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Geotechnical Investigation for Proposed Plan Change at

Fonterra Hautapu, 195 Swayne Road, Cambridge

Rev C **15 March 2024** **Job No. 230322**

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Name of Project:	Fonterra Hautapu, 195 Swayne Road, Cambridge
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Version History

Revision	Description	Date
A	For Issue	01 September 2023
B	Fixed transposed GW data PZ05/06 in Table 3 and Figure 4 Revised Aqtesolve outputs (Appendix D) and results in Table 5	09 November 2023
C	Client requested clarifications of guidelines/methods	15 March 2024

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Report Summary

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

Feature	Commentary
Proposal	We understand a plan change is proposed from 'rural' to 'industrial' land use.
RMA	No *geotechnical* natural hazards were identified (as listed in the RMA) that are considered an undue impediment to future development or that cannot be reasonably addressed by typical engineering design & construction or via ground improvement options suitable for the mitigation of liquefaction-induced settlement.
Fill	Encountered to a maximum depth of 0.5m bpgl. The backfill associated with the extensive underground irrigation network across the site is likely to contain topsoil and where this is the case, is unsuitable for re-use as engineered fill.
Natural Soils	Hinuera Formation alluvial deposits comprising intermixed loose to medium-dense sands and firm to stiff sandy to clayey silts extending to depths of at least 40m.
Unduly Weak, Sensitive, or Compressible Soils	Not encountered outside of the stream floodplain area.
Groundwater	Recorded at depths ranging between 0.1m and 3.2m bpgl at the completion of drilling, with an average recorded groundwater depth of 1.2m bpgl. Measurements within nine standpipe piezometers over a one-month period following drilling recorded groundwater at depths ranging between 0.2m and 2.4m bpgl.
Seismic Site Class	Site Class D.
Liquefaction	The site is considered to have a 'High Liquefaction Vulnerability' however liquefaction risk is considered 'Medium' under SLS conditions.
Static Settlement	Static settlement under typical industrial structures is expected to be within acceptable tolerances or able to be mitigated by common engineering practises.
Slope Stability	In general, the site is near-level to gently sloping however there are localised steep stream banks. Overall, we consider the site to be suitable for development from a 'global' land stability perspective.
Foundations	Shallow foundations are expected to be capable of supporting typical industrial structures. Designs will be required to accommodate potential static and liquefaction induced settlement or ground improvement. The extensive irrigation network is expected to require excavation and backfilling to engineered standard. Should the network be left in situ, this will require consideration at the time of foundation design. Pile foundations will likely be required to extend to depths of at least 20m to avoid liquefaction-prone soils.

1.0 Introduction

Soil & Rock Consultants (S&RC) were engaged by Fonterra Co-operative Group Ltd to carry out a geotechnical investigation at Fonterra Hautapu, 195 Swayne Road, Cambridge (Bardowie Farm) regarding a proposed Plan Change from rural to industrial land use.

Our investigation has been informed by the Resource Management Act which lists 'Natural Hazards' that shall be considered by Council when assessing a subdivision consent application.

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

1.1 Limitations

This report has been prepared by S&RC for the sole benefit of Fonterra Co-operative Group Ltd (the client), their appointed consultants, and Council with respect to Fonterra Hautapu, 195 Swayne Road, Cambridge and the brief given to us. The data and/or opinions contained in this report may not be used in other contexts, for any other purpose or by any other party without our prior review and agreement. This report may only be read or transmitted in its entirety, including the appendices.

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

2.0 Site Description

The subject site, legally described as Lot 2 DP 529042, is irregular in shape and covers an area of 71.375 Ha (see Figure 1). The property, known as Bardowie Farm, is comprised primarily of grassed paddocks, however the majority of the internal fencing has been removed. Mangaone Stream flows through the northern portion of the site in an east-to-west direction.

Built development across the site is limited to a farmhouse and garage/shed near the entrance from Swayne Road, a small pump station and workshop roughly in the centre of the site, and an ancillary pump station in the southern-central portion of the site. An extensive underground irrigation network is present across the site, with the exception of the floodplain around the stream.

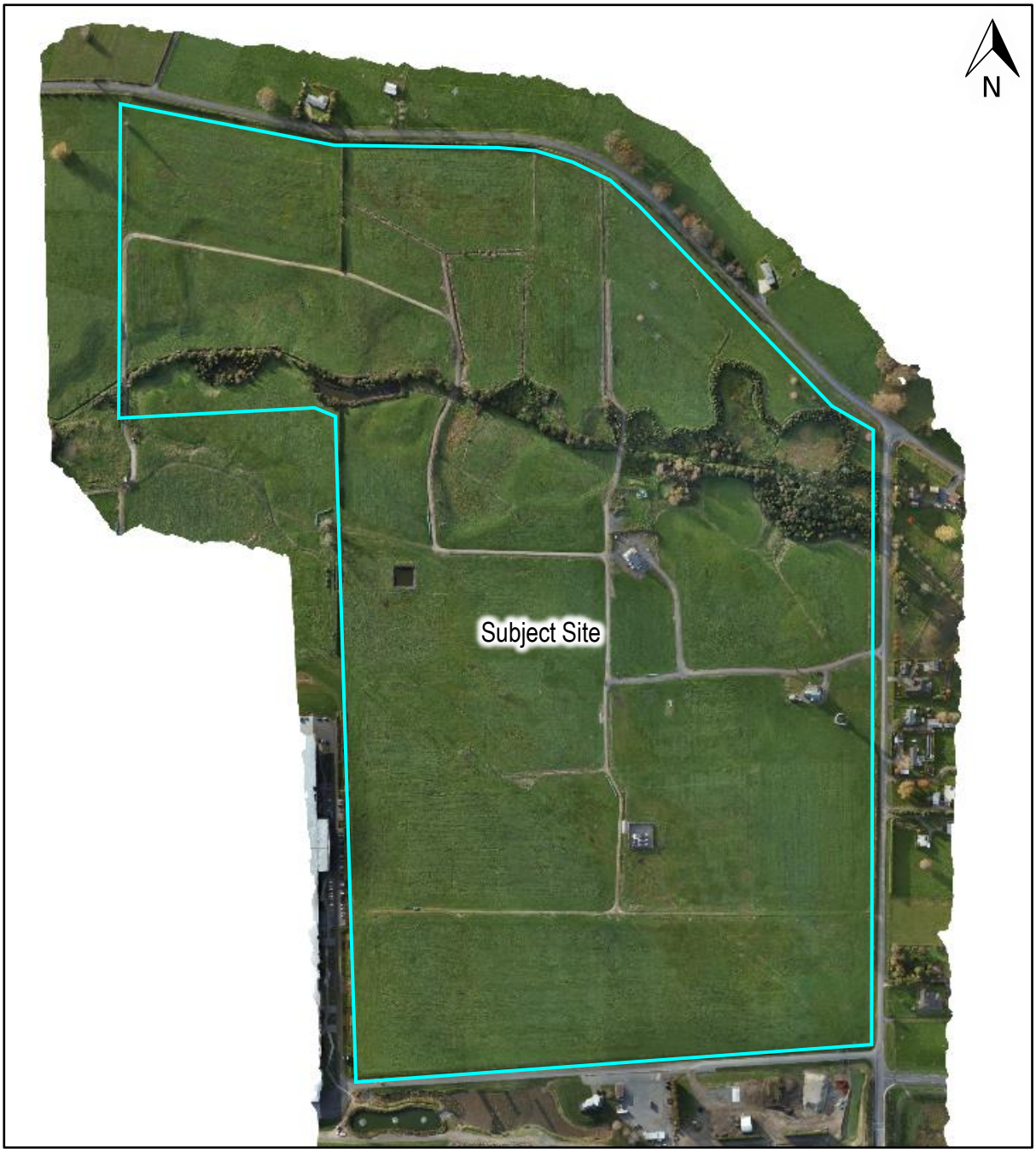

Figure 1: Aerial Image (Source: Drone Image Supplied by Harrison Grierson – Boundary Approximate)

The areas north and south of Mangaone Stream are generally near-level to very gently sloping down towards the stream. The stream channel itself is reasonably narrow (typically less than 2m wide) and surrounded by a relatively small floodplain with vegetated banks. The banks of the floodplain are typically less than 3m high and inclined at approximately 10°-12°. Short steeper slopes (up to approximately 25°) are present at the edge of the current channel, mostly in the central-western portion.

Two overhead high-tension power lines with pylons cross the site as shown on the attached Site Plan, Drawing No. 230322/1 (Appendix A).

2.1 Proposed Development

Masterplan drawings provided to S&RC indicate the site forms part of the C10 Growth Cell and a plan change rezone the land from 'rural' to 'industrial' is proposed.

3.0 Geology

Reference to the GNS New Zealand Geological Web Map 1:250,000 Geology map, indicates the site is underlain by Hinuera Formation alluvial soils of the Piako Subgroup (see Figure 1Figure 2) with recent alluvium present within the floodplain surrounding the stream. The Hinuera Formation soils are described as comprising fluvial pumiceous sand, gravel, and silt with occasional peat deposits.

Alluvial soils are often susceptible to consolidation (resulting in settlement) when subjected to foundation or fill loads, particularly where organic soils are present. Where cohesive material is dominant the soils shrink and swell with soil moisture content changes. Alluvium can be sensitive, often rapidly losing strength in response to disturbance by construction plant and/or exposure to the elements. The soils are potentially susceptible to liquefaction where sand-dominant material is present, particularly where saturated.

'Recent' alluvium as expected in the stream channel and associated flood plain is generally unsuited to use as a construction subgrade or re-use as engineered fill and is therefore usually removed from site.

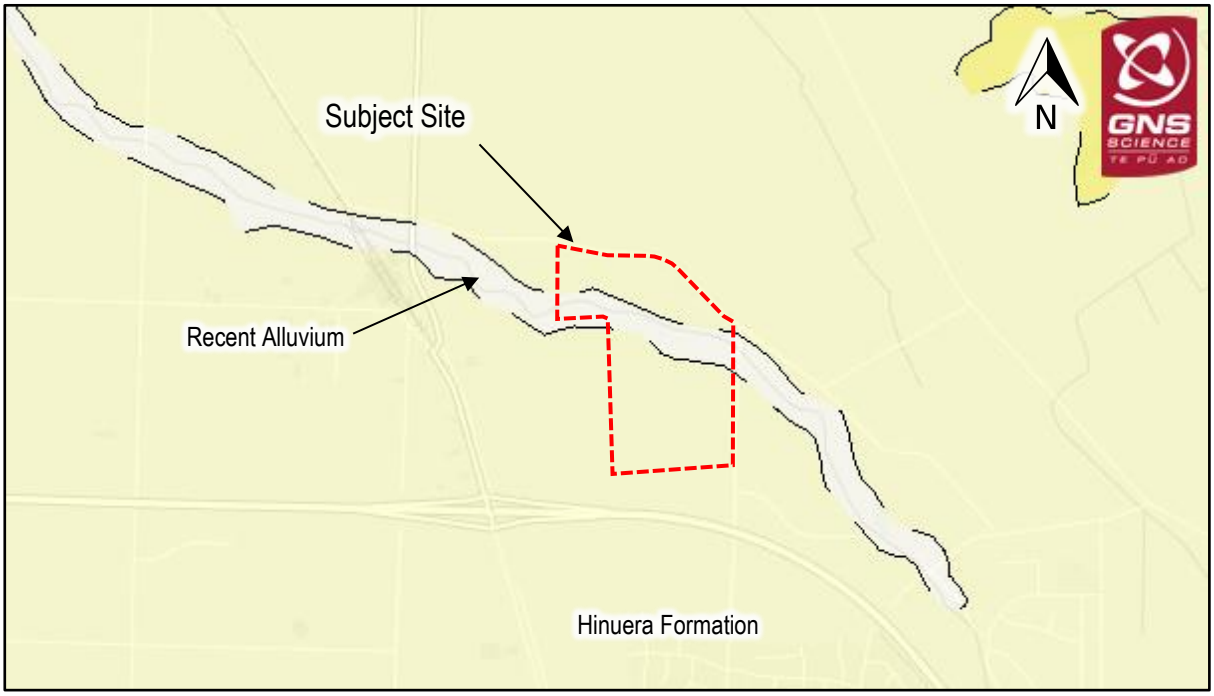

Figure 2: Geological Map (Source: GNS WebMaps Website)

3.1 NZGD Data

Reference has been made to the New Zealand Geotechnical Database (NZGD) regarding the subject site. Numerous test locations are present to the west and south of the site, and a small number of hand augerholes are shown within the site as per Figure 3.

The tests to the west of the site, largely within the footprint of the industrial building, includes Cone Penetration Test (CPT) and hand augerhole data. Further tests comprising CPTs, testpits, and machine boreholes are also present to the south of the site associated with the Waikato Expressway.

Figure 3: NZGD Test Locations (Source: New Zealand Geotechnical Database)

The available data from within the subject site comprises seven hand augerholes carried out by HD Geo in November 2019. These appear to have been undertaken to support the design and construction of the pump station. The augerholes encountered loose to medium-dense gravelly sand (Hinuera Formation) to the termination depths of the holes between 2.8m and 3.0m below ground level (bgl). Groundwater was encountered in four of the locations at depths ranging between 2.5m and 2.8m bgl.

The data from the neighbouring site to the west comprises 16 CPTs to 20m depth and 32 hand augerholes to depths typically ranging between 2.0m and 3.0m bgl, with occasional shallower holes. These tests were carried out in October 2018 by BCD Group with CPTs undertaken by Drillcore.

The hand augerhole logs show similar conditions to those encountered at the pump station within the subject site, typically loose to medium dense (Hinuera Formation) sands with lesser amounts of silt and gravel. No organic soils are noted in the logs. Groundwater was encountered at depths ranging between 1.4m and 3.0m bgl, however was not encountered at several test locations.

The CPT data indicates the loose to medium dense sands (as encountered in the augerholes) extend to depths of approximately 10m to 11m bgl. From this depth the silt and clay content of the soils increases to comprise intermixed silts, sands, and clays to the termination depths of the tests at 20m bgl. A single CPT was terminated at 12m depth bgl due to tip resistance exceeding 35MPa. Groundwater was measured within the CPT holes at depths ranging between 1.3m and 3.0m bgl.

A machine borehole to the south of the site was undertaken as part of the Waikato Expressway works by Opus Consultants (now WSP Consultants) on behalf of the New Zealand Transport Agency (NZTA) in September 2012, with drilling undertaken by Perry Geotech. The borehole extended to a depth of 40m. Loose to dense sands, sandy silts, and gravelly sands and occasional clayey silt zones were encountered to the termination depth of the borehole.

SPT ‘N’ values recorded during drilling ranged between 6 and 26 blows (typically less than 15) for 300mm of penetration over the upper 12m of the soil profile. However, between zero (where the equipment sank under its own static weight) and 9 blows per 300mm of penetration were recorded between 12m and 23m bgl, before blow counts increased to between 10 and 39 blows per 300mm penetration to the termination of the borehole.

No piezometer was installed within the borehole and no groundwater measurements are recorded on the borehole log, however the soils are logged as ‘wet’ from 0.5m bgl.

An additional borehole undertaken further to the southwest, within the nearby interchange of the expressway, was drilled in April 2008 by Opus for the SH1 NZTA Cambridge Bypass. Drilling was undertaken by Perry Drilling. The borehole was drilled to a depth of 54.5m bgl and encountered a similar profile to that outlined above, being loose to medium dense sands with increasing silt and clay content with depth. Very dense sands with SPT ‘N’ values of greater than 50 blows for less than 300mm of penetration were encountered from a depth of 47m bgl.

4.0 Field Investigation

The field investigation carried out in June 2023 comprised visual appraisal of the site and the following:

- Drilling of 55 hand augerholes (PZ01 – PZ09 and AH10 – AH55 inclusive) – Appendix B
- Installation of 9 standpipe piezometers (PZ01 – PZ09 inclusive) – Appendix B
- Machine excavation of 9 shallow testpits (TP01 – TP09) – Appendix B
- Advancement of 24 Cone Penetration Tests (CPT01 – CPT24 inclusive) – Appendix C
- Performing 9 Double Ring Infiltration tests (DRI-01 – DRI-09) within the test pits – Appendix D
- Performing 6 Soakage 'slug' tests within the installed piezometers – Appendix D

The test locations are shown on the Site Plan, Drawing No 230322/1 (Appendix A). The locations were determined from hand-held GPS and are therefore approximate only.

Measurements of undrained shear strength were undertaken in the augerholes at intervals of depth using a handheld shear vane in accordance with the New Zealand Geotechnical Society (NZGS) '*Guideline for Hand Held Shear Vane Test*', dated August 2001. Peak and remoulded vane shear strengths shown on the attached logs represent dial readings off the shear vane adjusted using the BS 1377 calibration correction factor.

A visual-tactile field classification of the soils encountered during drilling was carried out in accordance with the NZGS '*Guidelines for the Field Description of Soil and Rock'* (2005).

Dynamic Cone (Scala) Penetrometer testing was carried out in-lieu of shear vane testing where soils became sand-dominated and from the base of 25 augerholes. Scala Penetrometer testing was also carried out below the augerholes where the target depth could not be reached due to hole collapse. In these cases, testing was terminated at the target depth of the augerhole (3.0m or 5.0m depth). Elsewhere testing extended until refusal or the maximum practical testing depth of the equipment was reached. Refusal is defined as five consecutive blow counts of 10 or greater per 50mm penetration or a blow count of 20 for 50mm penetration. The results are provided in Appendix B.

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

4.1 Ground Model

In general, Hinuera Formation alluvial deposits were encountered, comprising intermixed sands and silts with lesser amounts of clay and gravel. Deposits of gravel-dominant material were encountered primarily in the southwestern portion of the site, typically resulting in early termination of the hand augerholes. Organic material was encountered to a very minimal extent outside of the stream floodplain. Isolated instances of fill were encountered, however the fill was of limited depth and inferred limited lateral extent.

The majority of our test locations are located outside of the stream floodplain as development within the floodplain is expected to be of limited extent. The average hand augerhole depth was 2.3m with further penetration typically prevented due to hole collapse. Subsurface conditions have been interpolated between the test locations and localised variations between and away from the test locations will exist.

An outline of the soil conditions and hand augerhole investigation results is given below and summarised in Table 1, and detailed descriptions of the soils are given on the attached logs (Appendix B).

- **Topsoil.** Topsoil was encountered at each test location and to a maximum depth of 0.3m below present ground level (bpgl). The average depth of topsoil encountered during our investigation was 150mm.

- **Fill.** Fill was encountered at five locations (AH42, AH46, AH47, AH51, and AH52) and to a maximum depth of 0.5m bpgl. Each of these test locations are in the central northern portion of the site, and typically near the banks of the floodplain.

  The fill was similar in composition and consistency to the underlying natural ground, however was intermixed with topsoil in places. We infer the fill encountered to be a product of the underground irrigation network across the site and/or minor/localised farming works.

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

- **Hinuera Formation.** Hinuera Formation alluvial deposits were encountered at each test location underlying the topsoil/fill to the termination depths of the augerholes (ranging between 0.8m and 4.2m bpgl). The alluvial soils typically comprised intermixed loose to medium dense sands or silty sands and/or firm to very stiff sandy silts or silts, with lesser amounts of clay and gravel.

  Typically the near-surface (<0.5m) soils tended to be silt-dominant, with sand-dominant material encountered below, however no distinct bedding or bands have been identified and the silts and sands appear indistinctly interspersed.

Peat and/or organic soils/materials were encountered in three locations (AH10, AH14, and AH40). In AH10 this comprised a 0.1m thick deposit of fibrous silt from 3.1m depth bpgl and no other organic material was encountered. Both AH14 and AH40 were drilled within the floodplain of the stream and encountered peat and organic material/soils 2.2m and 0.7m thick respectively. In AH14 the organic soils were encountered between 0.6m and 2.8m bpgl and comprised intermixed zones of peat, fibrous or organic silt, decomposed wood fibres, and silts, generally of a very soft to firm consistency. In AH40 soft to firm Peat and decomposed wood fibres were encountered between 1.3m and 2.0m bpgl.

Gravelly soils were encountered or obstructed further hand augerhole penetration at six locations (PZ05, AH23, AH27, AH29, AH44, and AH50). Four of these tests are located in the southwest corner of the site, however fine to medium gravels were encountered across the site.

Vane shear strengths recorded within the more-cohesive alluvial soils ranged from 15kPa to greater than 200kPa where the soil strength was in excess of the shear vane dial capacity or were 'UTP' – Unable to Penetrate into the soil. However, typically the instances of 'UTP' appear to be associated with instances of non-cohesive soils and may not be representative of the actual strength of the soil. Notwithstanding the above, very stiff to hard silts and clayey silts are present in places (e.g. AH47) and the cohesive soils are typically firm to very stiff. The ratio between the peak and remoulded vane shear strengths was generally high, indicative of sensitive soils. Reference should be made to Section 6.0 of this report in this regard.

Scala Penetrometer testing carried out within the less cohesive soils during drilling recorded counts of between zero (where the equipment sunk under its own weight) and 20 blows per 100mm of penetration. However, the testing generally recorded between 1 and 7 blows per 100mm of penetration indicating a loose to medium dense consistency is typical.

- **Scala Penetrometer Testing.** Scala Penetrometer testing was carried out from the base of the majority of the augerholes. Typically testing was terminated at the intended target depth of the augerhole at 3.0m or 5.0m bpgl as the majority of the holes were unable to penetrate to this depth due to hole collapse or no recovery. In these instances, refusal was not encountered.

  Refusal, inferred to be contact with dense alluvial deposits, was encountered at depths ranging between 2.8m and 5.0m bpgl in eight locations (PZ02, AH11, AH14, AH16, AH40, AH41, AH45, and AH49). The refusal depth encountered above is not considered representative of an underlying dense stratum across the site and is instead inferred to be due to contact with disconnected and/or isolated lenses of dense material and/or increasing friction on the rods.

- **Cone Penetration Testing.** A total of 24 CPTs were undertaken across the site to depths of 15.6m or 20.6m bpgl without encountering refusal. The termination depths and groundwater levels recorded at the completion of testing are provided in Table 2.

  CPT data was processed/interpreted using the CPeT-IT software. The results generally correlate with the ground profile observed in the hand augerholes with the near-surface soils typically being silt-dominant before encountering intermixed sand and silt deposits to the termination depths of the tests.

  Cone Tip Resistance varied from near-zero to greater than 30MPa with higher tip resistance values generally encountered between 6.0m and 12.0m depth bpgl, however this was not consistent across the site. In some instances, significantly lower Tip Resistance was recorded within this depth range (e.g. CPT05) however these tests locations were within or near the stream floodplain. The higher Tip Resistances are interpreted as being within dense sand deposits where lesser amounts of silt are inferred.

  Below approximately 12.0m depth bpgl Tip Resistance typically reduced to levels of between near-zero and 10MPa, similar to the soils above 6.0m depth.

- **Groundwater.** Groundwater measurements were carried out within the hand augerholes at the completion of drilling. Groundwater was recorded at depths ranging between 0.1m and 3.2m bpgl, with an average recorded groundwater depth of 1.2m bpgl.

  Groundwater was not encountered in six locations (PZ05, AH23, AH27, AH29, AH30, and AH44) on the day of drilling. In each of these instances the augerhole depth is less than 2.0m bpgl and all of these tests (except AH30) were terminated due to gravel obstructions. We infer groundwater would be encountered at relatively shallow depths below the termination depths of each of these augerholes.

  Groundwater levels recorded within the CPT hole at the completion of testing were measured at depths ranging between 0.1m and 3.1m bpgl.

  Groundwater measurements taken on the day of drilling and following CPT testing are not always an accurate portrayal of the actual long-term groundwater table. In order to better understand the groundwater profile, standpipe piezometers were installed at nine locations (PZ01 – PZ09 inclusive) following hand augerhole drilling. Reference should be made to Section 5.0 of this report regarding subsequent groundwater monitoring following the completion of drilling.

