant risk of liquefaction. Undrained shear strengths were in excess of 200kPa and therefore significant softening is unlikely.
- The soils between 3.5m to 4.2m have a Plasticity Index (PI) of 11 and therefore are considered marginally susceptible to liquefaction and the fines content was 30% making it marginal as to whether it is a Sandy SILT or Silty SAND. Despite this the peak undrained shear strengths were greater than 200kPa, although the high shear strengths could be attributed in part to some cementation. The sand content of the unit also varied slightly. This unit should be considered potentially susceptible.
- The soils between 4.2m to 5.0m have a fines content of 43% and are expected to behave as silts. From site observations, this unit is expected to have a plasticity index above 12. The unit was very stiff to hard and over consolidated. This unit is not considered at significant risk of liquefaction.

Based on the above, we adjusted the analyses by applying an aging factor of 1.2 and varying the fines correction factor (CFC) by 0.2. The adjustments made little changes to the analyses' results, which still indicated significant liquefaction in units where it would not be expected (as well as total free-field settlements far exceeding the values expected of the soils). Based on the review it was considered that the overestimation of liquefaction was primarily due to the dense / consolidated, high strength nature of the soils resulting in high cone tip resistance values / lower friction ratios that were creating a 'bias' towards sand-like behaviour (i.e. indicating a moderate strength sand-like deposit rather than a high-strength silt deposit).

To get the potentially liquefiable layers to match better with the nearby test pit observations and assessment / testing of soil types and plasticity, the Soil Behavior Type (I_c) cut-off needed to be adjusted. Several CPTs and nearby Test Pit Logs were reviewed to identify the I_c value at which units with tested (or estimated) plasticity above the typical liquefaction cut-off value (12) began to show as non-liquefiable. After several analyses a value of 2.3 was adopted as suitable for the I_c cut-off. Figure 15

shows the comparison between CPT08 (including liquefaction estimates) and TP31 which was undertaken adjacent to CPT08 for the purpose of collecting samples for the laboratory analyses discussed above. We note that even when adopting an I_c cut-off of 2.3 we still consider the result to be conservative.

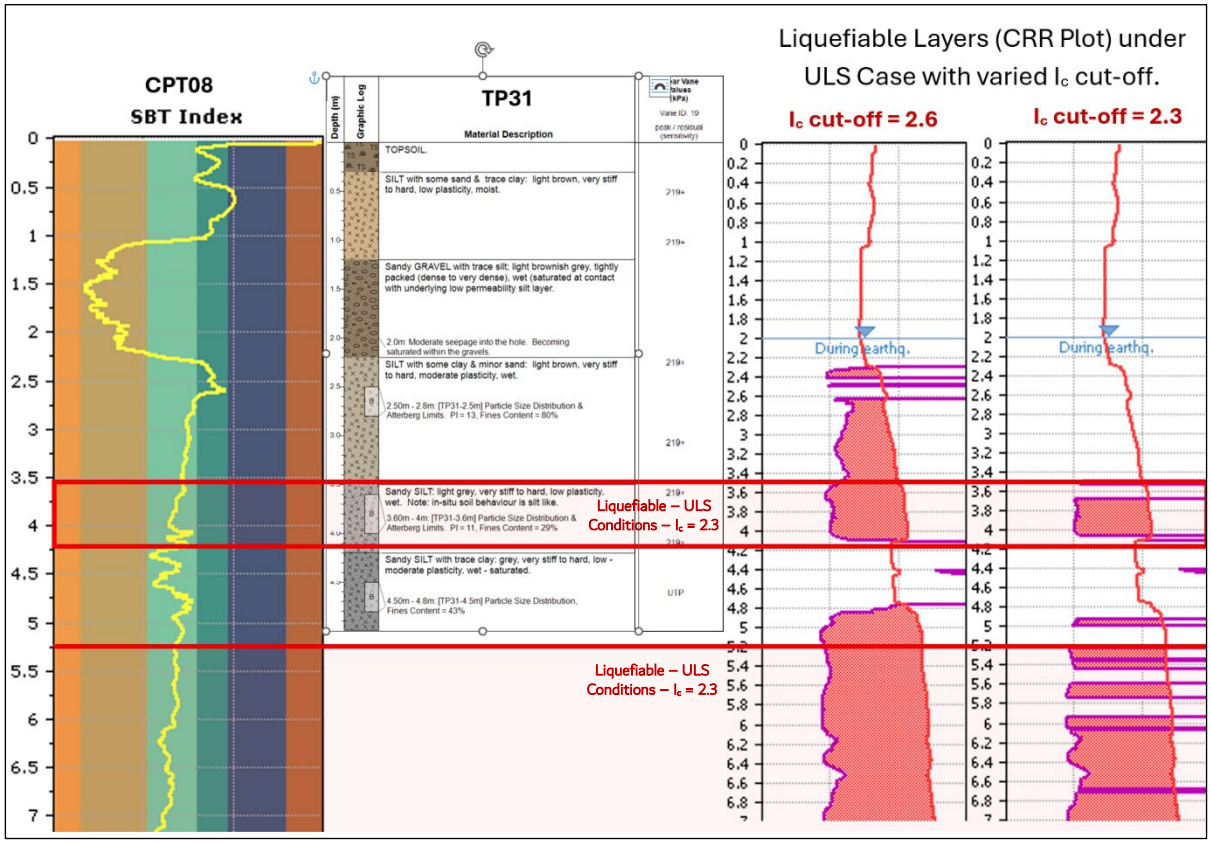

Figure 15: Comparison between CPT08 and TP31, including comparison of estimated liquefiable layers based on varying the I_c cut off.

6.2.3 Adopted Methodology

Based on our assessment of the site soils and review of the assessment parameters, the following methodology was adopted for the liquefaction assessment.

Proprietary geotechnical software (CLiq) was used for the calculations and the peak ground accelerations and magnitudes provided in Section 6.1 were adopted. The default soil behavior type index (Ic) cut-off of 2.3 was adopted and soil unit weights were automatically calculated based on SBT values. Liquefaction-induced free-field vertical volumetric strains were estimated based on Zhang et al. (2002). A lateral spreading assessment was not considered necessary given the no free faces are exposed below the groundwater table.

Limited site-specific fines testing was undertaken but in general shows good correlation with a fines fitting parameter C(FC) of 0.2 adopted. No corrections were made to the input data with respect to transition effects as only minor transition zones were noted.

The highest groundwater levels encountered on site were adopted as the prevailing levels. Given that much of the sitework was undertaken in, or following, wet conditions, the levels adopted are considered

conservative for long-term prevailing levels and potentially more indicative of prevailing or slightly elevated winter levels. It should be noted that investigations indicate some potential for perched or 'transient' water tables at the site. This generally occurs where gravels are present above the finer-grained, less permeable, soils causing infiltrating water to develop saturated zones above the boundary of the units. For the liquefaction analysis in this report, the groundwater table has generally been taken from the level at which seepage into the test pits was noted. This is considered conservative, given the potential for some units to not be fully saturated.

We appreciate that at times groundwater may rise above the levels recorded, however we consider that this would only result from storm events with their own annual exceedance probability, which should not be considered in conjunction with another exceedance probability (i.e. seismic events) as the probability of such events occurring simultaneously is considered highly unlikely.

6.2.4 Liquefaction Results & Discussion

The results of the preliminary liquefaction analysis are included in Appendix C and discussed below. The SLS detailed analysis outputs are not included as there was negligible to no liquefaction under this case.

It should be noted that where significant gravel deposits were present at surface, some CPTs were unable to penetrate significant depths and hence some liquefaction estimates may be underestimated. Whilst the liquefaction risk may be underestimated, these areas typically had a significant high strength, non-liquefiable raft present for ≥4m. The raft would be expected to mitigate liquefaction effects to the point that TC1 foundations are suitable.

Under SLS conditions negligible to no liquefaction is expected.

Under the ILS & ULS cases, the level of liquefaction estimated varies across the site but in general it is as follows:

- The north, western and central portions of the site are typically at low risk due to significantly greater gravel deposits being present and extending to greater depths. In addition, the groundwater table is typically lower in this area.
- The south-central portion of the site (refer to Figure 16) had more mixed results. In this area the gravel deposits were much thinner and there were significant fine-grained to sand-like soils present. The results in this area were typically within a TC2 category.
- The south-eastern quarter of the site is typically underlain by thick, dense gravel deposits extending to significant depths >4m and up to depths exceeding 6m (based on the deepest test pit undertaken TP12). The liquefaction risk in this area is considered low (TC1).

Taking into consideration the proposed earthworks, results of our investigations / analyses, the age of the deposits, and the presence of a high strength non-liquefiable raft across the majority of the site, we have developed a site plan (Figure 16) to assist in defining the areas / Lots which will require TC1 and TC2 Foundations.

Figure 16: Site Plan indicating the TC2 Class Zone (yellow) and lots requiring TC2 Foundations (Red). All other Lots can adopt TC1 Foundations.

6.3 Cyclic Failure

Based on our assessment and available data, the risk from cyclic failure is considered to be low. The saturated fine-grained soils encountered typically had high shear strengths and appear to be over consolidated. Analysis using the B&I2008 method indicates that cyclic softening has little to no contribution to the potential site response during cyclic loading. Based on this, the risk is considered adequately low and no further assessment is required.

6.4 Compressible Soils & Static Settlements

Compressible soils are those that will undergo a reduction in volume under an imposed load, such as the weight of fill or a structure. This generally occurs as a result of the expulsion of air and water from the soil void spaces, which causes restructure of the soil particles.

As part of any earthworks, we would anticipate that any shallow organic soils and uncertified fill would be removed prior to placing any fill, therefore we have excluded any assessment of static settlements in these soils. For the locations of expected uncertified fill and organic soils, please refer to Section 3.4 & 7.3.

The underlying soils typically have good strengths but under significant loading will undergo some consolidation. In addition, some deeper units with lower strengths may also undergo consolidation should the load be large enough and span a significant area.

The proposed development plans referenced in Section 2 of this report indicates that the proposed fill depths may range from the following:

- Fill of between ~0m to 1.0m across most of the site (CPTs 1, 2, 4, 5, 6, 10 & 11)
- Fill of ~1.0m to ~2.0m in the centre of the south-eastern third of the site (CPTs 8, 9, 12, 16, 17 & 18).
- Fill of typically around 3.0m in the eastern stream channel (CPTs 7, 13, 14 & 15).
- Fill of up to ~4.0m in central western area where Fill Slopes are indicated (Tonkin & Taylor CPT03 location).

Given the proposed development involves significant filling over a large area, we have undertaken a check for static settlements to assess the potential magnitude of settlements which may occur as a result of the proposed fill earthworks. Analyses were undertaken for each area by using the relevant CPT data for each area (predominantly relying on those which achieved the greatest depths). The analysis has assumed the following:

- 100m x 100m overall fill footprint for large fill areas, 25m x 200m area for the Eastern Channel Infill and a 25m x 50m area for the Western fill Slopes.
- An assumed FILL soil unit weight of 22kN/m^3.
- The calculated distributed loads were applied at 0.5m below ground level for most of the CPT tests but for the Eastern Channel Infill the excavation depth was increased to 1.2m (based on the indicative depth of weak and or organic soils – from Test Pitting). Where loads were embedded below ground, the excavation load was removed and an equivalent Fill load added to the calculations.

The analysis results are included in Appendix E (only the worst-case results have been reported). Results indicate the following:

- For the majority of the site (where fill does not exceed 1.0m) – Total settlements are unlikely to exceed 15mm and ~60% of the settlements are expected to occur within a short period (i.e. ~8 months). Differential settlements in the order of 10mm expected.
- Central south-eastern third of the site (where fill does not exceed 2.0m) – Total settlements are unlikely to exceed 15-20mm and ~90% of the settlements are expected to occur within a short period (i.e. ~8 months). Differential settlements in the order of 15mm expected.
- Eastern Channel Infill - Settlements are unlikely to exceed 30mm and over 90% of the settlements are expected to occur within a short period (i.e. 8 months).
- Western Fill Slope Area (CPT03) - Settlements are unlikely to exceed 25mm and most of the settlements are expected to occur within a short period (i.e. 8 months). Full settlement estimates may occur as differential settlements.

Based on the analysis, the proposed filling is unlikely to result in excessive ongoing (long duration / creep) settlements but may result in some significant settlements (in excess of 25mm) where Fill exceeding 2.0m is proposed. It is noted that in these areas, ~90% of the settlements are expected to occur over a relatively short timeframe (i.e. 8 months).

Mitigation measures will be required for areas were fill exceeds a 2.0m thickness (above the pre-existing ground level) over a significant area. This will likely require the use of settlement monitoring pins to be placed within engineered fills to allow for monitoring of settlements and comparison with estimates. It

is also advisable to place 1 or 2 pins within the area where proposed Fill is between 1.5m-2.0m above the current ground level (to confirm the estimated minor settlements). Proposed monitoring location are indicated in Section 7.4 of this report, but final locations will be determined by the Geotechnical Engineer during construction monitoring.

6.5 Slope Stability

The proposed slope configurations along the western boundary of the site have been assessed for slope stability. The proposed slope configurations have been based on the following drawings (included in Appendix F along with the stability analysis assumed parameters, analysis methodology and results):

- Maven Associates Project No. 135041 - Drawing No. C240, Sheets 0,1 & 2, Rev. A, dated June 2026 (with respect to proposed retaining wall heights and locations), and
- Maven Associates Project No. 135041 - Drawing No. C380, Sheets 1 & 6, Rev. A, June 2026 (with respect to proposed cut and fill slopes along the western boundary).

The analysis have also considered the proposed Stormwater Detention Pond (proposed as part of the subdivision of 86, 108 & 122 Arataki Road, Havelock North) and the potential influence of failures on the stability of the proposed western slope configurations.

It should be noted that due to design changes Retaining Wall 2 was not required and hence is not discussed in this report.

Based on the analyses & results (Appendix F), the proposed slope configurations have been assessed as having a suitable factor of safety against global instability provided that the recommendations included in Section 7.5 of this report are adhered to.

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6.6 Eastern Channel Bank Stability

The proposed development includes a proposal to realign the existing eastern ephemeral stream to a new alignment closer to the north-eastern site boundary.

We have undertaken a review of recent aerial imagery obtained following Cyclone Gabrielle (Figure 17) in order to identify possible levels, flows and effects on the stream banks under extreme rainfall events. The review indicates the stream levels during the event may have reached close to the top of the banks and that some small-scale instability may have occurred in areas along the bank during the event.

Figure 17: Aerial Imagery of the eastern ephemeral stream channel post Cyclone Gabrielle.

Based on the review of the performance of the stream banks during Cyclone Gabrielle, we consider the risk of significant bank instability is low provided that:

- New channels dimensions are equal to or greater than the previous channel and that bank slopes are kept to a shallow slope angle (i.e. 1V:3H). Or reinforced through specific design measures if steeper.
- Adequate mitigation measures are put in place to reduce scour and erosion. Mitigation options and design are beyond the commission of this report but may need to include similar measures to those indicate below, particularly in areas of significant scour risk:
    - Erosion protecting matting and/or grass and vegetation (in areas of low scour risk), and
    - Erosion protecting matting pinned to the soils or overlain by vegetated rip-rap in areas with high scour / erosion risk.

The most significant locations of scour are expected to be:

- Along the western bank at the beginning of the proposed realigned channel where there is a sharp bend to the north (to follow the eastern boundary),
- In the north of the proposed realigned channel, along the outside bend (northern bank) where the proposed channel diverts to the west (to rejoin the existing channel), and
- Where the proposed realigned channel rejoins with the existing channel (along the southern bank).

6.7 Expansive Soils

Site investigations did not encounter any soils across the site which exhibited properties typically associated with expansive soils. In addition, there was no obvious signs of distress to existing buildings, and the area is not known for having expansive soils. The risk is therefore considered low, and no further assessment is required.

6.8 Bearing Capacity

Site investigations indicate that the natural soils (below any topsoil, fill or organic soils) typically comprises of very stiff to hard Sandy SILT to Clayey SILT near surface and the underlying soils typically comprise of dense to very dense gravels. Both units are generally expected to have a geotechnical ultimate bearing capacity of at least 300kPa (100kPa allowable) and any unsuitable soils will be removed.

Shallow liquefaction or cyclic softening is not expected across the site and therefore significant loss of bearing capacity below shallow foundations is not expected under seismic conditions. Adequate bearing capacity of the subsoils will need to be checked during earthworks and later confirmed via further testing at the building consent stage for any proposed dwellings.

6.9 Services, Buildings & Previous Land Use

Any existing services and buildings that are no longer being used will need to be removed along with any uncertified filling associated with them to avoid risk to future developments. During earthworks, care must be undertaken to ensure that any services have been disconnected appropriately prior to removal. Any natural ground that is disturbed during the removal of services or buildings will also require remediation. The existing land has been used as a tree nursery and therefore, disturbed / weak ground and topsoil may be present to greater depths (due to the removal of the young trees).

6.10 Groundwater & Subsoil Drainage

Where existing overland or groundwater seepage paths are being removed or diverted, subsoil drainage should be installed to reduce the risk of significantly altering the groundwater table in the area (i.e. cutting of natural drainage paths by replacing free-draining soils with poorer draining fill).

Our review of piezometer data collected within the area of the proposed stormwater detention basin (over a period of significant rainfall) noted that the groundwater level within the area rose by ~0.5m as a result of significant rainfall events, reaching a maximum level of 3.1m. This level is likely to be ~1.0m below the base of the proposed stormwater detention basin (based on the indicated ~2.0m depth).

7 RECOMMENDATIONS

7.1 GENERAL

Based on our assessment, we consider the site is geotechnically suitable for the proposed subdivision provided the recommendations included in this report and during construction monitoring are adhered to. The key geotechnical risks requiring mitigation measures are those included in Table 3 below. The proposed mitigation options for each of these risks is also included and discussed in detail in the following sections. Earthworks Recommendations are summarised in Section 7.7 and include a proposed earthworks staging plan (from a geotechnical perspective) to allow for the best mitigation of risks.

Table 3: Summary of Key Geotechnical Risks and Mitigation Measures

Geotechnical Risk	Mitigation Options	Relevant Report Section
Earthquake Site Soil Class	Assume Site Soil Class D (Deep Soil)	Section 5.3
Liquefaction	Adopt Technical Category (TC) Classes provided for lots.	Section 6.2 & Section 7.2
Historical & Recent Uncertified Fill & Organic Soils	Remove all uncertified filling and organic soils from areas supporting infrastructure or potential building areas.	Section 3.4 & Section 7.3
Static Settlements from Fill induced loads.	Undertake Settlement Monitoring of areas where fill thickness (above 2.0m is proposed). Include confirmation monitoring for fill zones between 1.5m-2.0m thick.	Section 6.4 & Section 7.4
Slope Stability	Ensure that the recommendations included in this report are adhered to with respect to the proposed slope configurations and design requirements. Ensure that all fill slopes do not exceed 1V:3H / ~18-19° (unless slopes are specifically designed to be steeper)	Section 6.5 & Section 7.5
Groundwater post site development.	Ensure that where existing overland drains are being infilled that subsoil drains are installed to manage groundwater and direct it to the nearest natural path.	Sections 6.10 & 7.7 - Earthworks Section (Subsoil Drains)
Existing Services & Buildings	Ensure that existing services are disconnected / isolated before removal. Building foundations should be removed unless deemed suitable to remain by the geotechnical engineer. Any uncertified fill and disturbed ground associated with services or buildings should be removed / remediated.	Section 7.7 Earthworks Section (Existing Services)
Bank & Channel Stability	Adequate mitigation measures are put in place to reduce scour and erosion of stream banks.	Sections 6.6 & 7.7 - Earthworks Section (Bank & Channel Stability)
Proposed Retaining Walls	Retaining Wall to be specifically designed based on soil parameters for the proposed fill and final layout. Due to fill being placed behind the wall, an MSE type Wall is considered more suitable & cost effective.	Section 7.6

7.2 LIQUEFACTION

Taking into consideration the proposed earthworks, results of our investigations & analyses, the age of the deposits, and the presence of a high strength non-liquefiable raft across the majority of the site, we have developed a site plan (Figure 18) to assist in defining the areas / Lots which are suitable for TC1 Foundations and those requiring TC2 Foundations.

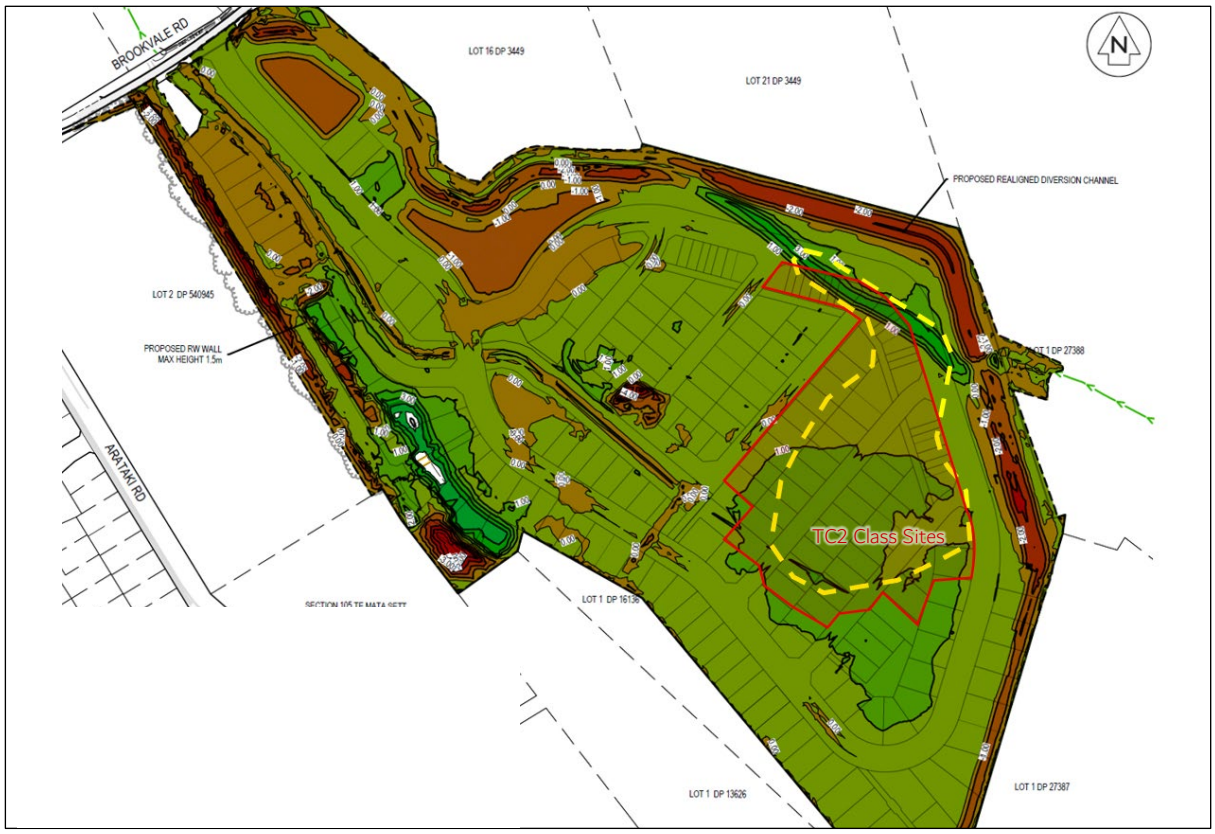


Figure 18: Site Plan indicating the TC2 Class Zone (yellow) and lots requiring TC2 Foundations (Red). All other Lots can adopt TC1 Foundations.

The final extents of lots requiring TC2 Foundations shall be confirmed at the completion of the earthworks works, once the final plans are known.

7.3 UNCERTIFIED FILL & ORGANIC SOILS

Based on our review of historical imagery, available property files and the investigations undertaken, we have identified several areas where uncertified fills and weak or organic soils have been encountered or are expected. The key areas are detailed below and provided in Figure 19.

- North-eastern elevated platform - There has been some cut and fill earthworks in this area to form the current platform. Fill was poor quality with organics and up to 3.4m deep.
- Central Commercial Area – Infilling of the old stream channel, potentially up to 2m thick (refer to Section 3.4).
- Central Commercial Area – Shallow uncertified fill, typically gravel hard fills (potentially reusable). Potential for areas of deeper fill and disturbed ground, particularly around services.
- Central North – Potential for shallow fill in this area from stockpiles laid out over the area.

- Central North / Historical Stormwater Pond Fill – Up to ~2.3m deep of uncertified fill placed.
- North-eastern existing ephemeral channel – Up to 1.2m of weak and organic soils.
- North-eastern Oxbow Fill – Infilling of the old ephemeral eastern stream channel where and oxbow had formed (refer to Section 3.4). Up to 3.0m of poor quality, organic fill anticipated.
- South-eastern channel infill – Up to ~1m deep of uncertified fill potentially present as well as potential for minor organic soils to be present.

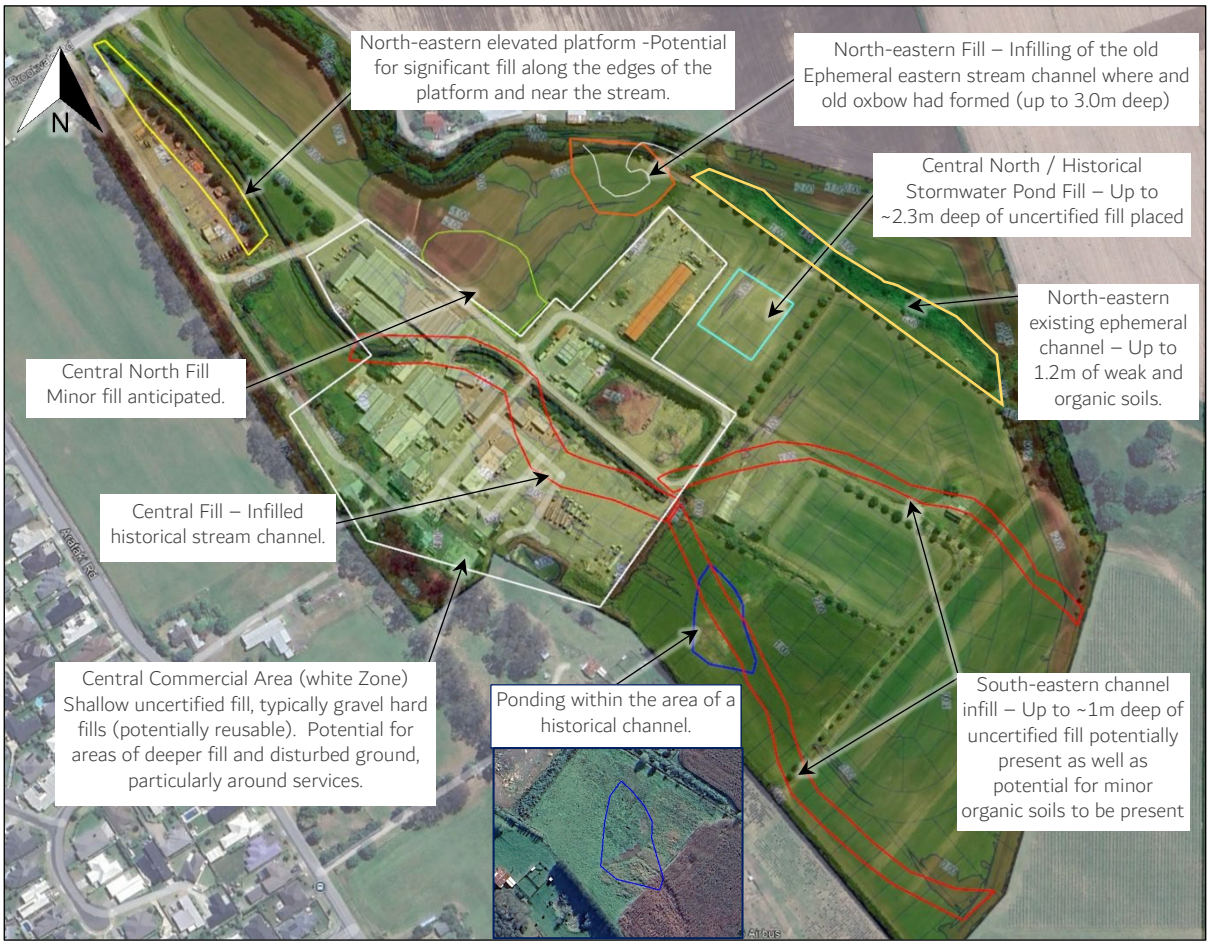


Figure 19: Site Plan indicating the areas of suspected uncertified fills and organic soils.

7.4 Compressible Soils & Static Settlements

As part of any earthworks, we would anticipate that any shallow organic soils and uncertified fill would be removed prior to placing any fill, therefore we have excluded any assessment of static settlements in these soils. For the locations of expected uncertified fill and organic soils, please refer to Section 7.3.

Based on the results of the analyses, included in Appendix E, settlements from the proposed fill are expected to result in:

- For the majority of the site (where fill does not exceed 1.0m) – Total settlements are unlikely to exceed 15mm and ~60% of the settlements are expected to occur within a short period (i.e. ~8 months). Differential settlements in the order of 10mm expected.

- Central south-eastern third of the site (where fill does not exceed 2.0m) – Total settlements are unlikely to exceed 15-20mm and ~90% of the settlements are expected to occur within a short period (i.e. ~8 months). Differential settlements in the order of 15mm expected.
- Eastern Channel Infill - Settlements are unlikely to exceed 30mm and over 90% of the settlements are expected to occur within a short period (i.e. 8 months).
- Western Fill Slope Area (CPT03) - Settlements are unlikely to exceed 25mm and most of the settlements are expected to occur within a short period (i.e. 8 months). Full settlement estimates may occur as differential settlements.

Based on the results, we consider that the proposed filling is unlikely to result in excessive ongoing (long duration / creep) settlements but may result in some significant primary settlements (in excess of 25mm) where proposed Fill thicknesses exceed 2.0m above the pre-existing ground level. The primary settlements are expected to occur over a relatively short timeframe (i.e. ~8 months) and hence most of these may occur prior to completion of the development (provided significant fills are undertaken early on in the project).

Mitigation measures (i.e. allowing time for settlements to occur and preloading where practicable) will be required for areas were fill exceeds a 2.0m thickness above the pre-existing ground level. This will require the use of settlement monitoring pins placed within engineered fills to allow for monitoring of settlements, comparison with estimates and confirmation of the time for most primary settlements to occur. It is also recommended to place 2 pins within the area where proposed Fill is between 1.5m-2.0m above the current ground level (to confirm the estimated minor settlements). Proposed monitoring locations are indicated in Figure 20 below, but final locations will be determined by the Geotechnical Engineer during construction.

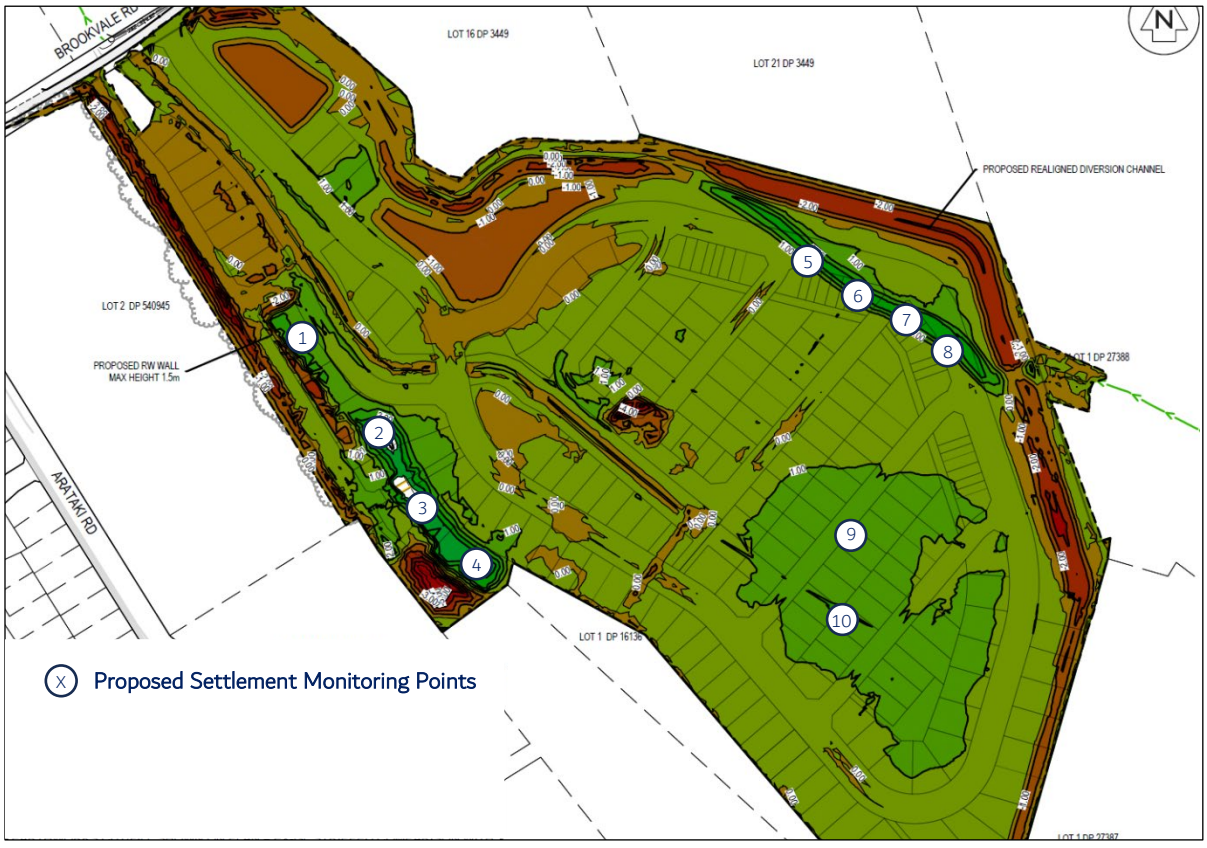


Figure 20: Marked up cut/fill earthworks plan showing proposed settlement monitoring locations.

7.5 Slope Stability

Based on the analyses & results (Appendix F), the proposed slope configurations have been assessed as having a suitable factor of safety against global instability provided that the recommendations below are adhered to:

- Where ground conditions differ from those assumed in this assessment, then we should be advised as further investigation and stability additional analyses may be required.
- Where the retaining wall varies from the proposed timber pole walls, or where slope configurations differ from those assessed, then we should be advised as further investigation and additional analyses may be required
- Retaining Walls shall be specifically designed based on the ground conditions encountered on site following any earthworks.
- Retaining Wall 1 should have pole spacings of 1.2m or less (centre to centre), be embedded a minimum of 1.5m below ground (to avoid any global instability) and have a minimum shear strength of 50kN (to prevent shear failure through the wall). Where slopes are less than 1.5m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depths and shear strength requirements may be reassessed.
- Retaining Wall 3 should have pole spacings of 1.2m or less (centre to centre), be embedded a minimum of 2.0m below ground (to avoid any global instability) and have a minimum shear strength of 90kN (to prevent shear failure through the wall). Where slopes are less than 3m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depth and shear strength requirements may be reassessed.
- Batter Slope 15 is recommended to comprise of a MSE Slope (geogrid reinforced earth slope) which will require specific design. The slope will require benching and some over excavation to accommodate the design. The design is best undertaken once the area has been cleared and ground conditions well investigated. Additional global stability checks will likely also be required at the design stage.
- For temporary cut slopes in excess of 30° (i.e. for retaining wall construction), the safe temporary excavation slope angle shall be confirmed by the geotechnical engineer based on the site conditions and work proposed.
- All slopes 20° or less will require topsoiling and hydroseeding. Prior to topsoil placement the face of any slopes shall be track rolled by an excavator (up and down the slope) to assist in topsoil stabilization. Topsoil should be lightly compacted / tracked rolled in. Slopes greater than 20° may require erosion protection matting at the discretion of the engineer.

Proposed fill slopes are typically at a 1V:3H grade or lower. Should any proposed fill slopes exceed this grade (~18°-19°), then further assessment may be required depending on the slope height and what it is supporting. Proposed Fill slopes may require drainage to be installed at the interface with natural soils. Fill slopes in excess of 3m may require internal drainage and geogrid reinforcing as required by the geotech depending on the material type.

7.6 Proposed Retaining Walls

Two retaining walls are proposed, referred to as Retaining Wall 1 (RW1) and Retaining Wall 3 (RW3). It should be noted that following design amendments, Retaining Wall 2 is no longer required. The locations of the proposed retaining walls are indicated in Figure 21. The details are included in the Maven Associates Drawings – Ref. Project No. 135041 - Drawing No. C240, Sheets 0,1 & 2, Rev. A, dated June 2026 (Appendix F – with Slope Stability Analyses).

We understand that the proposed walls will be specifically engineered timber pole walls. We have assessed the global stability of the retaining walls (Appendix F) and the requirements for the walls (to satisfy global stability) are included in Section 7.5 along with the slope stability recommendations.

The soil engineering parameters should be confirmed on site prior to designing the walls. For Retaining Wall 3 the retained soils are well known, but some trial augers may be required to investigate the soils within the passive wedge of the wall. Passive soil parameters for Retaining Wall 1 are likely to depend on the engineered fill to be placed in these areas.

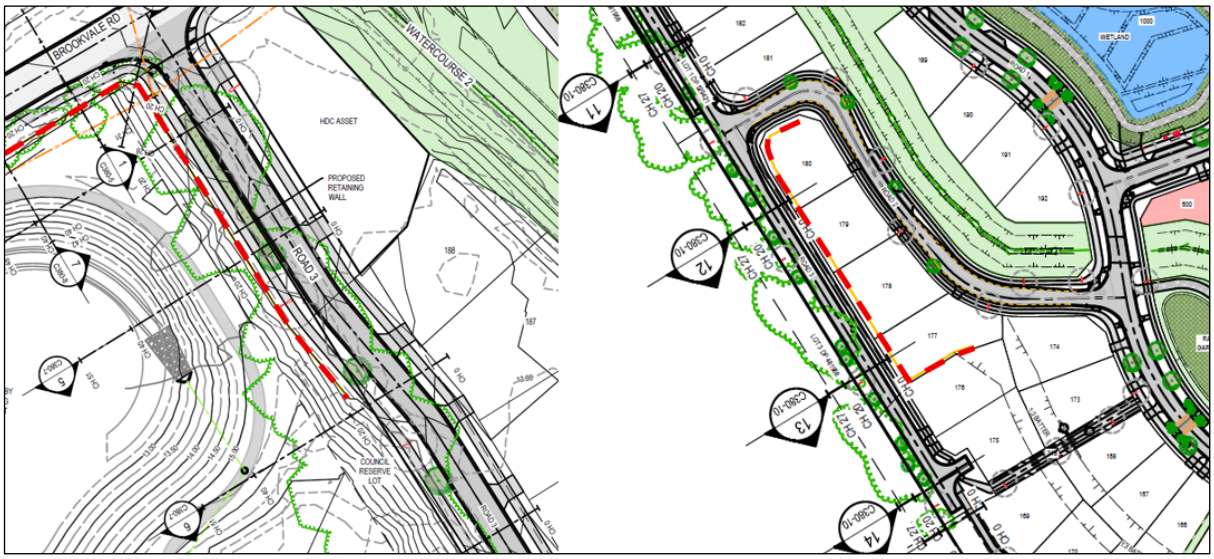


Figure 21: Excerpt from the proposed plans showing the location of the proposed retaining walls (red dashed lines).

7.7 Earthworks Recommendations

All earthwork activities must be undertaken under the guidance of a suitably qualified Geotechnical Professional and in accordance with the requirements of this report, NZS 4431:2022, and the Hastings District Council Engineering Code of Practice.

7.7.1 Material Suitability

Based on the proposed earthworks plan, the cut / excavated soils (expected to be suitable for re-use on site) comprise of the following in order of likely abundance:

- Sandy SILT to SILT with some clay: Present below topsoil across most of the proposed cuts / excavations in the flatter areas of the site. Expected to make up the majority of the soils excavated from the proposed stormwater pond and new channel realignment works.
- Sandy GRAVEL: Present in the slopes along the western site boundary.
- Gravel hardfill: Present as uncertified fill within the developed areas of the site.

We consider it unlikely that the cut earthworks below the proposed north-western lots (between the stream and western slopes), will not yield a significant volume of suitable fill material (for re-use) based on TP15 which encountered up to 3.2m of poor-quality fill and organics.

Soil properties and moisture contents are likely to vary widely, and therefore careful management of stockpiles & frequent laboratory checks will be required along with strict compaction control criteria. Laboratory testing and compaction targets will be assessed by the geotechnical engineer based on the soils used but shall adhere to the minimum requirements of NZS4431:2022.

It is recommended that for any proposed fill slopes placed in front of existing cut slopes, that the fill attempt to match the existing soils.

7.7.2 Subgrade Preparation

Subgrade preparation should comprise the stripping of all vegetation, topsoil and existing fill (refer to Section 7.3 for identified areas but assume other areas may be present). Due to previous land use (as a tree nursery) there may be areas of deeper topsoil and disturbed soils.

The base of any undercut must be inspected by the geotechnical engineer prior to placement of any soils. The excavated cut should be clean to allow for good observation of the soils. As part of the inspection, a proof roll (compaction in place), shall be completed under the supervision or instruction of the Geotechnical Engineer. Benching will be required in sloping areas or filling adjacent to slopes.

Care should be taken not to traffic subsoils in areas where there are wet silts (particularly with full trucks) to avoid issues with strength loss from excessive porewater pressures (causing 'jelly-like' soils).

7.7.3 Subsoil & Underfill Drains

Where existing overland or groundwater seepage paths are present, subsoil drainage should be installed to reduce the risk of significantly altering the groundwater table in the area. Subsoil drains should be determined on site, taking into consideration potential adverse weather effects and the surrounding soils.

Underfill and subsoil drains are likely to comprise of 160mm (SN8 strength) perforated pipe (with filter sock) laid within a free draining granular fill, wrapped in a Bidim A19 (or equivalent) Filter Fabric. Subsoil drains should exit into the closest overland flow paths. Additional perforated pipe may be required at below the existing channel that is being infilled (depending on the shallow groundwater seepage encountered).

Subsoils drainage may be required below or behind any fill slopes and within any fills of significant thickness (i.e. >3.0m) as required by the geotechnical engineer.

7.7.4 Cut Slopes & Fill Batters

As discussed in Section 7.5, the proposed slope configurations are considered suitable provided that the recommendations in Section 7.5 are adhered to. For any slopes outside of those assessed, we recommend the following preliminary maximum slope angles and heights:

- For western cut slopes – A maximum cut slope angle of 25° up to a maximum height of 4m (provide there is no seepage). For slopes with any seepage, slope heights exceeding 4m or angles exceeding 25°, stability analyses will be required (if not already assessed).
- All other cut slopes shall be 1V:2.5H or less, unless confirmed as suitable by the geotechnical engineer in writing.
- Fill Slopes shall not exceed 1V:3H without approval by the geotechnical engineer. Steeper slopes will likely need to be designed as geogrid reinforced soil slopes.

In addition to the above, all formed batters should be track-rolled or 'scarified' before being covered with ~150mm of topsoil and grassed as soon as practicable (to reduce the effects of surficial scour / erosion and shallow slumping). For slopes of 25° or greater, it is recommended to include a long-term turf re-enforcement matting to reduce topsoil scour, erosion or shallow failures (the mat shall be pinned to the slope as per the manufacturers recommendations). Alternatively, a less permanent erosion protection matting (i.e. coco coir) may be used if hydroseeding and planting with vetiver grass at 1m spacings.

7.7.5 Stockpiles

Careful consideration must be given to the location and separation of temporary stockpiles to ensure that they are not located immediately above steep or unstable slopes or banks, and that soils proposed for re-use are not mixed with differing soils (making review of compaction difficult) or contaminated with nearby unsuitable soil stockpiles.

The temporary stockpiles shall be preferentially located in areas of significant filling (to preload these areas and increase the rate of settlements). The preferred locations for stockpiling soils are:

- Over the engineered fill to be placed within the existing north-eastern stream channel (once settlement monitoring pins have been installed and engineered fill completed.
- Within the proposed thick filling along the western extent of the site (stockpile heights and locations will need to be approved by the engineer due to nearby slopes).
- Within the area of the deepest filling proposed in the south-eastern third of the site (where proposed filling typically ranges from 1.0m to 2.0m).

The location of all temporary stockpiles shall be approved by the Geotechnical Engineer prior to placement.

7.7.6 Compaction & Quality Control

As discussed previously, stockpiles of soils for re-use as fill shall be kept separate to allow for accurate compaction control. Stockpiles are likely to comprise of:

- Sandy SILTs (low plasticity silts)
- SILT with some to minor clay (moderate plasticity silts).
- Sandy GRAVELs with varying silt content.
- Gravel Hardfill – within developed industrial areas.

The differing silt units will need to be separated unless laboratory compaction results indicate similar maximum dry densities. Site won natural gravels and site won imported gravel hardfill should be kept separate. Each proposed fill will need standard compaction and solid density testing by an IANZ approved laboratory. NDM testing shall be undertaken for every 0.5m lift with (min) 1 test per 50m^2.

Fill should be placed in horizontal loose layers not exceeding 200mm in thickness (loose), moisture conditioned as necessary and compacted to achieve the following:

- Granular Fill – Either (A) 95% of the maximum dry density of the fill or (B) 82% of the solid density of the fill material, and for either test air voids shall be equal to or less than 15%.
- Fine-grained / cohesive (SILT) Fill – 95% of the maximum dry density of the soil, air voids <10%, shear vane peak strengths of ≥140kPa. Initial tests shall include oven corrections of samples to calibrate the Nuclear Density Meter (NDM) moisture readings.

7.7.7 Sediment & Erosion Control

Given the significant earthworks proposed within waterways and on slopes, a suitable sediment and erosion control plan will be required to mitigate the potential effects. Any temporary sediment control structures will require careful monitoring during remediation to ensure all unsuitable soils have been removed. The sediment & erosion control plan is beyond the scope of this report.

7.7.8 Bank & Channel Stability

Based on the review of the performance of the stream banks during Cyclone Gabrielle, we consider the risk of significant bank instability is low provided that:

- New channel dimensions are equal to or greater than the previous channel and that bank slopes are kept to a shallow slope gradient (i.e. 1V:3H).
- Adequate mitigation measures are put in place to reduce scour and erosion for the larger north-eastern channel. Mitigation options include:
    - Erosion protecting matting and/or grassing & vegetation (in areas of low scour risk), and
    - Stronger, more permanent erosion protecting matting, pinned to the banks or overlain by vegetated riprap (in areas with high scour / erosion risk).

The most significant locations of scour are expected to be (a) along the western bank at the beginning of the proposed realigned channel, where there is a sharp bend to the north, (b) in the north of the proposed realigned channel, along the outside / northern bank on the bend, and (c) where the proposed realigned channel rejoins with the existing channel (along the southern bank).

7.7.9 Proposed Earthworks Staging Plan

We have prepared a proposed earthworks staging plan that we consider works well to help mitigate site risks, particularly with respect to potential static settlements. The proposed staging plan is intended as guidance from a geotechnical perspective only and is not required to be adopted. It should be noted that important points are underlined. The proposed key stages in our preferred order are below, and we note that multiple stages could be undertaken at the same time. The key goal is to promote the preloading of any areas of significant fill to encourage static settlements to occur faster. Figure 24 provides the locations of the areas / stages discussed below.

Geotechnical inspections of the exposed subsoils must be undertaken following any excavation works (including cut-slopes) and the suitability of the subsoils (or slope) confirmed by the geotechnical engineer prior to proceeding with any fill of topsoil cover.

STAGE 1 – Channel Re-alignment Works

1. Install any required sediment & erosion control measures.
2. Proposed New Channel Cut - Undertake earthworks for the new diversion channels to capture water entering the site. Stockpile site won material for sampling and assessment for re-use.
3. Geotech to confirm minimum fine-grained soil cover requirements (0.4m - as per diversion channel assessment report by LWP limited dated, 16 April 2026).
4. Finish the diversion channel surface with suitable erosion protection matting (where required by the supervising engineer) and/or establish grass and vegetation cover.
5. Construct a temporary, keyed in, earth-dam to prevent surface and shallow groundwater flows from the existing channel to divert these to the newly constructed channel. The diversion channel should have some erosion protection established prior to its use.
6. Remove weak and unsuitable soils from within the 'old channel' (being diverted).
7. Install subsoil drainage within the 'old channel'.
8. Begin compacting fill within the 'old channel' using the site won material from the excavations undertaken for the 'new diversion channel'. Efforts should be made to try match surrounding soils with similar soils. Settlement monitoring pins to be installed in the base of the fill – as per Section 7.4.
9. Once the fill within the old channel has been lifted to the surrounding ground level, this area shall be used as a stockpile location to preload the fill and speed up any static settlements.

STAGE 2 – Western Cut Slopes & Filling

1. Install any required sediment & erosion control measures.
2. Remove the buildings and services from within the proposed western fill areas.
3. Undercut any unsuitable soils within the proposed filling areas, Geotech to inspect.
4. Initial cut earthworks should focus on reducing the angle of the existing steep cut slopes, this is also the most likely area that gravel soils will be won on site. These soils may provide a good base for any proposed filling and should have lab testing undertaken early on to confirm compaction targets.

5. Cut slopes to be inspected and approved as suitable prior to placing any required erosion protection measures (refer to Section 7.7.4)
6. Cut materials to be used to supply material to the surrounding areas of fill. Careful monitoring will be required to ensure that where fill material varies, there is a suitable compaction curve for the material, or that further testing is undertaken. Additional Fill material is likely to be required and may be won from nearby cut earthworks (i.e. the stormwater detention basin)

STAGE 3 – Stormwater Detention Basin / Northern Cut Earthworks & South-Eastern Central Fill

1. Install any required sediment & erosion control measures.
2. Strip unsuitable soils from within the South-Eastern Central Fill Area (refer to Figure 24). Focus should be on the area proposed to have the most significant fill heights. Geotech to Inspect.
3. Install any required sub-soil drains.
4. Install 2 x Settlement monitoring pins in the locations of the greatest fill thickness within the South-Eastern Central Fill.
5. Proceed with Northern Cut Earthworks and use this material to fill the South-Eastern Central Area to finished ground level. This area shall be used as a stockpile location to preload the fill and speed up any static settlements – The preload will likely come from topsoil stripped from the surrounding areas prior to surround fill earthworks (the topsoil can be stockpiled here for spreading following the completion of the surrounding filling).

STAGE 4 – Remaining Site-Wide Undercutting & Filling

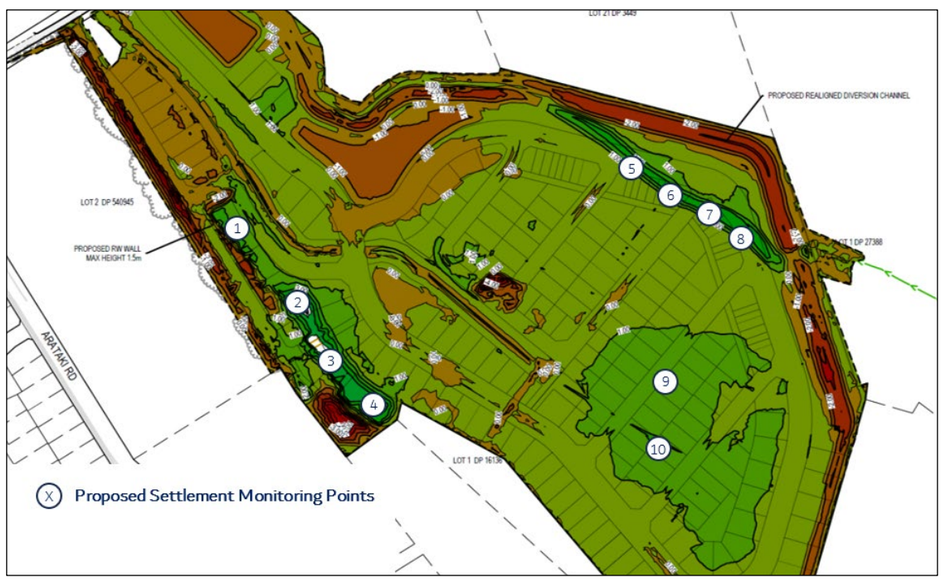
1. Install any required sediment & erosion control measures.
2. Remove the buildings and services from within the remaining developed areas.
3. Undercut any unsuitable soils within the proposed filling areas, Geotech to inspect. Topsoil shall be stockpiled on top of the engineered fill created in the South-Eastern Central area (Stage 3 – Point 5), to preload this fill and be re-used later (where practicable).
4. Ensure that any undercut imported hardfill is stockpiled separately for evaluation and potential re-use.
5. Install any required sub-soil drains under the direction of the geotechnical engineer.
6. Undertake the proposed fill earthworks.

The plan indicating the suggested stage extents is indicated in Figure 24 on the following page along with several key images, reproduced from previous sections.

Figure 24 - Proposed Earthworks Staging Areas

Levels that groundwater or seepage were encountered (m below ground level)

Site Plan indicating the areas of suspected uncertified fills and organic soils.



Marked up cut/fill earthworks plan showing proposed settlement monitoring locations.

7.8 Civil Recommendations

The following is recommended with respect to civil works:

- Subgrade CBR: At this stage a subgrade CBR of 4% can be assumed for the natural ground (typically very stiff SILT to Sandy SILT). For Engineered Fills a subgrade CBR of 5-6% may be assumed. It is recommended that a programme of testing is undertaken on the subgrade prior to road construction to inform the detailed design.
- Typical topsoil depths are around 0.3m but in areas used as a tree nursery (for growing small trees) the removal of the trees and subsequent reworking of the land may have resulting in disturbed and mixed soils to greater depths (i.e. up to 0.4-0.6m).

8 Further Work

Based on the analyses and assessment undertaken, we recommend that HB Geotech be involved in the following further work to progress the final design.

- Design Review: We should be given the opportunity to review any changes or amendment to the proposed plans. In addition, we should be given the opportunity to review the proposed erosion control measures for the proposed stream channels.
- We recommend a review is undertaken by the Land Water People (LWP) Hydrologist to confirm the suitability of the recommended subsoil drains (particularly outlets to channels). We consider that the proposed shallow subsoil drains discharging to existing channels is likely to keep shallow infiltrating water from the site, closer to the surface. Excluding the drains may affect groundwater movement and cause shallow infiltration to infiltrate deeper or cause excess pore pressures in areas.
- Specific Investigations & Engineering Design of the Retaining Walls.
- Stability Analyses: Depending on the proposed final cut earthworks plans, additional stability analyses will be required where:
    - Cut slopes exceed the recommended slope angles, or
    - Cut slopes exceed 4m in height (at 25° of more), or
    - Any seepage from the cut slope is identified.
- Further geotechnical investigations of ground conditions during construction monitoring with particular focus on areas of limited testing to date (due to access constraints) and regular inspections of cut faces / slope stability.
- Detailed design of remedial works during construction (i.e. engineering reinforcement of fill slopes & faces, undercutting and benching, subsoil drains)

9 Safety In Design

Table 4 below highlights key safety issues that will need to be addressed as part of the development of the site. Where applicable, recommendations have been included to reduce risks but for the potentially dangerous works detailed below, a safety analyses by the contractor is recommended (and review by the geotechnical engineer where applicable).

Table 4: Summary of Geotechnical Site Risks requiring Safety in Design Consideration

Geotechnical Risk	Details & Mitigation
Slope Stability where: (a) Slope angles exceed 30° and work is being undertaken above or below the slope. (b) The slope exceeds 5m in height. (c) Seepage is identified from the slope.	Undertake safety meeting with geotech prior to working on the slope. The main risk we can see is the fill work to be undertaken below the existing very steep slopes in the west. These areas may require a long reach excavator to trim the slopes and remove any loose or weak material (to protect operators in machinery below, particularly when using vibration). Any plant below the slope should have adequate cover / protection for the operator.
High / perched groundwater tables: There is potential for high groundwater tables to develop in shallow gravel units following significant rainfall, especially when the gravels are underlain by shallow fine-grained silts.	Consideration for the potential high groundwater tables following significant rain or wet periods. Seepage in these units is expected to cause significant trench instability which should be considered for civil works. Excavation works within stream channels should be avoided during significant rain or where very high groundwater levels occur. Potential for groundwater seepage to be encountered at shallow depths when clearing out the unsuitable soils within the existing eastern stream / channel. Drainage or dewatering may need to be installed early.
Services when undercutting	Services must be isolated and disconnected professionally before earthworks can be undertaken in the area. There are several cables expected to be running through the site to the surrounding pumps located at the well sites (and the dwelling in the south-east of the site). Developed industrial area is likely to have a significant number of services present within it.
Potential for contaminated soils	There is potential for contaminated soils to be present within the areas of industrial use. Review of contamination reports is recommended. Any suspect soils should be assessed prior to removal or further disturbance.

10 LIMITATIONS

This report has been prepared exclusively for Ed Sundstrum C/o Vermont Street Partners No. 4 Limited with respect to the particular brief given to us. No liability is accepted in respect to its use for any other purpose, or by any other person or entity other than any relevant council authorities. For any future developments within the parcel of land, geotechnical supervision & construction monitoring is required and may include further investigations, analyses & design as required.

The analysis, opinions and recommendations given in this report have been undertaken in general accordance with current standards, codes and guidance at the time of this report. These may be subject to change over time or due to significant changes to the proposed development. Therefore, if the project is modified in any significant way, or more than 24 months have passed since the date of this report, then Hawke's Bay Geotech should be given an opportunity to confirm that the recommendations are still valid.

Many of the values reported in geotechnical engineering are estimates due to the variability of ground conditions, soil properties and the difficulty in assessing the response to earthquake loading. It should be noted that many geotechnical methods of analysis carry some uncertainty and observations of effects can vary significantly from actual values. Therefore, the values included within this report are intended to be used as a proxy for assessing potential site performance (along with mitigating factors) and should not be considered to represent actual values.

The engineering recommendations included in this report have been based on available information including sources from other consultants and contractors which have been assumed to be correct. We accept no liability for incorrect information by third parties.

Investigation data only reflects the site conditions encountered at the time of the investigations and is undertaken at discrete locations. It should be noted that due to natural ground variability, conditions may vary from those assumed between investigation points. In addition, changes to site levels or earthworks not covered in this report can have a significant effect on the engineering advice and recommendations given. Therefore, we should be notified immediately if there are any significant variations to the ground conditions or proposed development from those assumed in this report.

Appendix A

Proposed Cut / Fill Earthworks Plan & Lot Layout

BULK SUBGRADE WORKS (SURFACE EX-SG COMPARISON WITH SURFACE PR-SG)

CUT VOLUME		69,000 m³
FILL VOLUME		95,000 m³
NET FILL		26,000 m³
TOPSOIL STRIPPED (200mm OVER EW AREA)	=	48,000 m³
EARTHWORKS AREA	=	24 Ha

EARTHWORKS CUT/FILL SHOWN ON PLAN = EX-GL STRIPPED COMPARISON WITH PR-GL

NOTE: NO ALLOWANCE FOR SERVICES TRENCHES, VOLUMES ARE UNFACTORED AND IN SITU

RESOURCE CONSENT

Cut/Fill Table

Number #	Minimum Elevation	Maximum Elevation	Color
1	-6.000	-5.000	
2	-5.000	-4.000	
3	-4.000	-3.000	
4	-3.000	-2.000	
5	-2.000	-1.000	
6	-1.000	0.000	
7	0.000	1.000	
8	1.000	2.000	
9	2.000	3.000	
10	3.000	4.000	
11	4.000	5.000	
12	5.000	6.000	

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH HASTINGS DISTRICT COUNCIL STANDARDS.
2. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY THEIR OPERATIONS.
3. THE CONTRACTOR SHALL COMPLY WITH ALL RELEVANT HEALTH AND SAFETY REQUIREMENTS.
4. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.
5. SEDIMENT CONTROL SHALL BE INSTALLED AND OPERATIONAL BEFORE EARTHWORKS START ONSITE IN ACCORDANCE WITH COUNCIL STANDARDS.
6. CONTRACTOR SHALL PROVIDE ASBUILT OF WORKING SEDIMENT CONTROL DEVICES AND CONFIRMATION OF POND/DECENT VOLUMES TO ENGINEER.
7. SEDIMENT CONTROL TO COMPLY WITH THE COUNCIL STANDARDS.

LEGEND

- EX BDY
- PROP BDY
- PROP EXTENT WORK

Rev	Description	By	Date
A	SUBSTANTIVE APPLICATION	RH	06/2026

	By	Date
Survey	TECH SP	02/2025
Design	RH	06/2026
Drawn	RH	06/2026
Checked	BB	07/2026

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Project
BROOKVALE GREEN
HAVELOCK NORTH
FOR
VERMONT STREET
PARTNERS NO. 4 LIMITED

Title
PROPOSED
CUT / FILL
PLAN

Project no.	135041		
Scale	1:3000 @ A3		
Cad file	135041-C220 CUT FILL.DWG		
Drawing no.	C220	Rev	A

DATE: 7/5/26 FILE PATH: P:\MAVEN\PROJECTS\135041 BROOKVALE\DWG\135041 C220 CUT FILL.DWG

Appendix B

Site Investigation Logs & Available Soil Information

Hand Auger Log

HAWKE'S BAY GEOTECH

Test ID:	**HA01**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602895.54mN, 1935033.20mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa)	In-situ Testing: Dynamic cone penetrometer (blows / 50mm)	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
0.0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.					0.0
	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.				219	
0.5						191 / 59 (3.2)	-0.5
						219	
						219	
1.0		SILT with some sand and minor to some clay: Light greyish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.				219	-1.0
						209 / 75 (2.8)	
1.5						187 / 66 (2.8)	-1.5
		SILT with some sand and minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff, moist.				178 / 56 (3.2)	
						187 / 59 (3.2)	
2.0		SILT with some sand and minor to some clay: Light greyish-brown with trace mottle, very stiff, high plasticity, wet.				137 / 50 (2.7)	-2.0
						131 / 50 (2.6)	
						134 / 41 (3.3)	
2.5						125 / 41 (3.0)	-2.5
						125 / 34 (3.7)	
3.0						128 / 34 (3.8)	-3.0
		Clayey SILT with minor fine sand: Light greyish-brown with trace to minor brownish mottle, very stiff, high plasticity, wet.				141 / 44 (3.2)	
						112 / 34 (3.3)	
3.5						128 / 31 (4.1)	-3.5
			Groundwater level encountered during drilling.			141 / 31 (4.5)	
		Silty CLAY with trace sand: Light bluish-grey, very stiff, high plasticity, saturated.				131 / 34 (3.9)	
4.0						125 / 31 (4.0)	-4.0
		Sandy GRAVEL with minor silt: light brownish grey, dense, saturated.					
4.3							4.3

Hole Depth: 4.30m **Termination:** Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA/S02
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602902.99mN, 1935270.94mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water
0.0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered
0.5	Alluvium	Organic SILT with minor sand and clay: blackish-brown, low plasticity, firm, moist to wet.	
		0.65m - 0.70m: Charcoal with silt.	
1.0		Sandy GRAVEL with minor silt: brownish grey, dense, wet.	
1.5			

In-situ Testing

Vane undrained shear strength, s_u (kPa): 50, 100, 150, 200

Dynamic cone penetrometer (blows / 50mm): 2, 4, 6, 8

12

Shear Vane Values (kPa)

Vane ID:

peak / residual (sensitivity)

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 1.00m

Termination: Refusal in Gravels.

Remarks:

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

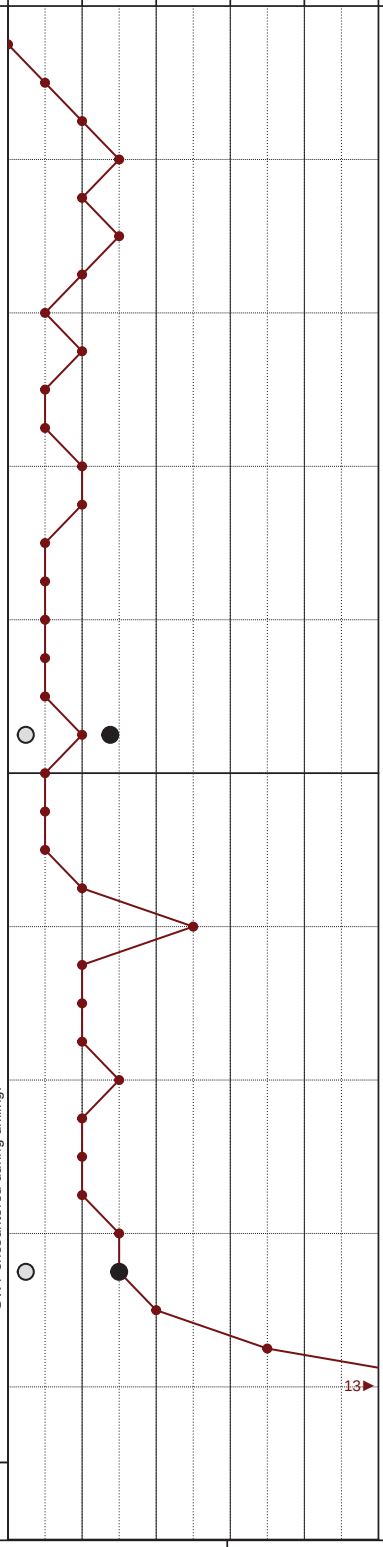
HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA/S03
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602841.10mN, 1935353.71mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water
0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	
	Alluvium	Organic SILT with minor sand and clay: blackish-brown, low plasticity, firm, moist to wet.	
0.5		Sandy GRAVEL with minor silt: brownish grey, loose, wet.	
		Organic SILT with minor sand and clay: blackish-brown, low plasticity, firm, moist to wet.	
		Organic Silty CLAY: blackish-brown, high plasticity, firm, wet.	
1.0		Gravelly SAND to Sandy GRAVEL: greyish-brown, medium dense, wet.	
1.5		Sandy SILT with trace organics; greyish brown, stiff, low plasticity, wet to saturated.	GWT encountered during drilling.
		Sandy GRAVEL with minor silt: brownish grey, medium dense to dense, saturated.	



