WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS

GEOTECHNICAL DUE DILIGENCE ASSESSMENT
238 STOCK ROAD AND 49A DUNDEE DRIVE
HASTINGS

Prepared for:

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Project Number: 1448-01-21

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SUMMARY OF FINDINGS AND CONCLUSIONS

Project Type	Residential housing development
Nature of Investigation	Due diligence / Conceptual planning
Investigations undertaken	Desktop study, 17 cone penetrometer tests (CPTs) up to ~10m depth; 13 test pits to ~1.5m
Subsurface soils	Topsoil with an inferred thickness of about 0.2m underlain by either dense sandy gravels or loose to dense sand/silty sand. Some areas underlain by shallow, ~2-3m thick, soft clay / organic soil layer.
Groundwater	Groundwater was measured at a depth of 2.3m below existing ground level in eastern part of site. Depth of groundwater across the site estimated to be in the order of 2m based on levels observed in streams running through the site.
Potential Geotechnical Hazards / Constraints	Much of the site away from the two stream channels is considered to have a relatively low liquefaction hazard. The liquefaction hazard is notably higher within the Dundee Drive parcel, but still meets the criteria for MBIE Canterbury 'TC2-equivalent' ground. There is a potential lateral spreading hazard present along the margins of Iron Gate stream and Wellwood Drain and a minimum building setback will be required along the stream and drain. This hazard will need specific engineering mitigation during project design.
Foundation options	For 1-2 storey NZS-3604 timber-frame construction - standard (i.e., NZS 3604-type) foundations in areas of the site not subject to liquefaction or lateral spreading. 'TC-2 type' stiffened shallow foundations in areas of the site subject to liquefaction. In some areas, these may need to be supported on a geogrid-reinforced gravel raft.
Further work required	Geotechnical investigation and assessment for resource/subdivision consent and building consent. This should include additional deep (i.e., CPTs/machined-drilled boreholes) and shallow site investigations (i.e., test pits and dynamic cone penetrometer tests) to further assess the potential for lateral spreading and design mitigation measures, confirm site 'foundation zones', and confirm foundation and pavement design parameters. This work should be completed after the site layout and structure types have been identified.

1.0
INTRODUCTION

This report presents the findings, conclusions and recommendations from Wentz-Pacific Ltd's (WP's) due diligence geotechnical investigation for a proposed residential subdivision (the project) located at 238 Stock Road and 49a Dundee Drive Road in the Flaxmere suburb of Hastings (refer to Plate A-1, Appendix A).

The work described herein was commissioned by Heretaunga Tamatea Settlement Trust (HTST) and was completed in accordance with WP's proposal and Short Form Agreement to HTST dated 19 July 2021.

1.1 PROJECT DESCRIPTION

WP understands that the site will be developed as a residential subdivision. For this assessment, it is assumed that the houses will be one-storey to two-storey structures comprised of NZZ 3604-type timber frame construction and lightweight roofing.

It is also assumed that the existing site level will be largely maintained and that only minimal earthworks will be required to achieve design site levels.

WP's understanding of the project is based on our discussions with Peter Chrisp of Egmont Dixon Ltd.

1.2 PURPOSE

The purpose of WP's geotechnical site investigation was to:

- characterise (from a geotechnical standpoint) the ground conditions across the site;
- identify potential geotechnical constraints that may be present;
- identify the potential need for mitigation of identified geotechnical constraints, the types of foundations are anticipated to be suitable for the proposed development, and whether there are any specific geotechnical issues which may affect earthworks or pavement design.

2.0
INVESTIGATIONS

2.1 DESKTOP STUDY

A review of select and available information pertaining to the site and/or surrounding vicinity was conducted. Specifically, this information included:

- select published and unpublished geotechnical investigation reports from projects within the site vicinity;
- aerial photographs contained on the Hawke's Bay Regional Council (HBRC) and Retrolens websites;
- natural hazard information contained on the HRBC and Hastings District Council (HDC) websites;
- regional geological information published by the Institute of Geological & Nuclear Sciences Limited (GNS).

2.2 FIELD INVESTIGATIONS

<u>Deep Investigations</u>
Seventeen cone penetrometer tests (CPTs) were performed across the site on 02 August 2021 at the approximate locations shown on Plate A-2 in Appendix A. The CPTs were advanced to depths ranging from about 1.0 to 10.0 m below existing ground level (bgl) based on a target depth of 10 m bgl. Eight of the CPTs did not reach the 10 m target depth due to cone refusal on dense gravelly soils. The results of the CPT investigation are presented in Appendix B.

<u>Shallow Investigations</u>
Thirteen machine-excavated test pits were excavated across the site on 06 August 2021 by WP to characterise the near-surface soils at the site. The maximum depth of excavation was 1.7 m. The approximate locations of the test pits are shown in Plate A-2 of Appendix A. The test pit logs are contained in Appendix C.

3.0
SITE AND GROUND CONDITIONS

3.1 SITE CONDITIONS

The site is located between Dundee Drive and State Highway 2 in the suburb of Flaxmere (Hastings). It is comprised of two adjoining parcels having a total area of approximately 28 ha. The 22.5 ha parcel ('Stock Road parcel') is accessed from 238 Stock Road and has a legal description PT LOT 5 DP 2976 SECS 18 20 22 SO 438108. The 5.67 ha parcel ('Dundee Drive parcel') is accessed from 49a Dundee Drive and has a legal description SEC 1 9 SO 454705 - GRAZING LICENSE.

The site is essentially level, and the two parcels are separated by Wellwood drain. The drain forms the western and eastern boundaries of the Dundee Drive and Stock Road parcels, respectively, and merges with the Iron Gate stream which runs along the western and southern sides of the 238 Stock Road parcel. The depth of drain channel was visually estimated be about 1.5 to 2 m. The depth of the Iron Gate stream channel is estimated to be in the order of 2 to 3 m.

At the time of WP's field investigations, the 238 Stock Road parcel was covered with actively cultivated orchard and vineyard. A house and implement shed were located in the western portion of the property. The Dundee Drive parcel had been recently cultivated and WP understands that it was soon to be planted in crops.

Two water wells are shown to be located on the Stock Road parcel according to HBRC information (well #s 3317 and 10799 – refer to Appendix A, Plate A-3). No pump houses, standpipes or other evidence of the wells was observed by WP during our field investigations, and the status of the two wells was unknown at the time of this report.

Transit NZ plans for the Napier – Hastings Motorway (State Highway 2) show that a borrow site was located in the eastern portion of the Stock Road parcel. The borrow area is shown to have a plan area of 120 x 235 m. A clear discoloration of the vegetation in the approximate location of the borrow site can be seen in Plate A-2. The NZ Transit plans for the borrow area are contained in Appendix D.

The site is bordered on the north by residential housing, on the east and south by State Highway 2 and agricultural land, and on the west by agricultural land.

3.2 GROUND CONDITIONS

3.2.1 Geology

Published geological information show the majority of the site to be underlain by Holocene-age alluvial river gravel (htg) from the Ngaruroro River, with the southern portion underlain by Holocene age alluvial deposits (htz) comprised of gravel, sand, silt and mud (Lee, et al, 2020).

3.2.2 Generalised Subsurface Profile

Based on the findings from the site investigations, the near-surface soils across the subject site can be divided into two relatively distinct units as described below:

<u>238 Stock Road parcel</u>
The soil profile generally consists of about 150 to 200 mm of silty topsoil overlying a layer of medium dense to dense sandy gravel to gravelly sand, some of which is interbedded with loose to medium dense sand and silty sand. The thickness of the gravelly soils throughout the central portion of the site is unknown as the CPTs were refused at depths of between about 1 and 2.5 m bgl throughout much of the site.

Along the eastern and western edges of the site near Iron Gate Stream and Wellwood Drain, the gravelly soil layer was notably thinner (i.e., ~2m or less) or absent, and underlain by a relatively continuous layer of medium dense sand ranging from about 3 to 5m in thickness. The sand layer was underlain by interbedded silt, clay and sand to the maximum depth of investigation (10 m).

An approximately 2m thick layer of soft to firm clay was found at a depth of about 2 m in CPT05-CPT07 along the Iron Gate Stream near the western site boundary.

A layer of soft organic clay / peat was found at a depth of about 2 m in CPT12 and CPT13 near the Wellwood Drain. This layer was in the order of 1-1.5 m thick.

<u>49a Dundee Drive parcel</u>
The gravel layer found across the 238 Block Road parcel appears to be largely absent on the Dundee Drive parcel. The soil profile generally consists of about 200 to 250 mm of silty topsoil overlying interbedded loose sand and non-plastic/low plasticity silt and clay to a depth of about 3 to 5 m. These soils are inferred to underlain by a continuous layer of generally medium dense sand and silty sand to a depth of about 9 m where interbedded sand and firm to stiff clay was found to the maximum depth of investigation (10 m).

An approximately 2 to 3 m thick layer of soft to firm clay was found at depths of about 1 to 3 m in CPT15-CPT17 in the central and northern portion of the site.

3.2.3 Groundwater

Groundwater or wet soils were not observed in any of the test pits. Groundwater could only be only measured in CPT test holes 15 and 17 due to a breakdown of the electronic measuring device. The measured depth to groundwater was 2.3 m bgl. This roughly corresponds to the depth of the water surface observed in both the Iron Gate Stream and Wellwood Drain where they run through the site.

Groundwater levels at the site may fluctuate over time due to variations in rainfall, irrigation practices (both on- and off-site), runoff conditions, and other factors. The groundwater levels reported herein may not be the same as those found during, or after, construction.

4.0
GEOLOGIC AND SEISMIC HAZARDS

4.1 AERIAL PHOTOGRAPH INTERPRETATION

A review of historical aerial photographs of the site dating back to the1940s (HDC Intramaps, 2021) did not indicate any evidence of stream channels, gullies, large open pits, or other potential sources of ground instability.

4.2 SLOPE INSTABILITY, EROSION, SUBSIDENCE

The site is essentially level and not bordered by steeply sloping or ground that otherwise appears to be potentially unstable or prone to slippage. At the time of our site investigation, no evidence of major erosion, slumping or ground subsidence was observed along the banks of either Iron Gate Stream or Wellwood Drain where they run through the site.

The site is not located within in area of 'suspected filling' (HDC Intramaps, 2021).

4.3 SURFACE FAULT RUPTURE

The Active Faults Database (2021) and HBRC hazard portal (2021) do not show any active faults (generally defined as faults which have deformed the ground surface within the past 125,000 years) running through, or close to the site, and WP did not observe geomorphic features indicative of active faulting at the site. A relatively well-defined segment of the active (Class IV recurrence interval) Awanui fault zone is shown on the HBRC hazard portal to be located approximately 1.7 km west-northwest of the site and running in southwest-northeast direction. Based on this information, we consider the probability of ground surface rupture along a fault trace at the site to be low.

4.4 EARTHQUAKE GROUND SHAKING

For geotechnical assessment, the peak ground acceleration (PGA) values for the *Serviceability Limit State* (SLS) and *Ultimate Limit State* (ULS) design scenarios were derived using the location-specific seismic hazard information contained in the GNS Science liquefaction hazard update for Hawke's Bay (Rosser, Dellows, 2017).

The ground motion parameters used for geotechnical assessment of the site are shown in Table 4-1.

Table 4-1 – Ground Motions for Liquefaction Assessment[1]

Return Period	Magnitude (M_w)	PGA (g)[2]
25 years (SLS)	6.2	0.14
100 years	6.3	0.25
500 years (ULS)	6.5	0.42

[1] Assumes an Importance Level 2 structure. [2] Assumes site subsoil class D (NZS 1170.5:2004).

Based on the relatively high seismicity of the Hawke's Bay region and the design levels of shaking derived for the site, the probability of at least moderately strong earthquake ground shaking to occur at the site within the assumed 50-year design life of the building is considered to be relatively high.

4.5 LIQUEFACTION HAZARD

4.5.1 Liquefaction Assessment

The eastern and western portions of the site are mapped as having a 'medium' liquefaction vulnerability, and the central part of the site is mapped as having a 'low' liquefaction vulnerability (Hawke's Bay Hazard Portal, 2021). The area mapped as having a 'low' vulnerability coincides quite well with the area of the site where our CPT soundings refused on shallow, dense non-liquefiable gravels.

The liquefaction potential of the soils found in the nine CPTs that did not refuse on shallow gravels was analysed using the CPT-based simplified triggering procedure developed by Boulanger and Idriss (2014). No laboratory testing of subsurface soils was performed as part of WP's investigation, hence a fines content fitting parameter (C_{FC}) of 0.0 was adopted for the analysis. A groundwater depth of 2.0 m bgl was used for analysis.

The results of WP's analyses are contained in Appendix E.

The analyses indicate that little to no liquefaction is expected to occur as a result of SLS-level of ground shaking. Liquefaction is predicted to occur at the site under both the 100- and 500-year levels of ground shaking. The estimated thickness of non-liquefiable crust ranges from about 3.5 to 5 m.

4.5.2 Potential Consequences of Liquefaction

The post-earthquake settlement of the liquefiable layers identified was computed using the CPT-based methodology of Zhang et al (2002). Table 4-2 summarises the liquefaction-induced free-field ground surface settlements computed for each design earthquake scenario.

Table 4-2 – Computed Free-Field Liquefaction-Induced Settlements in upper 10 m of Soil Profile

Design Event	Design Ground Motions	Ground Surface Settlement (mm)	LSN
25 year (SLS)	0.14g / M6.2	5-15 (5)	0-2 (1)
100 year	0.25 / M6.3	10-55 (25)	2-9 (5)
500 year (ULS)	0.42 / M6.5	30-80 (50)	7-13 (9)

Average values shown in brackets.

The potential for ground surface damage as a result of the computed liquefaction settlements was evaluated using a depth-weighted analysis that provides an index parameter termed the *Liquefaction Severity Number* (LSN). The LSN was developed in Christchurch and validated using site investigation data and structure / land damage observations across the Christchurch region following the 2010-2011 Canterbury earthquakes (van Ballegooy et al., 2014). Table 4-2 summarises the LSN computed for each design earthquake scenario.

The higher the LSN number, the greater the predicted potential for ground surface damage. General descriptors of the typical ground surface damage that might occur for a given range of LSN are shown in Table 4-3.

Table 4-3 – General Performance Levels for Liquefied Deposits[1]

Performance Level / Effects	Characteristics of Liquefaction and its Consequences	Characteristic LSN
L0 / Insignificant	No significant excess pore pressures (no liquefaction)	<10
L1 / Mild	Limited excess pore water pressures; negligible deformation of the ground and small settlements	5 - 15
L2 / Moderate	Liquefaction occurs in layers of limited thickness (small proportion of the deposit, say 10% or less) and lateral extent; ground deformation results in relatively small differential settlements.	10 - 25
L3 / High	Liquefaction occurs in significant portion of the deposit (say 30 to 50%) resulting in transient lateral displacements, moderate differential movements, and settlements of the ground in the order of 100mm to 200mm.	15 - 35
L4 / Severe	Complete liquefaction develops in most of the deposit resulting in large lateral displacements of the ground, excessive differential settlements and total settlement of over 200mm.	>30
L5 / Very Severe	Liquefaction resulting in lateral spreading (flow), large permanent lateral ground displacements and/or significant ground distortion (lateral strain/stretch, vertical offsets and angular distortion).	

[1] From New Zealand Geotechnical Society (2016)

238 Stock Road parcel

Most of the 238 Stock Road parcel away from the stream channels appears to have a low probability of liquefaction-induced ground surface damage (e.g., ground cracking, differential settlement) as a result of either SLS or ULS ground shaking because the underlying dense, gravelly soils are not susceptible to widespread liquefaction. However, there is a potential for damaging liquefaction-induced lateral spreading to occur along the margins of Iron Gate Stream and the Wellwood Drain as discussed in Section 4.6.

49a Dundee Drive parcel

The dense gravel layer found on the Stock Road parcel does not appear to be present across much of the 49a Dundee Drive parcel, and as a result, this part of the site is predicted to be potentially subject to ground surface damage as a result of liquefaction. Due to the thickness of the liquefiable crust, the effects at SLS through ULS levels of ground shaking are anticipated to be generally mild, with perhaps limited areas of moderate ground surface damage.

The results of WP's analysis do indicate that there is potential for damaging lateral spread to occur along the margins of the Wellwood Drain channel (refer to Section 4.6).

4.6 LATERAL SPREADING HAZARD

Lateral spreading occurs during or shortly after an earthquake when liquefied soil moves laterally toward a free face (e.g., stream bank or slope of an open channel), or when a non-liquefied “crust” moves laterally toward a free face on an underlying layer of liquefied soil. The greatest displacements typically occur near to the free face, and gradually reduce with increasing distance from the free face.

The magnitude of lateral spread that could potentially occur was calculated using the CPT-based methodology of Zhang et al (2004). Based on the results of WP’s analysis, it is estimated that potentially damaging lateral spreading could occur along the margins of both the Iron Gate Stream and the Wellwood Drain at both the 100-year and ULS design levels of shaking. The calculated magnitudes of lateral spread at both levels of shaking are summarised in Tables 4-4 and 4-5.

Table 4-4 – Calculated Magnitude of Lateral Spread along Iron Bank Stream

CPT	Distance from top of stream bank (m)	Calculated Lateral Spread (mm)	
		100-year shaking	ULS
04	15	150	270
05	15	570	670
06	15	120	420
07	15	300	490
04	30	80	140
05	30	290	330
06	30	60	210
07	30	150	250

Table 4-5 – Calculated Magnitude of Lateral Spread along Wellwood Drain

CPT	Distance from top of stream bank (m)	Calculated Lateral Spread (mm)	
		100-year shaking	ULS
12	10	160	290
13	10	160	510
12	30	80	150
13	30	80	250

The implications of the potential for liquefaction-induced lateral spreading at the site are discussed in Section 5.2. The lateral spreading assessment herein was done for due diligence and conceptual planning purposes. A more detailed assessment of the lateral spreading hazard, and its potential impact on the proposed development will need to be done as part of the subdivision resource consent.

4.7 COMPRESSIBLE OR LOW STRENGTH SOILS

The results of the field investigations did not indicate evidence that the site is likely to be underlain by widespread or thick layers of peat or other highly compressible soils.

The near-surface clayey and silty soils along the two stream channels, as well as in the central and northern portions of the 49a Dundee parcel were generally soft to firm and are anticipated to have an ultimate bearing capacity of less than 300 kPa, and possibly less than 200 kPa.

4.8 OLD TRANSIT NZ BORROW SITE

Due to site access restrictions associated with the vineyard and orchard, it was not possible to thoroughly investigate the reported borrow site. Test pit TP07 located within the inferred extents of the borrow site exposed relatively clean and generally loose sandy gravel and silty sand. The borrow site will need to be more fully investigated as part of the subdivision design.

4.9 EXPANSIVE SOILS

Expansive soils are defined as soils that undergo large volume changes (shrink or swell) due to variations in soil moisture content. Such volume changes may cause damaging settlement and/or heave of foundations, slabs-on-grade, pavements, etc. The near-surface soils found in the site investigations were generally non-plastic or low plasticity and are not considered susceptible to significant moisture-driven volume change.

4.10 FLOODING

The land along both sides of Iron Gate stream and Wellwood drain are located within a Hawkes Bay Regional Council identified 1:50 year “flood risk area” (HBRC, 2021). WP recommends that the HDC and/or HBRC be contacted to confirm if there are required mitigation measures or recommended building floor levels to address the potential for flooding at this site.

4.11 TSUNAMI

The site is not located within a tsunami inundation zone according to information contained in the HBRC hazards portal (HRBC, 2021).

5.0
CONCLUSIONS

Based on the results of our site investigations and geotechnical assessment, WP provides the following conclusions regarding the proposed site development.

5.1 GEOLOGIC/GEOTECHNICAL HAZARDS

Away from the Iron Gate Stream and Wellwood Drain, the 238 Stock Road parcel appears to have only a minor liquefaction hazard under the ULS design level of ground shaking (i.e., 500-year return period level of shaking). The potential liquefaction hazard is higher within the Dundee Drive parcel, but it is anticipated to be mitigated through the use of stiffened foundations.

There is a potential for damaging liquefaction-induced lateral spread to occur along the margins of both the Iron Gate stream and Wellwood drain.

Borrow site

The land adjacent to either side of the stream and drain is identified by the HBRC as having a potential flood risk.

5.2 FOUNDATION SUPPORT

The following discussion is for due diligence and conceptual planning purposes only – further field investigations and analysis will be for subdivision consent.

Based on WP's assessment, we have provisionally 'zoned' the site into areas where standard NZS 3604 type foundations are anticipated be suitable to support houses, and areas where stiffened foundations capable of resisting liquefaction-induced differential ground settlement and lateral spreading will be necessary for the proposed development. Refer to Plate A-4 for an aerial photograph of the site showing the zones.

It is emphasized that the extents of the zones, and the criteria used to develop them, will need to be confirmed based on further site-specific investigations prior to submitting for subdivision consent. This additional work should be done once a preliminary site plan is developed.

The 238 Stock Road parcel away from the stream and drain appears to have a low liquefaction hazard, and it is anticipated that NZS 3604-type foundations will be suitable for construction in this area. This area is shown as the green coloured 'Zone 1' on Plate A4.