Table 1 – Summary of Ground Conditions

Test ID	Termination		Depth of Topsoil/Fill	Strength Range		Scala Penetrometer Termination	Groundwater Depth
	Depth	Cause		Vane Shear (kPa)	Scala Blows per 100mm		
All depths measured in (m) below present ground level. (Rounded to 1 DP)							
PZ01	1.1	(HC)	0.3	102	-	3.8	0.9
PZ02	2.7	(TDTA)	0.1	71 kPa	0 – 12	3.7*	0.5
PZ03	2.3	(HC)	0.2	-	<1 – 6	6.0	2.2
PZ04	2.0	(HC)	0.1	-	<1 – 5	4.9	1.8
PZ05	2.0	(GO)	0.1	-	1 – 6	5.0	NE
PZ06	3.4	(HC)	0.3	62 – 200+	<1 – 6	5.0	0.8
PZ07	2.9	(HC)	0.2	87	3 – 8	5.9	2.9
PZ08	3.0	(HC)	0.1	67 – 103	0 – 5	6.0	2.5
PZ09	1.9	(HC)	0.2	116 – 134	2 – 13	5.0	1.2
AH10	3.4	(TDTA)	0.1	56 – 175	<1 – 5	5.0	0.9
AH11	0.9	(NR)	0.2	-	5 – 11	4.9*	0.7
AH12	4.2	(TDTA)	0.2	138	1 – 10	5.0	1.0
AH13	2.0	(HC)	0.1	-	1 – 5	5.0	1.8
AH14	3.0	(HC)	0.1	27 – 200+	-	4.0*	0.3
AH15	1.5	(NR)	0.2	153	4 – 10	5.0	1.0
AH16	3.4	(NR)	0.1	-	0 – 4	5.0*	1.8
AH17	4.1	(HC)	0.1	72 – 200+	1 – 10	5.0	0.1
AH18	2.0	(HC)	0.2	84	2 – 7	5.0	1.9
AH19	3.4	(NR)	0.1	54 – 140	2 – 8	5.0	0.8
AH20	3.2	(HC)	0.2	-	1 – 9	5.0	3.2
AH21	3.0	(TDTA)	0.1	43 – 200+	2 – 7	5.0	0.8
AH22	2.2	(HC)	0.1	-	1 – 4	5.0	2.0
AH23	1.1	(GO)	0.1	-	1 – 5	5.0	NE
AH24	3.2	(TDTA)	0.1	62 – 167	0 – 5	5.0	1.2
AH25	3.2	(TDTA)	0.1	172 – 176	2 – 8	5.0	0.8
AH26	3.0	(TD)	0.1	-	<1 – 4	NT	1.8
AH27	1.6	(GO)	0.1	-	2 – 6	3.0	NE
AH28	2.5	(HC)	0.1	-	1 – 6	3.0	2.3

Test ID	Termination		Depth of Topsoil/Fill	Strength Range		Scala Penetrometer Termination	Groundwater Depth
	Depth	Cause		Vane Shear (kPa)	Scala Blows per 100mm		
AH29	1.8	(GO)	0.1	-	1 – 5	3.0	NE
AH30	1.4	(HC)	0.1	-	1 – 3	3.0	NE
AH31	3.0	(TD)	0.1	80	1 – 10	NT	0.6
AH32	1.9	(HC)	0.1	-	1 – 4	3.0	1.8
AH33	2.0	(HC)	0.1	-	0 – 6	3.0	0.7
AH34	1.2	(HC)	0.1	-	1 – 2	3.0	0.8
AH35	3.0	(TD)	0.1	-	1 – 10	NT	0.3
AH36	2.1	(HC)	0.1	-	1 – 6	3.0	1.9
AH37	2.0	(HC)	0.2	111	1 – 5	3.0	1.5
AH38	2.6	(NR)	0.2	-	0 – 4	3.0	2.2
AH39	3.0	(TD)	0.3	49 – 150	1 – 6	NT	1.0
AH40	2.4	(TDTA)	0.2	19 – 37	-	2.9*	0.4
AH41	1.3	(HC)	0.2	183	1 – 5	2.8*	0.5
AH42	1.4	(HC)	0.2 (F)	-	0 – 2	3.0	1.2
AH43	2.0	(NR)	0.2	35 – 124	-	3.0	0.4
AH44	1.3	(GO)	0.2	-	1 – 14	3.0	NE
AH45	1.2	(NR)	0.1	15 – 17	-	3.0*	0.8
AH46	2.6	(NR)	0.4 (F)	44	4 – 8	3.0	1.1
AH47	2.8	(NR)	0.4 (F)	200+	3 – 7	3.0	1.9
AH48	1.3	(NR)	0.1	-	1.5 – 7	3.0	1.3
AH49	2.0	(HC)	0.1	-	3 – 11	3.0*	1.0
AH50	0.8	(GO)	0.1	105	4	3.0	0.6
AH51	1.2	(NR)	0.5 (F)	79	2	3.0	1.0
AH52	3.0	(TD)	0.3 (F)	25 – 125	2 – 9	NT	0.6
AH53	2.7	(TDTA)	0.2	-	<1 – 9	3.0	1.0
AH54	2.3	(NR)	0.1	17 – 39	5 – 6	3.0	0.7
AH55	1.8	(NR)	0.3	84 – 200+	4 – 20	3.0	1.6

(F) = Fill, (HC) = Hole Collapse, (GO) = Gravel Obstruction, (TD) = Target Depth, (TDTA) = Too Dense to Auger, (NR) = No Recovery

NE = Not Encountered, NT = Not Tested, * = Refusal Encountered

Table 2 – CPT Summary

Test ID	Termination Depth	Groundwater Depth*
All depths measured in (m) below present ground level. (Rounded to 1 DP)		
CPT01	20.6	0.9
CPT02	15.6	0.1
CPT03	15.6	1.0
CPT04	20.6	0.4
CPT05	15.6	0.1
CPT06	15.6	0.7
CPT07	15.6	0.5
CPT08	15.6	1.8
CPT09	15.6	1.8
CPT10	15.6	1.5
CPT11	15.6	0.6
CPT12	15.6	1.7
CPT13	15.6	1.7
CPT14	15.6	1.3
CPT15	15.6	1.6
CPT16	15.6	1.8
CPT17	15.6	3.1
CPT18	15.6	3.1
CPT19	15.6	0.7
CPT20	15.6	1.8
CPT21	15.6	2.4
CPT22	15.6	2.9
CPT23	15.6	1.1
CPT24	15.6	2.0

* Groundwater depth measured at completion of testing.

5.0 Groundwater Monitoring

Nine standpipe piezometers (PZ01 – PZ09 inclusive) were installed in hand augerholes at the completion of drilling. The augerhole/piezometer locations are shown on the Site Plan, Drawing No 230322/1 (Appendix A). The locations were determined using hand-held GPS and are therefore approximate only. Piezometer construction details are provided on the augerhole logs in Appendix B.

Groundwater level measurements were undertaken utilising downhole digital dataloggers (barometrically compensated) with readings undertaken every 30 minutes between 28 June and 24 July 2023.

Piezometer surface elevations have been estimated from the supplied Site Survey Plan by Harrison Grierson dated 12 July 2023. These elevations are compared to the measured groundwater depth to establish elevations as given in Table 3. Groundwater was not encountered in PZ03, PZ05, and PZ07 throughout the monitoring period.

Table 3 – Groundwater Elevations

Location	Ground Surface (mRL)	Groundwater Elevation (mRL)					Range (m)
		Maximum		Minimum		Mean	
		Level	Date	Level	Date		
PZ01	63.5	63.1	01 Jul	62.5	22 Jul	62.8	0.6
PZ02	60.75	60.5	01 Jul	60.3	23 Jul	60.4	0.2
PZ03	65.0	NE	-	NE	-	NE	NE
PZ04	66.0	64.3	08 Jul	64.2	12 Jul	64.3	0.1
PZ05	66.3	NE	-	NE	-	NE	NE
PZ06	65.0	64.8	02 Jul	64.5	24 Jul	64.6	0.3
PZ07	66.6	NE	-	NE	-	NE	NE
PZ08	65.2	63.0	28 Jun	62.8	23 Jul	62.9	0.2
PZ09	64.5	63.0	07 Jul	62.7	02 Jul	62.9	0.3

NE = Not Encountered

Groundwater was measured at depths ranging between 0.2m (PZ02 and PZ06) and 2.5m (PZ08) below ground level during the monitoring period with groundwater elevations ranging from 60.3mRL (PZ02 minimum) to 64.8mRL (PZ06 maximum). The range between the minimum and maximum groundwater levels recorded at any one piezometer location was typically less than 0.3m, however ranged between 0.6m (PZ01) and 0.1m (PZ04). Groundwater levels typically fell during the monitoring period.

The measured groundwater elevations are also shown in Figure 4 against local rainfall data recorded throughout the monitoring period at the Ruakura Climate (NIWA) rainfall monitoring station.

During the monitoring period the response in groundwater levels to rainfall events was minimal with groundwater levels rising by less than approximately 300mm in all piezometers and generally returning to pre-rainfall levels less than a week later.

Groundwater monitoring was carried out in mid-winter and whilst it may be expected that the upper limit of groundwater levels would occur during winter conditions, given the nature of the Waikato basin area a significant lag between high rainfall periods and groundwater levels may exist. This may result in higher groundwater levels during summer.

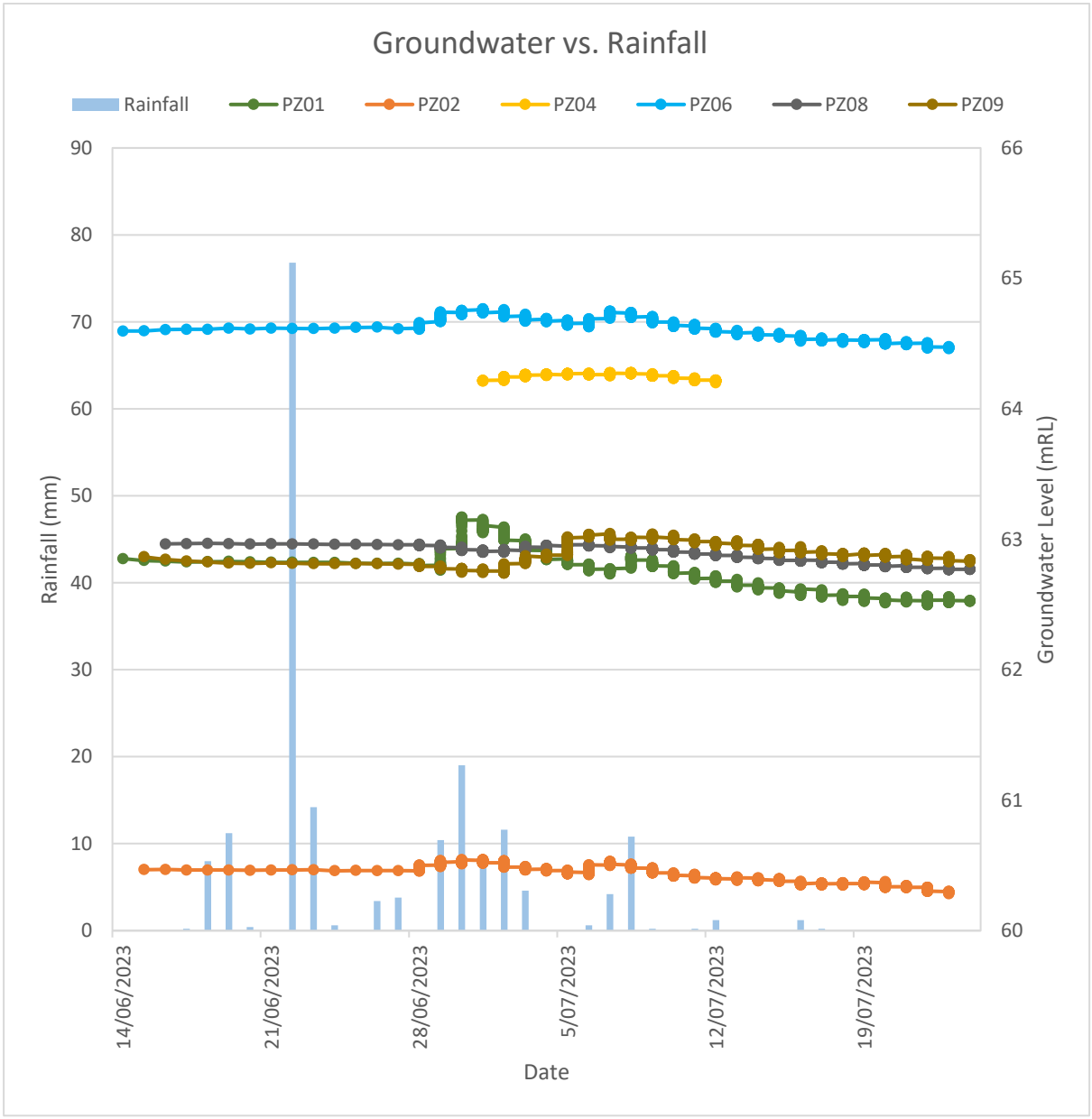

Figure 4: Hydrograph (Recorded Groundwater Levels and Rainfall)

5.1 Infiltration Testing

Nine vertical infiltration (Double Ring Infiltrometer) tests (DR01 – DR09 inclusive) were undertaken across the site to assess the vertical infiltration velocity. A summary of the test results is presented in Table 4.

The tests were undertaken within machine-excavated testpits, typically at a depth of 1.0m below ground level, except where groundwater was encountered within the testpit in which case testing was carried out at a shallower depth as shown in Table 4 and given on the calculation outputs attached in Appendix D.

Testing was undertaken in accordance with ASTM D3385-03 (Standard Test Method for Infiltration rate of Soils in Field Using Double-Ring Infiltrometer), as specified by the New Zealand Ground Investigation Specification (April 2017; Volume 1: Section 12.10).

Table 4 – Double Ring Infiltrometer Testing Summary

Location ID	Test Depth (m)	Initial Water Depth (cm)	Test Result	
			Time to stasis (minutes)	Infiltration Velocity (V_{IR}; cm/h)
DR01	0.3	5.6	NI	-
DR02	0.3	5.6	NI	-
DR03	1.0	5.6	8	252
DR04	1.0	6.0	NI	-
DR05	1.0	9.0	33	84
DR06	1.0	6.0	NI	-
DR07	1.0	5.6	7	325
DR08	1.0	5.6	6	157
DR09	1.0	6.0	16	300

NI = No Infiltration

5.2 Soakage Testing

In-situ hydraulic tests were conducted on 28 June 2023 within piezometers PZ02 through PZ06 inclusive. Slug tests (rising or falling head) were measured in each location with downhole level dataloggers. Rising Head tests were completed by rapidly removing water from the piezometer with a hand pump, Falling Head tests were completed by rapidly filling the piezometer. In both tests, continuous measurement of the returning groundwater level was carried out until static water levels were achieved (or at least to 90%).

Rising Head tests were carried out in PZ02 and PZ06, Falling Head tests were carried out in PZ03, PZ04, and PZ05.

To calculate the hydraulic conductivity of the material at each location, the recorded data was analysed using the Aqtesolv software package utilising the Bouwer & Rice (unconfined aquifer) and Hvorslev (confined aquifer) methods. The results of the analyses are presented in Table 5 and the calculation outputs are attached in Appendix D.

Table 5 – Hydraulic Conductivity Testing Results

Piezometer ID	Bouwer & Rice Method m/sec	Hvorslev Method m/sec	Average
PZ02	1.20E-07	1.20E-07	1.20E-07
PZ03	4.76E-06	7.93E-06	6.35E-06
PZ04	4.78E-06	6.27E-06	5.53E-06
PZ05	4.40E-06	6.09E-06	5.25E-06
PZ06	1.99E-07	1.42E-07	1.71E-07
Average	2.85E-06	4.11E-06	3.48E-06
Overall Average	**3.48E-06**		

6.0 Sensitive Soils

The site soils are generally sandy and particularly susceptible to mechanical disturbance and/or exposure to the elements. These soils can test well in-situ but perform poorly when construction is underway. Care is therefore required during development works to ensure the soils are protected to ensure favourable short and long-term subgrade and foundation performance.

7.0 Seismic Design Parameters

The site is not a Class A, B or E site as defined by NZS 1170.5:2004. Based on nearby borehole data (see Section 3.1 of this report), the depth of soils exceed that listed in Table 3.2 of the standard for loose non-cohesive soils (i.e. greater than 40m). We therefore consider the site to be classified as a ‘Class D – Deep or Soft Soil Site’.

The Peak Ground Acceleration (PGA) values adopted for stability and liquefaction analysis of the site with respect to Importance Level 2 structures are 0.28g (ULS) and 0.1 (SLS) with an effective earthquake magnitude of 5.9. These values have been adopted based on MBIE/NZGS Module 1 guidance.

7.1 Liquefaction Vulnerability

Reference to the Waikato Regional Hazards Portal indicates the site has been subject to a Level A (Basic Desktop Assessment) as defined in the Ministry of Business, Innovation and Employment (MBIE) '*Planning and engineering guidance for potentially liquefaction-prone land Resource Management Act and Building Act aspects'* document dated September 2017.

The site has been classified by Council as 'Liquefaction Damage is Possible' under their Level A assessment. As 'commercial or industrial development' is proposed, Table 3.5 of the above document indicates a Level B assessment is required to support a plan change application.

The CPTs, hand augerholes, and groundwater monitoring undertaken during our investigation and reference to the data available from the NZGD (per Section 3.1 of this report) satisfy the requirements for informing a Level B assessment as per the MBIE guidelines. In addition, we have undertaken preliminary quantitative analyses to assess liquefaction risk.

Quantitative Assessment

Quantitative analyses of liquefaction potential utilising the GeoLogismiki CLiq software were carried out based on the method of Boulanger & Idriss (2014) following the Zhang et. al. (2002) procedure to determine possible ground subsidence during design seismic events. Analyses have been carried out for Ultimate Limit State (ULS – 1:500-year return period) and Serviceability Limit State (SLS – 1:50-year return period) design seismic events. The analysis outputs are attached in Appendix C.

As the majority of the site is generally near-level, lateral displacements were assessed only for those CPT locations within approximately 50m of the stream channel/banks, i.e. CPT04 – CPT06, and CPT 11 & CPT12. Lateral displacements have not been assessed at the other CPT locations where the ground surface is near-level to very gently sloping. A groundwater depth of 0.5m bpgl has been adopted for each CPT location. The 'actual' groundwater depth will vary seasonally.

Liquefaction Conclusions

The analyses indicate vertical liquefaction-induced settlements are projected to range between 129mm and 390mm under a ULS design event, and from <3mm to 52mm under an SLS design event. Lateral displacements are projected to range between 263mm and 2.0m under a ULS design event, and between 10mm and 128mm under an SLS design event.

Based on the results above and the findings of our geotechnical investigation and groundwater monitoring, the site is considered to have a 'High' liquefaction vulnerability, with a 'Medium' liquefaction risk under SLS conditions.

The requirement for a ULS event is that the general structure does not collapse, and non-structural components do not cause a hazard to human life. Each event is not expected given built development in the immediate vicinity of the stream bank will require some form of erosion protection and/or instability mitigation that will have a positive effect on liquefaction potential.

8.0 Slope Stability

Qualitative Assessment

The ground surface across the site is generally near-level to very gently sloping. Whilst steeper slopes are present around the stream channel, these slopes are of limited height (<3m) and of a localised lateral extent. Any associated instability is therefore considered to be of a localised nature and limited to minor failures of the near-surface soils forming the stream banks i.e., unlikely to affect structures.

At the time of our investigation no visual evidence of major, deep-seated instability was identified.

Quantitative Assessment

To quantitatively check the overall stability of the stream bank slopes, stability analyses have been undertaken for the existing topography through cross sections A-A' and B-B' as indicated on the Site Plan, Drawing No. 230322/1.

The RocScience Inc. SLIDE2 software was used for stability analyses. Stability of theoretical circular surfaces was assessed using the Spencer method.

Stability analyses have been undertaken for the measured groundwater, extreme (worst credible) groundwater, and seismic conditions. The measured groundwater condition has been adopted for the seismic condition. Peak Ground Acceleration (PGA) values for the region have been determined as per Section 7.0 of this report.

Lower-bound effective stress parameters used for our analyses are summarised in Table 6. These have been developed from the soil description, in-situ strength testing, limited back analysis, and our experience with these soil types in the wider region.

Table 6 – Effective Stress Parameters

Soil Type	Estimated Unit Weight γ (kN/m³)	Effective Cohesion on the Failure Plane c' (kPa)	Effective Angle of Internal Friction ø' (°)
Hinuera Formation Alluvial Deposits	18	2	30

The ratio of resisting forces to disturbing forces is presented as a 'Factor of Safety' (FOS) against slope instability occurring. A FOS of 1 indicates a slope near or at equilibrium. The minimum factors of safety typically acceptable to Council are provided in the 'Required' column in Table 7 alongside the calculated FOS results.

Table 7 – Stability Analysis Results

Section	Modelled Conditions	Global Factor of Safety		Compliant
		Required	Calculated	
A-A'	Measured Groundwater	1.5	2.7	Yes
	Extreme (Worst Credible) Groundwater	1.3	1.9	Yes
	Seismic Loading	1.0	1.0	Yes
B-B'	Measured Groundwater	1.5	2.0	Yes
	Extreme (Worst Credible) Groundwater	1.3	1.8	Yes
	Seismic Loading	1.0	1.1	Yes

Stability Conclusions

The global minimum FOS results in Table 7, and as shown on the outputs in Appendix E, are greater than or equal to the typical Council requirements for all modelled scenarios.

We therefore consider the site to be suitable for development from a global land stability perspective contingent upon the recommendations of this report being adopted in design and construction.

Specific assessment is recommended where development is proposed adjacent to or over (in the case of bridges/culverts) the stream bank.

9.0 Static Settlement

Significant thicknesses of organic or otherwise compressible soils were not encountered outside of the stream floodplain during our investigation.

In the case of 'typical' industrial structures where foundation loads are limited to 150kPa and floor slab loads to 20kPa UDL, we consider the potential for intolerable total or differential static settlement as a result of development to be low, however this should be confirmed by specific investigation and analysis prior to detailed design of any proposed structure.

10.0 Natural Hazards Assessment

Section 106 of the Resource Management Act (RMA) requires consenting authorities to consider the possible risks that various natural hazards pose to sites where development is planned. The likelihood of each of the possible natural hazards of a geotechnical basis affecting the site has been assessed and summarised as below.

- **Earthquake.** The site is considered to have a 'High' liquefaction vulnerability and a 'Medium' liquefaction risk under SLS conditions. Reference to the GNS 1:250,000 Geology map, indicates the nearest mapped active fault is the Kerepehi Fault approximately 30km east of the site. Near-source hazards such as fault rupture are therefore not expected.
- **Coastal, Bank, and Sheet Erosion.** The site is not coastal and therefore no coastal hazard exists. The potential for sheet erosion is considered to be negligible given the site topography. Development will likely reduce runoff and any structure/earthworks in the vicinity of the stream bank will require stream bank improvement, therefore post-development erosion is likely to be less than is currently occurring naturally.
- **Volcanic and Geothermal Activity.** The site is located more than 70km from the nearest known active volcano (Rotorua Caldera). The site is therefore not considered to be subject to any unusual risk of volcanic or geothermal activity.
- **Landslip.** The overall site is gently sloping to near-level. Whilst steeper slopes exist within the banks of the current stream channel, these slopes are of limited height and lateral extent and therefore any instability is expected to be of a localised nature. Quantitative analysis outlined in Section 8.0 of this report indicates an acceptable factor of safety is present in terms of 'global' stability. No landslip inundation risk exists.
- **Subsidence.** Significant thicknesses of organic or otherwise compressible soils were not encountered outside of the stream floodplain during our investigation and the risk of intolerable static settlement or subsidence is therefore considered to be low.
- **Sedimentation.** The risk of significant sedimentation affecting the site is considered to be negligible.

No geotechnical natural hazards were identified that are considered an undue impediment to development or that cannot be reasonably addressed by typical engineering design and construction.