Shear Vane Values (kPa)
Vane ID: 3762
peak / residual (sensitivity)

69 / 12 (5.8)

75 / 12 (6.3)

-0.5
-1.0
-1.5

Hole Depth: 1.90m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

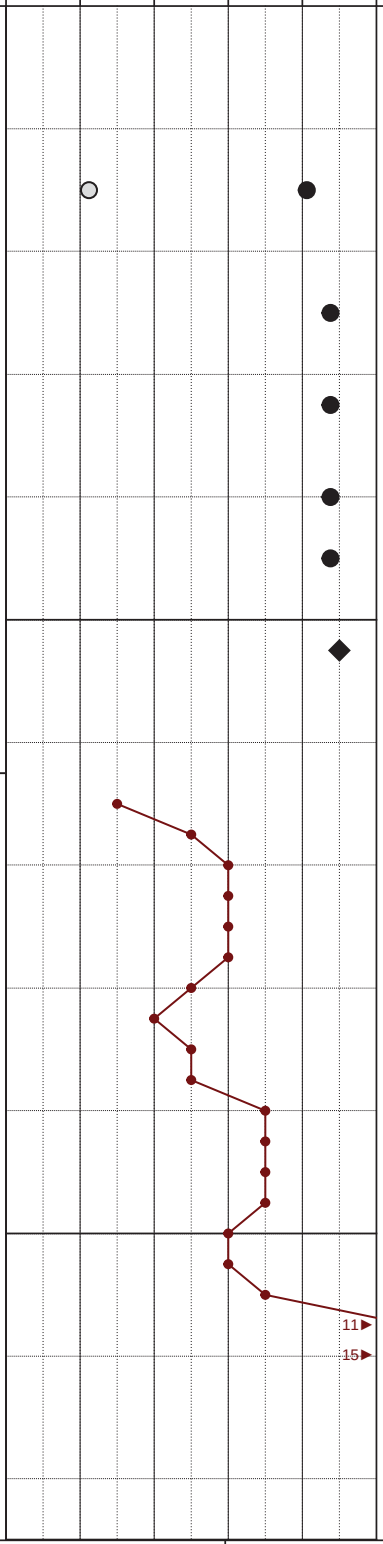
HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA/S04
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602776.83mN, 1935380.10mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water
0.0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	
0.5	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	
		Clayey SILT with minor fine sand: Light greyish-brown with trace to minor brownish mottle, very stiff to hard, high plasticity, moist.	
1.0		Sandy SILT with trace clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, moist to wet.	Groundwater not encountered
		Sandy GRAVEL with minor silt: light brownish grey, dense, moist to wet.	
1.5			
2.0			



Shear Vane Values (kPa)	
Vane ID: 3762	
peak / residual (sensitivity)	
203 / 56 (3.6)	
219+	
219+	
219+	
219+	
UTP	

Hole Depth: 1.25m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

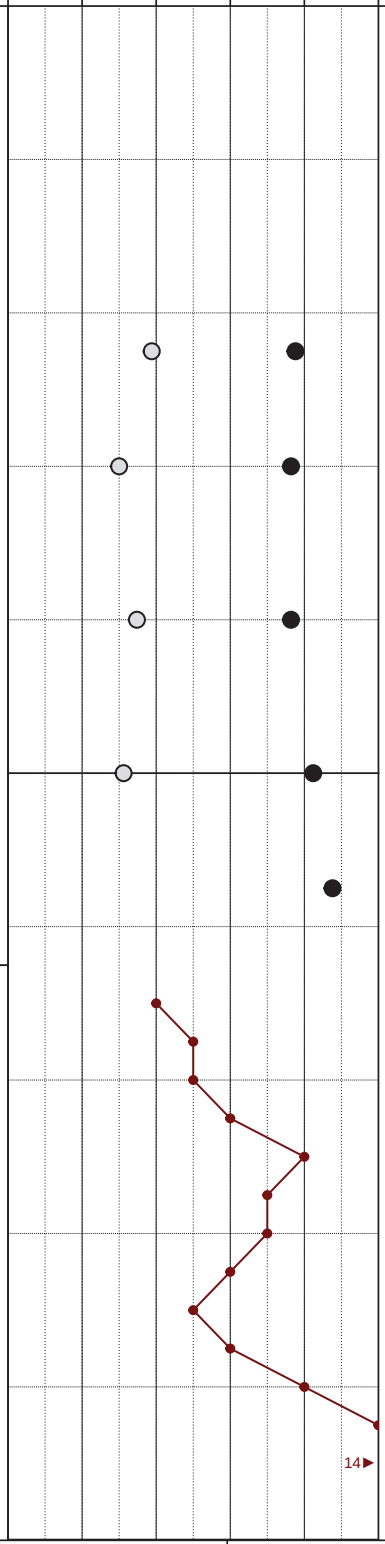
Test ID: HA/S05
Project ID: 25030
Sheet: 1 of 1

Client: Ed Sundstrum C/o Vermont Street Partners No. 4
Project: Geotechnical Investigations
Location: 174 & 176 Brookvale Road, Havelock North

Coordinates: 5602742.75mN, 1935257.92mE
System: NZTM
Test Location: Refer to Test Location Plan

Test Date: 26/05/2025
Logged By: CJG
Checked By: CJG

Depth (m)	Geology	Material Description	Water
0.0	Uncertified Fill	TOPSOIL & Gravel FILL.	Groundwater not encountered
0.5	Alluvium	Clayey SILT with minor fine sand: Light greyish-brown with trace to minor brownish mottle, very stiff, high plasticity, moist to wet.	
1.0		Sandy SILT with trace to minor clay: Light brown with trace orangish-brown mottle, very stiff to hard, low plasticity, moist to wet.	
		Sandy GRAVEL with minor silt: light brownish grey, dense, moist to wet.	
1.5			



Shear Vane Values (kPa)	
Vane ID: 3762	
peak / residual (sensitivity)	
194 / 97 (2.0)	-0.5
191 / 75 (2.5)	
191 / 87 (2.2)	-1.0
206 / 78 (2.6)	
219+	-1.5

Hole Depth: 1.25m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

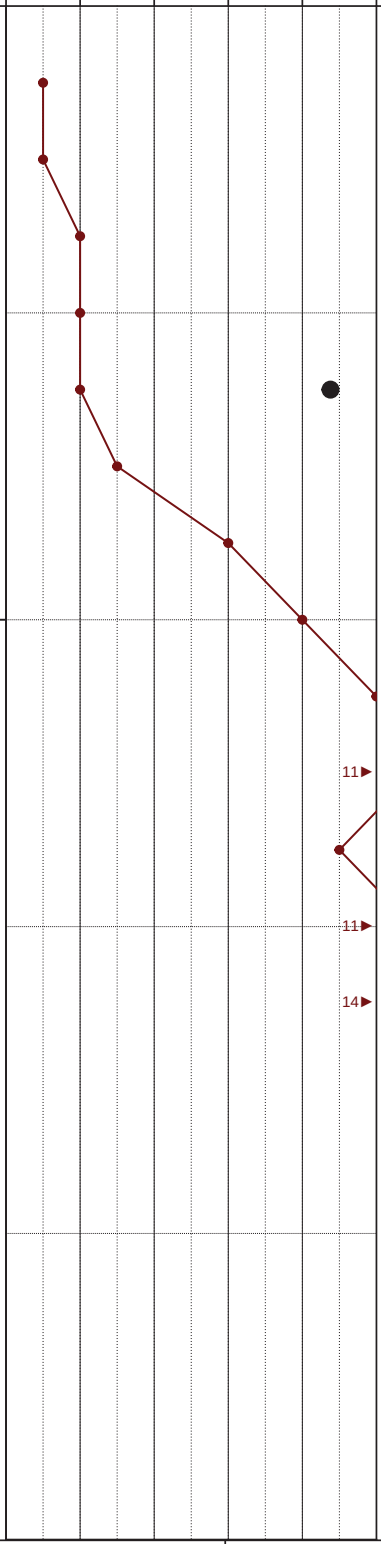
HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA/S06
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602644.66mN, 1935302.61mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water
0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered
	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	
0.5		Sandy GRAVEL with minor silt: light brownish grey, dense, moist to wet.	



Shear Vane Values (kPa)	Depth (m)
Vane ID: 3762	
peak / residual (sensitivity)	
219+	-0.5

Hole Depth: 0.40m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

Hand Auger Log

HAWKE'S BAY GEOTECH

Test ID:	**HA07**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4 L	**Coordinates:**	5602938.08mN, 1935160.97mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Additional Details: This area was infilled in the past and the old channel diverted to a more staight path. Please refer to the images below and the Geotechnical Report for further details.

Depth (m)	Geology	Material Description	Water
0.0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	
0.5	FILL	FILL - Organic SILT with minor gravel, sand and clay: blackish-brown, low plasticity, firm, moist to wet.	
		0.80m: ...becoming with trace gravel and very weak.	
		Indicative Fill	
1.0			
1.5		1.60m - 2.40m: VERY WEAK - Hand auger advanced under very light weight to 2.4m. Some organics recovered, rootlets and decaying plant matter. Saturated from 1.8 to 2.4m.	Inflow in very weak layer.
2.0			
2.5	Alluvium	Organic SILT with minor sand and clay: blackish-brown, low plasticity, firm, moist to wet. Organic odor.	
3.0	Alluvium	Sandy GRAVEL with minor silt: brownish grey, loose, wet.	

Test Location (2014 Aerial Imagery)

Test Location (2023 Aerial Imagery)

Indicative Extents (white line is old channel)

Hole Depth:	3.10m
Termination:	Refusal in Gravels.

Remarks: Auger undertaken in an area where in filling of the old stream channel was suspected. Organics and Fill encountered in this area is expected to be very localized..

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger / Face Log 08

Test ID: HA08
Project ID: 25030
Sheet: 1 of 2

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4 L	**Coordinates:**	5602808.45mN, 1934921.75mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water
0	Topsoil	TS	TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered
	Alluvium		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	
0.5			Sandy Silty GRAVEL with minor clay: light brownish grey, tightly packed, dry to moist.	
1.0				
1.5				
2.0				
2.5				
3.0				
3.5				
4.0			Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	

Hole Depth: 8.00m
Termination: Refusal in Gravels.

Remarks: Note: Log is based on face observations taken in road cuts and in cut slopes below the road as indicated in the photos. The depths are indicative only given the log is not exactly continuous..

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger / Face Log 08 Cont...

Test ID:	**HA08**
Project ID:	25030
Sheet:	2 of 2

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4 L	**Coordinates:**	5602895.54mN, 1935033.20mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water
4.5			Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Groundwater not encountered
6.0	Alluvium		Sandy GRAVEL with some silt and minor clay: light brownish grey, tightly packed, dry to moist. Well cemented.	
7.0			Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	
8.0				

Hole Depth: 8.00m **Termination:** Refusal in Gravels.

Remarks: Note: Log is based on face observations taken in road cuts and in cut slopes below the road as indicated in the photos. The depths are indicative only given the log is not exactly continuous..

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

Hand Auger Log

HAWKE'S BAY GEOTECH

Test ID:	**HA09**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602905.68mN, 1935403.15mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
0.0	Topsoil		TOPSOIL: Brown organic SILT with some sand and minor clay.				0.0
0.5	Alluvium		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.			219+	-0.5
1.0						219+	-1.0
1.5			Clayey SILT with minor fine sand: Light greyish-brown with trace to minor brownish mottle, very stiff, high plasticity, moist to wet.	Groundwater not encountered		219+	-1.5
2.0						187 / 69 (2.7)	-2.0
2.5			Silty CLAY with trace sand: Light greyish-brown with trace to minor brownish mottle, very stiff, high plasticity, moist to wet.			181 / 66 (2.7)	-2.5
3.0			Andy SILT with trace clay: Light brown with slight orangish-brown mottle, very stiff to hard, low plasticity, wet.			184 / 75 (2.5)	-3.0
3.2			Sandy GRAVEL with minor silt: light brownish grey, dense, wet.			191 / 81 (2.4)	
						219+	

Hole Depth: 3.20m

Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA10
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602600.79mN, 1935454.97mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil		TOPSOIL: Brown organic SILT with some sand and minor clay.				
0.5	Alluvium		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Groundwater not encountered		162 / 41 (4.0)	-0.5
			Sandy, Silty GRAVEL; greyish brown, dense, moist. Rounded greywacke gravel, fine to coarse.			203 / 47 (4.3)	

Hole Depth: 0.85m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA11
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602530.05mN, 1935250.73mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil		TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered			
0.5	Alluvium		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, stiff, low plasticity, very wet.		○ ●	70 / 16 (4.4)	-0.5
			Sandy, Silty GRAVEL; greyish brown, dense, moist. Rounded greywacke gravel, fine to coarse.				

Hole Depth: 0.60m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

● Vane peak
○ Vane residual
◆ Vane Unable to Penetrate (UTP)
▼ Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA12
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602598.45mN, 1935199.58mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil		TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered			
0.5	Alluvium		Sandy SILT with trace to minor clay: Light greyish-brown with slight orangish-brown mottle, stiff, low plasticity, very wet.		○ ●	72 / 19 (3.8)	-0.5
			Sandy, Silty GRAVEL; greyish brown, dense, moist. Rounded greywacke gravel, fine to coarse.				

Hole Depth: 0.60m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

● Vane peak
○ Vane residual
◆ Vane Unable to Penetrate (UTP)
▼ Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA/S13
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602856.93mN, 1934941.40mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.				
	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.				
		Silty SAND; light yellowish brown, dense, dry.	Groundwater not encountered		219	
0.5		Sandy GRAVEL with minor silt: light brownish grey, dense, saturated.				-0.5

Hole Depth: 0.50m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA14
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602898.40mN, 1935167.53mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) (50, 100, 150, 200) / Dynamic cone penetrometer (blows / 50mm) (2, 4, 6, 8)	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.				
0.5	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, wet to 0.6m then moist.	Groundwater not encountered		153 / 50 (3.1) 159 / 56 (2.8)	-0.5
1.0		SILT with some sand and minor to some clay: Light greyish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.			219+ 219+ 219+ UTP	-1.0
1.5		Sandy SILT with minor to trace clay: Light brownish grey with slight orangish-brown mottle, very stiff, moist.			219+	-1.5
2.0					175 / 50 (3.5) 178 / 50 (3.6)	-2.0
2.5						-2.5

Hole Depth: 2.20m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA15
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602801.81mN, 1935218.68mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200; Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
	Topsoil		TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered			
0.5	Alluvium		SILT with some sand and minor to some clay: Light greyish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, dry-moist.			200 / 44 (4.5) UTP UTP	-0.5

Hole Depth: 0.85m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA16/Piezo1
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602905.52mN, 1935017.23mE	**Test Date:**	01/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description
0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.
0.5	Alluvium	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.
1.0		SILT with some sand and minor to some clay: Light greyish-brown with slight orangish-brown mottle, very stiff to hard, moderate plasticity, moist.
1.5		Sandy SILT with minor clay: Light greyish-brown, very stiff, moist.
2.0		SILT with some clay and minor to some sand: Light brownish-grey, very stiff, moderate to high plasticity, moist to wet.
2.5		Clayey SILT with minor to some fine sand: Light brownish grey, stiff to very stiff, moderate to high plasticity, wet.
3.0		
3.5		Silty SAND; brownish grey, medium dense to dense, saturated.
		Sandy GRAVEL with minor silt: light brownish grey, dense, saturated.

Installation/Water: Bentonite; Sand backfill; Max level recorded (23/04/26) during drilling.

In-situ Testing
Vane undrained shear strength, s_u (kPa): 50, 100, 150, 200
Dynamic cone penetrometer (blows / 50mm): 2, 4, 6, 8

Depth (m)	Shear Vane Values (kPa) — Vane ID: 3762, peak / residual (sensitivity)
0.5	187 / 31 (6.0)
	219+
	219+
1.0	209 / 72 (2.9)
	194 / 56 (3.5)
1.5	112 / 34 (3.3)
	131 / 41 (3.2)
2.0	122 / 44 (2.8)
	112 / 37 (3.0)
2.5	112 / 37 (3.0)
	86 / 19 (4.5)
3.0	78 / 22 (3.5)
	84 / 25 (3.4)
3.5	103 / 22 (4.7)

Hole Depth: 3.80m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA17
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602907.98mN, 1934900.03mE	**Test Date:**	15/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200; Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: peak / residual (sensitivity)	Depth (m)
0.5	Alluvium		FILL - SILT with some clay and sand: Light yellowish-brown, stiff, low plasticity, moist. 0.80m: ...with some gravel.	Groundwater not encountered			-0.5

Hole Depth: 0.90m
Termination: Refusal in Gravels.

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

HAWKE'S BAY GEOTECH

Hand Auger Log

Test ID: HA18
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602630.99mN, 1935226.22mE	**Test Date:**	23/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered			0
0.5	Alluvium	Clayey SILT with trace to minor sand: Light greyish-brown, very stiff, high plasticity, moist-wet.			162 / 59 (2.7)	-0.5
		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff, low plasticity, moist.			219+	
		Sandy, Silty GRAVEL; greyish brown, dense, moist to wet. Rounded greywacke gravel, fine to coarse.				

Hole Depth: 0.85m
Termination: Difficult to Auger

Remarks:

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

Hand Auger Log

HAWKE'S BAY GEOTECH

Test ID:	**HA19**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602666.75mN, 1935023.90mE	**Test Date:**	03/06/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Graphic Log	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa) 50 100 150 200 / Dynamic cone penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)	Depth (m)
0.0	Topsoil	TS	TOPSOIL: Brown organic SILT with some sand and minor clay.	Groundwater not encountered			0.0
0.5	Alluvium		Sandy SILT with trace to minor clay: Light yellowish brown, very stiff to hard, low plasticity, dry.		○ ●	131 / 22 (6.0)	-0.5
1.0					○ ●	141 / 22 (6.4)	-1.0
1.5			Sandy GRAVEL with some silt and trace clay; brownish grey to orangish brown, tightly packed (dense to very dense), dry to moist.		◆	UTP	-1.5
2.0							-2.0
2.5							-2.5
3.0							-3.0
3.5							-3.5
4.0							-4.0

Hole Depth: 3.20m

Termination: Refusal in Gravels.

Remarks: Note: Log is based on a Face Log to 2.8m, followed by a Hand Auger / spade pit at the toe of the face to 0.6m. .

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

● Vane peak
○ Vane residual
◆ Vane Unable to Penetrate (UTP)
▼ Standing Groundwater Level

Hand Auger Log

HAWKE'S BAY GEOTECH

Test ID:	**HA20**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602666.75mN, 1935023.90mE	**Test Date:**	03/06/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Test Location:**	Refer to Test Location Plan	**Checked By:**	CJG

Depth (m)	Geology	Material Description	Water	In-situ Testing: Vane undrained shear strength, s_u (kPa)	In-situ Testing: Dynamic cone penetrometer (blows / 50mm)	Shear Vane Values (kPa) Vane ID: 3762 peak / residual (sensitivity)
0	Topsoil	TOPSOIL: Brown organic SILT with some sand and minor clay.				
	Alluvium	SAND with minor to trace silt: light yellowish brown, medium dense to dense, dry.				
0.5		Sandy SILT with trace to minor clay: Light brown with slight orangish-brown hue, very stiff to hard, low plasticity, dry to moist.				94 / 28 (3.4)
						159 / 16 (9.9)
1.0		0.80m - 1.00m: ... With minor gravel (unable to take shear vane reading due to gravels).				
						159 / 22 (7.2)
						125 / 34 (3.7)
1.5			Groundwater not encountered			156 / 22 (7.1)
						206 / 22 (9.4)
						206 / 16 (12.9)
2.0						219+
		SAND with minor to trace silt: light yellowish brown, medium dense to dense, dry.				219+
2.5						
3.0		3.20m: ...becoming difficult to auger.				
3.5						
4.0						

Hole Depth:	3.20m
Termination:	Refusal in dense sands.

Remarks: Note: Log is based on Hand Auger to 1.2m then a face Log to 2.3m, followed by a Hand Auger at the toe of the face to 1.2m. .

Materials logged and described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).

- Vane peak
- Vane residual
- Vane Unable to Penetrate (UTP)
- Standing Groundwater Level

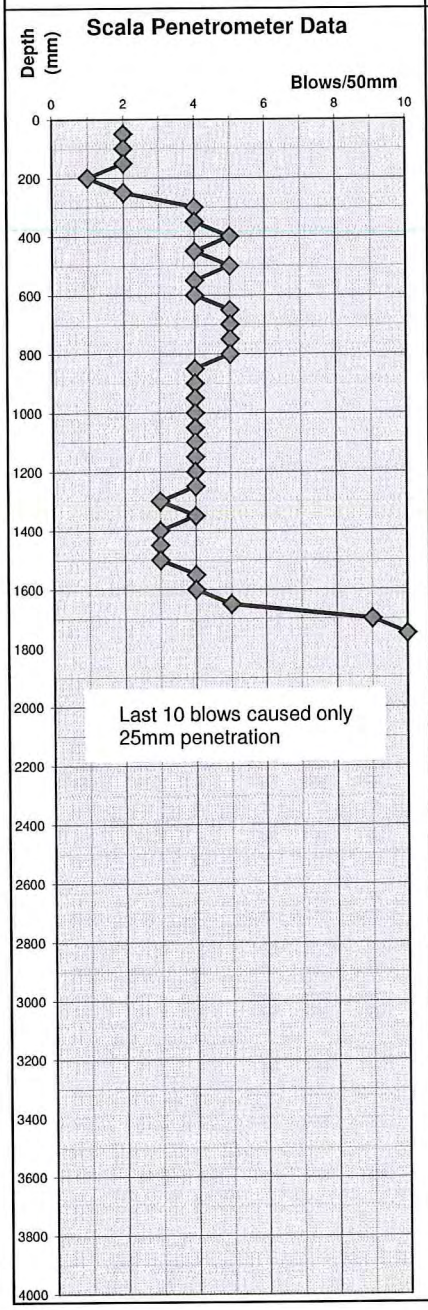
INVESTIGATION REPORT - GROUND TESTING

PROJECT:	Te Mata Mushroom Farm, Geotechnical Investigation
CLIENT:	Tonkin & Taylor Ltd
ENGINEER:	Tonkin & Taylor Ltd
DATE & TIME:	16-May-13
TESTED BY:	ES
TEST SITE:	1 - 3
LOCATION:	Refer photos page 1 and attached A3 plan
TEST METHODS:	Scala Penetrometer

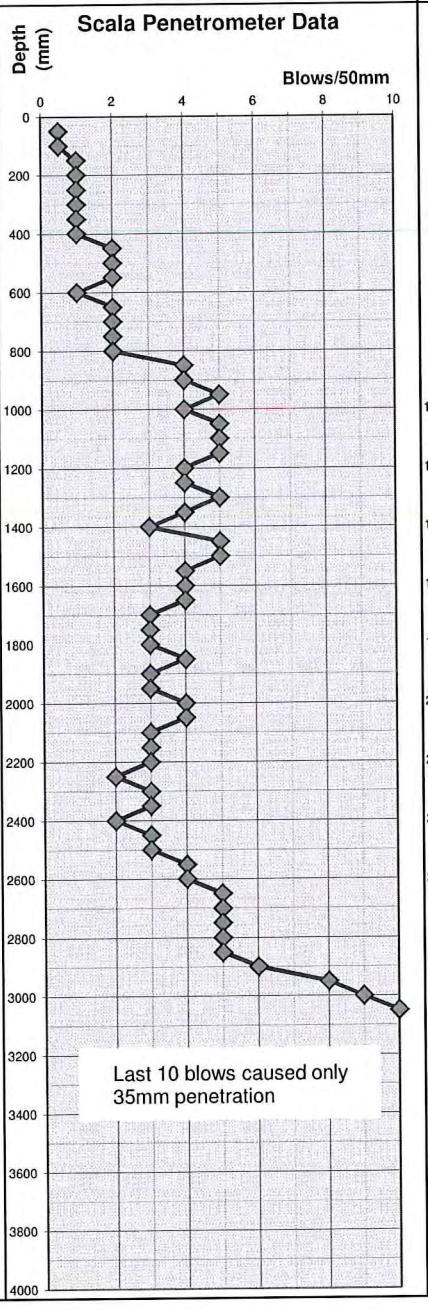
Report Number: CSR13/020

CIVIL SERVICES (HB) LTD
UNIT 8 88 TARADALE ROAD P.O. BOX 5011 NAPIER 4145 PHONE 06 843 6996 EMAIL admin@civilservices.co.nz WEB PAGE www.civilservices.co.nz

SITE 1



SITE 2



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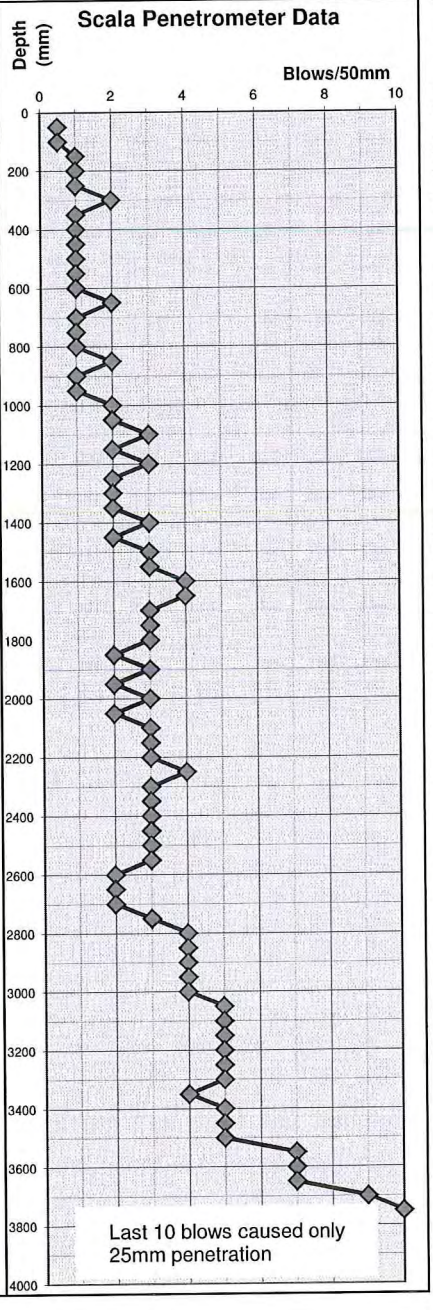


Comments:
All depths measured from ground levels at corresponding sites. Each test was stopped when 10blows/50mm exceeded (but still shown as 10blows/50mm on graphs here).

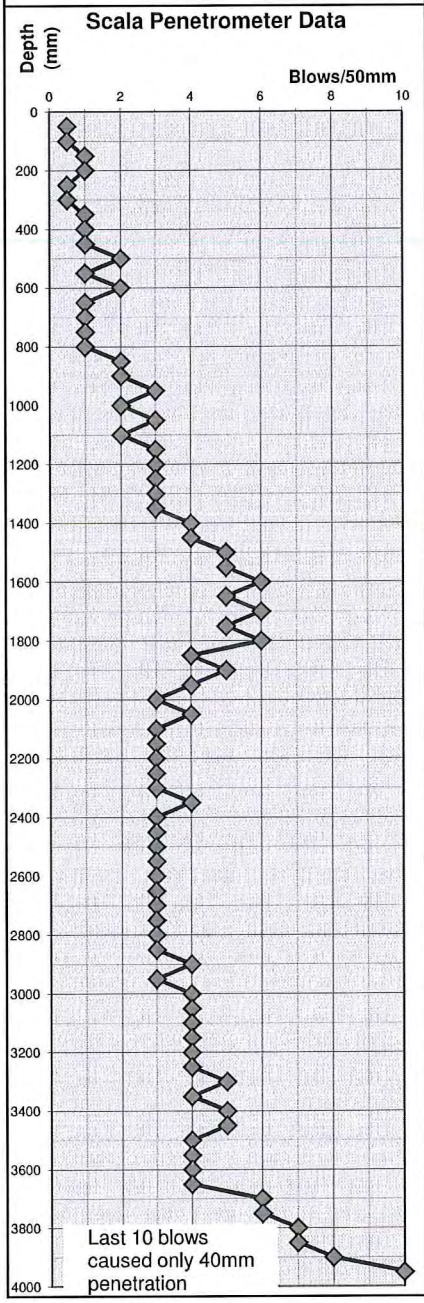
Testing Specifications:
Scala penetrometer testing specification NZS 4402:1988 Test 6.5.2

INVESTIGATION REPORT - GROUND TESTING

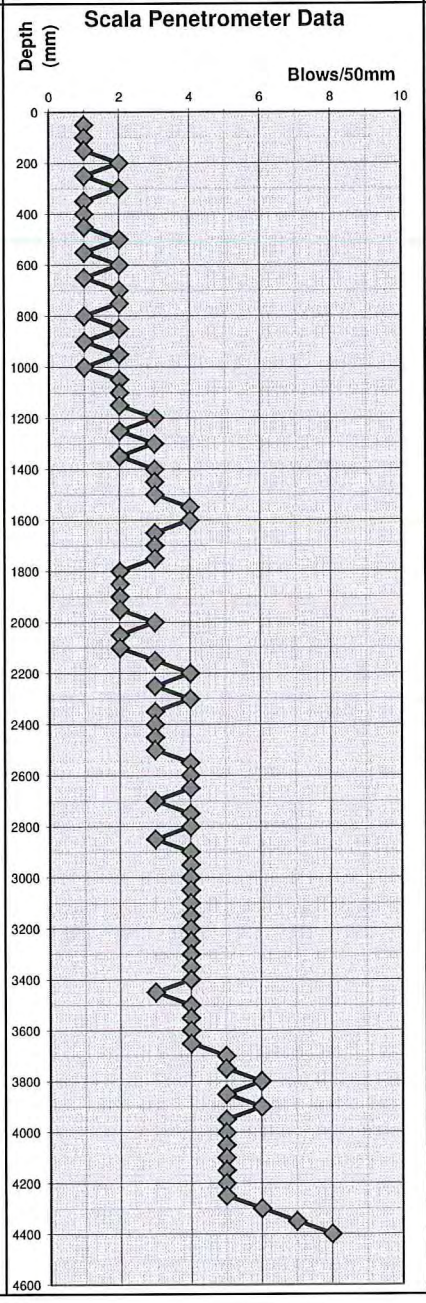
PROJECT: Te Mata Mushroom Farm, Geotechnical Investigation
CLIENT: Tonkin & Taylor Ltd
ENGINEER: Tonkin & Taylor Ltd
DATE & TIME: 16-May-13
TESTED BY: ES
TEST SITE: 4 - 6
LOCATION: Refer photos page 1 and attached A3 plan
TEST METHODS: Scala Penetrometer

Report Number: CSR13/020

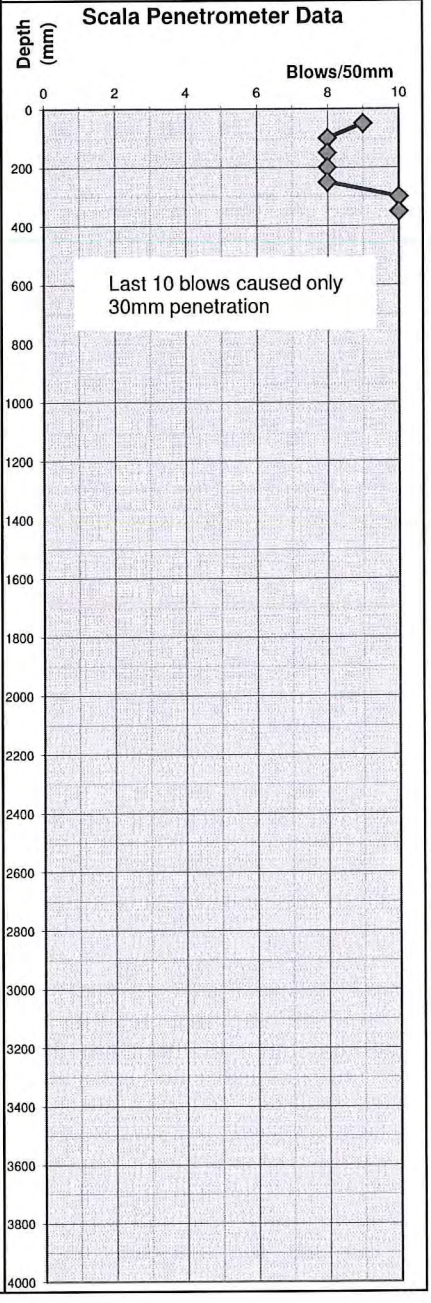
SITE 4



SITE 5



SITE 6



Comments:
Testing at site 5 did not reach refusal (10blows/50mm or more), and maximum depth had already exceeded the 4m maximum depth indicated by Tonkin & Taylor representative.

Testing Specifications/Notes:
Scala testing specification NZS 4402:1988 Test 6.5.2.

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TONKIN & TAYLOR LTD

EXCAVATION LOG

BOREHOLE No: TP(1)
Location: 174 Brookvale Rd Havelock North
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Road, — JOB No: 29272

CO-ORDINATES: mN 2845055.89 mE 6164467.10 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED:

R.L. m — EQUIPMENT: 15 T Excavator — EXCAV FINISHED:

DATUM — OPERATOR: 4m deep x 1m wide — LOGGED BY: SRS

DIMENSIONS: — CHECKED BY:

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 50 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
					0			0 - 0.3m gravelly Silt, Dark Brown moist, contains Rootlets, firm	m	F		Top Soil	
	Not Required				1			0.3m Silt & minor clay, V. stiff moist, Orange Brown mottled. Low plasticity. trace Sand	m	V.St		Alluvial deposits (cohesive)	
					2								
					3			3.0m Becomes moist to wet. Stiff	m to w	St			
		3.8m			4			3.8m Sandy Silt, Contains gravel (Rounded). Bluish grey. firm, Sensitive. Saturated. Low plasticity	S	F			
								End of TP at 4.0m. Backfilled & Compacted by Bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

TONKIN & TAYLOR LTD

EXCAVATION LOG

BOREHOLE No: TP (2)
Location: 174 Brookvale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29272

CO-ORDINATES: mN 2 68 5084.29, mE 6 164 576.62 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED: 29/04/2013

EQUIPMENT: 15 T Excavator — EXCAV FINISHED: 29/04/2013

R.L. m — OPERATOR: — LOGGED BY: SRS

DATUM — DIMENSIONS: 4m deep x 1m wide — CHECKED BY:

EXCAVATION TESTS				ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
				0			0-0.3m Gravelly Silt, Dark Brown moist, contains Rootlets. firm	m	F		Topsoil	
	No support required	Dry on completion		0.3			0.3m Silt with minor clay. Contains gravel, trace Sand. Orange brown Mottled, V. stiff, dry	V.St	dry		Alluvial deposits (cohesive)	
				1			1.5m becomes V. stiff to Hard	V.St to Hard	dry			
				2			2.0m Gravel. Rounded (River gravel?), Dense, Clast supported with minor Sand Matrix. Poorly Sorted.	D	Moist		Alluvial deposits (granular)	
				3			3m Becomes wet	D	Wet			
				4			End of TP @ 4.0m Backfilled & compacted using Bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

TONKIN & TAYLOR LTD

EXCAVATION LOG

BOREHOLE No: TP③
Location: 174 Brookvale Rd Havelock nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29272

CO-ORDINATES: mN 2845023.73, mE 6164570.81 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED:

EQUIPMENT: 15 T Excavator — EXCAV FINISHED:

R.L. m — OPERATOR: 4m deep × 1m wide — LOGGED BY: SRS

DATUM — DIMENSIONS: — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 100 150 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
					0			0–0.3m gravelly silt, Dark brown, moist, contains rootlets	m	f		Topsoil	
	No Support Required				1			0.3m Silt with minor clay V.Stiff, contains gravel. Orange Brown mottled. dry. Low plasticity.	d	V.St		Alluvial deposits (cohesive)	
					2			1.2m Becomes V.Stiff to Hard	d	V.St to Hard			
		3.3m			3			3.7m Gravel, Rounded (River gravel?). Dense, Clast Supported with minor sand matrix. Poorly Sorted. Wet	W			Alluvial deposits (granular	
					4								

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

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EXCAVATION LOG

BOREHOLE No: TP (4)
Location: 174 Brookvale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29272

CO-ORDINATES: mN 2844970.30 mE 6164557.33 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED: 29/04/2013

EQUIPMENT: 15T Excavator — EXCAV FINISHED: 29/04/2013

R.L. m — OPERATOR: — LOGGED BY: SRS

DATUM — DIMENSIONS: 3.8m deep x 1m wide — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION					GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 50 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
								0-0.3m Gravelly Silt, Dark Brown, Moist, Contains Rootlets	M	f		TopSoil	
	No Support Required				1			0.3m Silt with minor clay. V.Stiff, Contains gravel. Orange Brown Mottled Moist.	M	V.St			
					2			2.0m Becomes stiff, moist to wet	M to W	St			
		3.8m			3			3.0m Becomes firm to stiff, wet to Saturated	W to Sat	f to St			
					4			End of TP at 3.8m. Backfilled & Compacted by digger bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

TONKIN & TAYLOR LTD

EXCAVATION LOG

BOREHOLE No: TP⑤
Location: 174 Brookdale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29772

CO-ORDINATES: mN 2844903.13, mE 6164623.14 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED: 29/04/2013

R.L. m — EQUIPMENT: 15T Excavator — EXCAV FINISHED: 29/04/2013

DATUM — OPERATOR: — LOGGED BY: SRS

DIMENSIONS: 4m deep x 1m wide — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION					GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 20 50 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
								0-0.3m Gravelly silt, Dark Brown, moist, Contains Rootlets	m	f		Topsoil	
	No Support Required				1			0.3m Silt with minor clay. Stiff, moist, Low plasticity. occassional gravel Orange Brown Mottled	m	st			
					2			2.5m Becomes moist to wet, firm to stiff, mod plasticity	m to w	f to st			
		3.6m			3			3.0m Sandy silt with minor clay. Bluish grey, wet to saturated, firm, moderate plasticity. occassional gravel, Sensitive	w to sat	f			
					4			End of TP at 4.0m. Backfilled & compacted by digger bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

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EXCAVATION LOG

BOREHOLE No: TP (6)
Location: 174 Brookvale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mutu Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29272

CO-ORDINATES: mN 2844824.68, mE 6164687.81 — EXPOSURE TYPE: Test pit — EXCAV. STARTED: 29/04/2013

EQUIPMENT: 15T Excavator — EXCAV FINISHED: 29/04/2013

R.L. m — OPERATOR: — LOGGED BY: SRS

DATUM — DIMENSIONS: 4m deep x 1m wide — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
1 2 3	No Support Required	3.7			0		SM	0 - 0.3m Gravelly silt, Dark Brown moist, Contains Rootlets	m	F	50 100 150 200	Topsoil	
					1			0.3m Silt with minor clay V.stiff, moist, Low plasticity occassional gravel orange Brown mottled	m	V. St			
					2			2.5m Becomes moist to wet, firm to stiff, Mid plasticity	m to w	f to St			
					3			3.0m Sandy Silt with minor clay wet to saturated, Bluish grey, firm, moderate plasticity. occassional gravel, Sensitive	w to sat	f			
					4			End of TP at 4.0m. Backfilled & Compacted by digger bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

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EXCAVATION LOG

BOREHOLE No: TP (7)
Location: 174 Brookvale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd, Havelock Nth — JOB No: 29272

CO-ORDINATES: mN 7845081.43, mE 6164422.46 — EXPOSURE TYPE: Test Pit — EXCAV. STARTED: 29/04/2013

R.L. m — EQUIPMENT: — EXCAV FINISHED: 29/04/2013

DATUM — OPERATOR: — LOGGED BY: SRS

DIMENSIONS: — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 100 200 300	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
								0 - 0.3m Gravelly silt, Dark Brown, moist, Contains Rootlets fm	m	F		Topsoil	
1 Collapsed Bot 3.2m	No Support Required	Dry on Completion	U		1 2			0.3m Silt with minor clay, V. stiff occassional gravel, orange Brown mottled. dry to Moist	d to m	V. st			
					3			2.5m Gravel with Minor Sand Contains cobbles, Source: River gravels? Dense, clast supported with minor Sand matrix Poorly sorted, wet					
					4			End of Test pit at 3.8m, Backfilled & compacted using Bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9/07

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EXCAVATION LOG

BOREHOLE No: TP (8)
Location: 174 Brookvale Rd Havelock Nth
SHEET 1 OF 1

PROJECT: Te Mata Mushroom Farm — LOCATION: 174 Brookvale Rd — JOB No: 29272

CO-ORDINATES: mN 2644913.76, mE 6164471.67 — EXPOSURE TYPE: Test pit — EXCAV. STARTED: 29/04/2013

EQUIPMENT: 15T digger — EXCAV FINISHED: 29/04/2013

R.L. m — OPERATOR: SRS — LOGGED BY: SRS

DATUM — DIMENSIONS: 4m deep x 1m wide — CHECKED BY:

EXCAVATION TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION (1 2 3)	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 50 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
					0			0-0.4m Gravelly silt, Dark brown moist, contains Rootlets, firm	m	F		Topsoil	
								0.4m Clayey silt, Blackish Brown, contains organics, firm, wet, mod Plasticity	w	f		Buried topsoil	
	No support required dry on completion				1			0.7m Silt with minor clay, occassional gravel, v.stiff, dry, gravel is Rounded, occassional Rootlets. Low Plasticity. orange brown Mottled	d	V. St			
					2			2.0m Gravelly Sand, moist. gravel is Rounded. Med dense orange brown mottled	m	MD			
					3								
					4			End of testpit at 4.0m, backfilled & compacted by digger bucket					

SKETCH

Log Scale 1:41.6666666666667

EXCAVLOG TP.GPJ 27/9.07

TEST PIT INVESTIGATION
TEST REPORT

WSP | OPUS

Project : Proposed Subdivison Consent
Location : Arataki Road, Havelock North
Client : Surveying The Bay
Contractor : WSP-Opus

Water level (m) : Not Encounted
Reduced level (m) : Existing Ground Level

TP 1 - E1934790 N5602991

Project No :	**2-S5376.00**
Lab Ref No :	**NA2061 / 1**
Client Ref No :	**'00001**

Test Results

Depth (m)	Shear Strength (kPa)	Sample Details	Material Description
0.20			SILT, Black, Soft, Moist, Non Plastic, Topsoil
0.50			Silty Fine SAND, Reddish Brown, Stiff, Moist, Minor Gravel
0.65			GRAVEL, Reddish Brown, Tight Packed, Moist, Traces of Sand & Silt, Well Graded 60mm Sub Rounded
1.10			SILT, Reddish Brown, Weakly Cemented, (Hard Pan)
2.50			GRAVEL, Reddish Brown, Tight Packed, Moist, Well Graded 200mm, Sub Rounded & Sub Angular, Minor Sand & Traces of Silt
			Test Pit END at 2.5mbgl, Target Depth Reached

Test Methods	Notes
Field Description of Soils and Rocks in Engineering Use, NZ Geomechanics Society	

Date tested : 14/09/18
Date reported : 02/10/18

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Approved

Designation : **Laboratory Manager**
Date : 02/10/18

WSP Opus
Napier Laboratory
Quality Management Systems Certified to ISO 9001

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Telephone +64 6 833 5590
Website www.wsp-opus.co.nz

TEST PIT INVESTIGATION
TEST REPORT

WSP | OPUS

Project : Proposed Subdivison Consent
Location : Arataki Road, Havelock North
Client : Surveying The Bay
Contractor : WSP-Opus

Water level (m) : Not Encounted
Reduced level (m) : Existing Ground Level

TP 2 - E1934224 N56022924

Project No :	**2-S5376.00**
Lab Ref No :	**NA2061 / 2**
Client Ref No :	**'00001**

Test Results

Depth (m)	Shear Strength (kPa)	Sample Details	Material Description
0.20			SILT, Black, Soft, Moist, Non Plastic
0.50			Silty Fine SAND, Reddish Brown, Soft, Moist
0.70			SILT, Light Brown, Soft, Moist, Low Plasticity, Traces of Gravel
0.90			Gravely SAND, Reddish Brown, Tight, Moist, 20mm
2.50			GRAVEL, Reddish Brown, Tight, Moist, Minor Sand & Traces of Silt, 200mm,
			Test Pit END at 2.5mbgl, Target Depth Reached

Test Methods	Notes
Field Description of Soils and Rocks in Engineering Use, NZ Geomechanics Society	

Date tested : 14/09/18
Date reported : 02/10/18

This report may only be reproduced in full

Approved

Designation : **Laboratory Manager**
Date : 02/10/18

WSP Opus
Napier Laboratory
Quality Management Systems Certified to ISO 9001

90 Prebensen Drive
Private Bag 6019, Hawkes Bay Mail
Centre, Napier 4142, New Zealand

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TEST PIT INVESTIGATION
TEST REPORT

Project : Proposed Subdivison Consent
Location : Arataki Road, Havelock North
Client : Surveying The Bay
Contractor : WSP-Opus

Water level (m) : Not Encounted
Reduced level (m) : Existing Ground Level

TP 4 - E1934910 N5602761

Project No :	**2-S5376.00**
Lab Ref No :	**NA2061 / 4**
Client Ref No :	**'00001**

Test Results

Depth (m)	Shear Strength (kPa)	Sample Details	Material Description
0.20			SILT, Black, Soft, Moist, Non Plastic, TOPSOIL
1.10			GRAVEL, reddish Brown, Tight Moist, Well Graded 60mm, Minor Sand & Silt Pockets of Clayey SILT at 0.80 & 0.85
2.50			GRAVEL, Reddish Brown, Some Sand, Tight,Moist, Well Graded, Sub rounded
			Test Pit END at 2.5mbgl, Target Depth Reached

Test Methods	Notes
Field Description of Soils and Rocks in Engineering Use, NZ Geomechanics Society	

Date tested : 14/09/18
Date reported : 02/10/18

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Approved

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TEST PIT LOG - TP03-25

Client: CDL Land NZ Ltd
Project: Arataki Residential Subdivision
Site Location: Havelock North
Project No.: NAP2024-0007
Date: 20/02/2025
Test Pit Location: Refer to Site Plan Logged by: KvR Checked by: MK Scale: 1:25 Sheet 1 of 1

CMW Geosciences
Great People | Practical Solutions

Position: 1934987.7mE; 5602654.2mN Projection: NZGD2000
Elevation: 25.00m Datum: NZVD2016
Pit Dimensions: 2.0m by 1.0m
Survey Source: HDC GIS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			25.0			OL: Fine sandy SILT: Brown. Low plasticity. Sensitive. Trace rootlets. (Topsoil)		VD	2	
			24.9			ML: Fine sandy SILT: Light brownish grey. Low plasticity. Moderately sensitive. (Pleistocene River Deposits)			2	
			24.6			GM: Fine to coarse sandy fine to coarse GRAVEL with trace cobbles: Light brownish white. Well graded. Subangular to subrounded. (Pleistocene River Deposits)	D	VD		
				1				MD	6	
									10	
									10	
								D	9	
									7	
									14	
							M	VD	2	
									1	
			23.0	2		GM: Fine to coarse GRAVEL with some fine to coarse sand, some silt, minor cobbles: Dark orange brown. Well graded. Subrounded to subgular. Red metal (Pleistocene River Deposits)	M to W	TP		
				3			W			
				4		Test pit terminated at 4.00 m				
				5						

Termination Reason: Target depth reached.
Shear Vane No: DCP No: 35

Remarks: Groundwater not encountered. DCP cconducted next to pit. DCP conducted at 1.0mbgl in pit. 26tn Excavator.

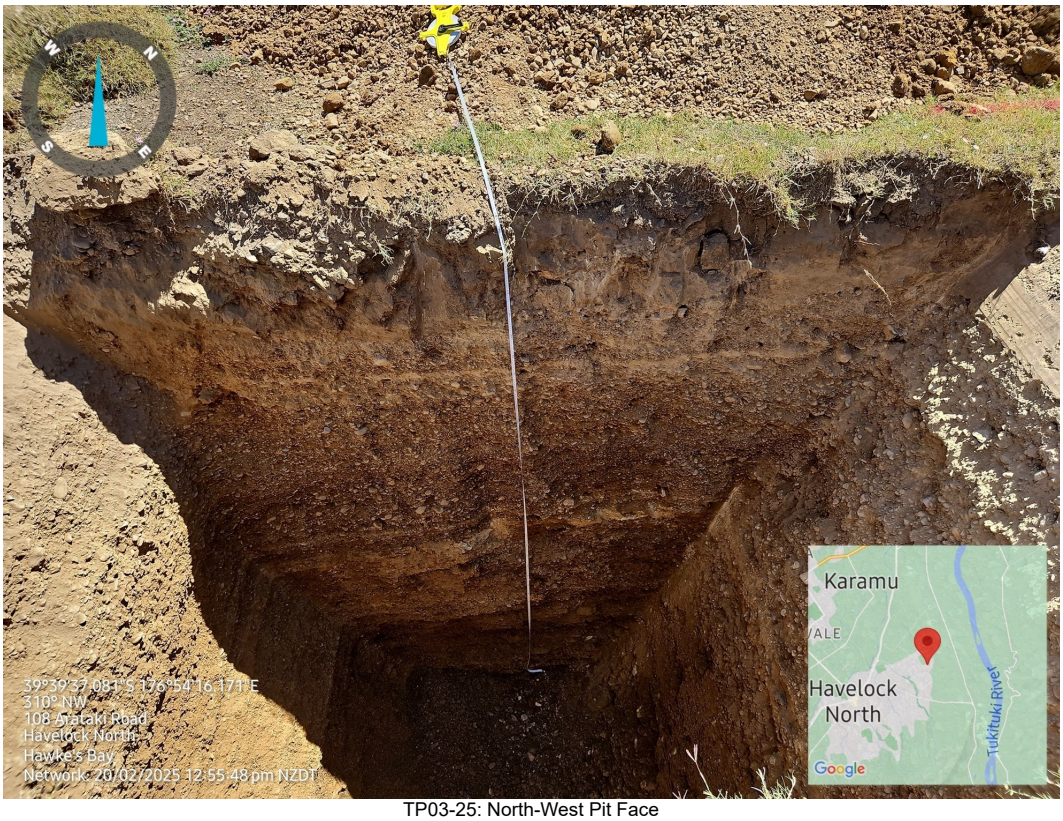
This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

PHOTOGRAPH SHEET - TP03-25

Client: CDL Land NZ Ltd
Project: Arataki Residential Subdivision
Location: Havelock North
Project ID: NAP2024-0007
Date: 20/02/2025

CMW Geosciences
Great People | Practical Solutions

TP03-25: North-East Pit Face



TP03-25: North-West Pit Face

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP09
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602940.24mN, 1935199.22mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil
0.5	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium
1.5	SILT with minor sand and clay: light brown, very stiff, low plasticity, moist to wet.	
2.0	Clayey SILT with minor fine sand: Light greyish-brown with trace to minor brownish mottle, very stiff, high plasticity, wet.	
3.5	GRAVEL with some sand, minor silt and trace clay: bluish grey, dense, saturated.	
4.0		

Water: ◁ at 3.0 m

In-situ Testing
Shear Vane, Su (kPa): 50, 100, 150, 200
Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

Depth (m)	Shear Vane Values (kPa)
0.5	191 / 44 (4.3)
1.0	172 / 34 (5.1)
1.5	156 / 50 (3.1)
2.0	159 / 37 (4.3)
2.5	141 / 34 (4.1)
3.0	144 / 37 (3.9)
3.5	159 / 37 (4.3)

Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP10
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602729.82mN, 1935386.54mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	TS	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil				0.0
0.5		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium		● ●	219+ 219+	-0.5
1.0		Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), moist to wet.					-1.0
1.5							-1.5
2.0							-2.0
2.5							-2.5
3.0							-3.0
3.5							-3.5
4.0		GRAVEL with minor sand, silt and trace clay: light greyish brown, dense, saturated.		◁			-4.0

Hole Depth: 4.00m

Termination: Safe Excavation Depth

Remarks:

Groundwater seepage can be seen at the base of the pit in the Photo.

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP11
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602668.96mN, 1935455.83mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	TS	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil	Groundwater Not Encountered			-0.0
0.5		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium			206 / 56 (3.7)	-0.5
1.0		SILT with minor sand and clay: light greyish brown, very stiff, low plasticity, moist to wet.				219+	-1.0
1.5		Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), moist to wet. Fine to medium with some coarse gravel.				219+	-1.5
2.0		GRAVEL with minor sand, silt and trace clay: light greyish brown, dense, moist to wet. Fine to coarse with trace cobbles.					-2.0
2.5		2.5m: .. Becoming wet.					-2.5
3.0							-3.0
3.5							-3.5
4.0							-4.0

Hole Depth: 4.40m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005) .

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP12**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602506.73mN, 1935424.77mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil
0.5	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium
1.0	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), moist to wet. Fine to medium with some coarse gravel.	
1.5	GRAVEL with minor sand, silt and trace clay: light greyish brown, dense, moist to wet. Fine to coarse with trace cobbles.	
2.0		
2.5	2.5m: .. Becoming wet.	
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0	GRAVEL with minor sand and silt: dark grey, tightly packed, wet to saturated. Fine to coarse with trace cobbles.	

Water: ◁ at 6.0

In-situ Testing

Shear Vane, Su (kPa): 50, 100, 150, 200

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)	Vane ID: 19	peak / residual (sensitivity)
206 / 56 (3.7)		

Hole Depth: 6.00m

Termination: Safe Excavation Depth

Remarks:

Maximum excavator reach.

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP13**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602399.29mN, 1935360.58mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil
0.3	Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium
0.5	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), moist to wet. Fine to medium with some coarse gravel.	
1.0	GRAVEL with minor sand, silt and trace clay: light greyish brown, dense, moist to wet. Fine to coarse with trace cobbles.	
2.5	2.5m: .. Becoming wet.	

Water: Groundwater Not Encountered

In-situ Testing

Shear Vane, Su (kPa): 50, 100, 150, 200

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)

Vane ID: 19

peak / residual (sensitivity)

206 / 56 (3.7)

Depth (m): -1.0, -2.0, -3.0, -4.0

Hole Depth: 4.40m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005) .

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP14
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602592.59mN, 1935246.79mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	TS	TOPSOIL: Brown organic SILT with some sand and minor clay.	Topsoil				
0.5		Sandy SILT with trace to minor clay: Light yellowish-brown with slight orangish-brown mottle, very stiff to hard, low plasticity, moist.	Alluvium			191 / 56 (3.4)	
1.0		Sandy GRAVEL with some silt and trace clay; brownish grey, tightly packed (dense to very dense), moist to wet. Fine to medium with some coarse gravel.					-1.0
1.5		GRAVEL with minor sand, silt and trace clay: bluish grey, dense, wet (Saturated at 2.0m).					
2.0				◁			-2.0
2.5							
3.0							-3.0
3.5							
4.0							-4.0
4.5		Silty CLAY with trace fien sand: grey, very stiff to hard, high plasticity, saturated.				206 / 56 (3.7) 219+	
5.0							-5.0

Hole Depth: 5.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP15
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602941.62mN, 1934881.08mE	**Test Date:**	26/05/2025
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: N/A peak / residual (sensitivity)	Depth (m)
0.0		FILL: Varying colours and composition. Significant organic soils and wood debris encountered. Some bluish grey soils with organic odour also encountered. Fill is with some to minor gravel but becomes gravelly below ~1.0m in the location investigated. The natural soils are considered to be indicated by the brownish Gravel unit at the base of the pit which was similar to natural units encountered across the site.	Uncertified Fill	Groundwater Not Encountered			-1.0
3.5		Sandy GRAVEL with some silt and trace clay; light brown, tightly packed (dense to very dense), moist.	Alluvium				-2.0
							-3.0

Hole Depth: 3.80m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

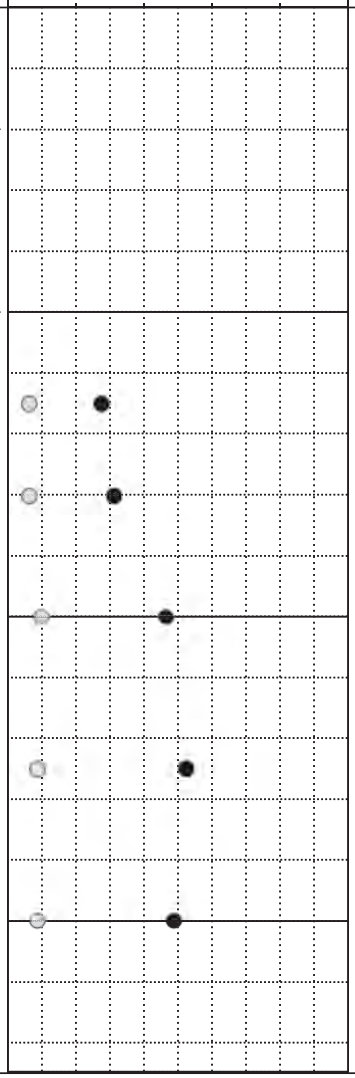
HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP16
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602665.77mN, 1935140.14mE	**Test Date:**	17/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water
	Gravel FILL.	FILL	
	FILL - Sandy SILT; yellowish brown, wet.	Alluvium	
0.5	Sandy SILT with minor clay & organics; blackish-brown, low plasticity, moist. Organic odor.	FILL	
1.0	1.0m: --> Heavy Seepage into the hole.		
	SILT with some sand and minor clay: light bluish grey, stiff to very stiff, moderate plasticity, wet to saturated.	Alluvium	
1.5			
2.0			
2.5			
3.0			
	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.		



Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

Depth (m)	Shear Vane Values (kPa)
1.0	69 / 16 (4.3)
1.5	78 / 16 (4.9)
2.0	116 / 25 (4.6)
2.5	131 / 22 (6.0)
3.0	122 / 22 (5.5)

Hole Depth: 3.40m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

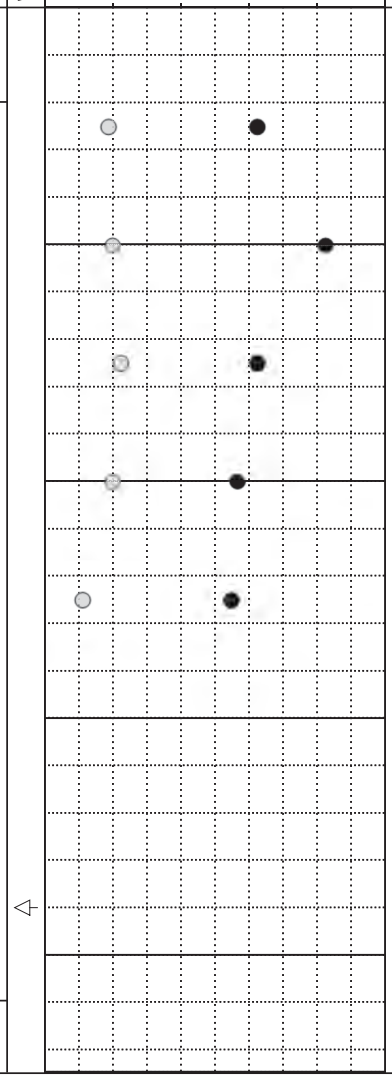
HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP17
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602857.53mN, 1935155.26mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	Gravel FILL.	FILL
	Sandy SILT with trace to minor clay: Light yellowish-brown, very stiff to hard, low plasticity, moist. Possible Fill.	
0.5	SILT with minor clay & sand: light brown, very stiff to hard, low plasticity, moist.	Alluvium
2.5	2.5m: ...becoming Sandy.	
3.0	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
4.0		



Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP18
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602911.29mN, 1935249.16mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	Sandy SILT with trace to minor clay: blackish-brown, low plasticity, moist to wet. Slight organic odor.	Organic Soils				0.0
1.0	Sandy SILT with minor clay: light greyish brown, very stif, low plasticity, moist to wet.	Alluvium			116 / 37 (3.1)	-1.0
1.5	Sandy GRAVEL with some silt and trace clay; light brown to yellowish brown, moderate to tightly packed (medium dense to very dense), wet to saturated. 1.5m: --> Slight Seepage into the hole.		◁			
2.0	Sandy GRAVEL with some silt and trace clay; brownish grey, tightly packed (medium dense to very dense), saturated. 2.0m: --> Heavy Seepage into the hole. Saturated.		◁			-2.0
3.0	3.4m: ... With minor cobbles.					-3.0
4.0						-4.0

Hole Depth: 3.50m

Termination: Safe Excavation Depth / Hole

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP19**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602855.75mN, 1935258.97mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology
0.0	TS	TOPSOIL.	Topsoil
0.5		Sandy SILT with minor clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium
1.0			
1.5		1.6m: ...becoming moist to wet.	
2.0		Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
2.5			
3.0			
3.5		3.5m: ... With minor cobbles and wet.	
4.0			

Water: Groundwater Not Encountered

In-situ Testing

Shear Vane, Su (kPa): 50, 100, 150, 200

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)	Depth (m)
Vane ID: 19	
peak / residual (sensitivity)	
159 / 25 (6.4)	-1.0
156 / 31 (5.0)	
172 / 41 (4.2)	-2.0
112 / 41 (2.7)	
172 / 47 (3.7)	-3.0
	-4.0

Hole Depth: 4.00m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP20**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602865.02mN, 1935320.02mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: N/A peak / residual (sensitivity)	Depth (m)
0.5		Sandy SILT with trace to minor clay: blackish-brown, low plasticity, moist to wet. Slight organic odor.	Organic Soils				-1.0
1.0							
1.5		Sandy GRAVEL with some silt and trace clay; light brown to yellowish brown, moderate to tightly packed (medium dense to very dense), wet to saturated. 1.5m: --> Heavy Seepage into the hole. Saturated.	Alluvium	◁			-2.0
2.0		Sandy GRAVEL with some silt and trace clay; brownish grey, tightly packed (medium dense to very dense), saturated. 2.0m: ... With minor cobbles.					
2.5							-3.0
3.0							
3.5							-4.0
4.0							

Hole Depth: 3.40m

Termination: Safe Excavation Depth / Hole

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP21
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602812.79mN, 1935317.06mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL.	Topsoil
0.5	Sandy SILT with minor clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium
1.5	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
2.0	2.0m: ...becoming moist to wet.	
3.2	3.2m: ... With minor cobbles and wet.	
4.0		

Water: Groundwater Not Encountered

In-situ Testing
Shear Vane, Su (kPa): 50, 100, 150, 200
Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

- 187 / 28 (6.7)
- 172 / 34 (5.1)
- 219+

Hole Depth: 4.00m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP22**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602808.42mN, 1935400.89mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.5	Sandy SILT with trace to minor clay: blackish-brown, low plasticity, moist to wet. Slight organic odor.	Organic Soils
1.0	Sandy GRAVEL with some silt and trace clay; light brownish grey, loosely packed (loose to medium dense), wet. 0.9m - 1.0m: ...minor seepage into the pit.	Alluvium
	SILT with minor sand & clay: light yellowish brown, very stiff, low plasticity, moist to wet.	
1.5	SILT with some sand and clay: light greyish brown, very stiff to hard, low plasticity, moist to wet.	
2.0		
2.5		
3.0		
3.5	Sandy SILT with minor to trace clay: light bluish grey, very stiff to hard, low plasticity, moist to wet.	
4.0		

Water

In-situ Testing

Shear Vane, Su (kPa): 50, 100, 150, 200

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Depth (m)	Shear Vane Values (kPa) (Vane ID: 19) peak / residual (sensitivity)
1.0	141 / 31 (4.5)
1.5	219+
2.0	219+
2.5	219+
3.0	172 / 41 (4.2)

Hole Depth: 4.00m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP23
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602652.37mN, 1935375.85mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water
0.0	TOPSOIL.	Topsoil	
0.5	Sandy SILT with trace clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium	
	Sandy GRAVEL with some silt and trace clay; light brown, tightly packed (dense to very dense), moist.		
1.0	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), moist to wet.		
1.5			
2.0	2.0m: ...with minor to some cobbles. 2.1m: --> heavy seepage into the hole. Saturated.		◁
2.5	Clayey SILT with trace sand: grey, very stiff to hard, high plasticity, saturated.		
3.0			
3.5			
4.0			

In-situ Testing
Shear Vane, Su (kPa): 50, 100, 150, 200
Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

- 153 / 28 (5.5)
- 191 / 41 (4.7)
- 187 / 34 (5.5)
- 219+
- 219+

Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP24**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602580.60mN, 1935307.51mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL.	Topsoil
0.5	Sandy SILT with trace clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium
	Sandy GRAVEL with some silt and trace clay; light brown, tightly packed (dense to very dense), wet.	
1.0		
	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense), wet. 1.4m: ...with minor to some cobbles. 1.5m: --> heavy seepage into the hole. Saturated.	
1.5		
2.0		
	Clayey SILT with trace sand: grey, very stiff to hard, high plasticity, saturated.	
2.5		
3.0		
3.5		
4.0		

Water

In-situ Testing

Shear Vane, Su (kPa): 50, 100, 150, 200

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Depth (m)	Shear Vane Values (kPa) — Vane ID: 19, peak / residual (sensitivity)
0.5	147 / 37 (4.0)
2.0	219+
2.5	219+
3.0	219+
3.5	219+
4.0	219+

Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP25
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602541.17mN, 1935369.15mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	TS	TOPSOIL.	Topsoil				0.0
0.5		Sandy SILT with trace clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium		●	219+	
1.0		Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.					-1.0
1.5		1.4m: ...with minor to some cobbles.					
2.0		2.0m: --> heavy seepage into the hole. Saturated.		◁			-2.0
2.5							
3.0							-3.0
3.5							

Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP26
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602464.67mN, 1935367.05mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	TOPSOIL.	Topsoil
0.5	Sandy SILT with trace clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium
1.0	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
1.5	1.6m: ...with minor to some cobbles.	
2.0	2.2m: ...becoming wet.	
2.5		
3.0		
3.5		
4.0		

Water: Groundwater Not Encountered

In-situ Testing
Shear Vane, Su (kPa): 50, 100, 150, 200
Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)
219+

Depth (m): -1.0, -2.0, -3.0, -4.0

Hole Depth: 4.20m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

HAWKE'S BAY GEOTECH

Test Pit Log

Test ID: TP27
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602763.65mN, 1935228.07mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)
0.0	Gravel FILL.	FILL			
0.5	SILT with minor clay & sand: light brown, very stiff to hard, low plasticity, moist.	Alluvium			209 / 50 (4.2)
1.0					153 / 41 (3.7)
1.5	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.				141 / 34 (4.1)
2.0	2.2m: --> moderate to heavy seepage into the hole. Becoming saturated.		◁		
2.5					
3.0	3.0m: ...with some cobbles.				
3.5					

-1.0 -2.0 -3.0

Hole Depth: 3.50m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP28
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602665.77mN, 1935140.14mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	Gravel FILL.	FILL
	Sandy SILT with trace to minor clay: blackish-brown, low plasticity, moist. Chemical odor.	Alluvium
0.5	SILT with some sand and minor clay: light bluish grey, very stiff to hard, low plasticity, moist. Very slight chmical odor in the upper 0.3m.	
1.0		
1.5	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
2.0		
2.5	Sandy GRAVEL with minor silt and cobbles; brownish grey, tightly packed (dense to very dense), wet to saturated (below ~3.2m).	
3.0	3.2m: --> Heavy Seepage into the hole.	
3.5		
4.0		

Water: ◁ at 3.2m

In-situ Testing
Shear Vane, Su (kPa): 50 100 150 200
Dynamic Cone Penetrometer (blows / 50mm): 2 4 6 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

- 219+
- 172 / 44 (3.9)

Depth (m): -1.0, -2.0, -3.0, -4.0

Hole Depth: 4.00m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP29
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602718.63mN, 1935164.59mE	**Test Date:**	05/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology
0.0	Gravel FILL.	FILL
0.5	Clayey SILT with trace sand: light greyish brown, very stiff to hard, high plasticity, moist.	Alluvium
1.0		
1.5	Sandy SILT with minor gravel and clay: light brown, very stiff, low plasticity, moist to wet.	
	Sandy GRAVEL with some silt and trace clay; light brownish grey, tightly packed (dense to very dense), wet.	
2.0	2.0m: ...becoming cobbley.	
	2.2m: --> slight seepage into the hole.	
2.5		
3.0		
3.5		
4.0		

Water: ◁ at 2.2m

In-situ Testing
Shear Vane, Su (kPa): 50, 100, 150, 200
Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane Values (kPa)
Vane ID: 19
peak / residual (sensitivity)

- 1.0m: 219+
- 1.5m: 219+
- 2.0m: 156 / 28 (5.6)

Depth (m): -1.0, -2.0, -3.0, -4.0

Hole Depth: 3.50m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005).

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID: TP30
Project ID: 25030
Sheet: 1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602718.63mN, 1935164.59mE	**Test Date:**	17/03/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: N/A peak / residual (sensitivity)	Depth (m)
0.0	Topsoil & Gravel FILL.	FILL	Groundwater Not Encountered			0.0
0.5	FILL Sandy GRAVEL: grey, medium dense, moist.					-0.5
	Sandy GRAVEL: brownish grey, medium dense to dense, moist.	Alluvium				
1.0	SILT with some sand and minor clay: light brown, hard, low plasticity, moist to wet.					-1.0
	SAND with minor silt; light brown, very dense (comes out in blocks), moist.					
1.5						-1.5
	Sandy SILT with minor clay; light yellowish brown, hard, moist to wet.					
2.0						-2.0

Hole Depth: 2.00m

Termination: Target Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Shear Vane Testing was unable to penetrate the hard units.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005) .

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

HAWKE'S BAY GEOTECH

Test ID:	**TP31**
Project ID:	25030
Sheet:	1 of 1

Client:	Ed Sundstrum C/o Vermont Street Partners No. 4	**Coordinates:**	5602745.05mN, 1935317.07mE	**Test Date:**	10/04/2026
Project:	Geotechnical Investigations	**System:**	NZTM	**Logged By:**	CJG
Location:	174 & 176 Brookvale Road, Havelock North	**Elevation:**	Ground	**Checked By:**	CJG
Test Site:	Refer to Test Location Plan	**Located By:**	Site Map		

Depth (m)	Material Description	Geology	Water	In-situ Testing: Shear Vane, Su (kPa) 50 100 150 200 / Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8	Shear Vane Values (kPa) Vane ID: 19 peak / residual (sensitivity)	Depth (m)
0.0	TOPSOIL.	FILL				
0.5	SILT with some sand & trace clay: light brown, very stiff to hard, low plasticity, moist.	Alluvium			219+	
1.0					219+	-1.0
1.5	Sandy GRAVEL with trace silt; light brownish grey, tightly packed (dense to very dense), wet (saturated at contact with underlying low permeability silt layer.					
2.0	2.0m: Moderate seepage into the hole. Becoming saturated within the gravels.		◁			-2.0
2.5	SILT with some clay & minor sand: light brown, very stiff to hard, moderate plasticity, wet. B 2.50m - 2.8m: [TP31-2.5m] Particle Size Distribution & Atterberg Limits. PI = 13, Fines Content = 80%				219+	
3.0					219+	-3.0
3.5	Sandy SILT: light grey, very stiff to hard, low plasticity, wet to saturated. Note: in-situ soil behaviour is silt like. B 3.60m - 4m: [TP31-3.6m] Particle Size Distribution & Atterberg Limits. PI = 11, Fines Content = 29%				219+	
4.0					219+	-4.0
4.5	Sandy SILT with trace clay: grey, very stiff to hard, low - moderate plasticity, wet - saturated. B 4.50m - 4.8m: [TP31-4.5m] Particle Size Distribution, Fines Content = 43%				UTP	

Hole Depth: 5.00m

Termination: Safe Excavation Depth

Remarks:

14 Ton Excavator used. Soils were piled separately and replaced in their natural order with bucket compaction and track rolling at surface.