Based on the liquefaction hazard identified across the majority of the 49a Dundee Drive parcel, it is recommended that houses in this portion of the site (blue 'Zone 2' on Plate A4) be supported on a stiff shallow foundation system (i.e., stiff reinforced raft slabs, waffle slabs) designed to resist liquefaction-induced differential settlement. The calculated ground surface settlements (away from the Wellwood drain channel) meet the criteria for "TC2-type" ground as described in the guidance document *Repairing and rebuilding houses affected by the*

Canterbury earthquakes – Version 3, dated December 2012, by the Ministry of Business, Innovation & Employment (MBIE).

For conceptual planning purposes, WP recommends that 'Zone 2' foundations meet the stiffness requirements of a TC2 – Option 2, 3 or 4 enhanced foundation slab (i.e., accommodate a 4 m, two-way interior free span, and a 2 m cantilever at foundation edges, within acceptable deformation limits). The foundations may need to be supported on gravel rafts in areas of soft, shallow soils. The maximum anticipated thickness of the rafts is 600mm, however this will need to be confirmed during design.

Due to the potential for damaging lateral spreading to occur along the margins of both Iron Gate stream and the Wellwood Drain, a minimum setback zone of 20 m (yellow 'Building Setback Zone' on Plate 4) is recommended for conceptual planning purposes. Houses located between 20 m and 40 m from the tops of the stream and channel banks should be assumed to require at least a 'TC2 equivalent' foundation system as described above.

5.3 BULK EARTHWORKS

Based on the results of WP's site investigations, the sandy and gravelly soils present below the topsoil layer are anticipated to be suitable for use as engineered fill.

Based on the investigations completed for this report, the average depth of topsoil is estimated to in the order of 200 mm, however there may be areas where it is deeper – most likely in the lower-lying areas of the site near the stream / drain channels and State Highway 2.

There are two water wells shown to be located on the site (refer to Plate A-3). The wells will need to be abandoned by appropriate backfilling and capping.

5.4 PAVEMENT DESIGN

Based on the results of WP's site investigation, the site soils (not topsoil) are anticipated to have a California Bearing Ratio (CBR) value of 3% within the 'Zone 1' area, and 2% in the 'Zone 2' area.

5.5 FURTHER WORK

Should the project proceed, further geotechnical work will be required to support subdivision and building consent. This work will include additional deep and shallow site investigations (e.g., CPTs, test pits, dynamic cone penetrometer tests and potentially machine-drilled boreholes), and further engineering assessment to develop geotechnical criteria for foundation design and earthworks. Additional assessment of the potential for seismically induced lateral spread along Iron Gate stream and Wellwood Drain will also be required. This work should be done after the site layout and proposed structure types are defined.

6.0

APPLICABILITY AND LIMITATIONS

This report was prepared solely for the exclusive use of Mt Brown Holdings Limited (the Client) and their consultants with respect to the particular brief given to WP. No other entity or person shall use or rely upon this report, or any of WP's work products without prior review and written agreement by us.

This report is solely intended to inform a due diligence assessment for land purchase, and it is not to be used for design.

WP's services consist of professional opinions and conclusions developed in accordance with generally accepted geotechnical engineering principles and practices. There is no other warranty, either expressed or implied.

The opinions and recommendations in this report are based on subsurface information collected from discrete investigation / test locations, and the subsurface conditions away from these locations are inferred. It must be appreciated that the actual soil conditions could vary from those described in this report.

7.0

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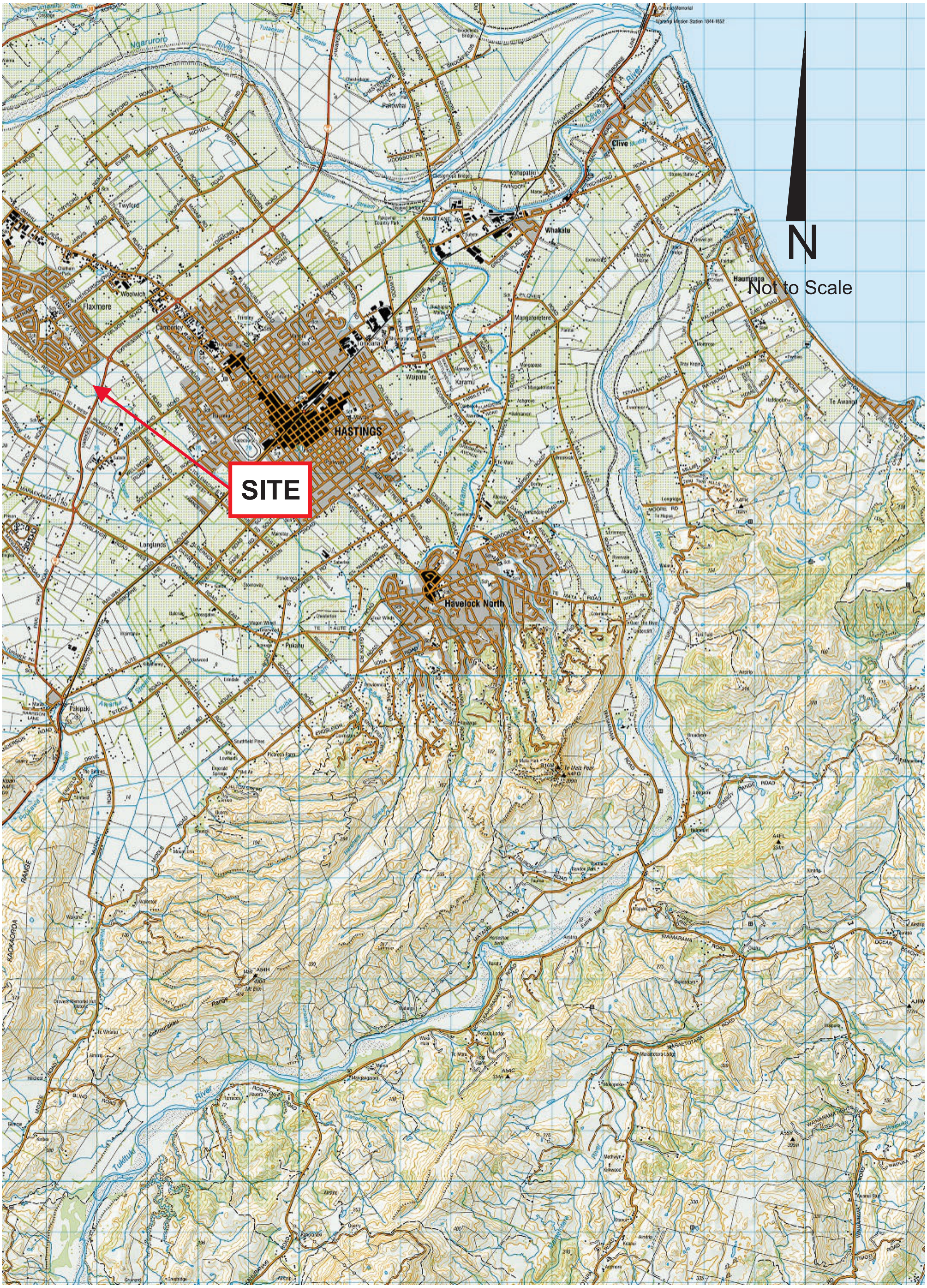
APPENDIX A

PLATES



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Project No.: 1448-01-21
Reviewed: DD
Drawn: RW
Date: August 2021

SITE VICINITY MAP

238 Stock Rd / 49a Dundee Dr
Hastings

PLATE

A-1

Source: HDC Rural Imagery 2019/2020

Scale: ~ 1:4000 at A4

▲ APPROXIMATE LOCATION OF CPT

▨ APPROXIMATE LOCATION OF TEST PIT

— SITE BOUNDARY

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS

Project No.: 1448-01-21
Reviewed: DD
Drawn: RW
Date: August 2021

SITE INVESTIGATION PLAN

238 Stock Rd / 49a Dundee Dr
Hastings

PLATE
A-2

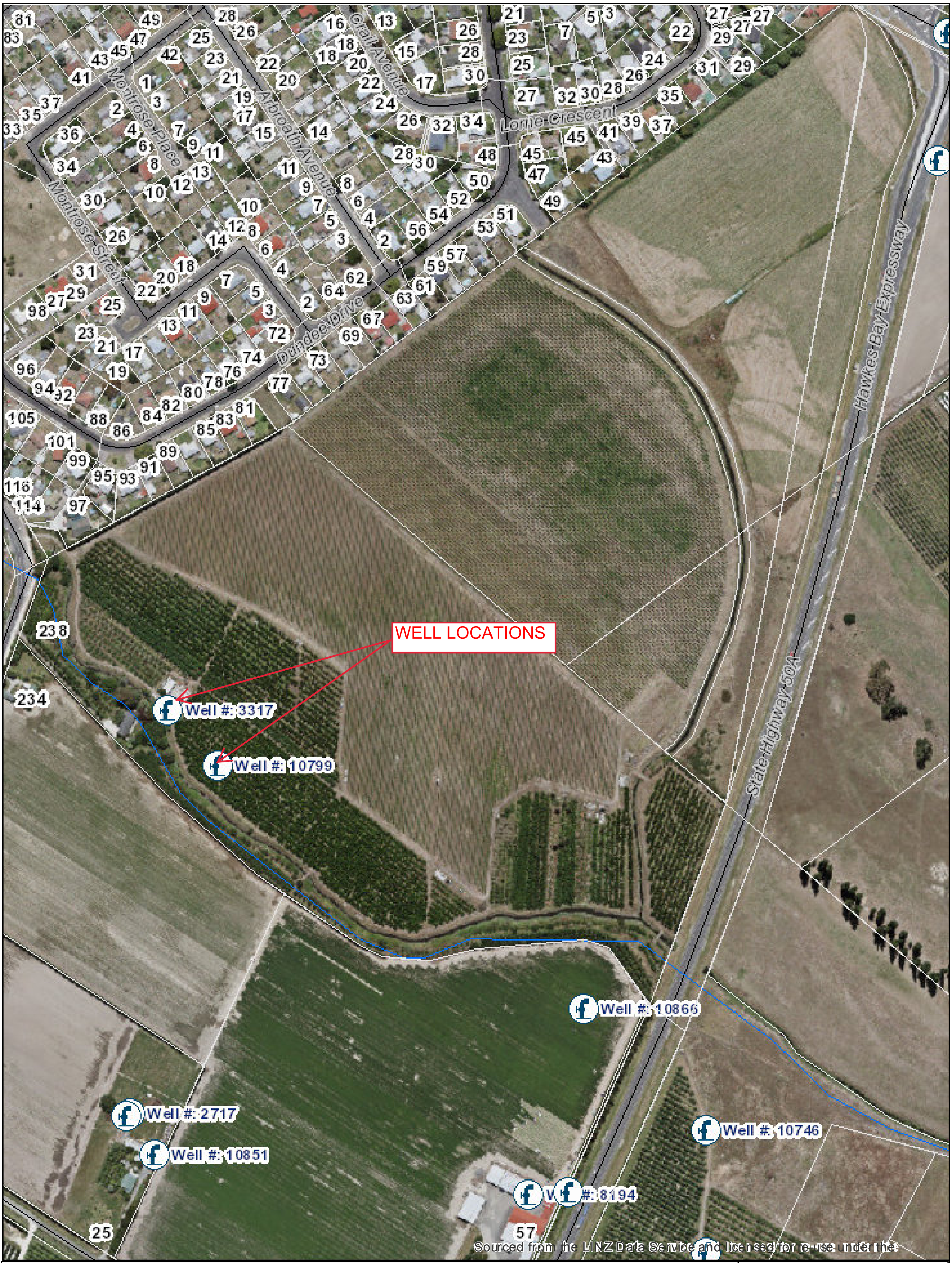


PLATE A-3

The information displayed is schematic only and serves as a guide.
It has been compiled from Hawke's Bay Regional Council records and is made available in good faith but its accuracy or completeness is not guaranteed.
Cadastral information has been derived from Land Information New Zealands (LINZ) Core Record System Database (CRS).

Scale:1:4,000
Saturday, September 11, 2021

Original Sheet Size 210x297mm

Source: HDC Rural Imagery 2019/2020

Scale: ~ 1:4000 at A4

🟨 20m WIDE BUILDING SETBACK ZONE FROM TOP OF STREAM BANK

🟩 ZONE 1 - TC1-TYPE / NZS 3604 FOUNDATIONS

🟦 ZONE 2 - TC2-TYPE FOUNDATIONS

NOTE: ZONING IS FOR CONCEPTUAL PLANNING PURPOSES ONLY AND IS NOT TO BE USED FOR CONSENT

━ SITE BOUNDARY

WENTZ - PACIFIC GEOTECHNICAL ENGINEERS	Project No.: 1442-01-21 Reviewed: DD Drawn: RW Date: August 2021	**SITE INVESTIGATION PLAN** **238 Stock Rd / 49a Dundee Dr Hastings**	PLATE A-4

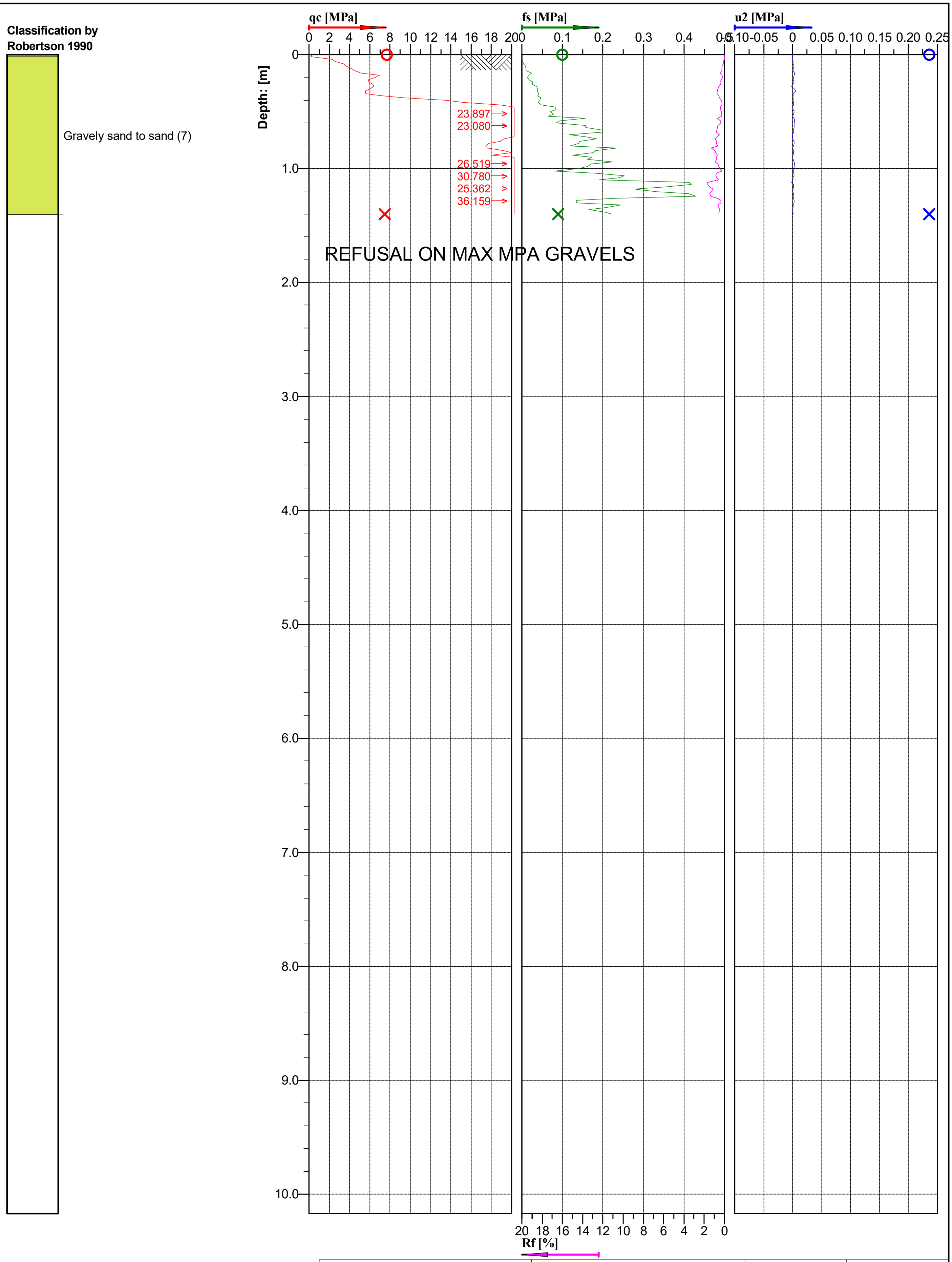
APPENDIX B

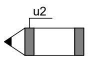
CONE PENETRATION TEST LOGS

CONE PENETRATION TESTS

Seventeen cone penetration tests (CPTs) were advanced at the site by Geotech Drilling under the commission of Wentz Pacific Ltd on 02 August 2021. The soundings were conducted with a 20-tonne truck-mounted and a 10-tonne track-mounted cone rig. All CPTs were performed utilizing an integrated electronic piezocone system (cone tip area of 10 cm^2). The tests were performed in general accordance with ASTM standard D 5778-12 - *Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils*.

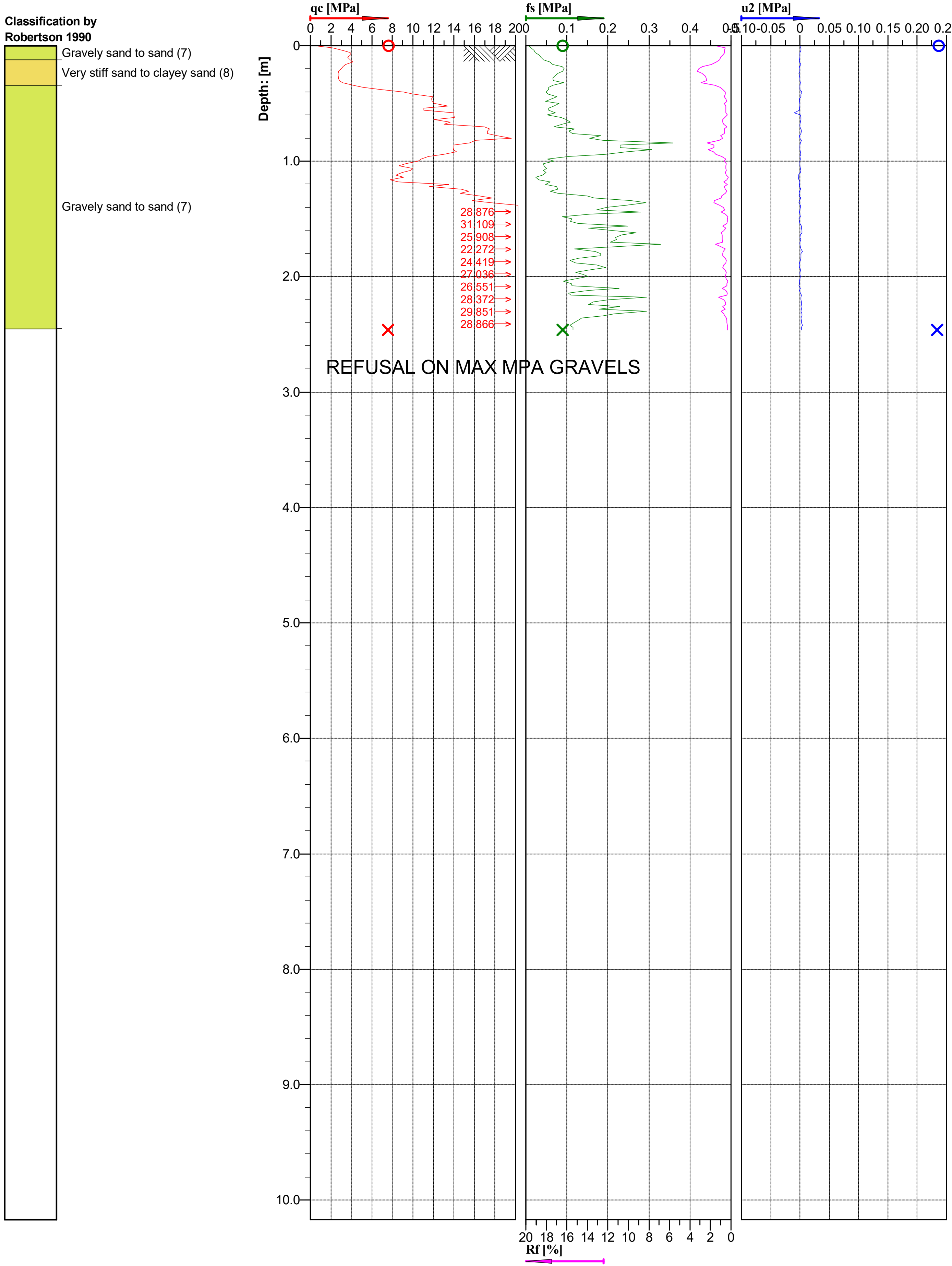
The approximate locations of the CPT soundings are shown on Plate A-2, and the CPT logs produced by Geotech Drilling are contained herein.





Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

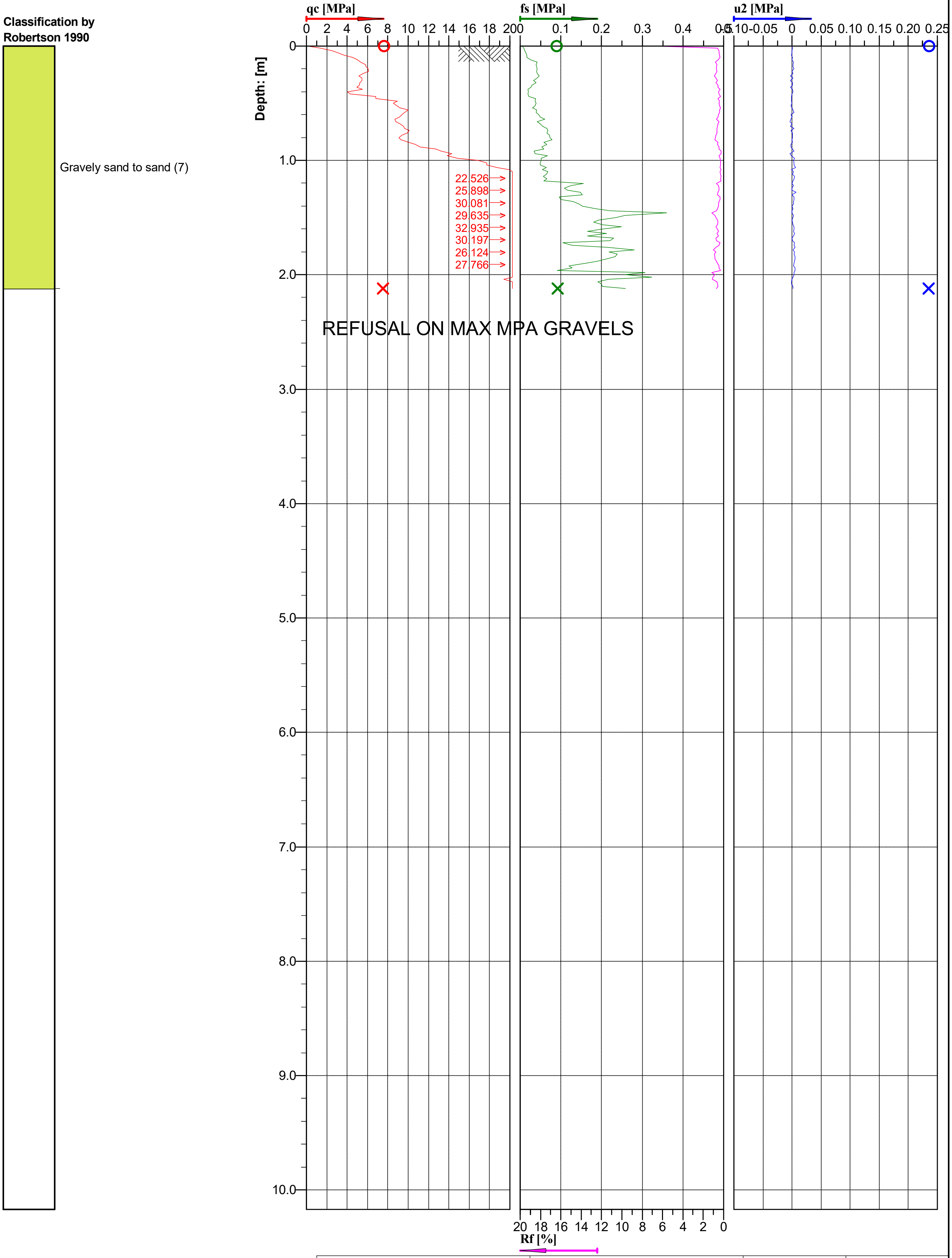
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT01
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT01.cpt	



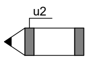
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT02
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT02.cpt	

u2

Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

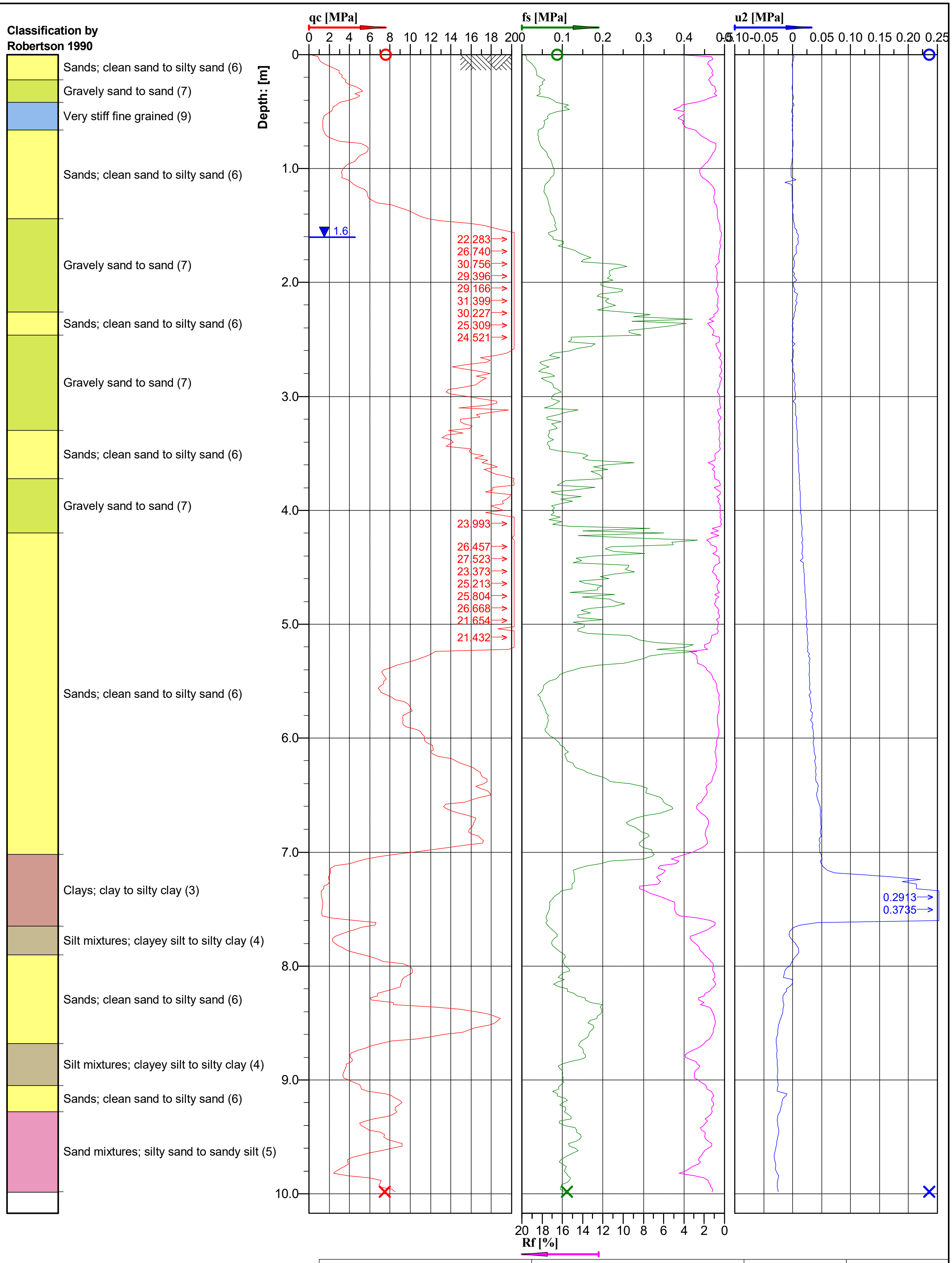


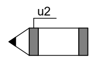
REFUSAL ON MAX MPA GRAVELS



Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT03
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT03.cpt	





Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: FLAXMERE

Position: X: 0.00 m, Y: 0.00 m

Ground level: 0.00

Test No.: CPT04

Project ID:

Client: WENTZ PACIFIC LTD

Date: 2/08/2021

Scale: 1 : 45

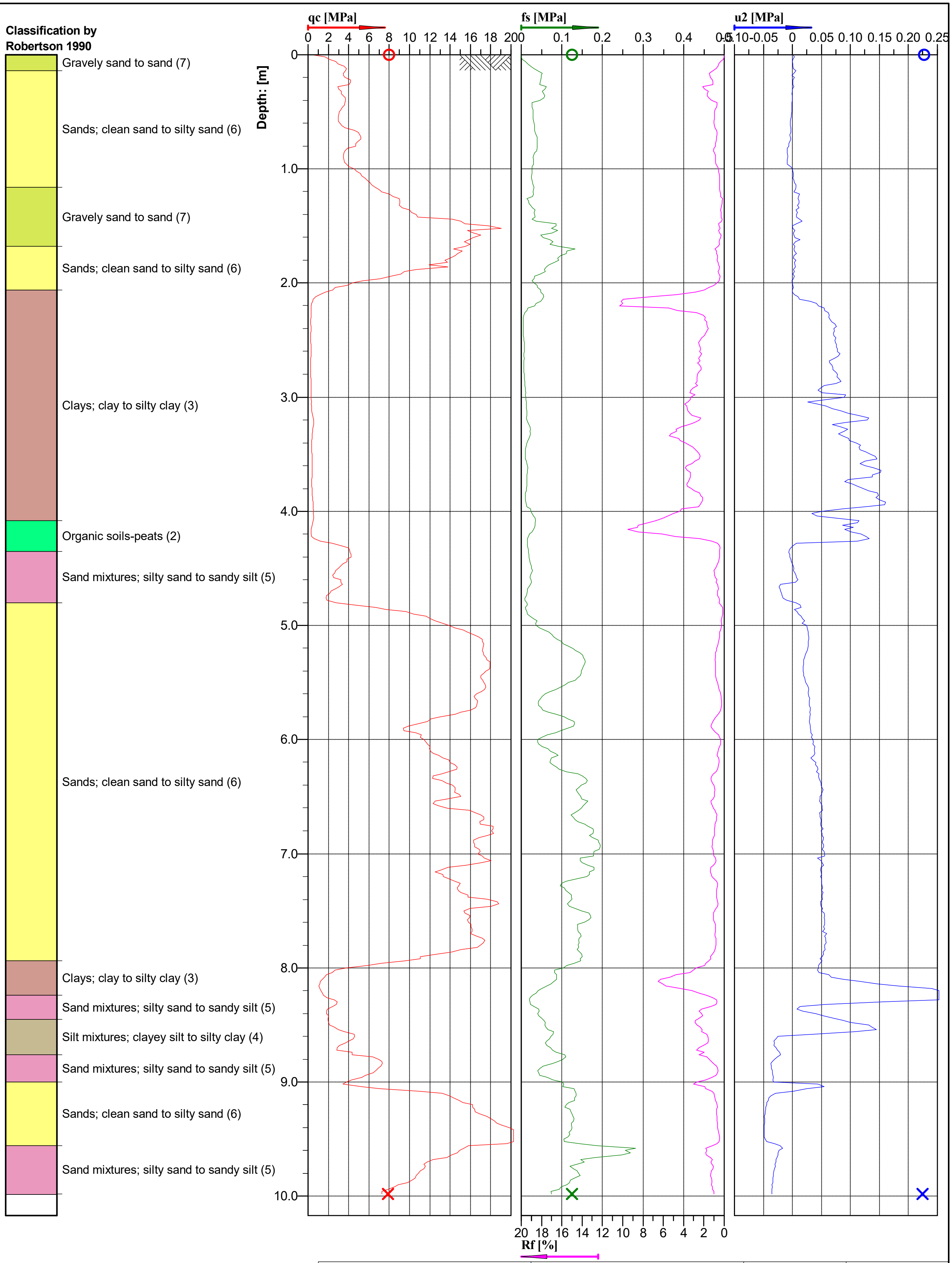
Project: 238 STOCK RD

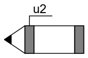
S 39.63610 E 176.79297

Page: 1/1

Fig.:

File: CPT04.cpt

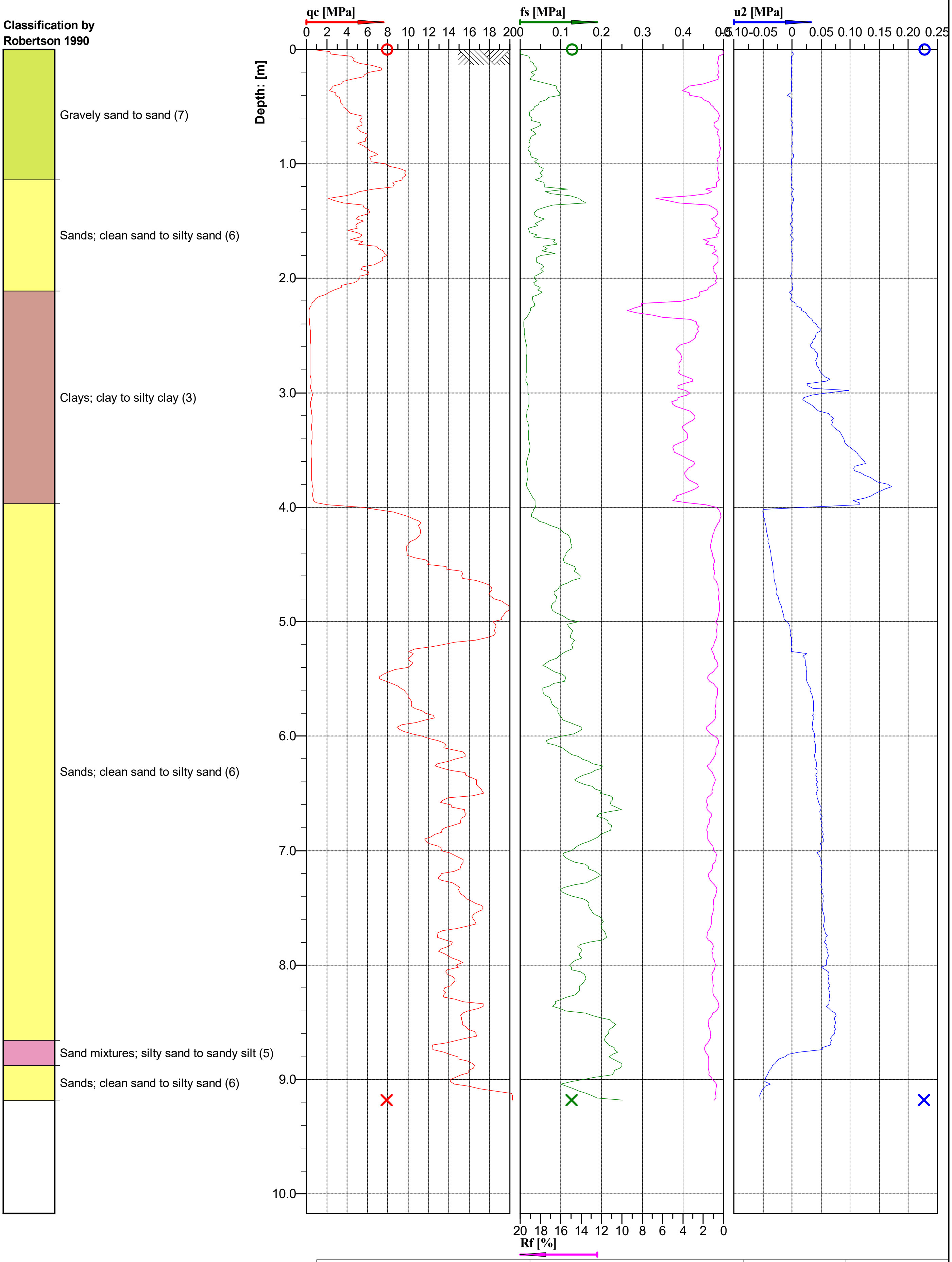


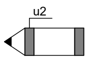


GEOTECH DRILLING

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

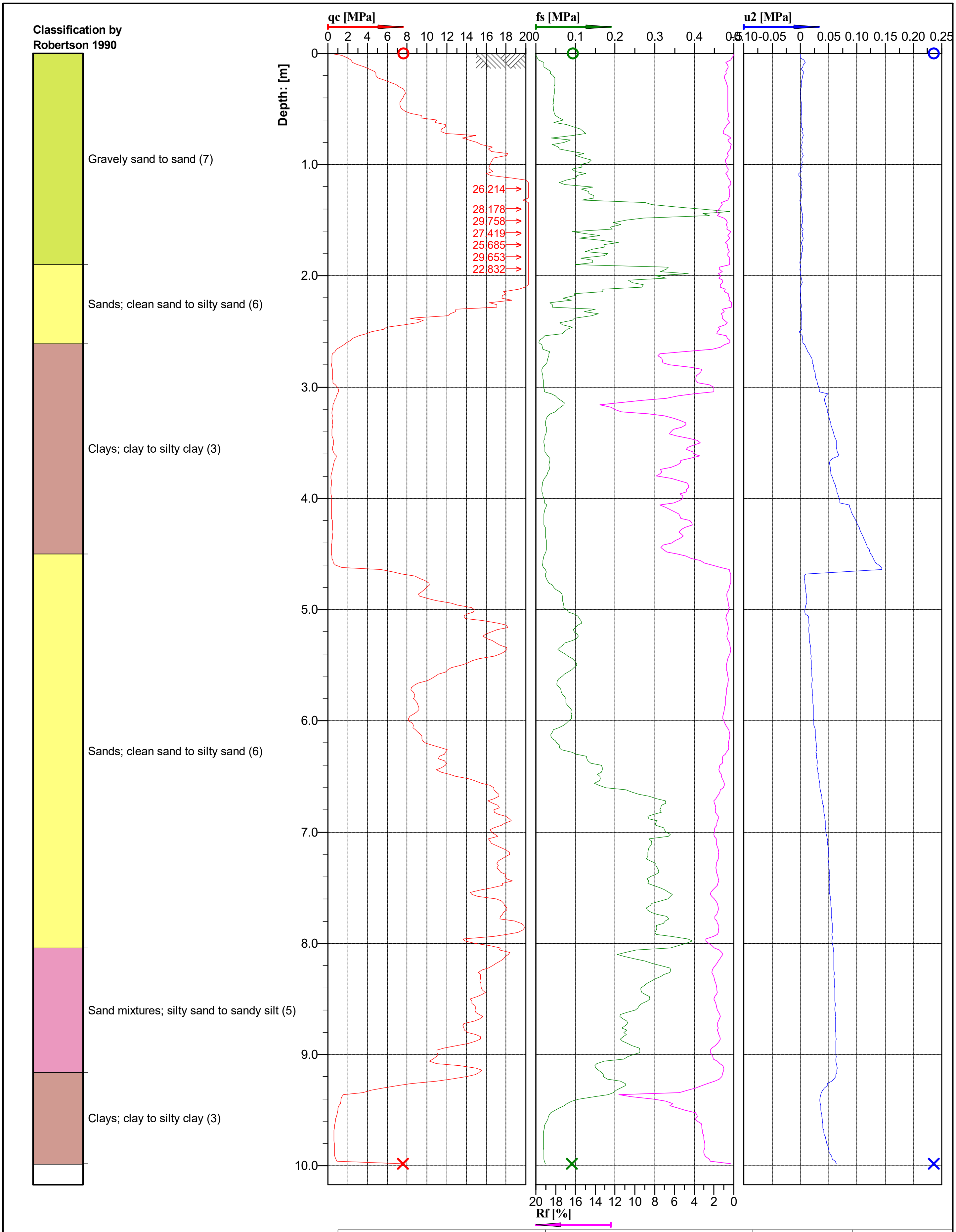
Location: FLAX MERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT05
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63705 E 176.79410		File: CPT05.cpt	



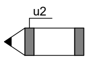


Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT06
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63770 E 176.79529		File: CPT06.cpt	