Natural hazards such as tsunami, inundation by flood or atmospheric hazards are not of a geotechnical nature and therefore excluded from our assessment.

11.0 Geotechnical Constraints

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

Geotechnical constraints requiring specific consideration by the development designers are outlined below. We recommend these aspects be subject to development-specific geotechnical investigation at the Resource/Building Consent stage (as appropriate).

Liquefaction

The site is considered to have a 'High' liquefaction vulnerability and a 'Medium' liquefaction risk under SLS conditions.

Our quantitative analyses indicate vertical liquefaction-induced settlements and lateral displacements are projected to exceed typically acceptable levels for built structures under ULS conditions. Under SLS conditions vertical liquefaction-induced settlements and lateral displacements are projected to be significantly less, however specific assessment will be required to determine any mitigation required.

Specific liquefaction assessment should be undertaken prior to Resource Consent application with respect to any proposed earthworks, particularly any filling.

Ground improvement in the form of reinforced gravel rafts or Rammed Aggregate Piers (RAPs) may be required to mitigate liquefaction and/or lateral spreading effects for any proposed structures, particularly in the vicinity of the stream. Pile foundations to mitigate liquefaction would necessitate pile lengths in excess of 20m to penetrate beyond liquefiable soils.

Groundwater

Groundwater was recorded within the hand augerholes at the completion of drilling at depths ranging between 0.1m and 3.2m bpgl, with an average recorded groundwater depth of 1.2m bpgl. Subsequent monitoring of nine standpipe piezometers over a one-month period recorded maximum groundwater levels of between 0.2m and 2.2m bpgl and minimum levels of between 0.45m and 2.8m bpgl. The range of groundwater level at any one piezometer over the monitoring period was typically less than 300mm.

Surface water ponding was observed in several locations across the site and the potential for groundwater ingress should be considered for any proposed excavations. Bulk excavations are likely to require dewatering during construction and given the sandy nature of the site soils, temporary support and a specific construction methodology are likely to be required for deeper excavations.

Static Settlement

Significant thicknesses of organic or otherwise compressible soils were not encountered outside of the stream floodplain during our investigation.

Whilst the potential for intolerable total or differential static settlement is expected to be low, specific investigation and analysis will be required prior to Building Consent application for any proposed structure, particularly for large commercial/industrial buildings. This may include retrieval and laboratory testing of consolidation samples to inform maximum floor loadings for such structures.

The scale or scope of any development within the stream floodplain was unknown at the time of preparation of this report. Should earthworks or development within this area be proposed, specific analysis of static settlement will be required, particularly with respect to the placement of fill. Fill placement in this area is more likely to induce settlement of the underlying ground and significant 'mucking out' of unsuitable material is likely to be required prior to filling. In addition, settlement monitoring during and following earthworks may be required.

Stream Bank Stability

Quantitative assessment of the 'global' stability of the existing topography of the stream bank returned acceptable factors of safety through two representative cross sections (A-A' and B-B'). Slopes throughout the site are typically gentle with the exception of the banks of the stream channel.

Whilst the risk of large-scale 'global' instability is considered to be negligible, development (including bulk earthworks) in the vicinity of the stream banks should be carefully considered. Specific stability analysis will be required to confirm an acceptable factor of safety is maintained during and following any proposed development.

Earthworks

The site soils are sandy (generally non-cohesive) and therefore particularly susceptible to mechanical disturbance and/or exposure to the elements. Soils of this type that test well in-situ can perform poorly when earthworks or construction are underway. Care is therefore required during development works to protect the soils to ensure favourable short and long-term subgrade and foundation performance.

The natural site soils (exclusive of the floodplain area) are generally expected to be suitable for use as engineered fill capable of achieving the requirements of NZS 4431:2022, however moisture conditioning is likely to be required in combination with a specific earthworks methodology/specification. That specification should be informed by specific testing including New Zealand Standard Compaction testing.

Bulk excavations are likely to encounter groundwater and reference should be made to the groundwater constraints section above in this regard.

Rubbish and/or offal pits were not encountered during our investigation however they could be present (albeit small compared to the scale of the site). Where these are encountered during earthworks or future development, they should be excavated and engineered fill placed.

Irrigation Network / Existing Fill

No significant thicknesses of fill were encountered during our investigation (maximum 0.5m thick), however S&RC are aware that underground irrigation is present across the site.

We understand the irrigation network was installed at a depth of approximately 600mm below ground level and we infer a 'cut and cover' construction method was used rather than thrusting. The nature of the backfill material is unknown; however, it is considered likely that topsoil will be intermixed within the backfill material such that the bulk of that material is unsuitable for re-use as engineered fill.

We infer the irrigation network and drainage channels will be remediated as part of development works. Earthworks budgeting in terms of both time and cost should assume this material will be required to be excavated and spread/placed in non-critical areas, used for 'topsoiling', or removed from site and the excavations backfilled with engineered fill. Should the network be left in situ, the likely presence of loose material within the trench/channel must be considered in earthworks and foundation design.

Bearing Capacity

The near-surface soils typically comprise loose to medium-dense sands or firm to stiff sandy silts and clayey silts, however very loose saturated sands and soft clayey silts were encountered.

Whilst an Ultimate Bearing Capacity of 300kPa is typically expected to be available, the in-situ soils may present a reduced bearing capacity (relative to the above) in some areas. Additional geotechnical investigation is required to determine the extent of such areas (if present).

Expansive Soils

The near-surface soils are typically comprised of sands or sandy silts, therefore expansive soils as defined in AS2870:2011 are not expected to be present. However, clayey silts were encountered in places and where any exposed subgrade presents such material, we recommend laboratory testing be carried out to confirm the soil expansivity classification. That testing is best carried out at the Building Consent stage as it then better reflects the actual development proposal and post-earthworks ground conditions.

12.0 Preliminary Geotechnical Design Guidance

Preliminary geotechnical guidance intended to inform concept design is provided in Sections 12.1 through 12.8 of this report. Specific geotechnical assessment is recommended to confirm or modify this guidance as appropriate for any proposed development given the constraints outlined in Section 10.0 of this report.

12.1 Earthworks

Any proposal to create cuts or fills greater than 500mm in height should be the subject of specific design advice as groundwater and settlement constraints should be assessed.

The potential for groundwater ingress should be considered for any proposed excavations. Bulk excavations are likely to require dewatering during construction and given the sandy nature of the site soils, temporary support and a specific construction methodology are likely to be required for deep excavations. Specific assessment of groundwater drawdown related settlement effects will be required should permanent dewatering be proposed.

Sumps/pumps will be required to remove groundwater from the excavations and earthworks/construction during summer is likely to be beneficial in this regard.

The site soils are expected to be suitable for use as engineered fill, however moisture conditioning is likely to be required in combination with a specific earthworks methodology/specification. That specification should be informed by specific testing including New Zealand Standard Compaction testing.

Should the use of external (off-site) earth (cohesive) fill be proposed, inspection of the material prior to importing to site is recommended in addition to a New Zealand Standard Compaction Curve to inform compaction requirements.

All fills, regardless of depth, must be placed in accordance with NZS 4431:2022 with respect to subgrade preparation and standard of compaction.

12.2 Ground Improvement

Ground improvement may be required to mitigate liquefaction and/or lateral spreading effects for any proposed structures, particularly in the vicinity of the stream. This typically comprises the installation of Rammed Aggregate Piers (RAPs) or stone columns below the load-bearing walls of proposed structures, however ground improvement ‘reinforcement’ solutions covering wider areas may be more cost-effective given the large area of potential development.

Reinforcement options typically involve the construction of underground walls which usually intersect to form a lattice. The subterranean walls can be formed using ground solidification techniques or contiguous/closely spaced concrete piles.

The use of such ground improvement methods typically results in only minor changes to traditional shallow foundation design as those foundations can be directly supported by the same.

Ground improvement can greatly increase the stiffness of the soil profile resulting in amplification of seismic accelerations at the surface and may also influence seismic wave propagation and the seismic response at neighbouring sites. Therefore, the potential effect of ground improvement on the seismic response of adjacent properties and structures should be considered in the design.

Reference should be made to the MBIE '*Earthquake Geotechnical Engineering Practice Module 5. Ground Improvement of Soils Prone to Liquefaction*' for further information regarding ground improvement design considerations. Additional investigation and laboratory testing will be required to assess and/or confirm the appropriate ground improvement method.

Following detailed geotechnical investigation, we recommend a specialist contractor assess the findings of that investigation, analyses, and report in order that a suitable ground improvement design be prepared.

12.3 Temporary Stability

The shallow depth to groundwater and loose sandy nature of the site soils will necessitate the use of temporary support if/where bulk excavations are proposed. The use of sheet piling or similar 'sealed' support systems are likely to be required for all bulk excavations including temporary excavations for service trenches. Trench shields will likely be required for all temporary excavations for service trenches deeper than approximately 1.0m.

We recommend the "*Good Practice Guidelines – Excavation Safety*" by WorkSafe New Zealand (2016) be followed by the designer and the contractor.

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

In-ground barrier-pile or 'soldier-pile' walls may be considered with respect to the stability of development areas in close proximity to stream banks, however the potential for material to 'flow through' such a wall should be considered in the design and grout curtains, multiple parallel rows, or other improvement measures may be required.

12.4 Retaining Structures

The site soils are generally suited to all types of retaining, however bored excavations for retaining poles will be susceptible to collapse due to groundwater ingress and temporary casing will be required. Mechanically Stabilised Earth (MSE) or other gravity walls are likely to be easier to construct, particularly where supporting engineered fill.

We recommend retaining systems be Engineer-designed and consider both the local and global stability of the site, and any surcharge applicable to the wall. Particular attention should be paid to the influence of building surcharges above, and sloping ground below, any retaining wall.

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

12.5 Floor Slabs and Pavements

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

Given the elevated groundwater levels observed during our investigation, any concrete floor slab or pavement is required to be underlain by a basecourse of clean, free-draining granular fill as specified by the designer.

Under-slab drainage or 'tanking' will be required should excavations below the groundwater table be proposed.

12.6 Shallow Foundations

The natural soils are generally considered suitable for the use of shallow foundations comprising 'waffle' or 'rib-raft' slabs (surface-supported, no embedment) or traditional spread footings subject to liquefaction and settlement considerations.

The use of shallow (spread) foundations is subject to site specific requirements to mitigate liquefaction risk. In the absence of broader ground improvement, reinforced gravel rafts extending outside of the building footprint are likely to be required for the purposes of mitigating intolerable liquefaction-induced settlement effects.

Any irrigation trenches within the influence zone of foundations must be excavated and backfilled to an engineered standard. The slab designer can determine whether or not this work is required for any trenches present under floor slabs.

For concept design purposes we expect a Design (Dependable) Bearing Capacity of 150kPa likely to be available for Ultimate Limit State Design of shallow foundations. However, the in-situ site soils may present a reduced bearing capacity (relative to the above) or increased static settlement risk in some areas. Additional geotechnical investigation is required to determine the extent of such areas (if present).

A Strength Reduction Factor ($Ø_{bc}$) of 0.5 has been applied to the Geotechnical Ultimate Bearing Capacity value above to determine the Design Bearing Capacity.

12.7 Pile Foundations

Pile foundations will be required where structural or civil design calls for:

- The bridging of public underground services.
- Bearing capacity requirements greater than those available for shallow foundations.
- Significant depths of non-engineered fill or other unsuitable material to remain in-situ.
- The mitigation of intolerable static or liquefaction-induced settlement.
- Existing irrigation/drainage trenches in close proximity to foundations remain in situ

The use of pile foundations is expected to necessitate pile lengths in excess of 20m to penetrate beyond liquefiable soils. Specific geotechnical investigation in the form of machine boreholes and detailed analysis is recommended to inform pile design parameters and design should be followed by installation of ‘test’ piles.

Where practical (in terms of pile length) driven piles are recommended as pile excavations that penetrate groundwater or very loose sands will be susceptible to collapse and casing will be required, likely over the full length of the pile.

12.8 Stormwater

Concentrated flows from all impermeable areas (roofs, guttering, impermeable pavements, etc.) must be collected and carried in sealed pipes to a disposal point approved by Council. Stormwater flows of this nature must not be allowed to saturate the ground as this could adversely affect foundation conditions.

13.0 Underground Services

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

We reiterate that trench shields will likely be required for all temporary excavations for service trenches deeper than approximately 1.0m due to the shallow depth to groundwater and presence of loose sandy soils. Shallower support or wide battering of trenches may be required where the groundwater is particularly shallow.

14.0 Further Work

This report has been prepared to support a plan change. Specific geotechnical investigation is recommended, as outlined within this report, prior to application for Subdivision/Resource and Building Consent.

The purpose of such additional investigation is to mitigate the risk of the geotechnical constraints discussed in Section 11.0 of this report, confirm or modify the preliminary geotechnical design guidance provided in Sections 12.1 through 12.8 of this report, and provide geotechnical design parameters suitable to inform preliminary and detailed earthworks/foundation design.

End of Report Text – Appendices Follow

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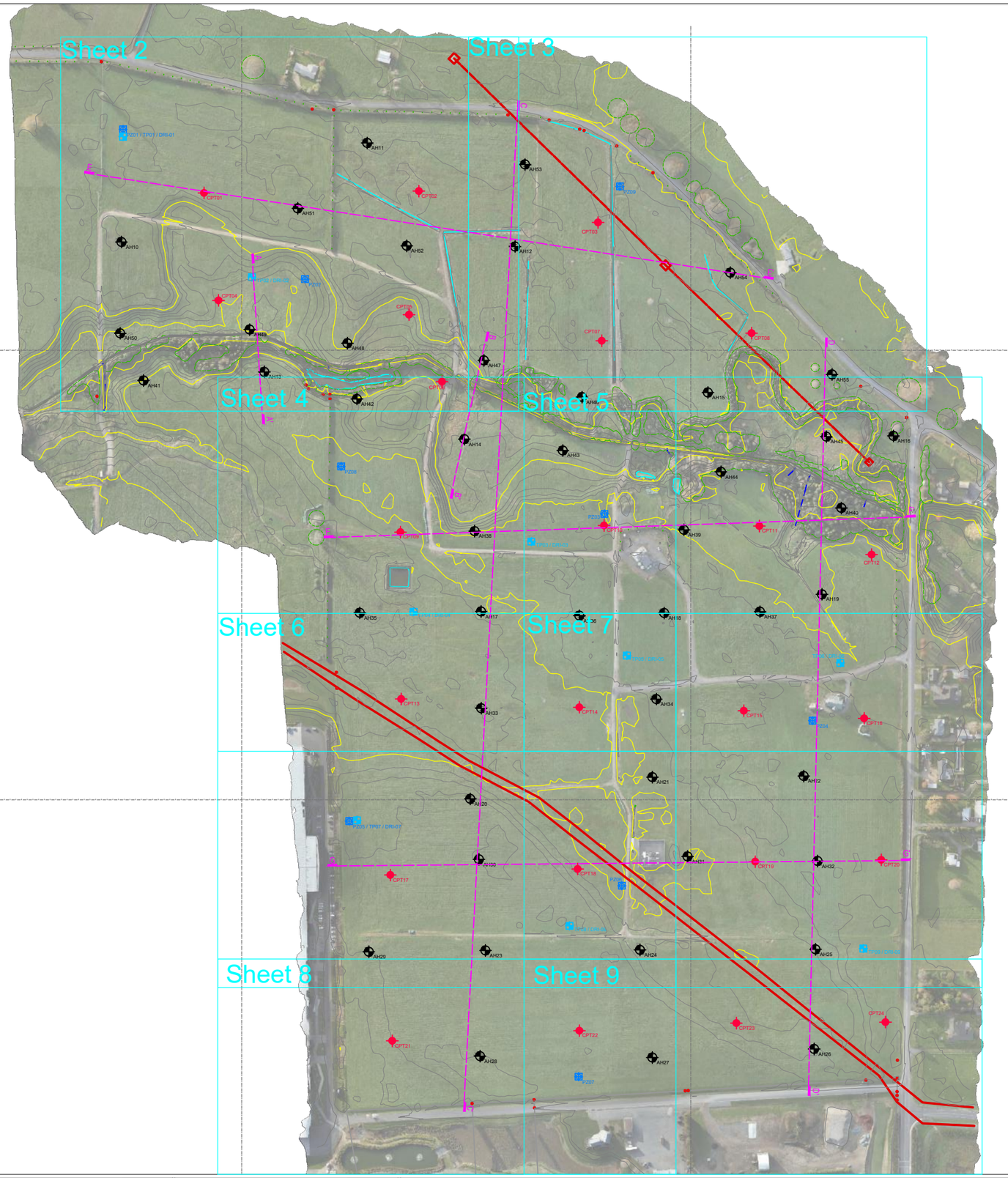
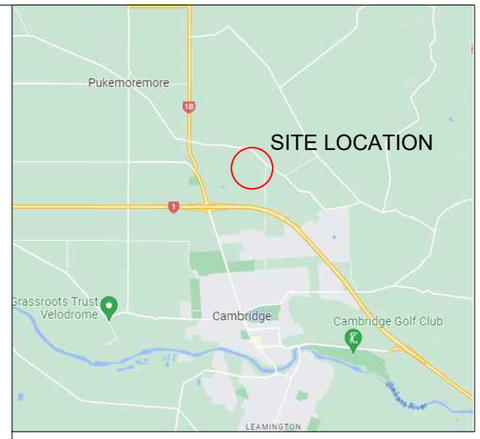
Appendix A

Drawings





LOCATION MAP

NOTES:

1. Locations of features approximate only.
2. Location of all buried services to be verified prior to construction.
3. Original sheet size A3.
4. Boundary information on this Site plan adapted from Auckland Council Aerial Photographs and/or GIS Data.
5. Underground Services not shown.

KEY:

- Overhead Power
- Site Boundary
- Contour - Major
- Contour - Minor
- AH01 — Approximate Hand Augerhole Locations, Soil & Rock Consultants, June 2023
- AH01 — Approximate Standpipe Piezometer Locations, Soil & Rock Consultants, June 2023
- TP01 — Approximate Testpit / Double Ring Infiltrometer Locations, Soil & Rock Consultants, June 2023
- CPT01 — Approximate Cone Penetration Test Locations, Soil & Rock Consultants, June 2023
- A — A' — Approximate Cross Section Locations, Soil & Rock Consultants, June 2023

AMENDMENTS		
DATE	REV	DESCRIPTION

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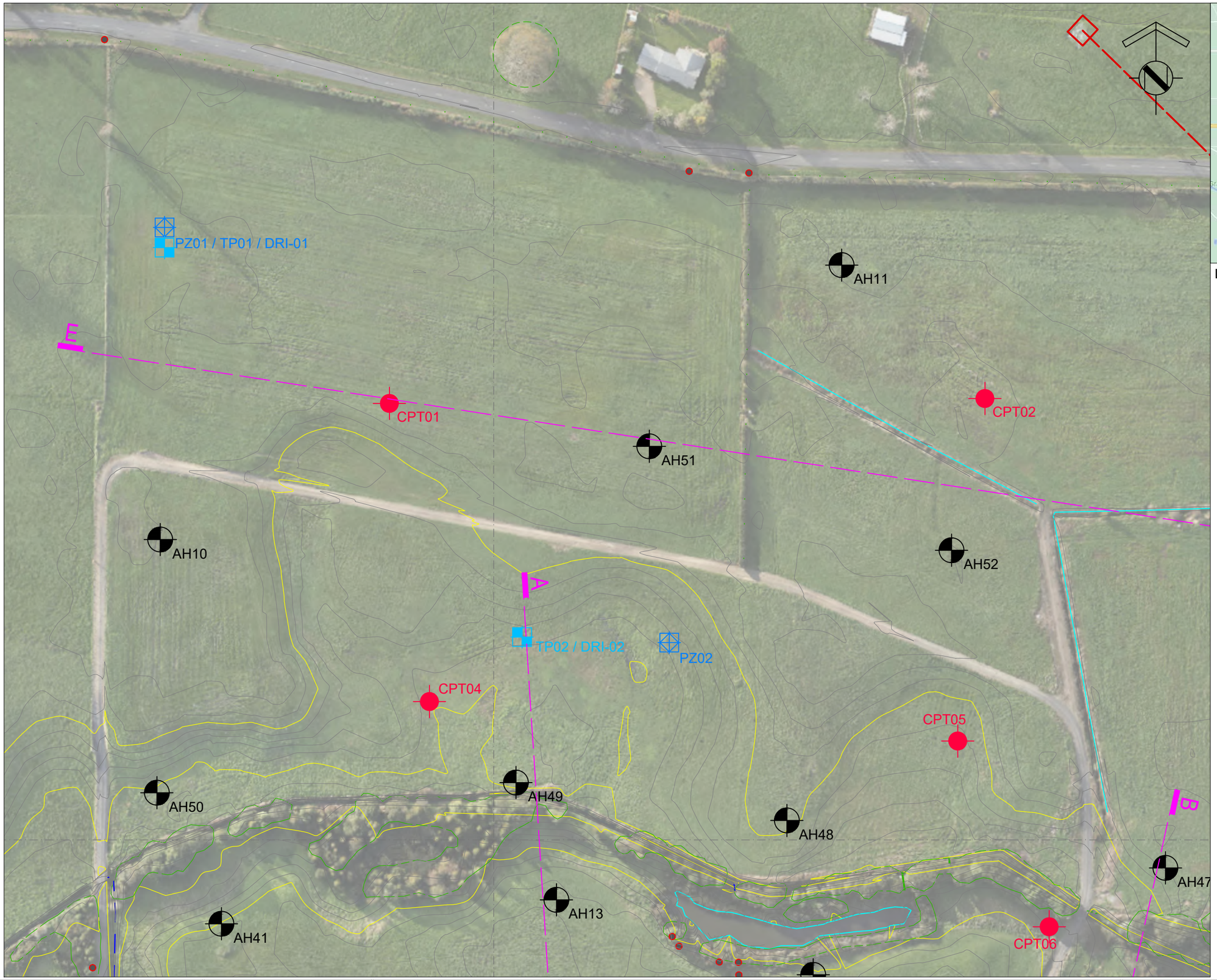
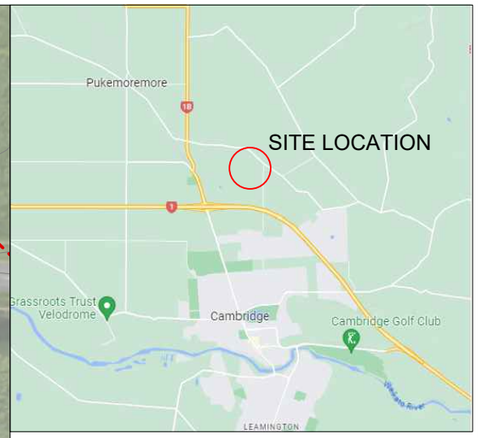
FONTERRA HAUTAPU
195 SWAYNE ROAD
CAMBRIDGE

SITE PLAN
SHEET 1

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 5000 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - site plan -aug2023.dwg		





LOCATION MAP

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5. Underground Services not shown.