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005) .

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

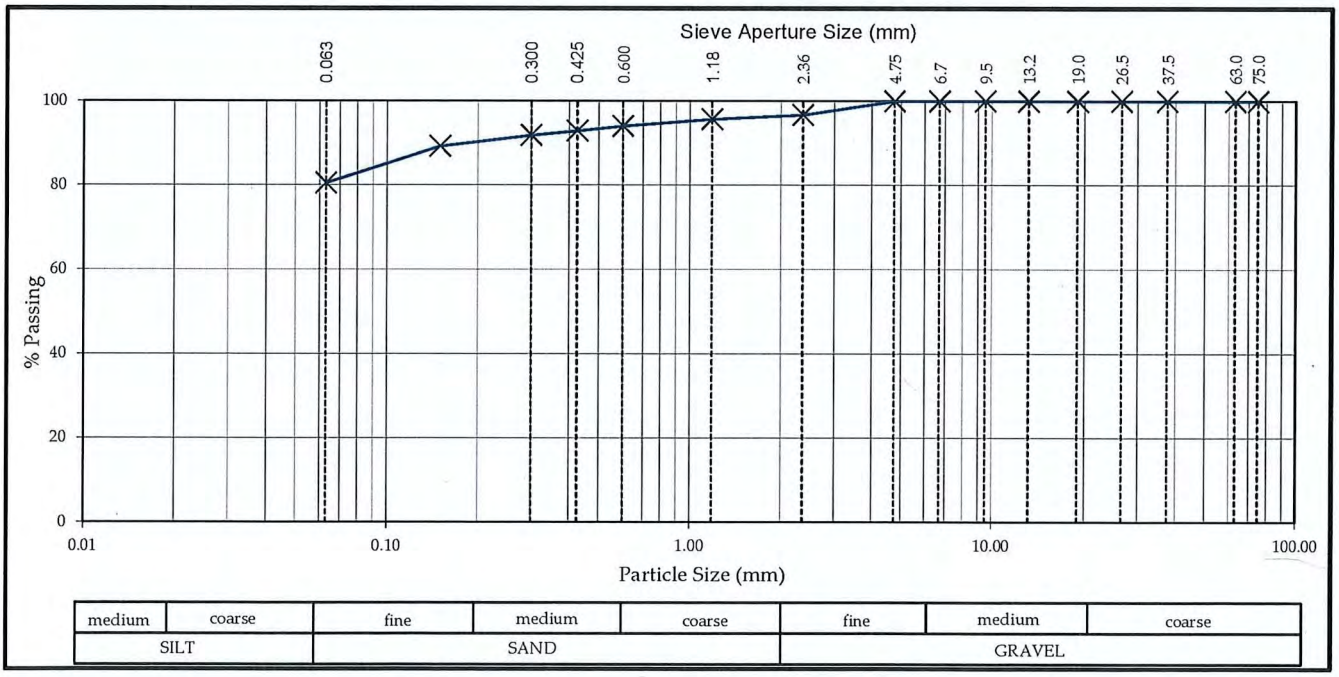
WET SIEVE ANALYSIS
TEST REPORT

Project :	Brookvale Rd Development
Location :	Brookvale Rd
Client :	C. Goss
Contractor :	Hawkes Bay Geotech Limited
Sampled by :	Client
Date sampled :	10/04/26
Sampling method :	Unknown
Sample description :	SILT with some some sand & trace of gravel
Sample condition	As Received
Bore hole no :	TP31
Depth (m) :	2.5m

Project No :	2 - L0696.24
Lab Ref No :	NA10594
Client Ref No :	26030

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	100	4.75	100	0.425	93
63.00	100	13.20	100	2.36	97	0.300	92
37.50	100	9.50	100	1.18	96	0.150	89
26.50	100	6.70	100	0.600	94	0.063	81



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: TP 33 - 2.5m Fraction tested: Whole Dispersant Used: Nil All information supplied by Client *Fraction passing finest sieve is by difference.*

Date tested : 17/04/26
Date reported : 21/04/26

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full

Approved Signatory

Designation : *Laboratory Manager*
Date : 21/04/26

ACCREDITED IANZ TESTING LABORATORY

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WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone 06 833 5590
Website www.wsp.com/nz

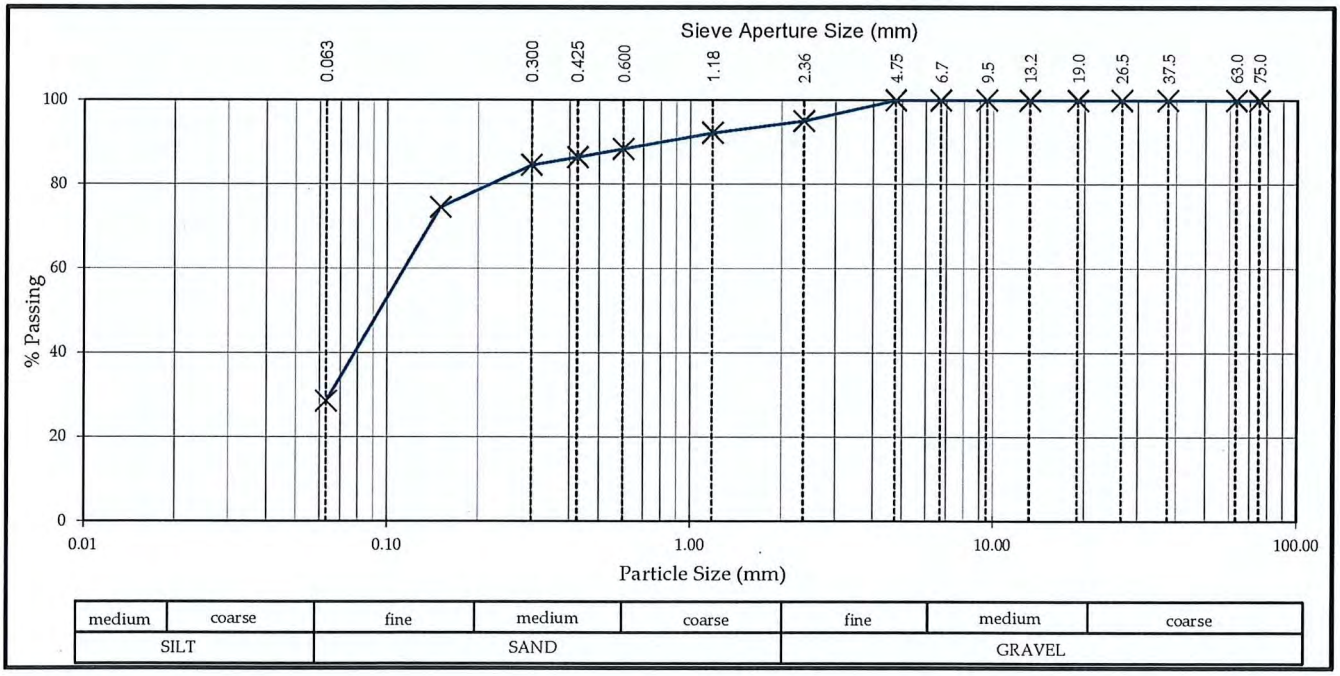
WET SIEVE ANALYSIS
TEST REPORT

Project :	Brookvale Rd Development
Location :	Brookvale Rd
Client :	C. Goss
Contractor :	Hawkes Bay Geotech Limited
Sampled by :	Client
Date sampled :	10/04/26
Sampling method :	Unknown
Sample description :	Silty SAND with trace gravel
Sample condition	As Received
Bore hole no :	TP31
Depth (m) :	3.6m

Project No :	2 - L0696.24
Lab Ref No :	NA10594
Client Ref No :	26030

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	100	4.75	100	0.425	86
63.00	100	13.20	100	2.36	95	0.300	85
37.50	100	9.50	100	1.18	92	0.150	75
26.50	100	6.70	100	0.600	88	0.063	29



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: TP 33 - 3.6m Fraction tested: Whole Dispersant Used: Nil All information supplied by Client *Fraction passing finest sieve is by difference.*

Date tested : 17/04/26
Date reported : 21/04/26

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Approved Signatory

Designation : *Laboratory Manager*
Date : 21/04/26

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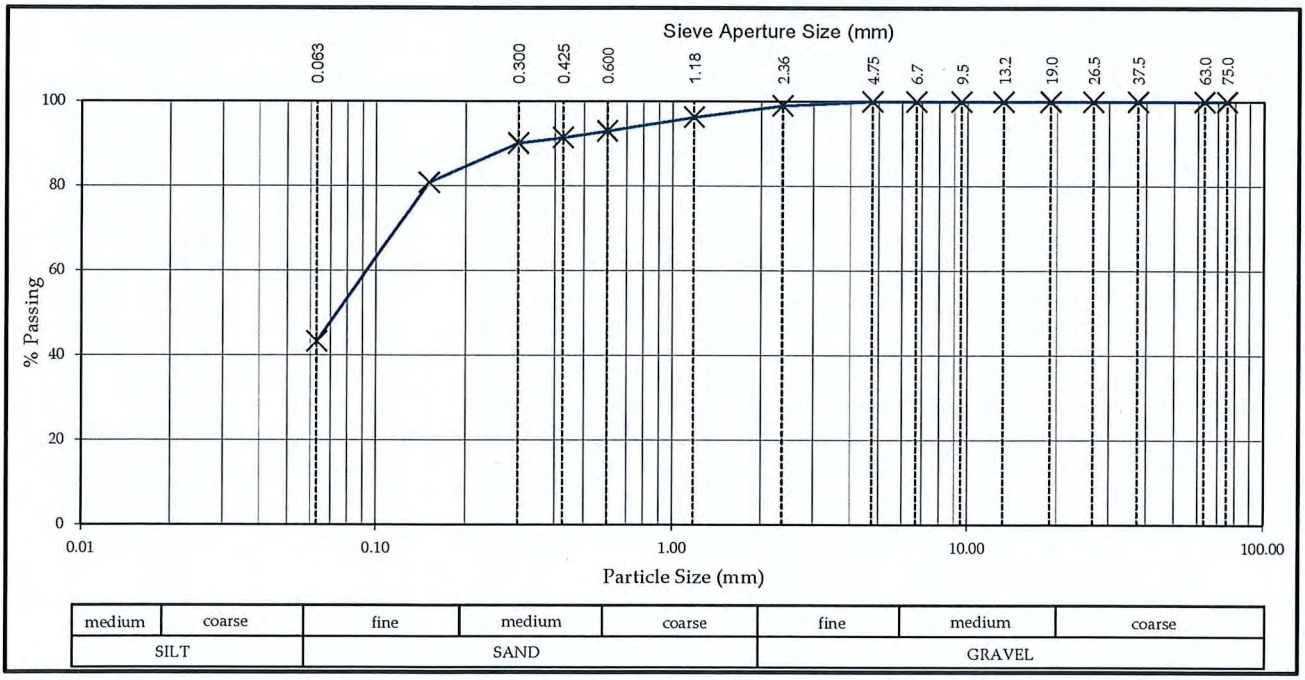
WET SIEVE ANALYSIS
TEST REPORT

Project :	Brookvale Rd Development
Location :	Brookvale Rd
Client :	C. Goss
Contractor :	Hawkes Bay Geotech Limited
Sampled by :	Client
Date sampled :	10/04/26
Sampling method :	Unknown
Sample description :	Silty SAND with trace gravel
Sample condition	As Received
Bore hole no :	TP31
Depth (m) :	4.5m

Project No :	2 - L0696.24
Lab Ref No :	NA10594
Client Ref No :	26030

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	100	4.75	100	0.425	91
63.00	100	13.20	100	2.36	99	0.300	90
37.50	100	9.50	100	1.18	96	0.150	81
26.50	100	6.70	100	0.600	93	0.063	43



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received water content :- 25.3%
NZS 4402 : 1986, Test 2.1	Fraction tested: Whole
	Dispersant Used: Nil
	All information supplied by Client
	Fraction passing finest sieve is by difference.

Date tested : 17/04/26
Date reported : 21/04/26

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Approved Signatory

Designation : *Laboratory Manager*
Date : 21/04/26

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PLASTICITY INDEX FOR SOILS
TEST REPORT

Project :	Brookvale Rd Development
Location :	Brookvale Rd
Client :	C. Goss
Contractor :	Hawkes Bay Geotech Limited
Sampled by :	Client
Date sampled :	10/04/26
Sampling method :	Unknown
Sample description :	SILT with some sand & trace of gravel
Sample condition :	As Received
Sample reference:	TP 31
Sample depth:	2.5m

Project No :	2-L0696.24
Lab Ref No :	NA10594
Client Ref No :	26030

Test Results		
Liquid Limit :	41	
Plastic Limit :	28	
Plasticity Index :	13	
Natural Water Content :	25.6	%
Linear Shrinkage (%):	9	

Test Methods		Notes
Liquid Limit	NZS 4402 : 1986, Test 2.2	Materials used: Passing 425um sieve
Plastic Limit	NZS 4402 : 1986, Test 2.3	
Plasticity Index	NZS 4402 : 1986, Test 2.4	
Water Content	NZS 4402 : 1986, Test 2.1	All information supplied by Client
Linear Shrinkage	NZS 4402: 1986, Test 2.6	

Date tested : 18/04/26
Date reported : 21/04/26

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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Approved Signatory

Designation : *Laboratory Manager*
Date : 21/04/26

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PLASTICITY INDEX FOR SOILS
TEST REPORT

Project :	Brookvale Rd Development
Location :	Brookvale Rd
Client :	C. Goss
Contractor :	Hawkes Bay Geotech Limited
Sampled by :	Client
Date sampled :	10/04/26
Sampling method :	Unknown
Sample description :	Silty SAND with trace of gravel
Sample condition :	As Received
Sample reference:	TP 3.1
Sample depth:	3.6m

Project No :	2-L0696.24
Lab Ref No :	NA10594
Client Ref No :	26030

Test Results		
Liquid Limit :	38	
Plastic Limit :	27	
Plasticity Index :	11	
Natural Water Content :	25.3	%
Linear Shrinkage (%):	7	

Test Methods		Notes
Liquid Limit	NZS 4402 : 1986, Test 2.2	Materials used: Passing 425um sieve
Plastic Limit	NZS 4402 : 1986, Test 2.3	
Plasticity Index	NZS 4402 : 1986, Test 2.4	
Water Content	NZS 4402 : 1986, Test 2.1	All information supplied by Client
Linear Shrinkage	NZS 4402: 1986, Test 2.6	

Date tested : 18/04/26
Date reported : 21/04/26

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Approved Signatory

Designation : *Laboratory Manager*
Date : 21/04/26

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH01**

SHEET: 1 OF 1

PROJECT: Te Mata Mushrooms | LOCATION: 174 Brookvale Rd, Havelock North | JOB No.: 1014649.0000

CO-ORDINATES: (NZTM2000) 5602804.00 mN 1934984.00 mE

R.L.: 11.00m

DATUM: NZVD2016

DRILL TYPE:

DRILL METHOD: RC

DRILL FLUID:

HOLE STARTED: 09/07/2020

HOLE FINISHED: 09/07/2020

DRILLED BY: Geotech Drilling Ltd

LOGGED BY: JWY CHECKED: TRMC

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Topsoil											M	St				TOPSOIL and rootlets.
Fill																Gravelly SILT, some sand; dark brown. Stiff, moist, low plasticity; sand, fine.
Holocene Alluvial Deposits			93	HA				10	1							Clayey SILT; dark grey, mottled brown. Stiff, moist, medium to high plasticity.
			100	SPT		0/2 1/1 2/2 **N=6**										
			76	HQTT				9	2		W	F				Sandy SILT, minor clay; dark greyish brown. Firm, wet, low plasticity, slightly dilatant.
																2.75-3.0m: CORE LOSS.
Box 1, 0.0-3.7m			66	SPT		4/4 5/5 5/7 **N=22**		8	3		S	MD				Sandy, fine to medium, minor coarse GRAVEL, trace silt; dark bluish grey. Medium dense, saturated, well graded; sand, fine to coarse.
																3.3-3.45m: CORE LOSS.
			100	HQTT				7	4							[CONT] Sandy, fine to medium, minor coarse GRAVEL, trace silt; dark bluish grey. Medium dense, saturated, well graded; sand, fine to coarse.
			0	SPT		4/2 3/3 3/3 **N=12**		6	5							4.5-4.95m: CORE LOSS.
			28	HQTT								VD				Medium to coarse GRAVEL, some cobbles, minor sand, and silt; dark brownish grey. Very dense, well graded; gravel, sub-angular to sub-rounded, greywacke; sand, fine to coarse.
Pleistocene Alluvium / Colluvium and Fan Deposits																5.25-6.0m: CORE LOSS.
			50	SPT		12/21 22/23 for 75mm **N>=50**		5	6							[CONT] Medium to coarse GRAVEL, some cobbles, minor sand, and silt; dark brownish grey. Very dense, well graded; gravel, sub-angular to sub-rounded, greywacke; sand, fine to coarse.
																6.15-6.3m: CORE LOSS.
			91	HQTT				4	7							[CONT] Medium to coarse GRAVEL, some cobbles, minor sand, and silt; dark brownish grey. Very dense, well graded; gravel, sub-angular to sub-rounded, greywacke; sand, fine to coarse.
Box 2, 3.7-8.0m			94	SPT		11/22 25/25 for 50mm **N>=50**		3	8							7.4-7.5m: CORE LOSS.
																[CONT] Medium to coarse GRAVEL, some cobbles, minor sand, and silt; dark brownish grey. Very dense, well graded; gravel, sub-angular to sub-rounded, greywacke; sand, fine to coarse.
			41	HQTT							W					Sandy, fine to medium and minor coarse GRAVEL, some silt, minor gravel; dark brown. Very dense, wet, well graded; gravel, sub-rounded, greywacke.
Box 3, 8.0-9.2m																8.23-9.0m: CORE LOSS.
			100	SPT		17/33 for 50mm **N>=50**		2	9							[CONT] Sandy, fine to medium and minor coarse GRAVEL, some silt, minor gravel; dark brown. Very dense, wet, well graded; gravel, sub-rounded, greywacke.
																9.15m: END OF BOREHOLE

COMMENTS:

Hole Depth 9.15m

Scale 1:50

Rev.: A

BoreLog - 24/07/2020 11:20:51 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **BH01**

PROJECT: Te Mata Mushrooms		LOCATION: 174 Brookvale Rd, Havelock North	JOB No.: 1014649.0000
CO-ORDINATES: (NZTM2000)	5602804.00 mN 1934984.00 mE	DRILL TYPE:	HOLE STARTED: 09/07/2020
R.L.:	11.00m	DRILL METHOD: RC	HOLE FINISHED: 09/07/2020
DATUM:	NZVD2016	DRILL FLUID:	DRILLED BY: Geotech Drilling Ltd
			LOGGED BY: JWY CHECKED: TRMC

0.00-3.70m

3.70-7.95m

Bore Log - 24/07/2020 11:20:52 am - Produced with Core-GS by GeRoc v9.0

CORE PHOTOS

BOREHOLE No.: **BH01**

PROJECT: Te Mata Mushrooms		LOCATION: 174 Brookvale Rd, Havelock North	JOB No.: 1014649.0000
CO-ORDINATES: (NZTM2000)	5602804.00 mN 1934984.00 mE	DRILL TYPE:	HOLE STARTED: 09/07/2020
R.L.:	11.00m	DRILL METHOD: RC	HOLE FINISHED: 09/07/2020
DATUM:	NZVD2016	DRILL FLUID:	DRILLED BY: Geotech Drilling Ltd
			LOGGED BY: JWY CHECKED: TRMC

7.95-9.15m

BoreLog - 24/07/2020 11:20:52 am - Produced with Core-GS by GeRoc v9.0

BOREHOLE LOG

BOREHOLE No.: **BH02**

SHEET: 1 OF 1

PROJECT: Te Mata Mushrooms		LOCATION: 174 Brookvale Rd, Havelock North	JOB No.: 1014649.0000
CO-ORDINATES: (NZTM2000)	5602860.00 mN 1935206.00 mE	DRILL TYPE:	HOLE STARTED: 09/07/2020 HOLE FINISHED: 09/07/2020
R.L.:	12.00m	DRILL METHOD: RC	DRILLED BY: Geotech Drilling Ltd
DATUM:	NZVD2016	DRILL FLUID:	LOGGED BY: JWY CHECKED: TRMC

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Topsoil			60	HA				11	1		M	St				TOPSOIL, and rootlets.
Holocene Alluvial Deposits			100	SPT		2/2 3/2 2/3 **N=10**		10	2							SILT, some clay; dark brown, mottled light brown. Stiff, moist, medium plasticity.
			100	HQTT												
			44	SPT		5/8 9/10 11/10 **N=40**		9	3		W	D				Sandy, fine and some medium GRAVEL, minor silt; dark brownish grey. Dense, wet, well graded; gravel, sub-rounded, greywacke.
			47	HQTT												3.45-4.0m: CORE LOSS.
								8	4							COBBLES, minor gravel and sand; dark brownish grey. Dense, wet, gap graded; cobbles and gravel, sub-rounded, greywacke; sand, fine.
Box 1, 0.0-4.7m			100	SPT		10/40 for 75mm **N>=50**						VD				Sandy, fine to medium GRAVEL, some silt; dark greyish brown. Very dense, wet, well graded; gravel, sub-rounded, greywacke.
Pleistocene Alluvium / Colluvium and Fan Deposits			85	HQTT				7	5							
			90	SPT		6/24 for 65mm **N>=50**		6	6							6.215-7.0m: CORE LOSS.
			31	HQTT				5	7							Sandy, coarse GRAVEL, minor silt, some cobbles; dark grey. Very dense, wet, well graded; gravel and cobbles, sub-rounded, greywacke.
			100	SPT		10/22 25/25 for 75mm **N>=50**		4	8							Sandy, fine to medium GRAVEL, minor silt; dark brownish grey. Very dense, well graded; gravel, greywacke.
Box 2, 4.7-9.2m			50	HQTT												
			100	SPT		17/20 50 for 65mm **N>=50**		3	9							9.21m: END OF BOREHOLE

COMMENTS:

Hole Depth 9.21m

Scale 1:50

Rev.: A

BoreLog - 24/07/2020 11:20:26 am - Produced with Core-GS by GeRoc

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CORE PHOTOS

BOREHOLE No.: **BH02**

SHEET: 1 OF 1

PROJECT: Te Mata Mushrooms		LOCATION: 174 Brookvale Rd, Havelock North	JOB No.: 1014649.0000
CO-ORDINATES: (NZTM2000)	5602860.00 mN 1935206.00 mE	DRILL TYPE:	HOLE STARTED: 09/07/2020
R.L.:	12.00m	DRILL METHOD: RC	HOLE FINISHED: 09/07/2020
DATUM:	NZVD2016	DRILL FLUID:	DRILLED BY: Geotech Drilling Ltd
			LOGGED BY: JWY CHECKED: TRMC

0.00-4.65m

4.65-9.21m

BoreLog - 24/07/2020 11:20:27 am - Produced with Core-GS by GeRoc

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH02

CLIENT: Development Nous
SITE LOCATION: Arataki Road and Brookvale Rd, Havelock North
PROJECT: Arataki Extension Residential Subdivision
Project Ref.: P-001190

CO-ORDINATES: 1934895mE, 5602668mN
ELEVATION: 22.9m
CONTRACTOR: Geotech Driiling
START DATE: 22/09/2021

Co-ordinate system: NZTM
Datum: NZVD 2016
RIG: CRS-T (Sonic)
END DATE: 22/09/2021

Location method: GPSH
Level method: CONTOUR
DRILLER: Drew
LOGGED BY: MDH

ORIENTATION (°): Vertical
INCLINATION (°): 90
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Topsoil	SILT, with some rootlets, with trace sand; dark brown. Low plasticity; sand, fine. 0.30m: grades to brown	TS				22.0		SNC	100						
Pleistocene River Deposits	Sandy GRAVEL. with minor silt. Low plasticity; gravel, subround; sand, fine to medium.				1										
	Gravelly SILT, with minor sand; brown. Hard; low plasticity; gravel, fine to medium, subround.				2	21.0		SPT	100		6, 6 / 9, 8, 6, 9 N=32				
								SNC	88					Bentonite	Box 1, 0.0-2.4m
	3.90m: Grades to dry				3	20.0		SPT	100		6, 11 / 17, 13, 14, 6 for 30mm N=50+ for 255mm				
					4	19.0		SNC	90						
	Sandy gravelly SILT; brown. Hard; high plasticity; moist.					18.0		SPT	100		8, 9 / 7, 7, 5, 13 N=32				Box 2, 2.4-5.4m
	SILT, with some sand; brown. Hard; low plasticity; sand, fine.				5			SNC	100						
	Gravelly SILT, with some sand; brown. Hard; low plasticity; gravel, fine to coarse, subround, moderately weathered; sand, fine.					17.0									
	SILT, with trace sand; brown. Very stiff; low plasticity; sand, fine.				6			SPT	100		2, 3 / 1, 2, 2, 2 N=7				
						16.0		SNC	100						
					7										
	EOH: 7.95m					15.0		SPT	100		4, 5 / 6, 5, 6, 6 N=23			7.95m	Box 3, 5.4-8.0m
						14.0									
						13.0									

REMARKS:
GWL was not encountered

Generated with CORE-GS by Geroc - Drillhole_Initia - 9/02/2022 1:43:59 pm

CORE PHOTOS

HOLE NO.: BH02
JOB NO.: P-001190

Box 1, 0.0-2.4m

Box 2. 2.4-5.4m

Box 3, 5.4-8.0m

Generated with CORE-GS by Geroc - Drillhole_Initia - 9/02/2022 1:43:59 pm

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

CLIENT: Development Nous	**SITE LOCATION:** Arataki Road and Brookvale Rd, Havelock North	**HOLE NO.:** BH03
PROJECT: Arataki Extension Residential Subdivision		**Project Ref.:** P-001190
CO-ORDINATES: 1934968mE, 5602576mN	**ELEVATION:** 25.7m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** NZVD 2016	**RIG:** CRS-T (Sonic)
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Drew
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**START DATE:** 21/09/2021
		END DATE: 22/09/2021
		LOGGED BY: MDH
		CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Top soil	SILT (TOPSOIL), with minor rootlets, with trace sand; dark brown. Sand, fine to coarse.	TS			0	25.0		SNC	100						
Pleistocene River Deposits	Silty sandy GRAVEL. Non-plastic; gravel, fine to coarse, subround.				1										
	Clayey SILT; grey. Very stiff; high plasticity.														
	Sandy SILT, with minor gravel; brown. Low plasticity; sand, fine to coarse; gravel, fine to medium, subround.					24.0		SPT	100		4, 7 / 7, 7, 9, 10 N=33				
	Silty sandy GRAVEL; brownish grey. Dense; gravel, fine to medium, subround.				2			SNC	90						Box 1, 0.0-2.5m
	Silty SAND, with minor gravel, with trace cobbles. Dense; low plasticity; sand, fine to coarse; gravel, fine.					23.0		SPT	44		4, 6 / 7, 9, 12, 12 N=40				
					3			SNC	100						
	4.50m: Grades to very dense					22.0		SPT	57		7, 10 / 24, 20, 6 for 40mm N=50+ for 190mm				
					4			SNC	91						Box 2, 2.5-5.5m
						21.0		SPT	100		5, 12 / 15, 14, 12, 9 for 35mm N=50+ for 260mm				
					5			SNC	91						
	Silty sandy GRAVEL, with trace cobbles. Very dense; gravel, fine to coarse, subangular to subround.					20.0		SPT	100		20, 24 N=50+			Bentonite	Box 3, 5.5-7.7m
					6										
	EOH: 7.65m					19.0								7.65m	
					7										
						18.0									
						17.0									
						16.0									

REMARKS:
GWL was not encountered

Generated with CORE-GS by Geroc - Drillhole_Initia - 9/02/2022 1:44:18 pm

CORE PHOTOS

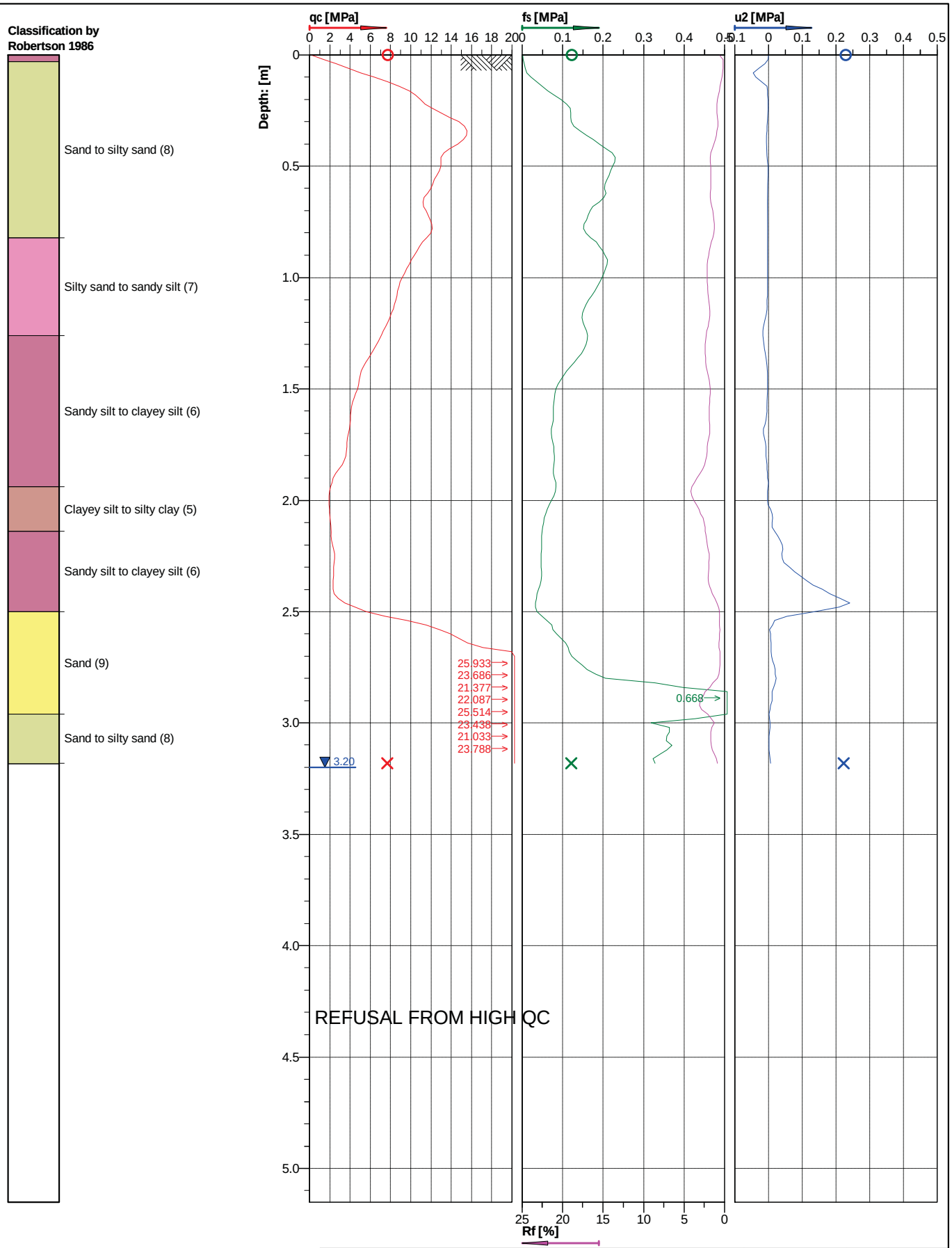
HOLE NO.: BH03
JOB NO.: P-001190

Box 1, 0.0-2.5m

Box 2, 2.5-5.5m

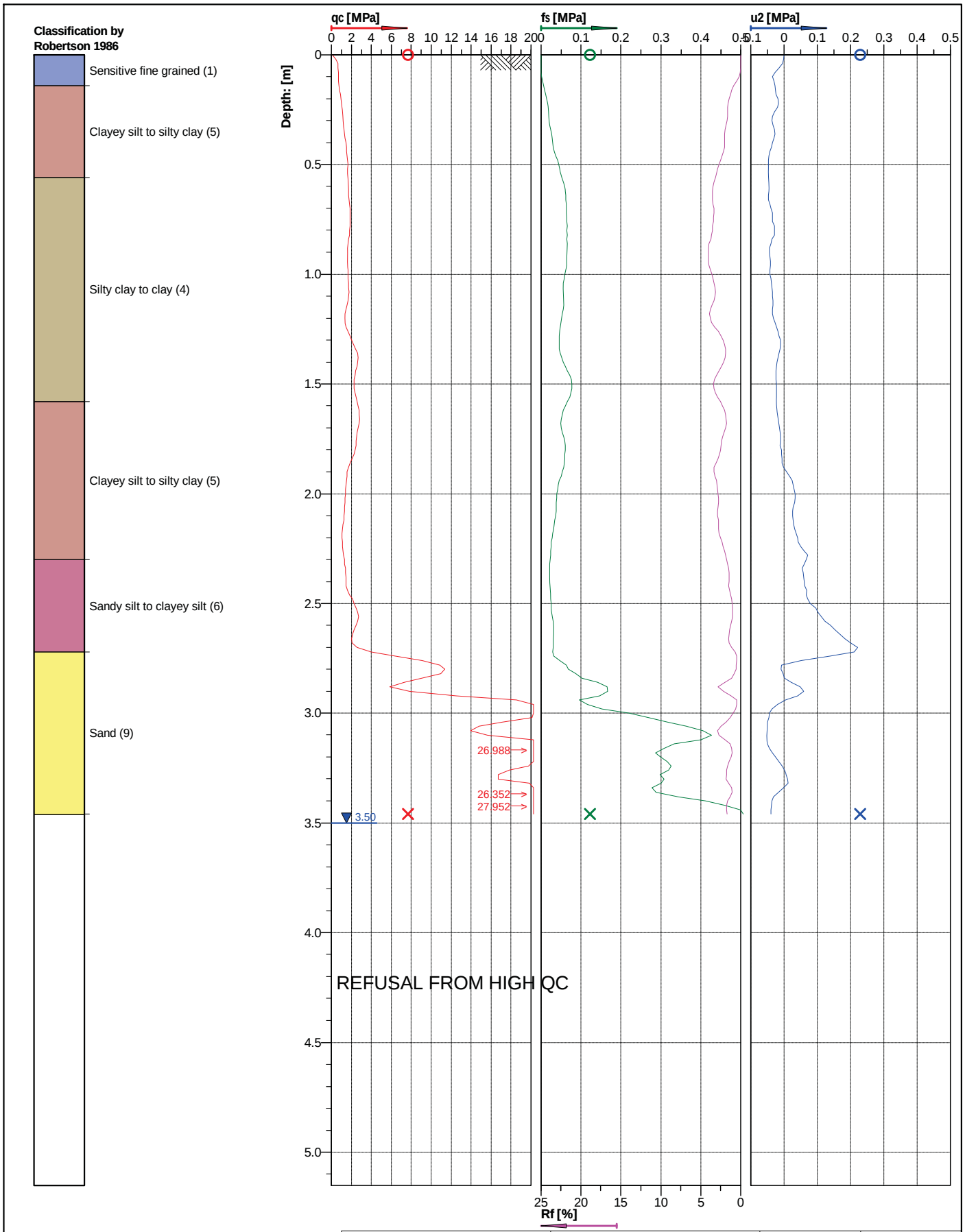
Box 3, 5.5-7.7m

Generated with CORE-GS by Geroc - Drillhole_Initia - 9/02/2022 1:44:18 pm



Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: HAVELOCK NORTH	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT01
Project ID:	Client: TONKIN + TAYLOR	Date: 1/07/2020	Scale: 1 : 23
Project: 174 BROOKVALE RD		Page: 1/1	Fig.:
S 39.65836, E 176.90698		File: CPT01.cpt	

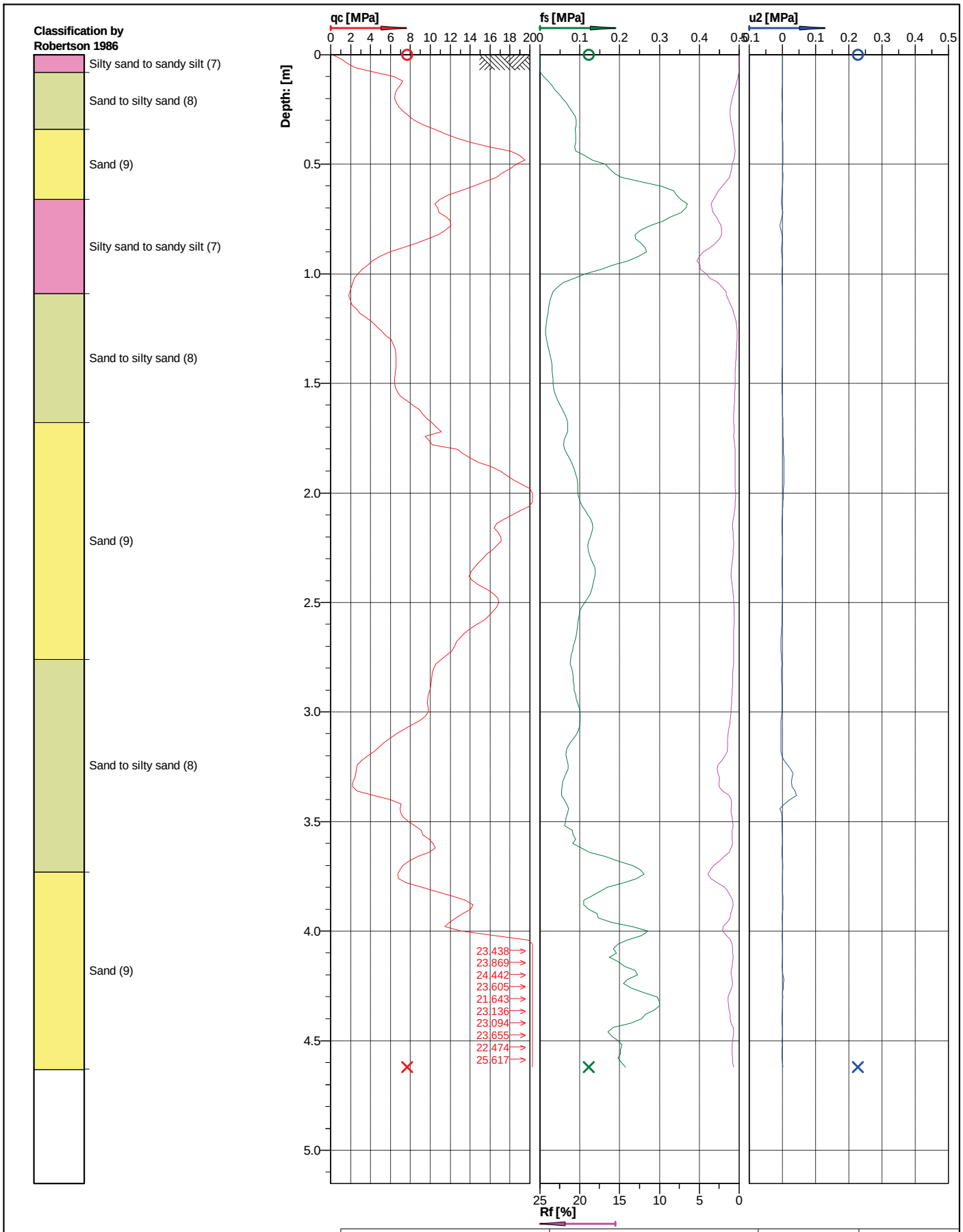


Location: HAVELOCK NORTH	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT02
Project ID:	Client: TONKIN + TAYLOR	Date: 1/07/2020	Scale: 1 : 23
Project: 174 BROOKVALE RD		Page: 1/1	Fig.:
S 39.65839, E 176.90541		File: CPT02A.cpt	

GEOTECH DRILLING

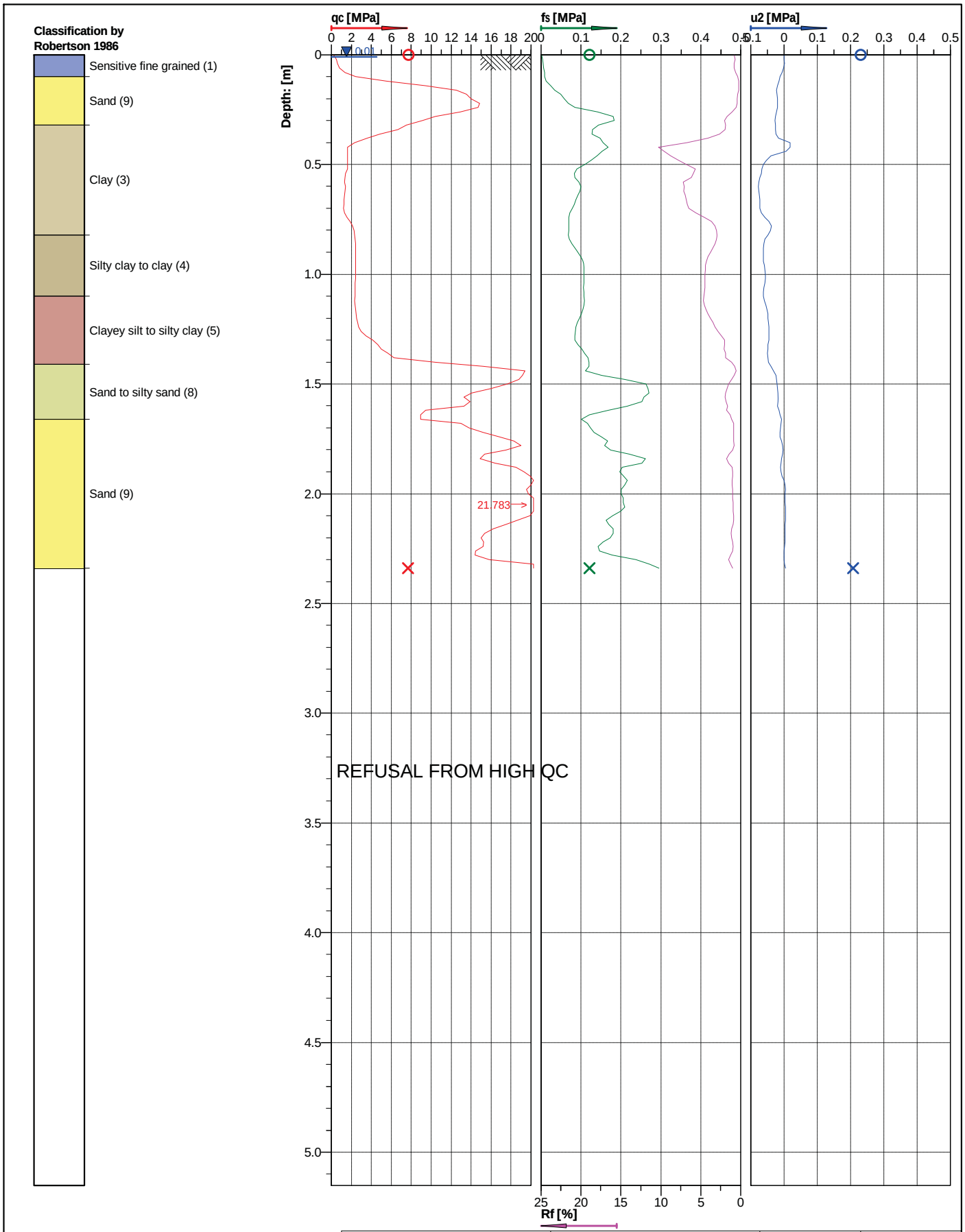
u2

Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: HAVELOCK NORTH	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT03
Project ID:	Client: TONKIN + TAYLOR	Date: 1/07/2020	Scale: 1 : 23
Project: 174 BROOKVALE ROAD		Page: 1/1	Fig.:
S 39.65990, 176.90498		File: CPT03A.cpt	



Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150

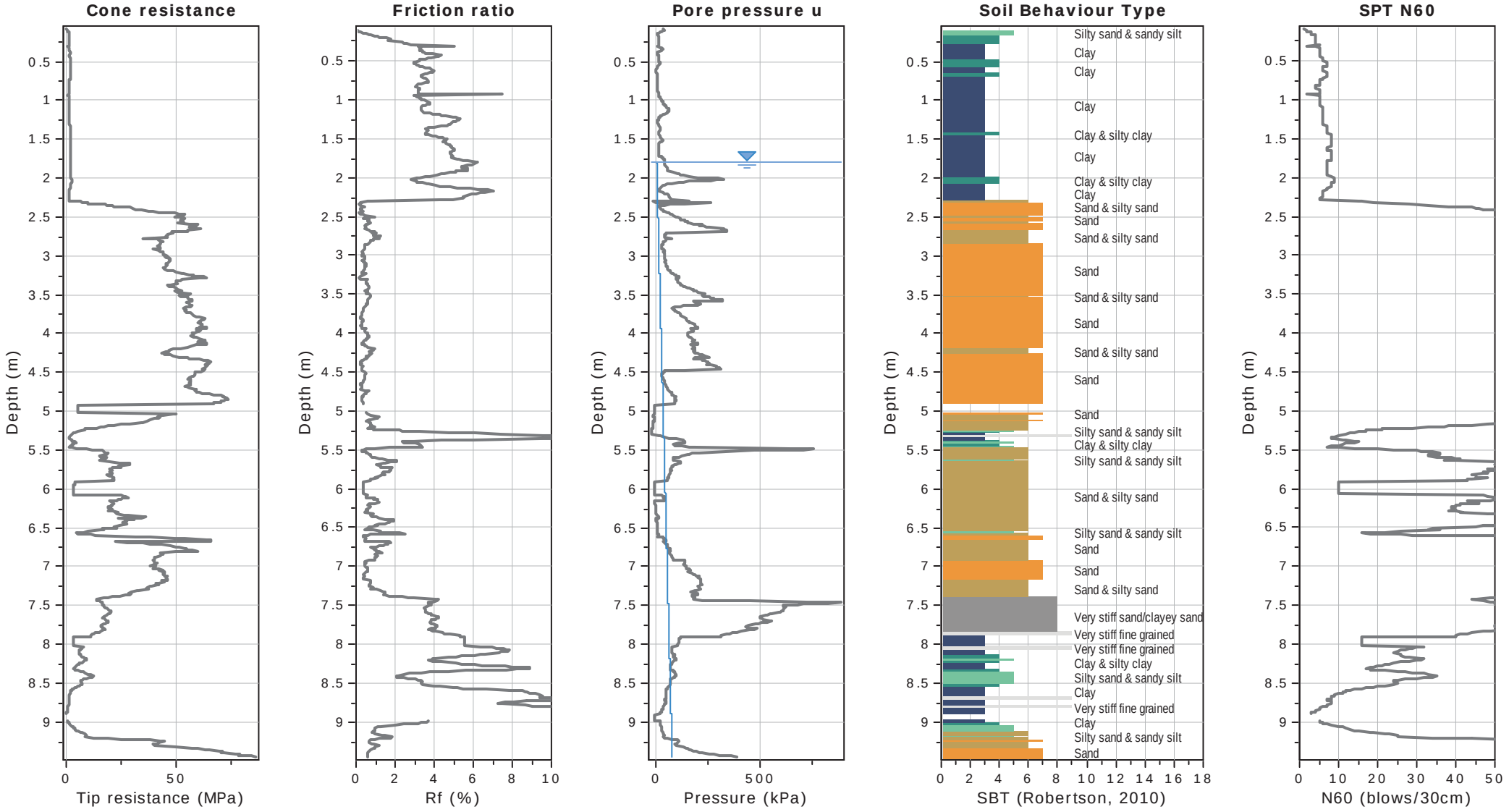
Location: HAVELOCK NORTH	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT04
Project ID:	Client: TONKIN + TAYLOR	Date: 1/07/2020	Scale: 1 : 23
Project: 174 BROOKVALE RD		Page: 1/1	Fig.:
S 39.65976, E 176.90570		File: CPT04.cpt	

Hawkes Bay Geotech
Geotechnical Engineers

CPT: CPT 05

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

Total depth: 9.45 m
Est. GWL: 1.80 m

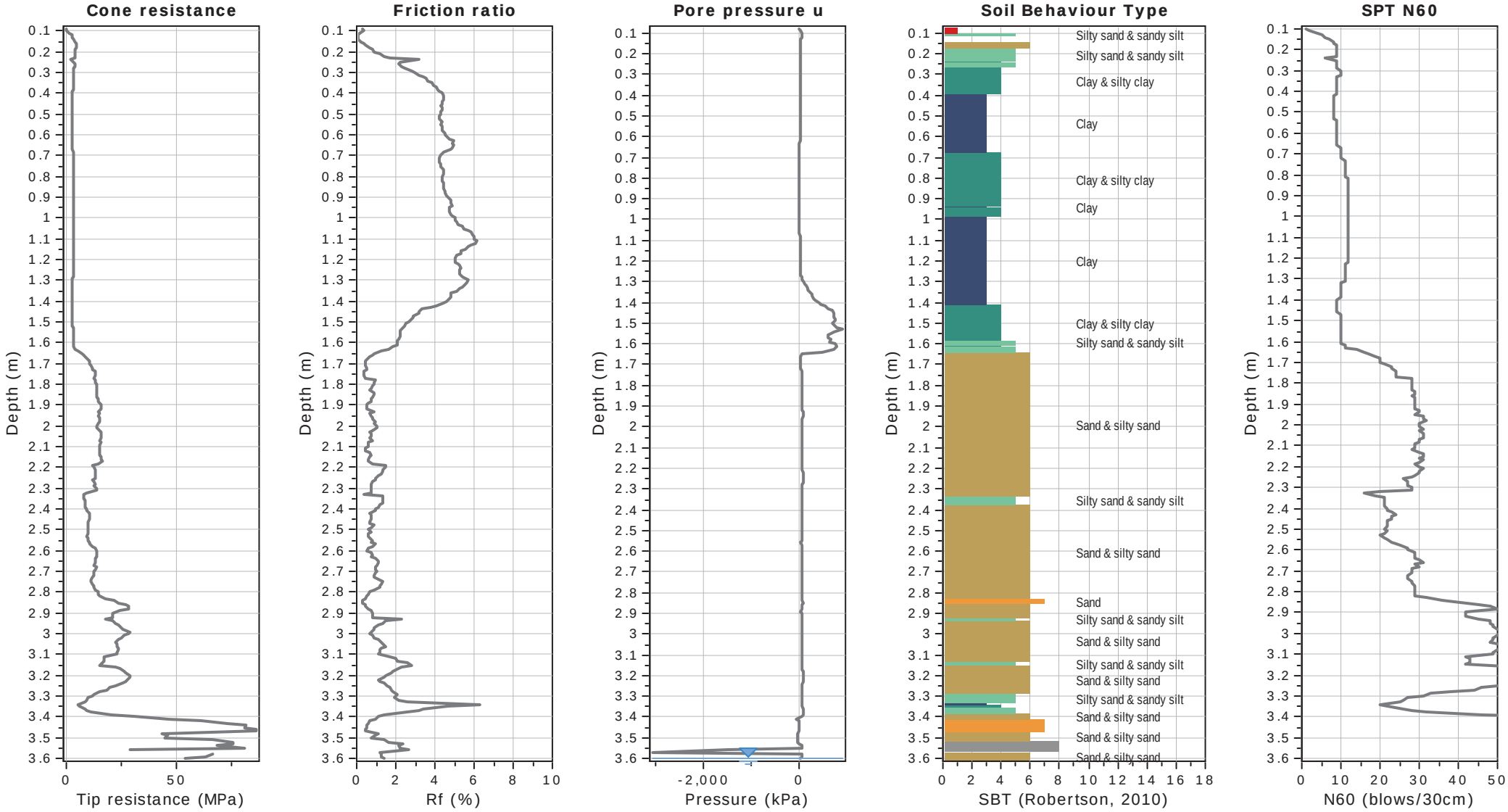


Hawkes Bay Geotech
Geotechnical Engineers

CPT: CPT 06

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

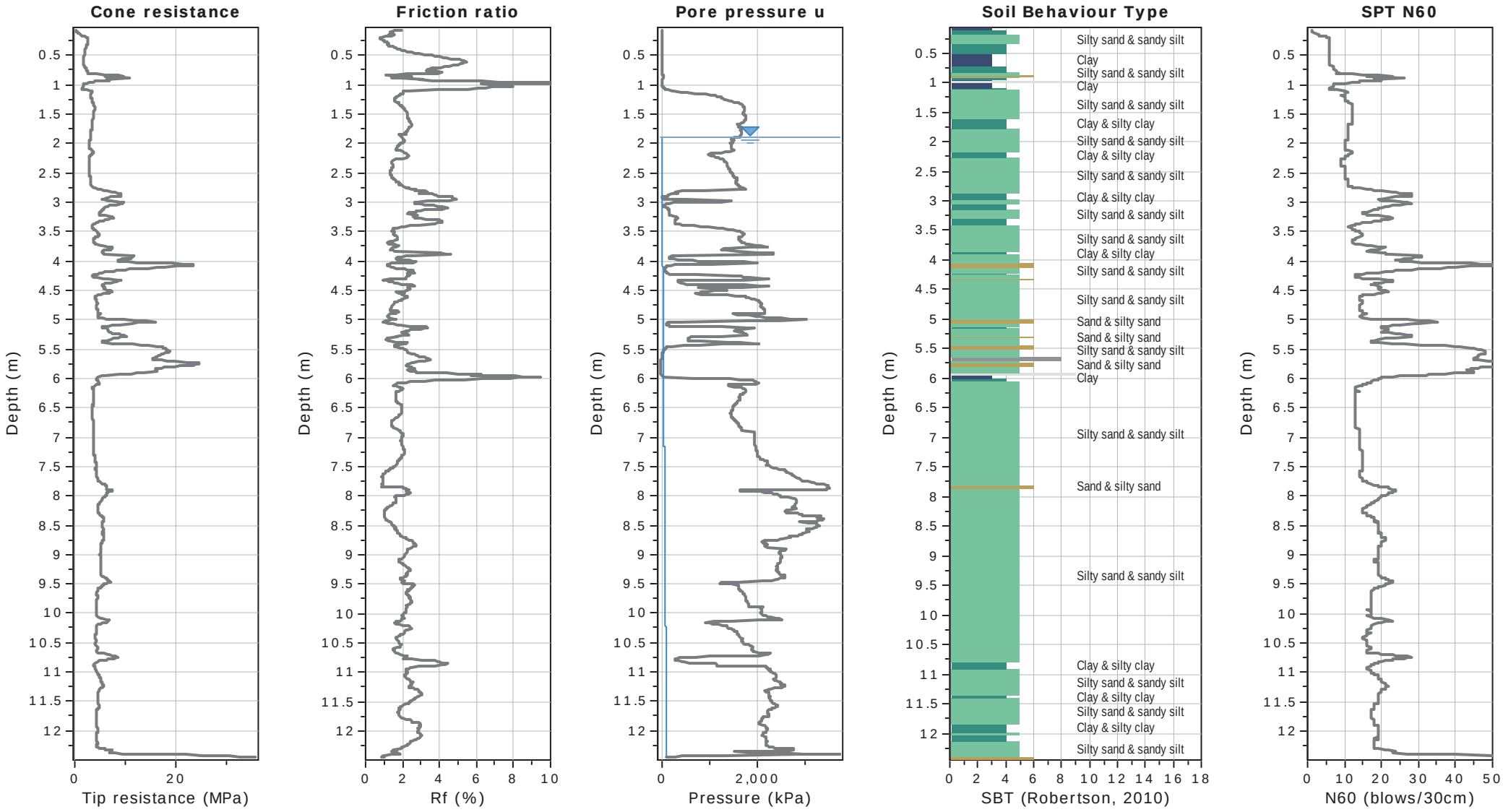
Total depth: 3.60 m
Est. GWL: 3.60 m



CPT: CPT 07

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

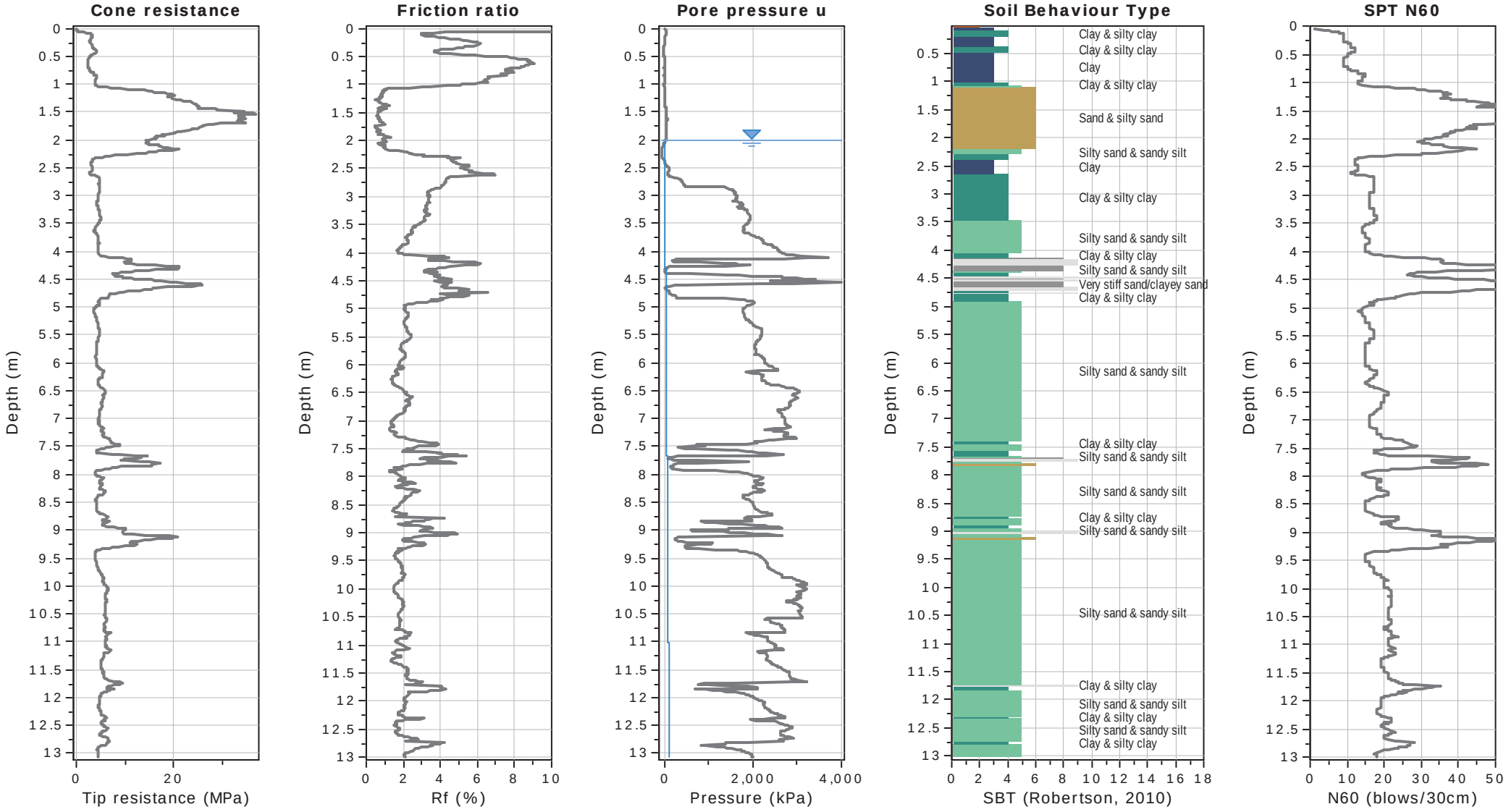
Total depth: 12.45 m
Est. GWL: 1.90 m



CPT: CPT 08

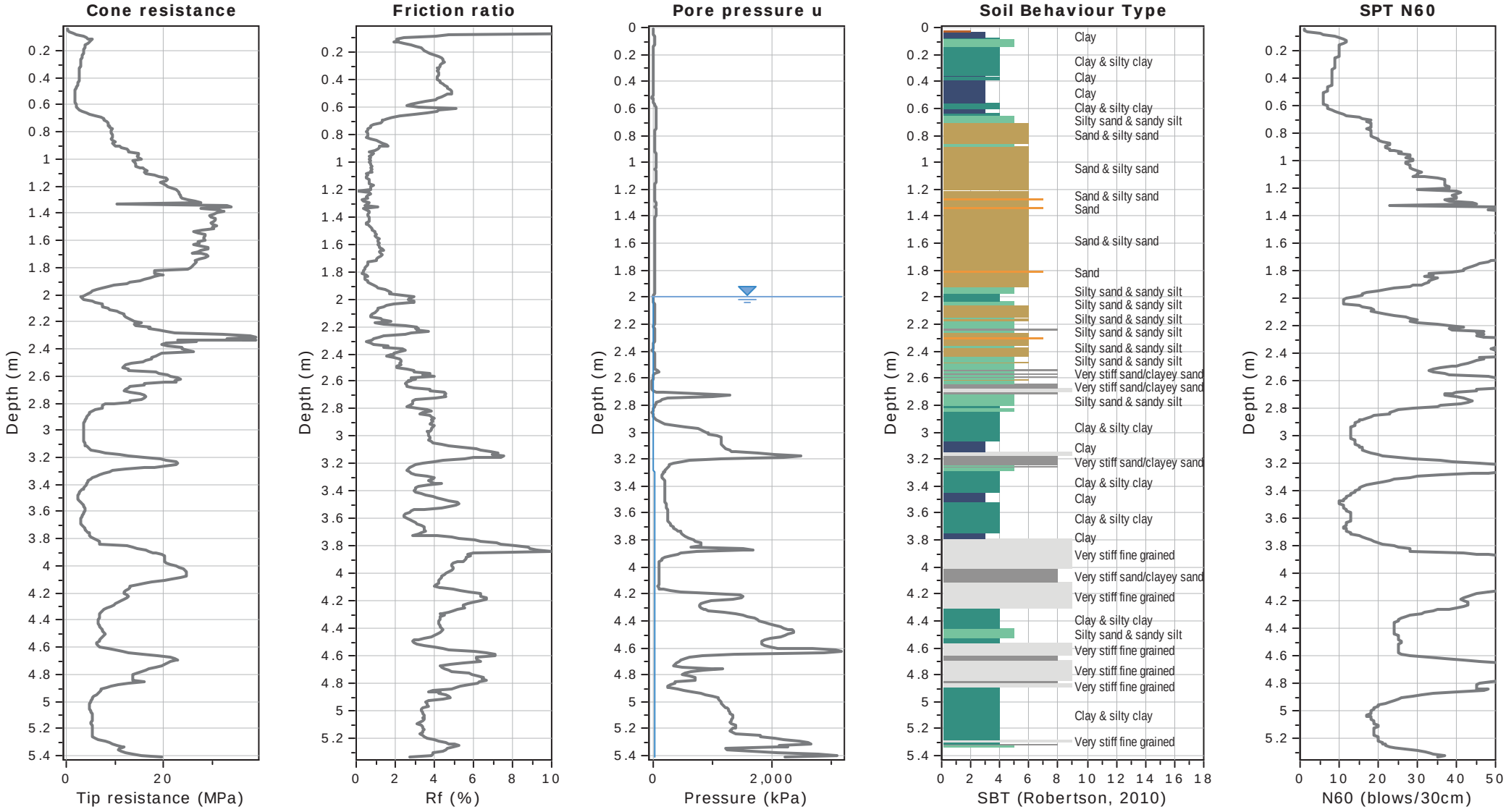
Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

Total depth: 13.07 m
Est. GWL: 2.00 m



CPT: CPT 09
Total depth: 5.41 m
Est. GWL: 2.00 m

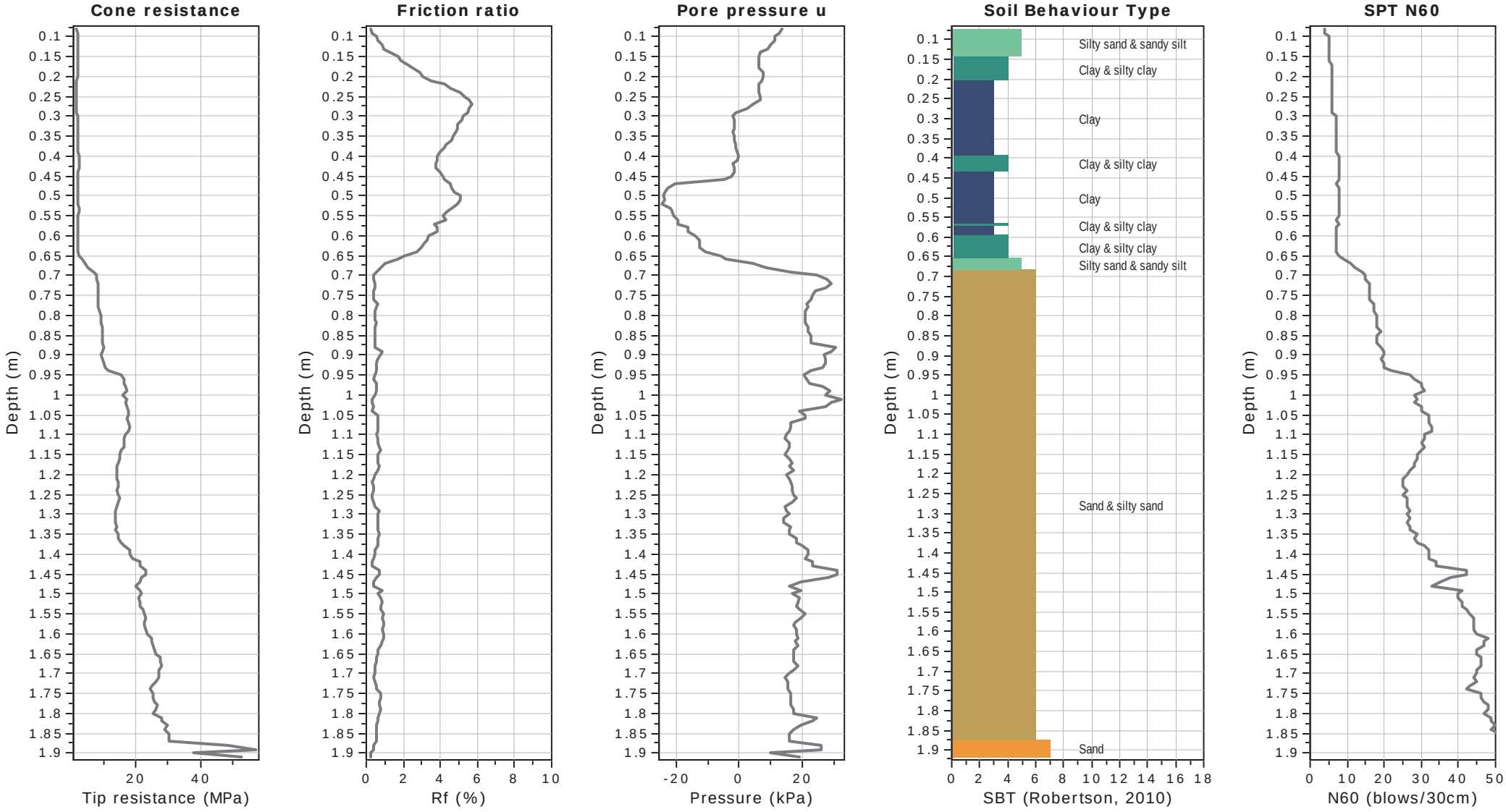
Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North