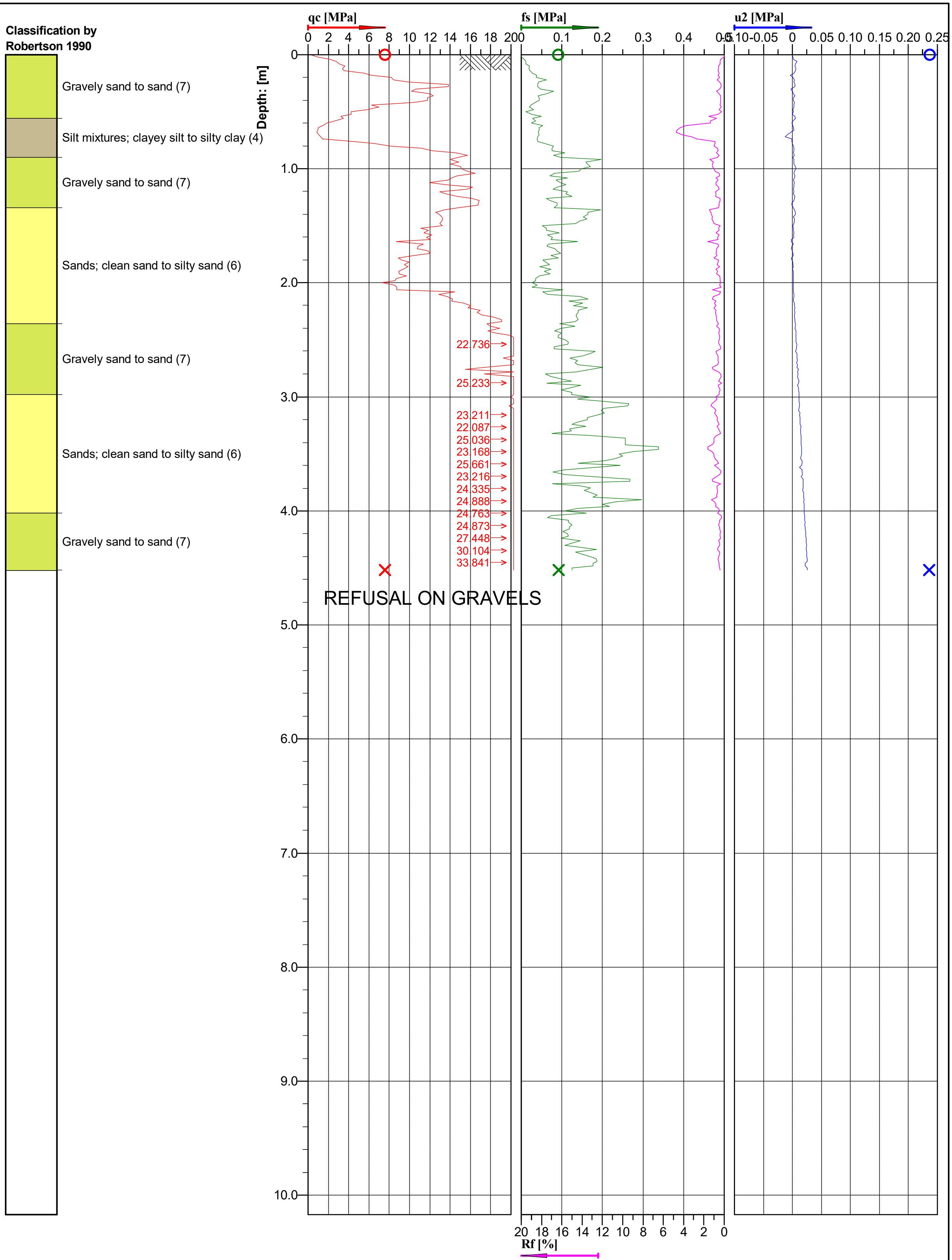


GEOTECH
DRILLING



Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

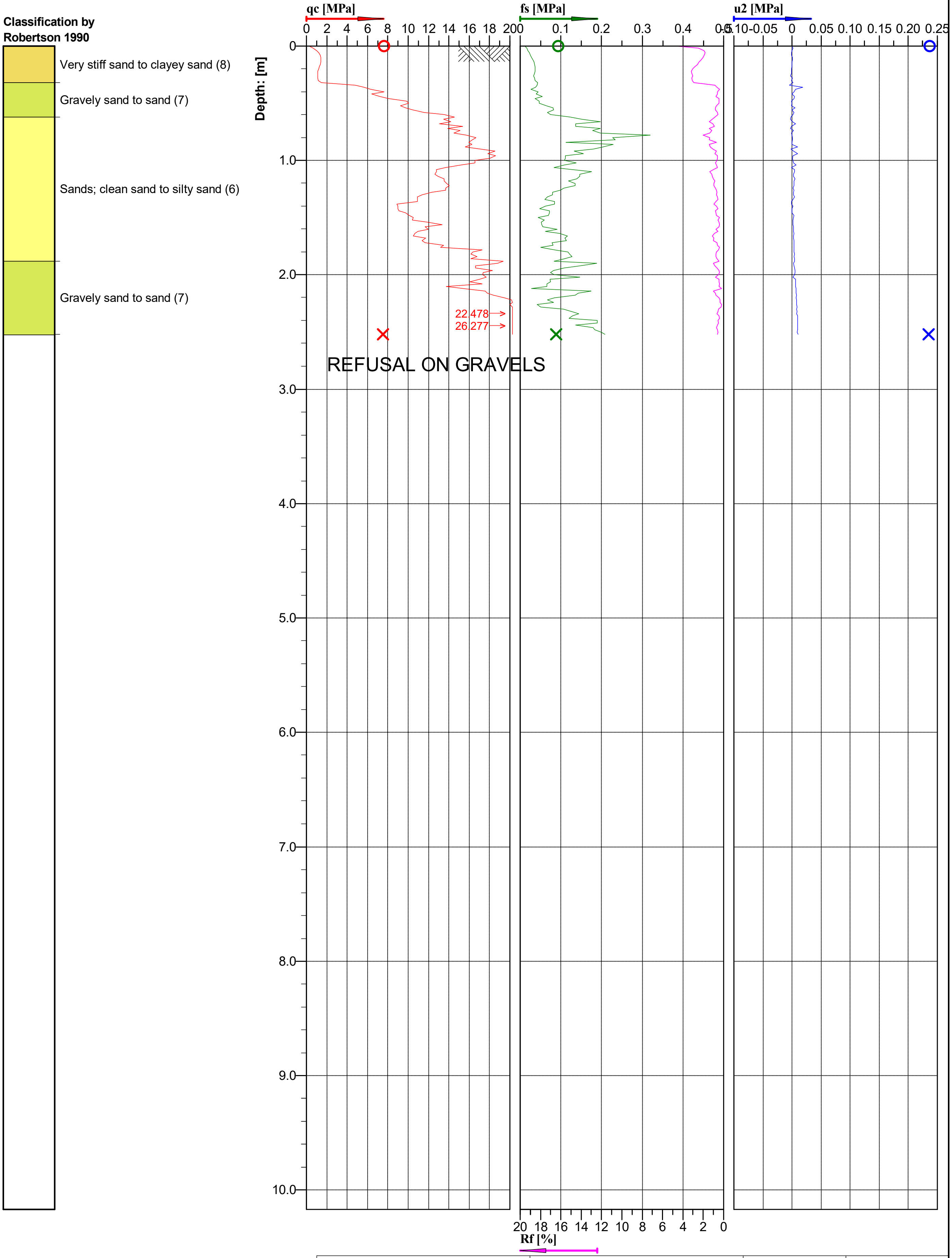
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT07
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT07.cpt	

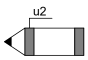


u2

Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

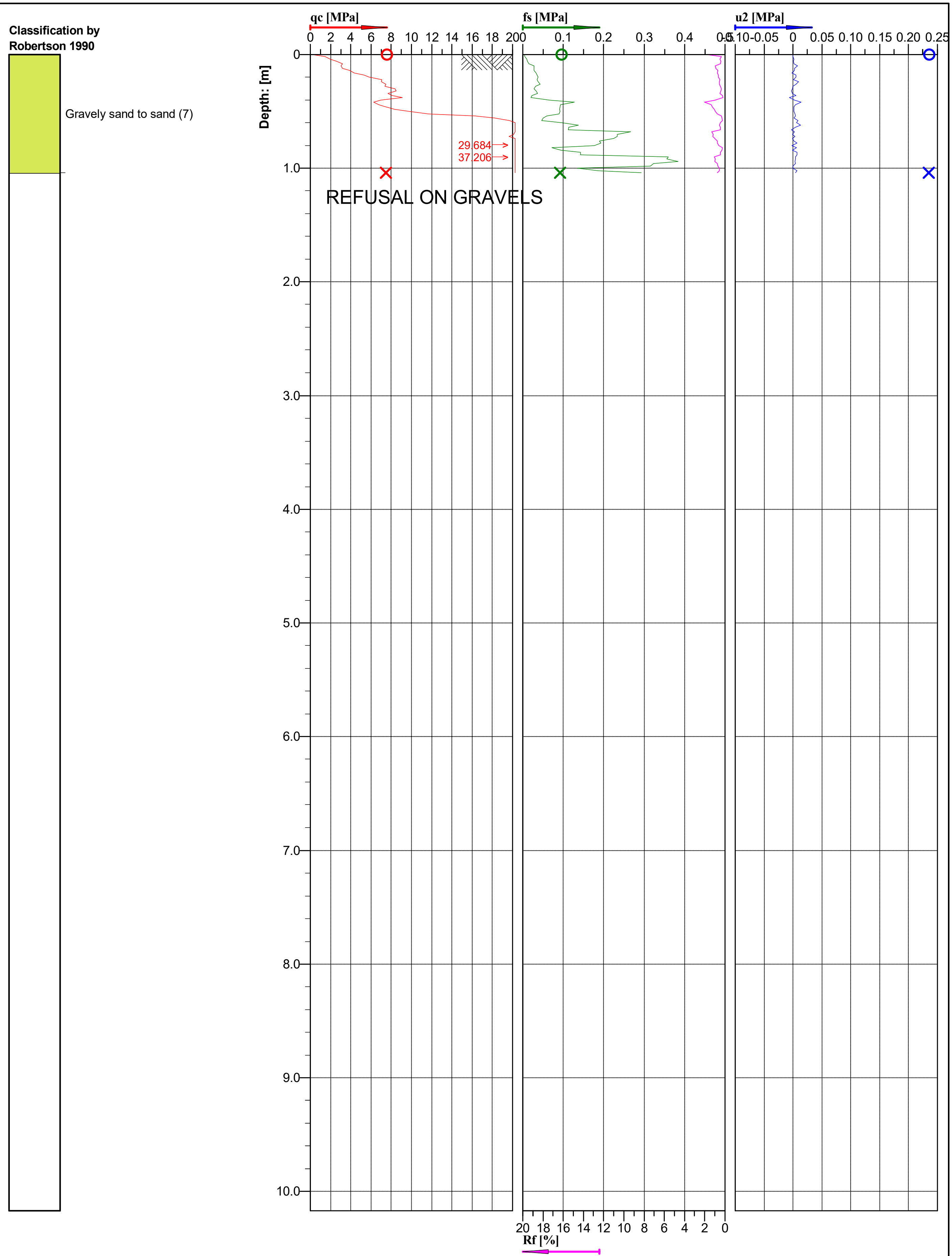
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT08
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT08.cpt	

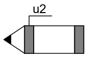




Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

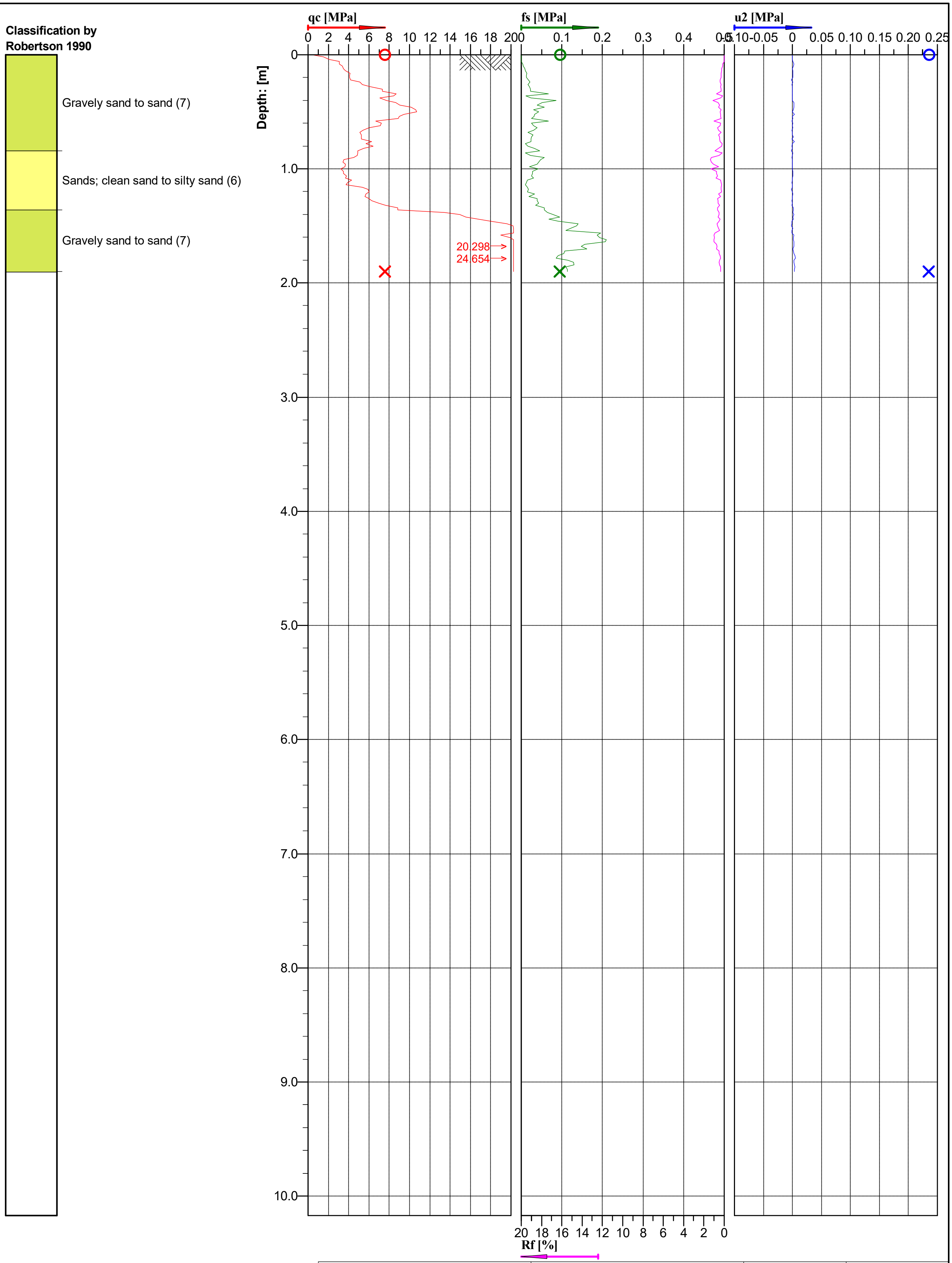
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT09
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63620 E 176.79858		File: CPT09.cpt	

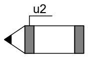




Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

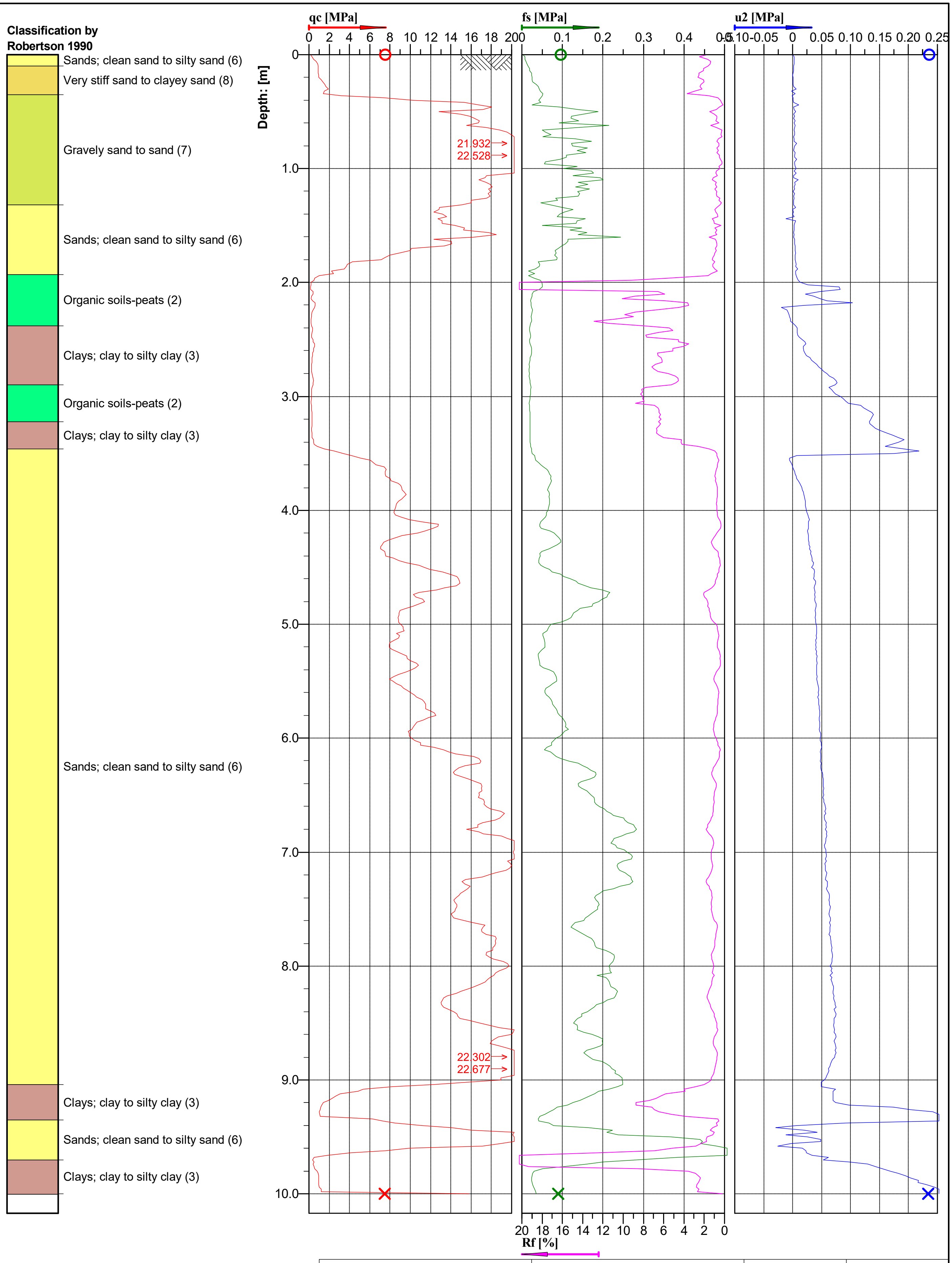
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT10
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63490 E 176.79681		File: CPT10.cpt	

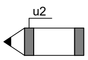




Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

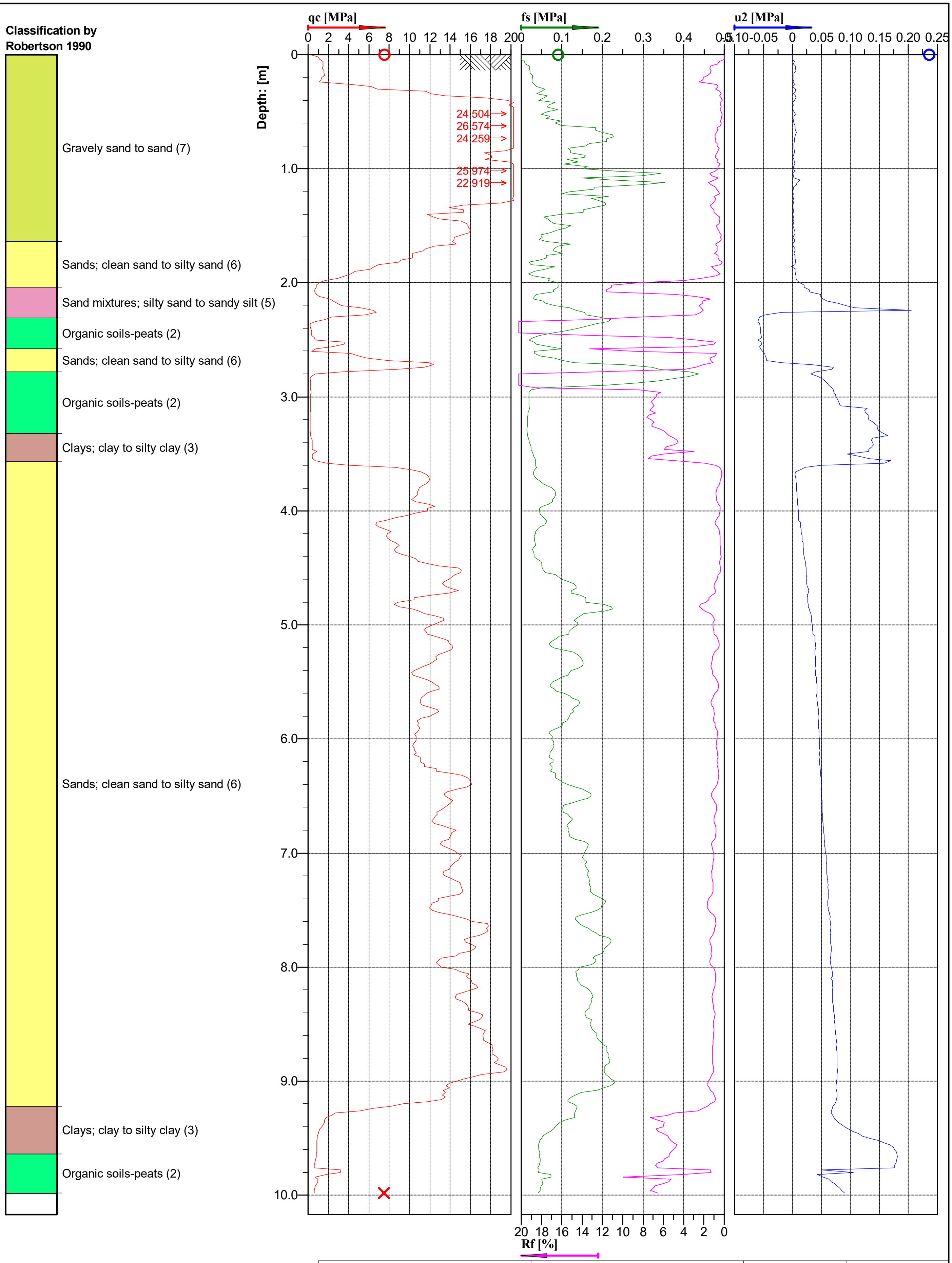
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT11
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63403 E 176.79547		File: CPT11.cpt	