KEY:

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- CPT01 — Approximate Cone Penetration Test Locations Soil & Rock Consultants, June 2023
- A A' — Approximate Cross Section Locations Soil & Rock Consultants, June 2023

AMENDMENTS		
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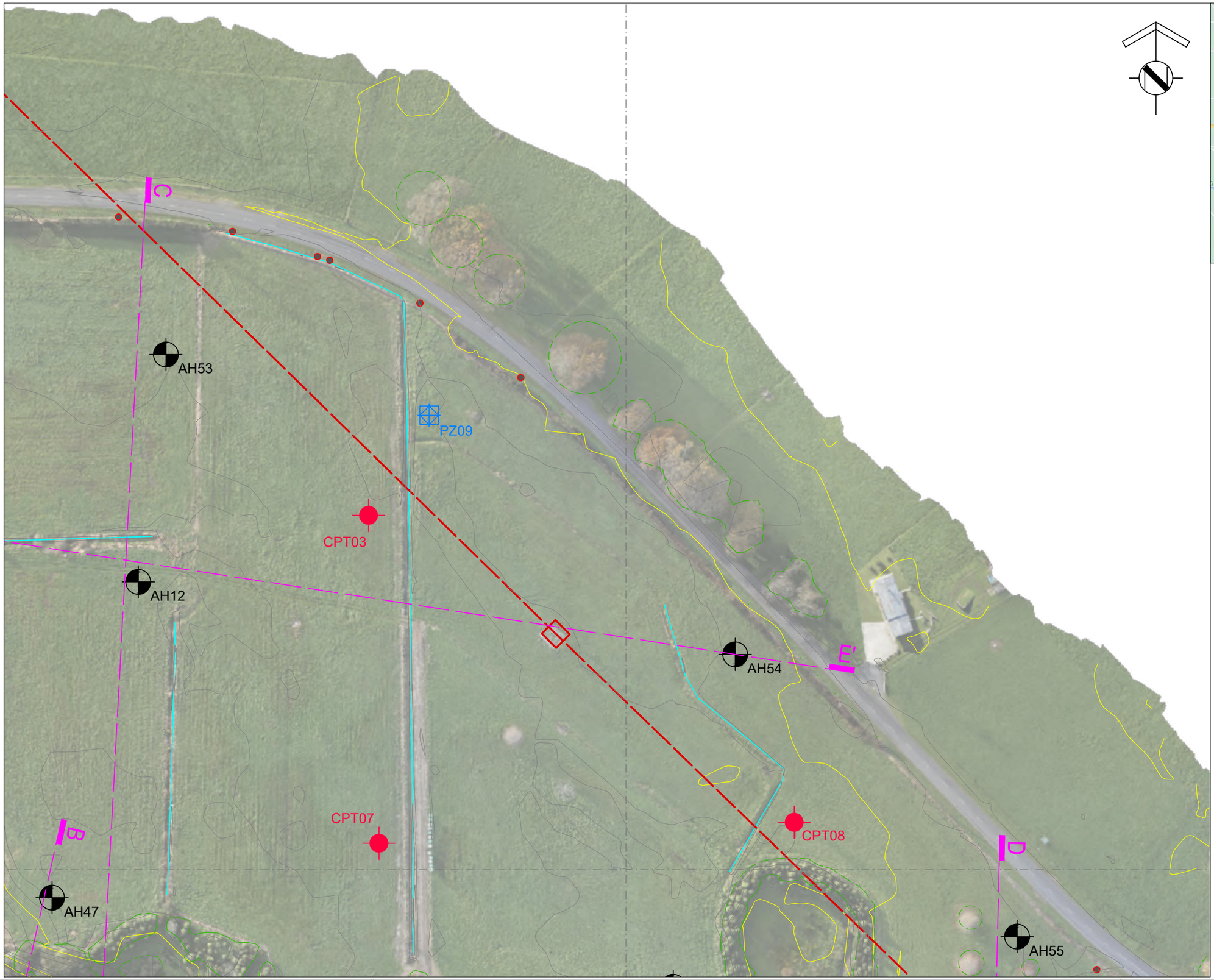
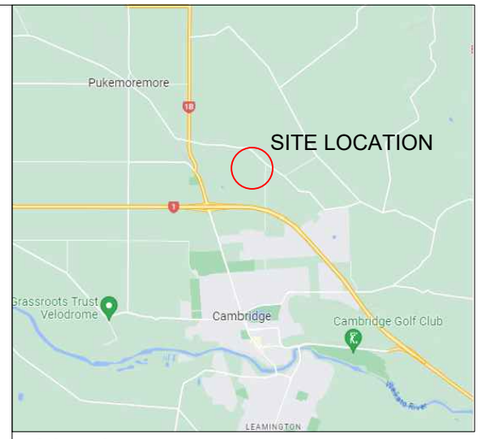
FONTERRA HAUPATU
195 SWAYNE ROAD
CAMBRIDGE

SITE PLAN
SHEET 2

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - site plan -aug2023.dwg		





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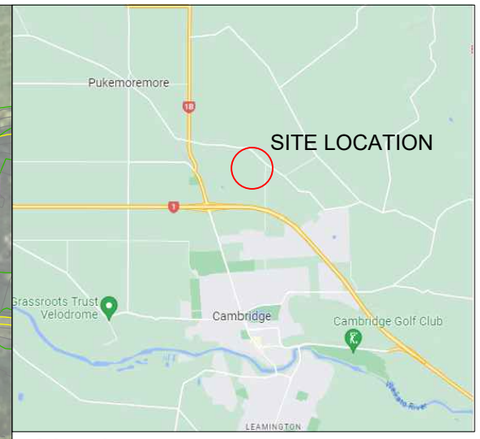
SITE PLAN
SHEET 3

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - site plan -aug2023.dwg		



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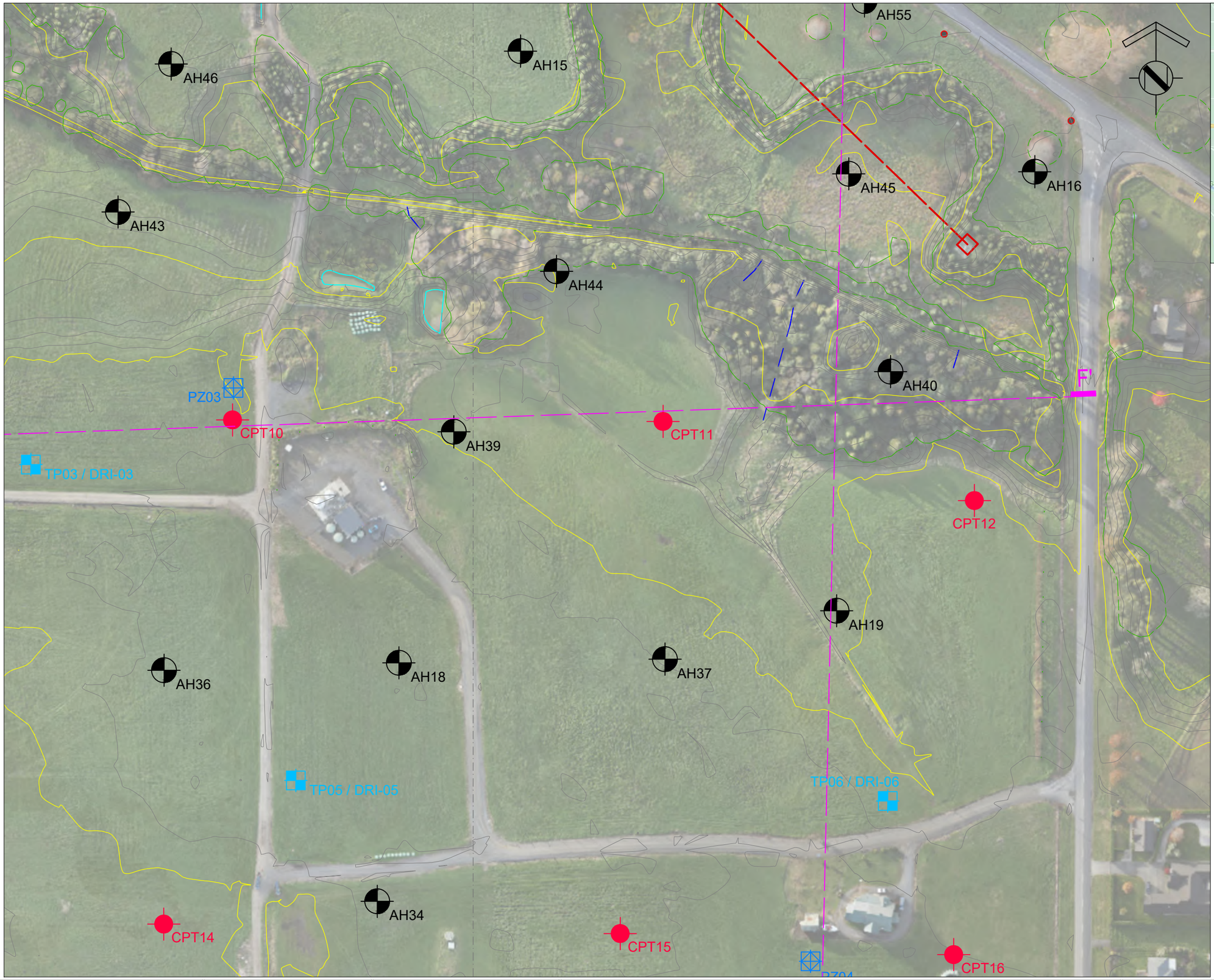
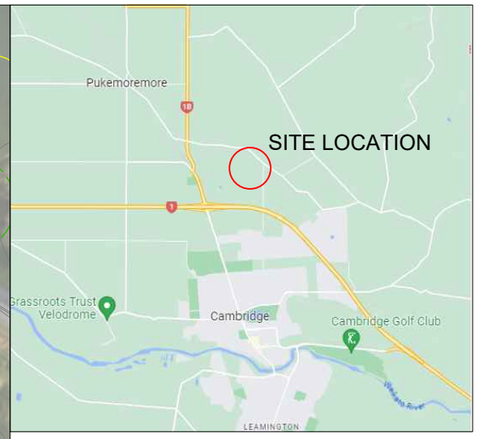
SITE PLAN
SHEET 4

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 230322 - site plan -aug2023.dwg





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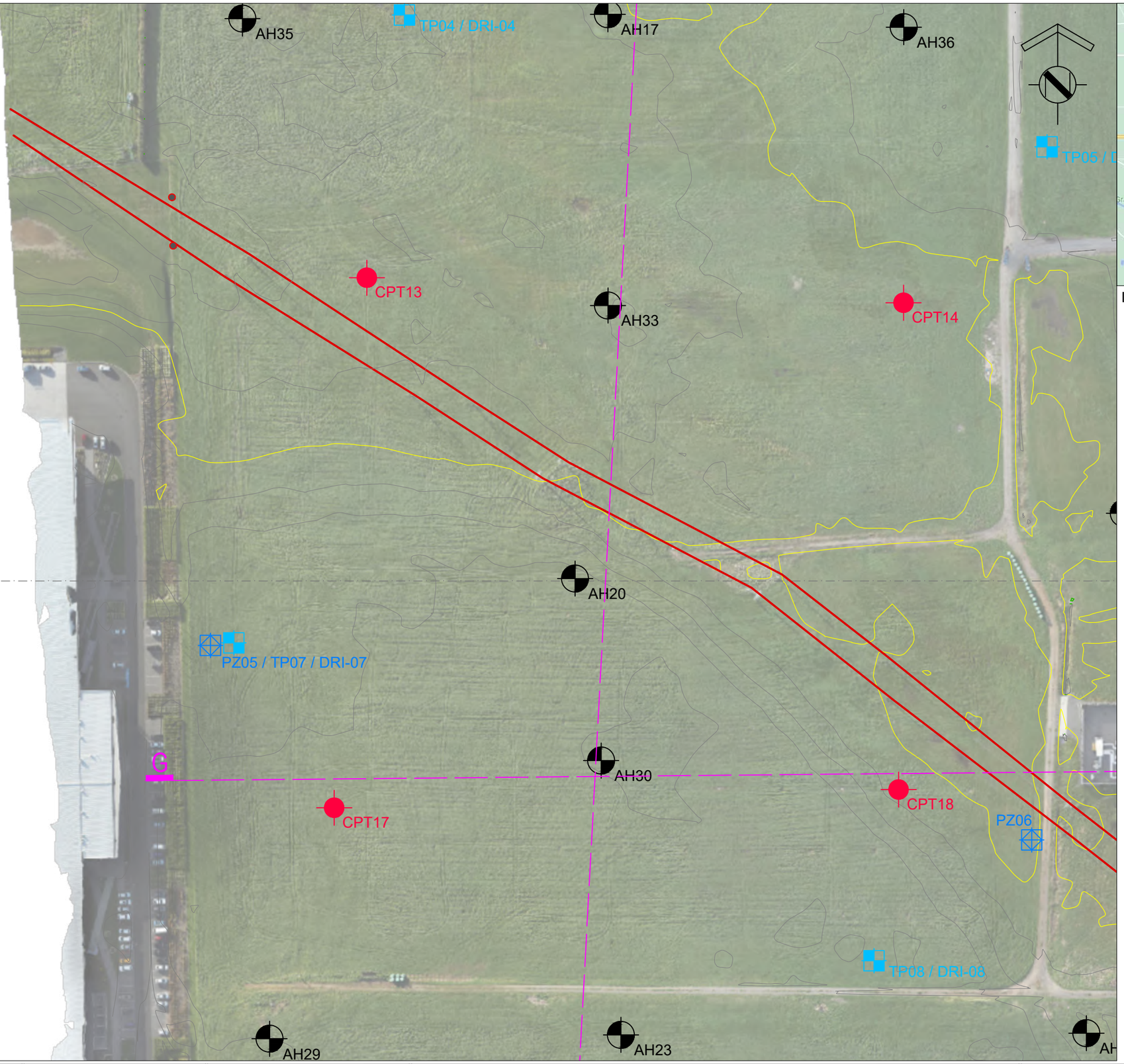
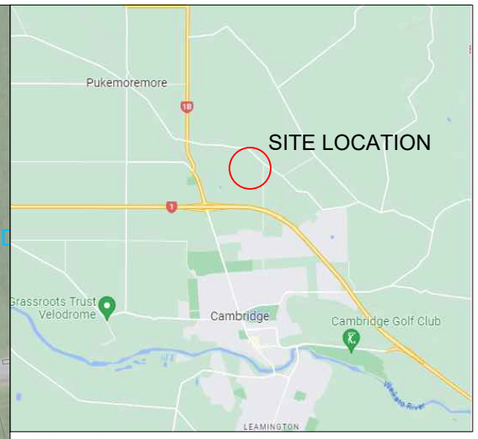
SITE PLAN
SHEET 5

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 230322 - site plan -aug2023.dwg





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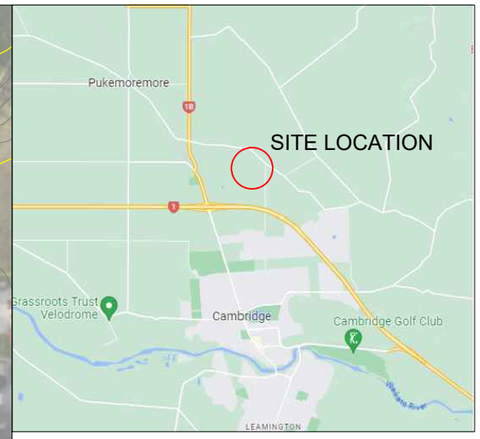
SITE PLAN
SHEET 6

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - site plan -aug2023.dwg		

AH36
AH18
AH37
TP05 / DRI-05
TP06 / DRI-06
AH34
CPT14
CPT15
PZ04
CPT16
AH21
AH22
AH31
CPT19
AH32
CPT20
G'
CPT18
PZ06
TP08 / DRI-08
AH24
AH25
TP09 / DRI-09



LOCATION MAP

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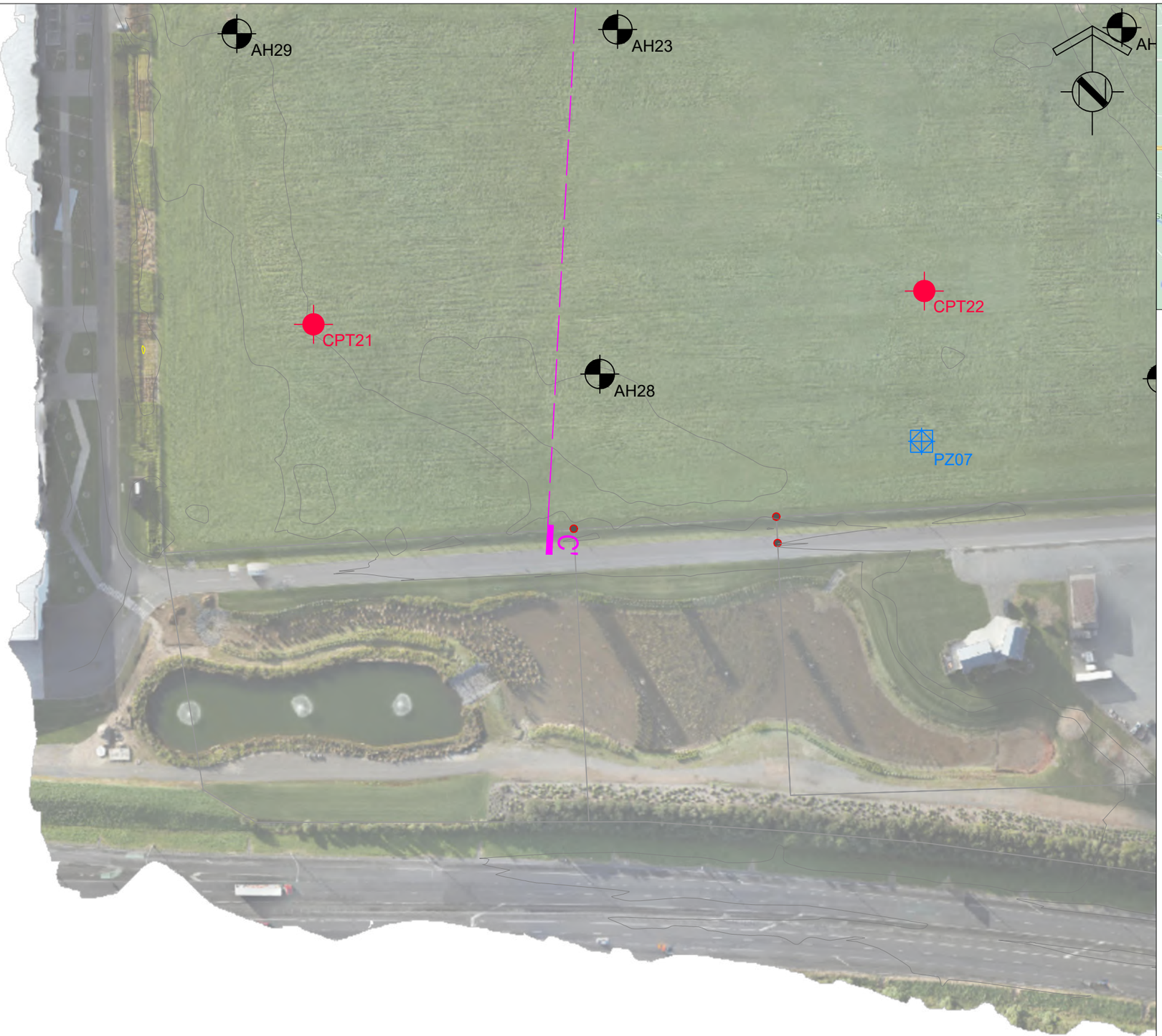
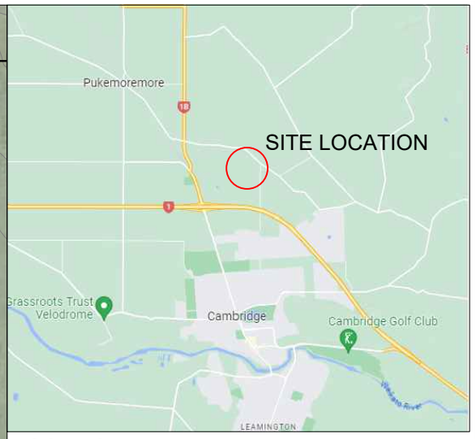
SITE PLAN
SHEET 7

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 230322 - site plan -aug2023.dwg





LOCATION MAP

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FONTERRA HAUPATU
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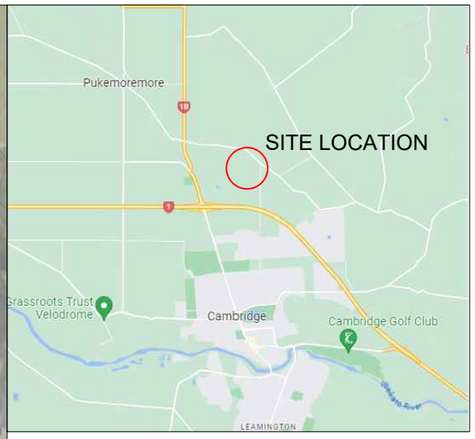
CAMBRIDGE

SITE PLAN
SHEET 8

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 230322 - site plan -aug2023.dwg



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AMENDMENTS		
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FONTERRA HAUPATU
195 SWAYNE ROAD
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SITE PLAN
SHEET 9

230322 / 1	DRAWN: B.Smith	DATE: 14-Aug-23
SCALES: 1: 1500 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - site plan -aug2023.dwg		

North
A

South
A'

TP02

AH49

Stream Channel

AH13

Fence on Bdy

Vertical Distance in m / Approximate RL in m

Horizontal Distance in m

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

0 10 20 30 40 50 60 70 80 90 100 110 120

KEY TO CROSS SECTION SYMBOLS

AH01 Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill
Clay
Silt
Sand
Gravel
Peat / Organic Material
Sandstone

NOTES:

1. Soil & Rock Consultants cross sections generated from Topographical Plan supplied by Harrison Grierson.
2. Soil descriptions shown approximate only, refer to borelogs for details.
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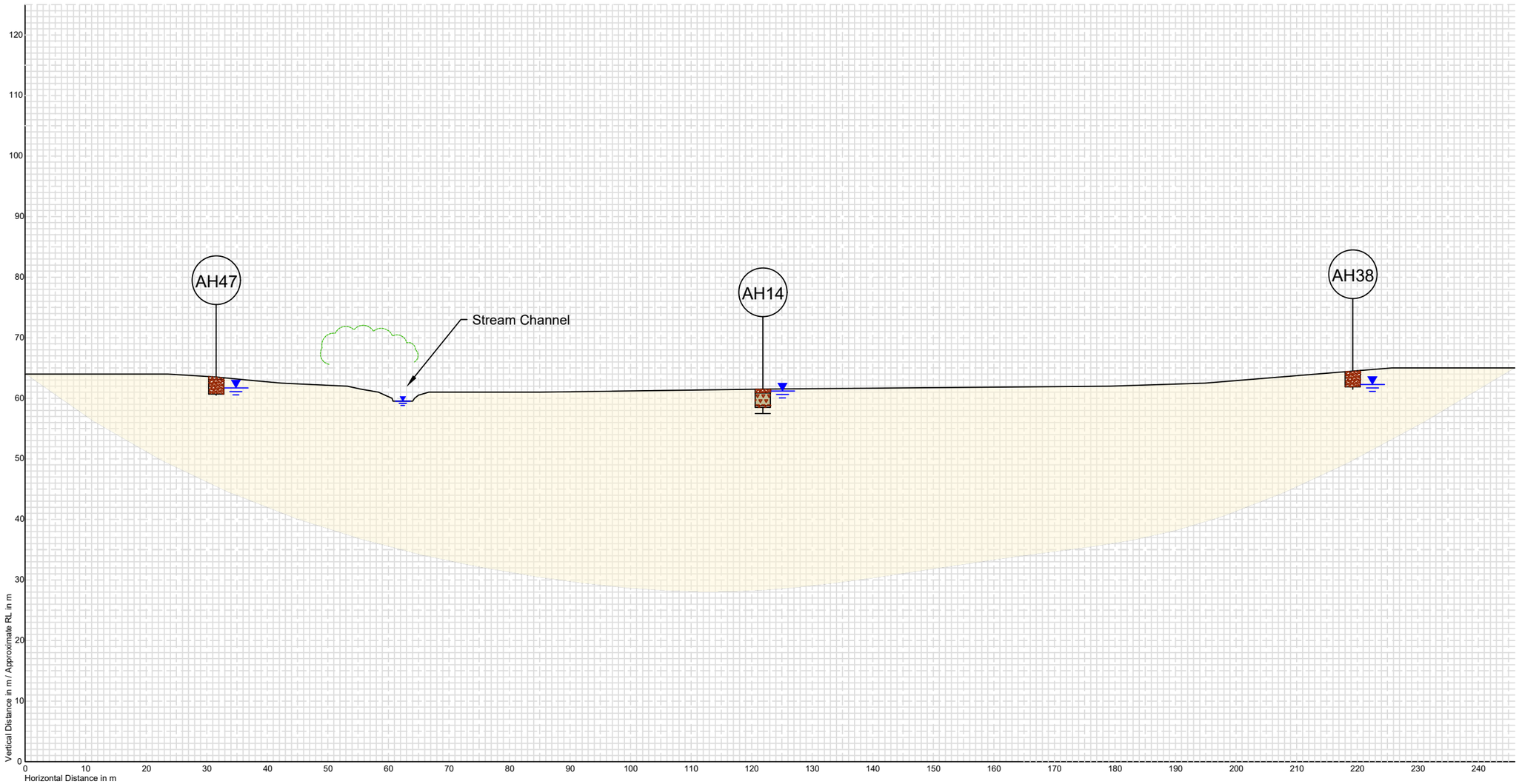
CROSS SECTION A-A'