CPT: CPT 10

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

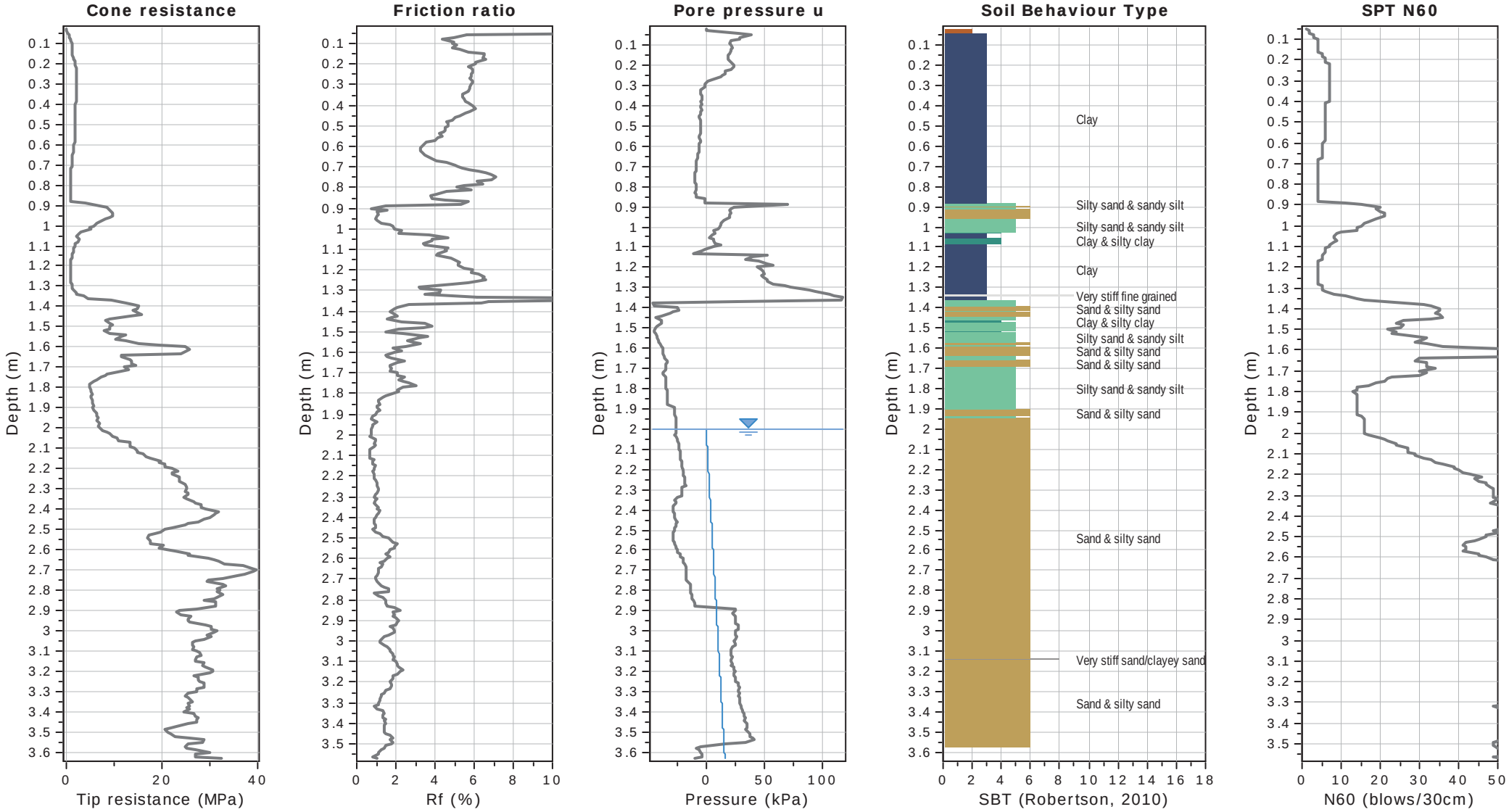
Total depth: 1.91 m
Est. GWL: 2.00 m



CPT: CPT 11

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

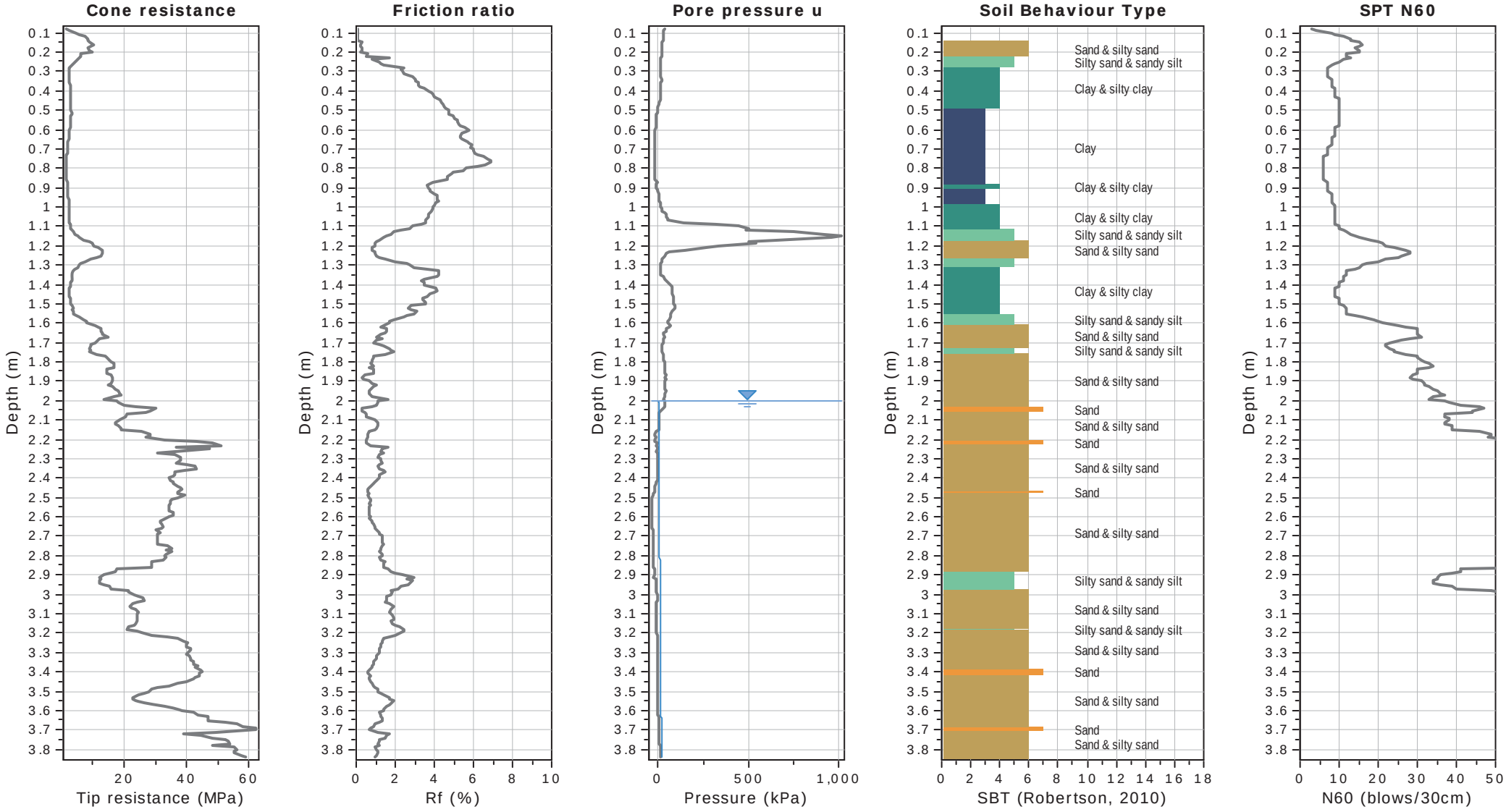
Total depth: 3.63 m
Est. GWL: 2.00 m



CPT: CPT12

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

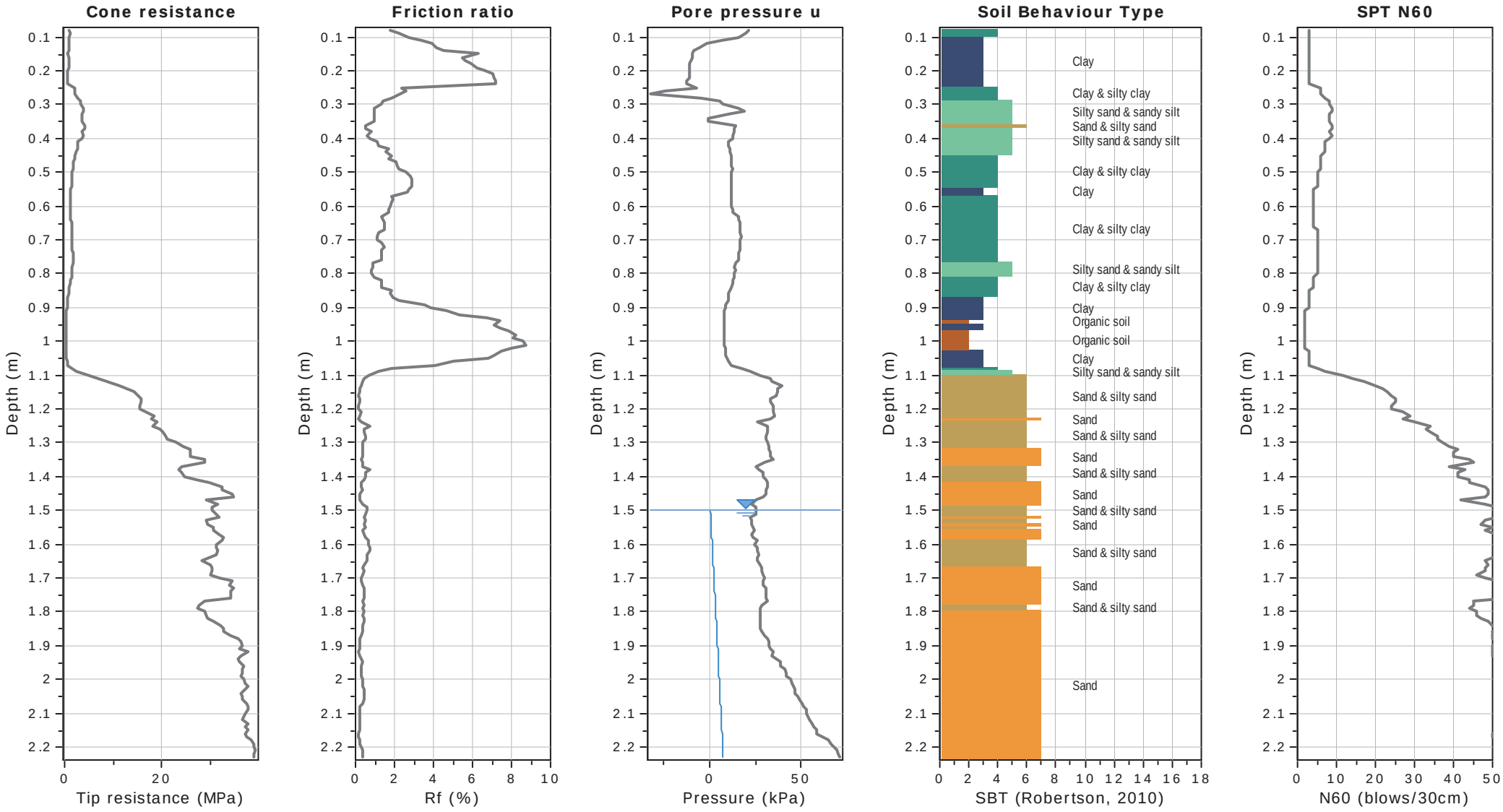
Total depth: 3.84 m
Est. GWL: 2.00 m



CPT: CPT13

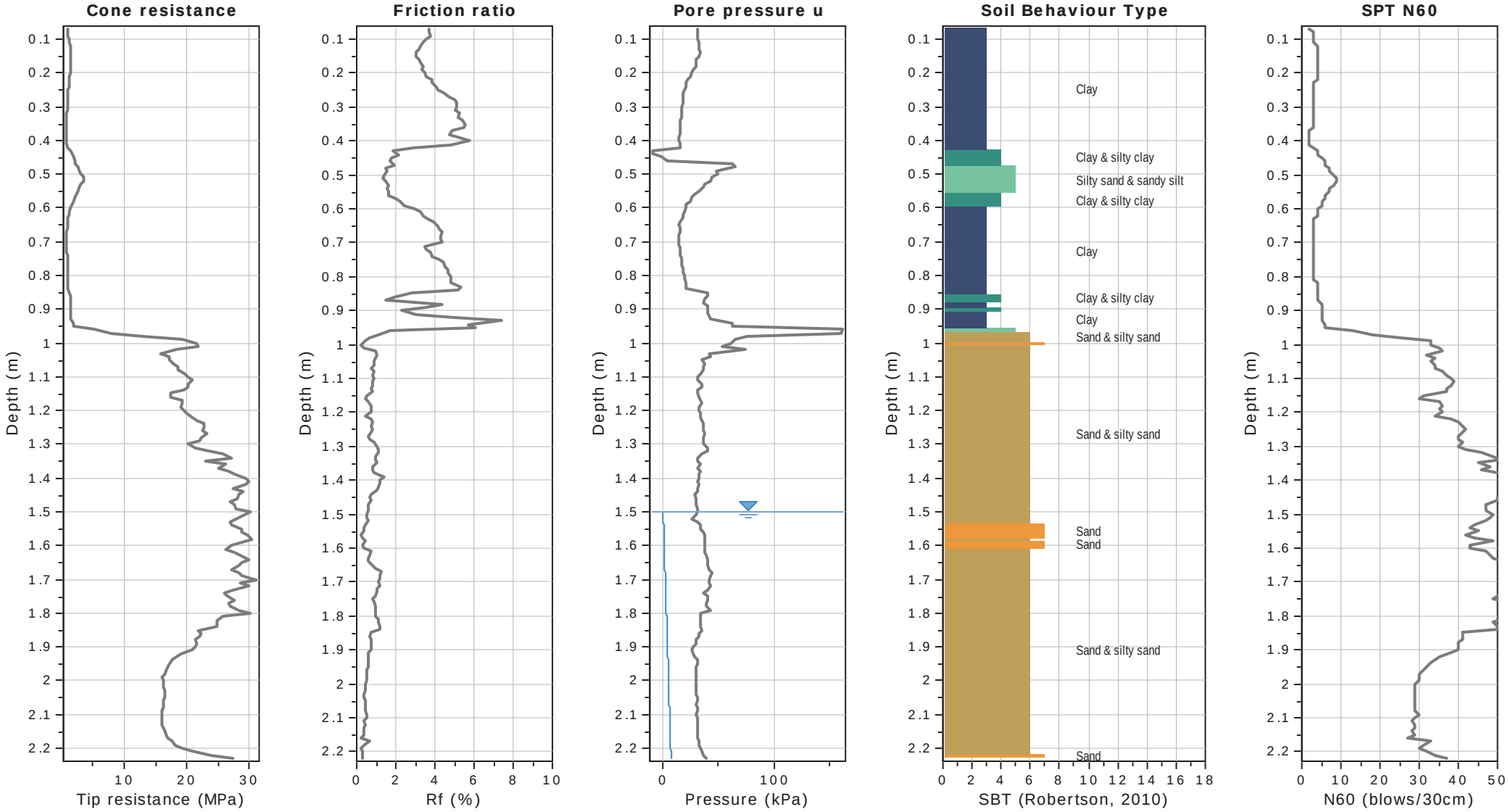
Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

Total depth: 2.23 m
Est. GWL: 1.50 m



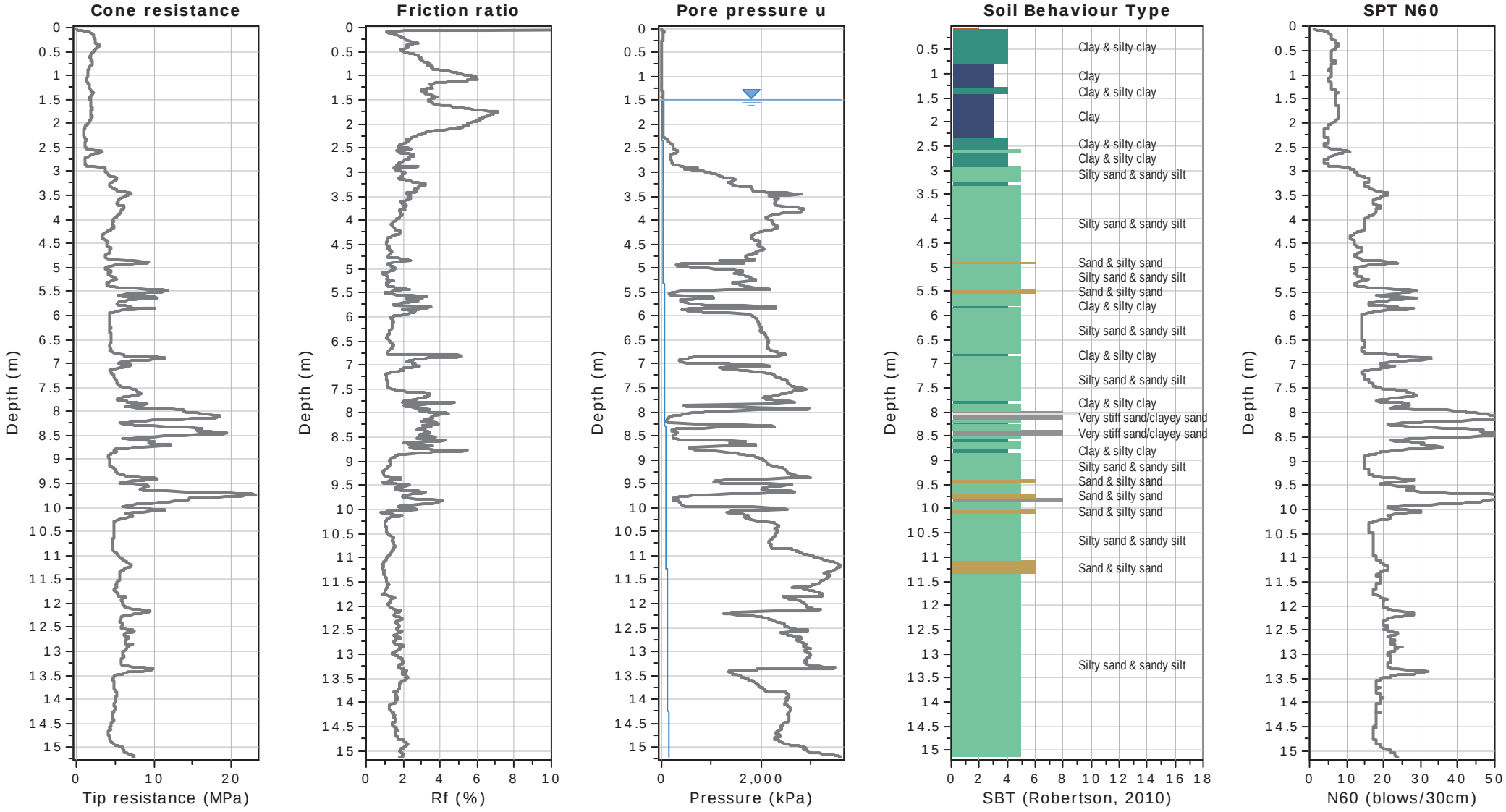
CPT: CPT14
Total depth: 2.23 m
Est. GWL: 1.50 m

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North



CPT: CPT15
Total depth: 15.20 m
Est. GWL: 1.50 m

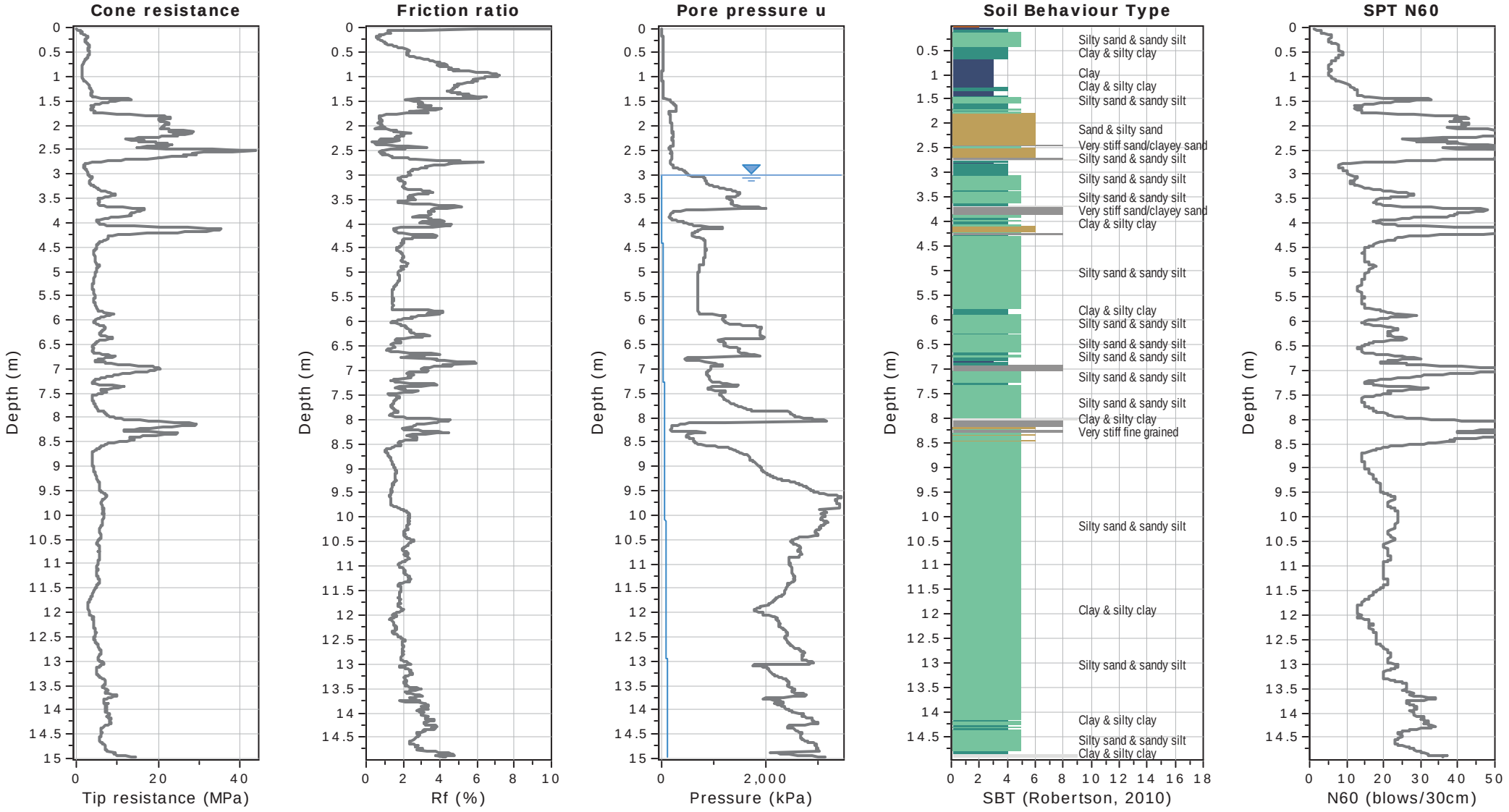
Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North



CPT: CPT16

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

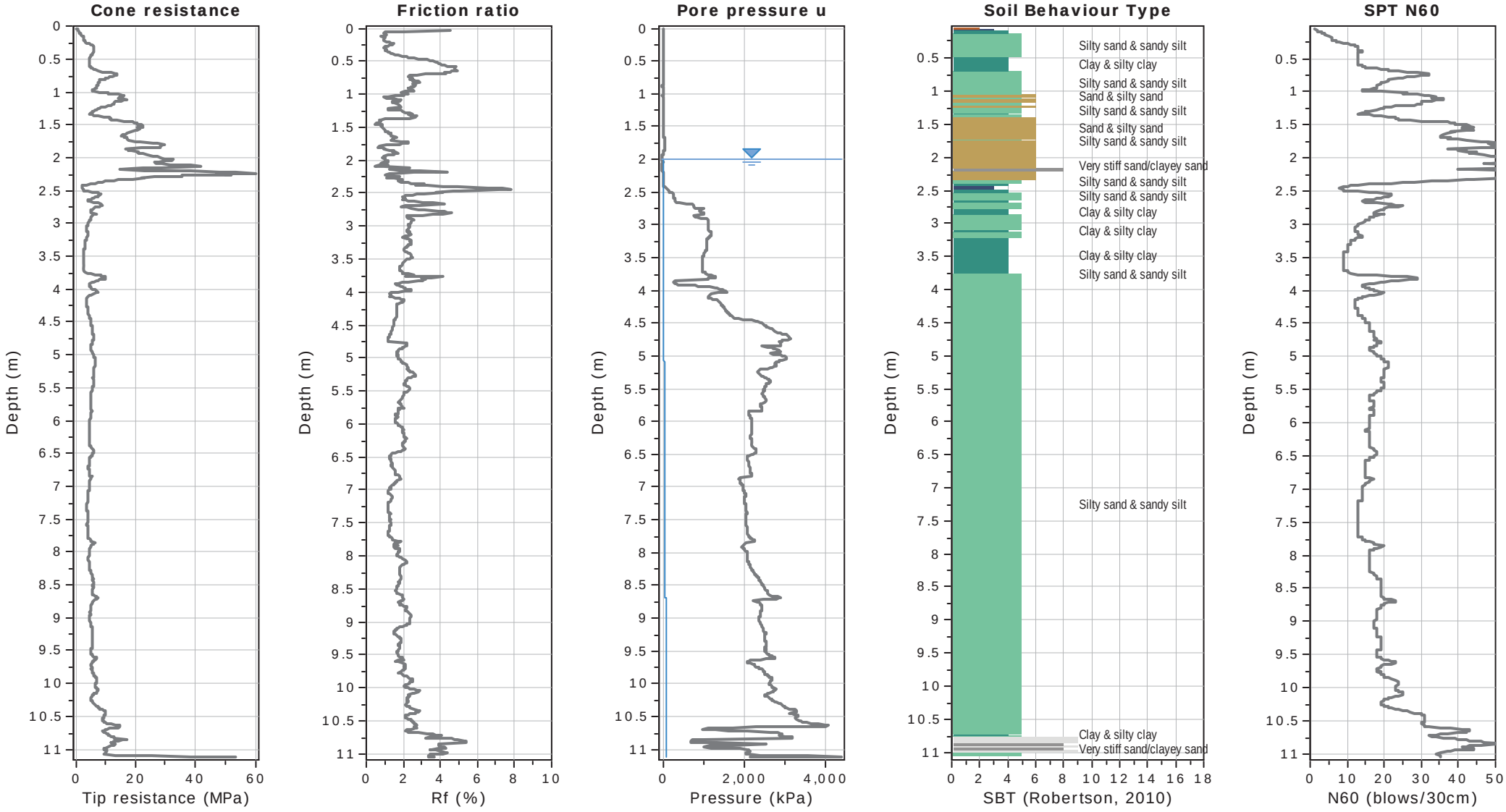
Total depth: 14.97 m
Est. GWL: 3.00 m



CPT: CPT17

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

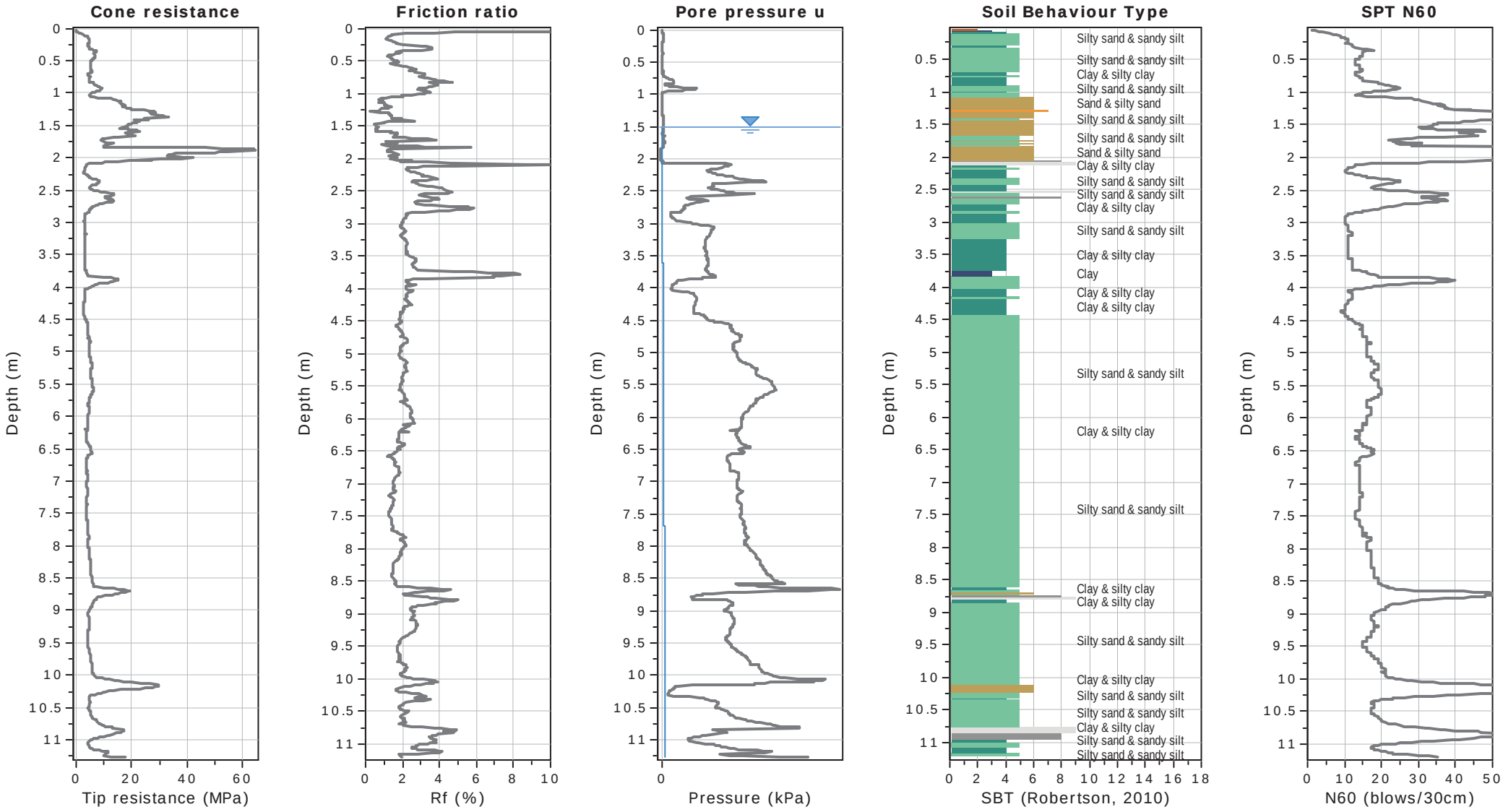
Total depth: 11.12 m
Est. GWL: 2.00 m



CPT: CPT18

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

Total depth: 11.27 m
Est. GWL: 1.50 m



HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 258

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	27/11/1972
NZTM Easting	1935043.142	**Driller**	Boag & Hill Ltd
NZTM Northing	5602759.745	**Casing Diameter (mm)**	100
Method		**Bore Depth (m)**	
Address	BROOKVALE RD	**Well Depth (m)**	23.4599990844727
		Screen top (m)	23.4599990844727
		Screen bottom (m)	0
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-1.82
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	Confined
Comments	Permit number is 258 Metric Grid Reference : V21:7.4 199990 Driller is BOAG Owner is TE NGAWA FARM Well location is BROOKVALE RD Legal description is LOT 1 DP 16311 BLK 1V TE MATA SD Depth of casing is 23.46m

Aquifer Test

Test Date	27-11-1972
Report Number	
Maximum Pumping Rate (l/s)	1.55
Maximum DrawDown (m)	
Duration (hours)	

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Number Of Pumping Steps	
Aquifer Thickness (m)	
Transmissivity (m^2/d)	
Storativity	
Hydralic Conductivity (m/d)	
Specific Capacity ((l/s)/m)	

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	3.35	CLAY
3.35	14.02	GRAVEL with clay
14.02	20.11	GRAVEL
20.11	23.46	SILTSTONE

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 826

IDENTIFICATION		WELL INFORMATION	
WQ Site	27/ 1	**Drill Date**	935975 30/ 0
NZTM Easting	3074329.2B/	**Driller**	o ag& H i lLLt d6
NZTM Northing	4192170.143	**Casing Diameter (mm)**	399
Method		**Bore Depth (m)**	
Address	ARAOAKV RE i AD8t Un K k Oi	**Well Depth (m)**	21.70000013w4797
		Screen top (m)	21.70000013w4797
		Screen bottom (m)	9
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	I WeWar W

Aquifer Information

VWdgLv gd- qt - u- L	fB
VWdgLv gd- qt - u- LEgd-	
AhylC- qt ldmaLa&s	
AhylC- qn aW6ldaW	n aWdW- 6
n aP P - Wdb	M- qP ldWyP c - qlb w21 G - dq: T q6 R - C- q- W - ND23Nw.B 2930wB EqlL- qlb oUAT H i Vt Ur W- qlb i I k O8 R E G v - lLLa: gdaWlb ARAOAKVRE i AD8t Un K k Oi T - W- qgLq- P gqeb N F: q- - Wdsp- lb 2P M8 RSURAO8 E t - &gL6- b: qpdaWlb t UO 3 EM 37214 ot K 3D O8 GAOA FE E

Aquifer Test

O- bdEgd-	93f97f30/ 0
R- paqdk yP c - q	

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GgxlP yP MyP plW& Rgd- (L5b)	7.1
GgxlP yP Ecgr Ear W(P)	
Eycgdla W(maycb)	
k yP c- qUCMyP plW& Fd- pb	
AhylC- qOm1: eW- bb (P)	
OcgWbP lbblulds (P^256)	
Fdacgdluld s	
i s6cgLL: n aW6y: dulds (P 56)	
Fp- : lC1: n gpg: lds ((L5b)5P)	

Bore Log

SqaP E- pdm(P)	Oa E- pdm(P)	t ldmala&s
9	2.3	OUMFUVt
2.3	1.0	cly- 5cqar WT RAD8 t
1.0	w.B	s- llar n t AY (u- qs : - P - W4 6)
w.B	32	(baG)
32	2B	cqar WT RAD8 t
2B	21.B	OW- cqar WT RAD8 t (u- qs OW-)

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 1129

IDENTIFICATION		WELL INFORMATION	
WQ Site	1908	**Drill Date**	09/07/1981
NZTM Easting	1935129.206	**Driller**	Hill Well Drillers Ltd
NZTM Northing	5602830.837	**Casing Diameter (mm)**	200
Method	Differential GPS	**Bore Depth (m)**	
Address	BROOKVALE RD HAVELOCK NTH (L/C)	**Well Depth (m)**	18.1000003814697
		Screen top (m)	15.1999998092651
		Screen bottom (m)	21.2000007629395
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	0
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	Confined
Comments	Screen type is 6m STAINLESS STEEL 2.5mm SLOT Legal description is LOT 2 DP 16311 BLK 1V TE MATA SD & BLK Measuring point: top of casing Previous owner - Davidson, H J & others Not sampled on site visit June 2003. Unable to locate sampling point.

Aquifer Test

Test Date	09-07-1981
Report Number	
Maximum Pumping Rate (l/s)	15.5
Maximum DrawDown (m)	5
Duration (hours)	1

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Number Of Pumping Steps	
Aquifer Thickness (m)	
Transmissivity (m^2/d)	
Storativity	
Hydralic Conductivity (m/d)	
Specific Capacity ((l/s)/m)	3.1

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	1	TOPSOIL
1	3	brown CLAY (soft)
3	13.5	blue/brown GRAVEL
13.5	14.5	yellow CLAY with gravel
14.5	15.2	yellow CLAY
15.2	20.3	blue/brown GRAVEL
20.3	22.92	blue CLAY (mud)

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 1280

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	18/09/1982
NZTM Easting	1935181.227	**Driller**	Hill Well Drillers Ltd
NZTM Northing	5602945.961	**Casing Diameter (mm)**	200
Method	Hand-held GPS	**Bore Depth (m)**	
Address	BROOKVALE RD HAVELOCK NTH (L/C)	**Well Depth (m)**	25
		Screen top (m)	16.7999992370605
		Screen bottom (m)	22.7999992370605
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-1.3
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	Confined
Comments	Permit number is 1280 Metric Grid Reference : V21:7.4 197991 Driller is HILL Owner is THOMPSON T N Well location is BROOKVALE RD HAVELOCK NTH Screen type is 6m STAINELSS STEEL Legal description is LOT 1 DP 16311 BLK 1V TE MATA SD Depth of casing i

Aquifer Test

Test Date	18-09-1982
Report Number	
Maximum Pumping Rate (l/s)	

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Maximum DrawDown (m)	
Duration (hours)	
Number Of Pumping Steps	
Aquifer Thickness (m)	
Transmissivity (m^2/d)	
Storativity	
Hydralic Conductivity (m/d)	
Specific Capacity ((l/s)/m)	

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	1	brown SILT
1	13	blue/brown GRAVEL
13	13.1	brown CLAY
13.1	16.5	blue/brown GRAVEL
16.5	17.8	GRAVEL (very cemented)
17.8	22.8	blue/brown GRAVEL
22.8	25	blue CLAY

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 1910

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	12/06/1985
NZTM Easting	1935275.539	**Driller**	Hill Well Drillers Ltd
NZTM Northing	5602085.161	**Casing Diameter (mm)**	150
Method	Differential GPS	**Bore Depth (m)**	
Address	ALBANY LANE OFF ARATAKI RD HAVELOCK NORT	**Well Depth (m)**	55.2999992370605
		Screen top (m)	55.2999992370605
		Screen bottom (m)	61.1599998474121
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-29
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	
Comments	Permit number is 850190 Driller was Hill Welldrillers Legal description:Lot2, DP 4464, Blk IV Te mata S.D. Blk I Kidnappers S.D. Screen type:PVC 125mm Length: 5.86m Location:Albany lane off arataki road Havelock North API Steel 56m Owner is Errig

Aquifer Test

Test Date	02-04-1987
Report Number	138
Maximum Pumping Rate (l/s)	10.66

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Maximum DrawDown (m)	5.77
Duration (hours)	12
Number Of Pumping Steps	627
Aquifer Thickness (m)	
Transmissivity (m^2/d)	950
Storativity	
Hydralic Conductivity (m/d)	
Specific Capacity ((l/s)/m)	1.85

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	0.5	TOPSOIL with sand
0.5	1.5	SILT (cemented, pan)
1.5	3	SILT (cemented, pan)
3	3.75	red/yellow SAND
3.75	12.8	brown/red GRAVEL with clay (tight bands)
12.8	14.8	white CLAY
14.8	16	blue CLAY (sticky)
16	28	blue CLAY (dense)
28	32.8	brown/red GRAVEL (stained)
32.8	33.1	brown CLAY with sand
33.1	34.2	brown/red GRAVEL (tight)
34.2	48.5	blue CLAY (sticky, firm)
48.5	53.5	brown GRAVEL (loose)
53.5	53.8	brown GRAVEL with clay (tight)

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 1910

53.8	55.3	brown GRAVEL (loose)
55.3	56	brown CLAY
56	56.1	blue CLAY
56.1	93	blue CLAY

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 4337

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	08/04/1999
NZTM Easting	1934900.909	**Driller**	Honnor Drilling Limited
NZTM Northing	5603126.057	**Casing Diameter (mm)**	100
Method		**Bore Depth (m)**	
Address	BROOKVALE & NAPIER ROAD	**Well Depth (m)**	44
		Screen top (m)	
		Screen bottom (m)	
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-2.38
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	
Comments	There is some doubt about the association of the lithological log and the other details, Consent dated 19/8 1999 refers to 150mm hole, drillers record refers to 100 mm hole and a drill date of 8/4/1999.

Aquifer Test

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	2.8	SILT with clay
2.8	8.5	GRAVEL (good water yield)
8.5	9.8	brown GRAVEL with clay
9.8	12	brown GRAVEL with clay (tight)

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12	12.6	brown CLAY
12.6	14.7	blue CLAY
14.7	14.9	(wood)
14.9	15.4	blue SILT
15.4	16.3	blue CLAY
16.3	17.1	coarse blue GRAVEL
17.1	18.2	blue/brown GRAVEL
18.2	21.5	brown GRAVEL with clay/sand
21.5	22.5	GRAVEL with clay (claybound)
22.5	31	medium GRAVEL with clay/sand (water yielding)
31	36	medium GRAVEL with sand
36	38.5	GRAVEL (looser, water yielding)
38.5	40.2	GRAVEL with clay (tight claybound)
40.2	44	GRAVEL (looser, water yielding)

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 4338

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	08/48/1999
NZTM Easting	1983. 9Hb94n	**Driller**	r Di i Dl g lumit eld l562
NZTM Northing	7n48109c479	**Casing Diameter (mm)**	344
Method		**Bore Depth (m)**	
Address	BROOKVAeE & NAPIER ROAg Uk r AVEeOwK NORar	**Well Depth (m)**	8n
		Screen top (m)	
		Screen bottom (m)	
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Wl vi D- i

Aquifer Information

li l5qmu q56l e6f 6m	h0o8.
li l5qmu q56l e6f 6mg q56	
AyCls6l el5TDmDt b	
AyCls6l wDi 2l5Di	
wDd d 6i 5c	aT6l6 lc cDd 6s2DC, 5q, DC5 5T6 qccDFlq5Di Ds5T6 m5TDmDt LFqmmDt - l5T 5T6 D5T6l 265qlm Ds5T6 - 6mmaT6 2llm2q56 lc plDl 5D 5T6 FDi c6i 52q56o

Aquifer Test

Bore Log

(lDd g 6p5T)d S	aDg 6p5T)d S	el5TDmDt b
4	0o	, lD- i aOPUOle - l5T cl55
0o	8o1	, lD- i weAG - l5T t lqf 6m
8o1	8o	, lD- i YRAVEe
8o	H	, lD- i YRAVEe)- q56l bl6m2li t S

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 4338

H	9o7	, lD- i weAG
9o7	14o	, m06 weAG
14o	11o1	, m06/, lD- i YRAVEe
11o1	11o7	, m06 weAG - l5T t lqf 6m
11o7	10o	, m06 weAG
10o	18o8	PEAa/VEY/u OOg)- DD2S
18o8	13o	, m06 weAG
13o	17o0	FDqlc6 , m06 YRAVEe
17o0	1Ho	, m06 weAG
1Ho	1. o1	, m06 YRAVEe
1. o1	00	, lD- i /l62 YRAVEe - l5T Fmqb
00	8n	l62 YRAVEe - l5T Fmqb)5t T5 Fmqb, DCi 2S

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 10497

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	24/10/1958
NZTM Easting	1935398.476	**Driller**	Boag & Hill Ltd
NZTM Northing	5602793.874	**Casing Diameter (mm)**	100
Method	Hand-held GPS	**Bore Depth (m)**	
Address	ARATAKI	**Well Depth (m)**	30.7999992370605
		Screen top (m)	29
		Screen bottom (m)	30.7999992370605
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-4.6
Initial Water Level Date	
Aquifer Lithology	
Aquifer Condition	Flowing confined
Comments	Bore Sealed by Honnor's 23/11/201. Permit number is 10497 Metric Grid Reference : V21:452645 Driller is V F BOAG Owner is GEORGE WHEELER Well location is ARATAKI Pump capacity is 909.7 Screen type is PERF PIPE Water level is -4.6M/581024

Aquifer Test

Test Date	24-10-1958
Report Number	
Maximum Pumping Rate (l/s)	15.45

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Maximum DrawDown (m)	
Duration (hours)	
Number Of Pumping Steps	
Aquifer Thickness (m)	
Transmissivity (m^2/d)	
Storativity	
Hydralic Conductivity (m/d)	
Specific Capacity ((l/s)/m)	

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	4.3	red GRAVEL
4.3	7.3	brown CLAY
7.3	8.5	SILT with sand
8.5	9.8	GRAVEL with sand
9.8	12.8	blue CLAY (mud)
12.8	19.5	SAND with gravel
19.5	23.8	blue CLAY (mud)
23.8	24.4	GRAVEL
24.4	25.9	LIMESTONE with sand
25.9	26.8	brown CLAY
26.8	30.8	brown GRAVEL

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HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Well Number: 16691

IDENTIFICATION		WELL INFORMATION	
WQ Site		**Drill Date**	14/11/2017
NZTM Easting	1935396.474	**Driller**	Honnor Drilling Limited
NZTM Northing	5602793.874	**Casing Diameter (mm)**	100
Method	Hand-held GPS	**Bore Depth (m)**	16
Address	174 Brookvale Road, Havelock North	**Well Depth (m)**	13.3999996185303
		Screen top (m)	11.5
		Screen bottom (m)	13.3999996185303
		Open hole top (m)	
		Open hole bottom (m)	
		Water access	Unknown

Aquifer Information

Initial Water Level	-5
Initial Water Level Date	14-11-2017
Aquifer Lithology	
Aquifer Condition	
Comments	Very hard gravel, could not advance casing beyond 13.4 m

Aquifer Test

Test Date	14-11-2017
Report Number	
Maximum Pumping Rate (l/s)	5
Maximum DrawDown (m)	5.68
Duration (hours)	0.5
Number Of Pumping Steps	
Aquifer Thickness (m)	
Transmissivity (m^2/d)	
Storativity	
Hydralic Conductivity (m/d)	

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Specific Capacity ((l/s)/m)	0.88

Bore Log

From Depth (m)	To Depth (m)	Lithology
0	0.5	TOPSOIL
0.5	8.6	brown CLAY
8.6	9.5	brown GRAVEL
9.5	10.8	blue CLAY
10.8	11	brown GRAVEL
11	12.8	blue GRAVEL with clay (clay bound gravel)
12.8	13.5	brown GRAVEL with clay (clay bound gravel)
13.5	16	brown GRAVEL

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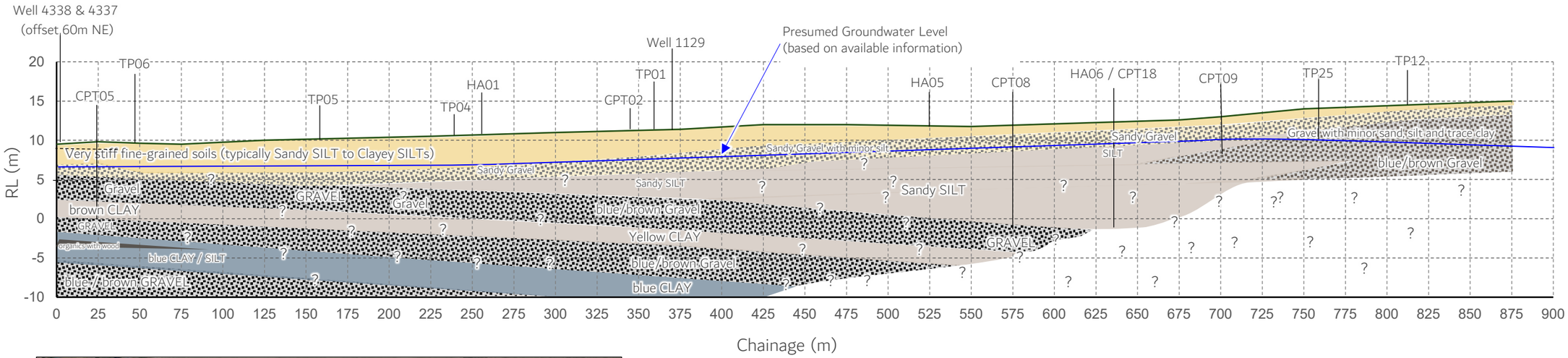
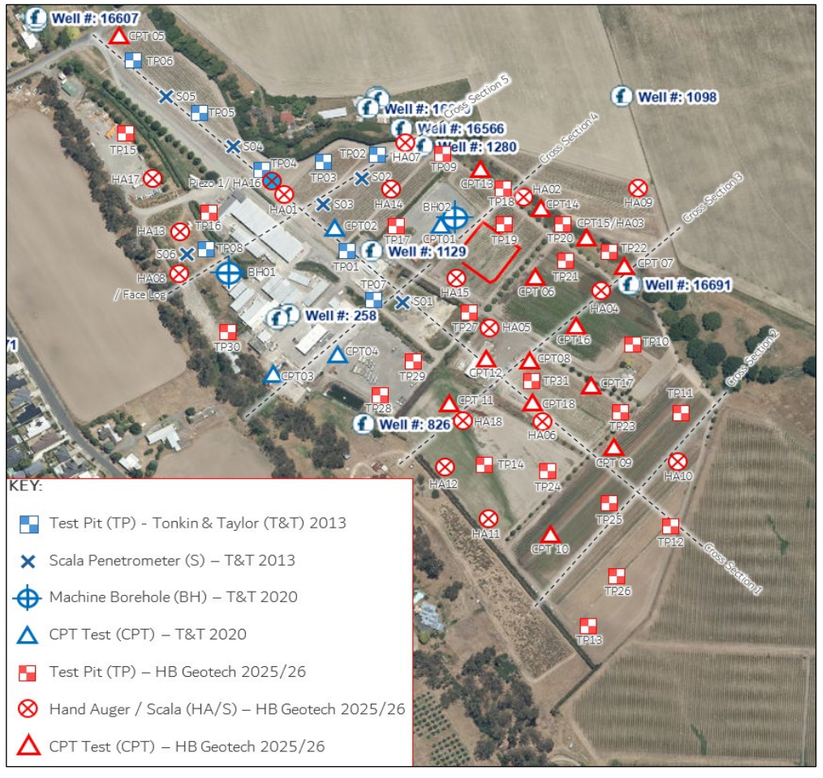
Appendix C

Cross Sections / Ground Models

GROUND MODEL - CROSS SECTION 01 (Note 5 x Vertical Exaggeration)





Notes:

- Ground profile is indicative only and RL's are based on NZVD 2016. 4 x Vertical exaggeration has been applied.

- Soil stratigraphy is based on investigations by HB Geotech and other parties including Well Logs in the area, particularly for the deeper soils.

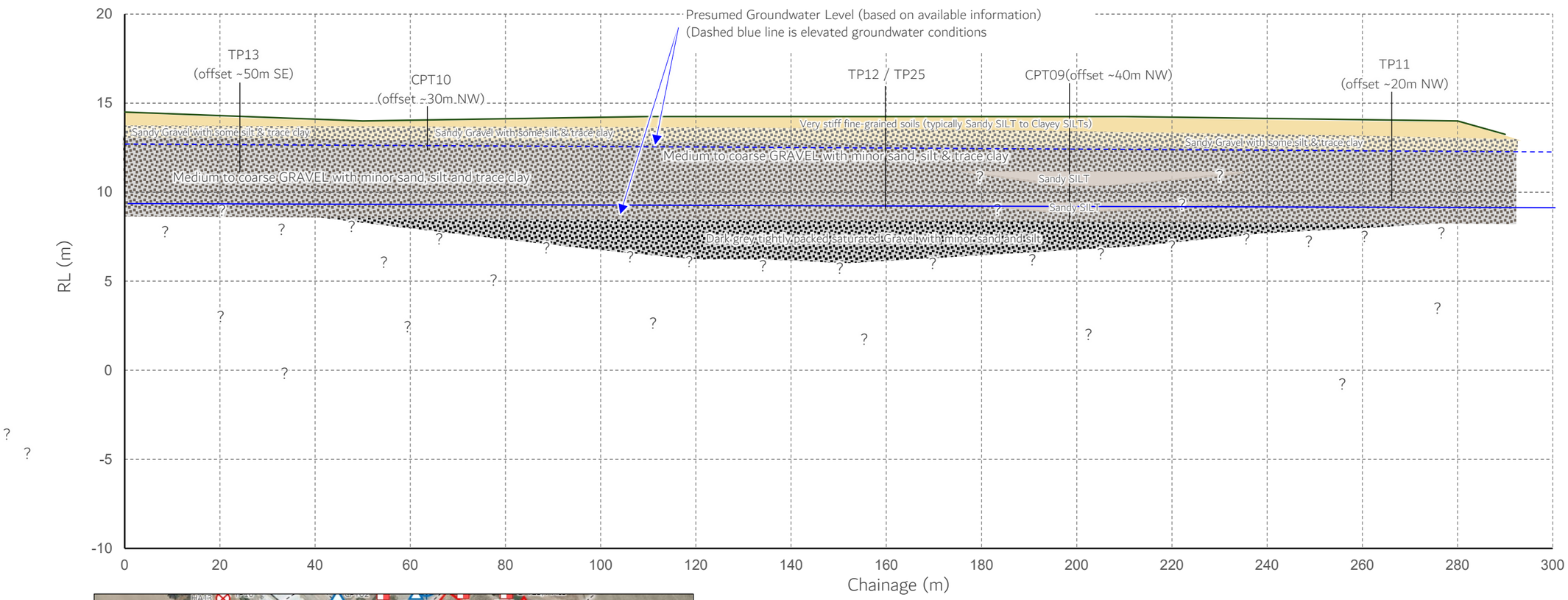
- Well Logs are considered suitable for differentiating between gravels, sands and fine-grained soils but typically not for differentiating between clays & silts.

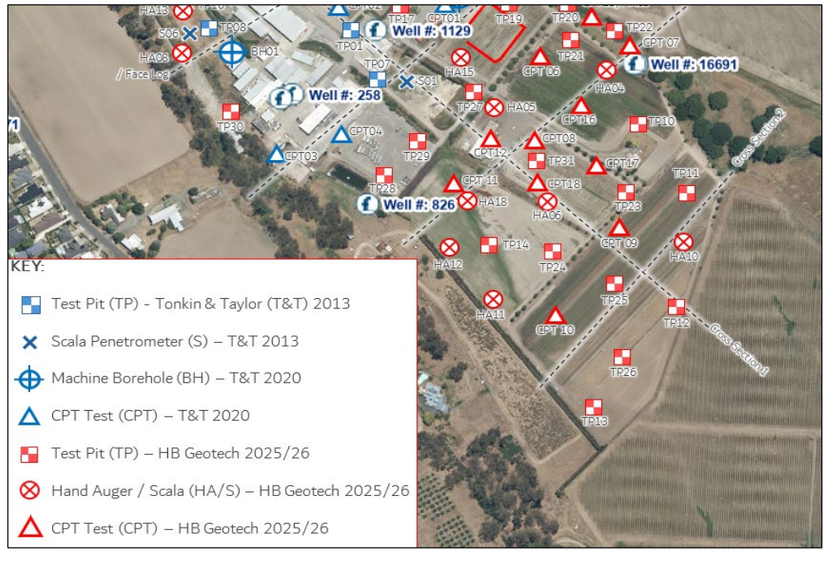
- Ground conditions between investigations points have been inferred and therefore natural ground conditions may vary from those assumed.

HAWKE'S BAY GEOTECH

Project:	174 & 176 Brookvale Road, Havelock North		
Project ID:	25030A	Drawing Ref:	25030A – Section 1
Drawn By:	CJG	Drawing Date:	30/04/2026
Scale:	As shown	Issued For:	Information

GROUND MODEL - CROSS SECTION 02 (Note 4 x Vertical Exaggeration)





Notes:

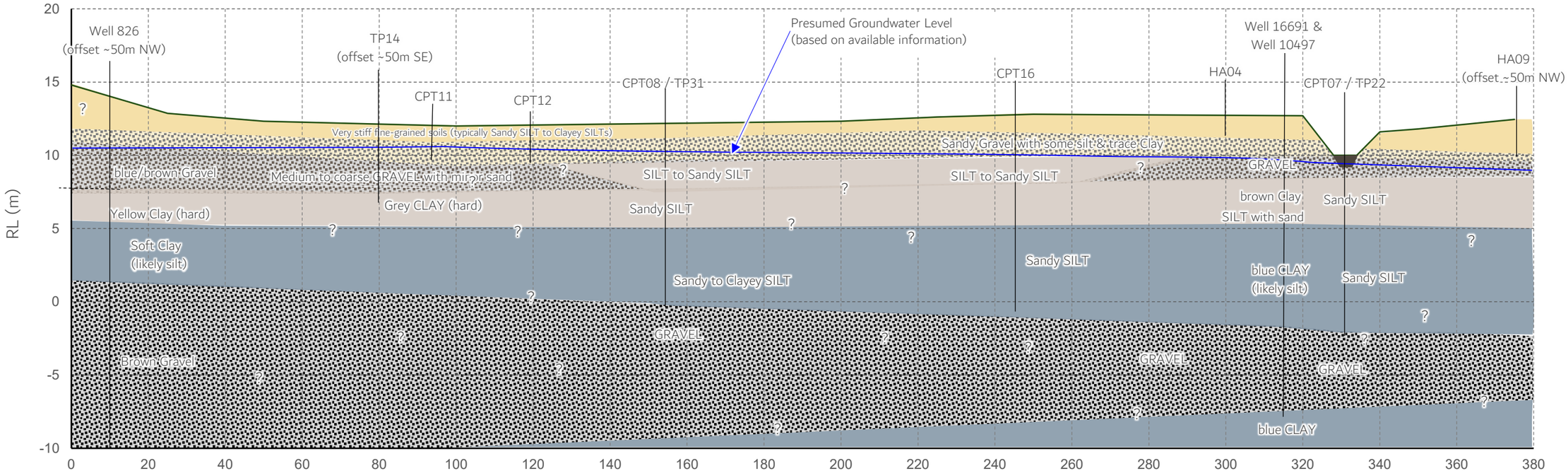
- Ground profile and test locations are indicative only and RL's are based on NZVD 2016. 4 x Vertical exaggeration has been applied.

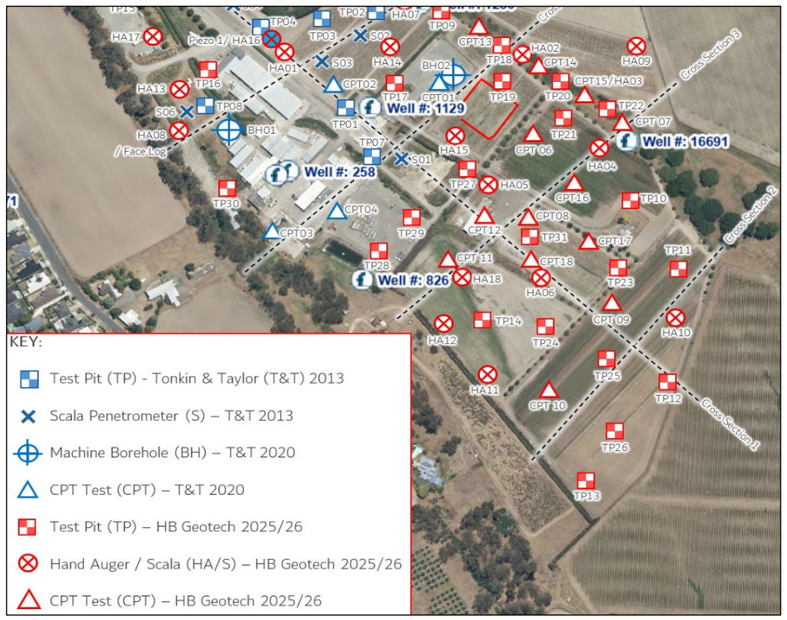
- Soil stratigraphy is based on investigations by HB Geotech and other parties including Well Logs in the area, particularly for the deeper soils.

- Ground conditions between investigations points have been inferred and therefore natural ground conditions may vary from those assumed.

HAWKE'S BAY GEOTECH	Project:	174 & 176 Brookvale Road, Havelock North		
	Project ID:	25030	Drawing Ref:	25030A – Section 2
	Drawn By:	CJG	Drawing Date:	30/04/2026
	Scale:	As shown	Issued For:	Information

GROUND MODEL - CROSS SECTION 03 (Note 4 x Vertical Exaggeration)





Notes:

- Ground profile is indicative only and RL's are based on NZVD 2016. 4 x Vertical exaggeration has been applied.

- Soil stratigraphy is based on investigations by HB Geotech and other parties including Well Logs in the area, particularly for the deeper soils.

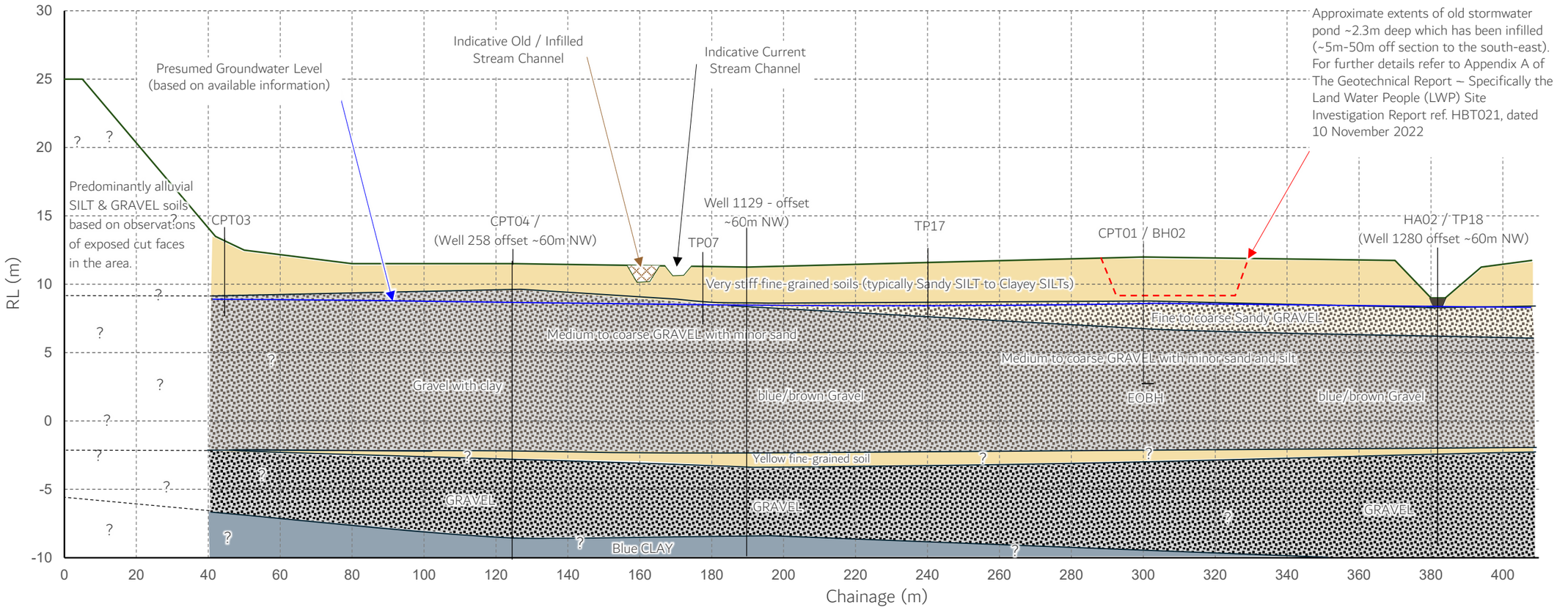
- Well Logs are considered suitable for differentiating between gravels, sands and fine-grained soils but typically not for differentiating between clays & silts.

- Ground conditions between investigations points have been inferred and therefore natural ground conditions may vary from those assumed.

HAWKE'S BAY GEOTECH

Project:	174 & 176 Brookvale Road, Havelock North		
Project ID:	25030A	Drawing Ref:	25030A – Section 3
Drawn By:	CJG	Drawing Date:	30/04/2026
Scale:	As shown	Issued For:	Information

GROUND MODEL - CROSS SECTION 04 (Note 4 x Vertical Exaggeration)



Notes:

- Ground profile is indicative only and RL's are based on NZVD 2016. 4 x Vertical exaggeration has been applied.

- Soil stratigraphy is based on investigations by HB Geotech and other parties including Well Logs in the area, particularly for the deeper soils.

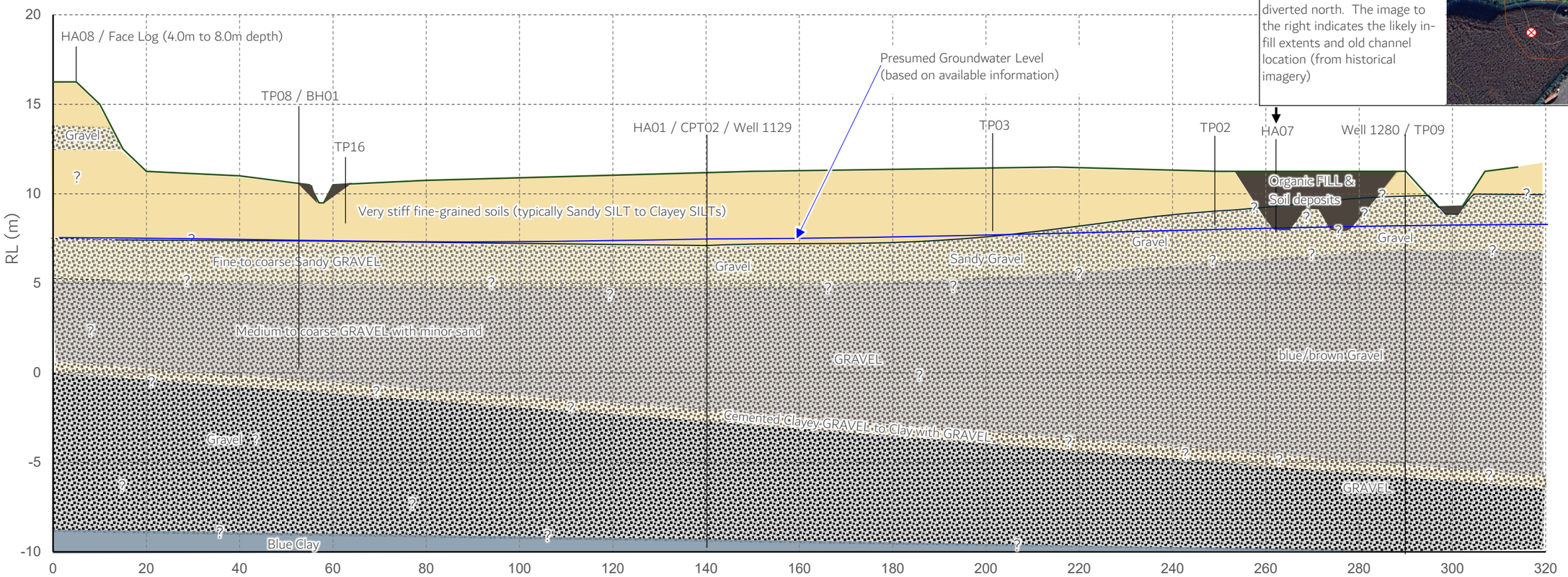
- Well Logs are considered suitable for differentiating between gravels, sands and fine-grained soils but typically not for differentiating between clays & silts.

- Ground conditions between investigations points have been inferred and therefore natural ground conditions may vary from those assumed.

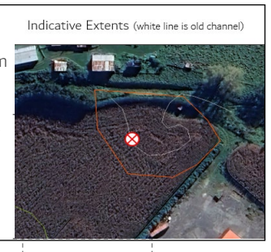
HAWKE'S BAY GEOTECH

Project:	174 & 176 Brookvale Road, Havelock North		
Project ID:	25030A	Drawing Ref:	25030A – Section 4
Drawn By:	CJG	Drawing Date:	30/04/2026
Scale:	As shown	Issued For:	Information

GROUND MODEL - CROSS SECTION 05 (Note 4 x Vertical Exaggeration)



HA07 was undertaken in the location of an old infilled stream channel which has been diverted north. The image to the right indicates the likely in-fill extents and old channel location (from historical imagery)



Notes:

- Ground profile is indicative only and RL's are based on NZVD 2016. 4 x Vertical exaggeration has been applied.

- Soil stratigraphy is based on investigations by HB Geotech and other parties including Well Logs in the area, particularly for the deeper soils.

- Well Logs are considered suitable for differentiating between gravels, sands and fine-grained soils but typically not for differentiating between clays & silts.

- Ground conditions between investigations points have been inferred and therefore natural ground conditions may vary from those assumed.