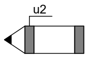


Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT12
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
		File: CPT12.cpt	

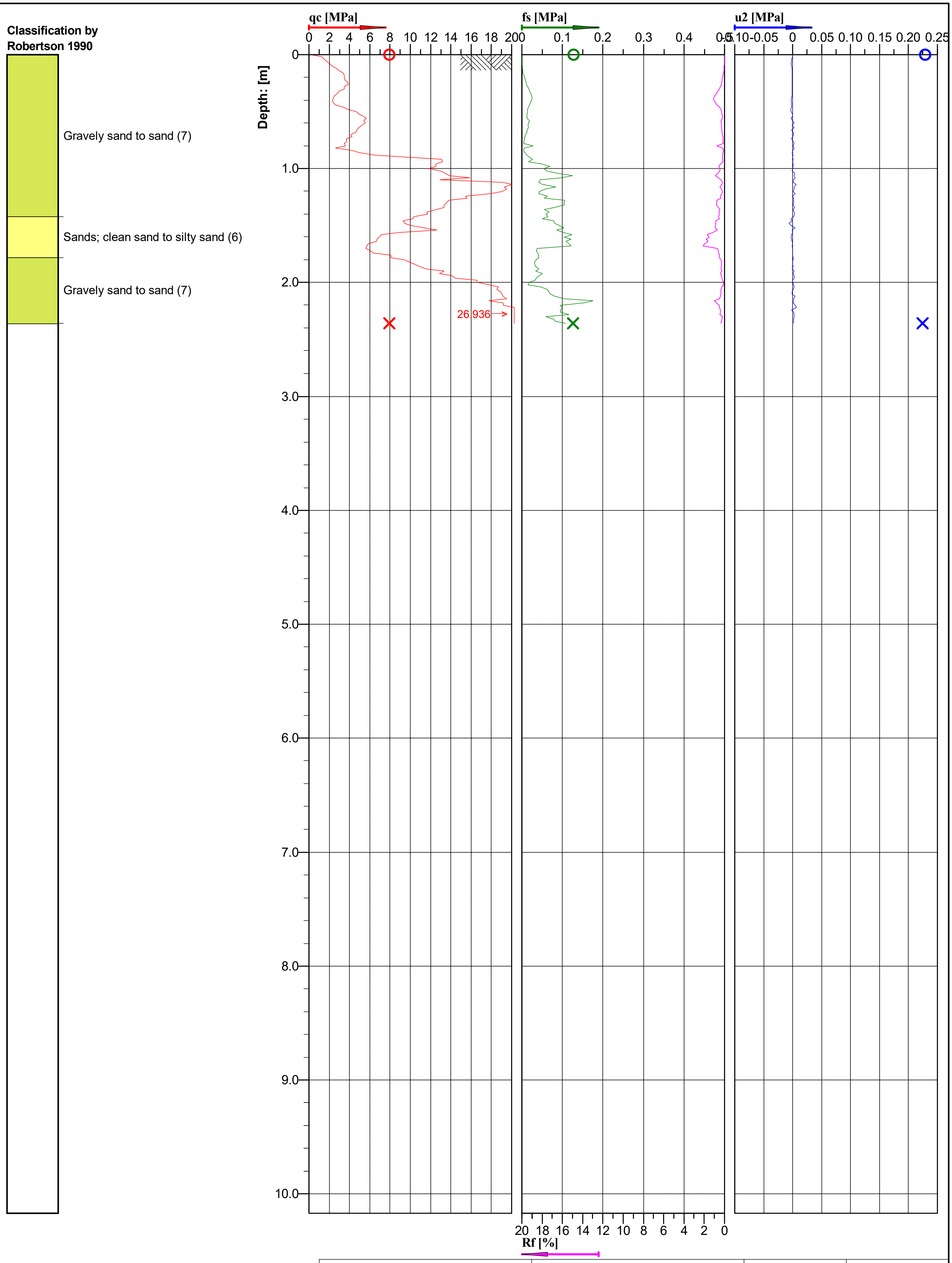


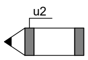
GEOTECH DRILLING



Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

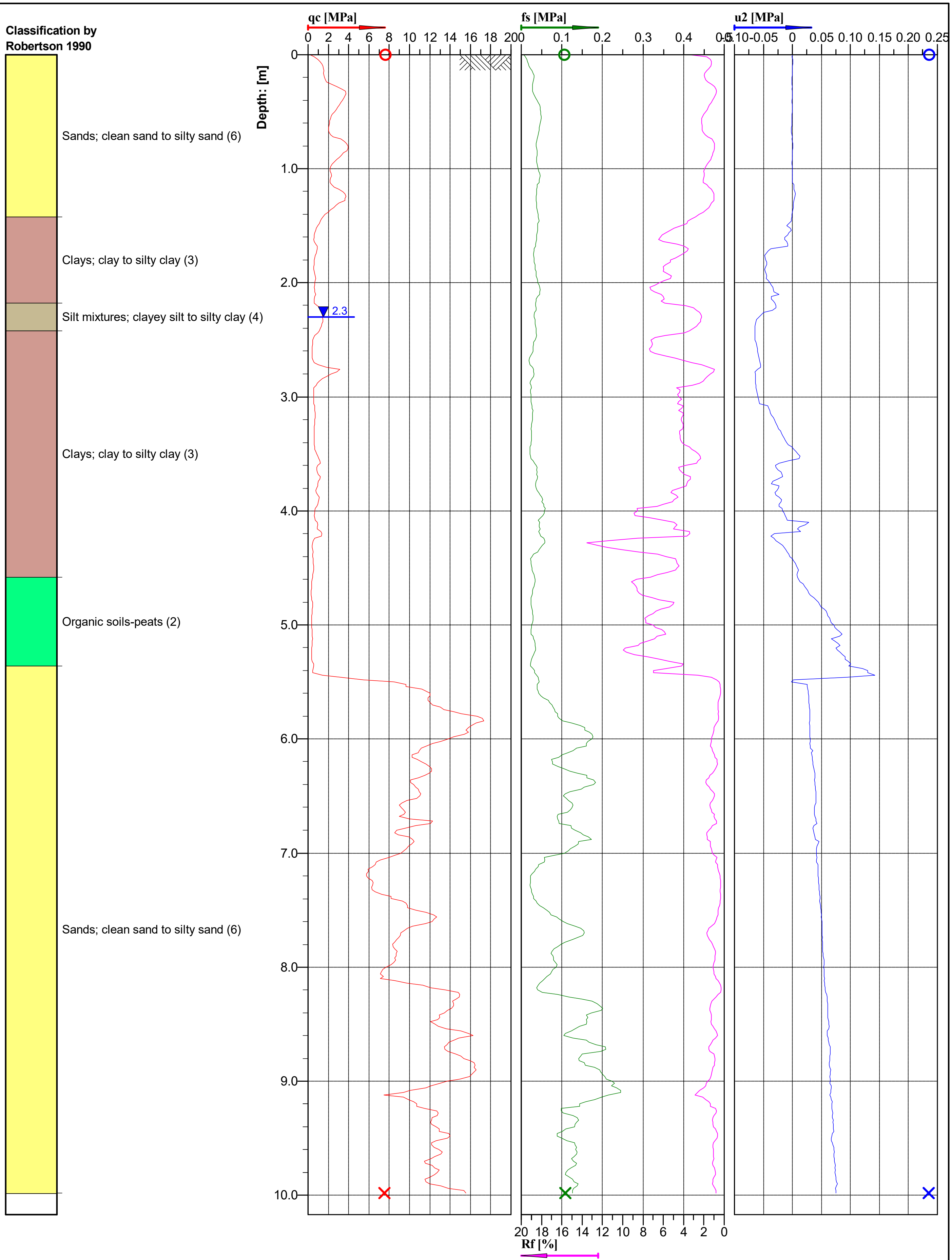
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT13
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63410 E 176.79855		File: CPT13.cpt	

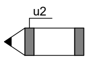




Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150

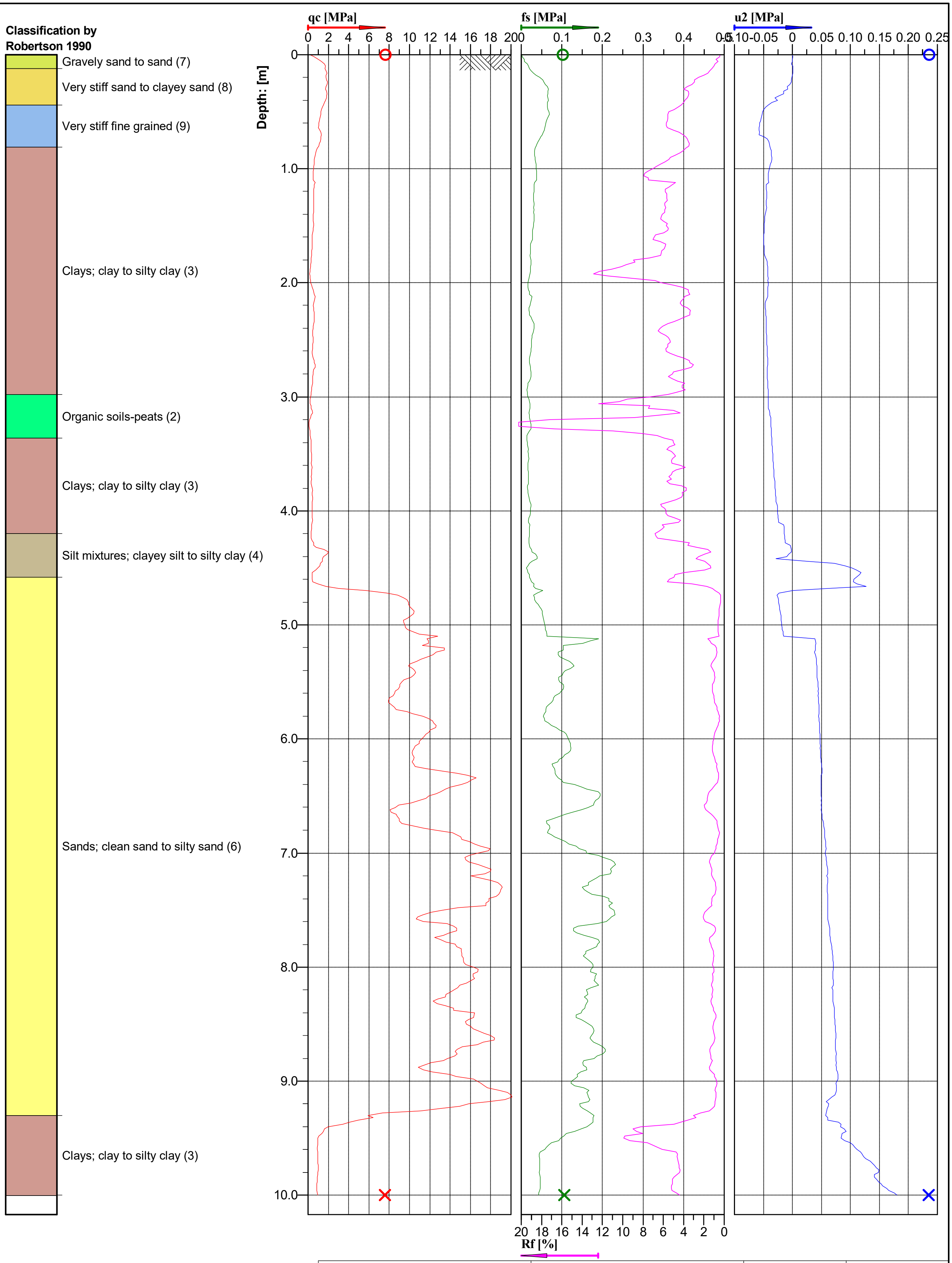
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT14
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63483 E 176.79945		File: CPT14.cpt	

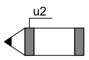




Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

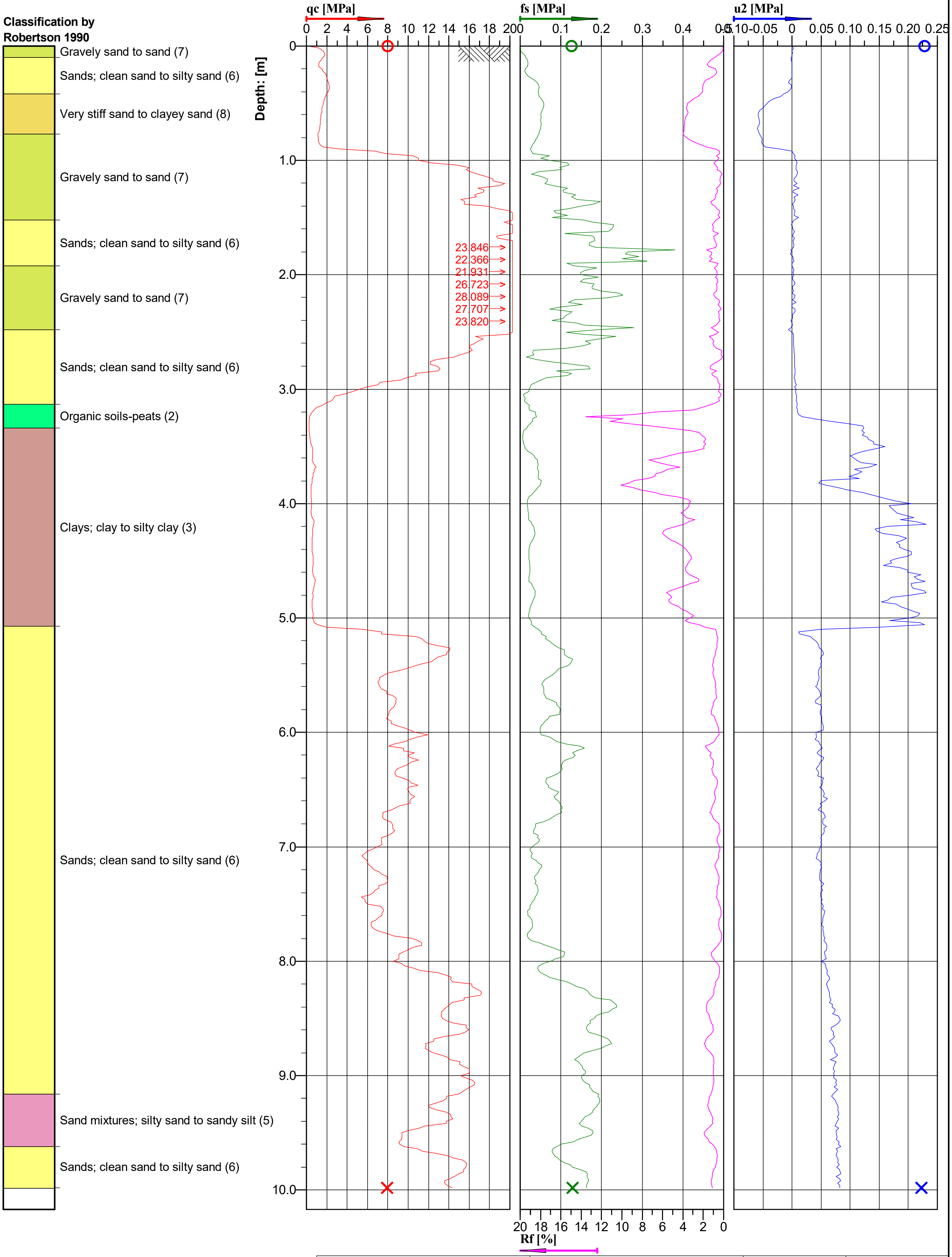
Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT15
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63305 E 176.79968		File: CPT15.cpt	

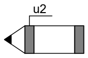




Cone No: 5545
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT16
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63221 E 176.79852		File: CPT16.cpt	





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

Location: FLAXMERE	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT17
Project ID:	Client: WENTZ PACIFIC LTD	Date: 2/08/2021	Scale: 1 : 45
Project: 238 STOCK RD		Page: 1/1	Fig.:
S 39.63139 E 176.79976		File: CPT17.cpt	

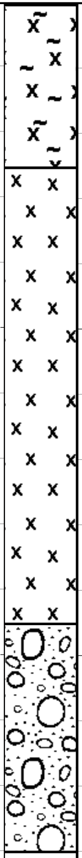
APPENDIX C

TEST PIT LOGS

WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	TP01
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
		Date drilled:	6/08/2021
		Checked by:	DD
		Date checked:	13/08/2021
Driller:		**Max depth:**	1.30
Contractor:	Fulton Hogan	**Equipment:**	Sun SWE35UF
R.L:	~13		
Notes:	400 mm wide bucket		

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm)	SCALA PENETROMETER (mm/blow)
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	SILT, trace clay, brown, firm-stiff, brown, moist, intermittently sandy	ML					
0.5							
1.0	Sandy fine to coarse GRAVEL, grey-brown, loose to medium dense, moist, well graded, trace cobble to 150mm dia	GW					
	Term. test pit at 1.3 m, no groundwater observed						
1.5							
2.0							
2.5							



SCALA (blows/100mm): 0 5 10 15 20

SCALA PENETROMETER (mm/blow): 20 34 50 100 150

WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	**TP02**
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
		Date drilled:	6/08/2021
		Checked by:	DD
		Date checked:	13/08/2021
Driller:		**Max depth:**	1.70
Contractor:	Fulton Hogan	**Equipment:**	Sun SWE35UF
R.L:	~13		
Notes:	400 mm wide bucket		

Depth (m)	LITHOLOGY	USCS
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL
	Fine sandy SILT, brown, loose, moist, non-plastic	ML
0.5	Clayey SILT, greyish-brown, stiff, moist, low plasticity	ML
1.0		
	Becomes grey mottled rust	
1.5		
	Term. test pit at 1.7 m, no groundwater observed	
2.0		
2.5		

Graphic Log | Water Table | Samples

SCALA (blows/100mm): 0 5 10 15 20

SCALA PENETROMETER (mm/blow): 0 34 50 100 150

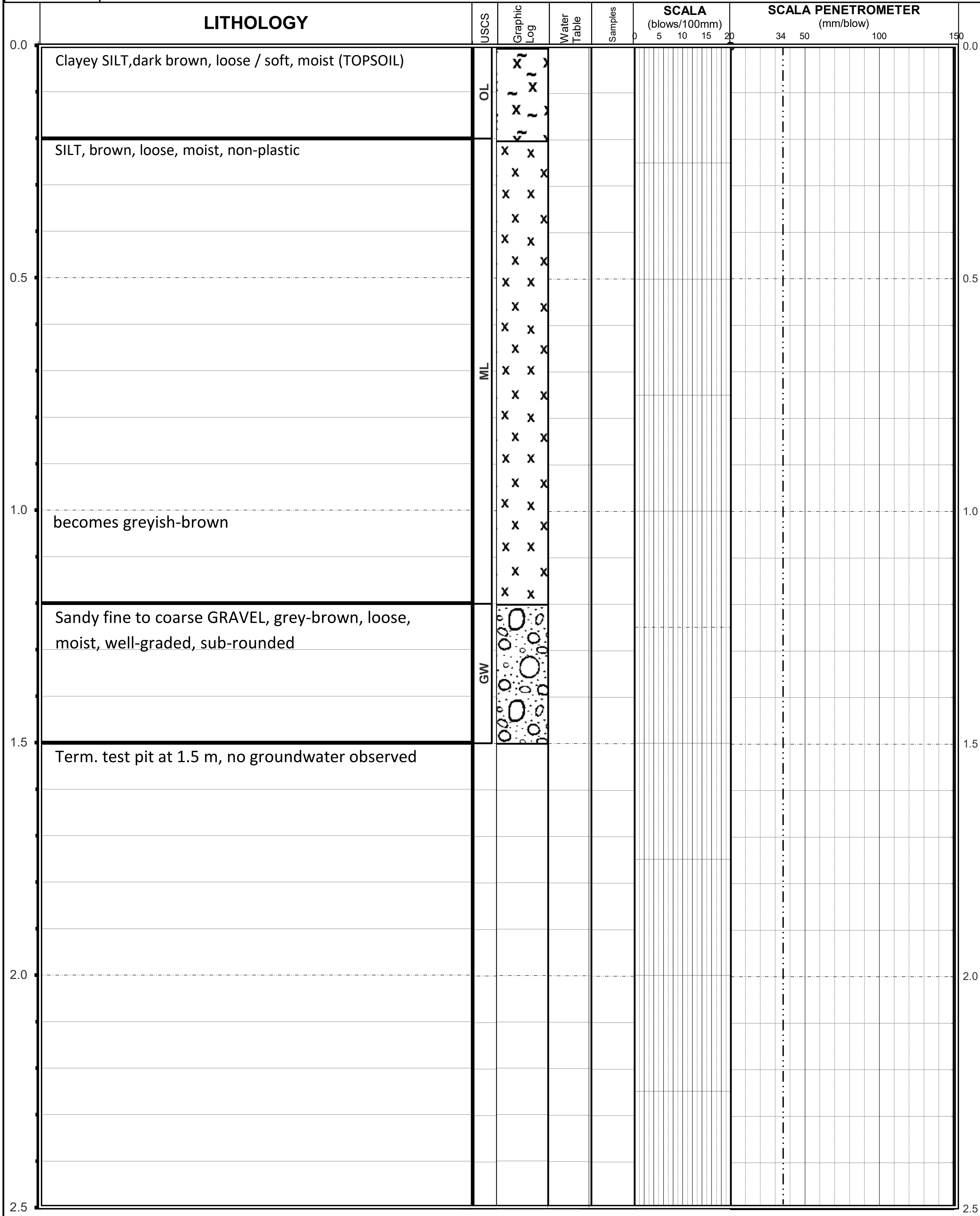
WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	TP03
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
Contractor:	Fulton Hogan	**Date drilled:**	6/08/2021
Equipment:	Sun SWE35UF	**Checked by:**	DD
R.L:	~14	**Date checked:**	13/08/2021
Driller:		**Max depth:**	1.70
Notes:	400 mm wide bucket		