230322/2A	DRAWN: B.Smith	DATE: 16-Aug-23
SCALES: 1: 500 AT A3	CHECKED:	REV.
	DESIGNED:	

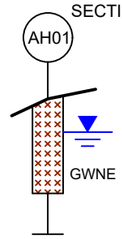
Filename: 230322 - sections -aug2023.dwg

North-Northeast
B

South-Southwest
B'



KEY TO CROSS SECTION SYMBOLS



Hand Drilled Augerhole

Groundwater Level

Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

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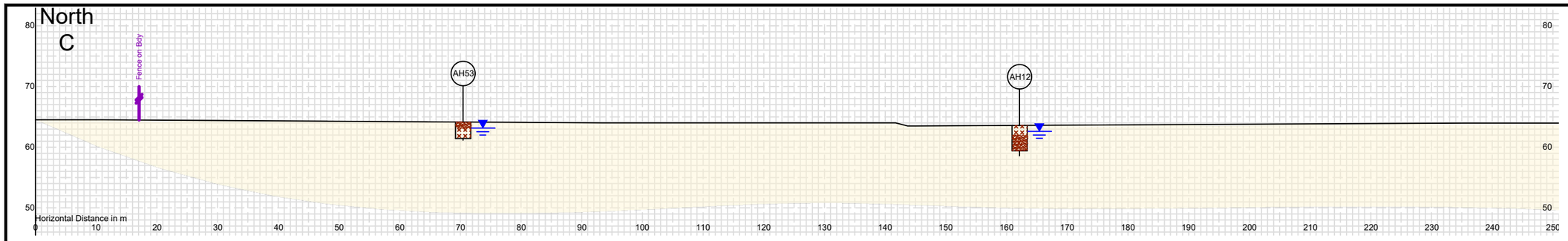
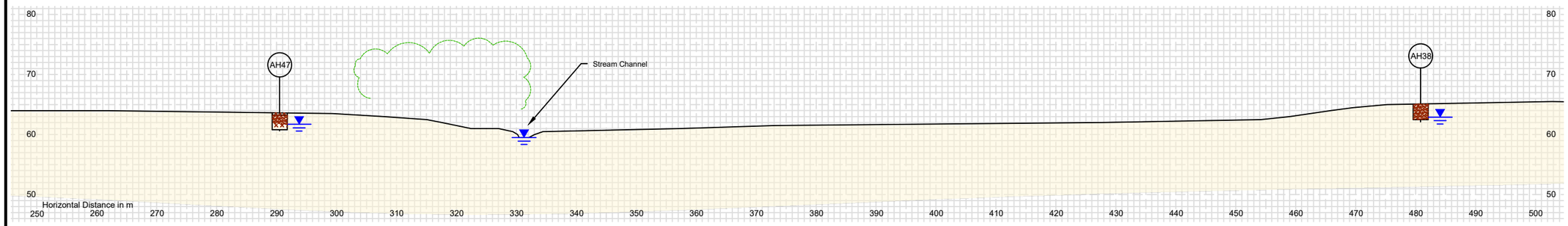
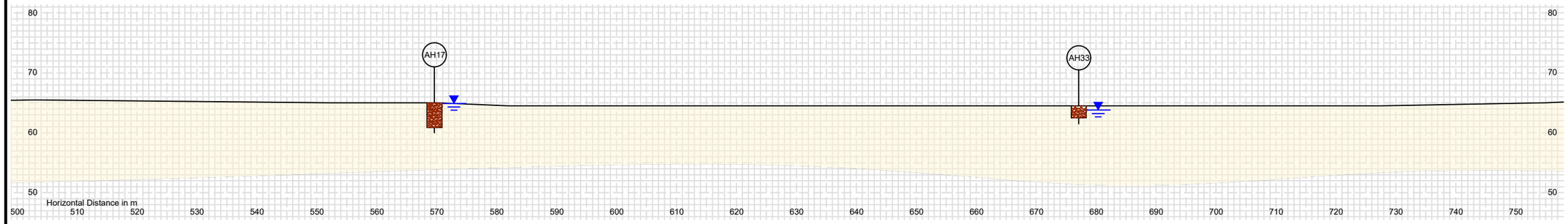
CROSS SECTION B-B'

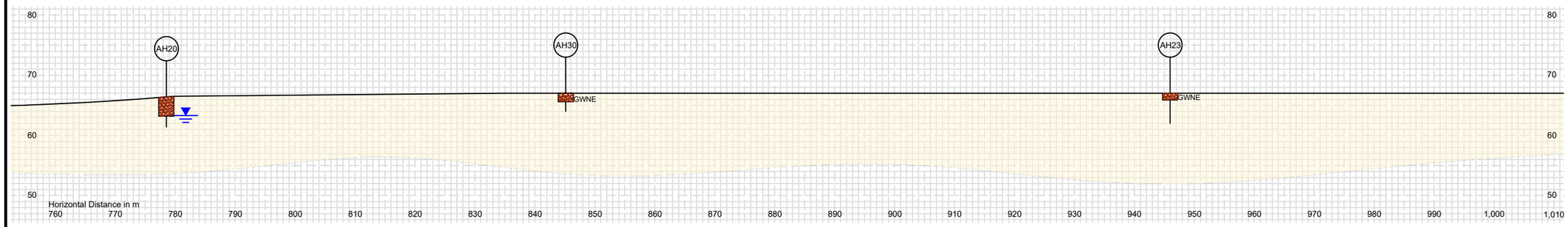
230322/2B	DRAWN: B.Smith	DATE: 16-Aug-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	

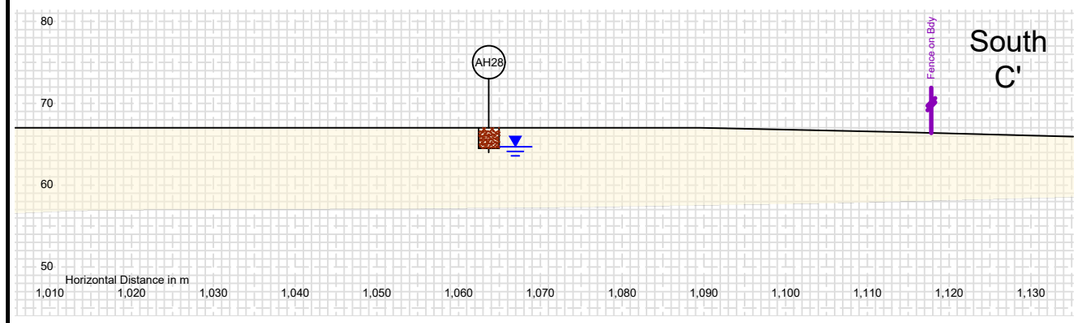
Filename: 230322 - sections -aug2023.dwg











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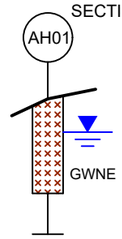

Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

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Gravel
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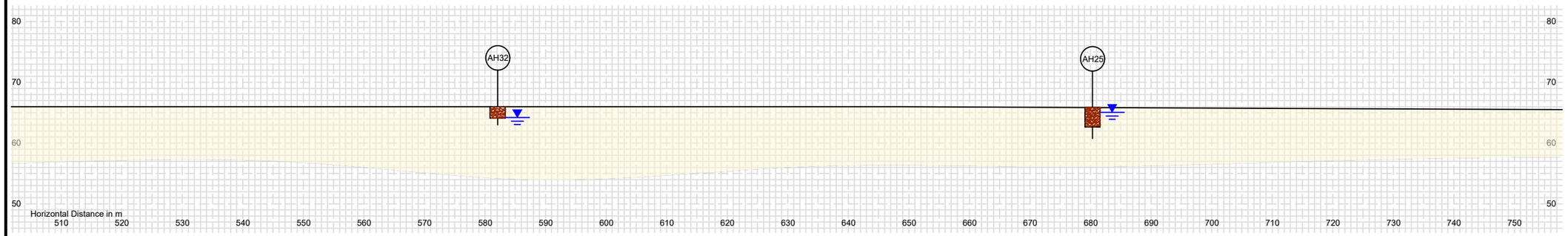
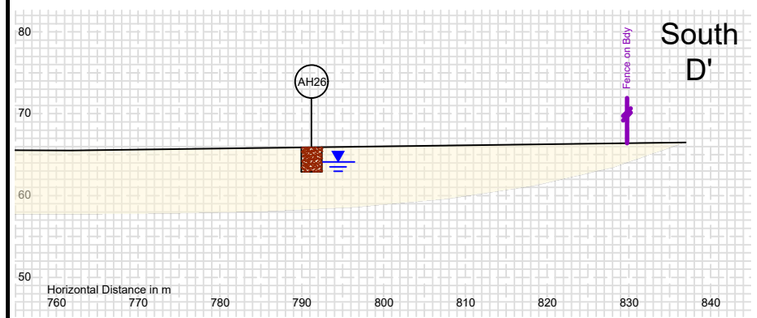
CROSS SECTION C-C'

230322/2C	DRAWN: B.Smith	DATE: 16-Aug-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 230322 - sections -aug2023.dwg





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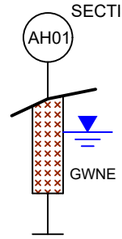

Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

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1. Soil & Rock Consultants cross sections generated from Topographical Plan supplied by Harrison Grierson.
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3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater measurements were made at completion of drilling.
5. Locations of features approximate only.

AMENDMENTS		
DATE	REV	DESCRIPTION

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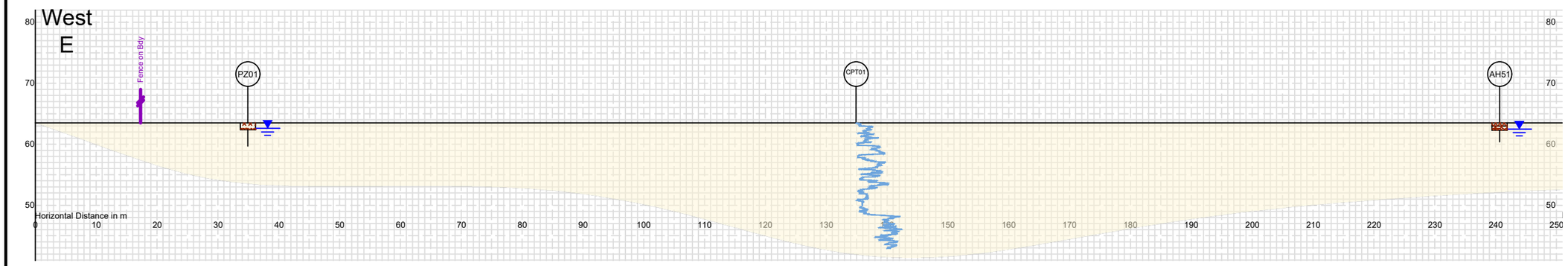
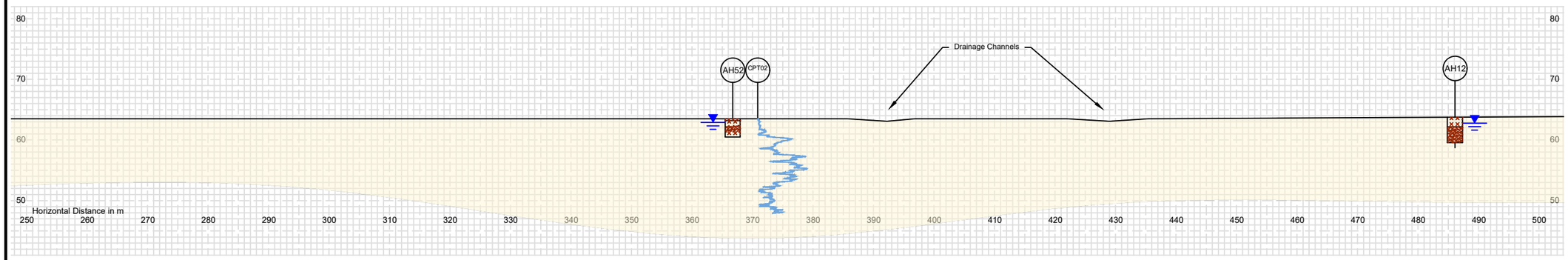
PO Box 21-424 Henderson, Waitakere 0650
Ph 09 835 1740 Fax 09 835 1847
www.soilandrock.co.nz

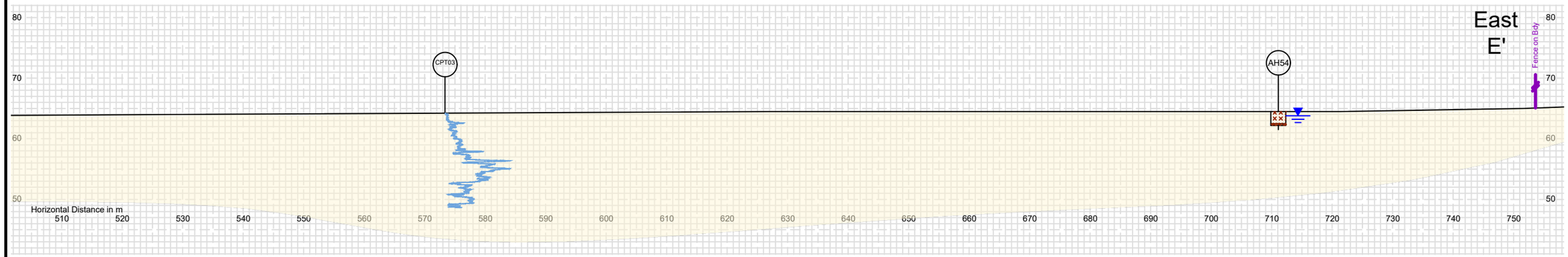
FONTERRA HAUTAPU
195 SWAYNE ROAD
CAMBRIDGE

CROSS SECTION D-D'

230322/2D	DRAWN: B.Smith	DATE: 16-Aug-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 230322 - sections -aug2023.dwg		







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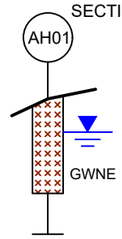

Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill

Clay

Silt

Sand

Gravel

Peat / Organic Material

Sandstone

NOTES:

1. Soil & Rock Consultants cross sections generated from Topographical Plan supplied by Harrison Grierson.
2. Soil descriptions shown approximate only, refer to borelogs for details.
3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater measurements were made at completion of drilling.
5. Locations of features approximate only.
6. CPT traces show uncorrected Tip Resistance.

AMENDMENTS		
DATE	REV	DESCRIPTION

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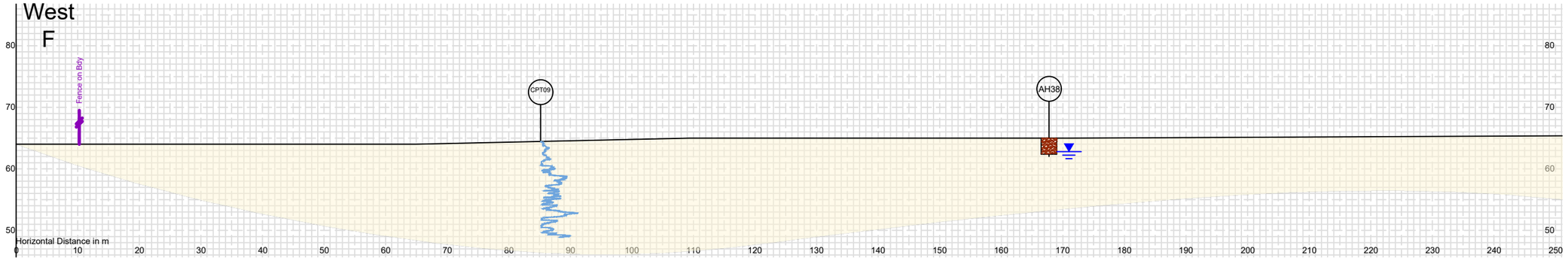
FONTERRA HAUTAPU
195 SWAYNE ROAD
CAMBRIDGE

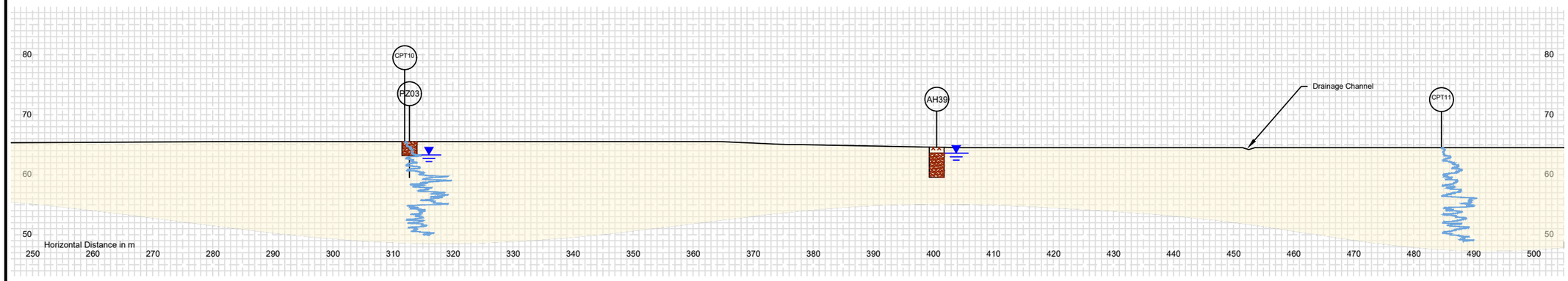
CROSS SECTION E-E'

230322/2E	DRAWN: B.Smith	DATE: 16-Aug-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	

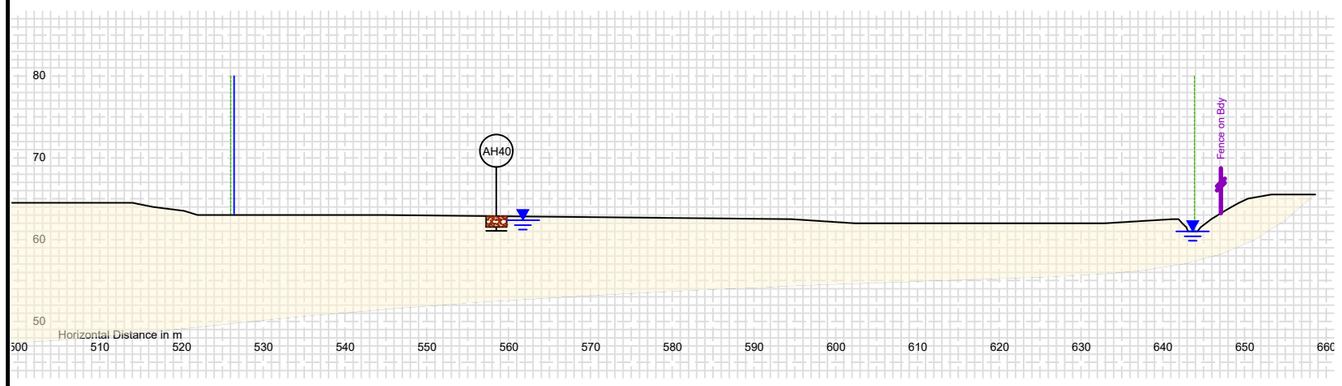
Filename: 230322 - sections -aug2023.dwg

West
F

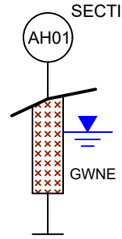




East
F'



KEY TO CROSS SECTION SYMBOLS



Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill

Clay

Silt

Sand

Gravel

Peat / Organic Material

Sandstone

NOTES:

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5. Locations of features approximate only.
6. CPT traces show uncorrected Tip Resistance.

AMENDMENTS		
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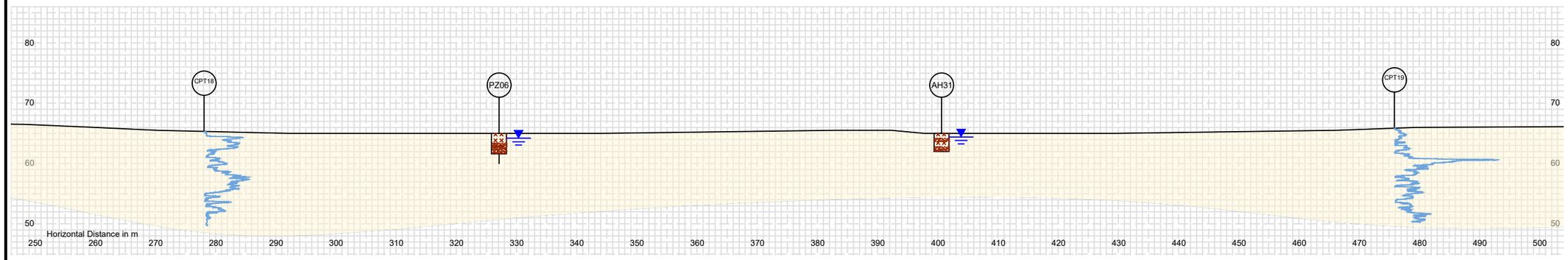
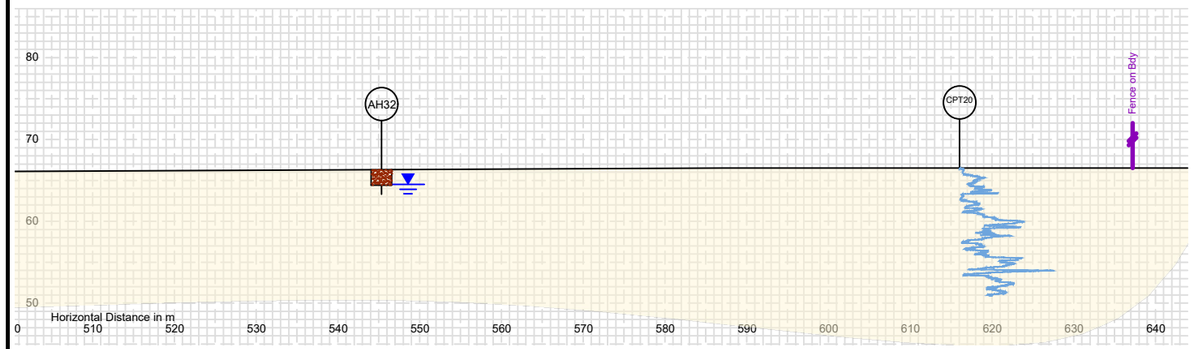
195 SWAYNE ROAD
CAMBRIDGE

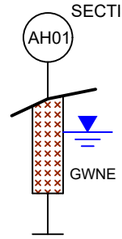
CROSS SECTION F-F'

230322/2F	DRAWN: B.Smith	DATE: 16-Aug-23	
SCALES: 1: 750 AT A3	CHECKED:		REV.
	DESIGNED:		
Filename: 230322 - sections -aug2023.dwg			





KEY TO CROSS SECTION SYMBOLS



Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill

Clay

Silt

Sand

Gravel

Peat / Organic Material

Sandstone

NOTES:

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2. Soil descriptions shown approximate only, refer to borelogs for details.
3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater measurements were made at completion of drilling.
5. Locations of features approximate only.
6. CPT traces show uncorrected Tip Resistance.