HAWKE'S BAY GEOTECH

Project:	174 & 176 Brookvale Road, Havelock North		
Project ID:	25030A	Drawing Ref:	25030A – Section 4
Drawn By:	CJG	Drawing Date:	30/04/2026
Scale:	As shown	Issued For:	Information

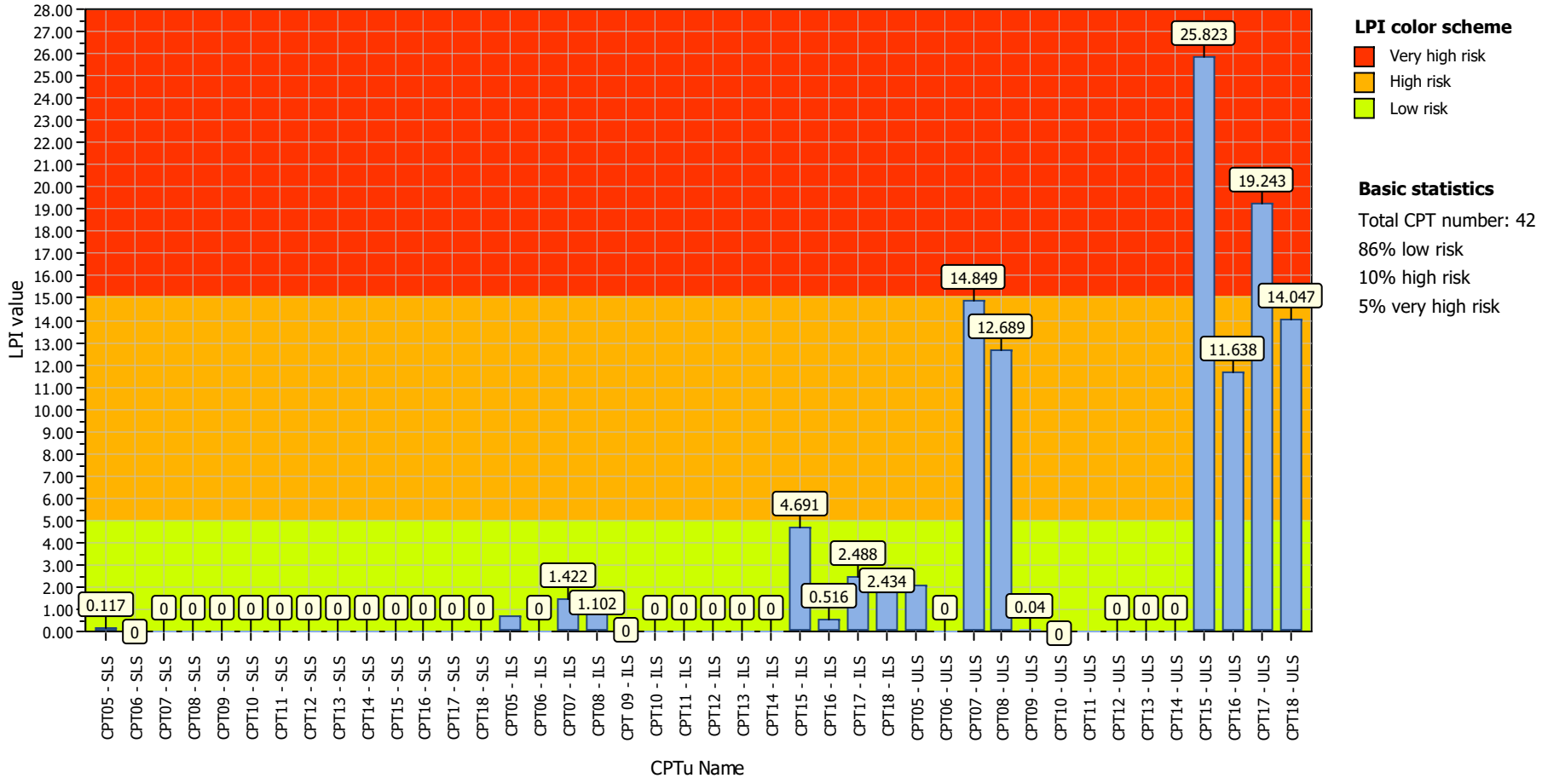
Appendix D

Liquefaction Analysis Results

Project title : CPT Assessment

Location : 174 & 176 Brookvale Road, Havelock North

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

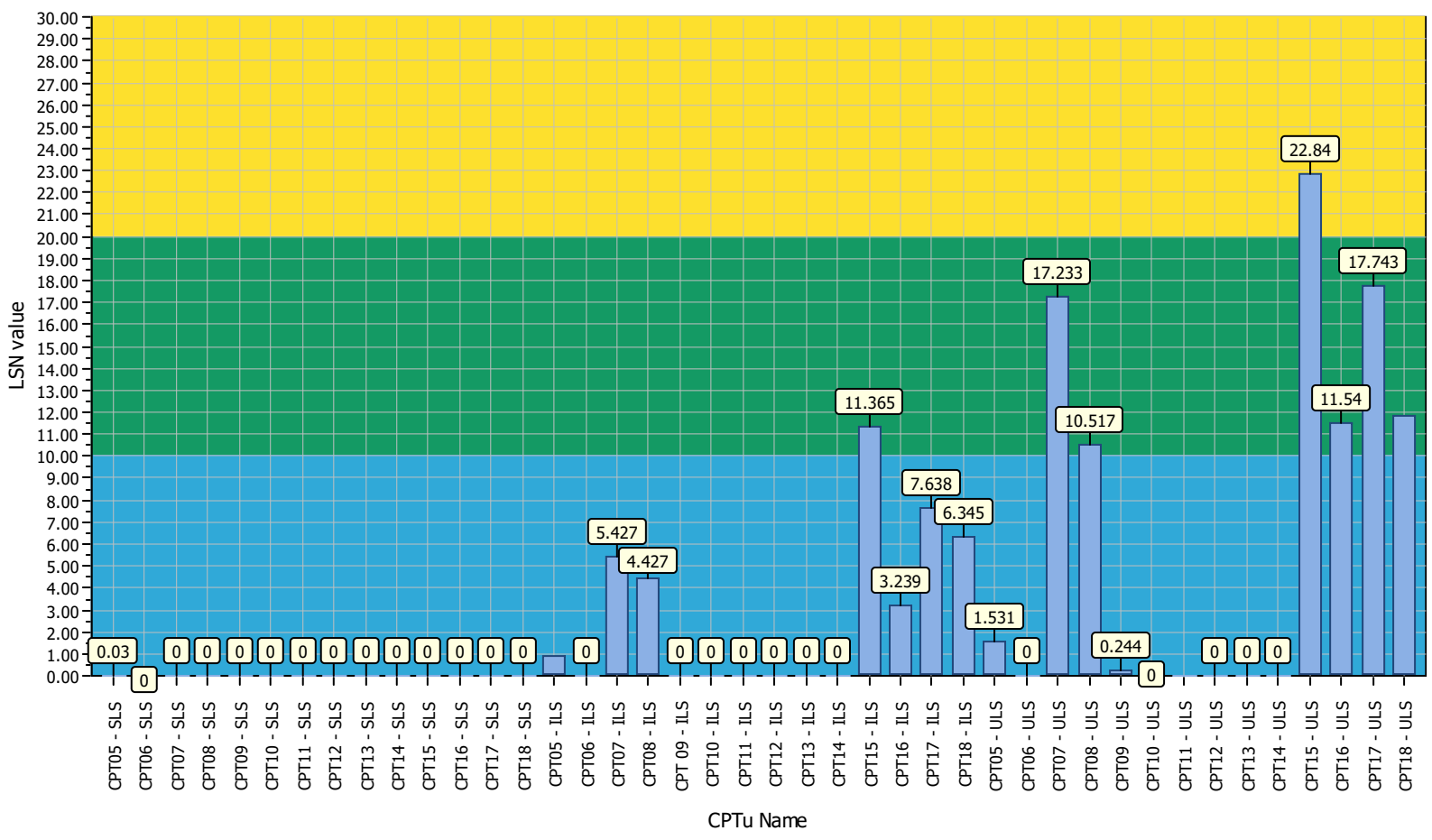
Basic statistics

Total CPT number: 42
86% low risk
10% high risk
5% very high risk

Project title : CPT Assessment

Location : 174 & 176 Brookvale Road, Havelock North

Overall Liquefaction Severity Number report



LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

Basic statistics

Total CPT number: 42

83% little liquefaction

14% minor liquefaction

2% moderate liquefaction

0% moderate to major liquefaction

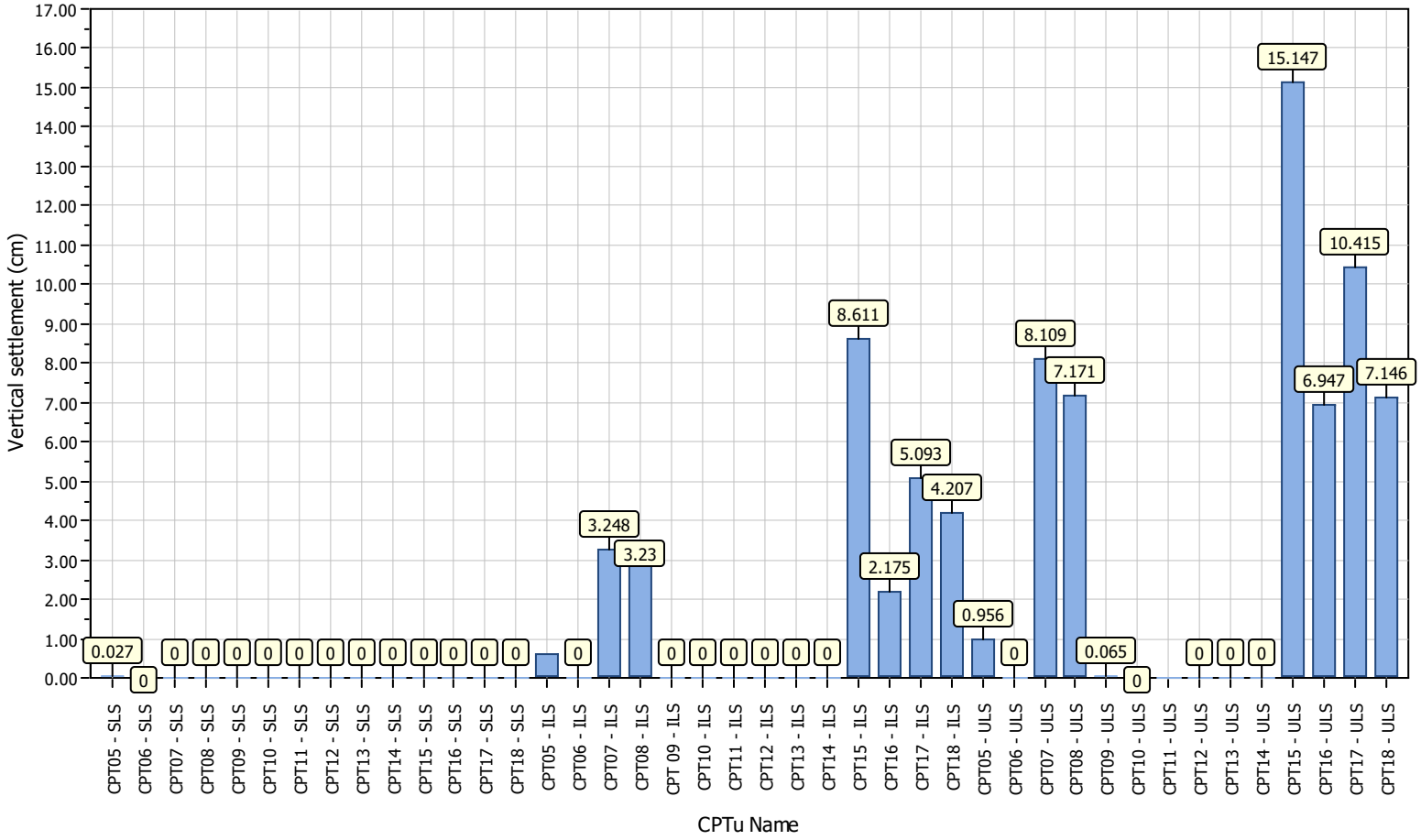
0% major liquefaction

0% severe liquefaction

Project title : CPT Assessment

Location : 174 & 176 Brookvale Road, Havelock North

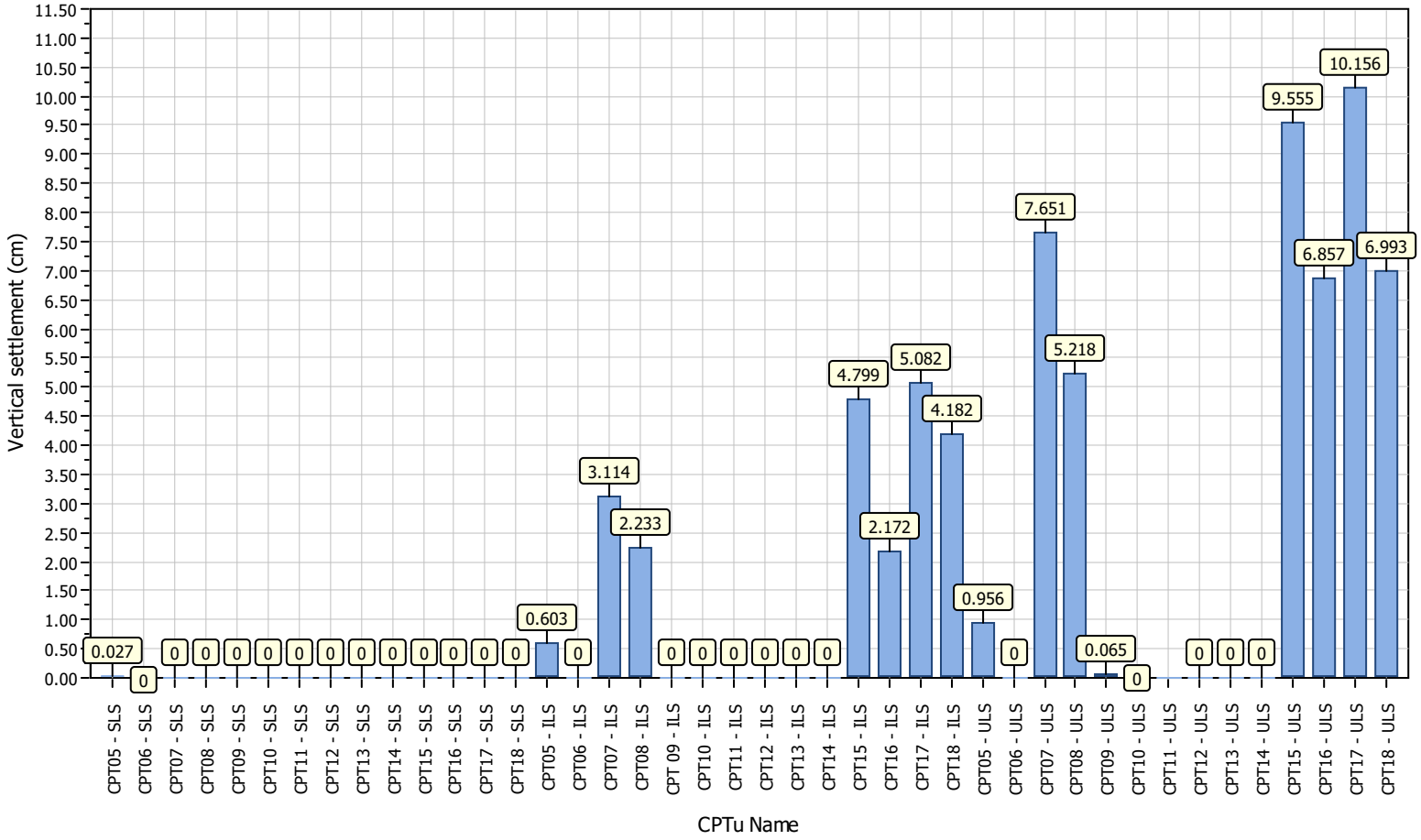
Overall vertical settlements report



Project title : CPT Assessment

Location : 174 & 176 Brookvale Road, Havelock North

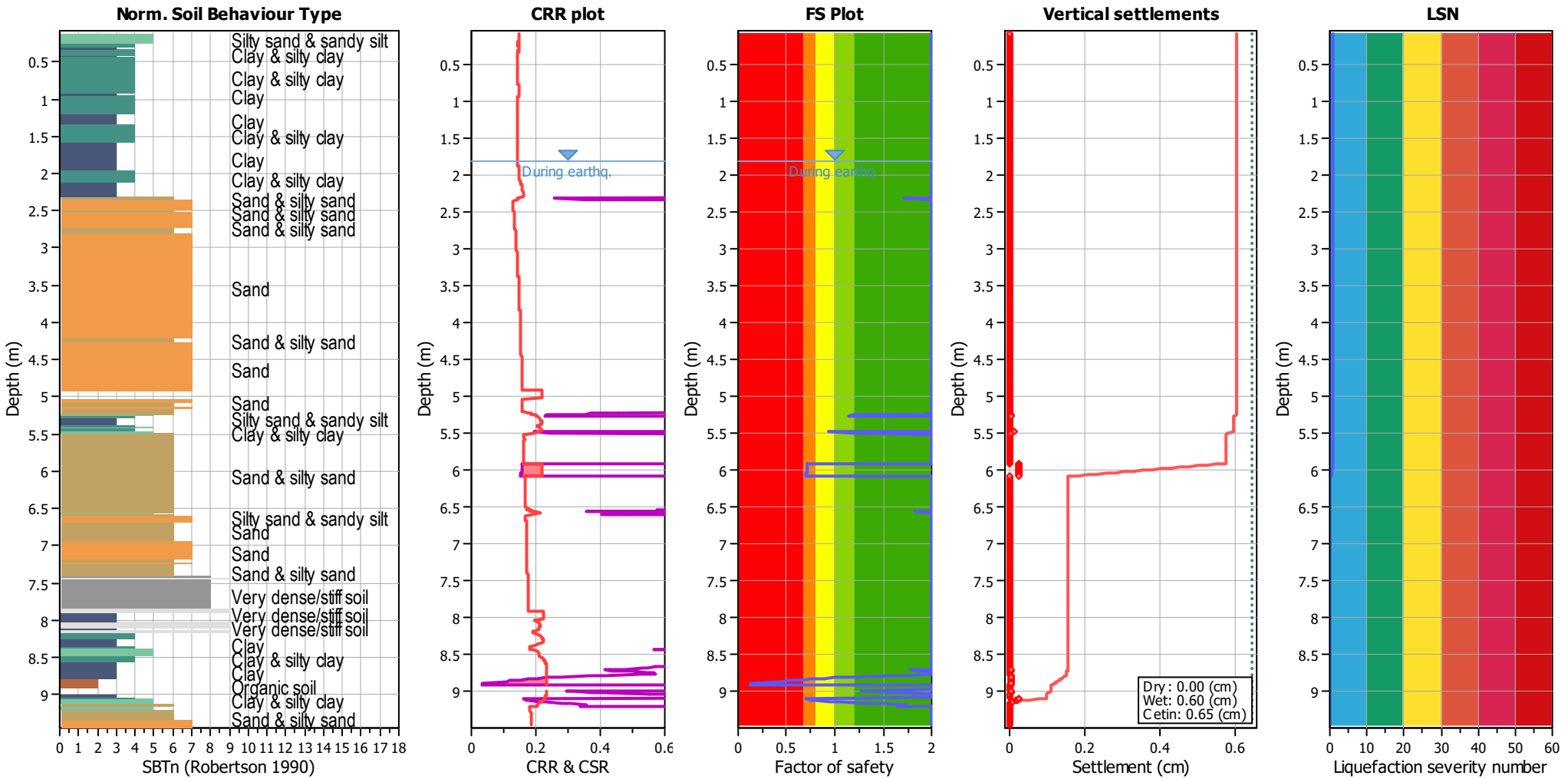
Overall vertical settlements report - Limited to 10m (Indexed Values)



Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

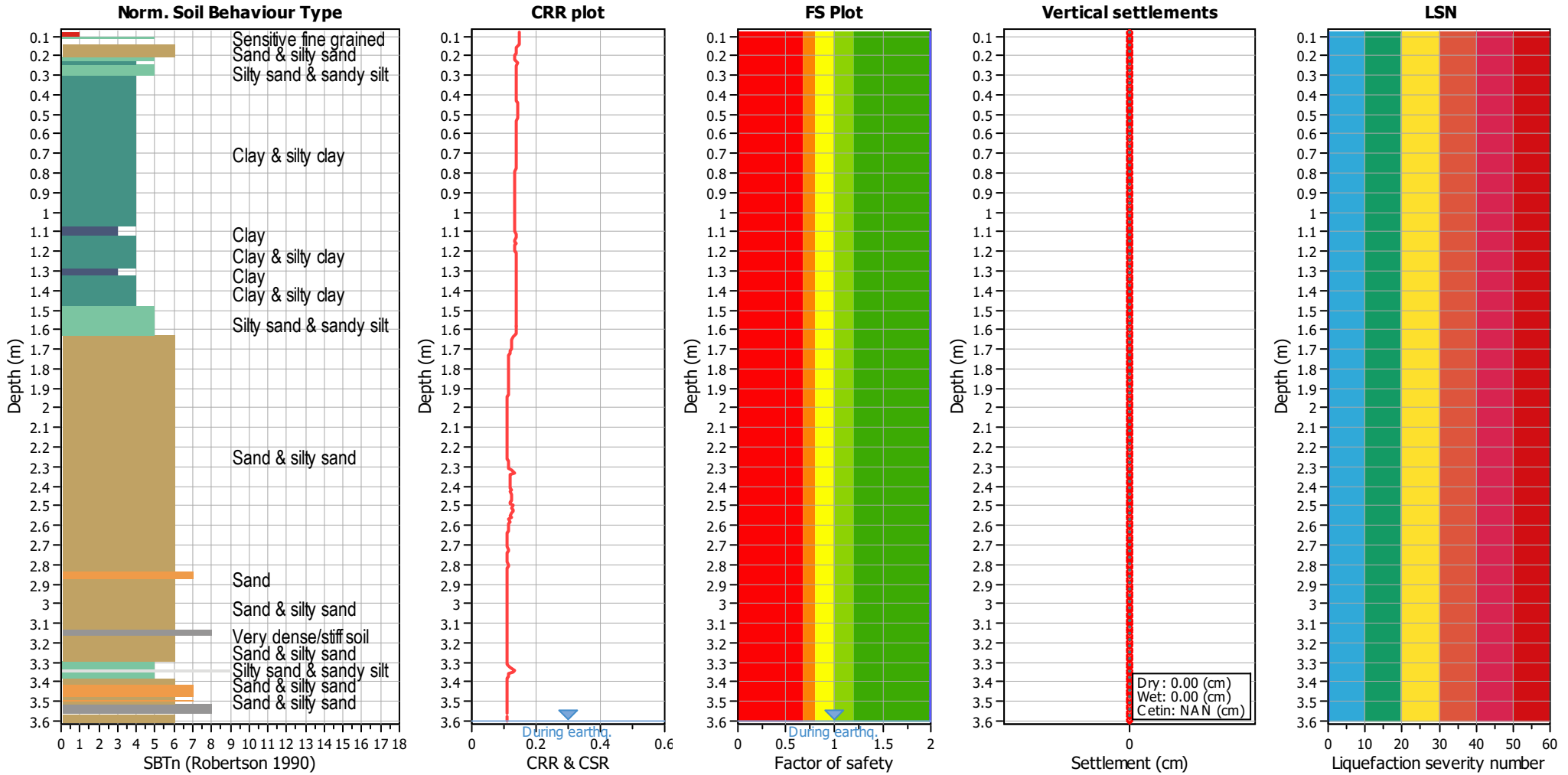
CPT: CPT05 - ILS
Total depth: 9.45 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

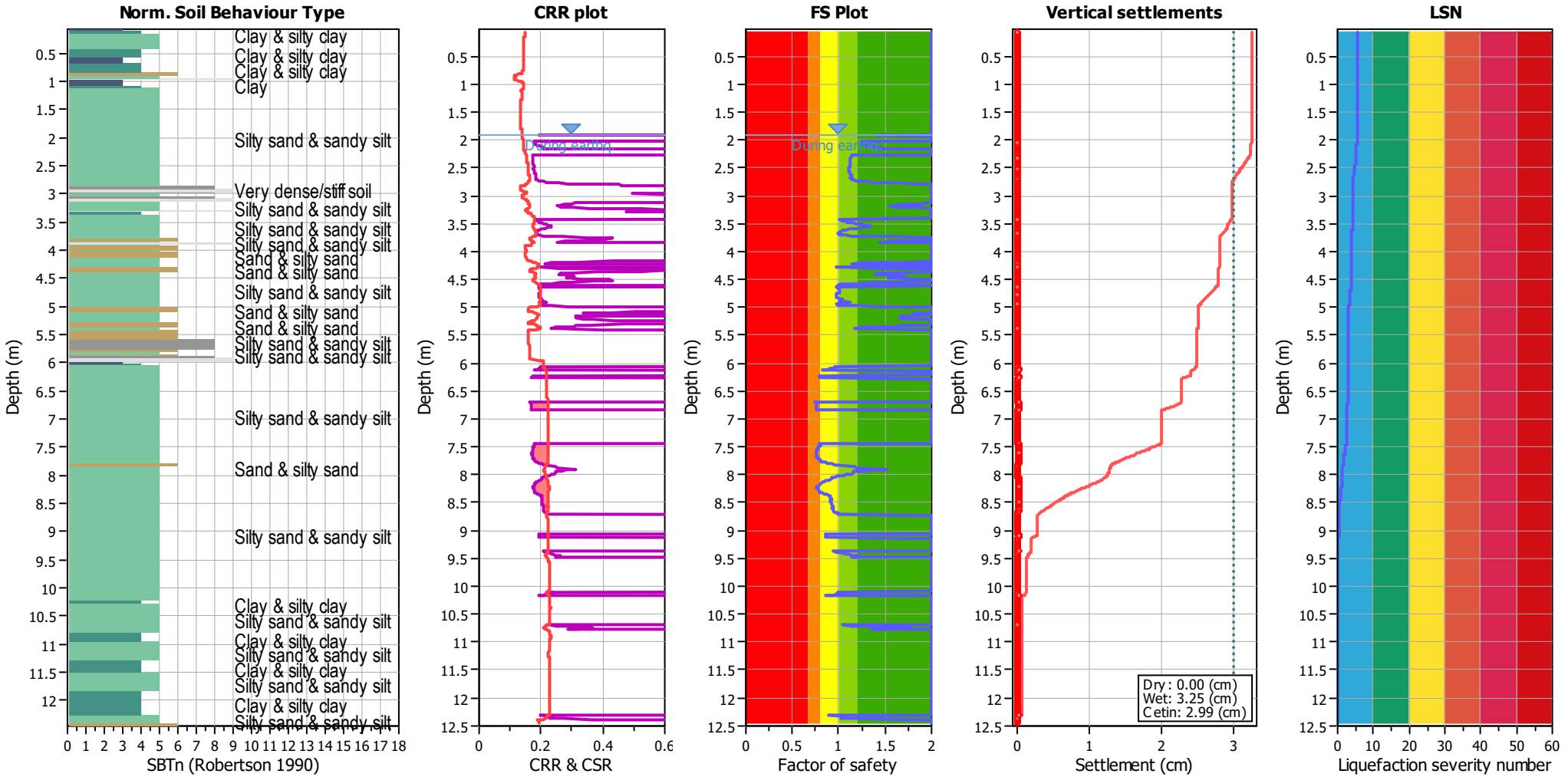
CPT: CPT06 - ILS
Total depth: 3.60 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.60 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.60 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT07 - ILS
Total depth: 12.45 m

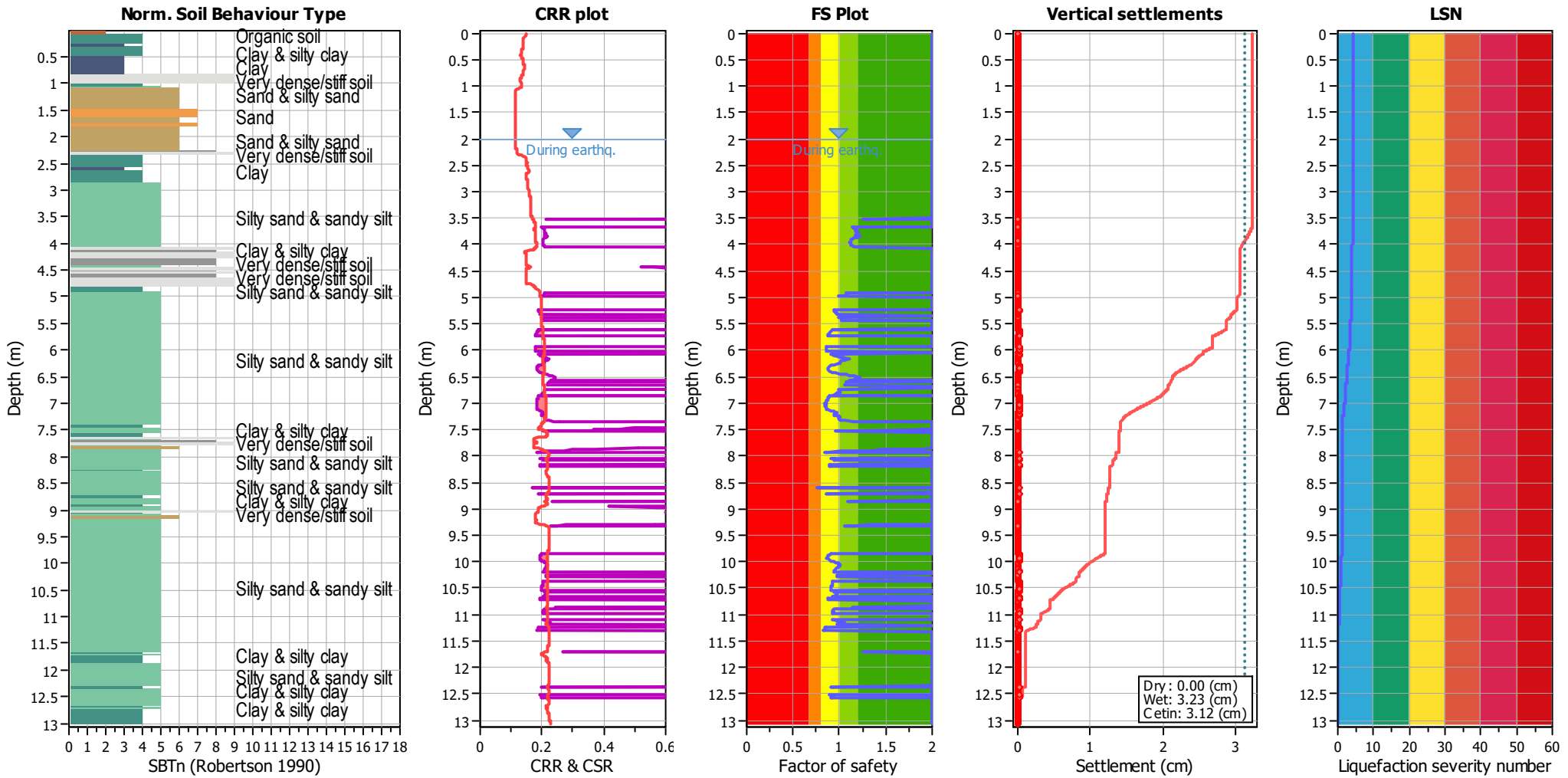


Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.90 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.90 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

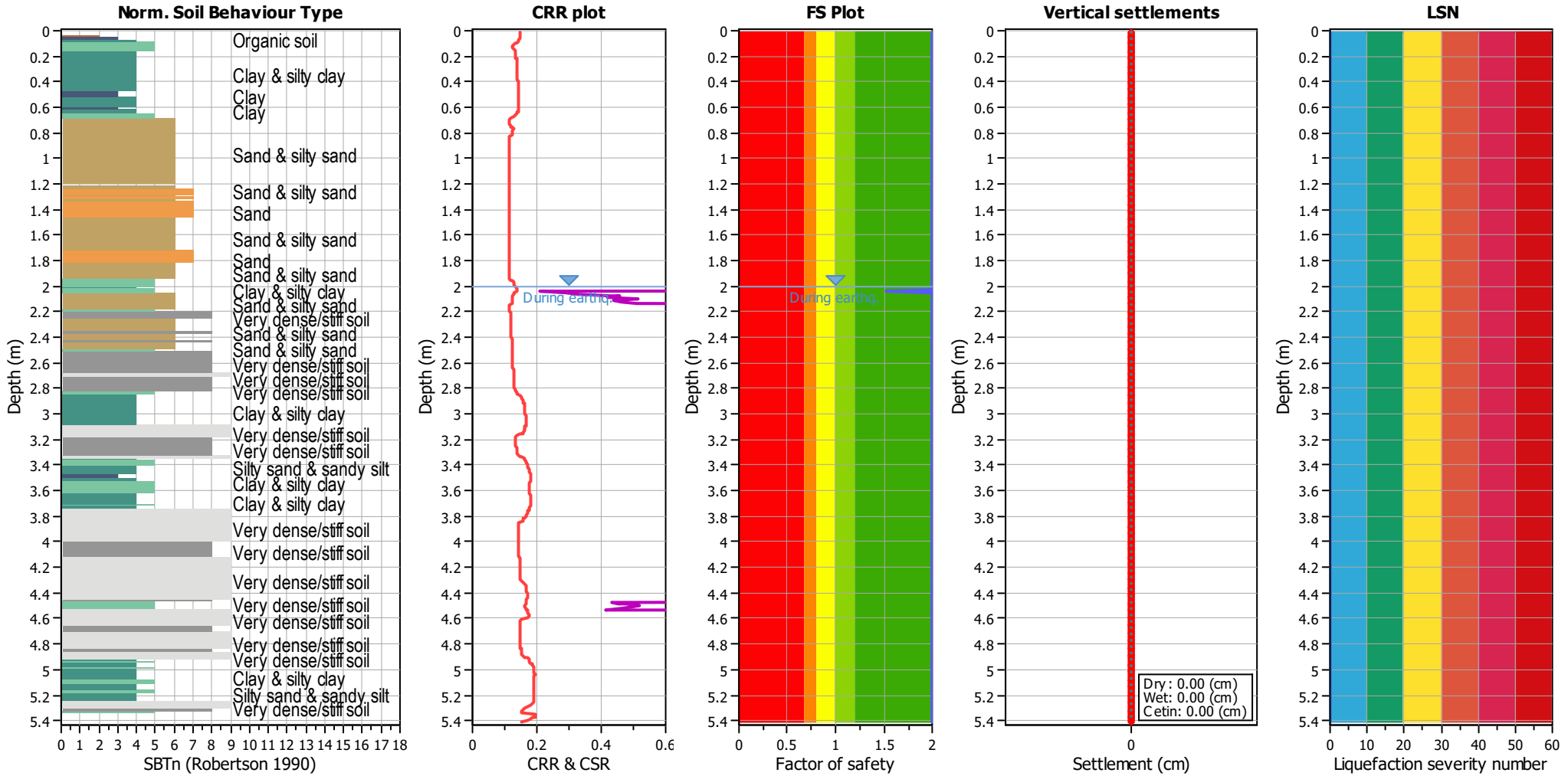
CPT: CPT08 - ILS
Total depth: 13.07 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

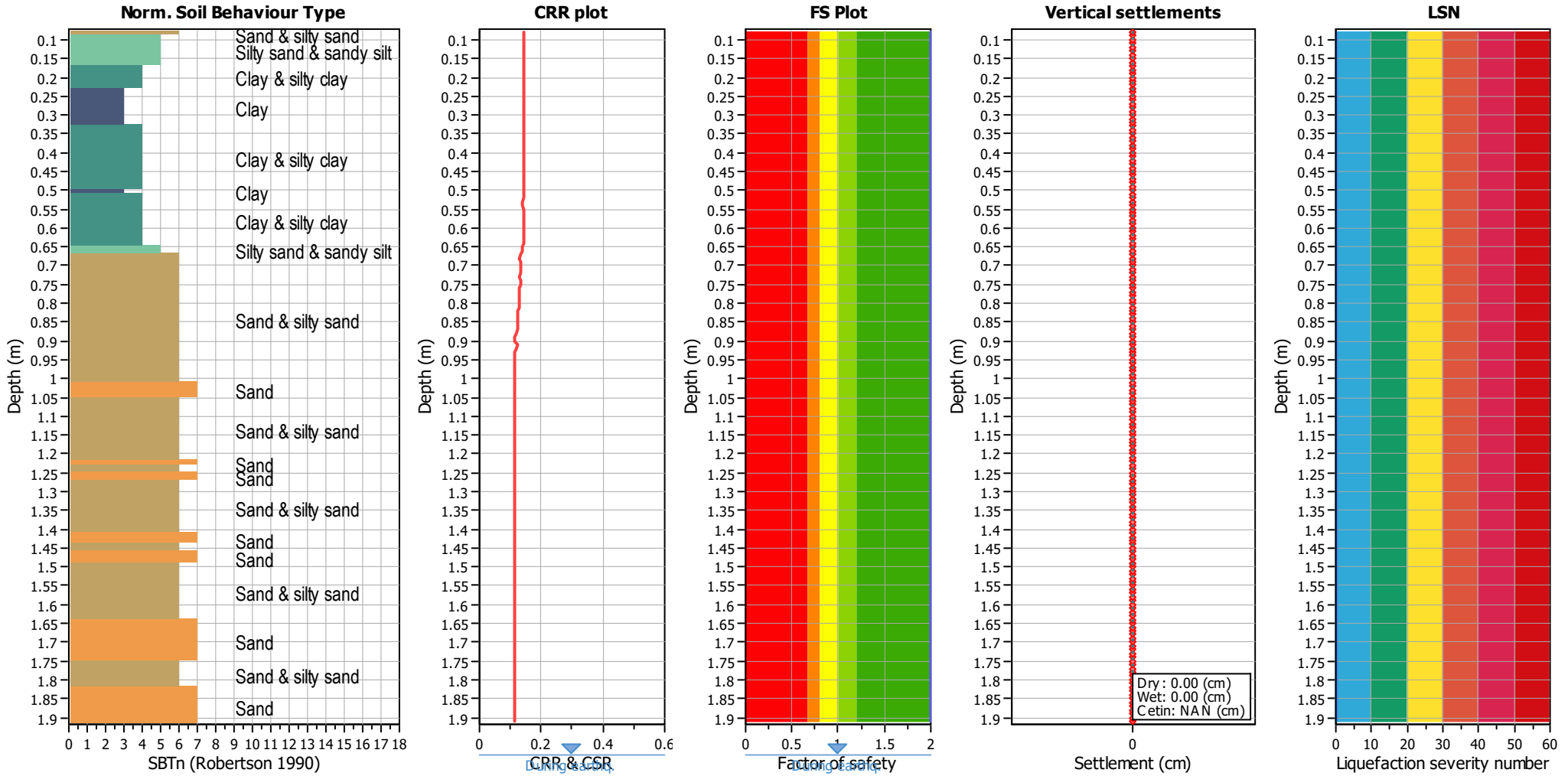
CPT: CPT 09 - ILS
Total depth: 5.41 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

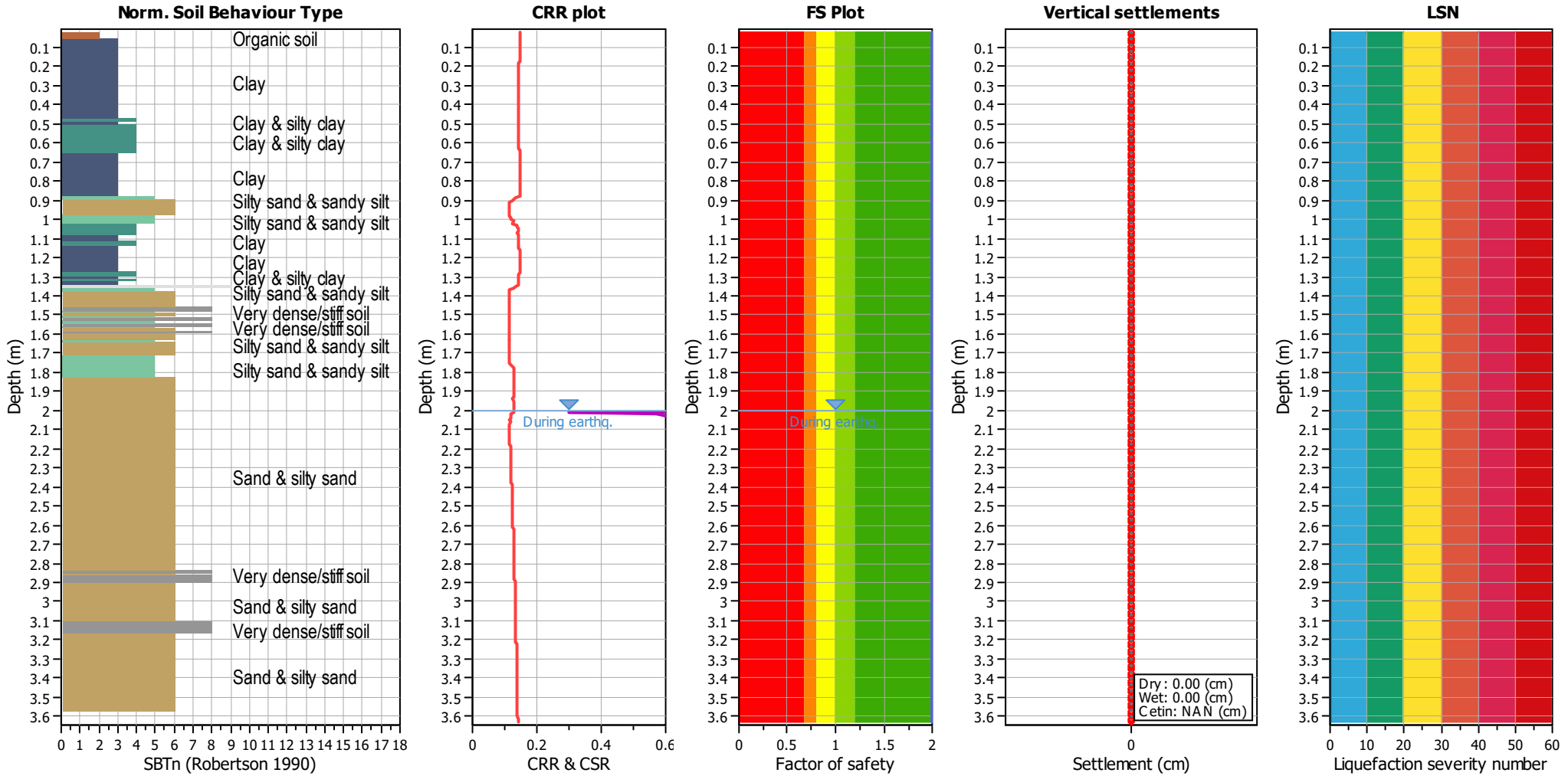
CPT: CPT10 - ILS
Total depth: 1.91 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

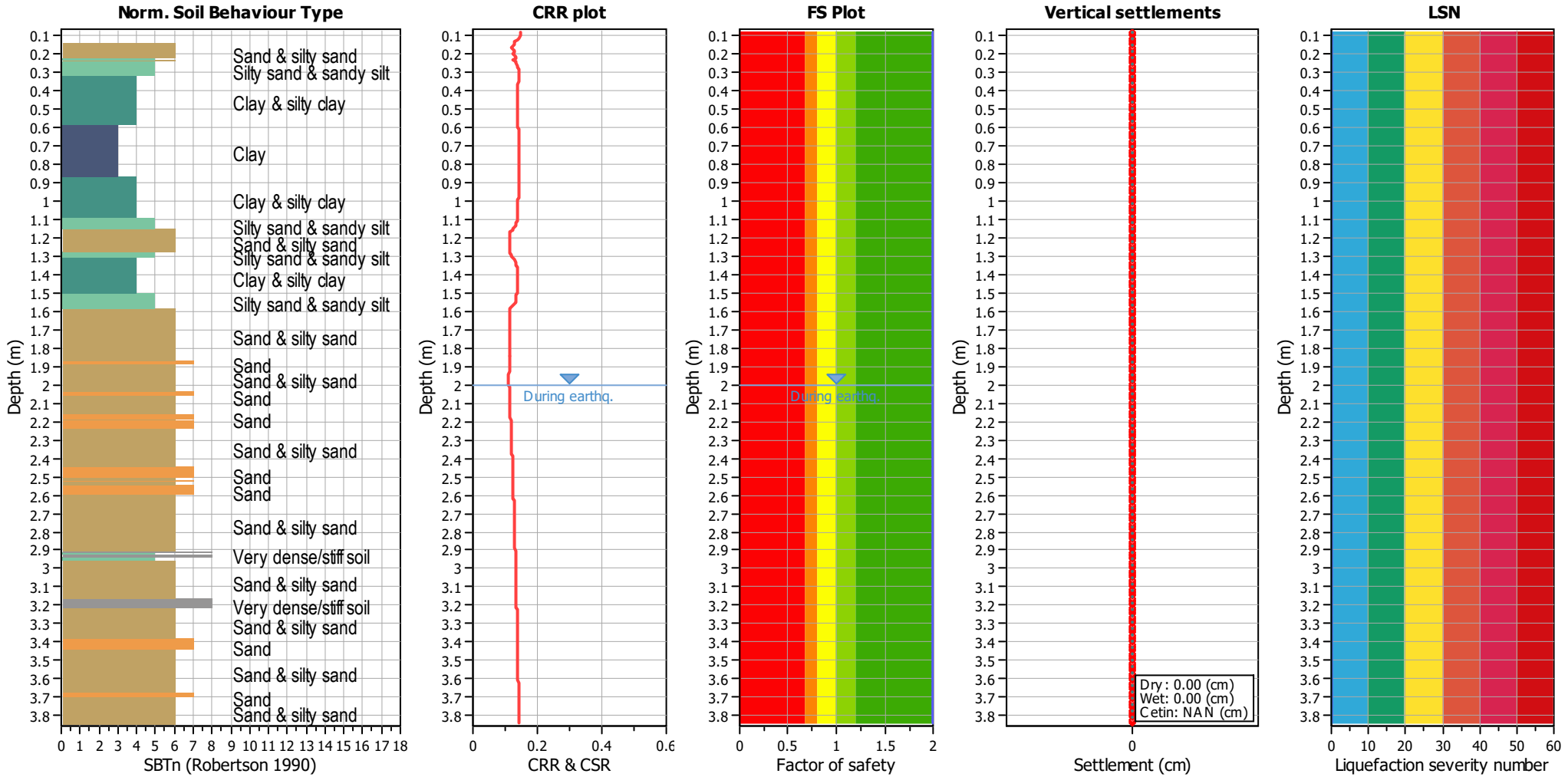
CPT: CPT11 - ILS
Total depth: 3.63 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

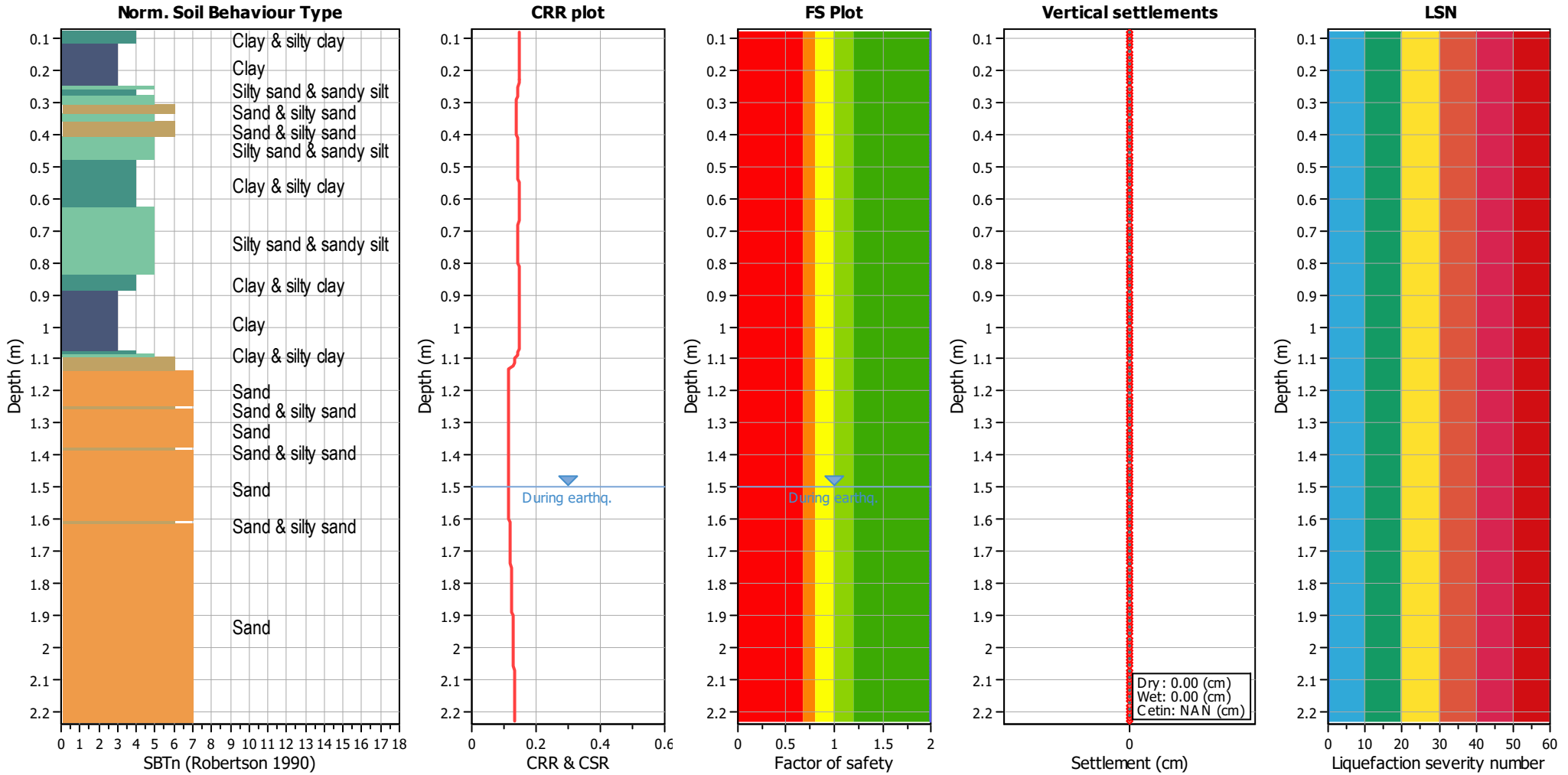
CPT: CPT12 - ILS
Total depth: 3.84 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

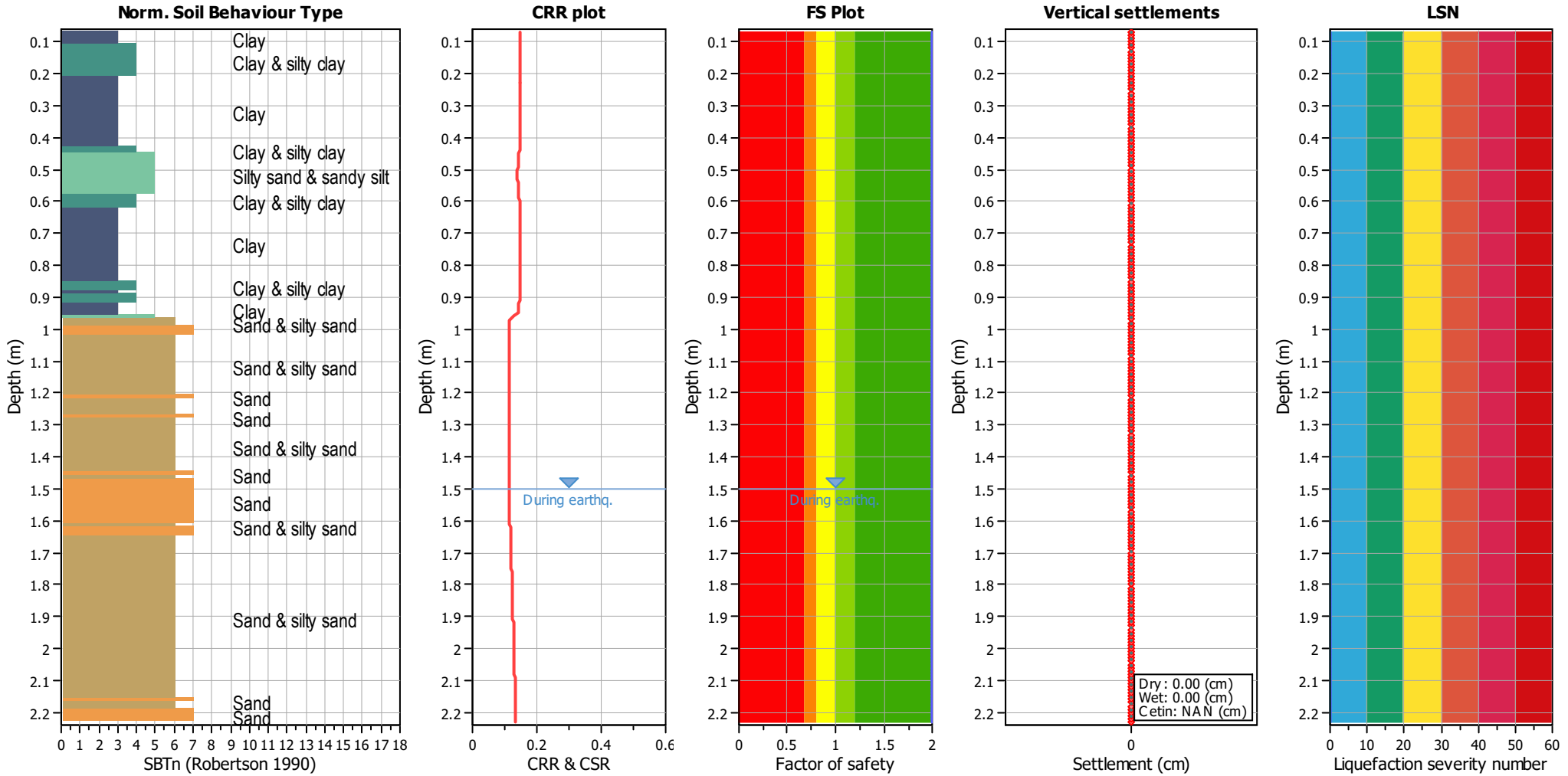
CPT: CPT13 - ILS
Total depth: 2.23 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

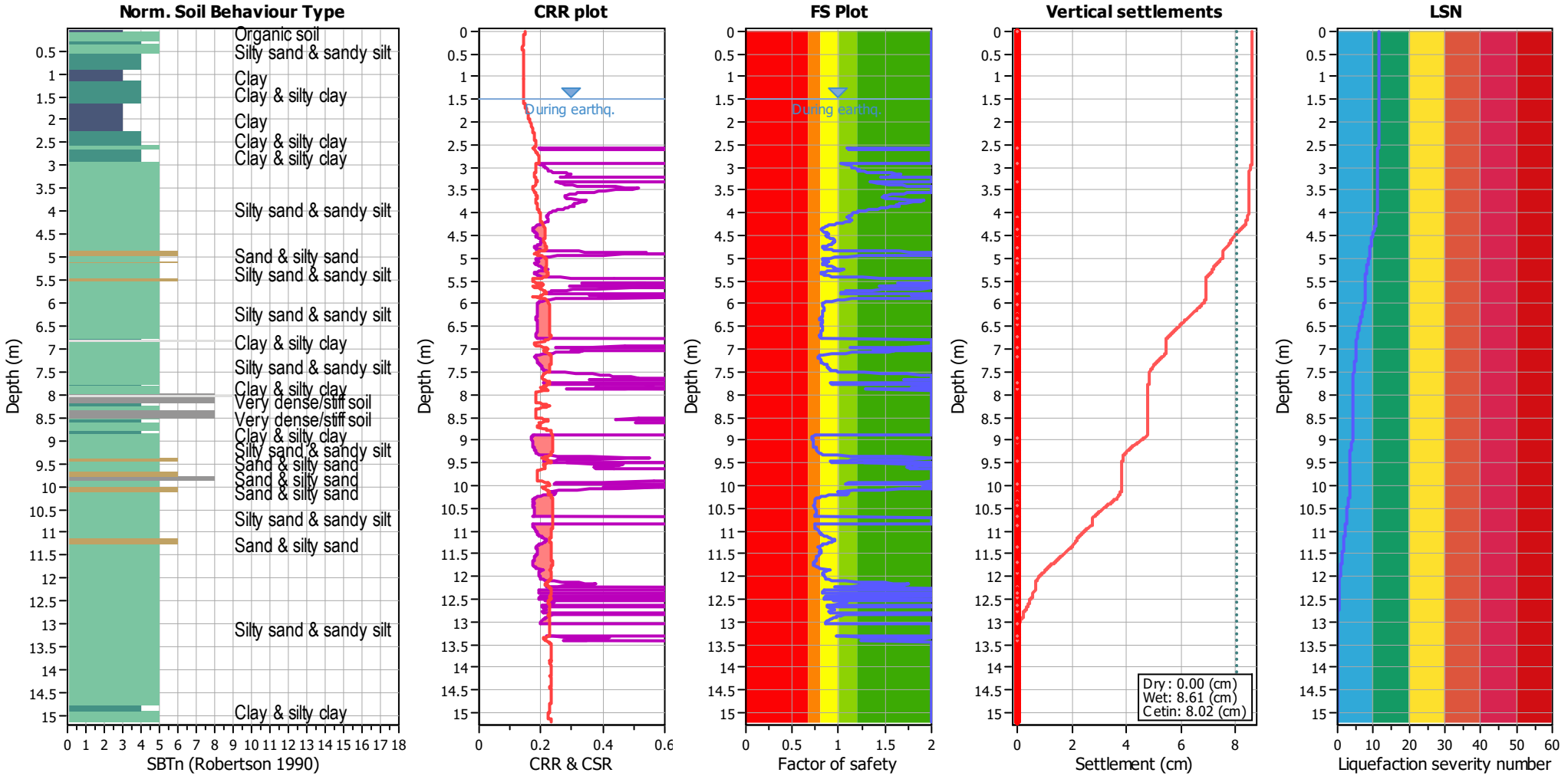
CPT: CPT14 - ILS
Total depth: 2.23 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

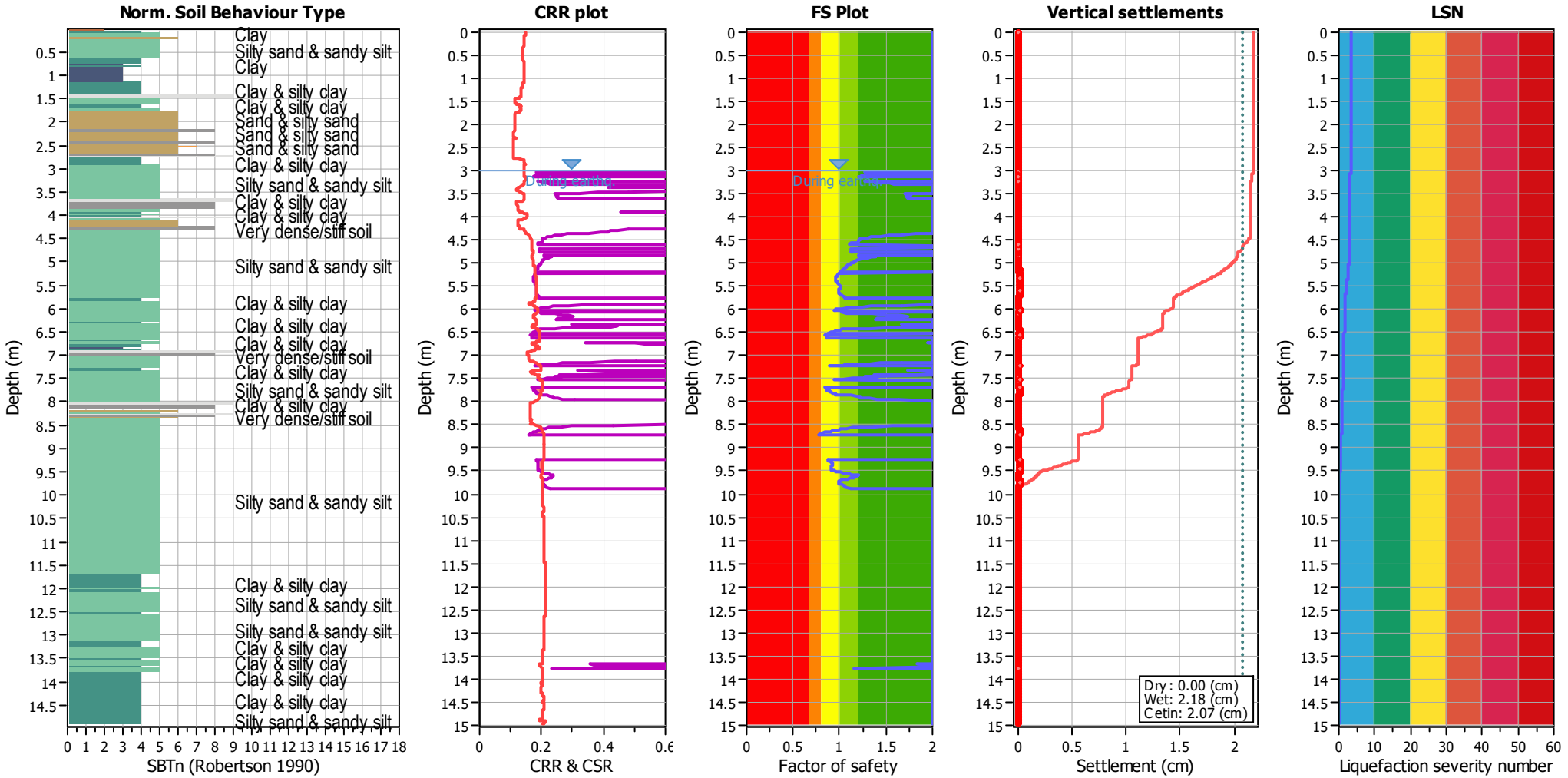
CPT: CPT15 - ILS
Total depth: 15.20 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

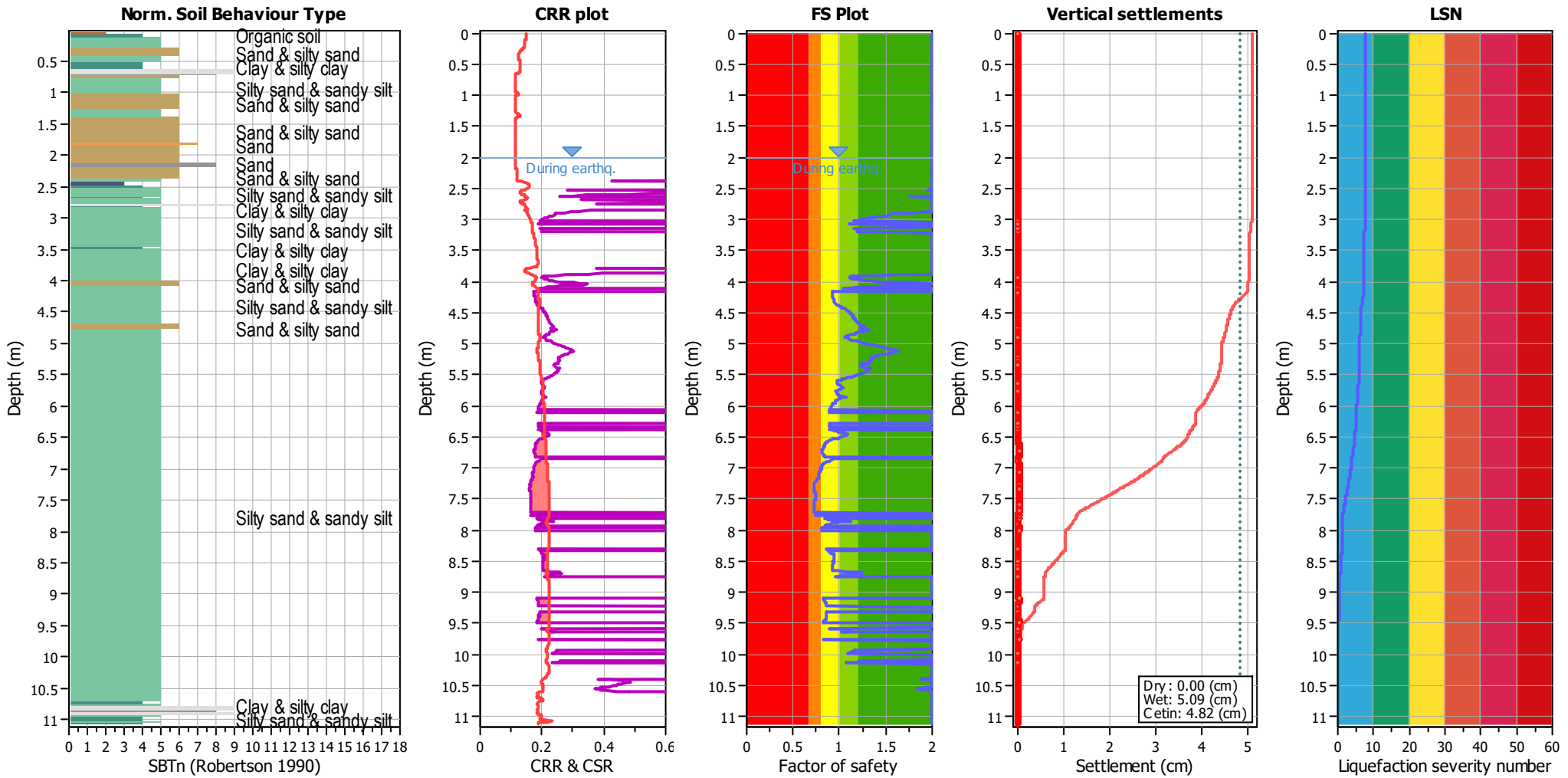
CPT: CPT16 - ILS
Total depth: 14.97 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

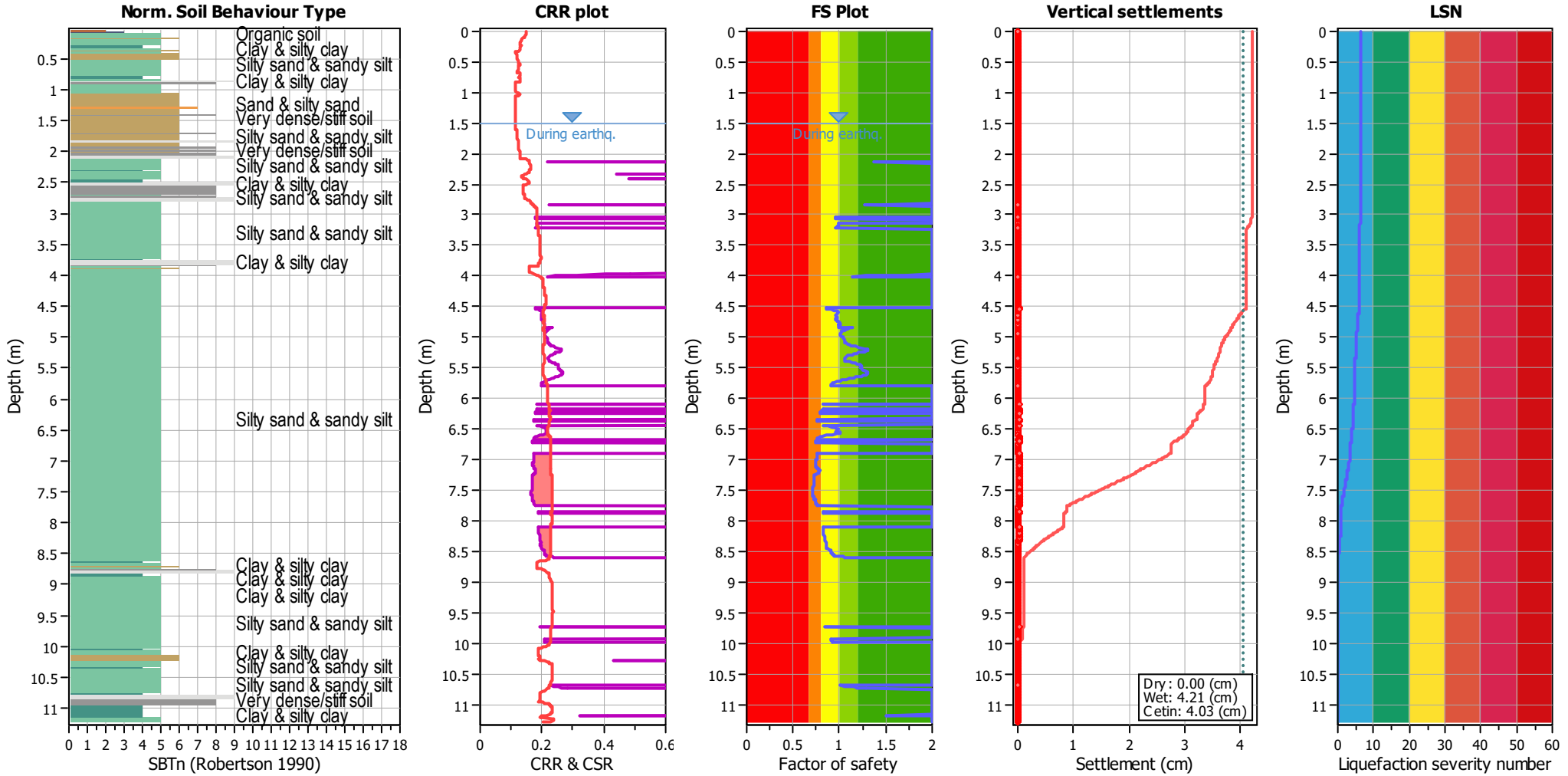
CPT: CPT17 - ILS
Total depth: 11.12 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