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	Fine silty SAND, brown, loose, moist	SM					
0.5							
1.0							
	~100mm thick sandy fine to coarse GRAVEL at 1., bluish-grey, loose, moist, w/pumice pieces						
1.5							
	Term. test pit at 1.7 m, no groundwater observed						
2.0							
2.5							

WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	TP04
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
Driller:		**Date drilled:**	6/08/2021
Contractor:	Fulton Hogan	**Checked by:**	DD
Equipment:	Sun SWE35UF	**Date checked:**	13/08/2021
R.L:	~14	**Max depth:**	1.50
Notes:	400 mm wide bucket		



Depth (m)	Lithology	USCS
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL
	SILT, brown, loose, moist, non-plastic	ML
1.0	becomes greyish-brown	
	Sandy fine to coarse GRAVEL, grey-brown, loose, moist, well-graded, sub-rounded	GW
1.5	Term. test pit at 1.5 m, no groundwater observed	

WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	**TP05**
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
		Date drilled:	6/08/2021
		Checked by:	DD
		Date checked:	13/08/2021

Driller:

Contractor: Fulton Hogan **Equipment:** Sun SWE35UF **R.L:** ~14 **Max depth:** 1.70

Notes: 400 mm wide bucket

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL	x ~ x ~				
	SILT, greyish-brown, loose-medium dense, moist, non-plastic, pumice pieces to ~100mm, piece of wood	ML	x x x				
0.5							
1.0							
	becomes brown mottled rust						
1.5	Fine silty SAND, brown/greyish-brown, loose, moist	SM	x x x				
	Term. test pit at 1.7 m, no groundwater observed						
2.0							
2.5							

WENTZ-PACIFIC LTD
TEST PIT LOG

Hole No:	**TP06**	**Job No:**	1448-01-21
Project:	238 Stock Road / 49a Dundee Drive	**Logged by:**	RW
Client:	Heretaunga Tamatea Settlement Trust	**Date drilled:**	6/08/2021
Hole location:	Refer to Site Plan	**Checked by:**	DD
Driller:		**Date checked:**	13/08/2021
Contractor:	Fulton Hogan	**Equipment:**	Sun SWE35UF
R.L:	~13	**Max depth:**	1.70
Notes:	400 mm wide bucket		

	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 0 34 50 100 150	
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL						0.0
	SILT, trace fine sand, brown, loose, moist, non-plastic	ML						
0.5	Fine silty SAND, brown, loose, moist	SM						0.5
	Fine sandy SILT, brown, loose, moist, non-plastic	ML						
1.0								1.0
	SILT, blue-grey mottled rust, firm-stiff, moist, low plasticity	ML						
1.5								1.5
	Term. test pit at 1.7 m, no groundwater observed							
2.0								2.0
2.5								2.5

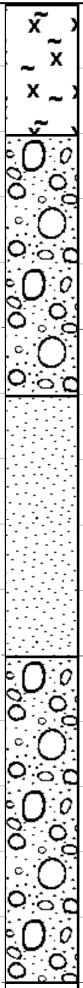
WENTZ-PACIFIC LTD
TEST PIT LOG

Hole No: TP07
Job No: 1448-01-21
Logged by: RW
Date drilled: 6/08/2021
Checked by: DD
Date checked: 13/08/2021
Max depth: 1.50

Project: 238 Stock Road / 49a Dundee Drive
Client: Heretaunga Tamatea Settlement Trust
Hole location: Refer to Site Plan
Driller:
Contractor: Fulton Hogan
Equipment: Sun SWE35UF
R.L: ~14
Notes: 400 mm wide bucket, TP located at northern end of reported NZTA borrow pit.

Depth	LITHOLOGY	USCS
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL
	Fine-coarse sandy GRAVEL/gravelly SAND, reddish-brown, loose, moist	GW
0.5		
	Fine-medium SAND, brown, loose, moist	SP
1.0	Fine-medium sandy GRAVEL/gravelly SAND, grey, loose-medium dense, moist Becomes finer gravel	GW
1.5	Term. test pit at 1.5 m, no groundwater observed	
2.0		
2.5		

Graphic Log



Water Table | Samples

SCALA (blows/100mm): 0 5 10 15 20

SCALA PENETROMETER (mm/blow): 34 50 100 150

WENTZ-PACIFIC LTD
TEST PIT LOG

Hole No: TP08
Job No: 1448-01-21
Logged by: RW
Date drilled: 6/08/2021
Checked by: DD
Date checked: 13/08/2021
Max depth: 1.50

Project: 238 Stock Road / 49a Dundee Drive
Client: Heretaunga Tamatea Settlement Trust
Hole location: Refer to Site Plan
Driller:
Contractor: Fulton Hogan
Equipment: Sun SWE35UF
R.L: ~14
Notes: 400 mm wide bucket

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 0 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	Fine-medium sandy GRAVEL, grey-brown, loose, moist, sub-rounded.	GW					
0.5	Becomes finer, more sand						
1.0							
1.5	Term. test pit at 1.5 m, no groundwater observed						
2.0							
2.5							

WENTZ-PACIFIC LTD
TEST PIT LOG

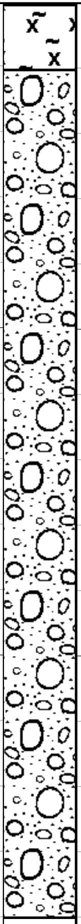
Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	**TP09**
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
		Date drilled:	6/08/2021
		Checked by:	DD
		Date checked:	13/08/2021

Driller:		**Contractor:**	Fulton Hogan	**Equipment:**	Sun SWE35UF	**R.L:**	~14	**Max depth:**	1.40

Notes: 400 mm wide bucket

Depth	LITHOLOGY	USCS
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL
	Fine-medium sandy GRAVEL/gravelly SAND, brown, loose-medium dense, moist	GW
0.5	Thin (~100mm) layer of fine-medium sand	
	Grey-brown, medium dense, moist	
1.0		
	Term. test pit at 1.4 m, no groundwater observed	
1.5		
2.0		
2.5		

Graphic Log



Water Table

Samples

SCALA (blows/100mm) 0 5 10 15 20

SCALA PENETROMETER (mm/blow) 0 34 50 100 150

WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive	**Hole No:**	**TP10**
Client:	Heretaunga Tamatea Settlement Trust	**Job No:**	1448-01-21
Hole location:	Refer to Site Plan	**Logged by:**	RW
		Date drilled:	6/08/2021
		Checked by:	DD
		Date checked:	13/08/2021
Driller:		**Max depth:**	1.00
Contractor:	Fulton Hogan	**Equipment:**	Sun SWE35UF
R.L:	~13		
Notes:	400 mm wide bucket		

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 0 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	Fine-medium sandy GRAVEL, grey-brown, medium dense moist	GW					
0.5	Rust-coloured between 500-600mm						
1.0	Term. test pit at 1.0 m, no groundwater observed						
1.5							
2.0							
2.5							

WENTZ-PACIFIC LTD
TEST PIT LOG

Hole No: TP11
Job No: 1448-01-21
Logged by: RW
Date drilled: 6/08/2021
Checked by: DD
Date checked: 13/08/2021
Max depth: 1.10

Project: 238 Stock Road / 49a Dundee Drive
Client: Heretaunga Tamatea Settlement Trust
Hole location: Refer to Site Plan
Driller:
Contractor: Fulton Hogan
Equipment: Sun SWE35UF
R.L: ~13
Notes: 400 mm wide bucket

Depth (m)	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm)	SCALA PENETROMETER (mm/blow)
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	Fine-coarse sandy GRAVEL/gravelly SAND, reddish-brown medium dense, moist	GW					
0.5	Thin (<100mm) layer red-brown silt Fine-coarse sandy GRAVEL, reddish-brown, dense, moist, hard digging						
1.0							
	Term. test pit at 1.1 m, no groundwater observed GWT ~ 2m based on adjacent stream level						
1.5							
2.0							
2.5							

SCALA (blows/100mm): 0 5 10 15 20

SCALA PENETROMETER (mm/blow): 20 34 50 100 150

WENTZ-PACIFIC LTD
TEST PIT LOG

Hole No:	**TP12**
Job No:	1448-01-21
Logged by:	RW
Date drilled:	6/08/2021
Checked by:	DD
Date checked:	13/08/2021
Max depth:	1.40
Project:	238 Stock Road / 49a Dundee Drive
Client:	Heretaunga Tamatea Settlement Trust
Hole location:	Refer to Site Plan
Driller:	
Contractor:	Fulton Hogan
Equipment:	Sun SWE35UF
R.L:	~14
Notes:	400 mm wide bucket

Depth (m)	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 0 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL	x ~ x ~ x ~				
	Fine SAND, some silt, brown, loose, moist	SP					
0.5							
	Fine-medium sandy GRAVEL, grey-brown, medium dense, moist, occasional small pumice pieces	GW					
1.0							
	Term. test pit at 1.4 m, no groundwater observed						
1.5							
2.0							
2.5							

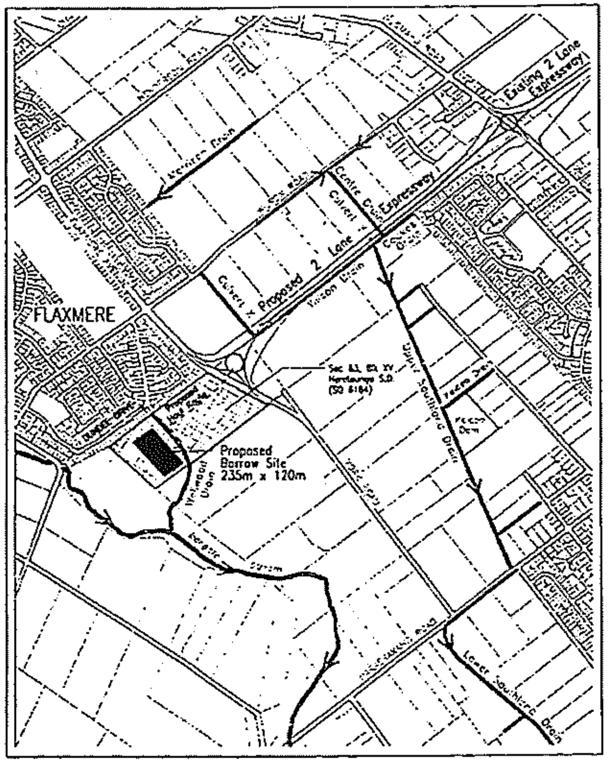
WENTZ-PACIFIC LTD
TEST PIT LOG

Project:	238 Stock Road / 49a Dundee Drive			**Hole No:**	**TP13**
				Job No:	1448-01-21
				Logged by:	RW
				Date drilled:	6/08/2021
Client:	Heretaunga Tamatea Settlement Trust			**Checked by:**	DD
Hole location:	Refer to Site Plan			**Date checked:**	13/08/2021
Driller:					
Contractor:	Fulton Hogan	**Equipment:**	Sun SWE35UF	**R.L:**	~14
				Max depth:	1.50
Notes:	400 mm wide bucket				

Depth	LITHOLOGY	USCS	Graphic Log	Water Table	Samples	SCALA (blows/100mm) 0 5 10 15 20	SCALA PENETROMETER (mm/blow) 0 34 50 100 150
0.0	Clayey SILT,dark brown, loose / soft, moist (TOPSOIL)	OL					
	Fine-medium sandy GRAVEL/gravelly SAND, brown to reddish-brown, medium dense, moist, easy digging	GW					
0.5							
	Fine-medium silty SAND, grey-brown, loose to medium-dense, moist	SM					
1.0							
	Grading with fine-medium gravel						
1.5	Term. test pit at 1.5 m, no groundwater observed						
2.0							
2.5							

APPENDIX D

NZ TRANSIT PLANS FOR BORROW SITE ON 238 STOCK ROAD PARCEL



LOCALITY PLAN

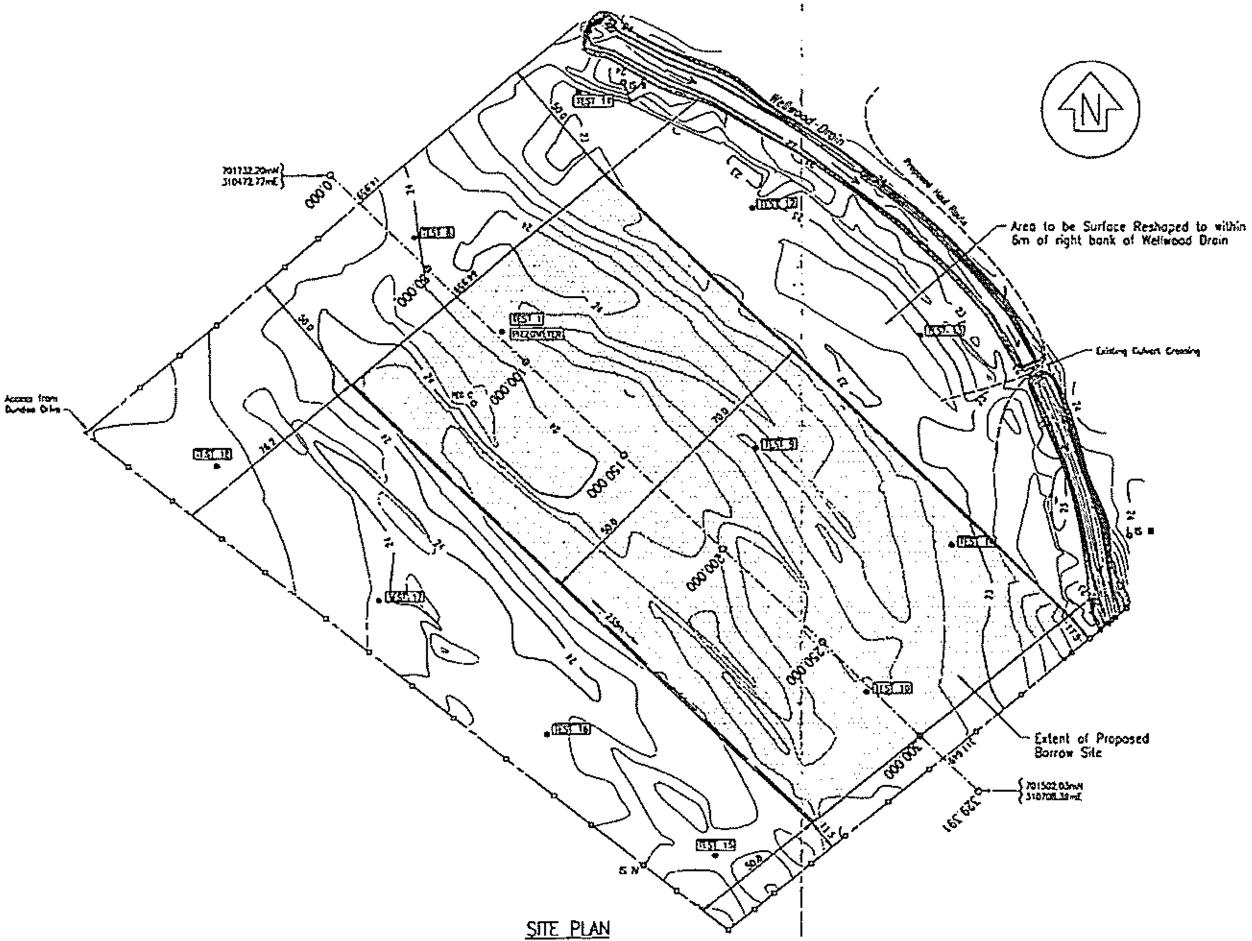
Not to Scale

Notes:

1. Coordinates are in terms of Trig 'A' Hawkes Bay 700,000mN 300,000mE
2. Levels are in terms of Opus International Consultants Limited precise level survey 1997. Datum = L.I.N.Z. Mean Sea Level + 10.0m

	Northing	Easting	Level
IS E	701766.45	310580.61	24.17
IS B	701597.02	310764.53	24.05
IS N	701474.88	310587.00	23.61

3. For Long Section refer to Sheet 2
4. For Cross Sections refer to Sheet 3



SITE PLAN

Scale 1:1000

		BY	CHECKED	DATE
	DESIGN	C. Daly		07/99
	DRAWN	G.Woods		07/99
	RECOM'D			
	APPROVED			7.99
AMENDMENT	APP'D	DATE		

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NAPIER REGIONAL OFFICE

OPUS
international consultants

Napier Office

Private Bag 6019
Napier, New Zealand

Tel (06) 835 8195
Fax (06) 835 0681

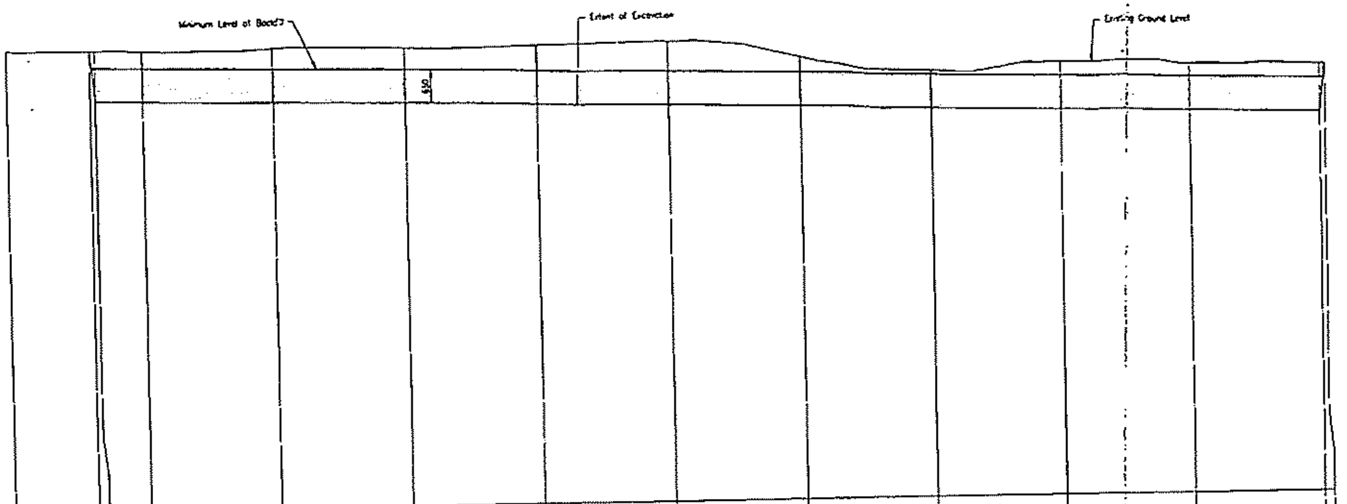
TITLE NAPIER – HASTINGS MOTORWAY
OMAHU ROAD – YORK ROAD (FLAXMERE AVENUE) SECTION
BORROW SITE

SCHEME: SITE AND LOCALITY PLANS

STATUS		FILE			
SCHEME		V0909.50.012ND			
SCALE	PLOT DATE	JOB	CODE	SHEET	REVISION
AS SHOWN (A1)	22/07/99	3/112/4	5304	1	

r:\motorway\v0909\50\012nd\3_112_4_5304_1.dwg ORIGINAL SHEET SIZE A1 (840x594)

GRAPHIC SCALES



Datum R.L. 15.000

Depth of Excavation			0.982	0.977	1.049	1.061	1.139	1.229	0.940	0.723	0.910	0.898	0.915	
Centreline Height			22.979	22.956	22.892	22.828	22.764	22.700	22.636	22.572	22.508	22.444	22.380	
Centreline Profile			-98.60%				-0.26% or 1 in 385							92.00%
Ground Level	24.000	23.967	23.966	23.933	23.941	23.889	23.903	23.929	23.576	23.293	23.418	23.340	23.295	23.300
Distance	49.00	64.96	65.56	75.00	100.00	125.00	150.00	175.00	200.00	225.00	250.00	275.00	300.00	301.00

BORROW SITE LONG SECTION

Horizontal Scale 1:500
Vertical Scale 1:50

	BY	CHECKED	DATE
DESIGN	C. Doty		07/99
DRAWN	C Woods		07/99
RECOM'D			
APPROVED			7-99

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AMENDMENT	APP'D	DATE

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Private Bag 6019
Napier, New Zealand
Tel (06) 833 5196
Fax (06) 835 0881