AMENDMENTS

DATE	REV	DESCRIPTION

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CROSS SECTION G-G'

230322/2G	DRAWN: B.Smith	DATE: 16-Aug-23	
SCALES: 1: 750 AT A3	CHECKED:		REV.
	DESIGNED:		
Filename: 230322 - sections -aug2023.dwg			

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Appendix B

Investigation Logs

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ01

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	0.9m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					TOP CAP
HINUERA FORMATION		SILT, minor clay, some fine to medium sand, minor fine to medium angular gravel, brown yellow, orange mottles, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)		0.5		V,102 VR,14			BENTONITE SEAL
		fine to medium sandy SILT, minor clay, grey, orange mottles, very stiff, moist, slightly plastic	26/06/2023						FILTER PACK
		fine SAND, some fine angular gravel, trace silt, grey, orange streaks, loose, saturated, non plastic		1.0					SLOTTED PIPE
		END OF BORE. 1.10 METRES. (HOLE COLLAPSE)		1.5					END CAP
				2.0					
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ02

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	0.5m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					TOP CAP
HINUERA FORMATION		fine to coarse silty SAND, dark grey brown, wet, very loose, non plastic (ALLUVIAL DEPOSITS)	26/06/2023						
		saturated		0.5		V,71 VR,15			BENTONITE SEAL
		fine to coarse SAND, minor silt, orange brown, very loose, saturated, non plastic				0			
		some silt				1			
		dark grey brown, trace fine to medium subangular gravel		1.0		2			
		white, light grey				2			FILTER PACK
		silty fine to coarse SAND, grey brown, very loose, saturated, non plastic				2			
		organic stained SILT, some clay, some fine to coarse sand, dark grey, dark brown, saturated, moderately plastic				2			
		grey, light grey		1.5		1			
		grey brown				2			
		some organic tree fragments				2			
						2			
		silty fine to medium SAND, grey, light grey, very loose, saturated, non plastic		2.0		0			SLOTTED PIPE
		fine to coarse sand				0.25			
		grey brown				0.5			
		grey, light grey				0.55			
						0.6			
		dense		2.5		2			
						8			
						12			END CAP
		END OF BORE. 2.70 METRES. (TOO DENSE TO AUGER)		3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ03

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	26/6/23	Water Level:	2.2m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0		0.66			TOP CAP
HINUERA FORMATION		fine to medium SAND, minor silt, orange, very loose, moist (ALLUVIAL DEPOSITS)				0.66 0.66 0.66 0.83			
		silty fine to medium SAND, orange, dark orange, very loose, moist		0.5		1.5 1 1.5			BENTONITE SEAL
		fine to coarse SAND, trace silt, dark orange, very loose, moist		1.0		1.5 1 1 1 1 1			
		medium to coarse SAND, some fine to medium angular gravel, orange, yellow, orange brown		1.5		0.5 0.5 1			FILTER PACK
		orange, orange grey, loose				3 4			SLOTTED PIPE
		wet, medium dense	26/06/2023	2.0		6			
		loose				4			
		saturated, no recovery				5			END CAP
		END OF BORE. 2.30 METRES. (HOLE COLLAPSE)		2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ04

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	26/6/23	Water Level:	1.8m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0		1			TOP CAP
HINUERA FORMATION		silty fine SAND, brown, very loose, moist (ALLUVIAL DEPOSITS) dark orange				2 2 2 2			
		fine to medium SAND, minor silt, trace fine to medium angular gravel, light orange, brown, loose, moist		0.5		1.5 1 1 1			BENTONITE SEAL
		some silt medium to coarse SAND, some fine to coarse angular gravel red brown, dark orange brown wet		1.0		1 0.6 0.6 0.6			FILTER PACK
		saturated	26/06/2023	1.5		2 2 4 4			SLOTTED PIPE
		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)		2.0		3 4 5			END CAP
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ05

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0		1			TOP CAP
HINUERA FORMATION		fine sandy SILT, brown, stiff, moist (ALLUVIAL DEPOSITS)				3			
		fine to medium SAND, some silt, dark orange, loose, moist				3			
						2			
						2			
				0.5		2			BENTONITE SEAL
		fine to coarse SAND, trace silt, trace fine to coarse subangular gravel				2			
						2			
						5			
		no fine sand				4			
		reddish brown		1.0		2			
						2			
						5			FILTER PACK
						5			
				1.5		2			
						1.5			
						1.5			
		fine to medium angular gravelly medium to coarse SAND, red brown, dark orange brown, very loose, wet				5			SLOTTED PIPE
		wet				6			
		medium dense				6			
				2.0					END CAP
		END OF BORE. 2.00 METRES. (GRAVEL OBSTRUCTION)							
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ06

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	0.8m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL trace clay, non-plastic		0.0					TOP CAP
HINUERA FORMATION		SILT, some clay, trace fine sand, light grey, orange brown mottles, very stiff, moist, slightly plastic (ALLUVIAL DEPOSITS) minor clay, slightly plastic	26/06/2023	0.5		V,126 VR,22			BENTONITE SEAL
		trace clay, saturated, non-plastic		1.0		V,139 VR,15			FILTER PACK
		fine to coarse sandy SILT, trace clay, light grey, very stiff, saturated, non-plastic for 100mm SILT, trace clay, light grey, very stiff, firm, non-plastic		1.5		V,139 VR,20			
		silty fine to coarse SAND, light grey, loose, saturated SILT, trace clay, minor fine sand, light grey, saturated, non-plastic trace fine sand		2.0		3 7 V,200+ UTP 5 3			
		fine to medium SAND, some silt, light grey, loose, saturated				3 4			SLOTTED PIPE
		SILT, some fine sand, light grey, firm, saturated, non-plastic		2.5		0.6 1.3			
		silty fine SAND, light grey, very loose, saturated				3 6			
		fine to medium SAND, some silt, light grey, medium dense, saturated		3.0		6 V,62 VR,25			
		END OF BORE. 3.40 METRES. (HOLE COLLAPSE)		3.5					END CAP
				4.0					
				4.5					
				5.0					

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ07

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	2.9m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					TOP CAP
HINUERA FORMATION		SILT, trace fine sand, trace clay, orange brown, stiff, moist, non-plastic		0.5		V,87 VR,27			BENTONITE SEAL
		trace fine subangular gravel							
		fine to coarse SAND, minor silt, trace fine subangular gravel, light brown, brown, loose, moist, non-plastic		1.0		6			
		very loose				6			
		loose				4			FILTER PACK
				1.5		6			
						7			
						8			
						6			
				2.0		3			
		very loose				5			
						5			
						3			
						4			
		loose				3			SLOTTED PIPE
				2.5		5			
						4			
			26/06/2023			5			
						5			
		saturated				6			
						5			
						5			END CAP
		END OF BORE. 2.90 METRES. (HOLE COLLAPSE)		3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ08

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	2.5m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					TOP CAP
HINUERA FORMATION		fine to medium sandy SILT, trace clay, dark yellow, very stiff, moist, non-plastic (ALLUVIAL DEPOSITS)		0.5		V,103 VR,30			BENTONITE SEAL
		fine to coarse sandy SILT		1.0		V,67 VR,45			
		fine to coarse SAND, trace silt, trace clay, yellow, very loose, moist		1.5		0			FILTER PACK
		some fine to medium angular gravel		2.0		0 0 0 0 0.4			
		saturated loose fine to medium SAND, some fine to medium angular gravel, white, light grey no recovery	26/06/2023	2.5		0.4 1.2 1.5 1.5 2 4 4 5 5			SLOTTED PIPE
		END OF BORE. 3.00 METRES. (HOLE COLLAPSE)		3.0					END CAP
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Auger Hole No: PZ09

Sheet 1 of 1

Drill Type:	75mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	26/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	26/6/23	Water Level:	1.2m 26/06/2023		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					TOP CAP
HINUERA FORMATION		SILT, some fine to medium sand, brown, firm, moist, non-plastic (ALLUVIAL DEPOSITS) some clay, light grey, brown streaks, stiff, slightly plastic very stiff		0.5		V,134 VR,39			BENTONITE SEAL
		light grey, orange brown		1.0		V,116 VR,28			FILTER PACK
		wet	26/06/2023						
		silty fine to medium SAND, minor coarse sand, trace fine angular gravel, light grey, yellow, loose, saturated		1.5		2 2 2 2 3 2 1.3			SLOTTED PIPE
		END OF BORE. 1.90 METRES. (HOLE COLLAPSE)		2.0					END CAP
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 230322 - PZ01-09 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 28/8/23

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CLIENT: Fonterra Co-operative Group Ltd

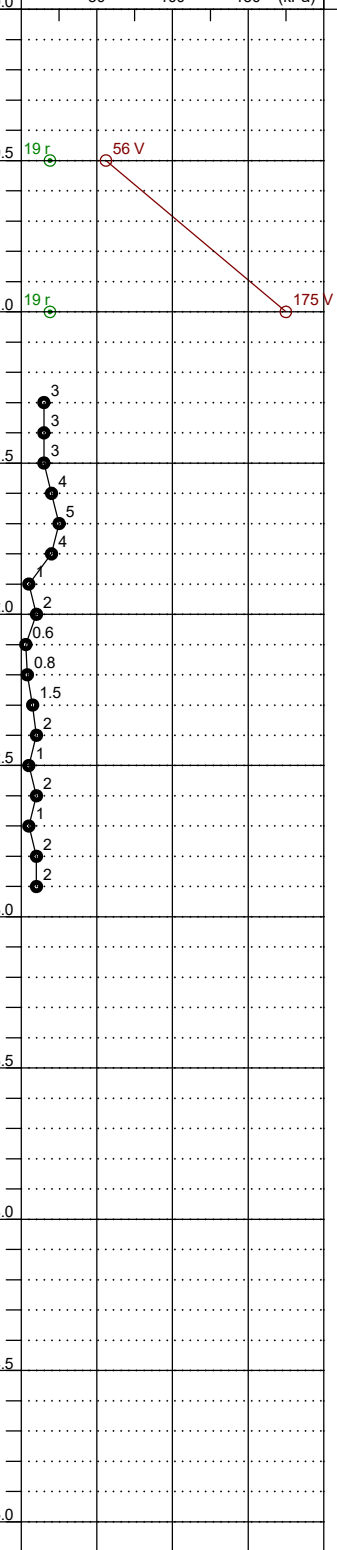
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH10

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	0.9m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			SILT, some clay, minor fine sand, brown, stiff, wet, slightly plastic (ALLUVIAL DEPOSITS)	
			orange, yellow, light grey	
	0.5			
			fine sandy SILT, minor clay, light grey, stiff, wet, slightly plastic	
			saturated	27/06/2023
	1.0		very stiff	
			trace clay, non-plastic	
			fine to medium SAND, minor silt, white, loose, saturated	
	1.5		some orange streaks	
			light brown grey	
	2.0			
			trace silt	
	2.5			
			fine to medium sandy SILT, trace clay, light grey, firm, saturated, non-plastic	
			SILT, minor fine sand, light grey, stiff, saturated, non-plastic	
	3.0			
			PEAT (fibrous SILT) brown, stiff, saturated, non-plastic	
			SILT, minor clay, minor fine sand, brown, stiff, saturated, slightly plastic	
			fine to coarse SAND, trace silt, dark green, dark grey, medium dense, saturated	
	3.5		END OF BORE. 3.35 METRES. (TOO DENSE TO AUGER)	
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH11

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	0.7m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
H.FORM			fine to medium sandy SILT, some clay, orange brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			trace hard SILT inclusions to 4mmØ	
	0.5		silty fine to coarse SAND, some clay, orange brown, brown and light grey yellow speckles, loose, moist	
			trace fine angular gravel, saturated	27/06/2023
			no recovery	
	1.0		END OF BORE. 0.90 METRES. (NO RECOVERY)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

5 11 7

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH12

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	1.0m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT, some clay, some fine sand, yellow grey, orange streaks, brown mottles, very stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			fine sandy SILT, minor clay, yellow grey, orange streaks, brown mottles, very stiff, moist, slightly plastic	
	1.0		silty fine SAND, trace clay, occasional orange patches, loose, moist	
			saturated	28/06/2023
	1.5		fine sandy SILT, some clay, light grey, very stiff, saturated, slightly plastic	
	2.0		silty fine to medium SAND, minor clay, light grey, medium dense, saturated	
			trace clay	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5		END OF BORE. 4.20 METRES. (TOO DENSE TO AUGER)	
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

15 r
138 V

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH13

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	27/6/23	Water Level:	1.8m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
TOPSOIL	0.0		TOPSOIL fine sandy SILT, trace clay, dark orange, very stiff, moist, non-plastic (ALLUVIAL DEPOSITS)		0.0		
HINUERA FORMATION	0.5		fine to coarse SAND, trace silt, dark orange, loose, moist, medium dense yellow brown loose red grey red orange		0.5	3 4 5 1 2 2 2	
	1.0				1.0	4 4 3 3 3	
	1.5		wet minor fine to medium angular gravel saturated	27/06/2023	1.5	3 3 5 4 4	
	2.0		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)		2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH14

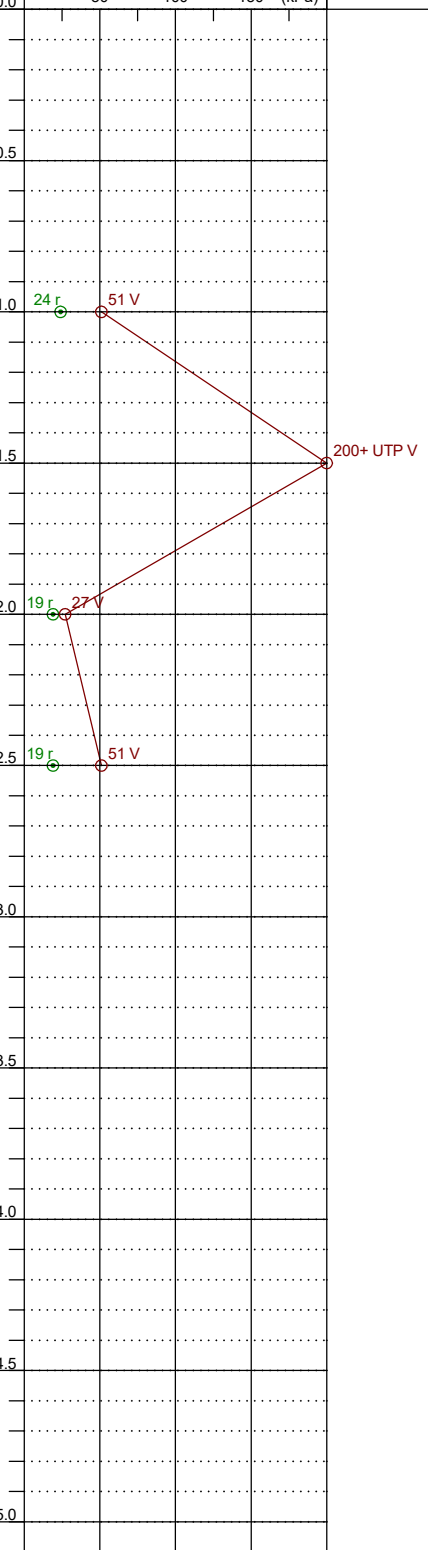
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Boggy Ground, Grass
Date Finished:	27/6/23	Water Level:	0.3m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
			silty fine to medium SAND, brown, very loose, wet (ALLUVIAL DEPOSITS)	
			fine to coarse SAND, minor silt, dark orange brown, very loose, saturated	27/06/2023
	0.5		PEAT (fibrous SILT) dark brown, firm, saturated, non-plastic	
			minor fine to coarse angular gravel, 20% sample recovery	
HINUERA FORMATION	1.0		SILT, some organic silt, minor fine to coarse sand, brown, firm, saturated, non-plastic	
			grey brown	
			some decomposed wood	
			very soft	
	1.5		PEAT (SILT, some decomposed wood) brown, very soft, saturated, non-plastic UTP due to wood obstruction, 5% sample recovery	
	2.0		SILT, minor fine to medium sand, minor clay, light grey, stiff, saturated, slightly plastic	
			DECOMPOSED WOOD	
	2.5		SILT, some decomposed wood, some organic silt, brown, firm, saturated, non-plastic	
			SILT, minor clay, some fine sand, light blue grey, firm, saturated, slightly plastic	
	3.0		silty fine to coarse SAND, grey, loose, saturated	
			END OF BORE. 3.00 METRES. (HOLE COLLAPSE)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH15

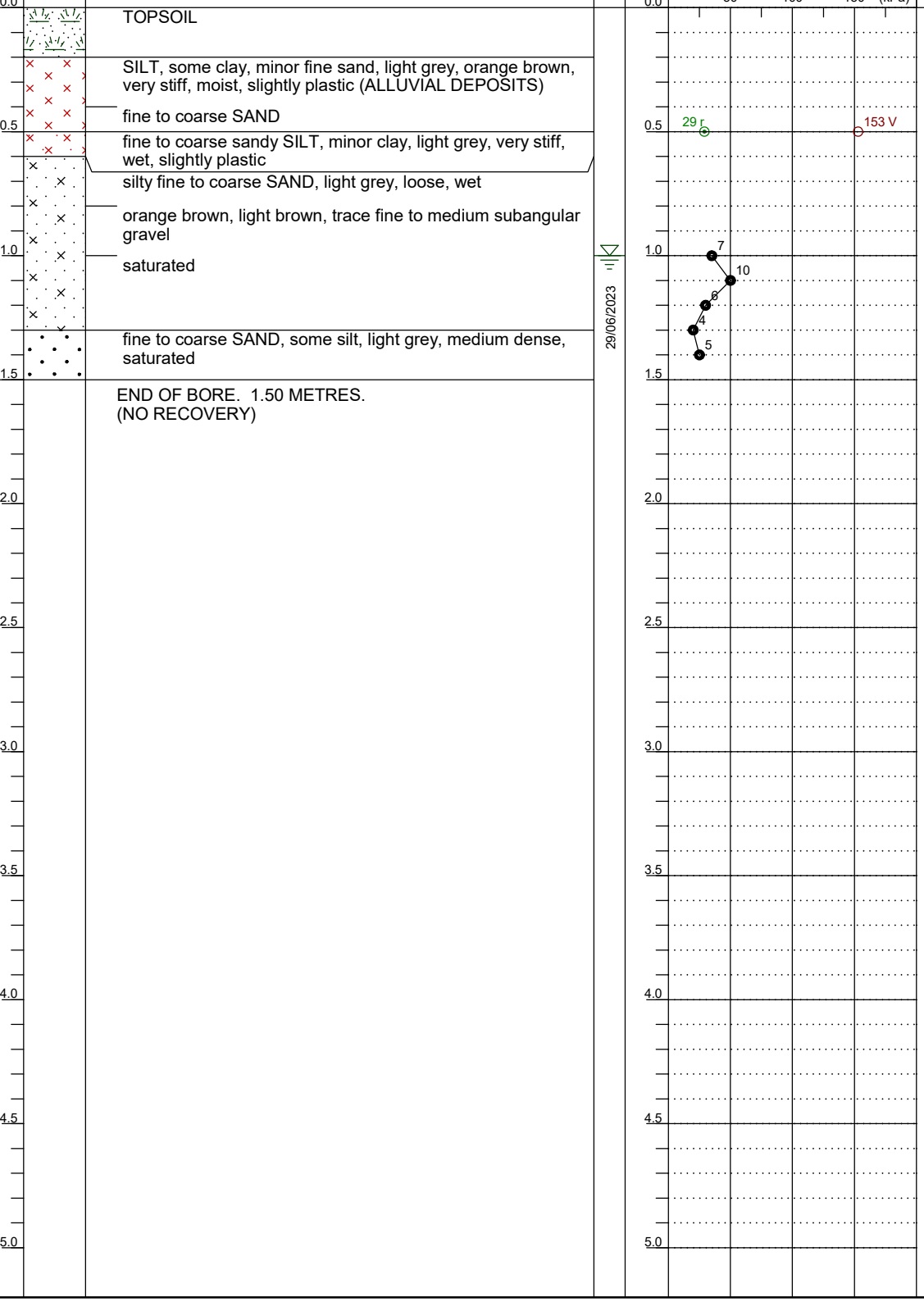
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	1.0m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT, some clay, minor fine sand, light grey, orange brown, very stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			fine to coarse SAND	
			fine to coarse sandy SILT, minor clay, light grey, very stiff, wet, slightly plastic	
	1.0		silty fine to coarse SAND, light grey, loose, wet	
			orange brown, light brown, trace fine to medium subangular gravel	
			saturated	29/06/2023
	1.5		fine to coarse SAND, some silt, light grey, medium dense, saturated	
			END OF BORE. 1.50 METRES. (NO RECOVERY)	

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

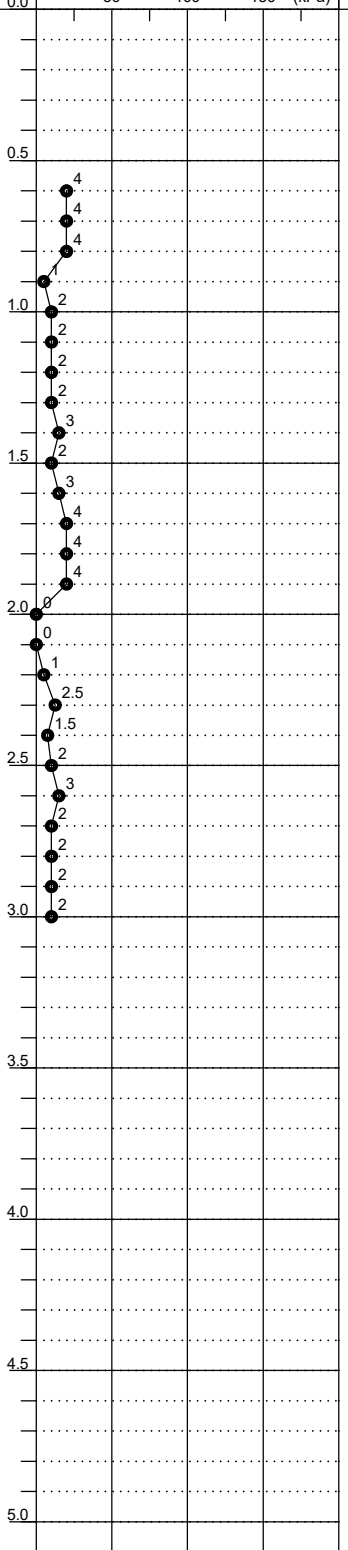
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH16

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	1.8m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, some clay, orange brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			fine to coarse sandy SILT	
	0.5		silty fine to coarse SAND, orange brown, loose, moist	
			silty fine to medium SAND, light grey yellow	
			some clay	
			for 100mm; fine to coarse sandy SILT	
	1.0			
	1.5		orange speckles	
			wet	
			silty fine SAND, light grey	
	2.0		silty fine to medium SAND, saturated	27/06/2023
	2.5		fine sandy SILT, minor clay, light grey, stiff, moist, slightly plastic	
	3.0		less than 10% recovery	
			no recovery	
	3.5		END OF BORE. 3.40 METRES. (NO RECOVERY)	
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

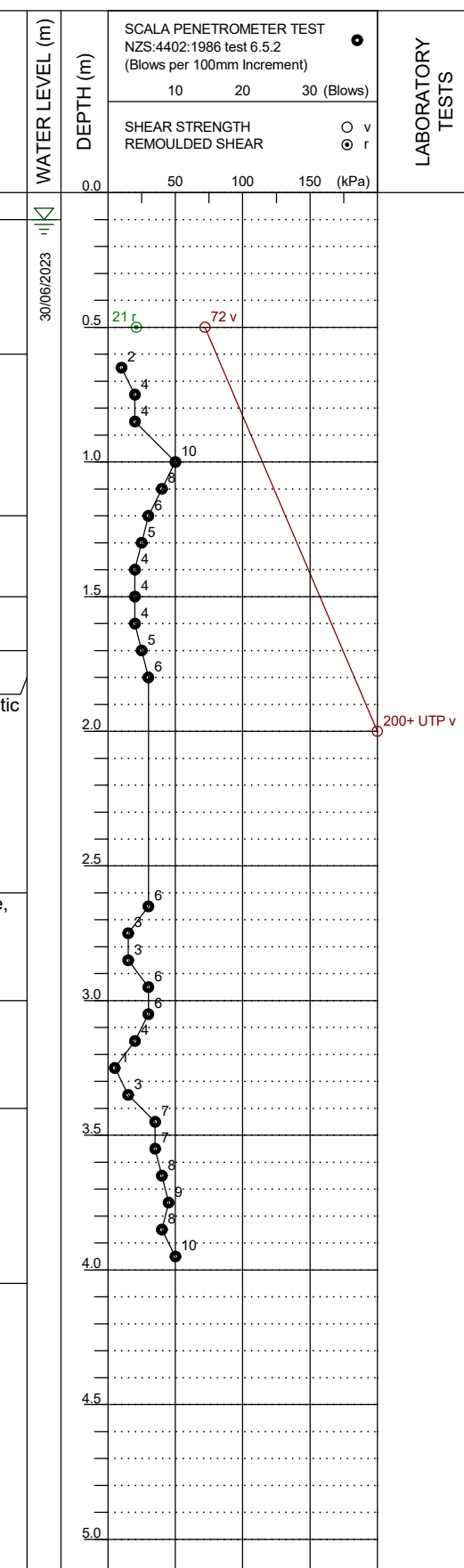
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH17