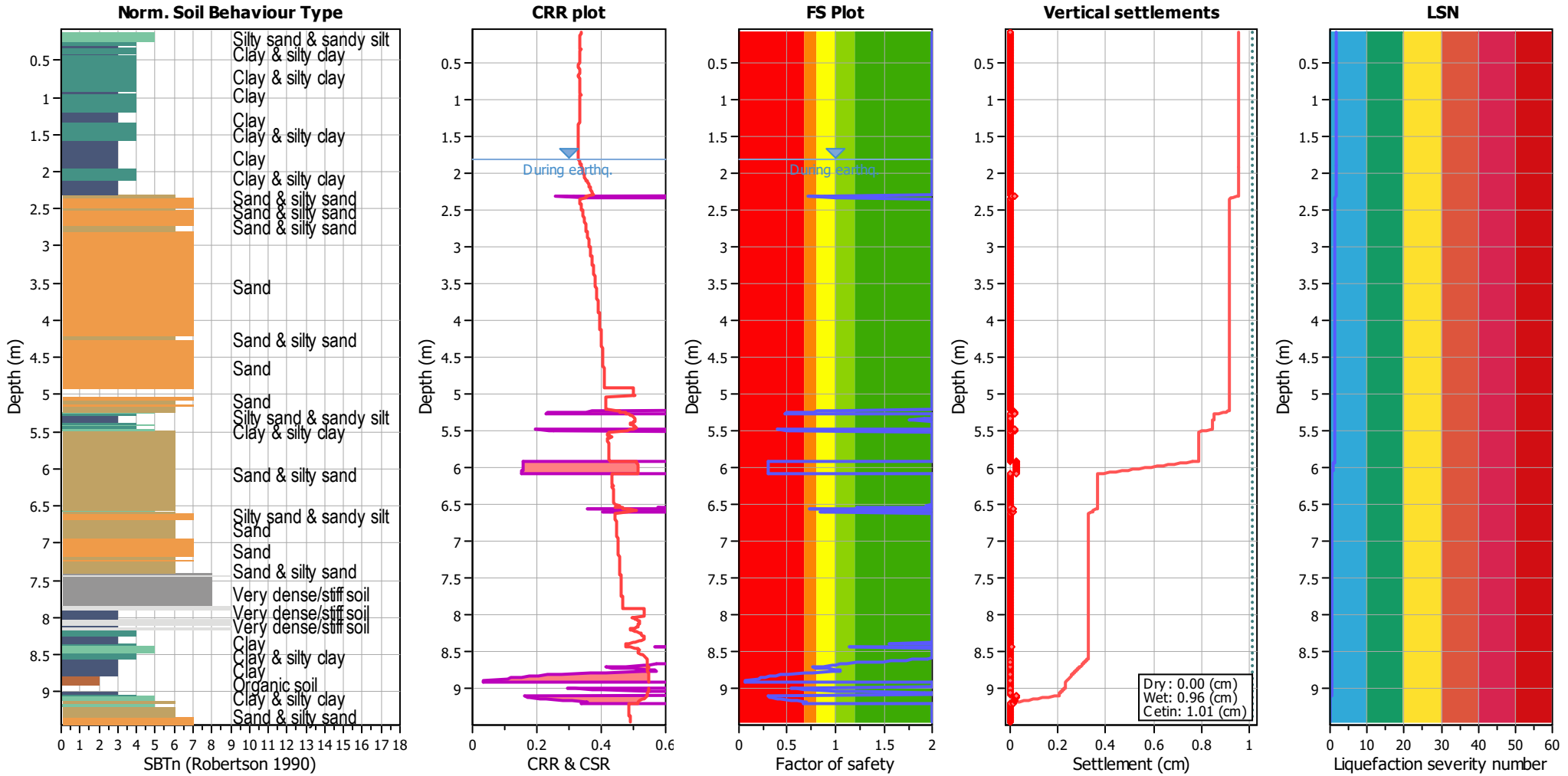
CPT: CPT18 - ILS
Total depth: 11.27 m



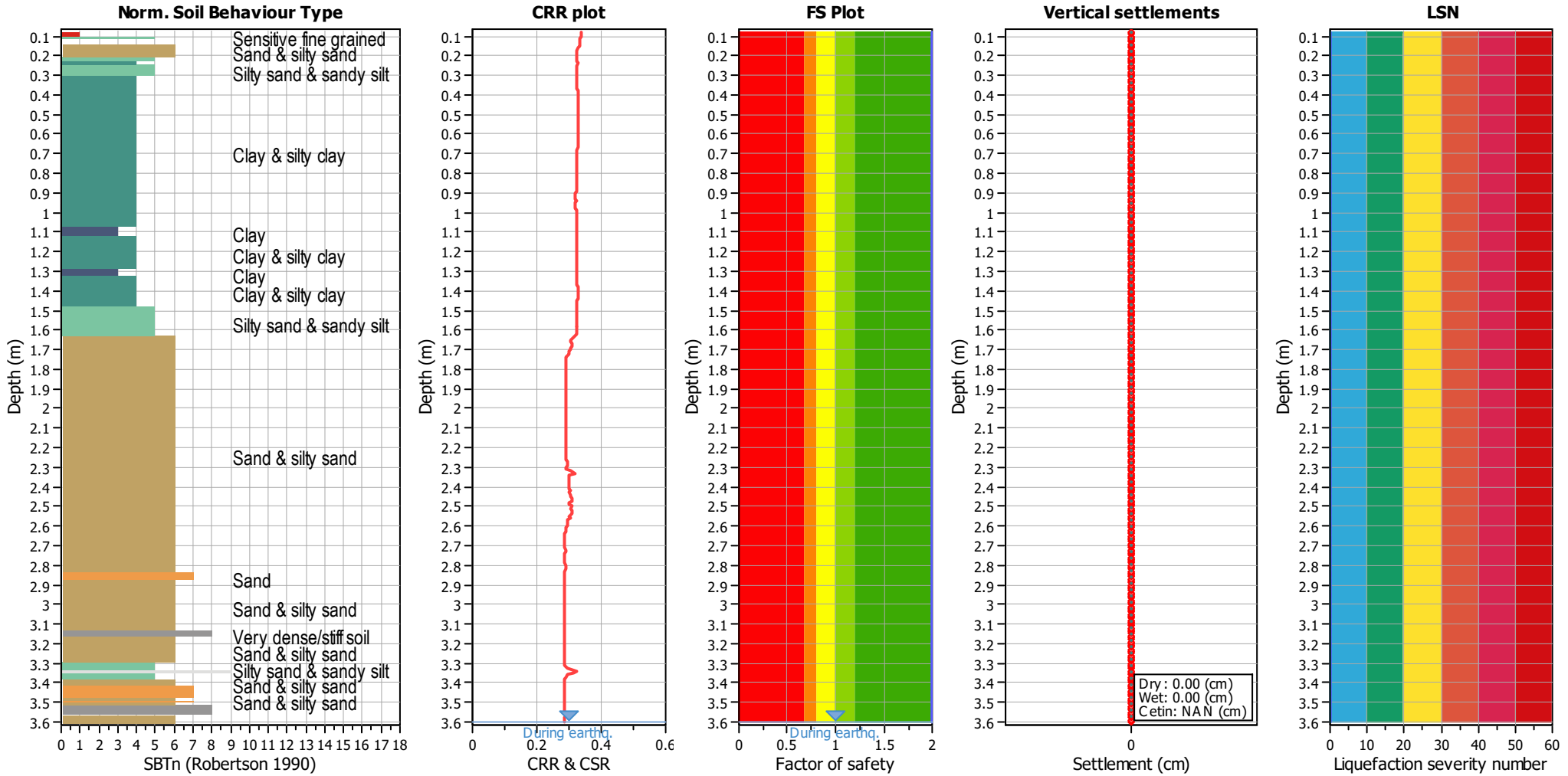
Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.30	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.26	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT05 - ULS
Total depth: 9.45 m



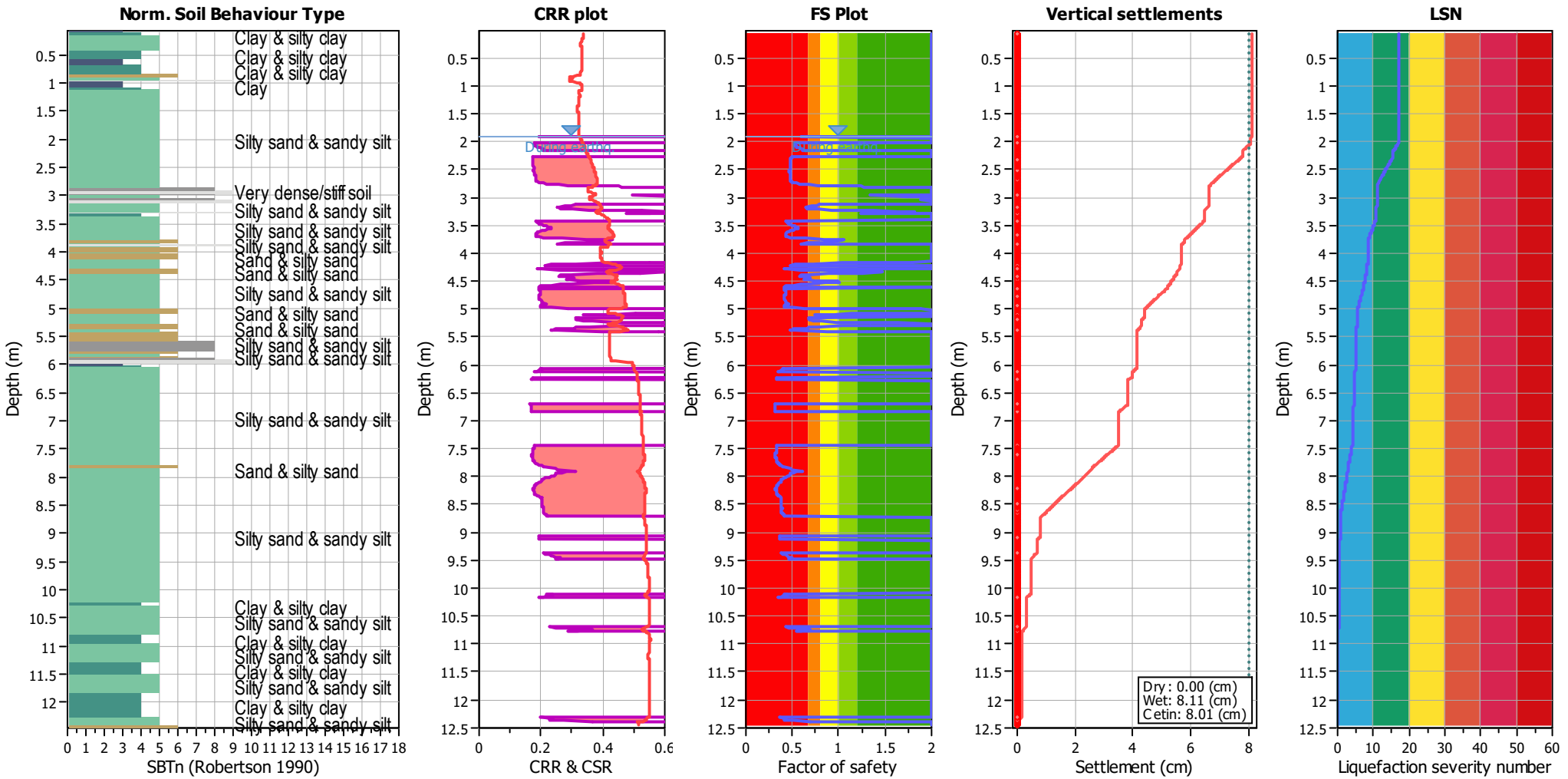
Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.60 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.60 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

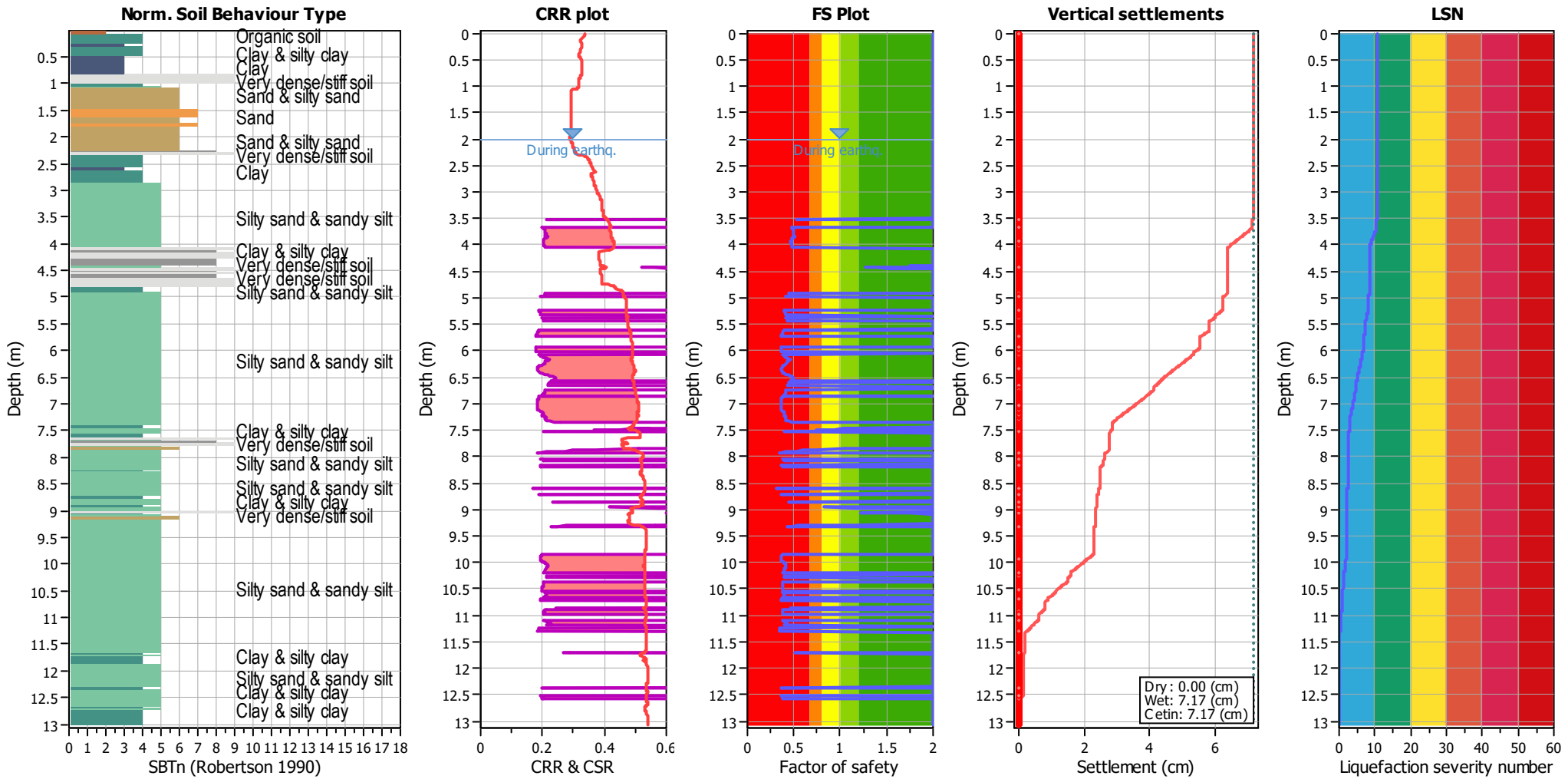
CPT: CPT07 - ULS
Total depth: 12.45 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.90 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.90 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

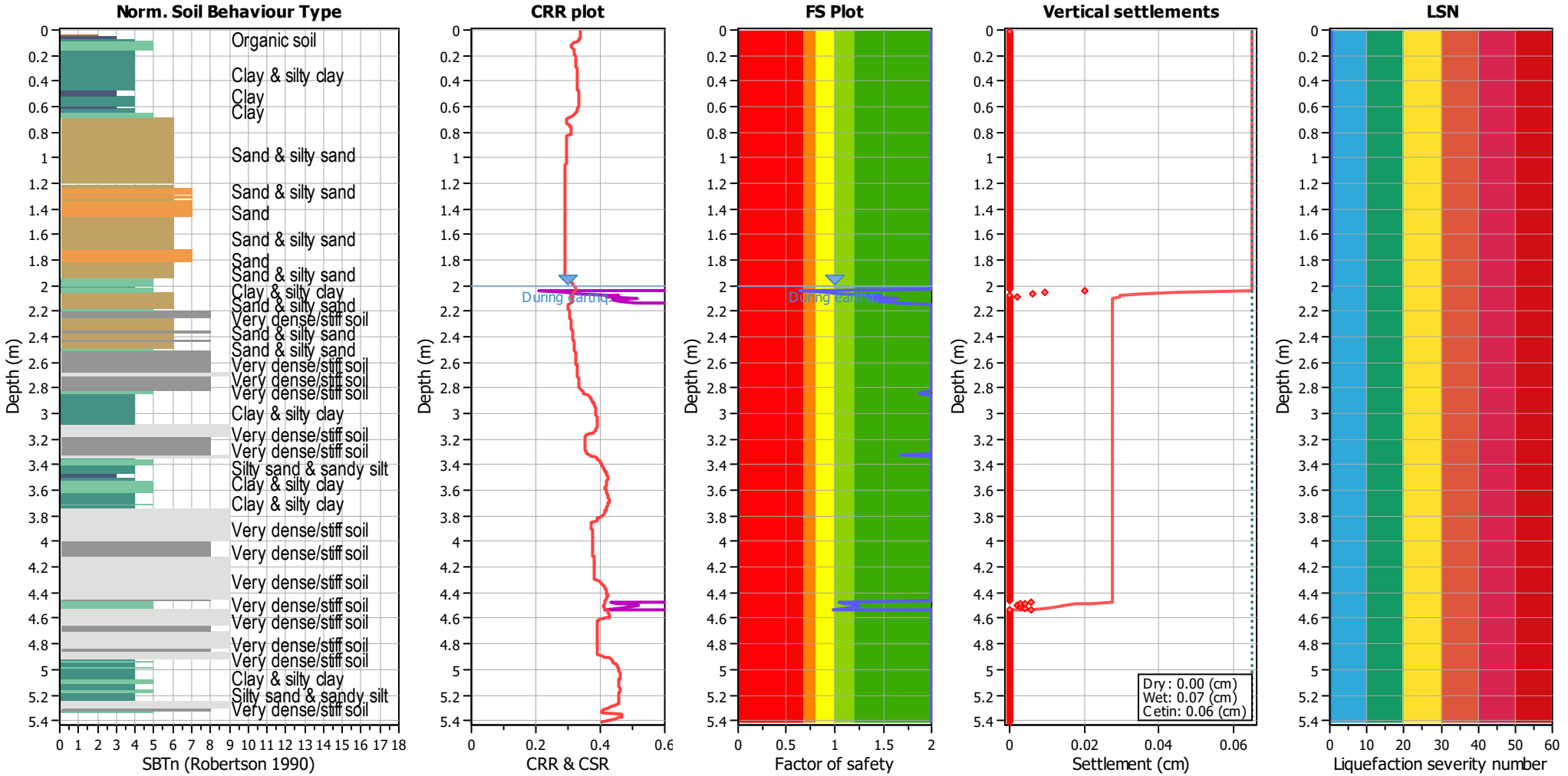
CPT: CPT08 - ULS
Total depth: 13.07 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

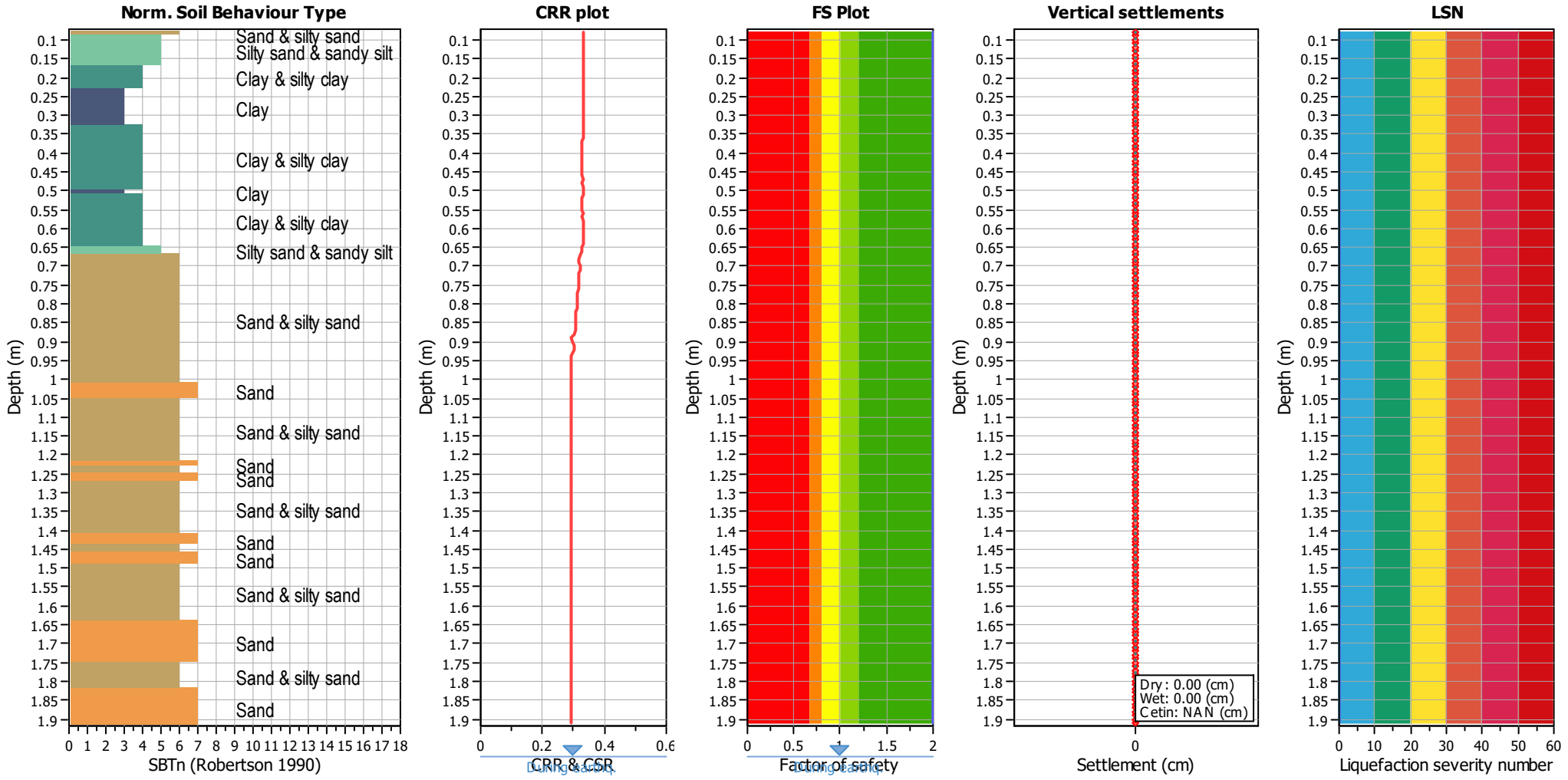
CPT: CPT09 - ULS
Total depth: 5.41 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

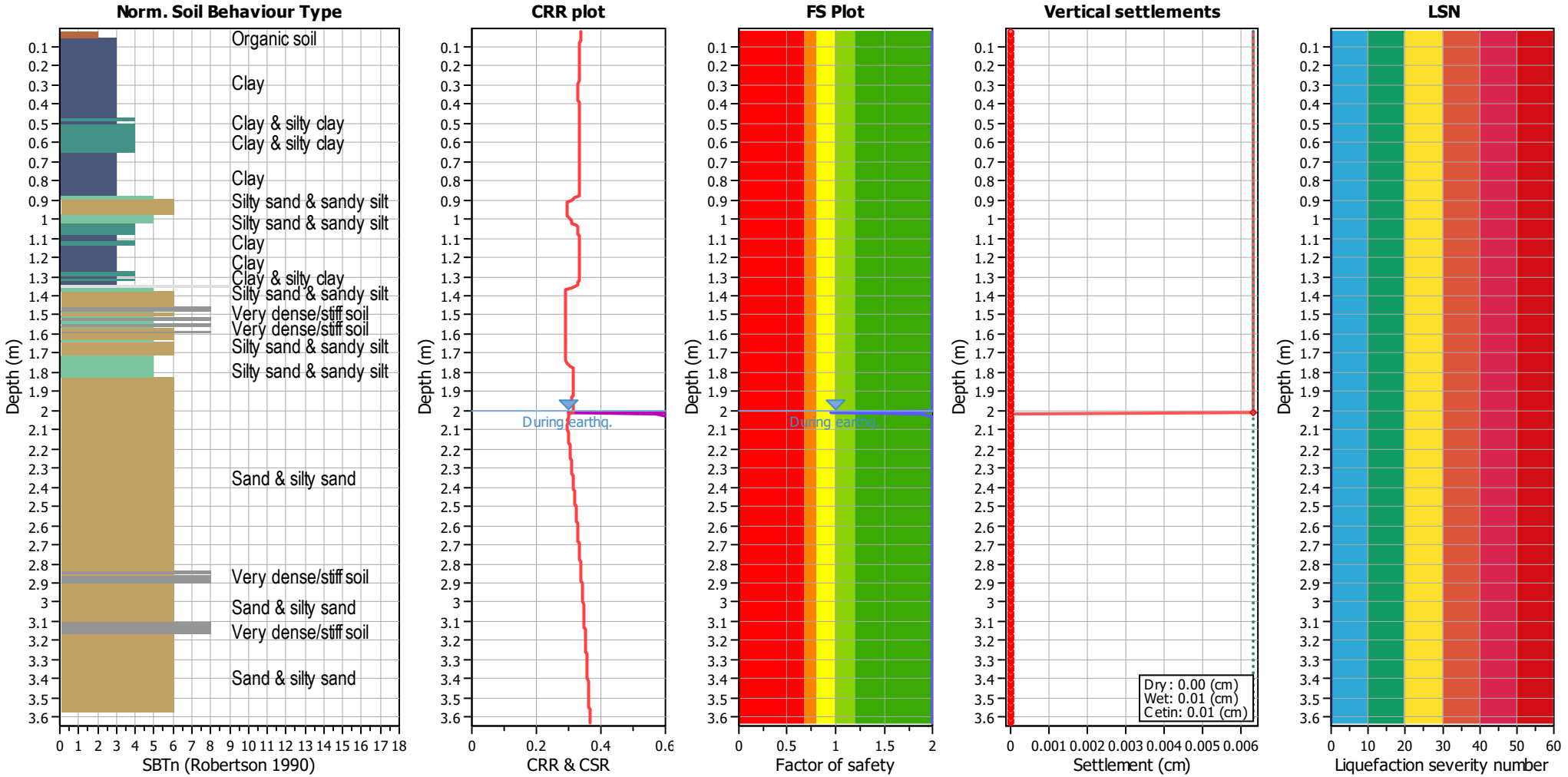
CPT: CPT10 - ULS
Total depth: 1.91 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

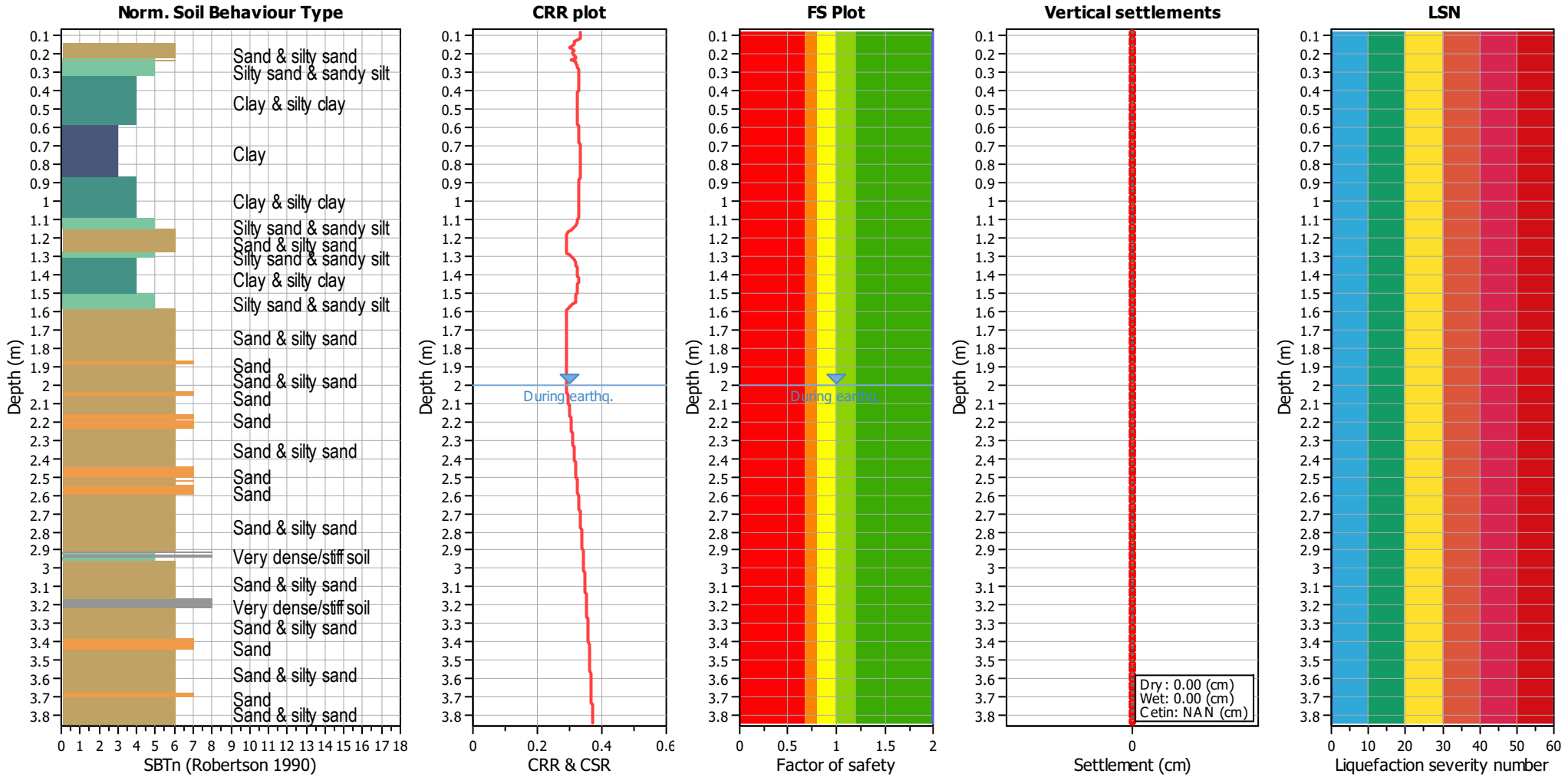
CPT: CPT11 - ULS
Total depth: 3.63 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

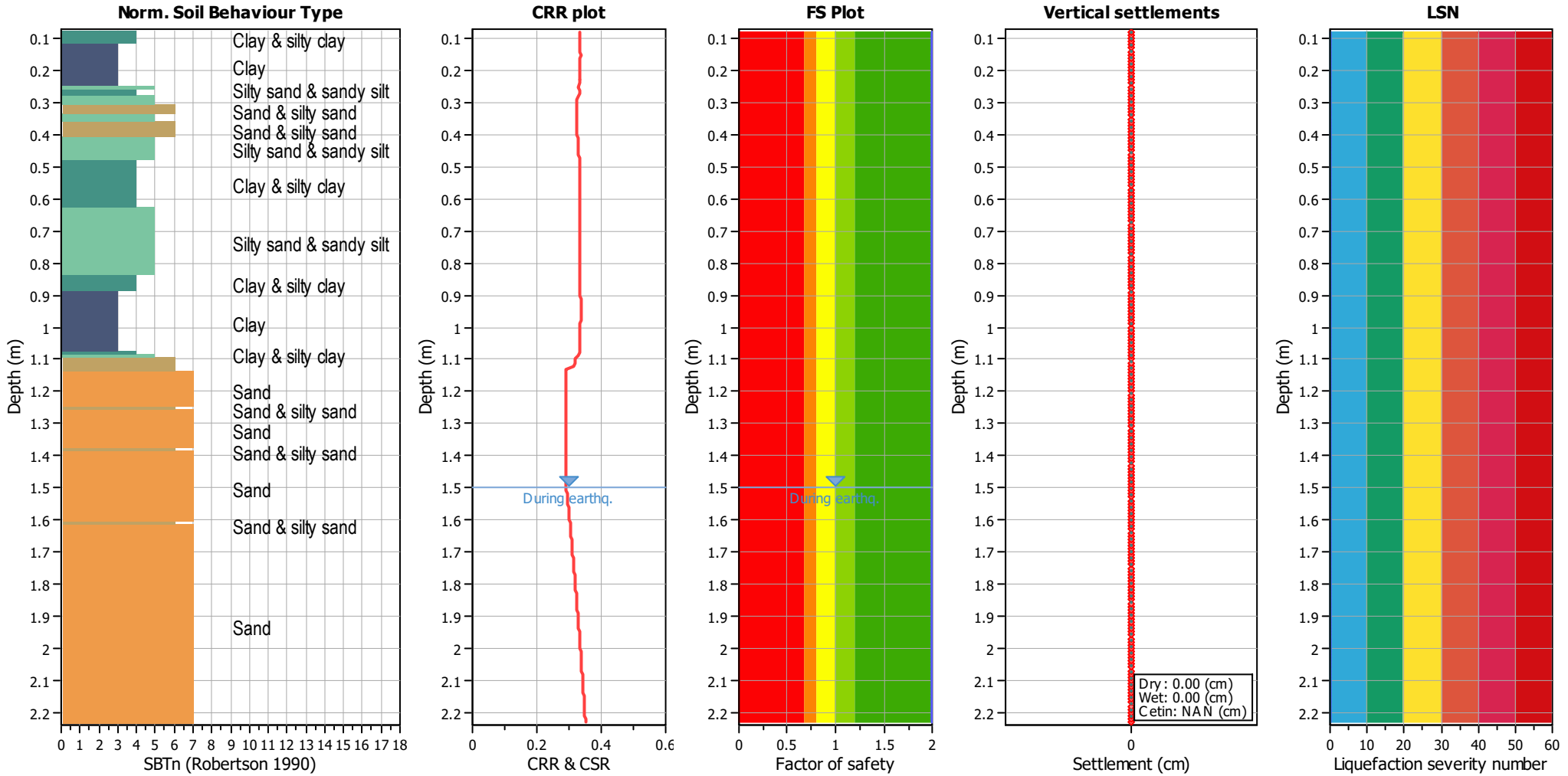
CPT: CPT12 - ULS
Total depth: 3.84 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

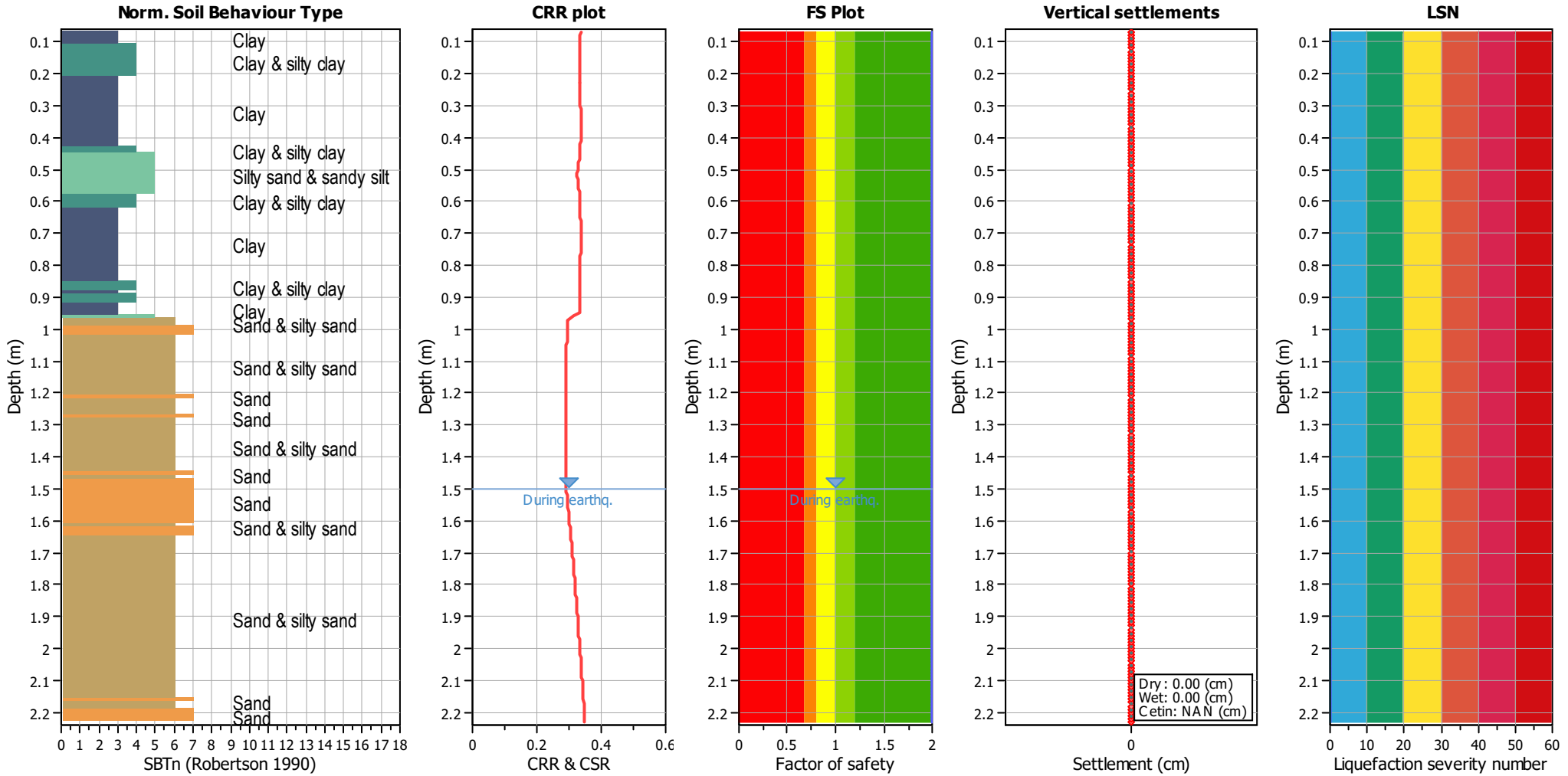
CPT: CPT13 - ULS
Total depth: 2.23 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

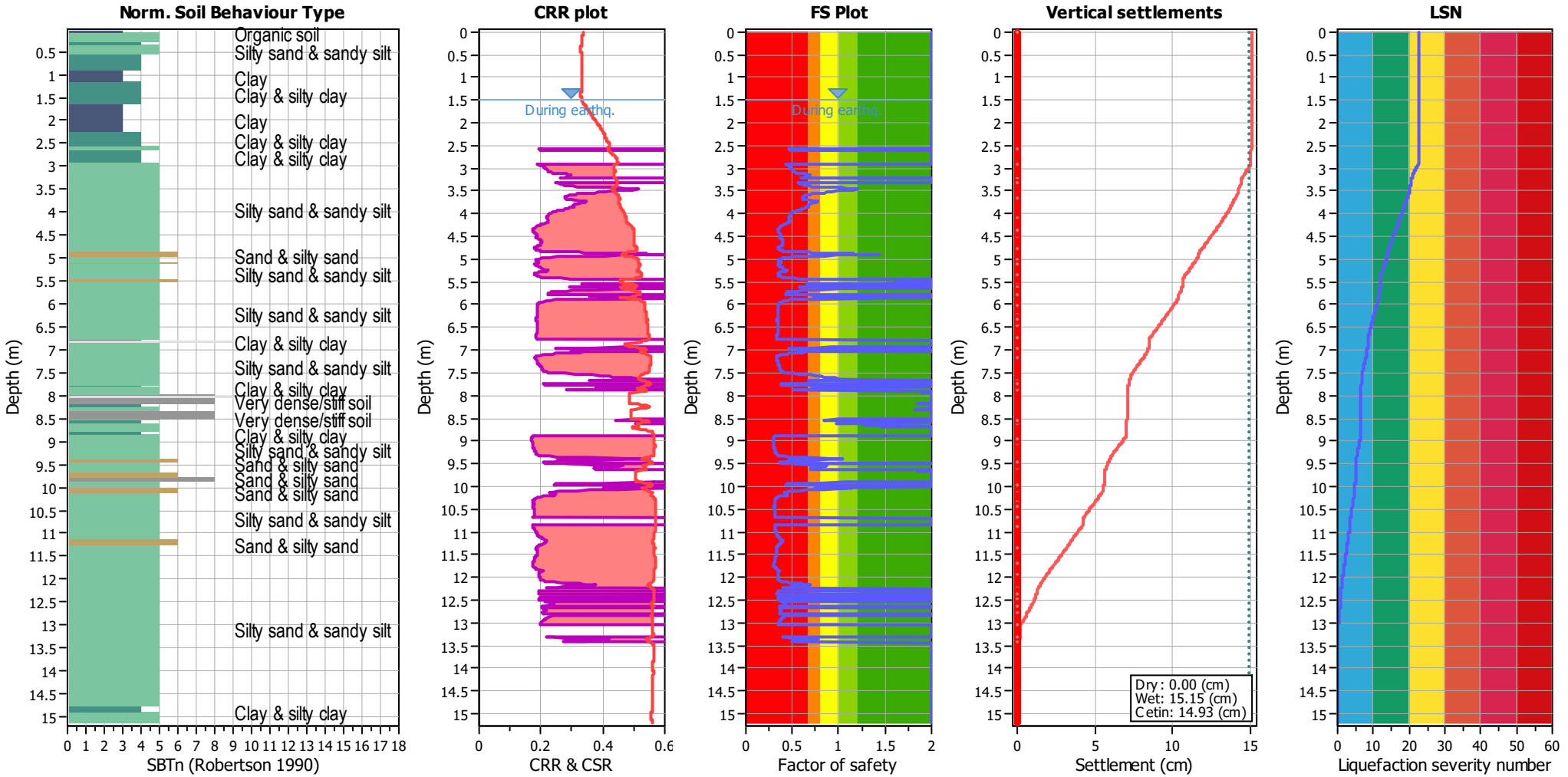
CPT: CPT14 - ULS
Total depth: 2.23 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

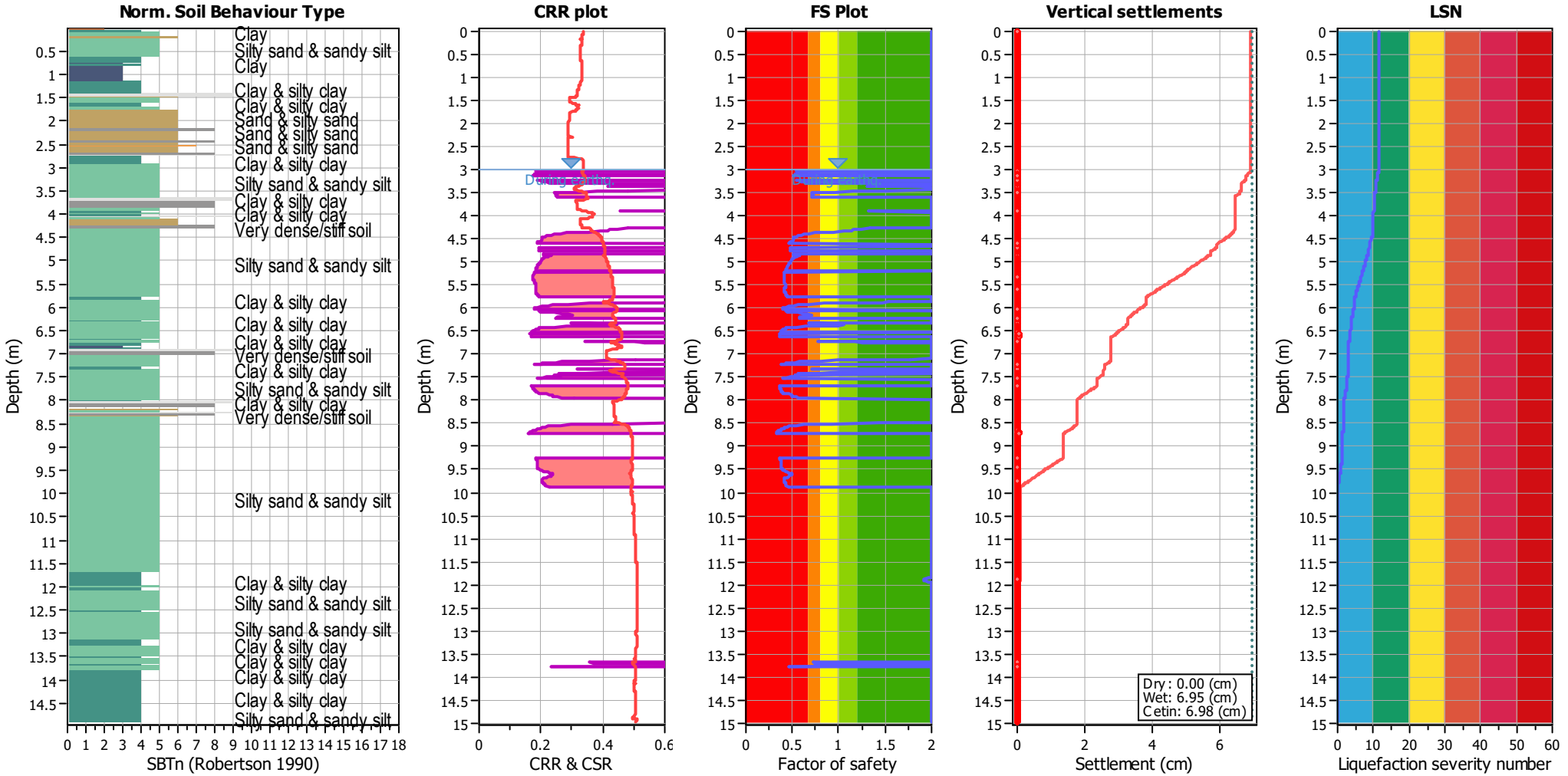
CPT: CPT15 - ULS
Total depth: 15.20 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

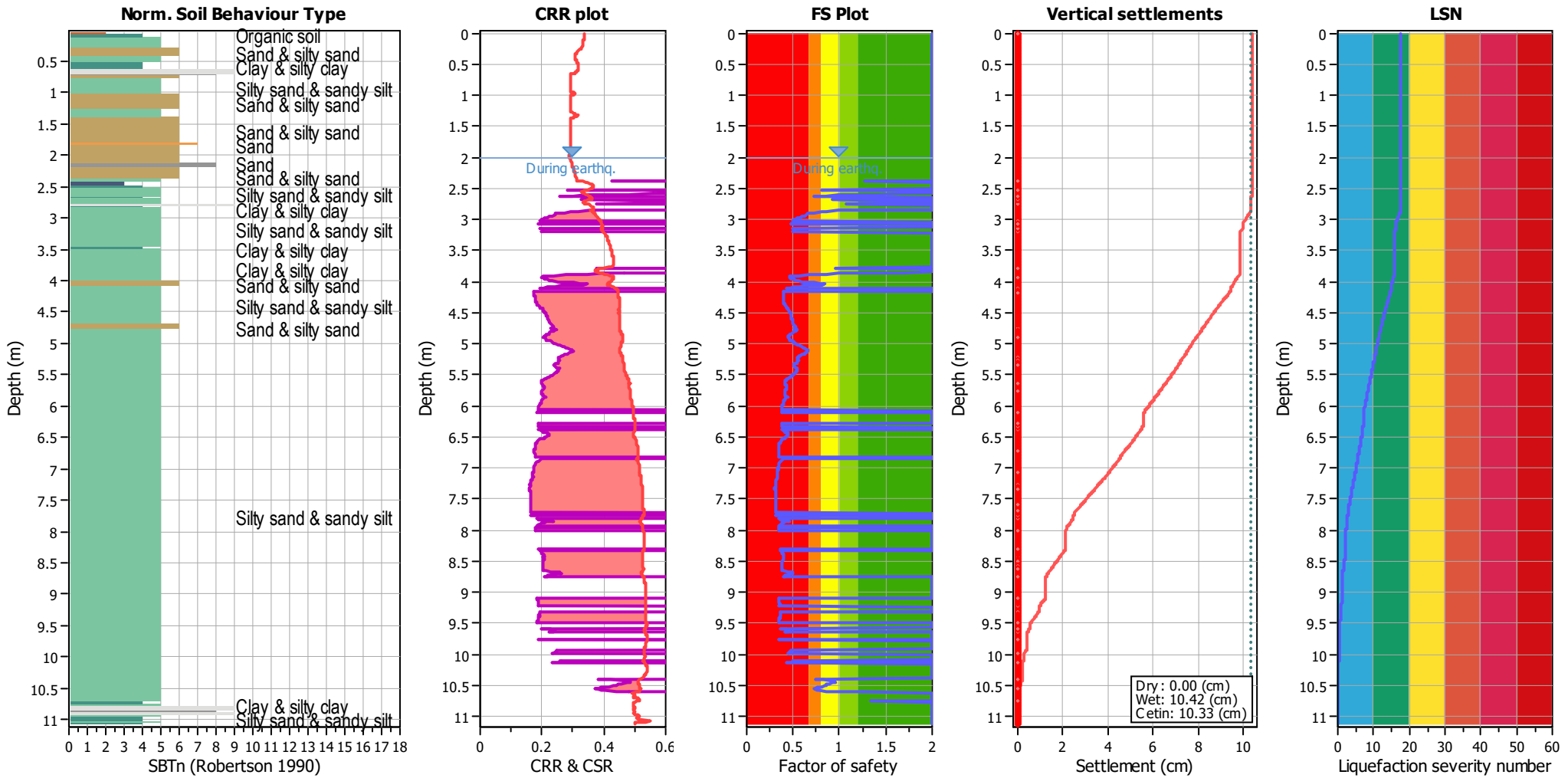
CPT: CPT16 - ULS
Total depth: 14.97 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

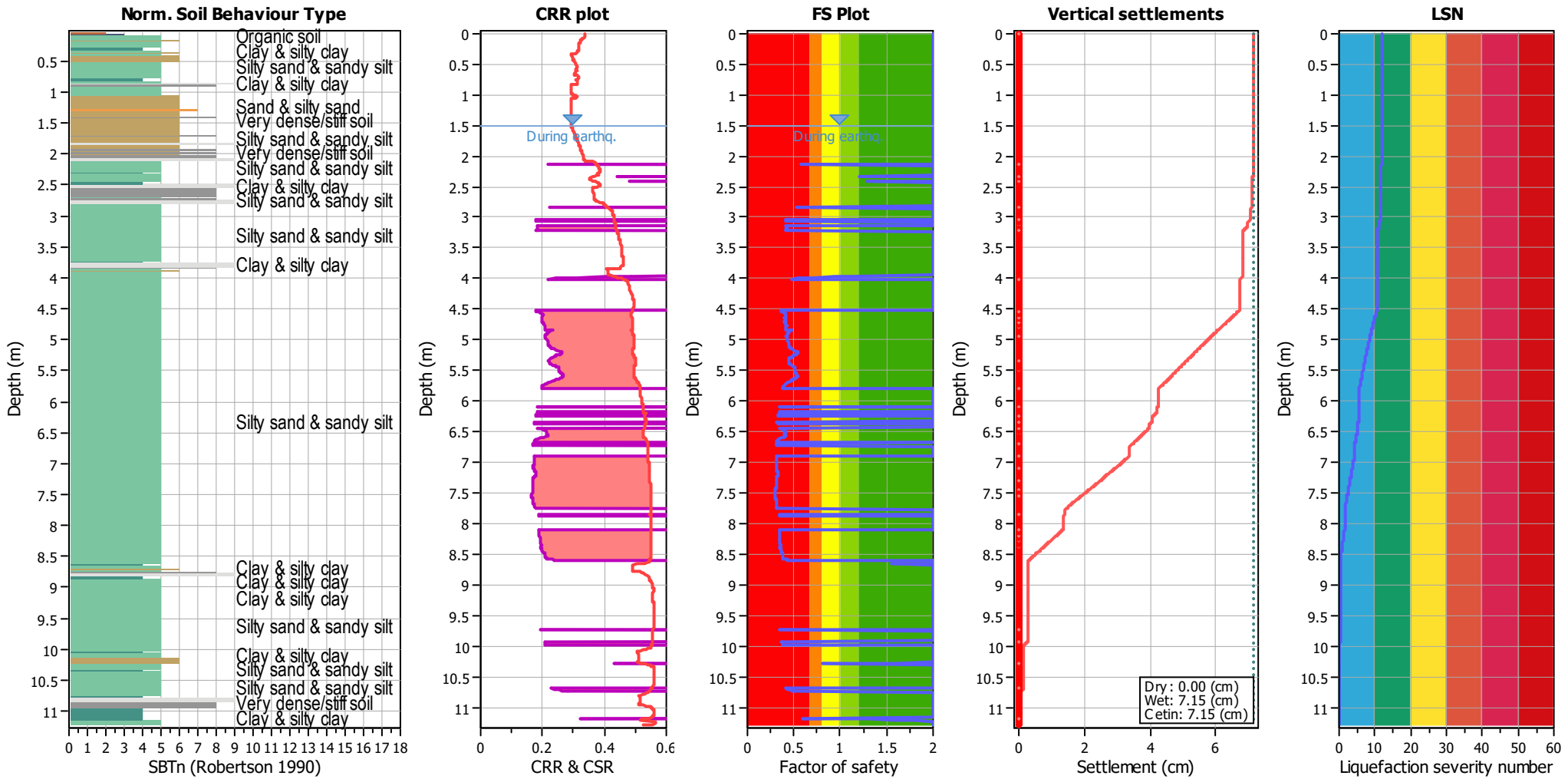
CPT: CPT17 - ULS
Total depth: 11.12 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT18 - ULS
Total depth: 11.27 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.58	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Appendix E

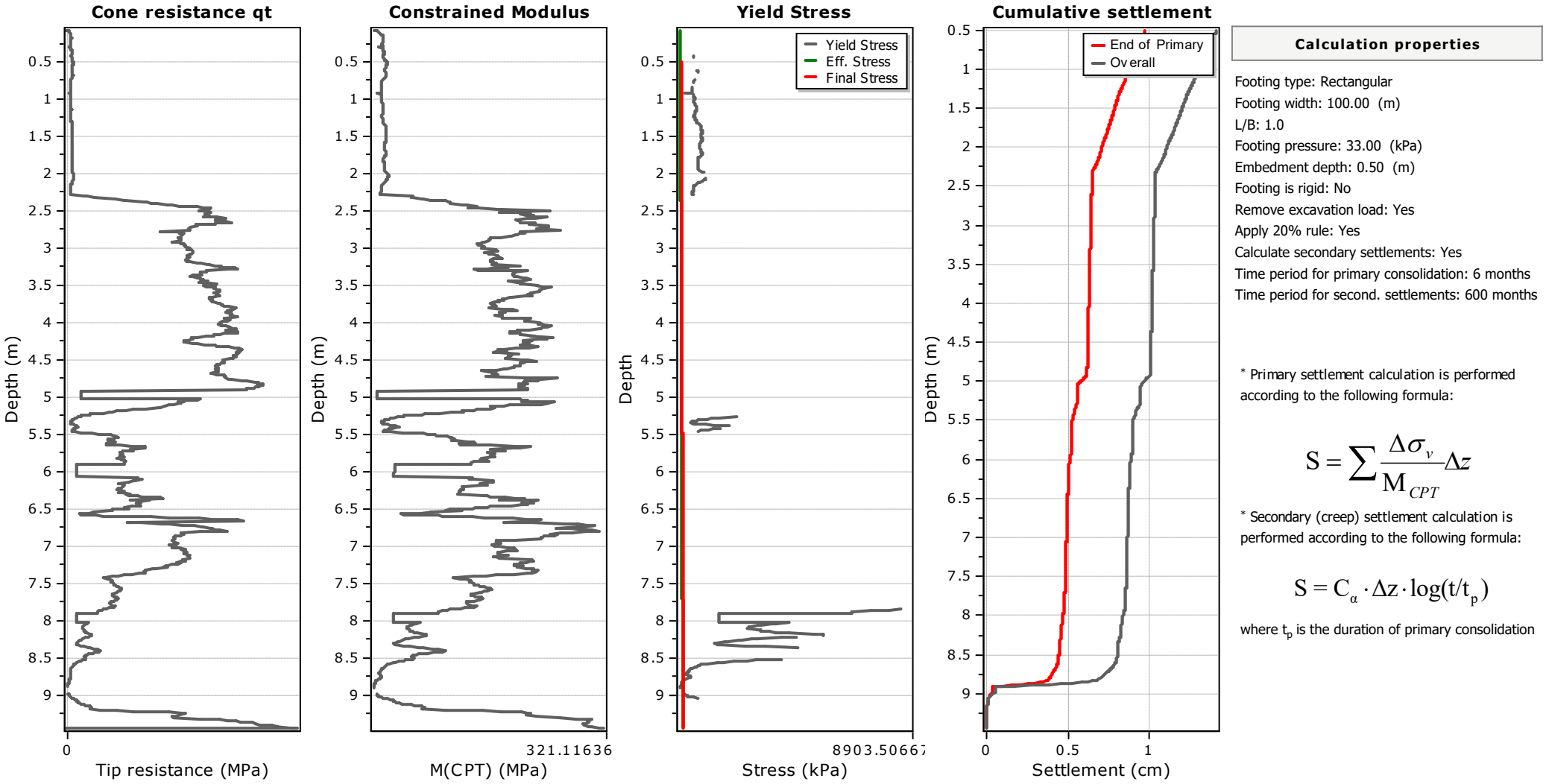
Static Settlement Analysis Results

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT 05
Total depth: 9.45 m
Est. GWL: 1.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 33.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

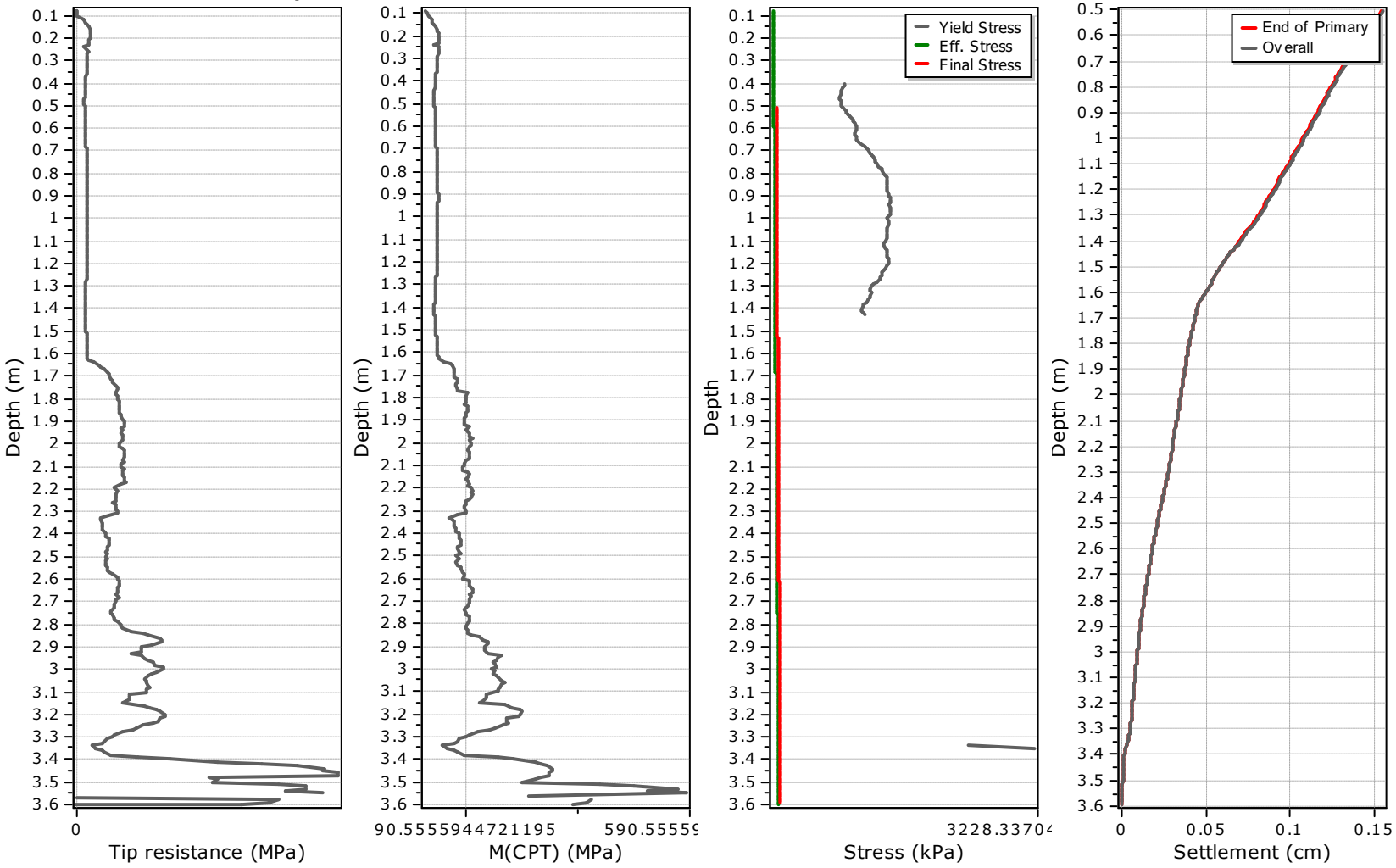
$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 33.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

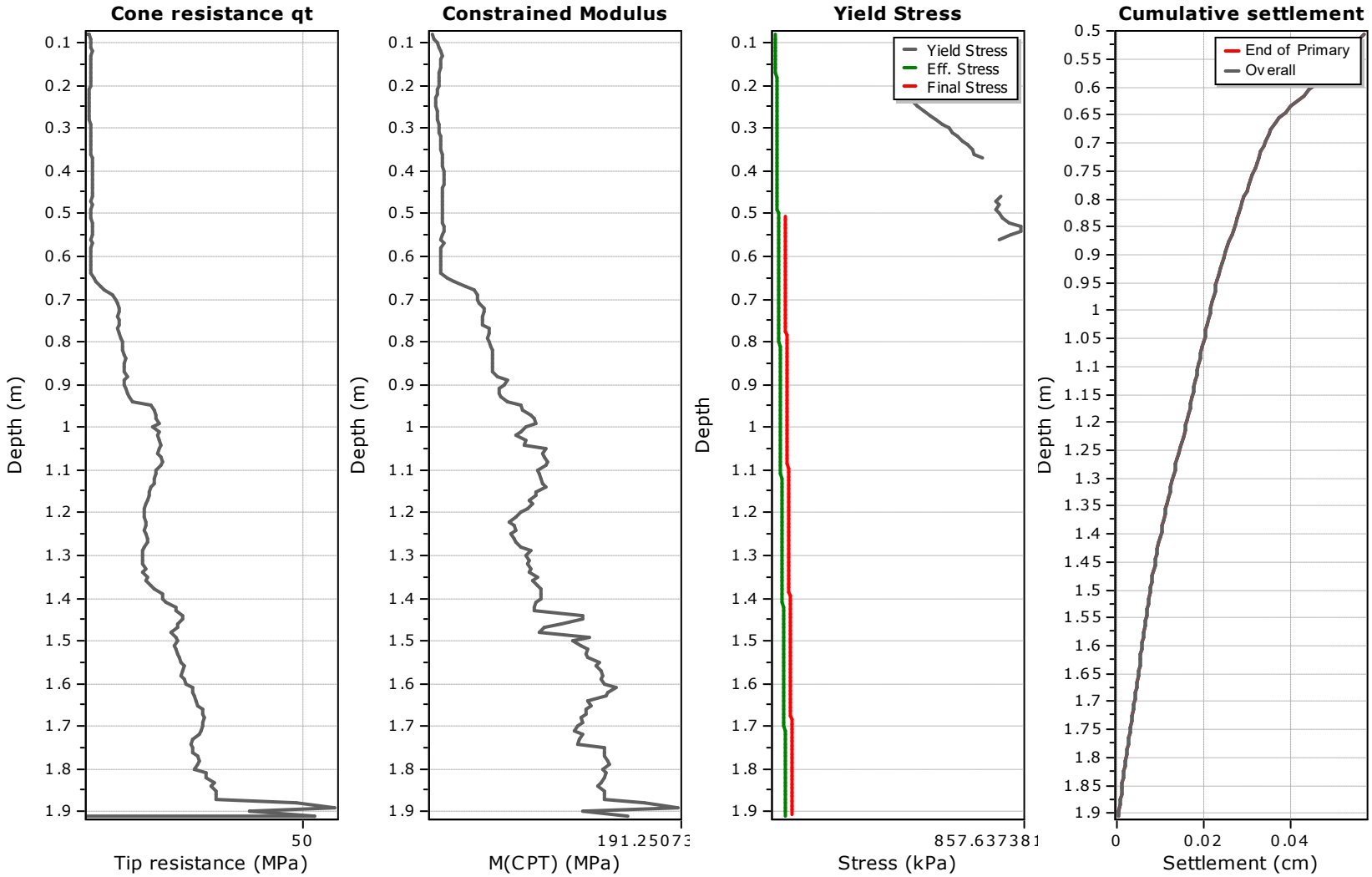
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT 10
Total depth: 1.91 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 33.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