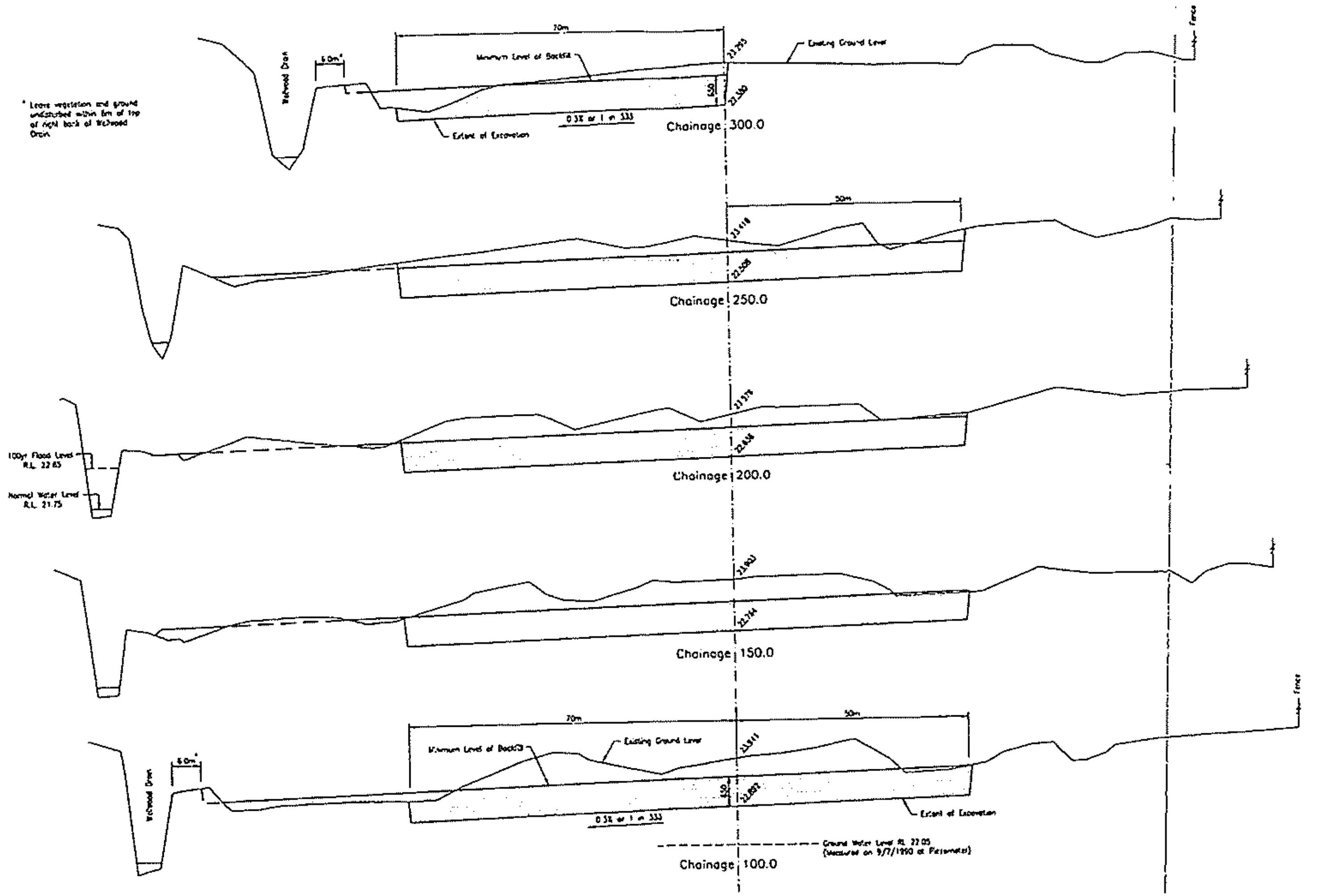
TITLE NAPIER – HASTINGS MOTORWAY
OMAHU ROAD – YORK ROAD (FLAXMERE AVENUE) SECTION
BORROW SITE

SCHEME: LONG SECTION

STATUS	FILE			
SCHEME	V0909.50.012ND			
SCALE	PLOT DATE	JOB	CODE	SHEET	REVISION
AS SHOWN (A1)	22/07/99	3/112/4	5304	2	

ORIGINAL SHEET SIZE A1 (840x594)

GRAPHIC SCALES
0 10mm 50 100



* Leave vegetation and ground undisturbed within 6m of top of right bank of Wetwood Drain.

BORROW SITE CROSS SECTIONS

Horizontal Scale 1:500
Vertical Scale 1:50

GRAPHIC SCALES

0 10mm 50 100 200 300

	BY	CHECKED	DATE
DESIGN	C. Doly		07/99
DRAWN	C.Woods		07/99
RECOM'D			
APPROVED			7.99

AMENDMENT	APP'D	DATE

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TITLE NAPIER - HASTINGS MOTORWAY
OMAHU ROAD - YORK ROAD (FLAXMERE AVENUE) SECTION
BORROW SITE

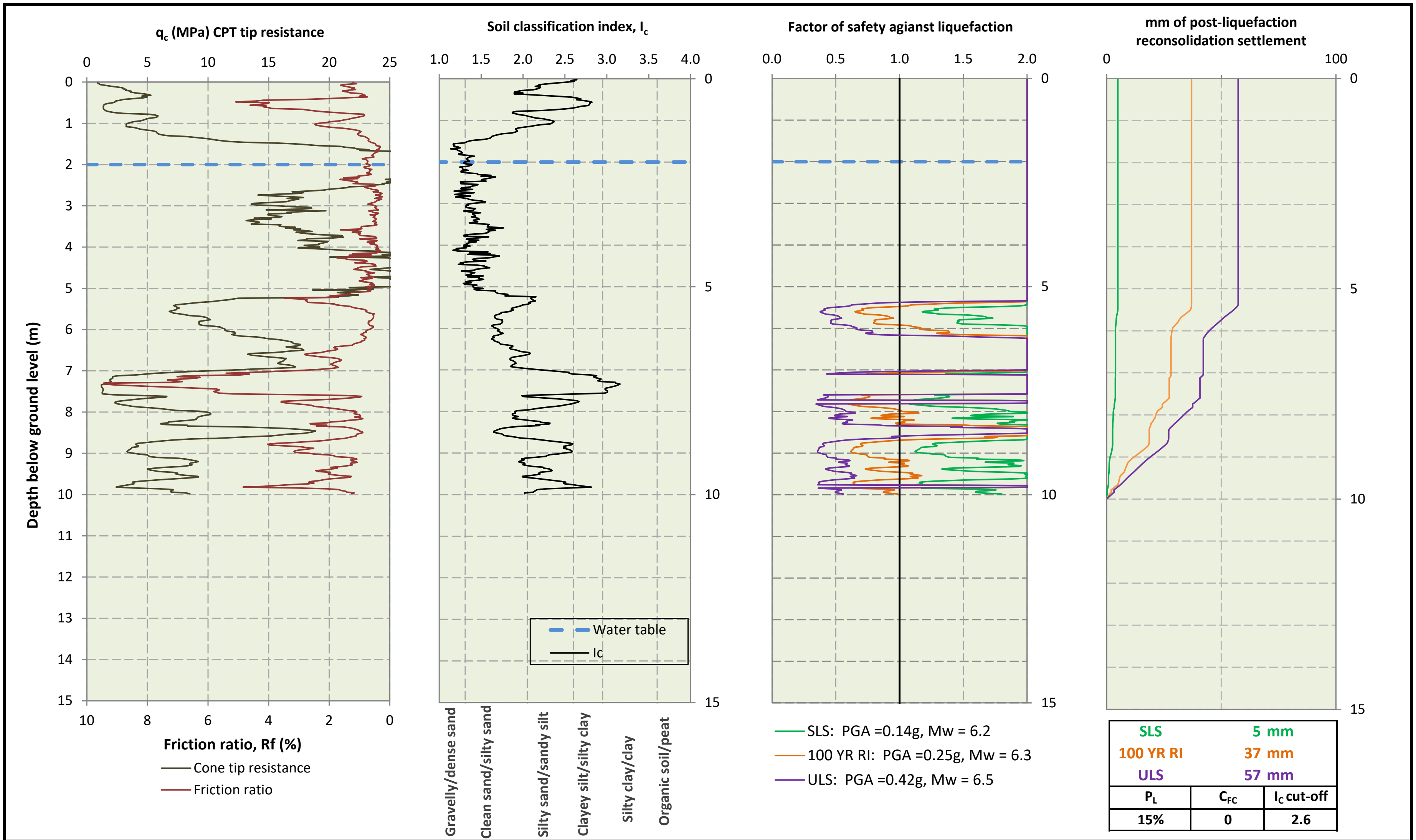
SCHEME: CROSS SECTIONS 100.0 TO 300.0

STATUS	SCHEME	FILE	V0909.50.012ND		
SCALE	PLOT DATE	JOB	CODE	SHEET	REVISION
AS SHOWN (A1)	23/07/99	3/112/4	5304	3	

ORIGINAL SHEET SIZE A1 (840x594)

APPENDIX E

LIQUEFACTION ANALYSIS



SLS	5 mm	
100 YR RI	37 mm	
ULS	57 mm	
P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-4

R Boulanger & I Idriss '14

Plate: E-1

Client: Heretaunga Tamatea Settlement Trust

Project: 238 Stock Rd / 49a Dundee Dr

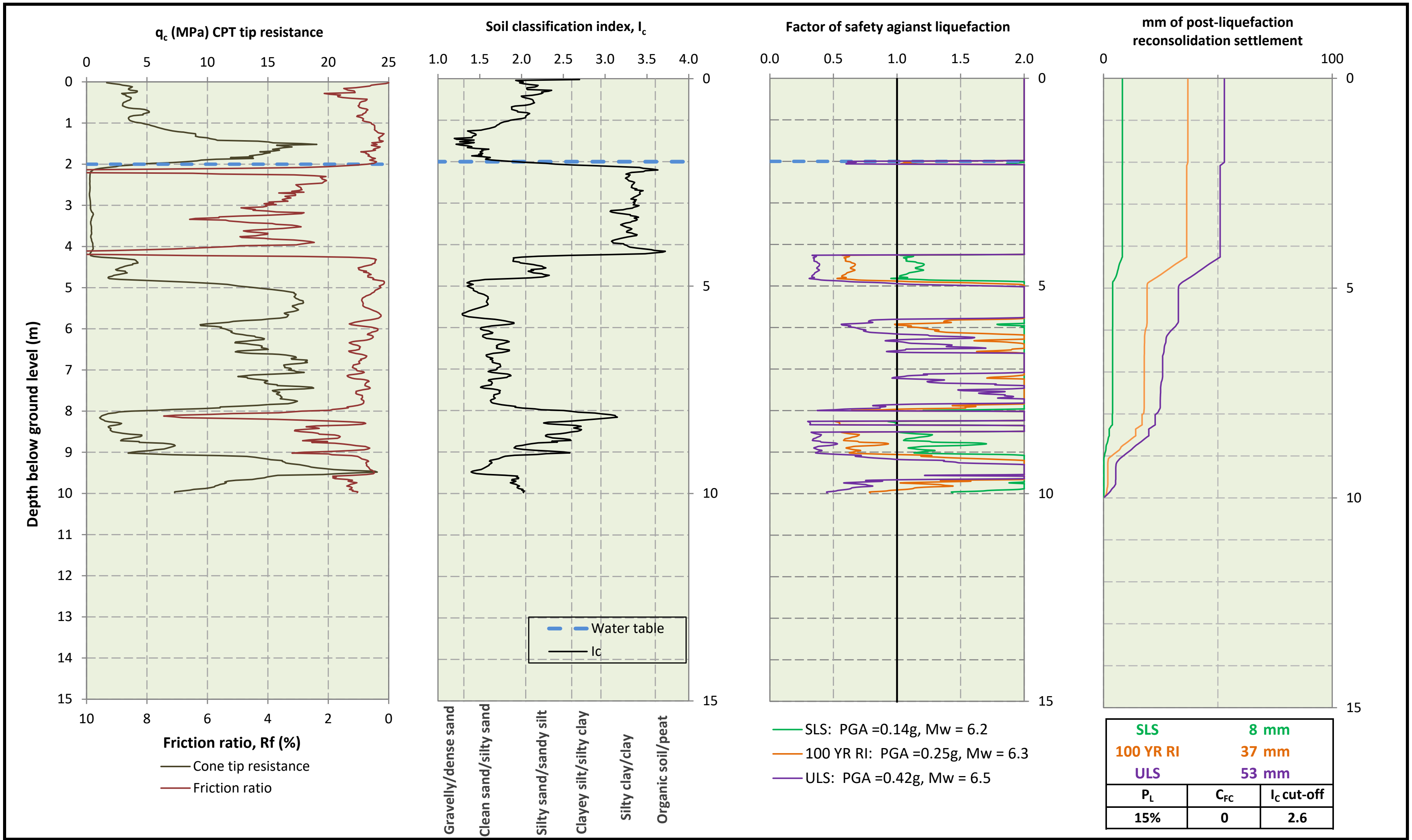
Job No. 1448-01-21

Analysis By: RW

Checked By: DD

Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	8 mm
100 YR RI	37 mm
ULS	53 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-5

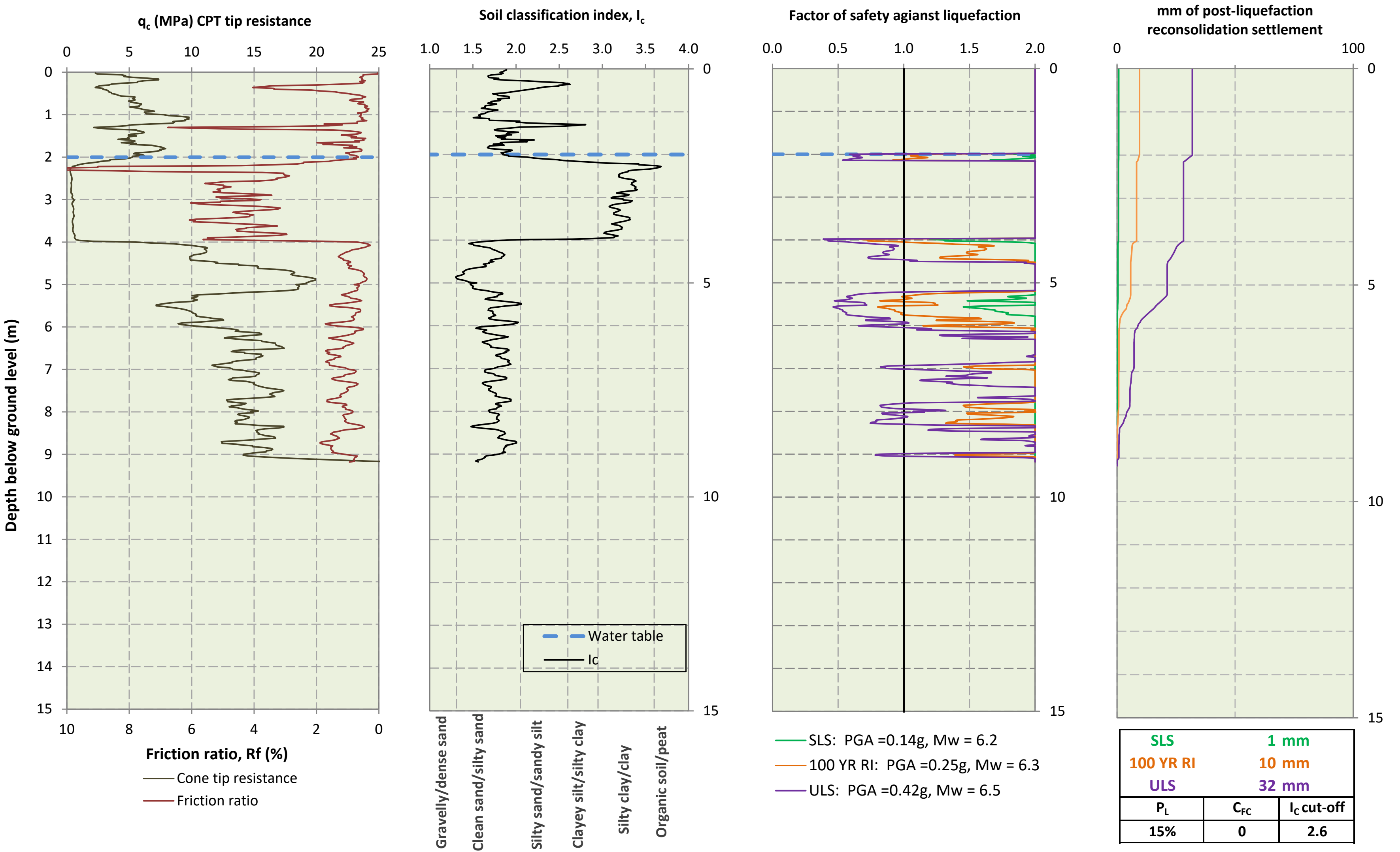
R Boulanger & I Idriss '14

Plate: E-2

Client:	Heretaunga Tamatea Settlement Trust
Project:	238 Stock Rd / 49a Dundee Dr
Job No.	1448-01-21

Analysis By:	RW
Checked By:	DD
Date:	9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	1 mm
100 YR RI	10 mm
ULS	32 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis
CPT-6

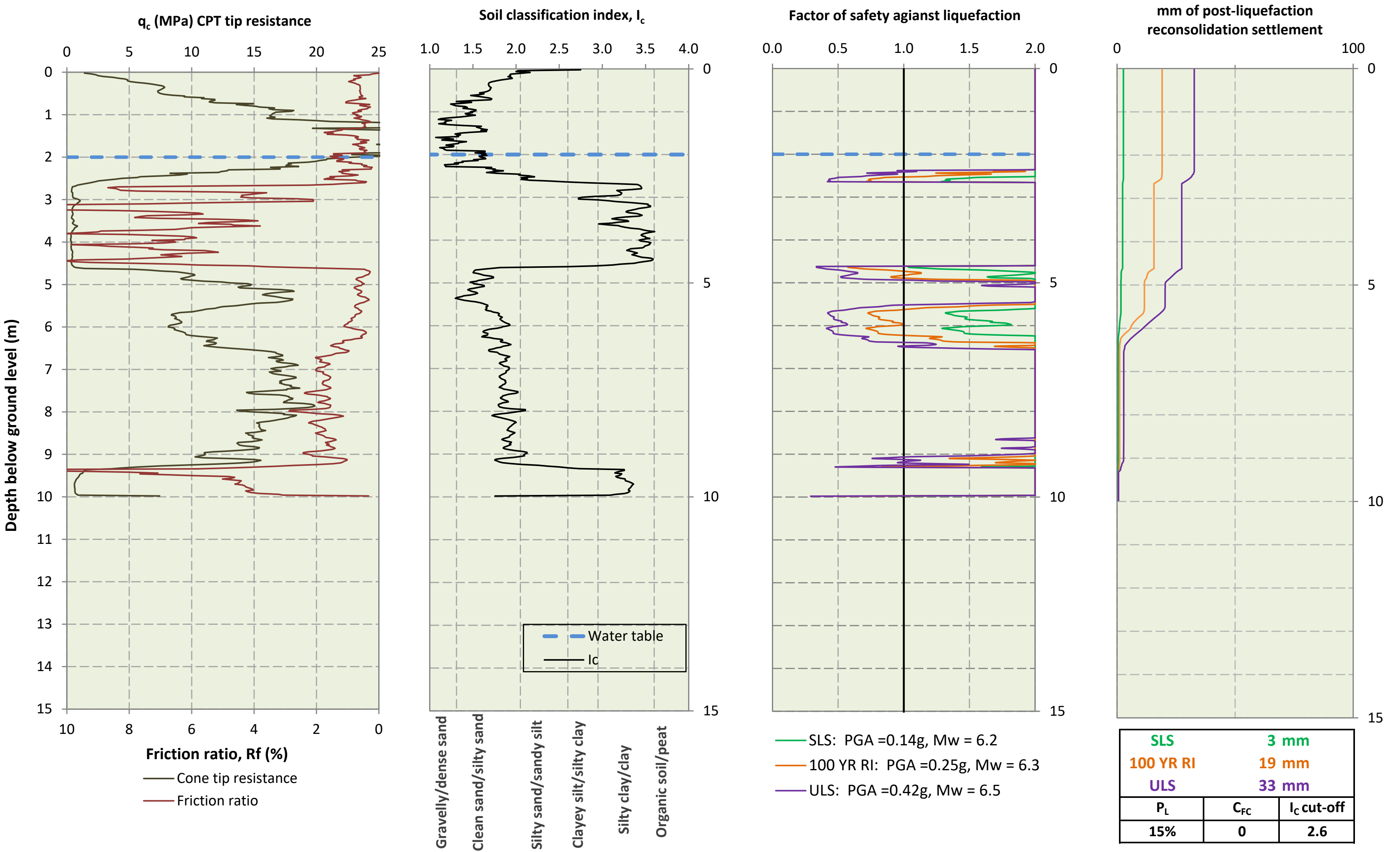
R Boulanger & I Idriss '14

Plate: E-3

Client: Heretaunga Tamatea Settlement Trust
Project: 238 Stock Rd / 49a Dundee Dr
Job No. 1448-01-21