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	30/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	30/6/23	Water Level:	0.1m 30/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine sandy SILT, brown, firm, saturated, non-plastic (ALLUVIAL DEPOSITS) minor clay, light yellow, orange, slightly plastic	30/06/2023
	0.5		stiff	
			fine to medium SAND, minor silt, light yellow, loose, saturated white medium dense trace silt	
	1.0		dense	
			fine sandy SILT, white minor clay, yellow, light orange, slightly plastic	
	1.5		SILT minor fine sand, white, stiff, saturated, non plastic, highly dilatant	
			fine sandy SILT, brown, stiff, saturated, non plastic, highly dilatant	
	2.0		SILT some fine sand, light brown, stiff, saturated, non plastic very stiff	
			stiff light grey	
	2.5		fine to medium SAND, minor silt, light blue, medium dense, saturated loose for 50mm; SILT, highly dilatant	
	3.0		fine sandy SILT, light blue, stiff, saturated, non plastic, highly dilatant	
	3.5		fine to medium SAND, minor silt, brown grey, blue grey, medium dense, saturated no recovery to base of augerhole, inferred sand dense	
	4.0			
			END OF BORE. 4.05 METRES. (HOLE COLLAPSE)	
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH18

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	1.9m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION			fine to medium sandy SILT, yellow brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)
	0.5		SILT some fine to medium sand, yellow brown, stiff, moist, non plastic
			fine to coarse sandy SILT, yellow brown, black speckles, stiff, moist, non plastic
	1.0		fine to coarse SAND, trace silt, yellow brown, loose, moist
			medium dense
			minor fine angular gravel, red brown with orange speckles
			some fine angular gravel
			trace medium angular gravel
	1.5		light grey
			wet
			loose
	2.0		saturated
			END OF BORE. 2.00 METRES. (HOLE COLLAPSE)
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 29/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

20 r
84 v

3 5 7 5 4 4 3 4 3 2

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH19

Sheet 1 of 1

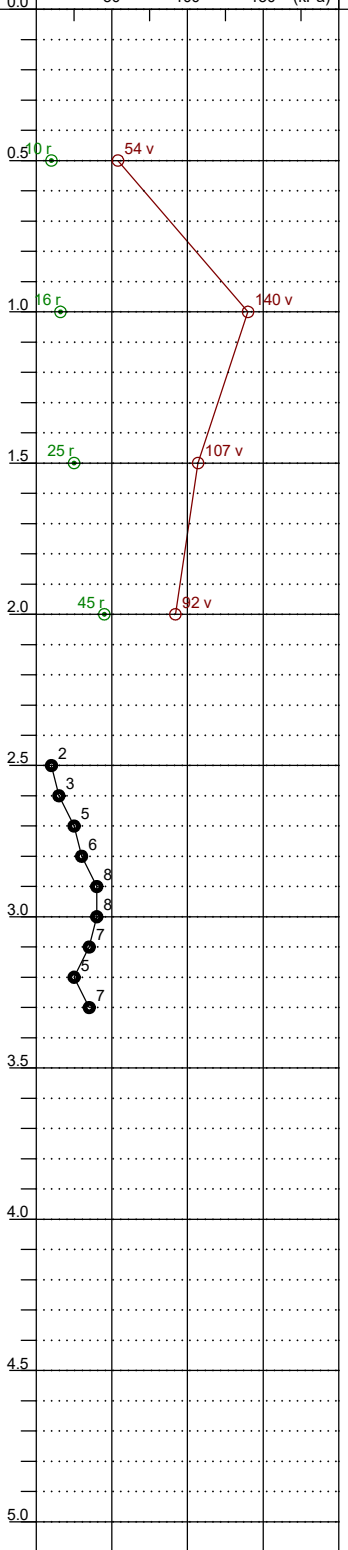
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	0.8m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some clay, trace fine sand, light grey, orange brown streaks, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)
			trace fine to coarse sand
	1.0		trace clay, trace fine sand, non-plastic
			saturated
			minor fine sand
			some fine sand
	1.5		fine to medium sandy SILT, light grey, very stiff, saturated, non-plastic
	2.0		SILT, trace fine sand, light grey, stiff, saturated, non-plastic
			trace clay
	2.5		silty fine SAND, light grey, loose, saturated
	3.0		SILT, minor fine sand, light grey, stiff, saturated, non-plastic
			some fine sand
			minor fine sand
			silty fine SAND, light grey, medium dense, saturated
			no recovery
	3.5		END OF BORE. 3.40 METRES. (NO RECOVERY)
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 29/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH20

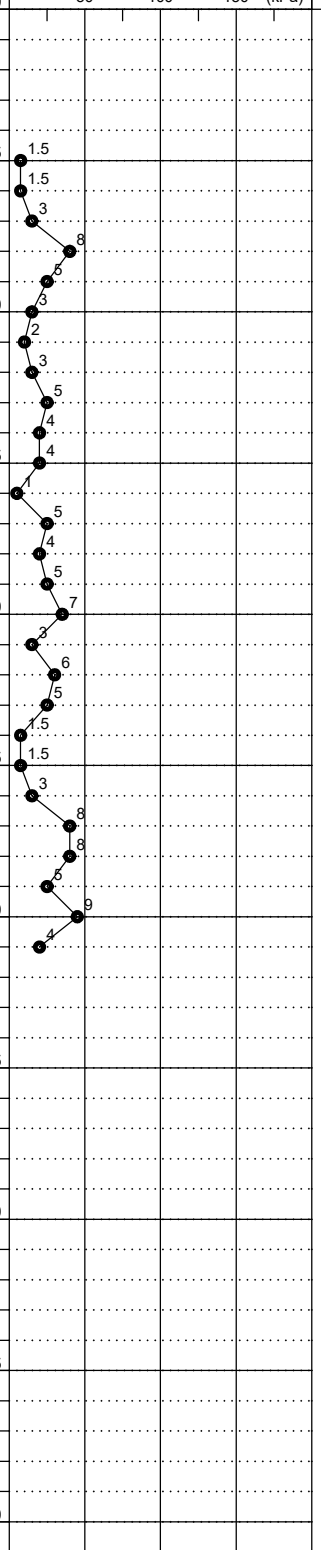
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	3.2m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION	0.0		fine SAND, some silt, dark orange, very loose, moist (ALLUVIAL DEPOSITS)	
	0.5		fine to medium sand	
			medium to coarse SAND, minor fine to medium angular gravel, no silt, loose	
			grey, medium dense	
	1.0		loose	
			wet	
	1.5		orange, orange brown, very loose	
			loose	
	2.0		light grey	
			medium dense	
			loose	
			medium dense	
	2.5		loose	
			trace fine to medium angular gravel	
			orange brown	
			some fine to coarse angular to rounded gravel, medium dense	
	3.0		dense	
			medium dense	
			saturated	28/06/2023
			END OF BORE. 3.20 METRES. (HOLE COLLAPSE)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH21

Sheet 1 of 1

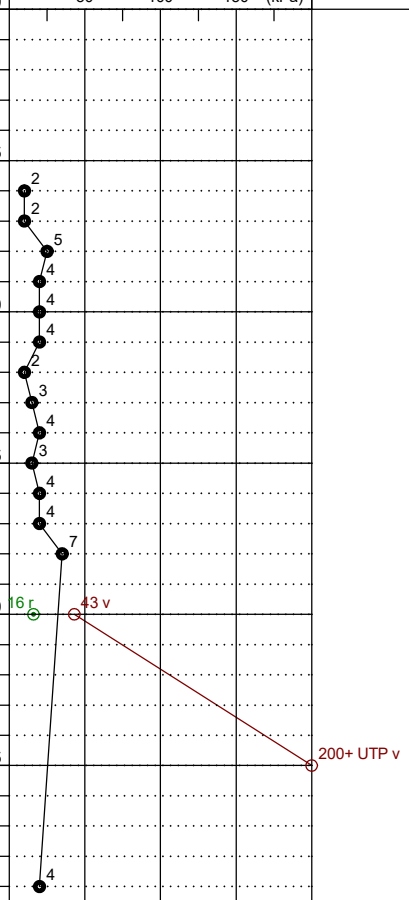
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	0.8m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
	0.0		TOPSOIL
			fine sandy SILT, minor clay, brown, stiff, wet, slightly plastic (ALLUVIAL DEPOSITS)
			some clay, orange, yellow
	0.5		fine to medium SAND, some silt, light grey, orange mottles, very loose, wet
			loose
			saturated
			medium dense
			light brown
	1.0		yellow brown
	1.5		trace silt
			fine sandy SILT, light grey, stiff, saturated, non plastic, highly dilatant
	2.0		orange, firm
			SILT some fine sand, some organic silt, minor clay, brown, stiff, saturated, slightly plastic
	2.5		SILT some fine sand, light grey, very stiff, saturated, non plastic, highly dilatant
			light brown, stiff
			light grey
	3.0		fine to medium SAND, some silt, light blue grey, medium dense, saturated
HINUERA FORMATION			END OF BORE. 3.00 METRES. (TOO DENSE TO AUGER)
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 27/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH22

Sheet 1 of 1

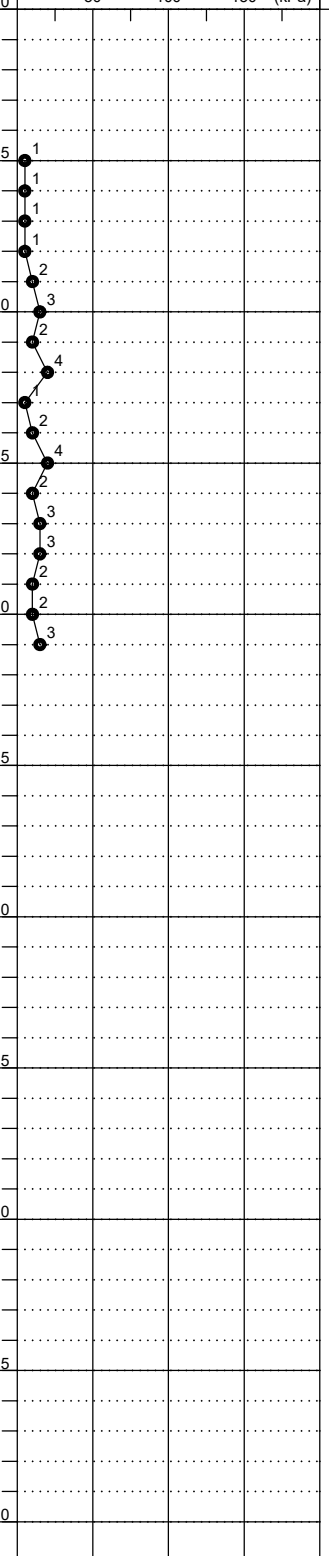
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	30/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	30/6/23	Water Level:	2.0m 30/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION			fine sandy SILT, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)
	0.5		fine SAND, minor silt, dark orange, very loose, moist
	1.0		fine to coarse SAND, trace silt loose light brown minor fine to medium angular gravel, loose medium dense very loose dark orange, orange, loose medium dense light brown, loose
	1.5		
	2.0		wet saturated
	2.5		END OF BORE. 2.20 METRES. (HOLE COLLAPSE)
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 30/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH23

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR ○ v ⊙ r 50 100 150 (kPa)	LABORATORY TESTS
T	0.0		TOPSOIL		0.0		
H.FORMATION	0.5		fine SAND, some silt, brown, very loose, moist (ALLUVIAL DEPOSITS) dark orange		0.5	1 1 1 2 2 3 3 5	
	1.0		fine to coarse SAND. minor fine to coarse angular gravel, no silt, loose orange, yellow medium dense		1.0		
	1.5		END OF BORE. 1.10 METRES. (GRAVEL OBSTRUCTION)		1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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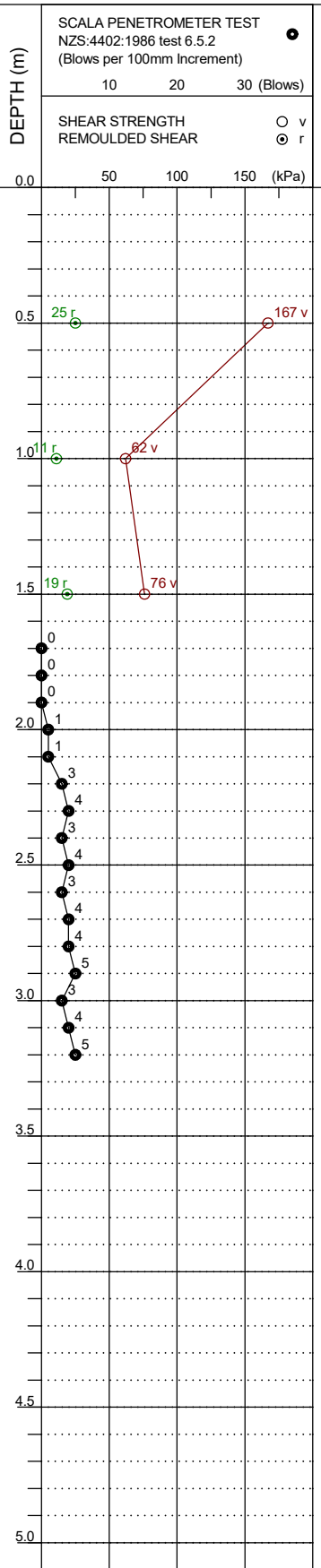
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH24

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	28/6/23	Water Level:	1.2m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
HINUERA FORMATION			fine sandy SILT, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
			minor clay, dark orange, slightly plastic	
	0.5		some clay, wet	
			orange, very stiff	
			trace clay, light grey, orange, very stiff, highly dilatant	
			stiff	
	1.0		white	
			saturated	28/06/2023
	1.5		fine to medium SAND, some silt, white, very loose, saturated	
			SILT some fine sand, white, firm, saturated, non plastic, highly dilatant	
	2.0		fine to medium SAND, minor silt, white, very loose, saturated	
			medium dense	
	2.5			
	3.0			
	3.5		END OF BORE. 3.20 METRES. (TOO DENSE TO AUGER)	
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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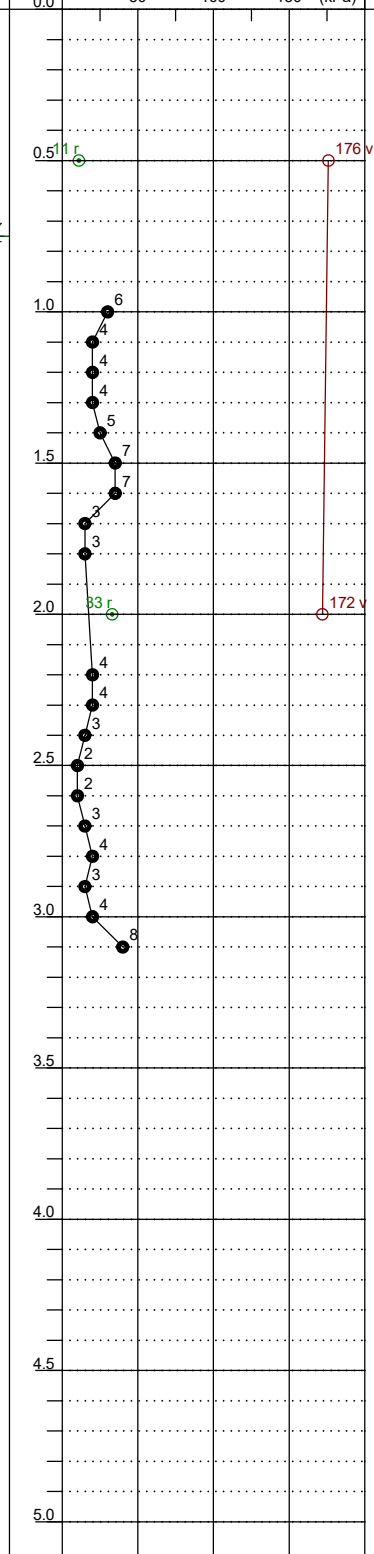
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH25

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	28/6/23	Water Level:	0.8m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
HINUERA FORMATION	0.0		TOPSOIL	
			fine sandy SILT, minor clay, brown, firm, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			some clay, dark orange	
			medium to coarse SAND, minor silt, orange, light grey, very loose, saturated	
	0.5		fine sandy SILT, minor clay, light grey, orange, very stiff, wet, slightly plastic	
			fine to coarse sandy SILT	
			SILT some clay, some fine sand, white, yellow streaks, very stiff, saturated, slightly plastic	28/06/2023
	1.0		fine to medium SAND, some silt, white, loose, saturated	
			SILT some fine sand, white, very stiff, saturated, non plastic, highly dilatant	
	1.5		fine sandy SILT, white, very stiff, saturated, non plastic, highly dilatant	
			firm	
	2.0		very stiff	
			fine to medium SAND, some silt, white, medium dense, saturated	
	2.5		SILT some fine sand, white, orange streaks, firm, saturated, non plastic, highly dilatant	
			fine to medium SAND, some silt, white, medium dense, saturated	
	3.0			
			END OF BORE. 3.15 METRES. (TOO DENSE TO AUGER)	
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH26

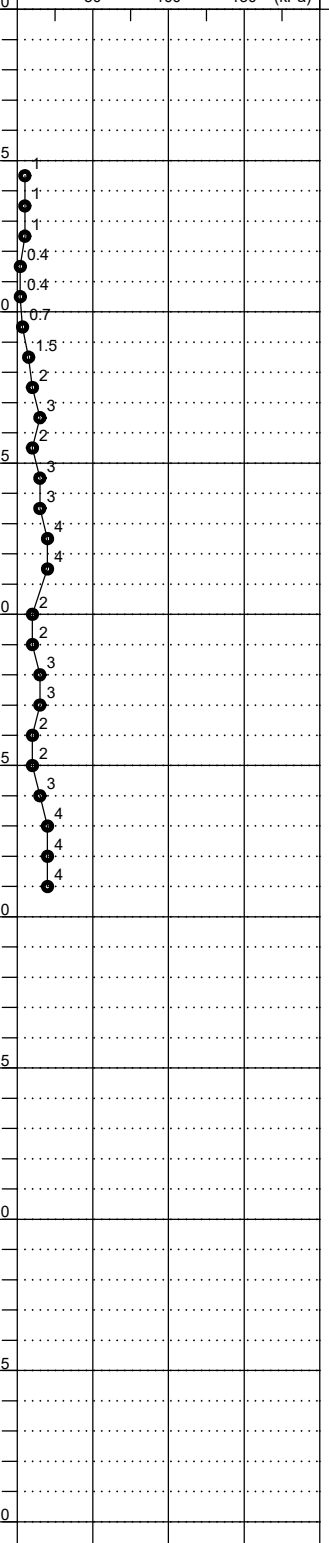
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	29/6/23	Water Level:	1.8m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
	0.5		fine to medium SAND, some silt, dark orange, very loose, moist	
			SILT some fine sand, minor clay, dark orange, stiff, moist, slightly plastic	
			fine to medium SAND, minor silt, orange, very loose, moist	
	1.0		SILT some fine to medium sand, some clay, yellow orange, firm, moist, slightly plastic	
			light grey, orange streaks	
	1.5		fine to medium sandy SILT, white, stiff, wet, non plastic	
			fine to medium SAND, minor silt, white, loose, wet	
			saturated	29/06/2023
	2.0		silty, fine to medium SAND, white, loose, saturated, highly dilatant	
			light grey, medium dense	
	2.5		fine to medium SAND, some silt, light grey, loose, saturated	
			loose	
			medium dense	
			light orange, light grey	
	3.0		fine sandy SILT, orange, light grey, stiff, saturated, non plastic, highly dilatant	
			END OF BORE. 3.00 METRES. (TARGET DEPTH)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH27

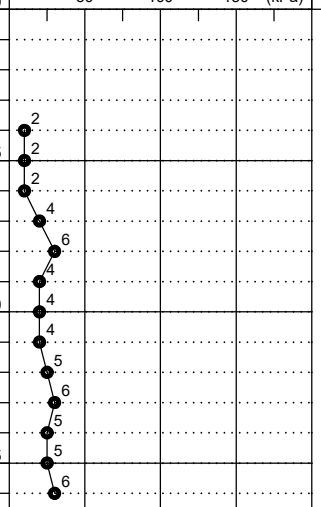
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, dark orange brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
			fine to medium SAND, minor silt, dark orange, loose, moist	
	0.5		minor coarse sand	
			medium to coarse SAND, minor fine to coarse rounded gravel, trace fine sand, trace silt, orange, light grey, dark orange	
	1.0		medium dense	
			wet	
			orange brown, dark orange	
	1.5			
			END OF BORE. 1.60 METRES. (GRAVEL OBSTRUCTION)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH28

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	2.3m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
			SILT some fine sand, minor clay, orange brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
HINUERA FORMATION	0.5		fine to medium SAND, some silt, dark orange, loose, moist	
			fine to coarse SAND	
			no silt	
			light orange, medium dense	
			wet	
	1.0		trace fine to medium rounded gravel, yellow, orange	
			yellow grey	
			orange brown	
	1.5		light grey, light brown	
	2.0		minor fine to coarse rounded gravel	
			loose	
			saturated	29/06/2023
	2.5		END OF BORE. 2.50 METRES. (HOLE COLLAPSE)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.0	
0.5	3, 2
	5, 5
1.0	3, 4
	4, 5
	6, 6
1.5	5, 6
	6, 4
2.0	4, 3
	3, 1.5
2.5	1, 1.5
3.0	
3.5	
4.0	
4.5	
5.0	

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH29

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR ○ v ◉ r 50 100 150 (kPa)	LABORATORY TESTS
T	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		fine SAND, some silt, dark orange, loose, moist (ALLUVIAL DEPOSITS)		0.5	2 2 3 2 4 4 3 1	
	1.0		fine to medium SAND medium to coarse SAND, minor fine to coarse subrounded gravel, orange, brown, light grey fine to coarse angular to rounded gravely, medium to coarse SAND, brown grey, loose, moist very loose		1.0	1 1 1 2 2 3	
	1.5		loose medium dense		1.5	4 4 5	
	2.0		END OF BORE. 1.80 METRES. (GRAVEL OBSTRUCTION)		2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH30

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR ○ v ◉ r 50 100 150 (kPa)	LABORATORY TESTS
	0.0		TOPSOIL		0.0		
			fine sandy SILT, dark orange, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)				
HINUERA FORMATION			fine SAND, some silt, dark orange, very loose, moist				
	0.5		loose		0.5	1 1 3	
			very loose			1 1 2	
			medium to coarse SAND, minor fine to coarse angular to rounded gravel, trace silt			1 2.5	
	1.0		orange grey, dark orange, loose		1.0	1 1 1.5 3	
			very loose				
			loose				
			very loose				
	1.5		END OF BORE. 1.40 METRES. (HOLE COLLAPSE)		1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH31