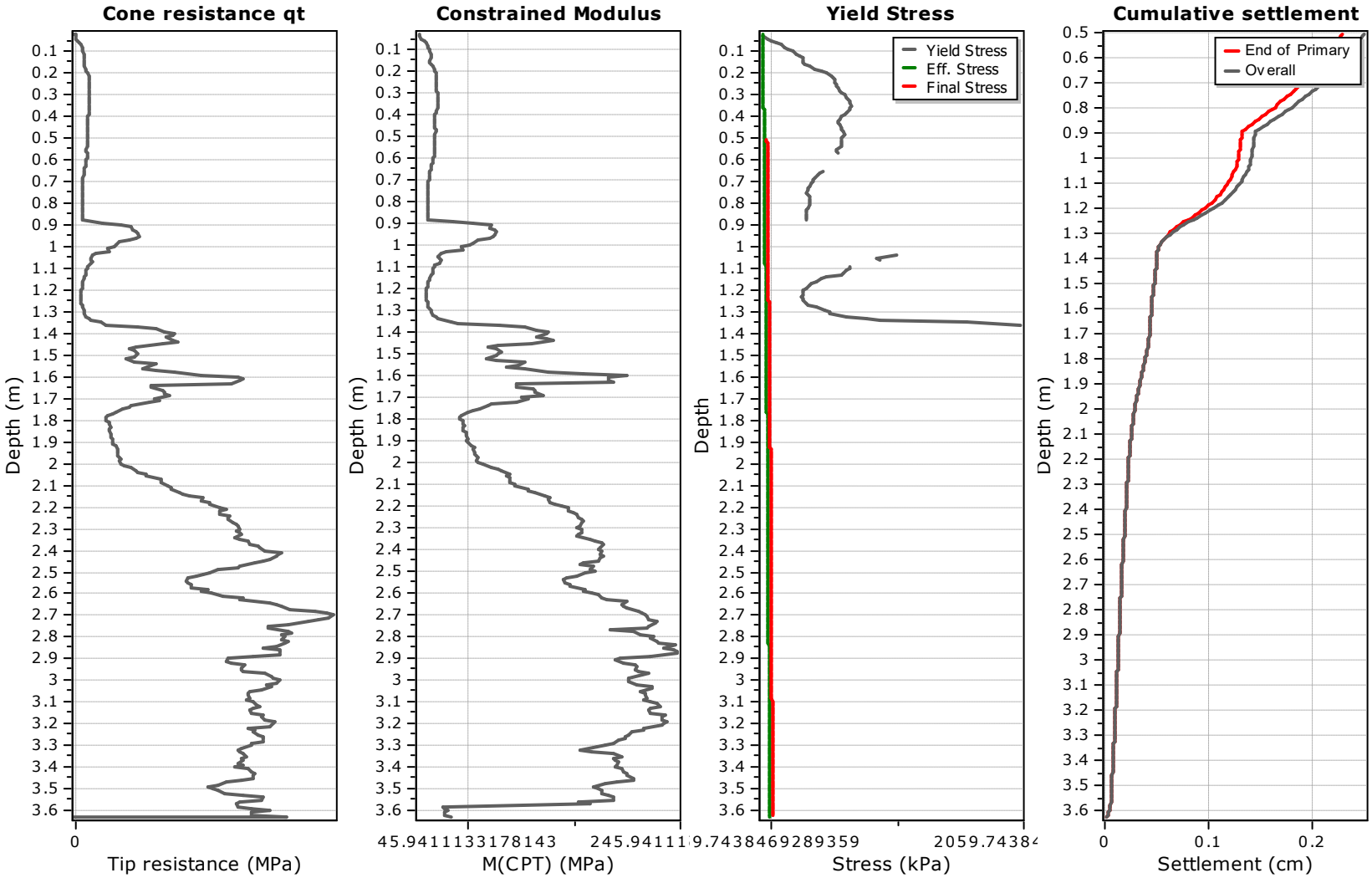
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT 11
Total depth: 3.63 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 33.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

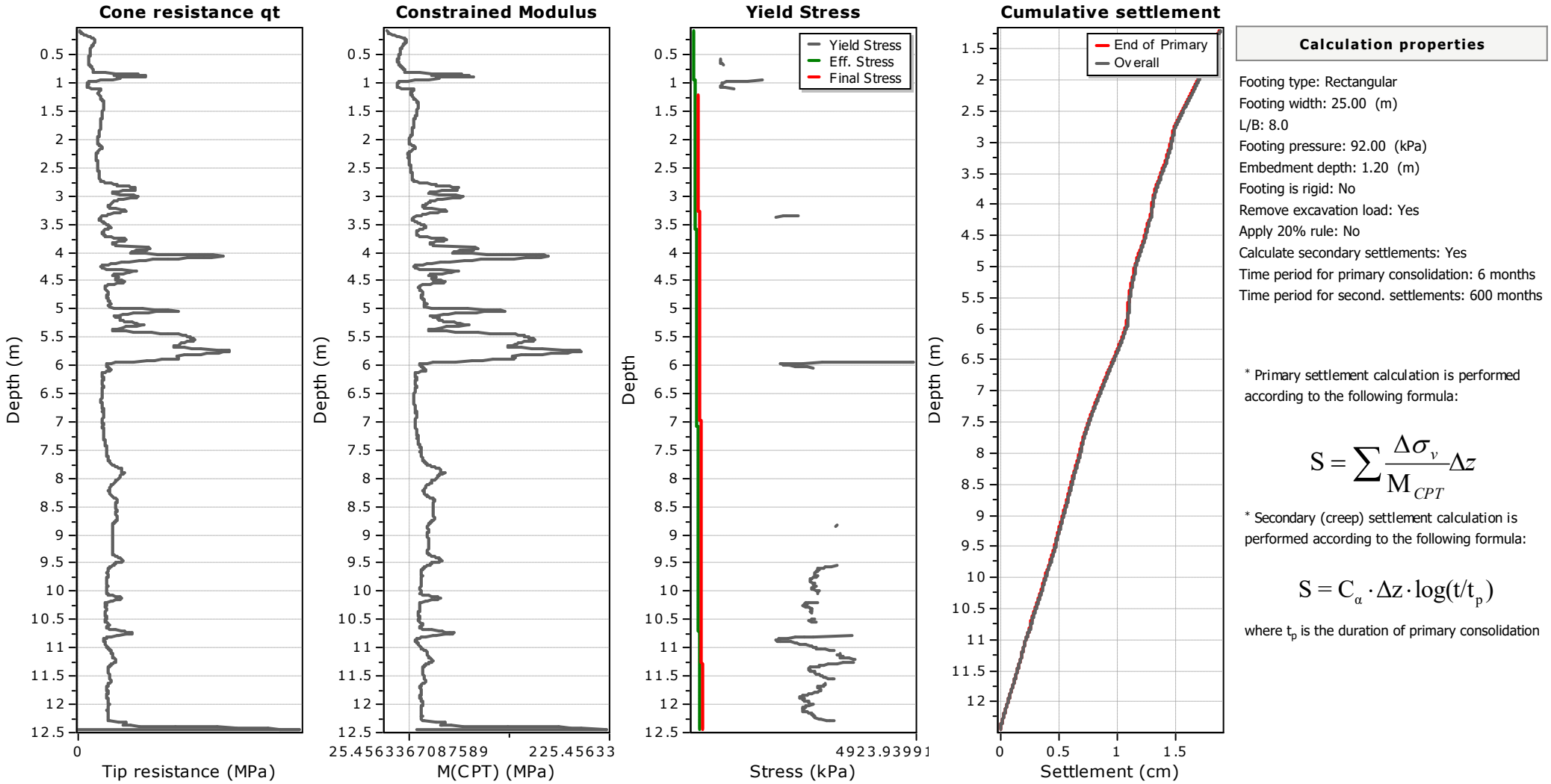
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT 07
Total depth: 12.45 m
Est. GWL: 1.90 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 25.00 (m)
L/B: 8.0
Footing pressure: 92.00 (kPa)
Embedment depth: 1.20 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

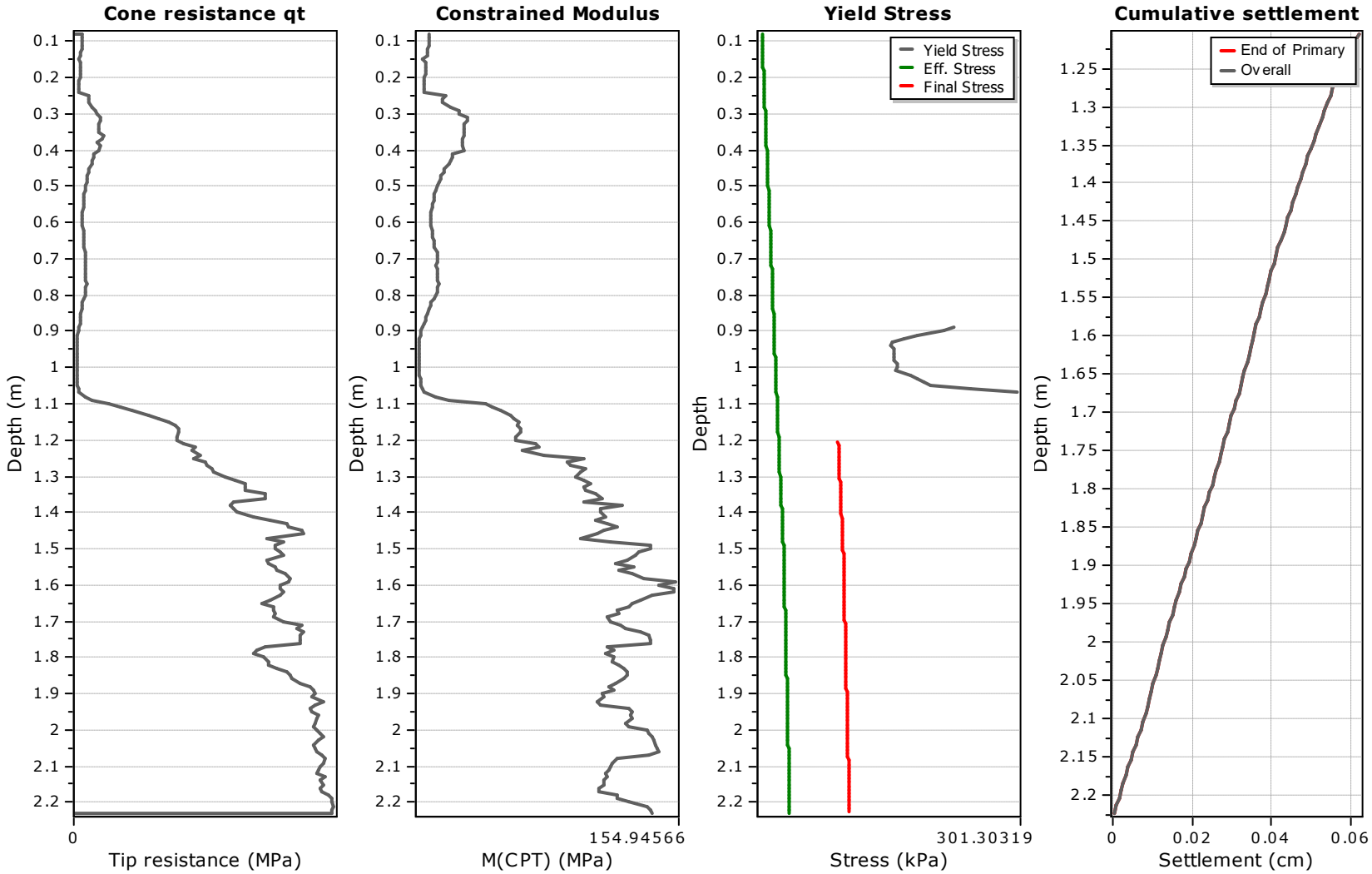
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: **CPT Assessment**
Location: **174 & 176 Brookvale Road, Havelock North**

CPT: CPT13
Total depth: 2.23 m
Est. GWL: 1.50 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 25.00 (m)
L/B: 8.0
Footing pressure: 92.00 (kPa)
Embedment depth: 1.20 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

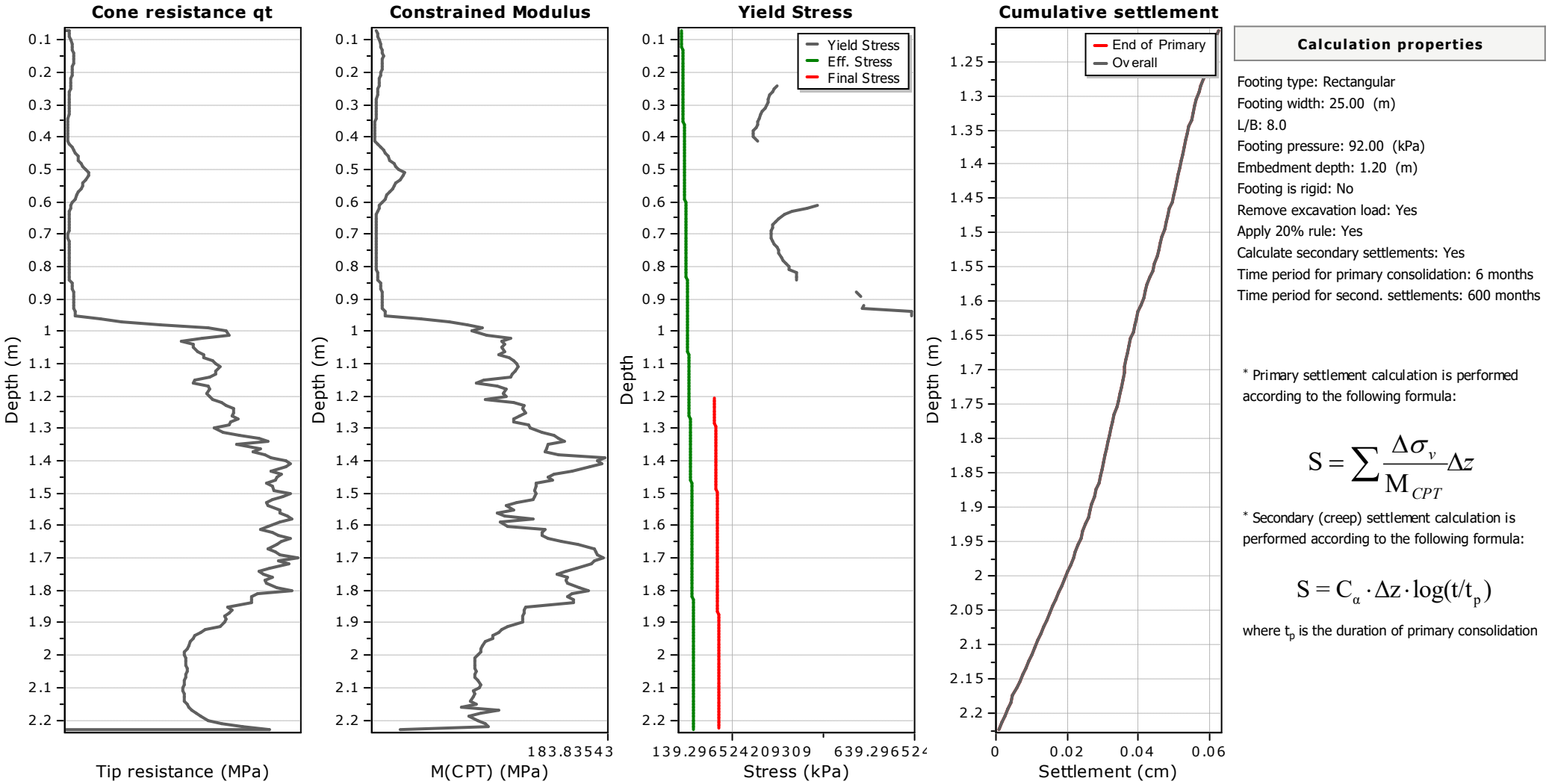
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT14
Total depth: 2.23 m
Est. GWL: 1.50 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 25.00 (m)
L/B: 8.0
Footing pressure: 92.00 (kPa)
Embedment depth: 1.20 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

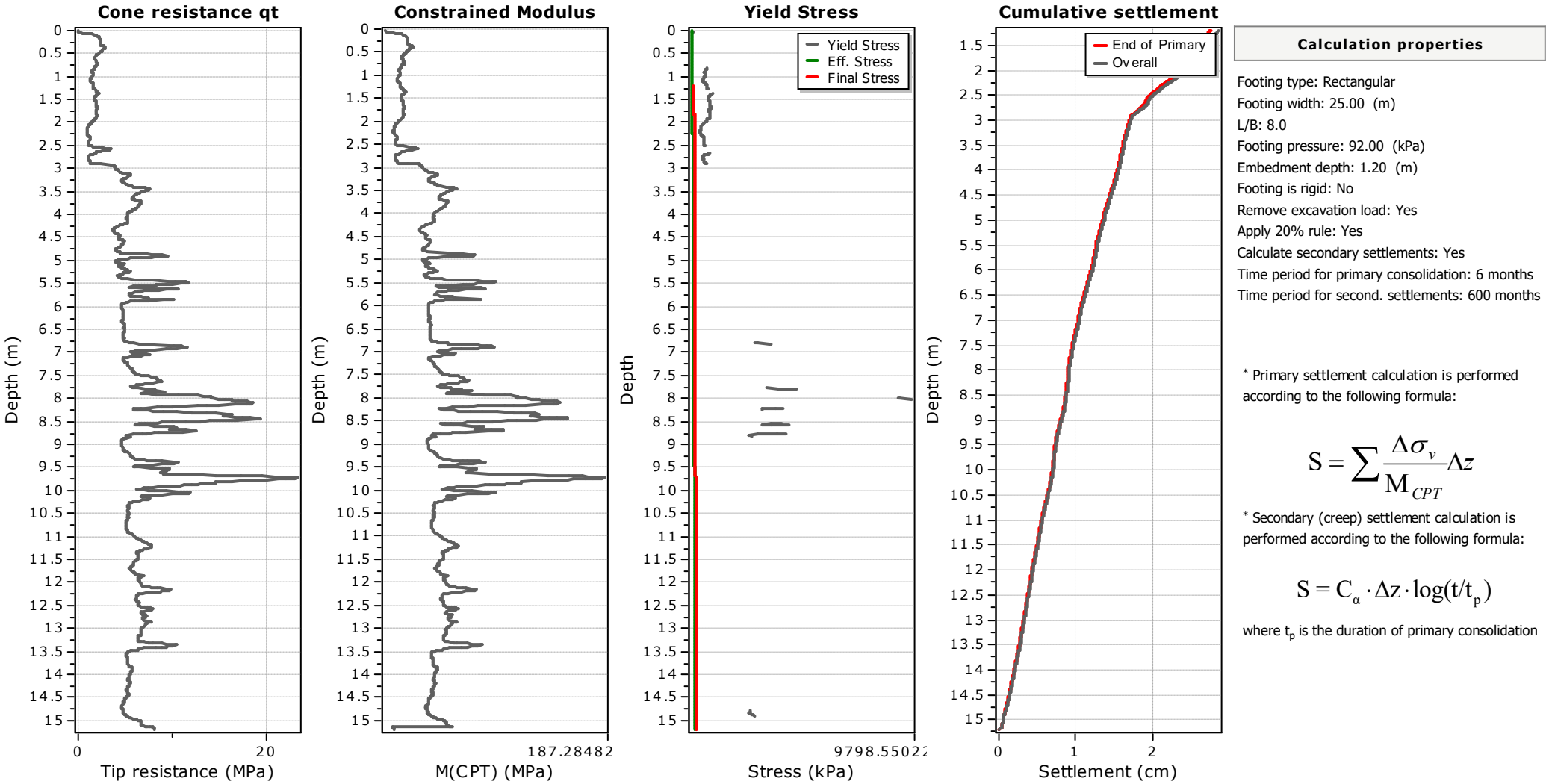
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT15
Total depth: 15.20 m
Est. GWL: 1.50 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 25.00 (m)
L/B: 8.0
Footing pressure: 92.00 (kPa)
Embedment depth: 1.20 (m)
Footing is rigid: No
Remove excavation load: Yes
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

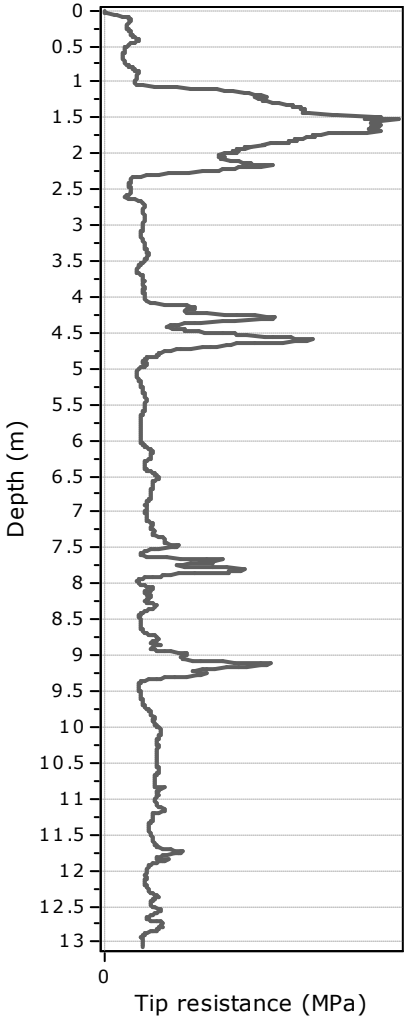
where t_p is the duration of primary consolidation

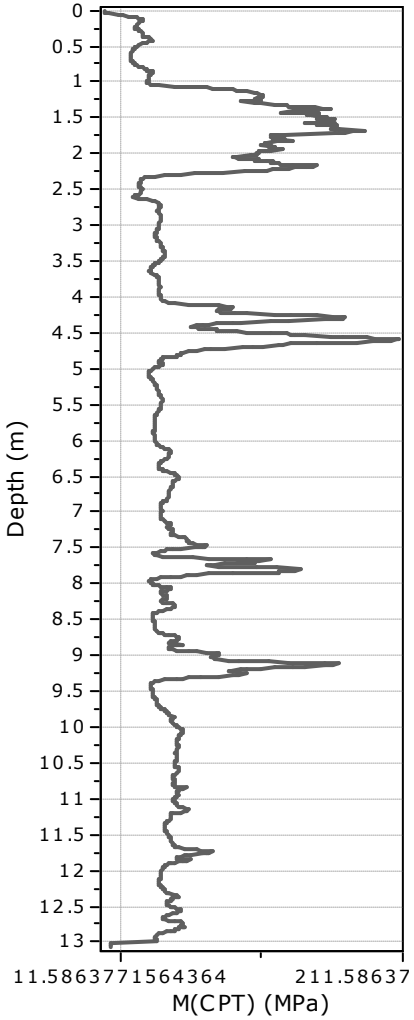
Hawkes Bay Geotech
Geotechnical Engineers

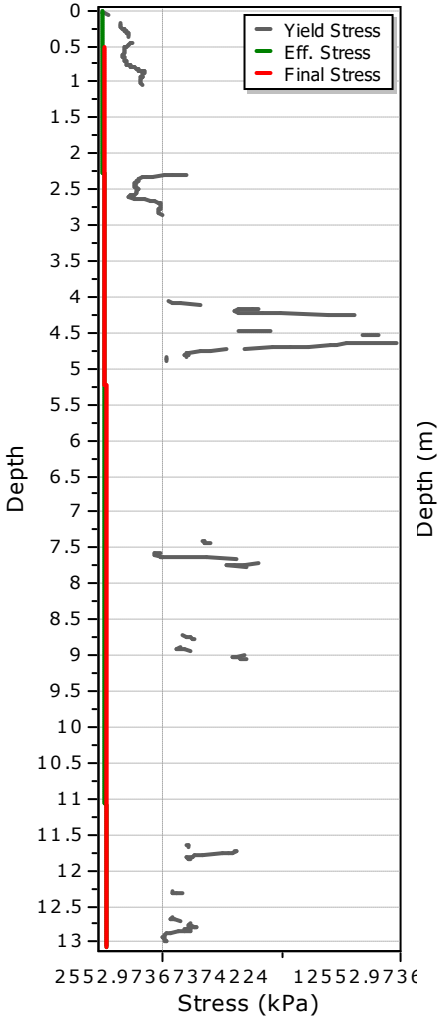
Project: **CPT Assessment**
Location: **174 & 176 Brookvale Road, Havelock North**

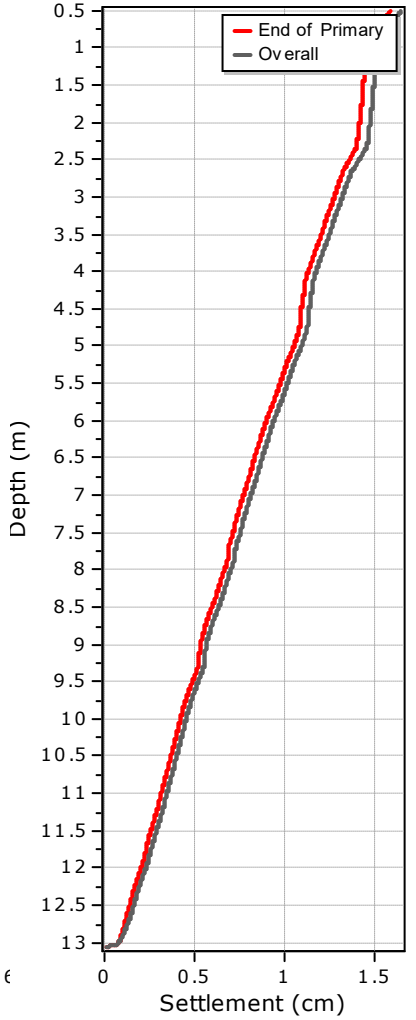
CPT: CPT 08
Total depth: 13.07 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*









Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

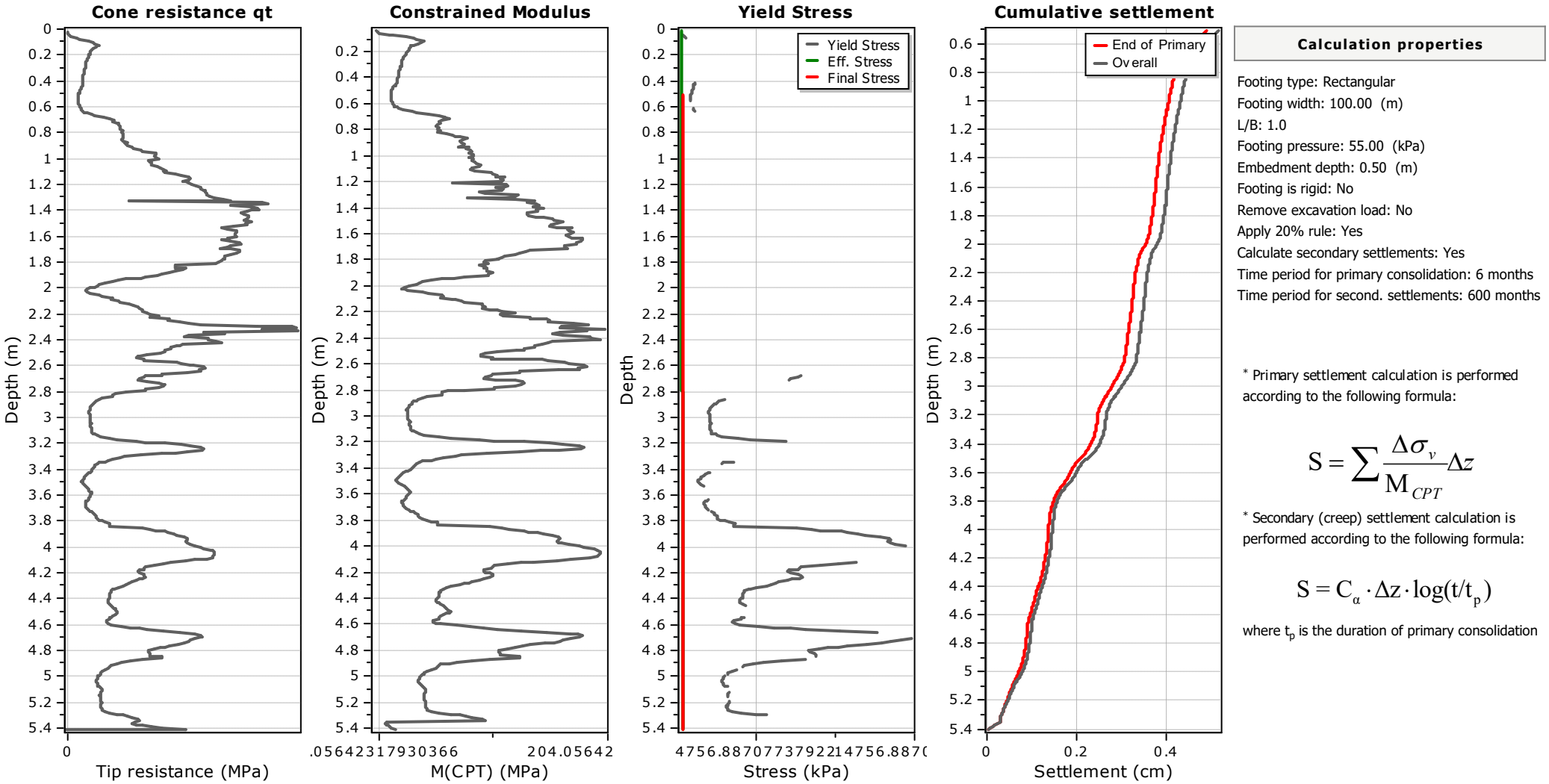
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: **CPT Assessment**
Location: **174 & 176 Brookvale Road, Havelock North**

CPT: CPT 09
Total depth: 5.41 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

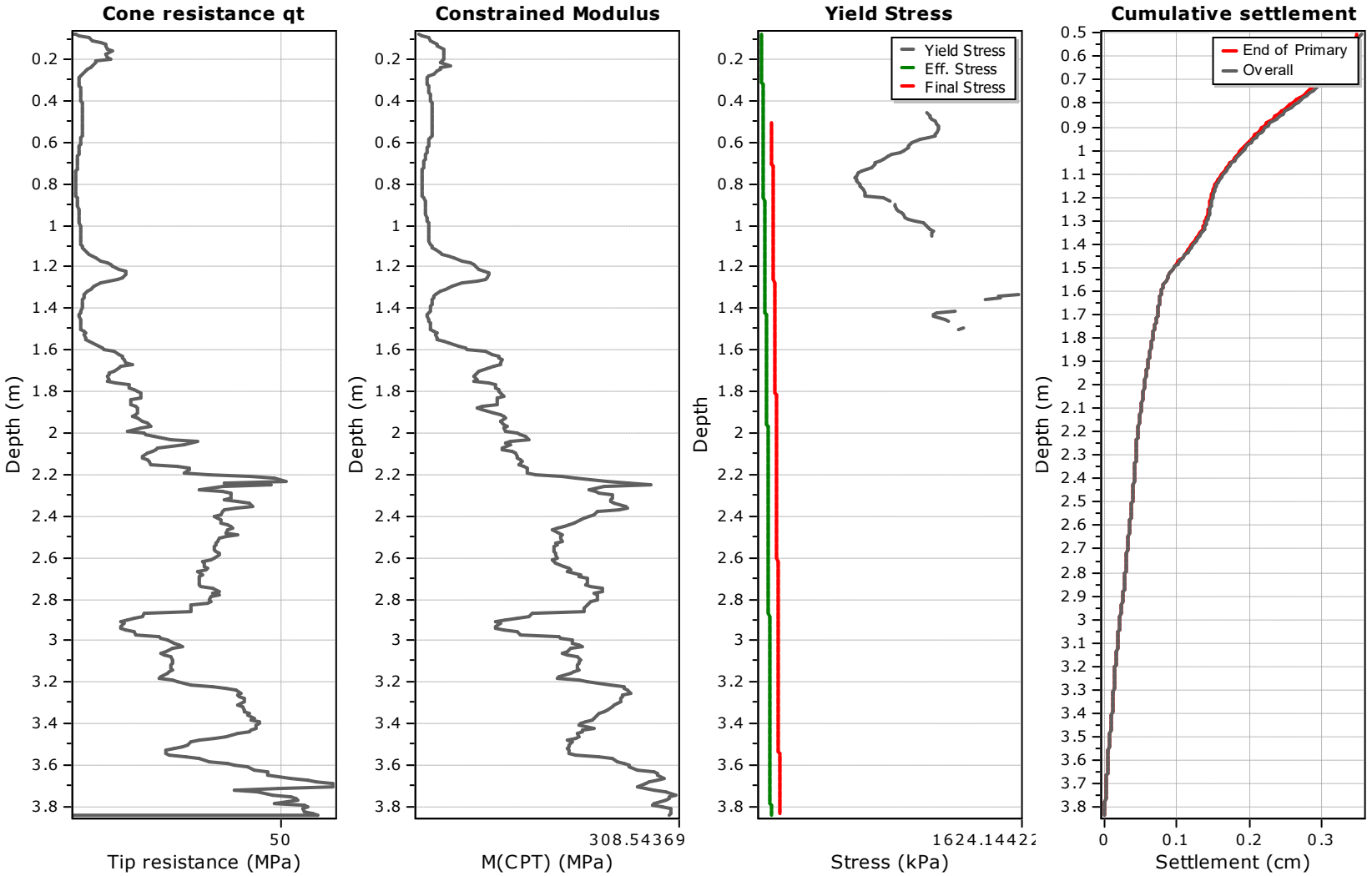
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT12
Total depth: 3.84 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

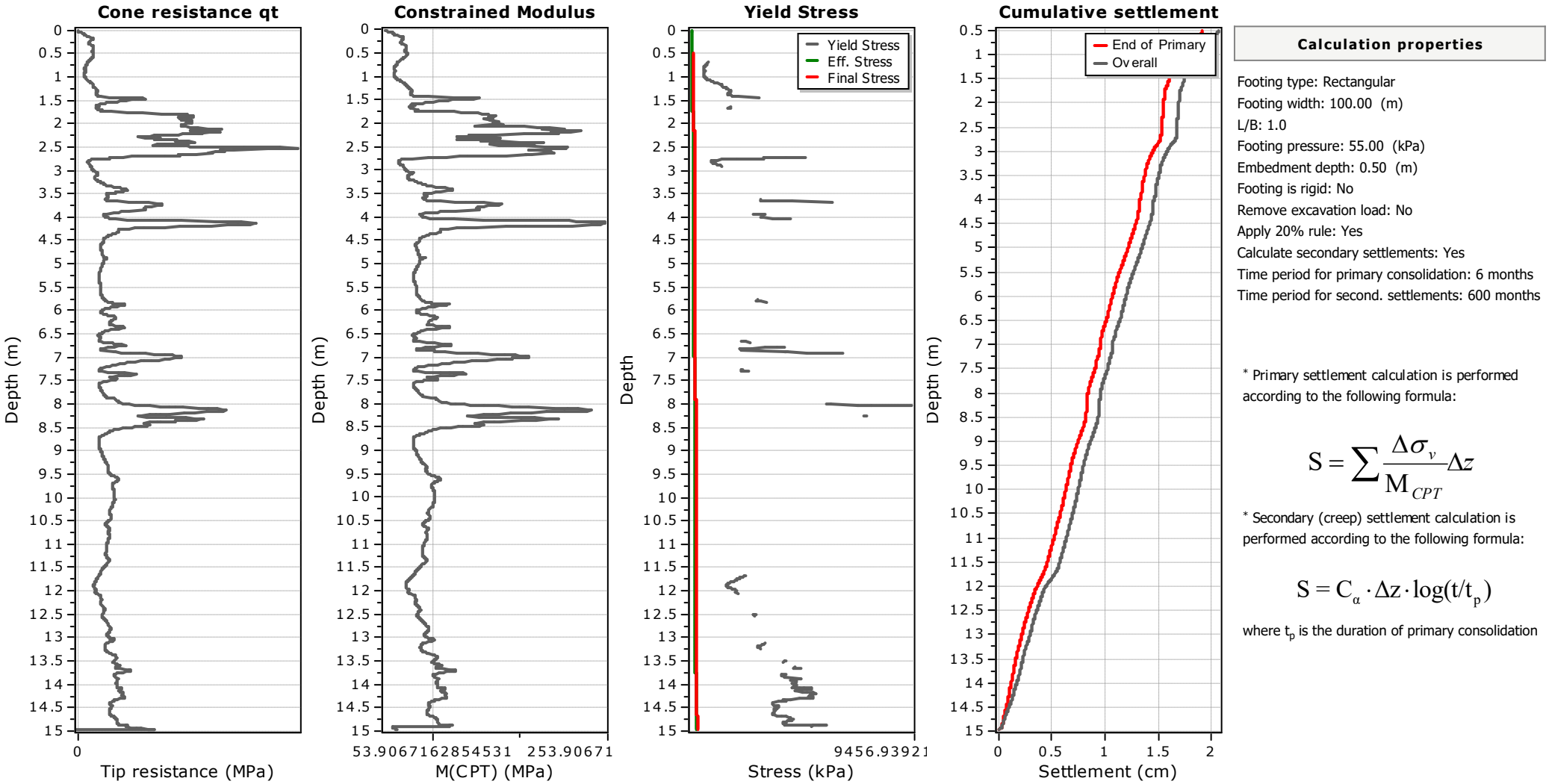
$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

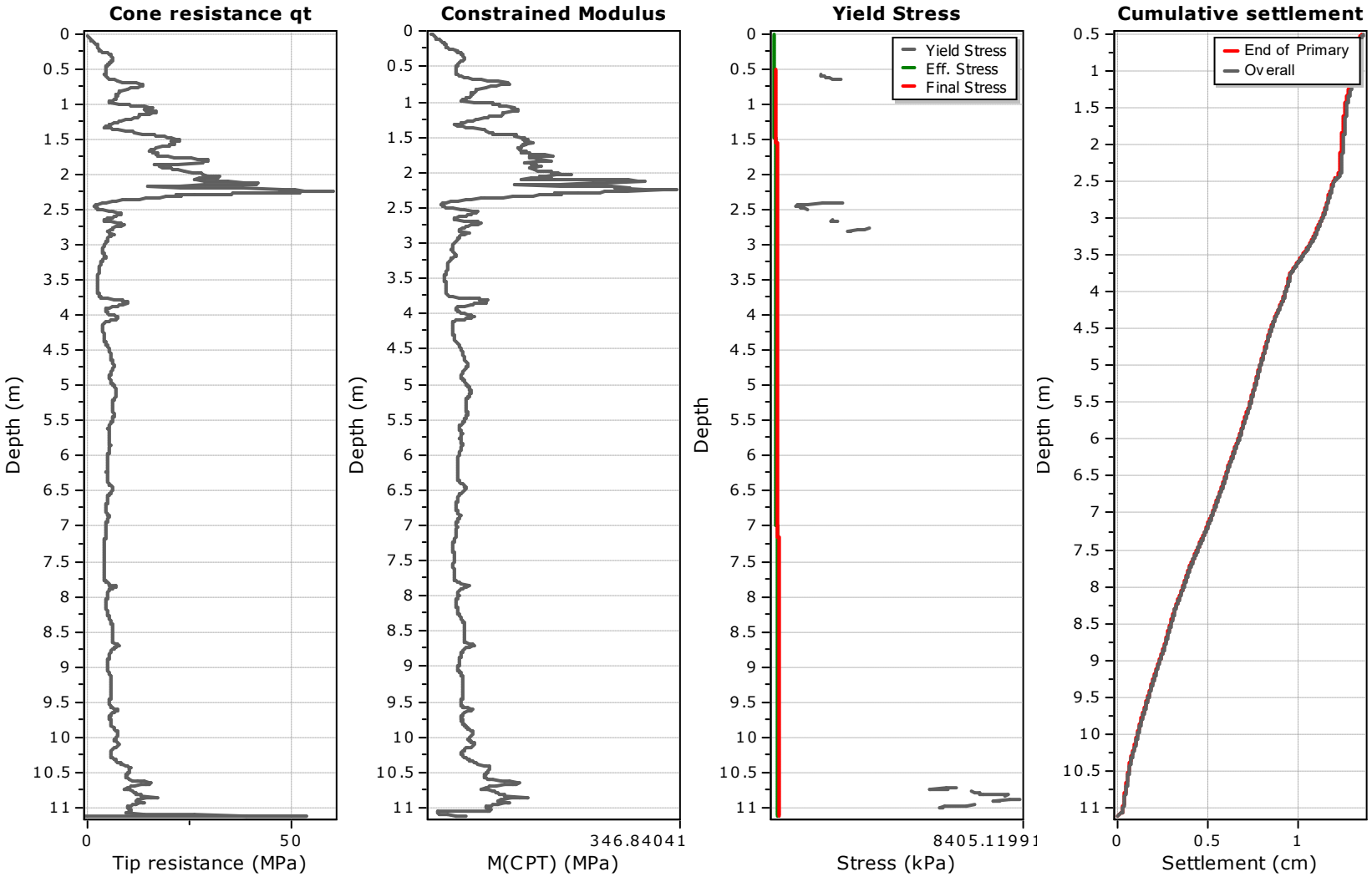
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: CPT Assessment
Location: 174 & 176 Brookvale Road, Havelock North

CPT: CPT17
Total depth: 11.12 m
Est. GWL: 2.00 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

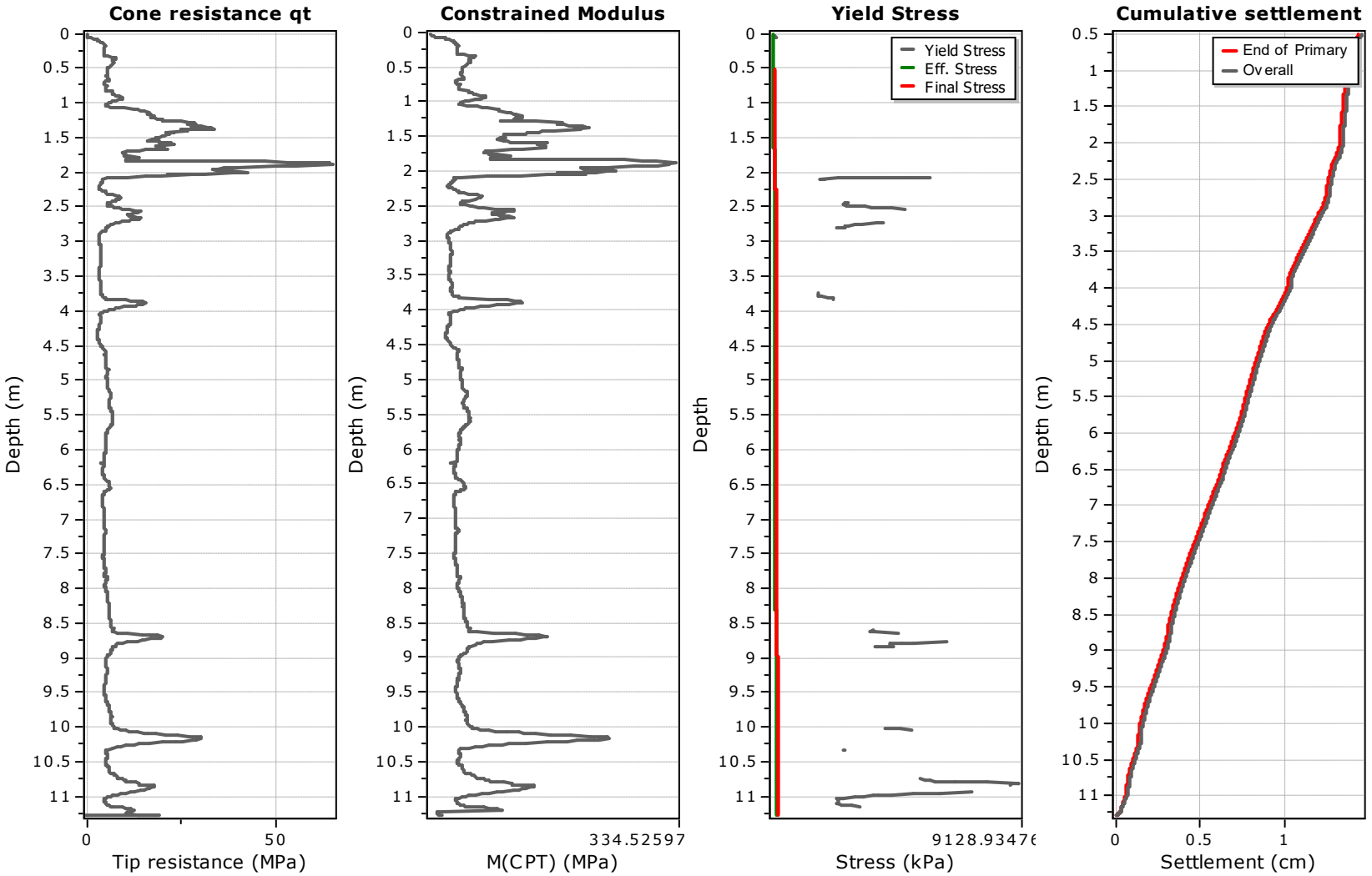
where t_p is the duration of primary consolidation

Hawkes Bay Geotech
Geotechnical Engineers

Project: **CPT Assessment**
Location: **174 & 176 Brookvale Road, Havelock North**

CPT: CPT18
Total depth: 11.27 m
Est. GWL: 1.50 m

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 55.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: Yes
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Appendix F

Slope Stability Analyses Parameters & Results

Sandy SILT to SILT
(Photo - Dry Condition)
Very Stiff to Hard

Presumed soil parameters based on back analysis of the existing steep slopes, typical values for similar soils, in-situ testing and the moisture condition of the units encountered. Analysis has assumed groundwater and porewater pressures effects on soils under storm conditions / prolonged wet periods and the potential for saturation due to failure of a nearby Stormwater Detention Pond (Located on 86, 108 & 122 Arataki Road, Havelock North). Seismic ULS conditions have assumed a Peak Ground Acceleration of 0.58g multiplied by a displacement factor (ks) of 0.65, resulting in a design PGA of 0.38g. Seismic SLS conditions were not assessed due to the suitable ULS Factors of Safety. Analysis have adopted the GLE Morgenstern-Price Method and assessed both circular and non-circular failures. Retained heights for the retaining walls has been conservatively modelled by using the maximum wall heights based on Maven Associates Project No. 135041 - Drawing No. C240, Sheets 0,1 & 3, Rev. A, May 2026. The relevant proposed plans are attached to this Analysis report. Nearby investigation data is included in Appendix B of this report and investigation data for the neighboring site was obtained from the CMW Geotechnical Report for the 86, 108 & 122 Arataki Road development,) referenced Job No. NAP2024-0007AC | Version 0, Dated 30 June 2025.

Sandy GRAVEL with silt
(Photo - Dry Condition)
Dense & Slightly Cemented

Unit	Unit Weight Y	Effective Cohesion c'	Friction Angle Ø	Groundwater (GW)			Seismic
				Prevailing Conditions (Ru)	Storm (Ru)	Pond Failure / Extreme Groundwater (Retaining Wall 3	Undrained Shear Strength (Su)
Sandy SILT Very Stiff to Hard	20	4	30	0	0.4	0.4	80
Sandy GRAVEL with silt Dense & Slightly Cemented	22	-	38	0	0.2 (0.5*)	Water Table	Mohr-Coulomb
Pleistocene Sandy SILT Very Stiff to Hard	20	2	34	0.15	0.3	N/A	60
Pleistocene SANDs Tightly Packed / Dense	20	0	36	0	0.2	N/A	Mohr-Coulomb

** Where gravels overly less permeable soils an ~1.0m thick saturated layer was assumed with Ru=0.5 has been adopted.*

Pleistocene Sandy SILT
(Photo – Dry to Moist Condition)
Very Stiff to Hard

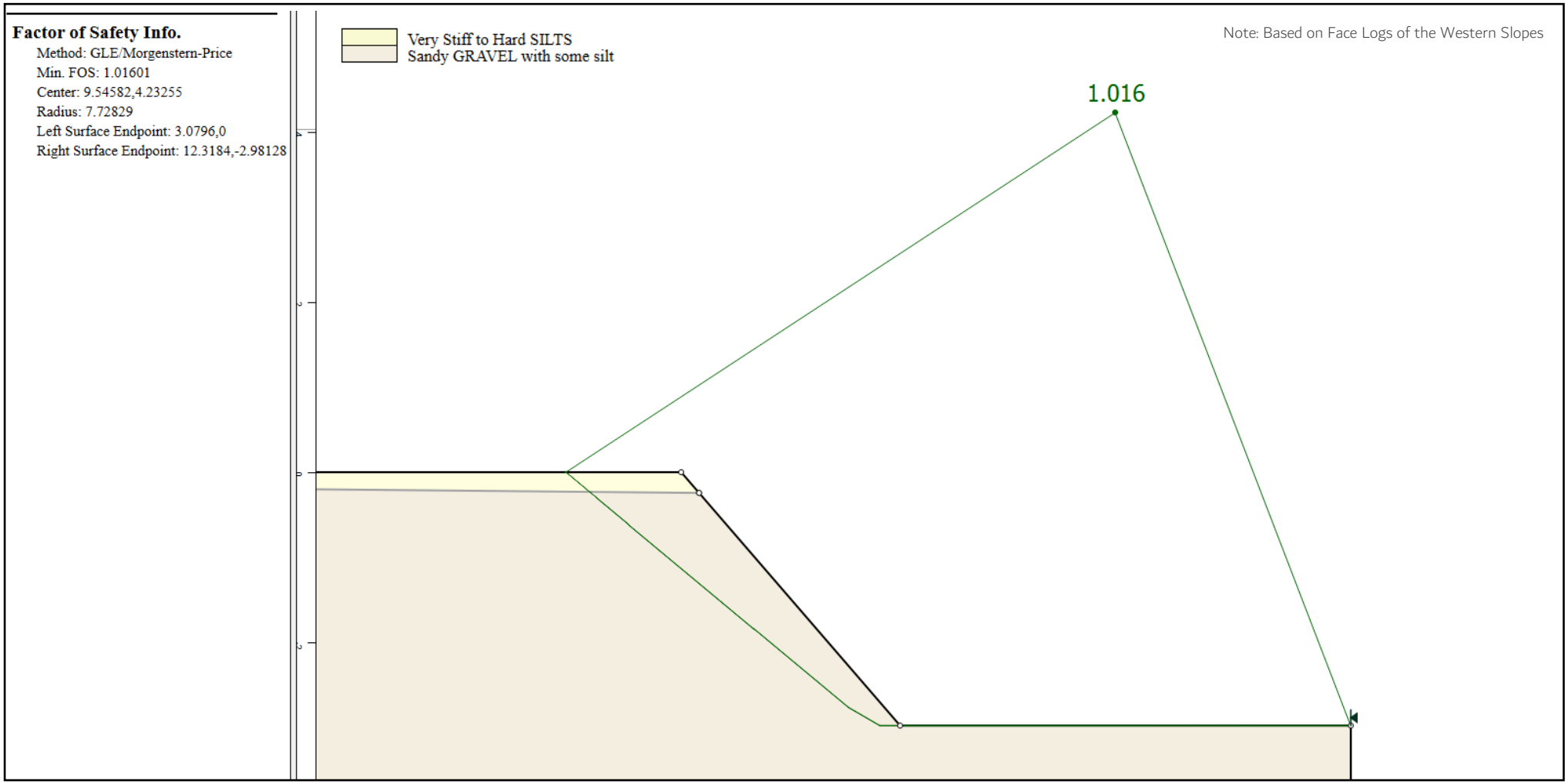
Pleistocene SAND – trace gravel & silt
(Photo - Dry Condition)
Tightly Packed / Dense

HAWKE'S BAY GEOTECH

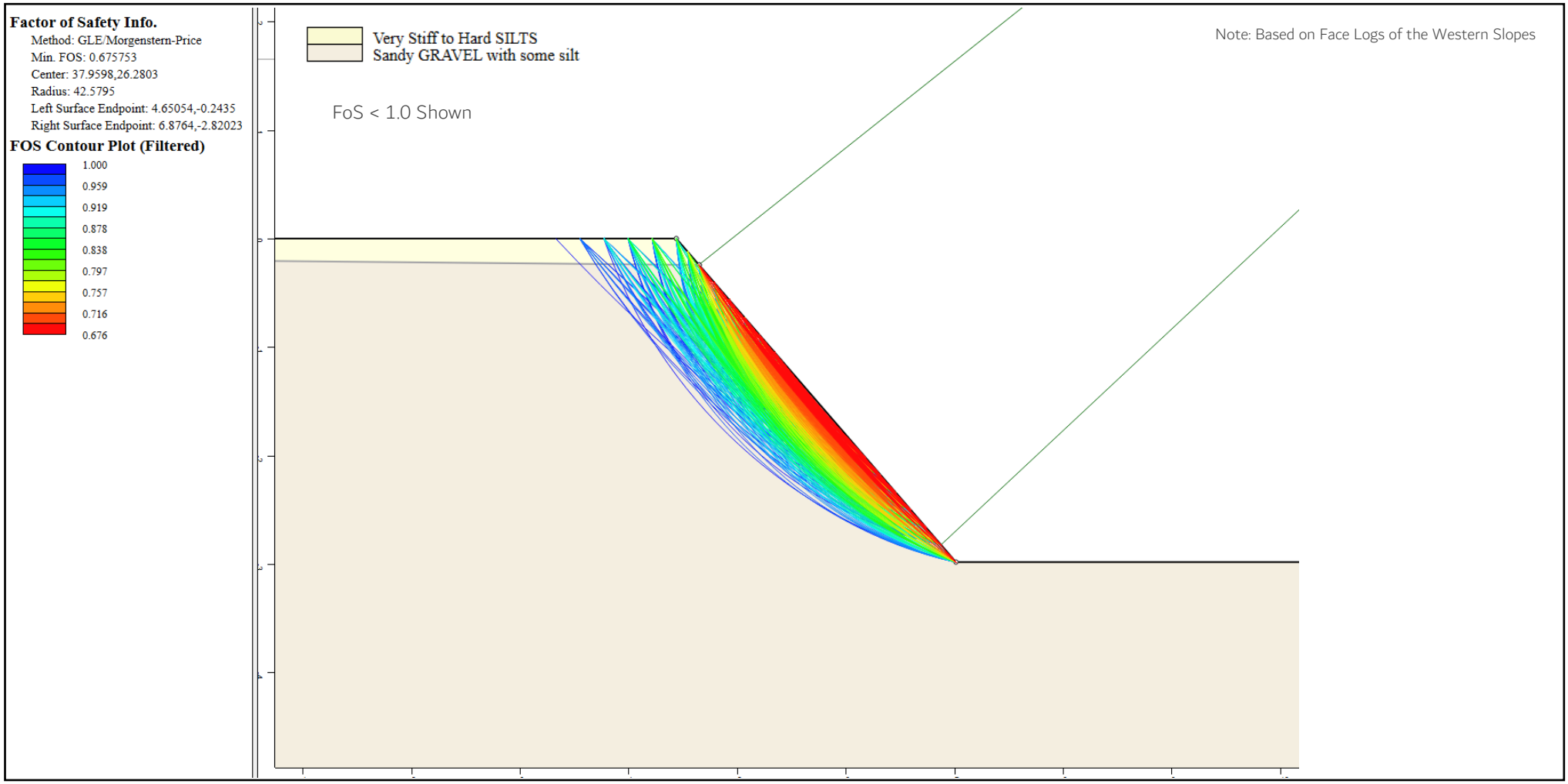
Title:	Analysis Details & Assumed Parameters
Section:	Western Slopes – Current Ground
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026

Current Steep Cut-Slopes – Used for Back Analysis

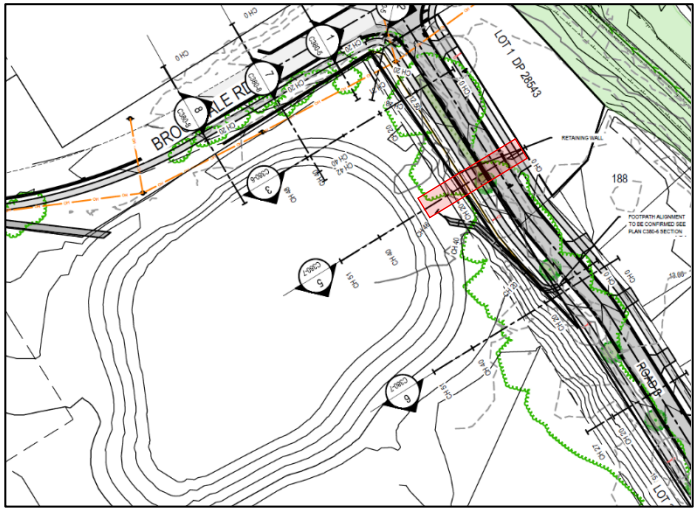
HAWKE'S BAY GEOTECH	Scenario:	Current Ground Conditions – Western Slopes
	Section:	Western Slopes – Current Ground
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Analysis By / Date:	CJG, 03 June 2026



HAWKE'S BAY GEOTECH	Scenario:	Current Ground – Steep Cuts of ~50° – Back Analysis (prevailing – non-circular)
	Section:	Western Slopes – Current Ground
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown



HAWKE'S BAY GEOTECH	Scenario:	Current Ground – Steep Cuts of ~50° – Back Analysis (prevailing –circular)
	Section:	Western Slopes – Current Ground
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown

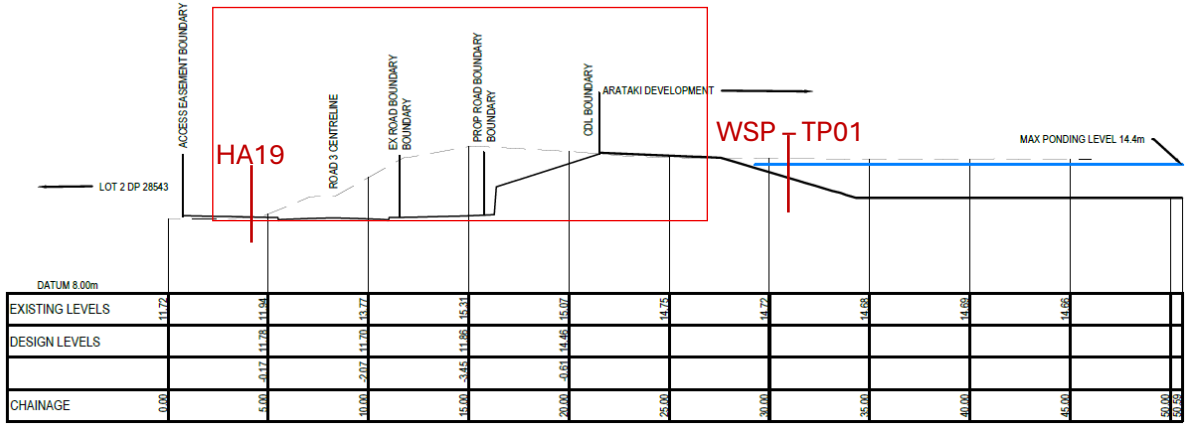


Current Slope

Section = Road 3 – Batter 5 & Retaining Wall 3

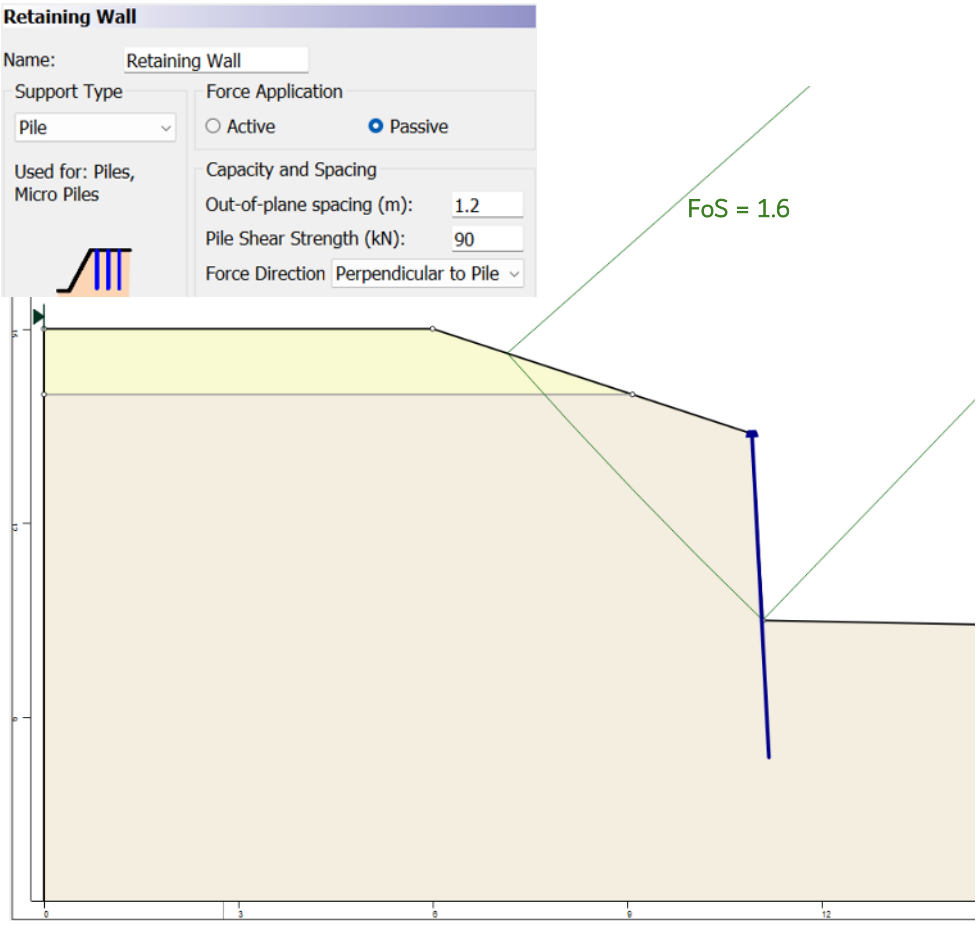
Analysis has assumed groundwater and porewater pressures effects on soils under storm conditions / prolonged wet periods in conjunction with the potential for saturation due to failure of a nearby Stormwater Detention Pond (Located on 86, 108 & 122 Arataki Road, Havelock North). This case has been referred to as the Extreme Groundwater Case and has assumed localised saturation of the slopes adjacent to the stormwater detention pond and proposed retaining walls (i.e. retaining wall drainage is insufficient). The required Factor of Safety (FoS) has been assessed as ≥1.2 for this case.

Unit	Unit Weight Y	Effective Cohesionc'	Friction Angle Ø	Groundwater (GW)			Seismic
				Prevailing Conditions (Ru)	Storm (Ru)	Pond Failure / Extreme Groundwater (Retaining Wall 3 only)	Undrained Shear Strength (Su)
Sandy SILT Very Stiff to Hard	20	4	30	0	0.4	0.4	80
Sandy GRAVEL with silt Dense & Slightly Cemented	22	-	38	0	0.2	Water Table	Mohr-Coulomb

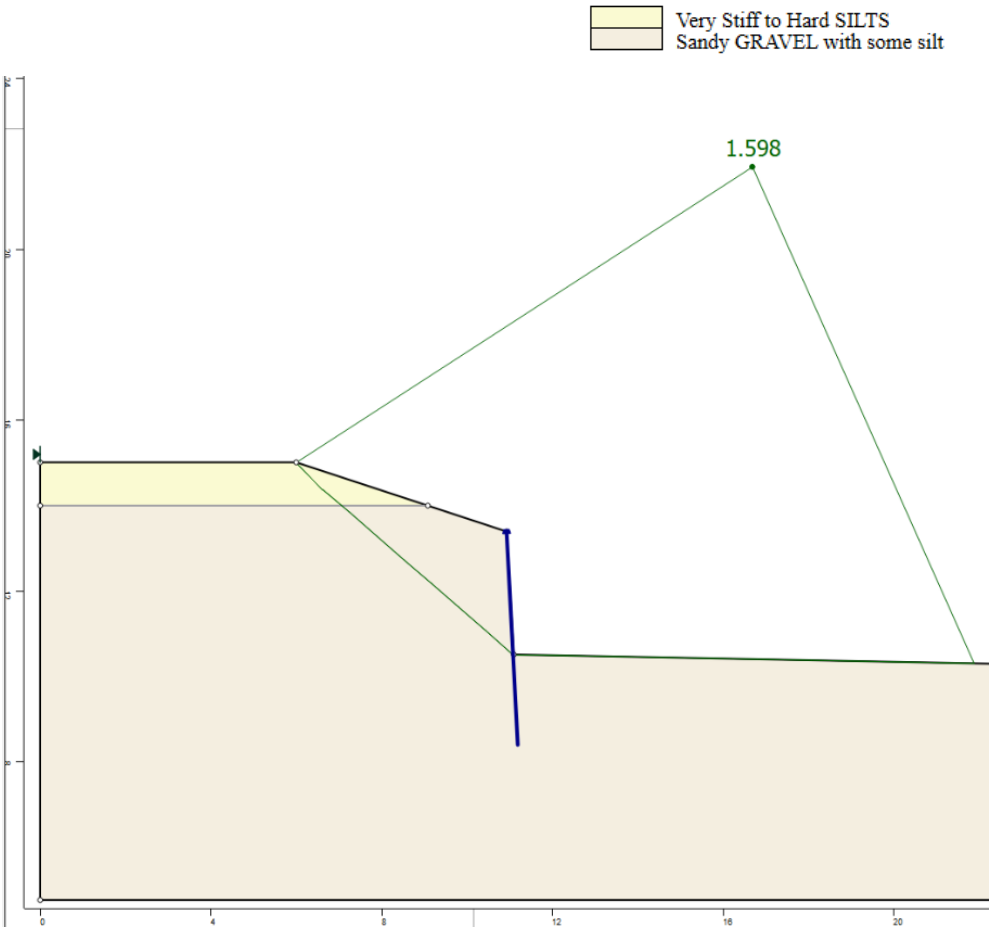


Section & Title:	Road 3 – Batter 5 & Retaining Wall 3 - Slope Stability Section Location & Details
Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheets 1 & 6, Rev. A, June 2026
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026

HAWKE'S BAY GEOTECH



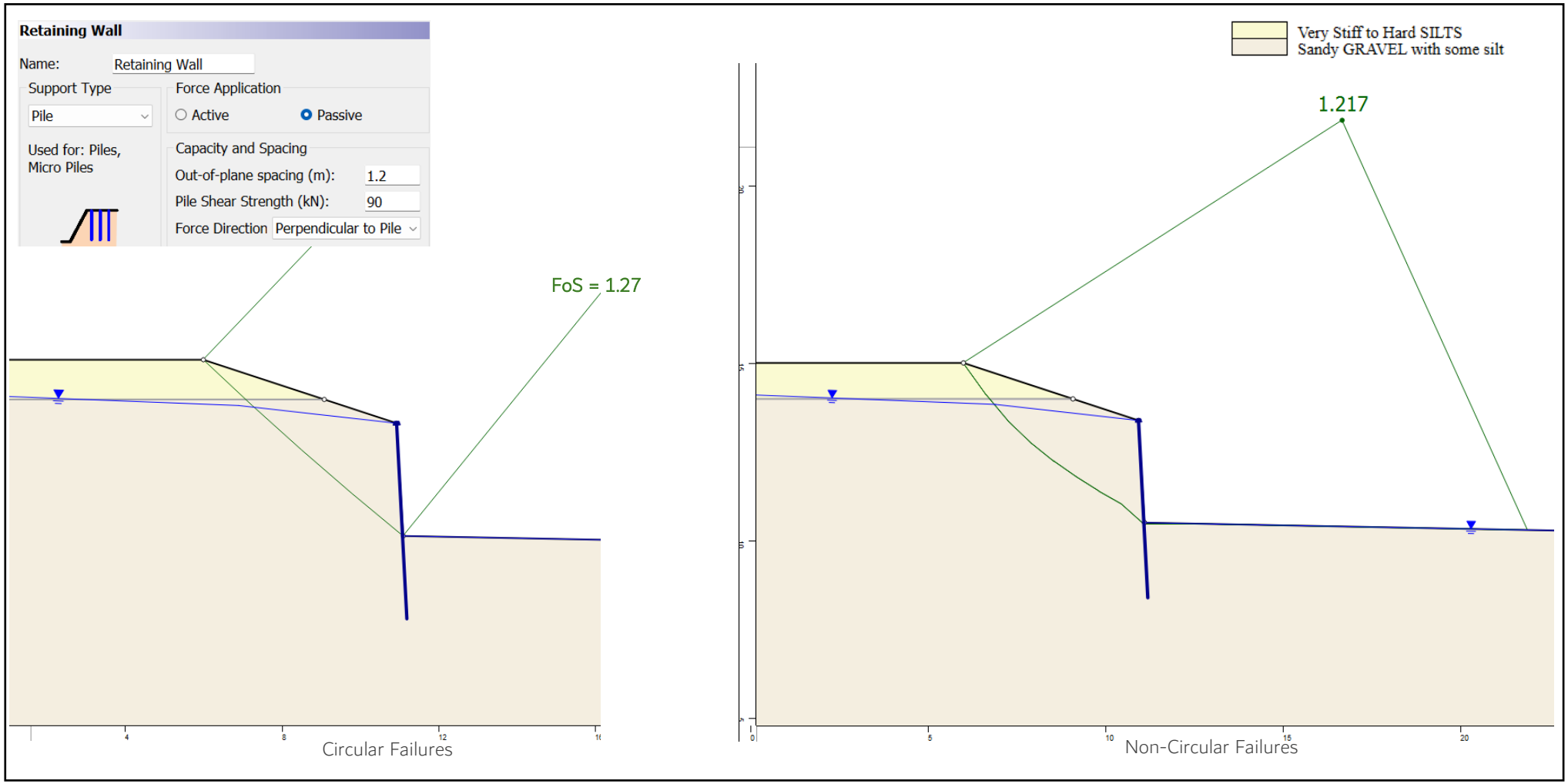
Circular Failures



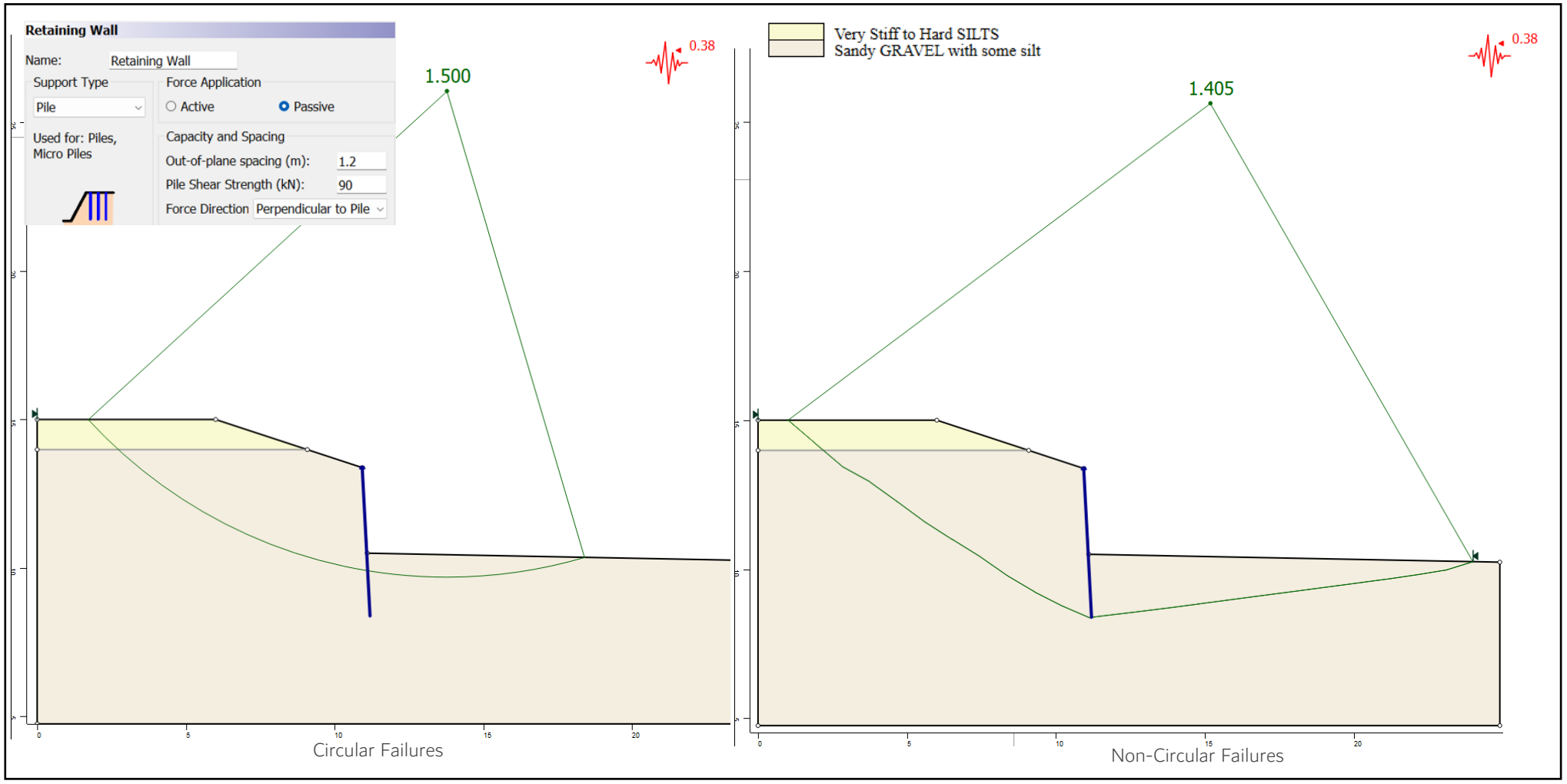
Non-Circular Failures

Scenario:	Prevailing Conditions
Section:	Proposed Ground - Road 3, Batter 5 & Retaining Wall 3
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

HAWKE'S BAY GEOTECH



HAWKE'S BAY GEOTECH	Scenario:	Extreme Groundwater Conditions (storm event & failure of nearby detention pond)
	Section:	Proposed Ground - Road 3, Batter 5 & Retaining Wall 3
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown



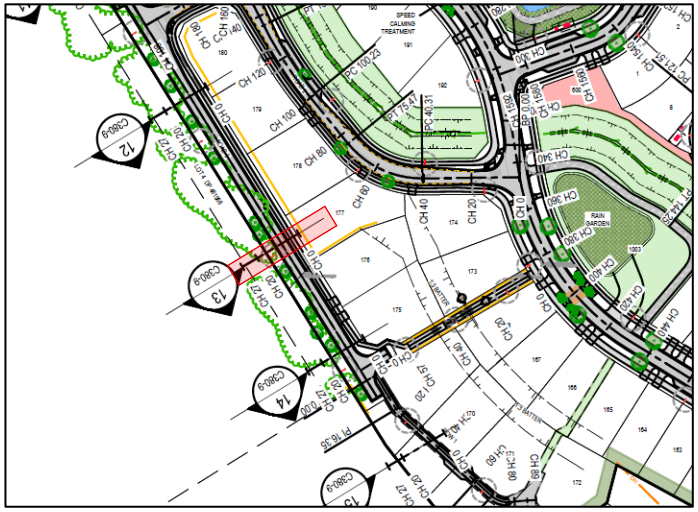
HAWKE'S BAY GEOTECH	Scenario:	Seismic Conditions – ULS (0.58g x ks=0.65 = Design PGA 0.38g)
	Section:	Proposed Ground - Road 3, Batter 5 & Retaining Wall 3
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown

Section = Road 3 – Batter 5 & Retaining Wall 3 - RESULTS

Based on the analyses there is an adequate factor of safety for the slope provided that Retaining Wall 3 is specifically designed. The analyses indicate a very low risk of global stability affecting the wall (or shear failure of the wall) provided that the following is adhered to:

- Retaining Wall 3 should have pole spacings of 1.2m or less (centre to centre)
- Retaining Wall 3 should be embedded a minimum of 2.0m below ground to avoid any global instability. Where slopes are less than 3m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depth of 2.0m may be reduced (pending analysis and confirmation by the geotechnical engineer).
- Retaining Wall 3 requires a minimum shear strength of 90kN to prevent shear failure through the wall. Where slopes are less than 3m high (above the wall) and the wall less than 1.5m high, then the minimum shear strength of 90kN may be reduced (pending analysis and confirmation by the geotechnical engineer). Alternatively, if pole spacings are 1.0m or less, then the required shear strength may be reassessed.