Analysis By: RW
Checked By: DD
Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	3 mm
100 YR RI	19 mm
ULS	33 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-7

R Boulanger & I Idriss '14 **Plate: E-4**

Client: Heretaunga Tamatea Settlement Trust

Project: 238 Stock Rd / 49a Dundee Dr

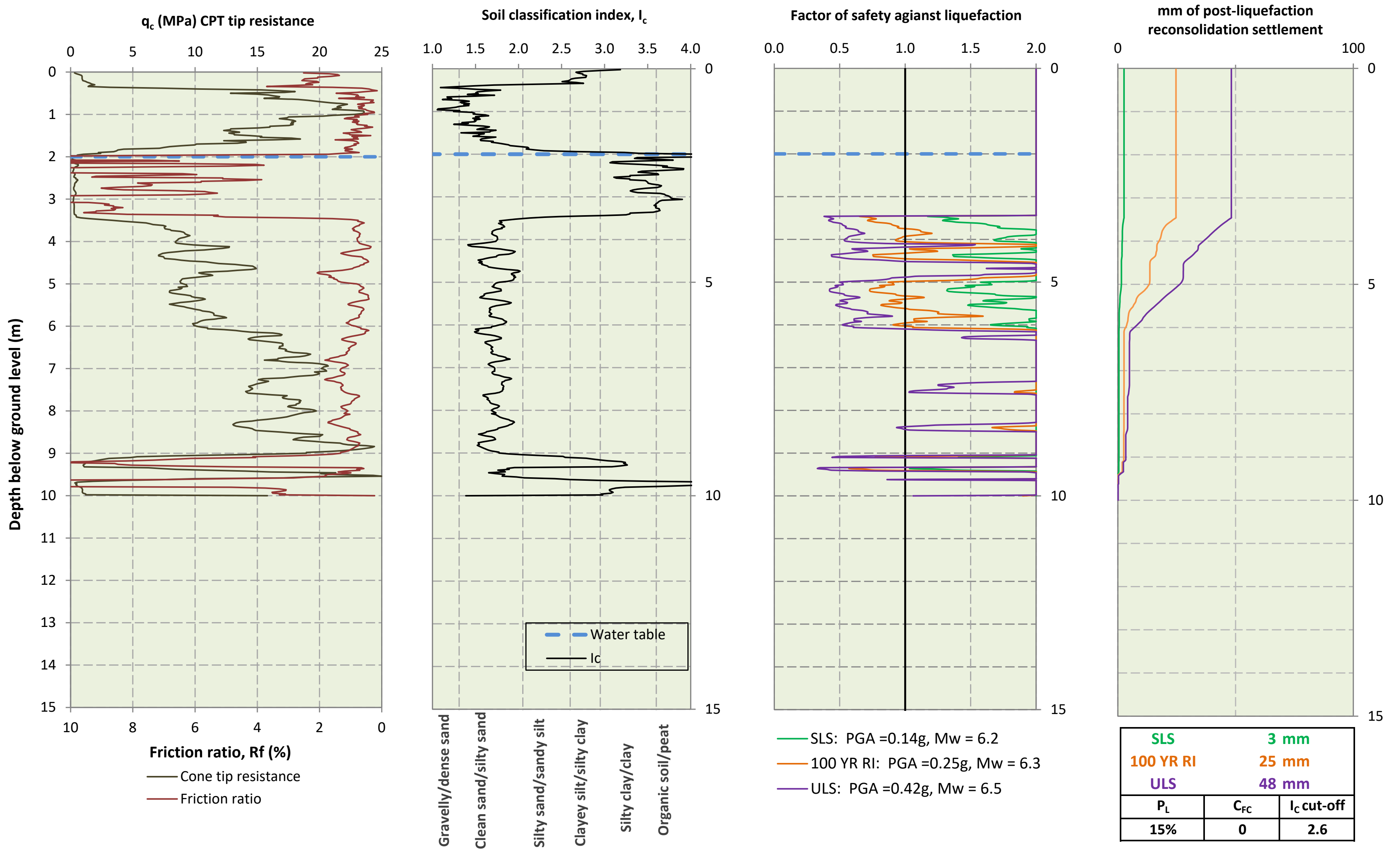
Job No. 1448-01-21

Analysis By: RW

Checked By: DD

Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	3 mm
100 YR RI	25 mm
ULS	48 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-12

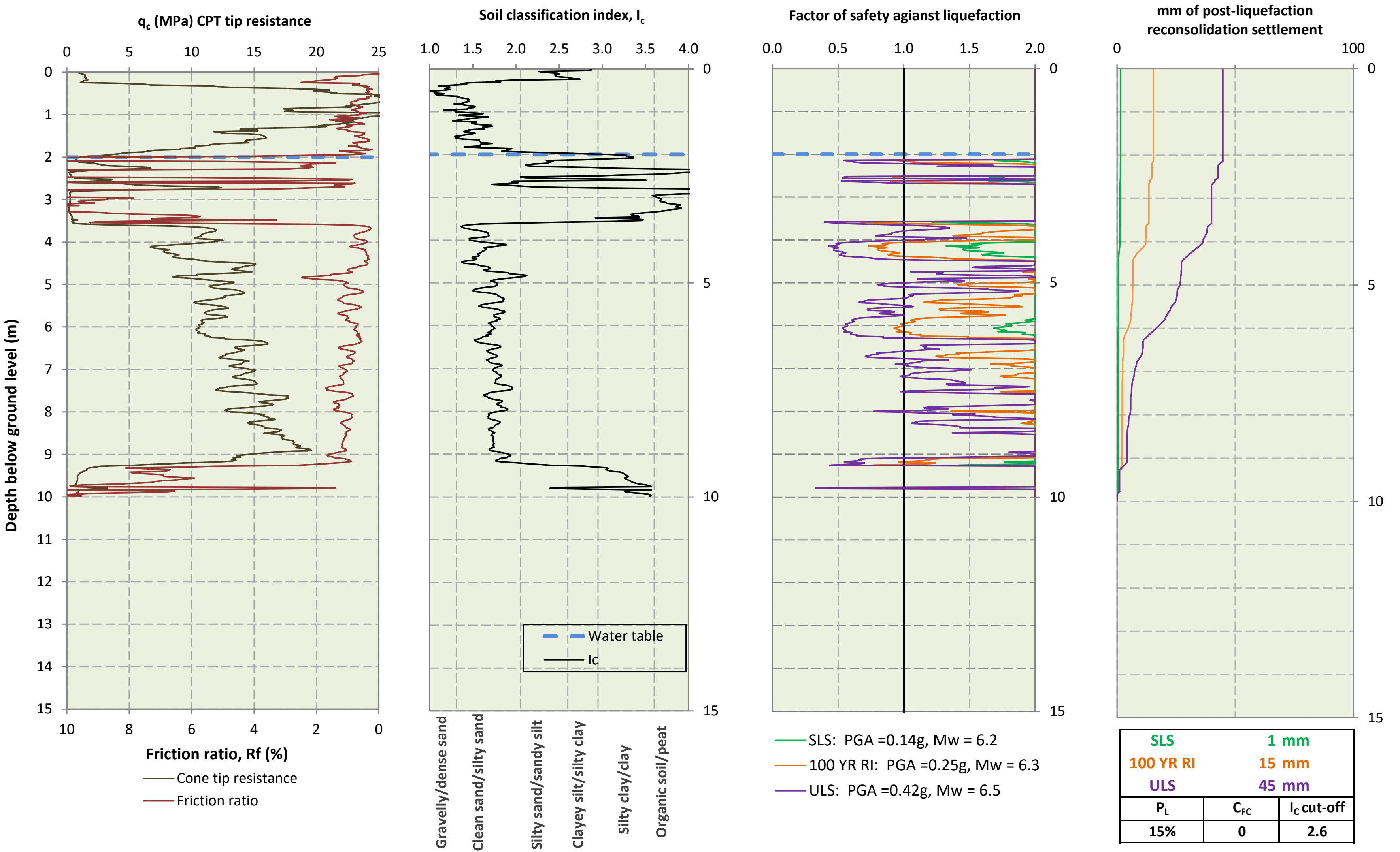
R Boulanger & I Idriss '14

Plate: E-5

Client: Heretaunga Tamatea Settlement Trust
Project: 238 Stock Rd / 49a Dundee Dr
Job No. 1448-01-21

Analysis By: RW
Checked By: DD
Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	1 mm
100 YR RI	15 mm
ULS	45 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-13

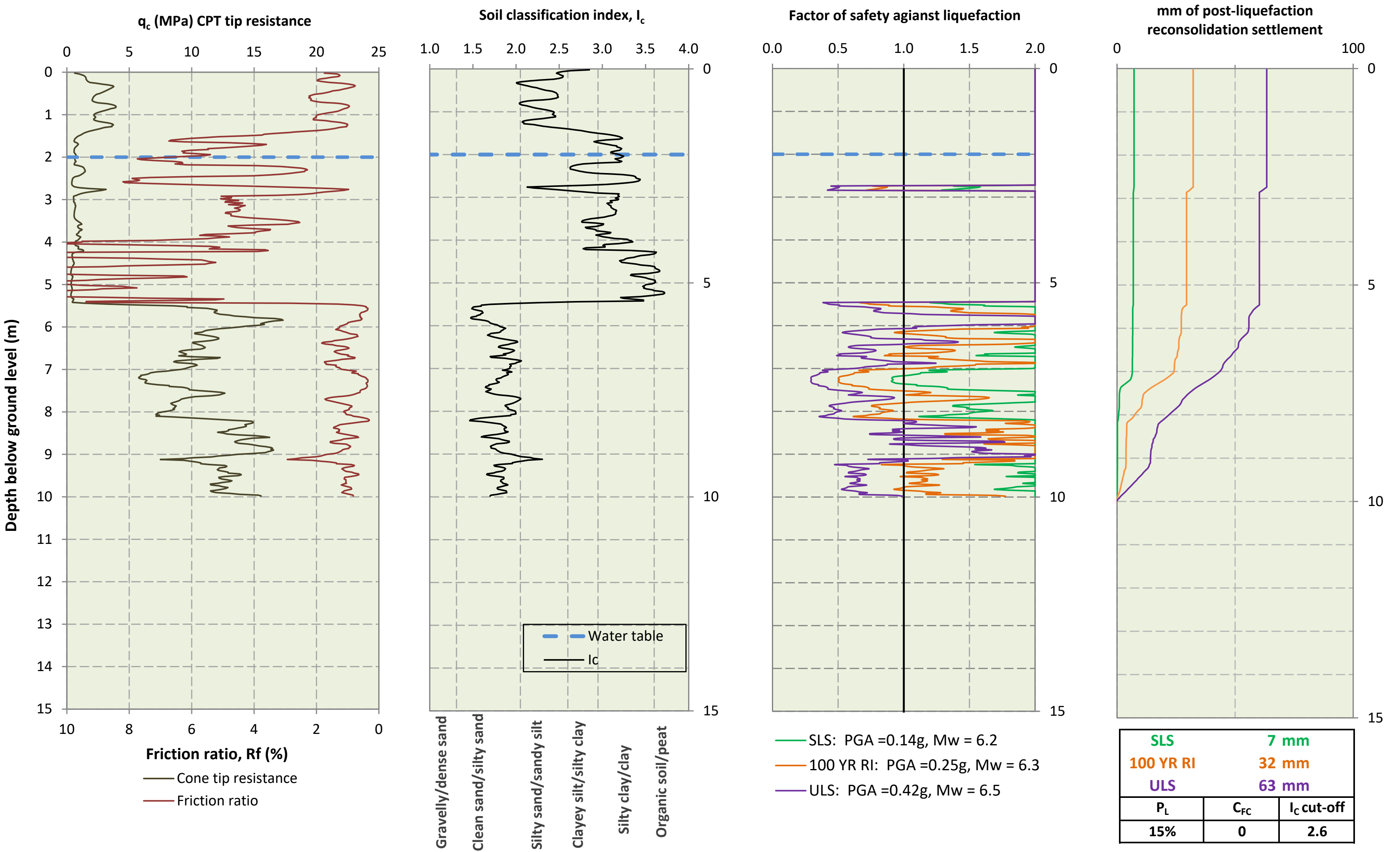
R Boulanger & I Idriss '14

Plate: E-6

Client: Heretaunga Tamatea Settlement Trust
Project: 238 Stock Rd / 49a Dundee Dr
Job No. 1448-01-21

Analysis By: RW
Checked By: DD
Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	7 mm
100 YR RI	32 mm
ULS	63 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

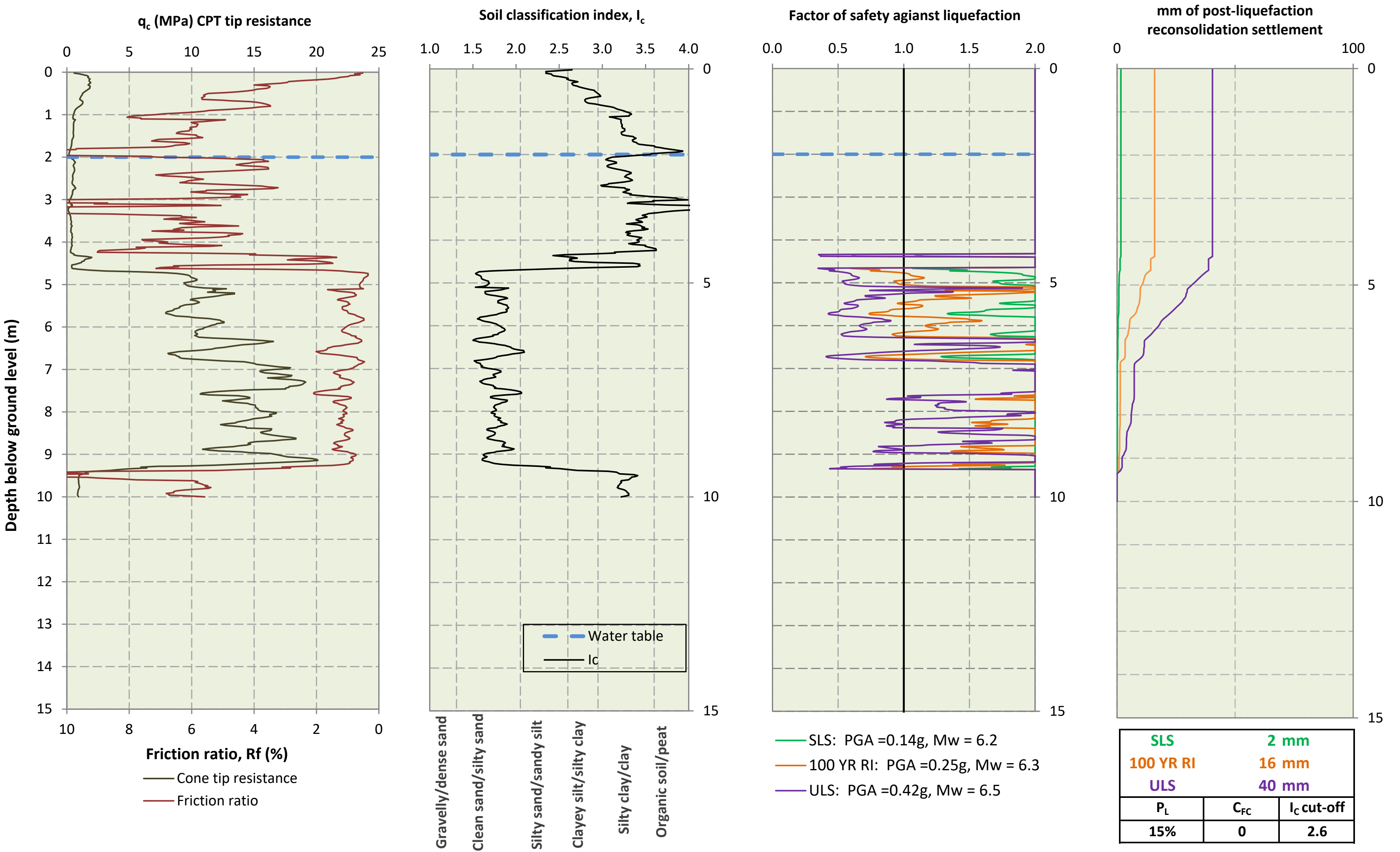
CPT-15

R Boulanger & I Idriss '14 **Plate: E-7**

Client: Heretaunga Tamatea Settlement Trust
Project: 238 Stock Rd / 49a Dundee Dr
Job No. 1448-01-21

Analysis By: RW
Checked By: DD
Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	2 mm
100 YR RI	16 mm
ULS	40 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis

CPT-16

R Boulanger & I Idriss '14

Plate: E-8

Client: Heretaunga Tamatea Settlement Trust

Project: 238 Stock Rd / 49a Dundee Dr

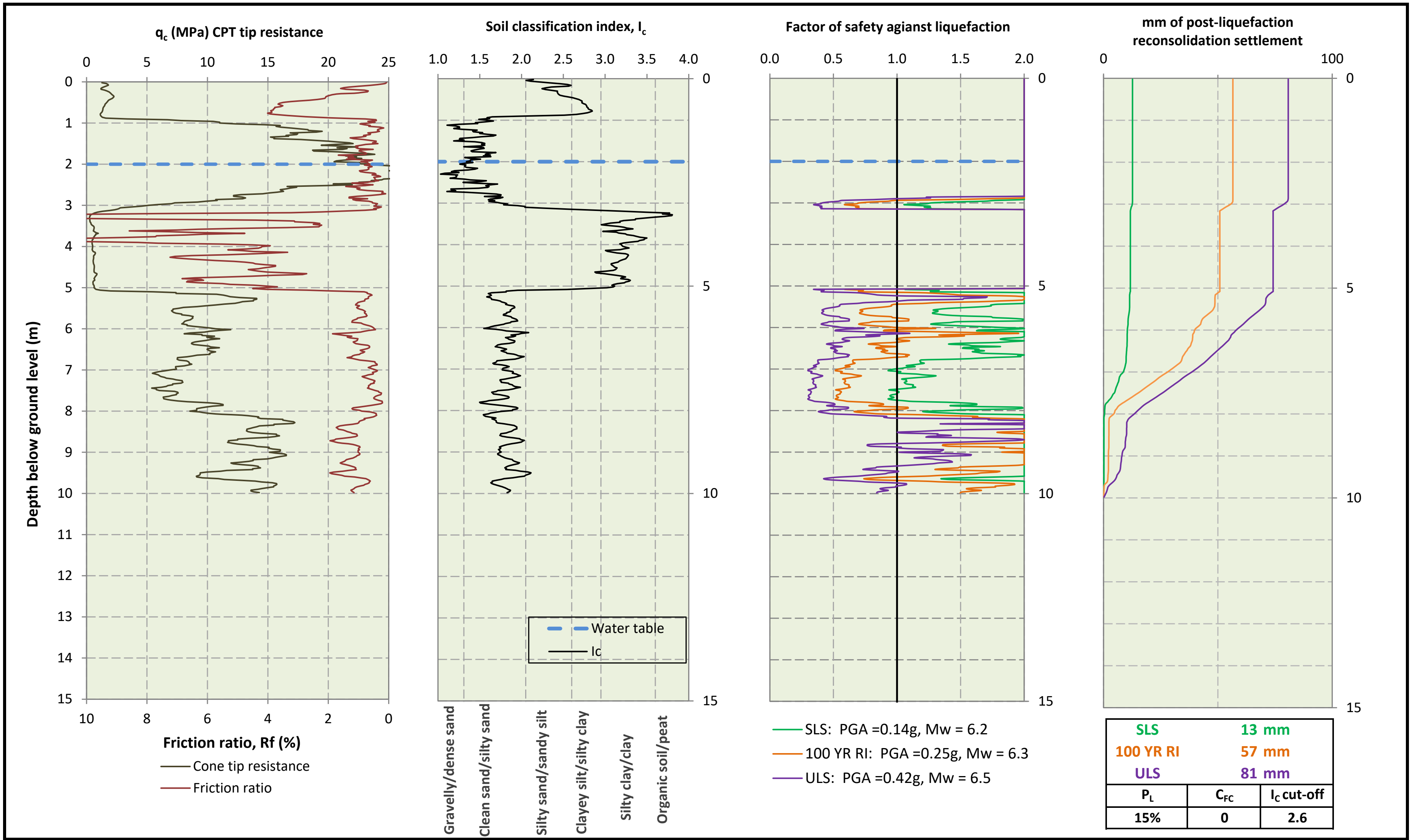
Job No. 1448-01-21

Analysis By: RW

Checked By: DD

Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS



SLS	13 mm
100 YR RI	57 mm
ULS	81 mm

P_L	C_{FC}	I_c cut-off
15%	0	2.6

Liquefaction analysis
CPT-17

R Boulanger & I Idriss '14

Plate: E-9

Client: Heretaunga Tamatea Settlement Trust
Project: 238 Stock Rd / 49a Dundee Dr
Job No. 1448-01-21

Analysis By: RW
Checked By: DD
Date: 9/09/2021

WENTZ - PACIFIC
GEOTECHNICAL ENGINEERS