HAWKE'S BAY GEOTECH	Title / Section:	Slope Stability Results & Retaining Wall Requirements - Road 3, Batter 5 & Retaining Wall 3
	Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheets 1 & 6, Rev. A, May 2026
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Analysis By / Date:	CJG, 03 June 2026



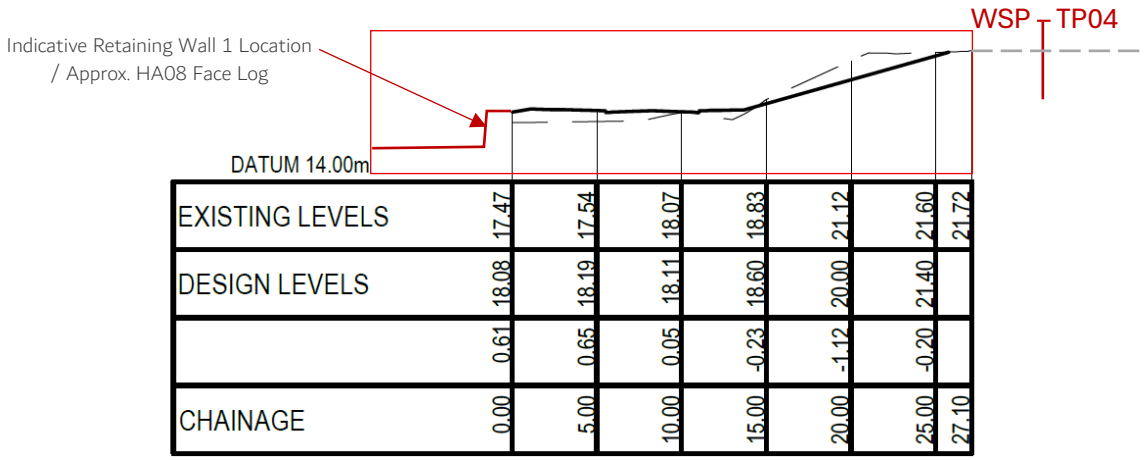
Current Slope

Section = General Batter 13 & Retaining Wall 1

Analysis has primarily been undertaken to investigate the global stability of the retaining wall, particularly under the seismic case.

Unit	Unit Weight Y	Effective Cohesionc'	Friction Angle Ø	Groundwater (GW)			Seismic
				Prevailing Conditions (Ru)	Storm (Ru)	Pond Failure / Extreme Groundwater (Retaining Wall 3 only)	Undrained Shear Strength (Su)
Sandy SILT Very Stiff to Hard	20	4	30	0	0.4	0.4	80
Sandy GRAVEL with silt Dense & Slightly Cemented	22	-	38	0	0.2 (0.5*)	Water Table	Mohr-Coulomb
Pleistocene Sandy SILT to Silty SAND Very Stiff to Hard / Dense	20	2	34	0.15	0.3	N/A	60

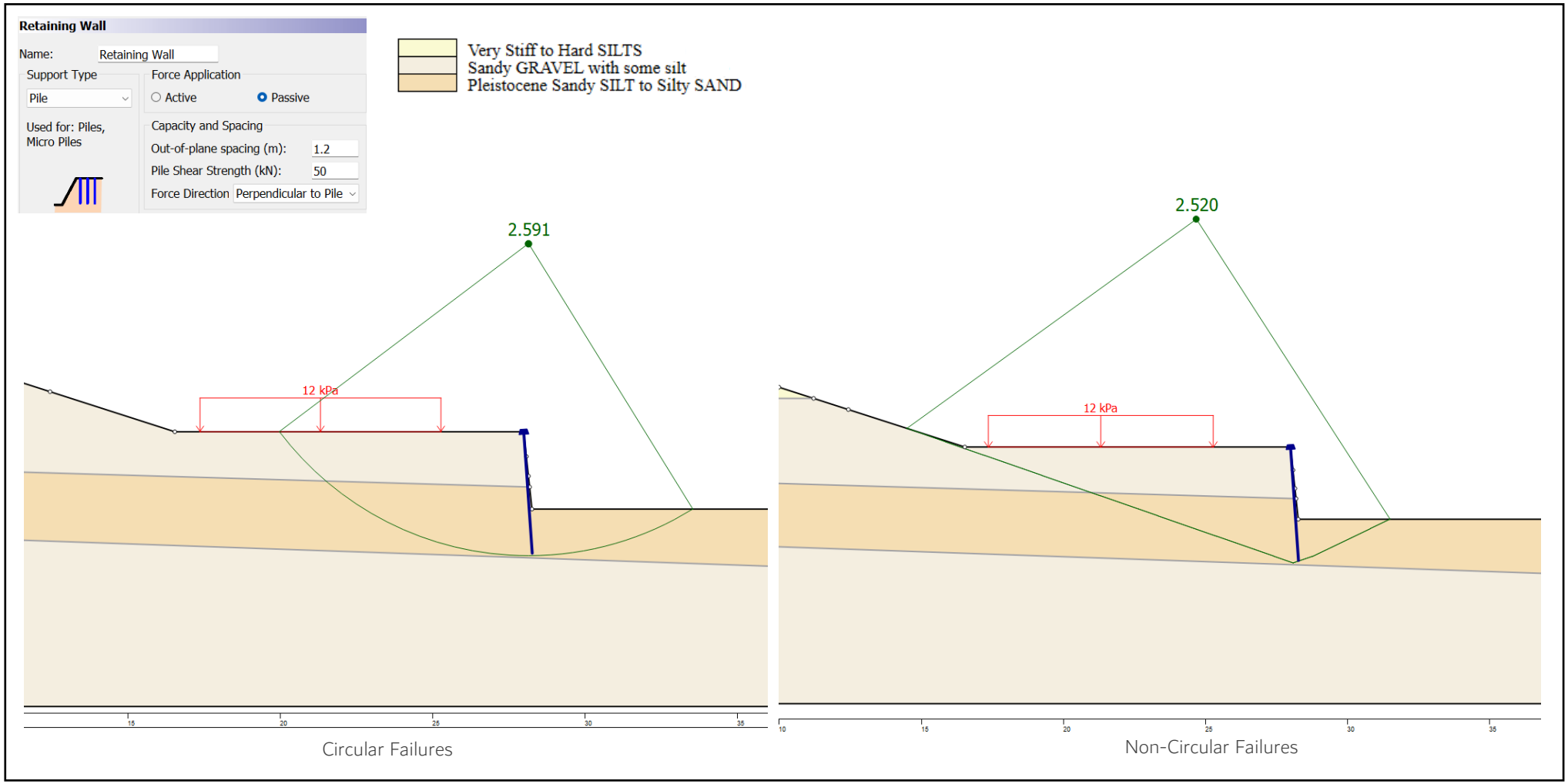
** Where gravels overly less permeable soils an ~1.0m thick saturated layer was assumed with Ru=0.5 has been adopted.*



PV - General Batter 13

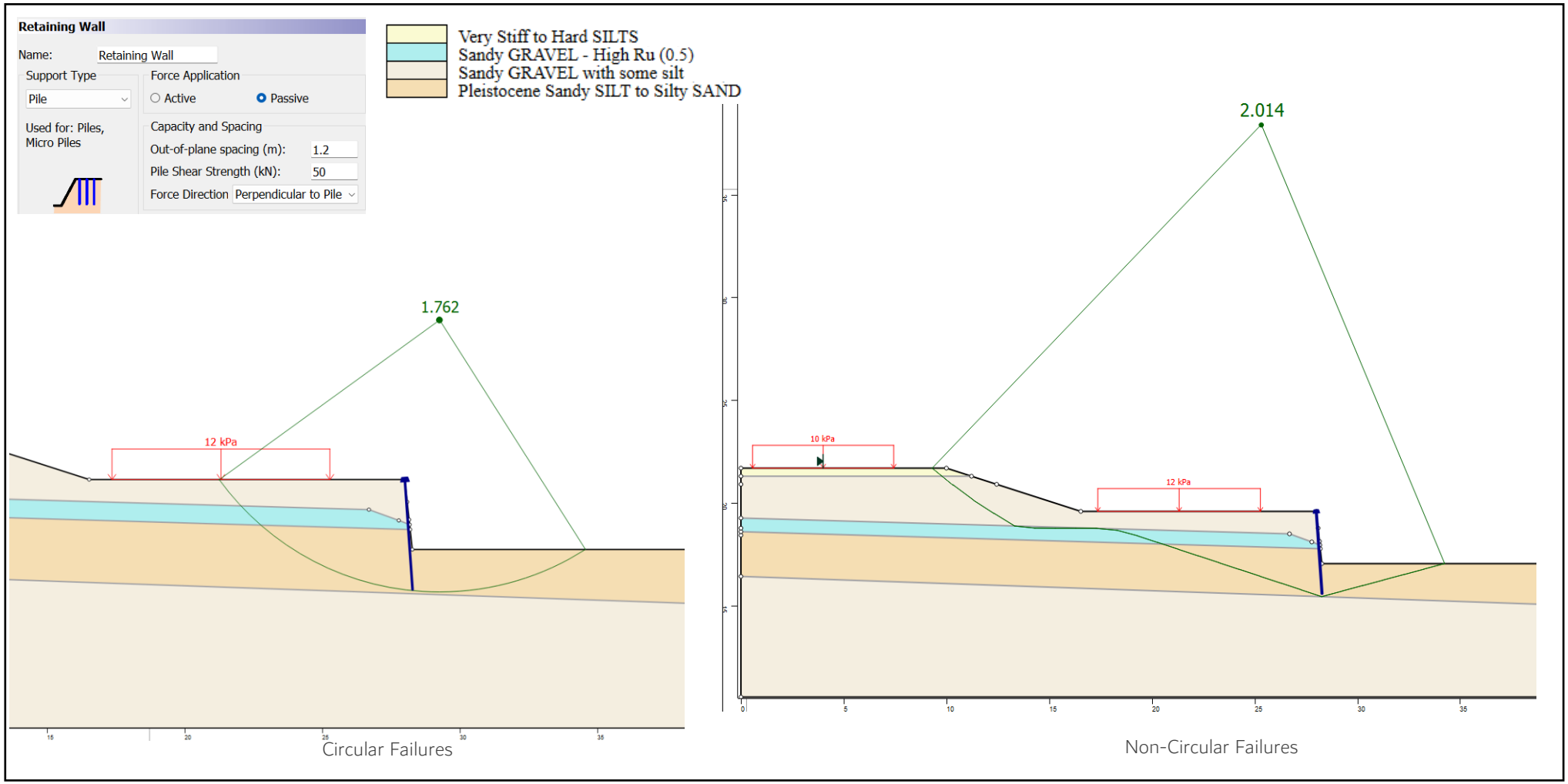
HAWKE'S BAY GEOTECH

Title / Section:	Slope Stability Section Location & Details - General Batter 13 & Retaining Wall 1
Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026



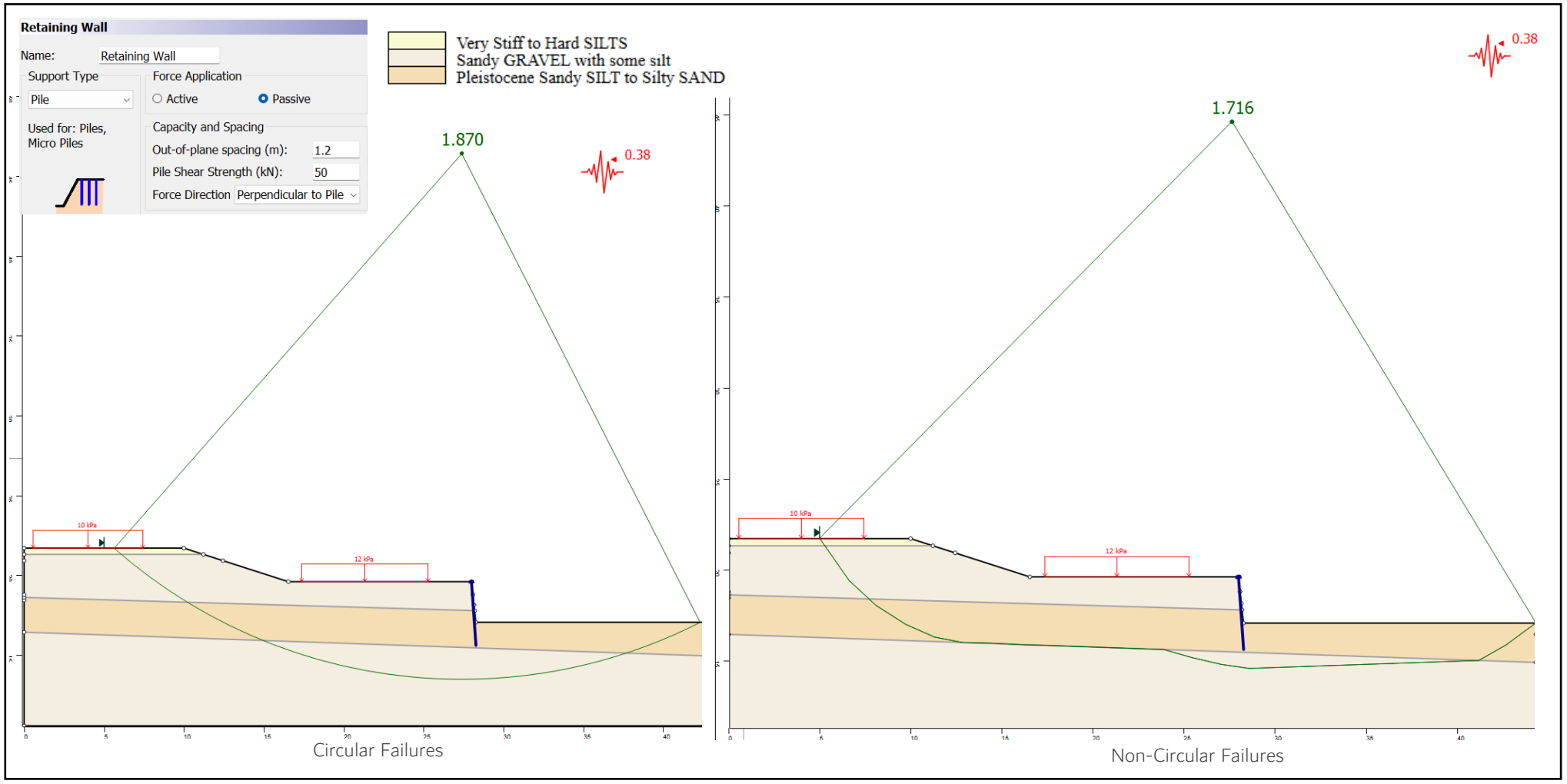
Scenario:	Prevailing Conditions
Section:	Proposed Ground - General Batter 13 & Retaining Wall 1
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

HAWKE'S BAY GEOTECH



Scenario:	Elevated Pore Pressures / Storm & Prolonged Wet Period Conditions
Section:	Proposed Ground - General Batter 13 & Retaining Wall 1
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

HAWKE'S BAY GEOTECH



Scenario:	Seismic Conditions – ULS (0.58g x ks=0.65 = Design PGA 0.38g)
Section:	Proposed Ground - General Batter 13 & Retaining Wall 1
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

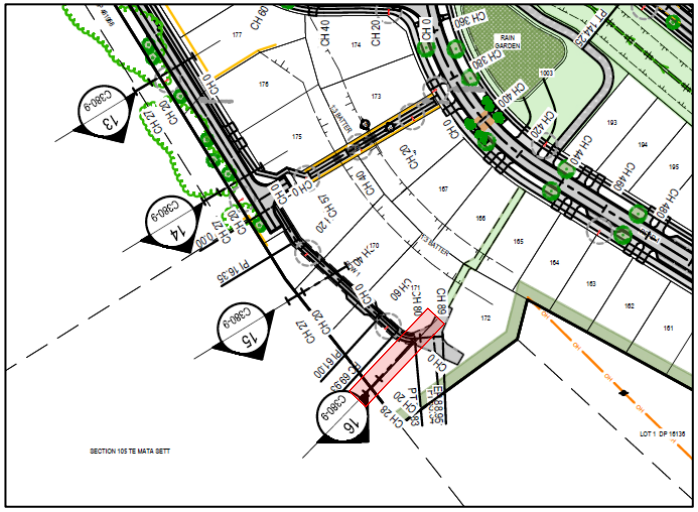
HAWKE'S BAY GEOTECH

Section = General Batter 13 & Retaining Wall 1 - RESULTS

Based on the analyses there is an adequate factor of safety for the slope provided that Retaining Wall 1 is specifically designed. The analyses indicate a very low risk of global stability affecting the wall (or shear failure of the wall) provided that the following is adhered to:

- Retaining Wall 1 should have pole spacings of 1.2m or less (centre to centre)
- Retaining Wall 1 should be embedded a minimum of 1.5m below ground to avoid any global instability. Where slopes are less than 1.5m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depth of 1.5m may be reduced (pending analysis and confirmation by the geotechnical engineer).
- Retaining Wall 1 requires a minimum shear strength of 50kN to prevent shear failure through the wall. Where slopes are less than 3m high (above the wall) and the wall less than 1.5m high, then the minimum shear strength of 50kN may be reduced (pending analysis and confirmation by the geotechnical engineer). Alternatively, if pole spacings are 1.0m or less, then the required shear strength may be reassessed.

HAWKE'S BAY GEOTECH	Title / Section:	Slope Stability Results & Retaining Wall Requirements - General Batter 13 & Retaining Wall 1
	Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Analysis By / Date:	CJG, 03 June 2026



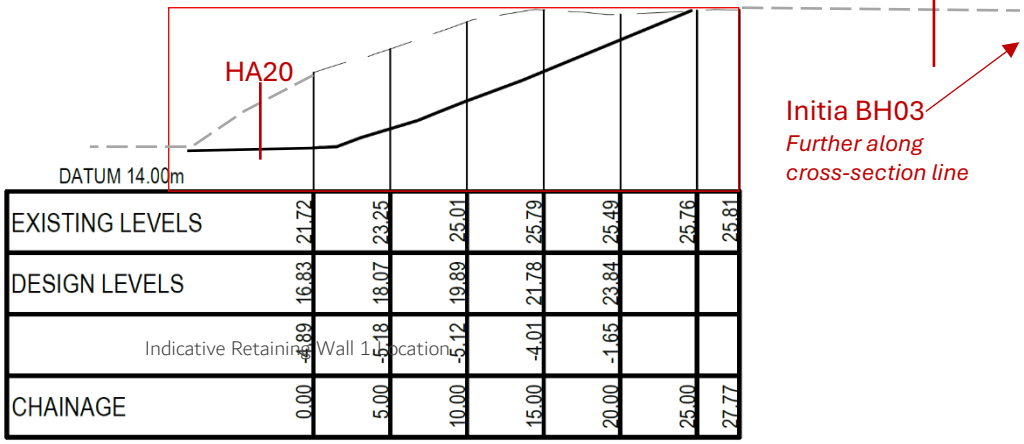
Section = General Batter 16

General Batter 16 is the highest batter at ~9m. Analysis has assumed a maximum cut slope of 20°. Additional Investigations were undertaken to investigate the lower slope units based on nearby borehole data and cut slope observations. The Investigation Logs are attached to this analysis summary report.

Unit	Unit Weight Y	Effective Cohesionc'	Friction Angle Ø	Groundwater (GW)			Seismic
				Prevailing Conditions (Ru)	Storm (Ru)	Pond Failure / Extreme Groundwater (Retaining Wall 3 only)	Undrained Shear Strength (Su)
Sandy SILT Very Stiff to Hard	20	4	30	0	0.4	0.4	80
Sandy GRAVEL with silt Dense & Slightly Cemented	22	-	38	0	0.2 (0.5*)	Water Table	Mohr-Coulomb
Pleistocene Sandy SILT to Silty SAND Very Stiff to Hard / Dense	20	2	34	0.15	0.3	N/A	60

** Where gravels overly less permeable soils an ~1.0m thick saturated layer was assumed with Ru=0.5 has been adopted.*

Current Slope



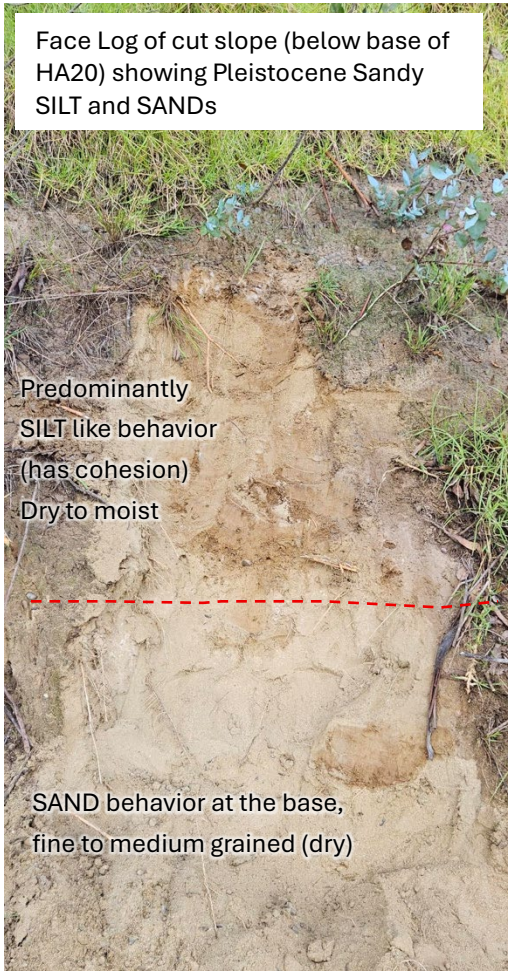
PV - General Batter 16

Title / Section:	Slope Stability Section Location & Details - General Batter 16
Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026

HAWKE'S BAY GEOTECH

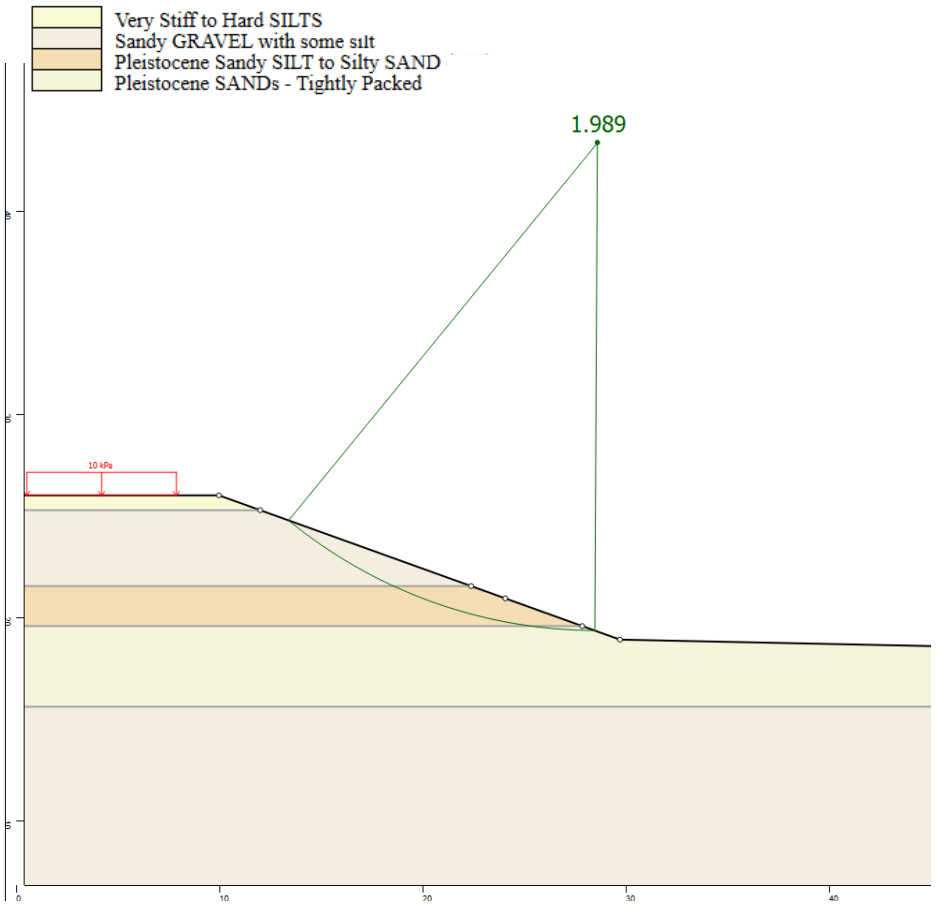
Section = General Batter 16 – Site Photos & Details Continued...

Pleistocene Sandy SILT & SAND in Cut Slopes

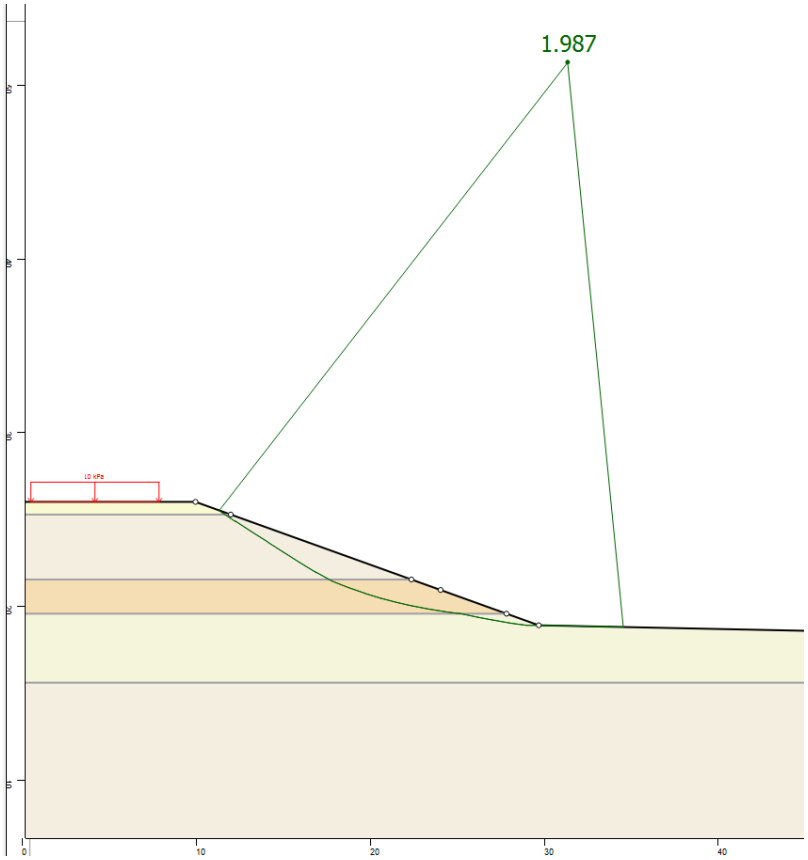


Pleistocene Sandy SILT – Has significant sand content but also Cohesion (dry to moist sample)

HAWKE'S BAY GEOTECH	Title / Section:	Continued... Slope Stability Section Details - General Batter 16
	Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Analysis By / Date:	CJG, 03 June 2026



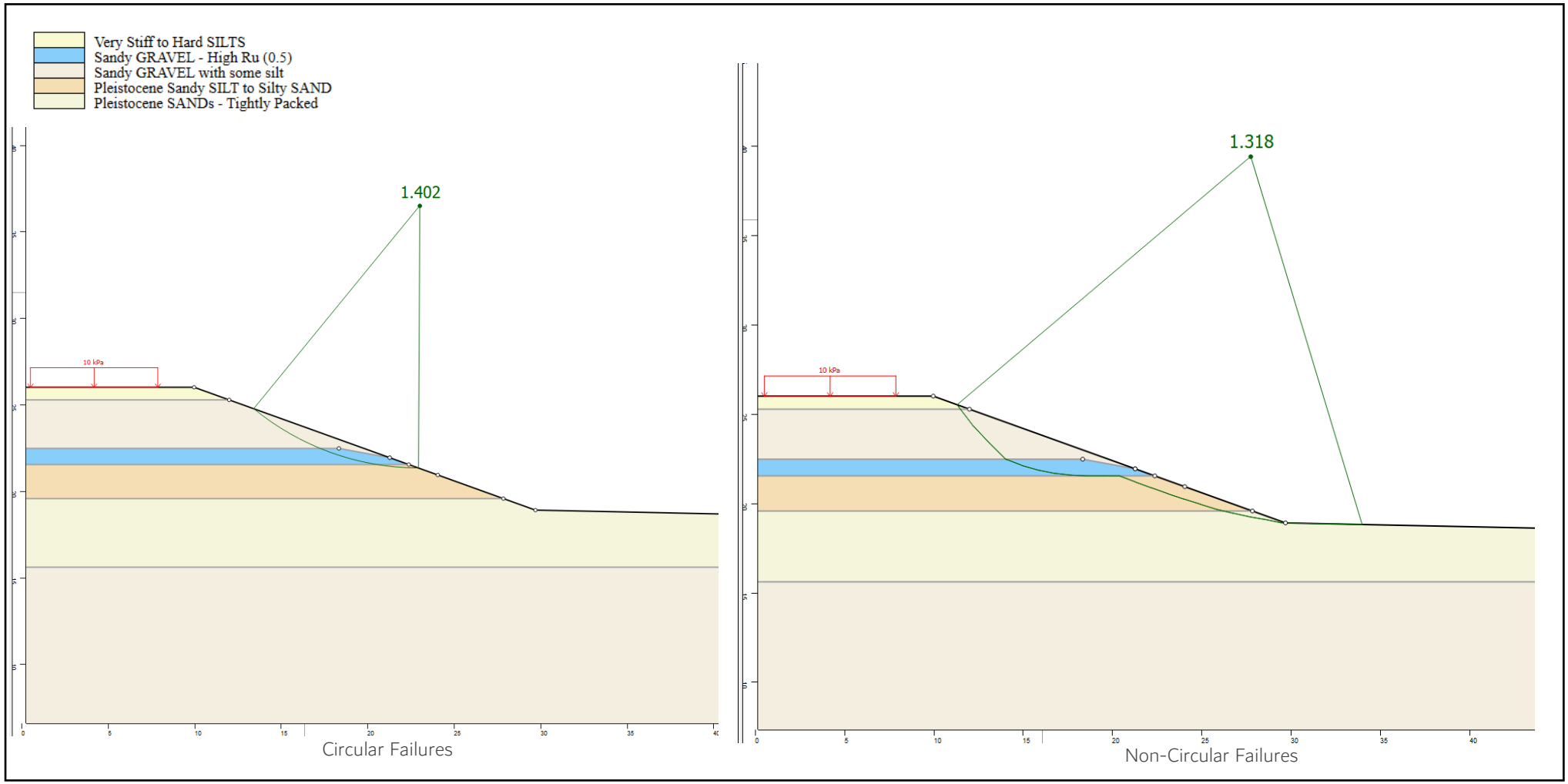
Circular Failures



Non-Circular Failures

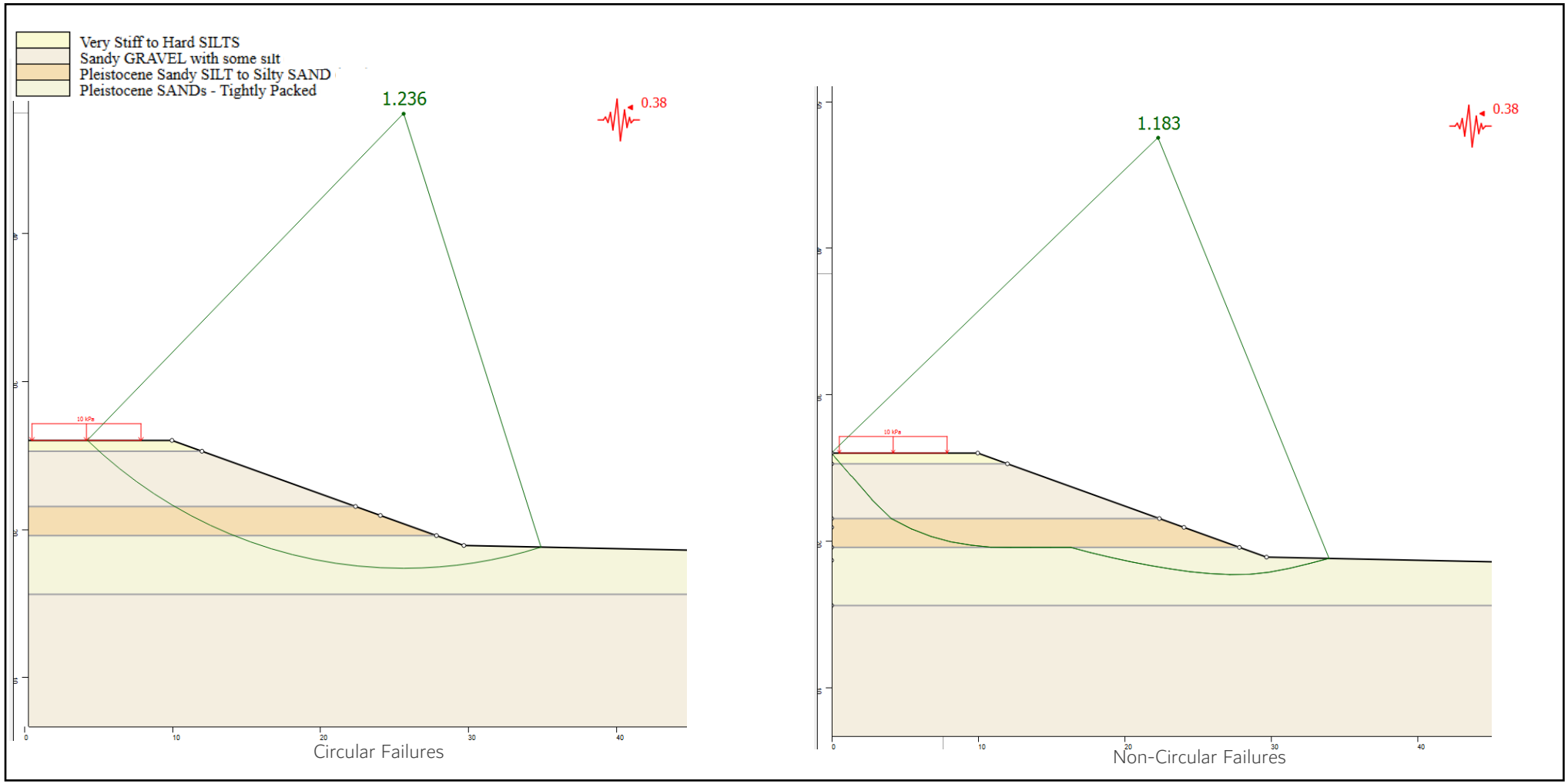
Scenario:	Prevailing Conditions
Section:	Proposed Ground - General Batter 16
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

HAWKE'S BAY GEOTECH



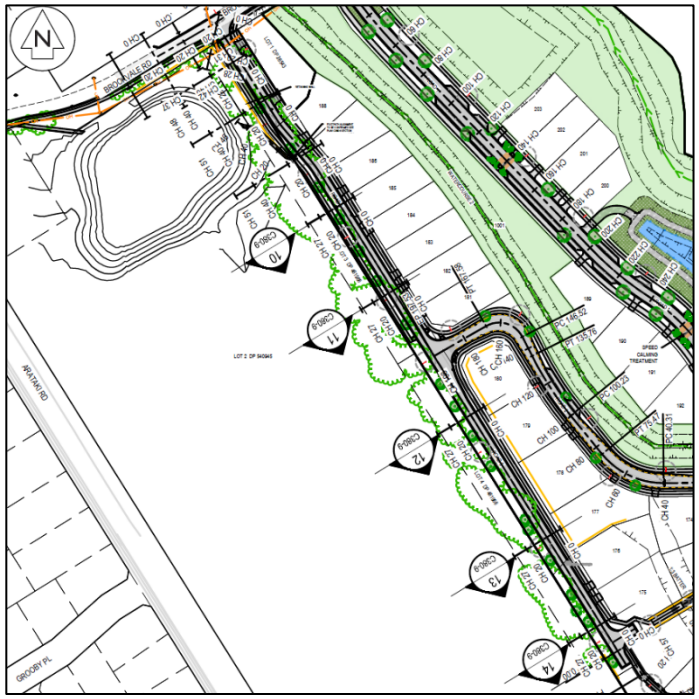
Scenario:	Elevated Pore Pressures / Storm & Prolonged Wet Period Conditions
Section:	Proposed Ground - General Batter 16
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

HAWKE'S BAY GEOTECH



HAWKE'S BAY GEOTECH

Scenario:	Seismic Conditions – ULS (0.58g x ks=0.65 = Design PGA 0.38g)
Section:	Proposed Ground - General Batter 16
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown



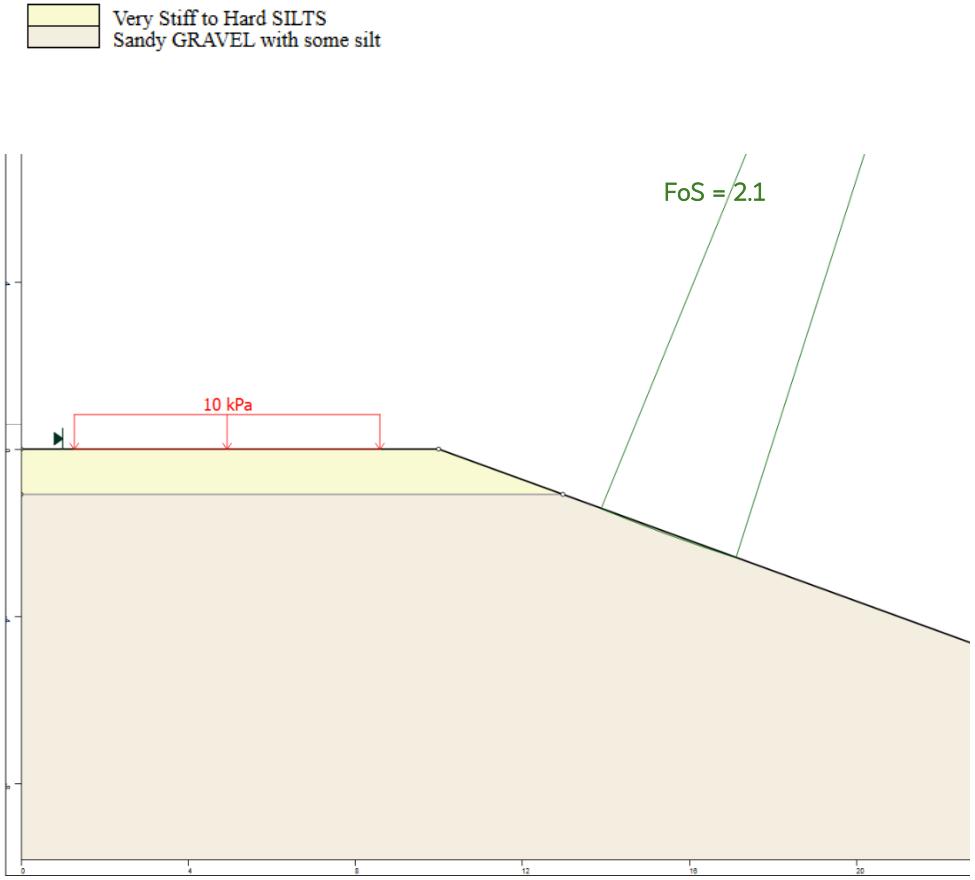
Section = Batter Slopes 10-14

Batter Slopes 10-14 have been assessed separately as these slopes comprise almost entirely of GRAVEL deposits and may behave differently under ULS loading. The analysis was conservatively undertaken by assuming a maximum slope height of 5m (higher than the design slopes) and a cut slope angle of 20°.

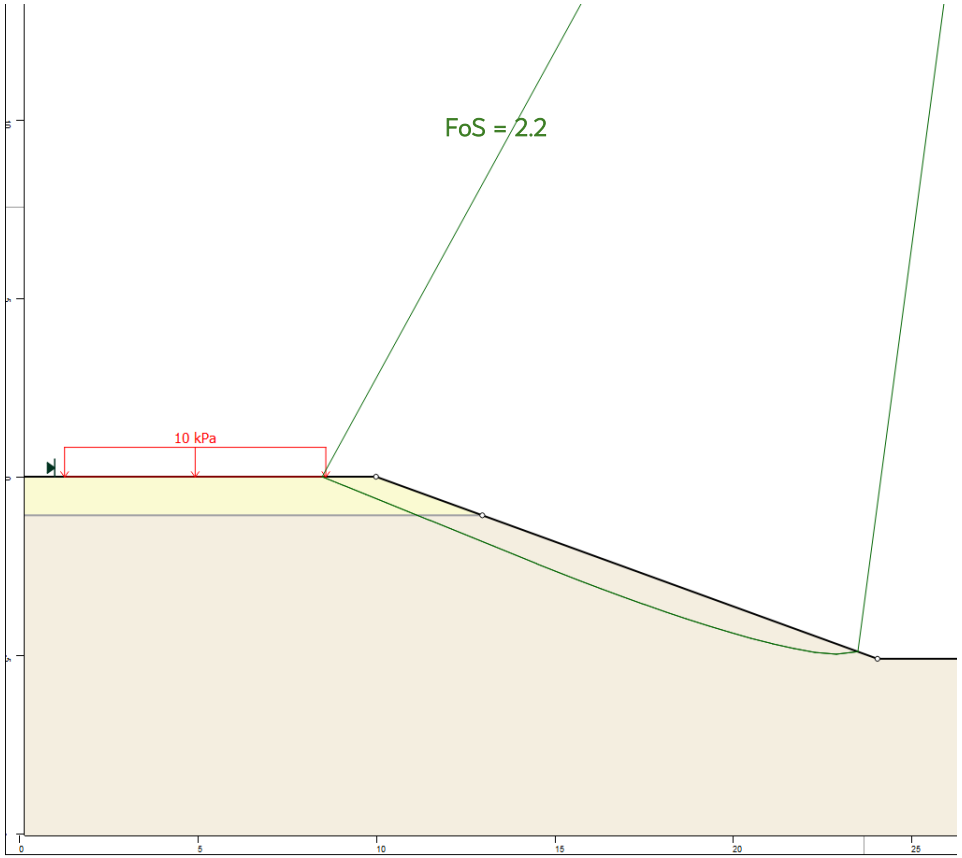
Unit	Unit Weight Y	Effective Cohesionc'	Friction Angle Ø	Groundwater (GW)		Seismic
				Prevailing Conditions (Ru)	Storm (Ru)	Undrained Shear Strength (Su)
Sandy SILT Very Stiff to Hard	20	4	30	0	0.4	80
Sandy GRAVEL with silt Dense & Slightly Cemented	22	-	38	0	0.2	Mohr-Coulomb

HAWKE'S BAY GEOTECH

Title / Section:	Slope Stability Section Location & Details - Batter Slopes 10-14
Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, April 2026
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026



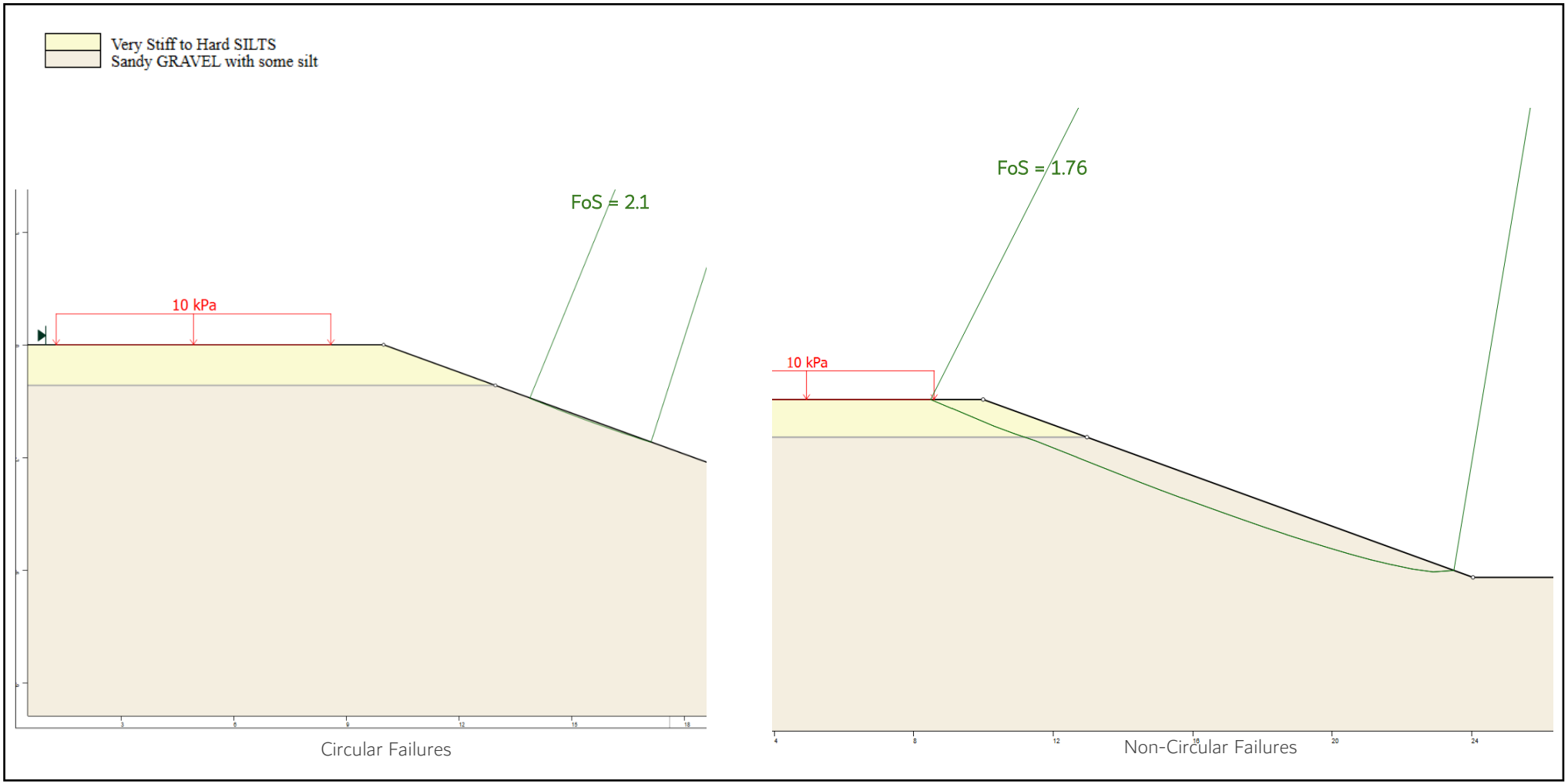
Circular Failures



Non-Circular Failures

Scenario:	Prevailing Conditions
Section:	Proposed Ground - Batter Slopes 10-14
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Scale:	As shown

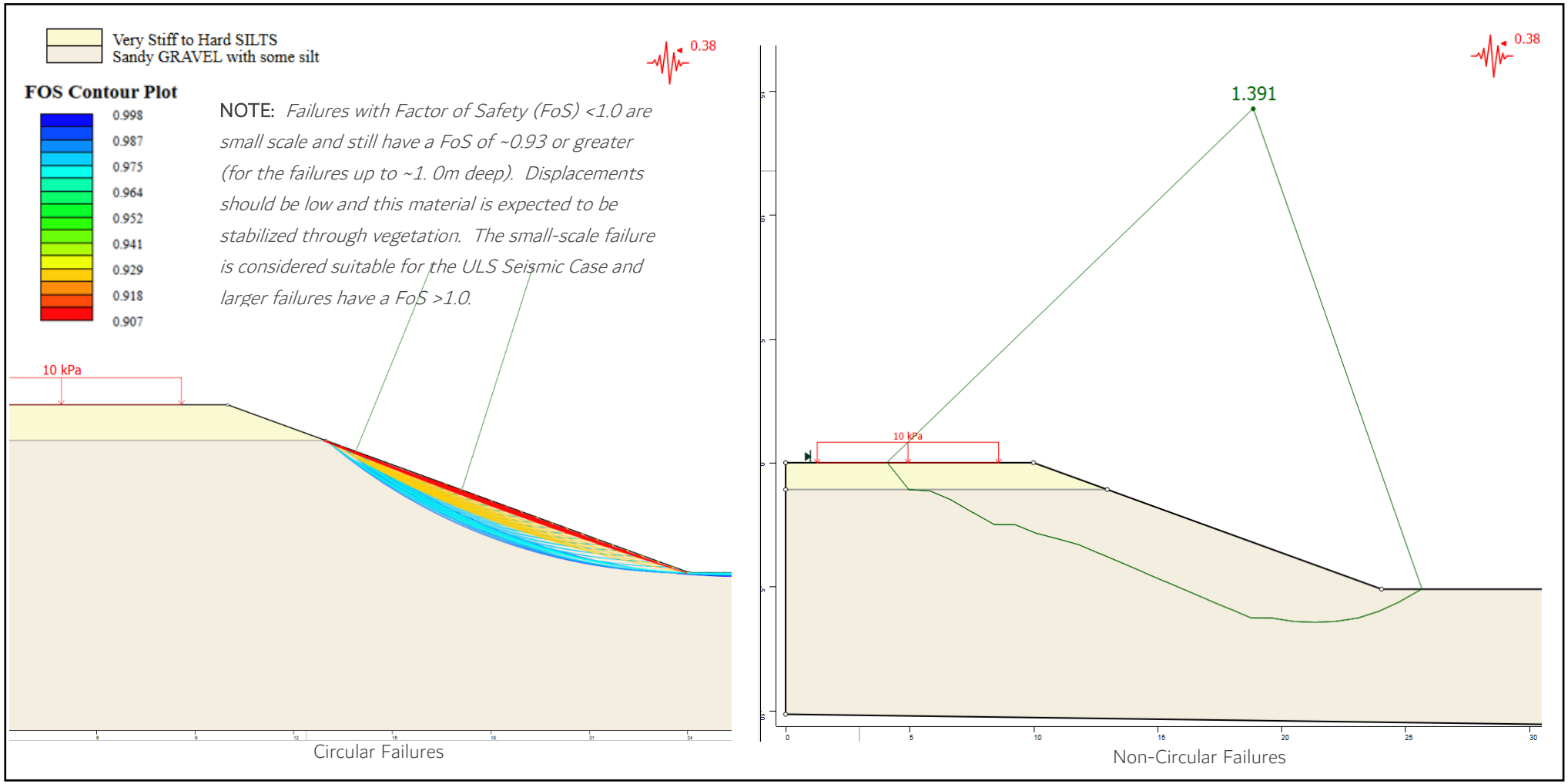
HAWKE'S BAY GEOTECH



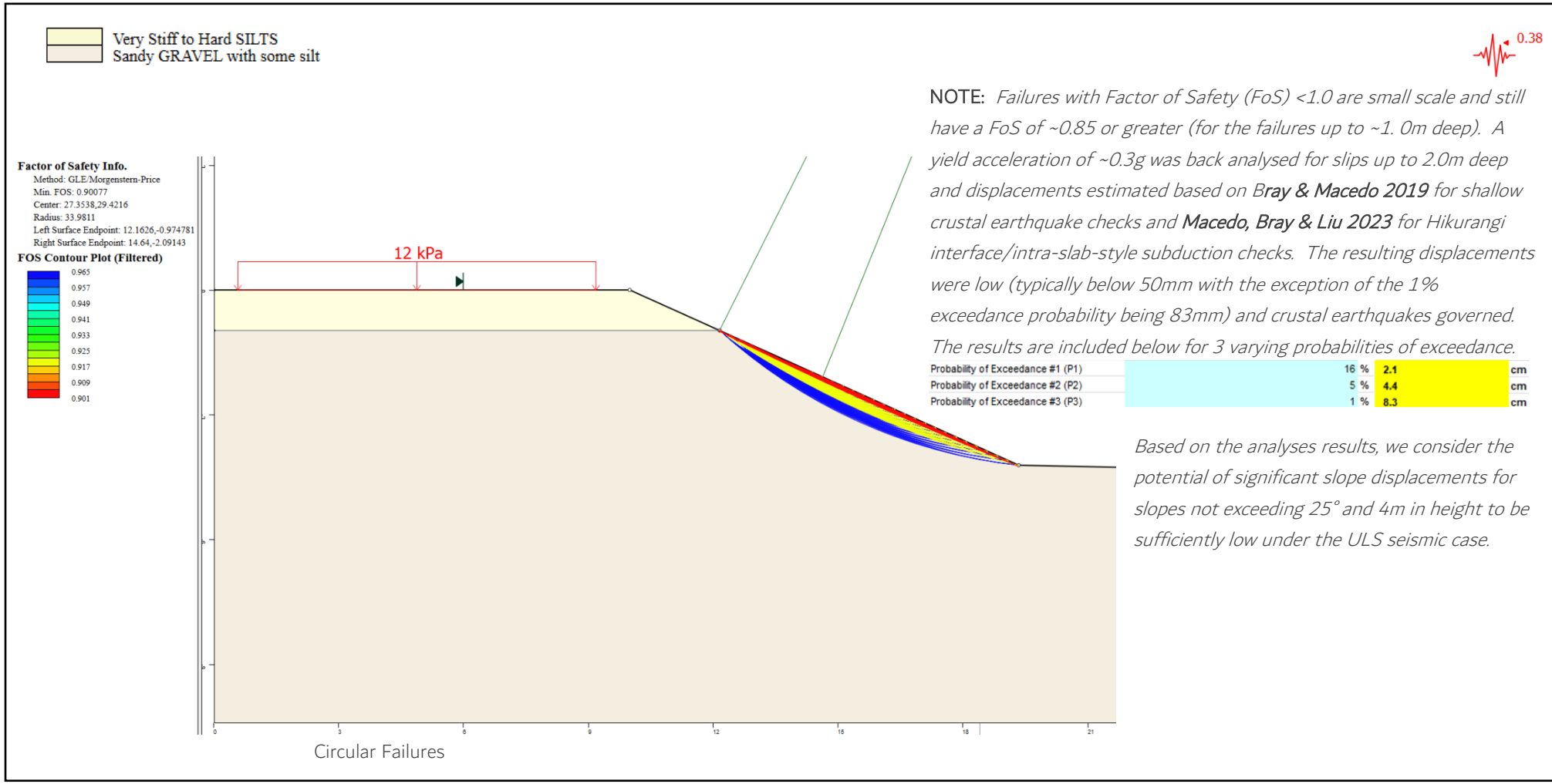
Circular Failures

Non-Circular Failures

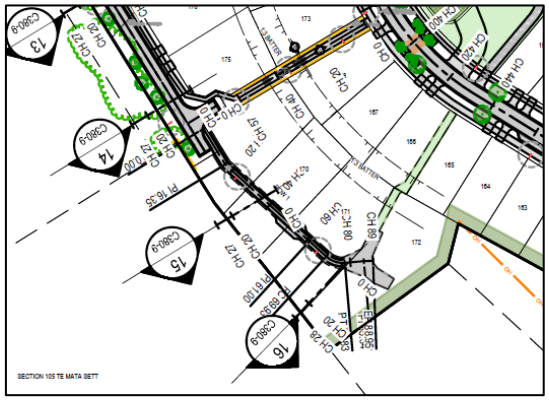
HAWKE'S BAY GEOTECH	Scenario:	Extreme Groundwater Conditions (storm event & failure of nearby detention pond)
	Section:	Proposed Ground - Batter Slopes 10-14
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown



HAWKE'S BAY GEOTECH	Scenario:	Seismic Conditions – ULS (0.58g x ks=0.65 = Design PGA 0.38g)
	Section:	Proposed Ground - Batter Slopes 10-14
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown

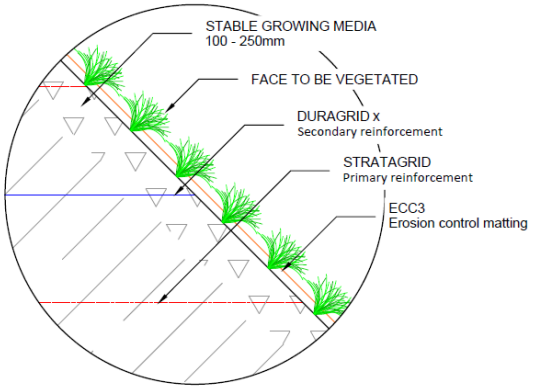


HAWKE'S BAY GEOTECH	Scenario:	Seismic Conditions – ULS (0.58g x ks=0.65 = Design PGA 0.38g)
	Section:	Proposed Ground - Batter Slope 17 Check – 25 degree slopes up to 4m high.
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	Scale:	As shown



Section = Batter Slopes 15

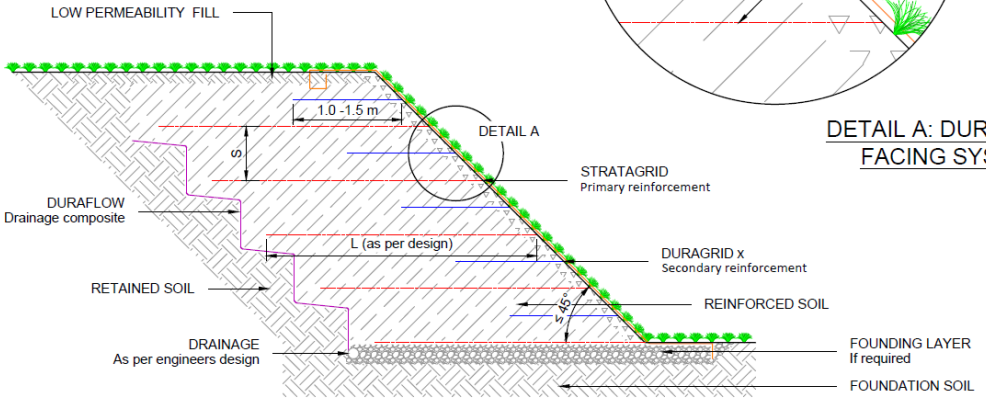
Batter Slopes 15 is ~6m high and has a proposed angle of ~24°. The proposed design involves placing fill in front of the existing slope to stabilize it. We recommend that this fill slope is engineered as a geogrid reinforced Mass Stabilized Earth (MSE) slope to ensure its stability / performance in the long term. A typical detail is provided below for the Cirtex DuraSlope MSE Slope System. The slope will require specific engineering design.



DETAIL A: DURASLOPE FACING SYSTEM

GENERAL NOTES :

1. Geometries and geotechnical design parameters shall be approved and verified on site prior to any construction.
2. All works shall be carried out in accordance with the specifications, method statements and recommendations of Cirtex Industries Ltd and the project engineer.
3. All levels and dimensions shall be verified on site prior to the commencement of any works. Any discrepancies shall immediately be brought to the attention of the engineers.
4. Refer sequence of work document for detailed installation methodology.
5. All dimensions are in meters unless noted otherwise.
6. Concept drawing only - NOT FOR CONSTRUCTION.



TYPICAL CROSS SECTION

CIRTEX GAIN MORE GROUND

DESIGN LEVEL: TECHNICAL SUPPORT
SCALE: NTS
REVISED BY: SHS, 06/08/2021
DWG NO: B 077 003

HAWKE'S BAY GEOTECH

Title / Section:	Slope Recommendations & Conceptual Details - Batter Slope 15
Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
Analysis By / Date:	CJG, 03 June 2026

Based on the investigation data available (attached), site inspections of cut slopes / faces and the analyses undertaken, we consider there is an adequate factor of safety for all of the proposed slope configurations assessed provided that the recommendations included below are adhered to.

1. Where ground conditions differ from those assumed in this assessment, then we should be advised as further investigation and stability additional analyses may be required.
2. Where the retaining wall varies from the proposed timber pole walls, or where slope configurations differ from those assessed, then we should be advised as further investigation and additional analyses may be required
3. Retaining Walls shall be specifically designed based on the ground conditions encountered on site following any earthworks.
4. Retaining Wall 1 should have pole spacings of 1.2m or less (centre to centre), be embedded a minimum of 1.5m below ground (to avoid any global instability) and have a minimum shear strength of 50kN (to prevent shear failure through the wall). Where slopes are less than 1.5m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depths and shear strength requirements may be reassessed.
5. Retaining Wall 3 should have pole spacings of 1.2m or less (centre to centre), be embedded a minimum of 2.0m below ground (to avoid any global instability) and have a minimum shear strength of 90kN (to prevent shear failure through the wall). Where slopes are less than 3m high (above the wall) and the wall less than 1.5m high, then the minimum embedment depth and shear strength requirements may be reassessed.
6. Batter Slope 15 is recommended to comprise of a MSE Slope (geogrid reinforced earth slope) which will require specific design. The slope will require benching and some over excavation to accommodate the design. The design is best undertaken once the area has been cleared and ground conditions well investigated. Additional global stability checks will likely also be required at the design stage.
7. For temporary cut slopes in excess of 30° (i.e. for retaining wall construction), the safe temporary excavation slope angle shall be confirmed by the geotechnical engineer based on the site conditions and work proposed.
8. All slopes 20° or less will require topsoiling and hydroseeding. Prior to topsoil placement the face of any slopes shall be track rolled by an excavator (up and down the slope) to assist in topsoil stabilization. Topsoil should be lightly compacted / tracked rolled in. Slopes greater than 20° may require erosion protection matting at the discretion of the engineer.
9. For any slopes outside of those assessed, we recommend the following preliminary maximum slope angles and heights:
    a) For western cut slopes – A maximum cut slope angle of 25° up to a maximum height of 4m (provide there is no seepage). For slopes with any seepage, slope heights exceeding 4m or angles exceeding 25°, stability analyses will be required (if not already assessed).
    b) All other cut slopes shall be 1V:2.5H or less, unless confirmed as suitable by the geotechnical engineer in writing.

HAWKE'S BAY GEOTECH	Title	Slope Stability Summary & Recommendations
	Drawing Reference:	Maven Associates Project No. 135041 - Drawing No. C380, Sheet 10, Rev. A, June 2026
	Project ID:	25030A-2, 174 & 176 Brookvale Road, Havelock North
	By / Date:	CJG, 19 June 2026

Slope Stability Analyses Attachments