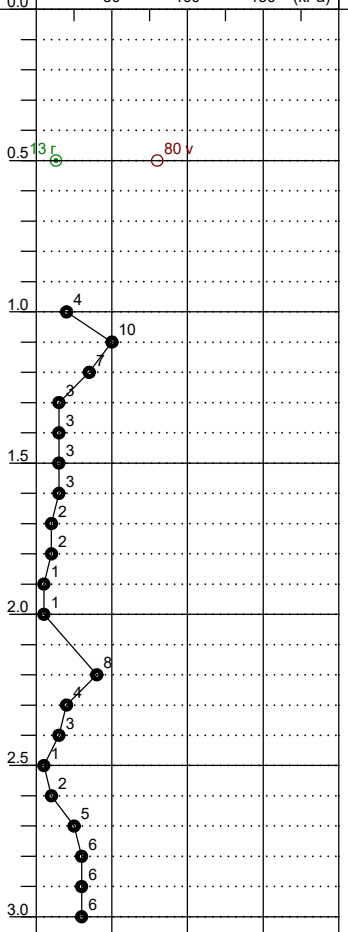
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	28/6/23	Water Level:	0.6m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
			fine sandy SILT, minor clay, brown, firm, wet, slightly plastic (ALLUVIAL DEPOSITS)	
			brown, grey brown, stiff	
	0.5		brown grey, wet	
			saturated, highly dilatant	28/06/2023
			fine to medium SAND, some silt, grey, light brown grey, very loose, saturated	
	1.0		light grey, medium dense	
			fine to coarse SAND, trace silt, dense	
			some orange mottles, medium dense	
HINUERA FORMATION			yellow grey	
	1.5		SILT minor fine sand, light grey, stiff, saturated, slightly plastic, highly dilatant	
			firm	
	2.0			
			fine to medium SAND, some msilt, white, medium dense, saturated	
	2.5		loose	
			fine sandy SILT, light brown, stiff, saturated, non plastic, highly dilatant	
			fine to medium SAND, some silt, light grey, medium dense, saturated	
	3.0		END OF BORE. 3.00 METRES. (TARGET DEPTH)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH32

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	30/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	30/6/23	Water Level:	1.8m 30/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
T	0.0		TOPSOIL		0.0		
HINUERA FORMATION			fine sandy SILT, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)				
			fine SAND, minor silt, orange, very loose, moist				
	0.5		loose		0.5	2	
			very loose			1	
			loose			2	
			fine to medium sand			2	
						2	
	1.0		red brown		1.0	3	
			fine to coarse SAND, trace fine to medium angular gravel			3	
						3	
			very loose			1.5	
			light brown			1.5	
	1.5				1.5	1.5	
			yellow, loose			2	
			wet			2	
			medium dense, saturated	30/06/2023		4	
	2.0		END OF BORE. 1.90 METRES. (HOLE COLLAPSE)		2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH33

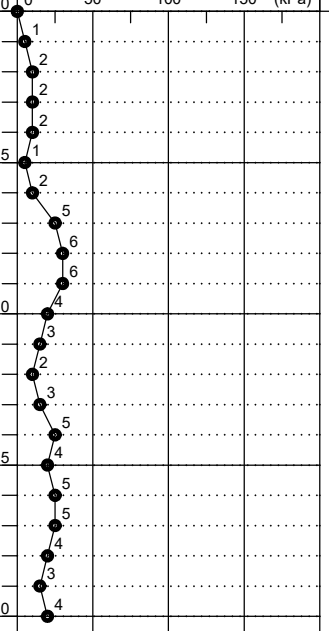
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	0.7m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
			fine sandy SILT, minor clay, brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			trace clay, light grey, non plastic	
	0.5		fine SAND, some silt, loose, wet	
			very loose	
			loose	
HINUERA FORMATION			white, medium dense	28/06/2023
	1.0			
			loose	
			medium dense	
	1.5			
	2.0			
			END OF BORE. 2.00 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
0 50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH34

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	28/6/23	Water Level:	0.8m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
HINUERA FORMATION	0.0		TOPSOIL		0.0		
			fine sandy SILT, minor clay, brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)				
			brown, red brown				
	0.5		fine to medium SAND, some silt, light grey, light orange, very loose, wet		0.5	2	
			loose			2	
			fine to medium sandy SILT, minor clay, light grey, light orange, stiff, wet, slightly plastic			2	
			fine to medium SAND, some silt, light grey, loose, saturated			2	
	1.0		very loose	28/06/2023	1.0	1	
						1	
						1.5	
			END OF BORE. 1.20 METRES. (HOLE COLLAPSE)				
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH35

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	30/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	30/6/23	Water Level:	0.3m 30/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
T	0.0		TOPSOIL		0.0		
HINUERA FORMATION			fine to medium sandy SILT, brown, grey brown, stiff, wet, non plastic (ALLUVIAL DEPOSITS) minor clay, slightly plastic				
			medium to coarse SAND, yellow, light orange, very loose, saturated	30/06/2023			
	0.5		medium dense		0.5	1 1 5 5 6	
	1.0		loose yellow grey, hole collapsing		1.0	4 2 4 2 4	
	1.5		SILT, minor fine sand, light grey, stiff, saturated, non plastice, highly dilatant light yellow		1.5	3 3 4 3 10	
			light brown				
	2.0		fine sandy SILT, brown and light brown, stiff, saturated, non plastic, highly dilatant		2.0	6 10 8 7 3	
			fine to medium SAND, minor silt, blue grey, medium dense, saturated				
	2.5		fine sandy SILT, light blue grey, very stiff, saturated, non plastic, highly dilatant		2.5	4 2 3 2 3	
			fine to medium SAND, blue grey, loose, saturated, hole collapsing back to 2.7m				
	3.0		Hole collapsing		3.0		
			END OF BORE. 3.00 METRES. (TARGET DEPTH)				
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH36

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	30/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	30/6/23	Water Level:	1.9m 30/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
			fine sandy SILT, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
			fine SAND, minor silt, very loose, moist	
	0.5			
			loose	
	1.0		medium to coarse SAND, minor fine to medium angular gravel, light brown	
			medium dense	
	1.5		light grey	
			dark orange	
			wet	
	2.0		light grey, saturated	30/06/2023
HINUERA FORMATION			END OF BORE. 2.10 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.0	
0.5	1
	1
	1
	1
	2
1.0	3
	2
	5
	5
	6
1.5	4
	4
	4
	6
2.0	4
	5
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH37

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	1.5m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT some fine to medium sand, orange brown, very stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
	1.0		fine to coarse SAND, minor silt, orange brown, loose, moist no silt, yellow, orange, orange brown minor fine angular gravel, red brown, yellow minor fine to medium angular gravel some silt, very loose, wet loose	
	1.5		no silt, brown, white, saturated medium dense some fine angular gravel, grey brown very loose	29/06/2023
	2.0		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

35 r
111 v

DEPTH (m)	Blows
1.0	3
	3
	3
	1
	3
	4
1.5	3
	2
	5
	5
	1.5
2.0	1.5

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH38

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	2.2m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		fine to coarse SAND, minor silt, orange brown, very loose, moist (ALLUVIAL DEPOSITS)
			trace fine subangular gravel, light grey, orange brown, medium dense
			loose
			medium dense
	1.0		loose
			very loose
	1.5		loose
			for 100mm; some silt, light grey, wet below this depth
	2.0		very loose
			for 100mm; light grey, saturated below this depth
			loose
	2.5		medium dense
	3.0		END OF BORE. 2.60 METRES. (NO RECOVERY)
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 29/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
⊙ r
50 100 150 (kPa)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Scala blows: 3, 3, 2, 3, 4, 4, 2, 2, 1.5, 1.5, 1, 2, 2, 2, 2, 0, 0, 0, 2, 3, 4, 4

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

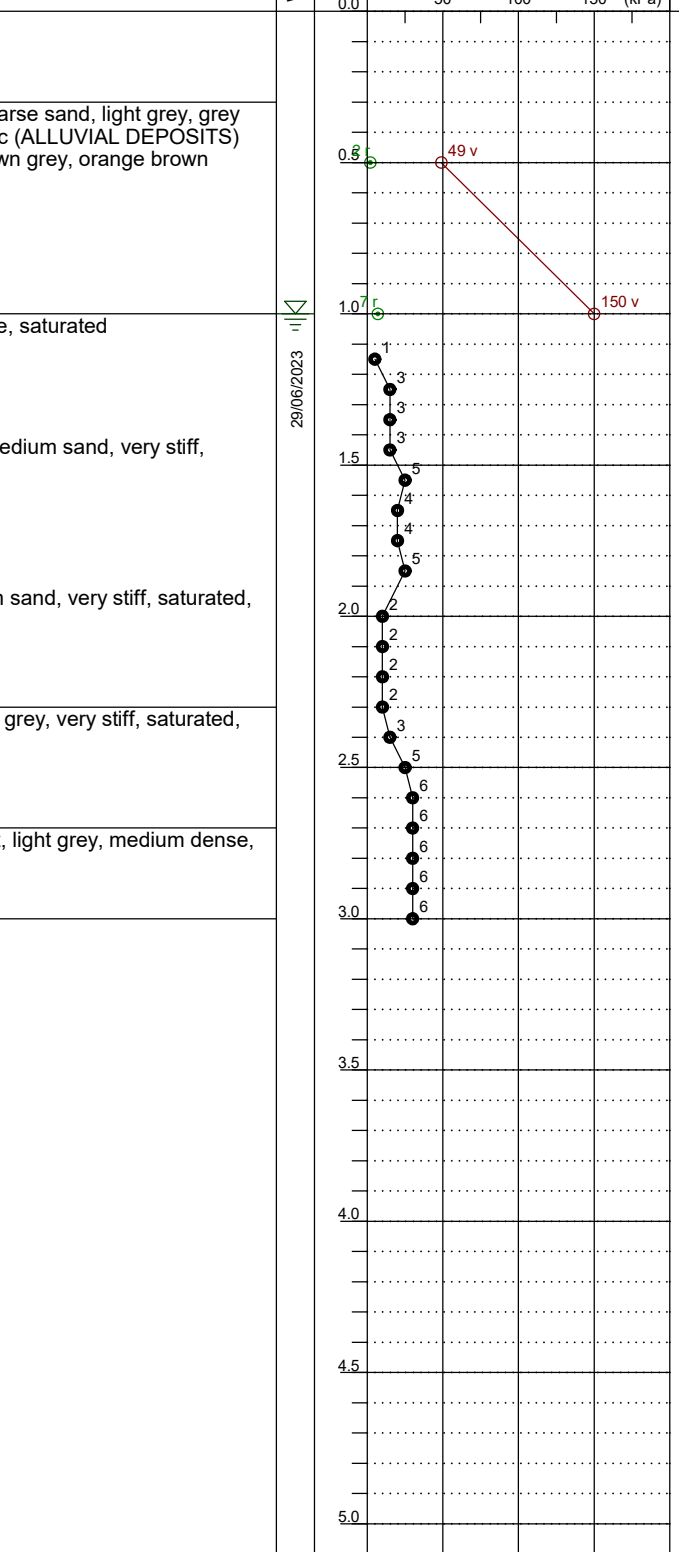
PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH39

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	1.0m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT some clay, trace fine to coarse sand, light grey, grey brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS) minor fine to medium sand, brown grey, orange brown streaks	
			some fine to medium sand	
	1.0		silty, fine SAND, light grey, loose, saturated	29/06/2023
	1.5		for 100mm; SILT trace fine to medium sand, very stiff, saturated, non plastic medium dense	
	2.0		for 100mm; SILT fine to medium sand, very stiff, saturated, non plastic	
	2.5		SILT trace clay, trace fine sand, grey, very stiff, saturated, non plastic	
	3.0		fine to medium SAND, some silt, light grey, medium dense, saturated	
			END OF BORE. 3.00 METRES. (TARGET DEPTH)	
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH40

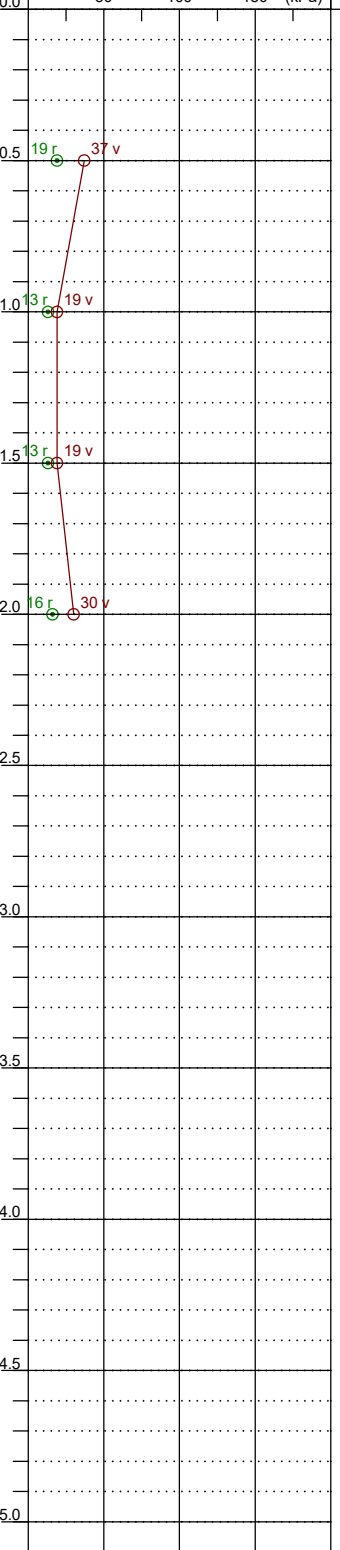
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	DEG
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Tree Leaves
Date Finished:	29/6/23	Water Level:	0.4m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT some fine sand, minor clay, brown, firm, wet, slightly plastic (ALLUVIAL DEPOSITS) saturated	29/06/2023
	1.0		fine sandy SILT, light grey, light brown, firm, saturated, non plastic soft brown some decomposed wood fragments	
			SILT some fine sand, minor clay, brown, firm, saturated, slightly plastic	
	1.5		decomposed WOOD	
			PEAT (SILT some wood fibres), brown, soft, saturated, non plastic some decomposed wood fragments	
	2.0		SILT, brown grey, soft, saturated, non plastic	
			silty, fine to medium SAND, dark brown, grey, medium dense, saturated	
	2.5		END OF BORE. 2.40 METRES. (TOO DENSE TO AUGER)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH41

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	27/6/23	Water Level:	0.5m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine to coarse SAND, some fine to medium angular gravel, orange brown, orange, very loose, wet (ALLUVIAL DEPOSITS)	
			SILT some clay, minor fine sand, orange, stiff, saturated, non plastic some fine to coarse sand	27/06/2023
	1.0		fine to coarse sandy SILT, minor clay, light grey, light orange, very stiff, saturated, slightly plastic	
			fine to medium SAND, some silt, grey, medium dense, saturated	
	1.5		END OF BORE. 1.30 METRES. (HOLE COLLAPSE)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

19 r
183 v
1
5
5
5

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH42

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	27/6/23	Water Level:	1.2m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
FILL	0.0		TOPSOIL / FILL	
			fine sandy SILT, trace clay, intermixed with, SILT minor clay, brown, orange, stiff, moist, slightly plastic (FILL)	
HINUERA FORMATION			fine to medium SAND, dark orange brown, very loose, moist (ALLUVIAL DEPOSITS)	
	0.5		fine to coarse sandy SILT, dark orange brown, firm, moist, non plastic	
	1.0		fine to coarse SAND, minor fine to medium angular gravel, yellow brown, grey brown, loose, wet	
			saturated	27/06/2023
	1.5		END OF BORE. 1.40 METRES. (HOLE COLLAPSE)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.0	
0.5	0
	0
	0
	0.5
	1.5
1.0	2
	2
	2
	2
	2
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH43

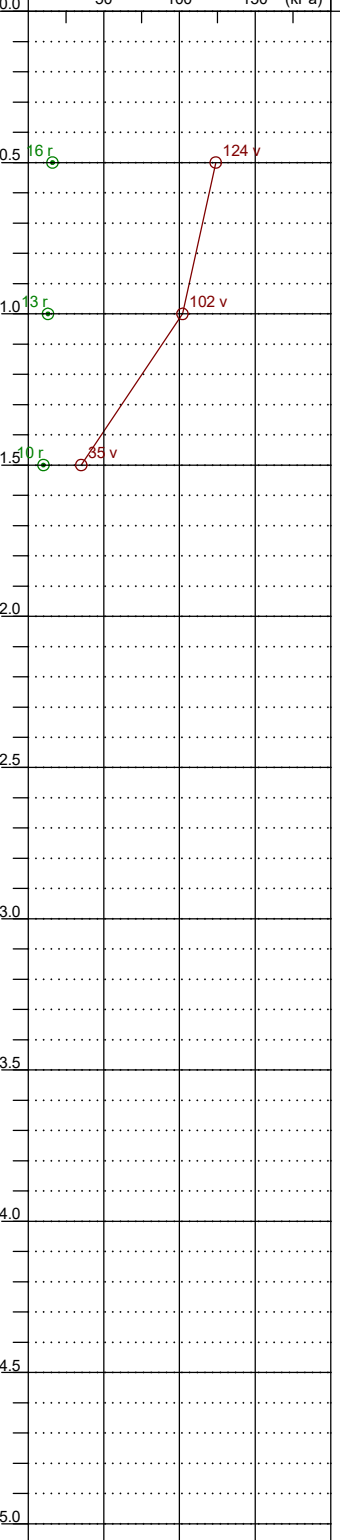
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	0.4m 29/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT some clay, minor fine sand, brown, very stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			saturated	29/06/2023
	1.0		clayey SILT, minor fine sand, grey brown, very stiff, saturated, moderately plastic	
	1.5		fine to medium sandy SILT, trace clay, grey brown, firm, saturated, non plastic	
			grey	
	2.0		minor roots to 6mm diameter	
			END OF BORE. 2.00 METRES. (NO RECOVERY)	

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH44

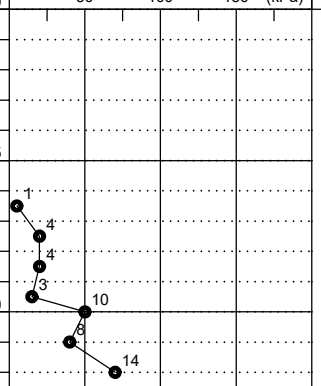
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	GROUNDWATER NOT ENCOUNTERED		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine to medium sandy SILT, minor clay, orange brown, black speckles, very stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
	1.0		silty, fine to coarse SAND, orange brown, white speckles, loose, moist medium dense dense black speckles, wet trace fine angular gravel	
	1.5		END OF BORE. 1.25 METRES. (GRAVEL OBSTRUCTION)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH45

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	0.8m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows); SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
T	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		SILT some clay, minor fine to coarse sand, organic stained, dark brown, black, soft, wet, slightly plastic (ALLUVIAL DEPOSITS)		0.5	15 v	
			trace fine sand				
			trace roots to 5mm diameter				
			minor fine to coarse sand, saturated	27/06/2023			
	1.0		<10% sample recovery		1.0	17 v	
			silty, fine to coarse SAND, trace roots to 2mm diameter, dark brown, black, very loose, saturated				
			END OF BORE. 1.20 METRES. (NO RECOVERY)				
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH46

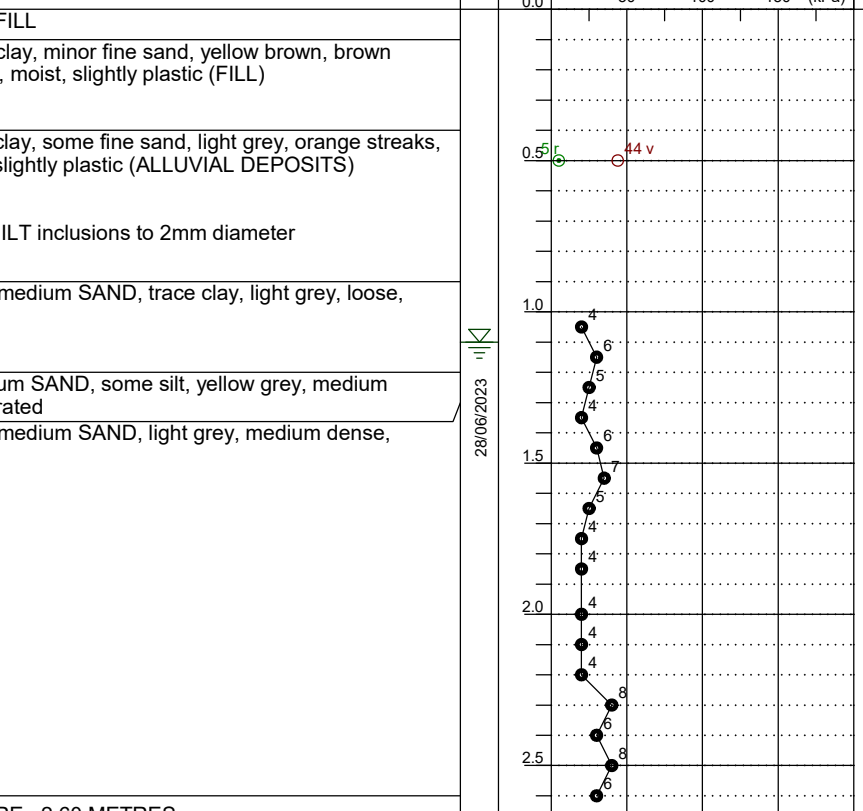
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	1.1m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
FILL	0.0		TOPSOIL / FILL	
			SILT minor clay, minor fine sand, yellow brown, brown streaks, stiff, moist, slightly plastic (FILL)	
HINUERA FORMATION	0.5		SILT some clay, some fine sand, light grey, orange streaks, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			trace hard SILT inclusions to 2mm diameter	
	1.0		silty, fine to medium SAND, trace clay, light grey, loose, moist	
			fine to medium SAND, some silt, yellow grey, medium dense, saturated	28/06/2023
	1.5		silty, fine to medium SAND, light grey, medium dense, saturated	
	2.0			
	2.5			
	3.0		END OF BORE. 2.60 METRES. (NO RECOVERY)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH47

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	28/6/23	Water Level:	1.9m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
FILL			fine to coarse sandy SILT, minor clay, intermixed with, TOPSOIL, grey brown, light grey streaks, stiff, moist, slightly plastic (FILL)	
HINUERA FORMATION	0.5		fine to coarse SAND, minor silt, light grey, medium dense, moist (ALLUVIAL DEPOSITS)	
			silty, fine to coarse SAND, minor silt, light grey, very loose, moist	
	1.0		fine to coarse SAND, some silt, grey, medium dense, moist	
			silty, fine to coarse SAND, light grey, light brown, medium dense, wet	
	1.5		saturated	
	2.0		clayey SILT, trace fine sand, light blue, light grey, hard, saturated, moderately plastic some fine sand	28/06/2023
			fine to medium sandy SILT, some clay, light grey, light blue, grey, green, yellow, hard, saturated, slightly plastic	
	2.5		SILT some clay, trace fine sand, light blue, light grey, hard, saturated, slightly plastic minor clay some fine to coarse sand	
	3.0		END OF BORE. 2.80 METRES. (NO RECOVERY)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.0	
0.5	4
	4
	4
	4
	4
1.0	4
	3
	5
	4
	4
1.5	6
	5
	7
	5
	5
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	

LABORATORY TESTS
2.0 200+ UTP v
2.5 200+ UTP v

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH48

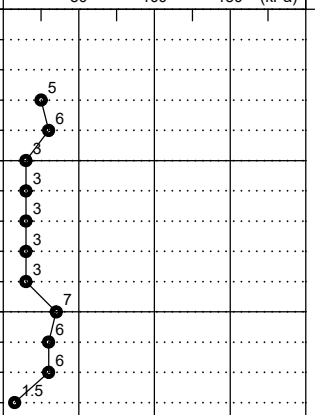
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	1.3m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to coarse SAND, minor silt, brown, dark brown, very loose, moist (ALLUVIAL DEPOSITS)	
			medium dense	
	0.5		loose	
			red brown, brown, wet	
	1.0		light grey, medium dense	
			loose, saturated	
			END OF BORE. 1.30 METRES. (NO RECOVERY)	28/06/2023
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH49

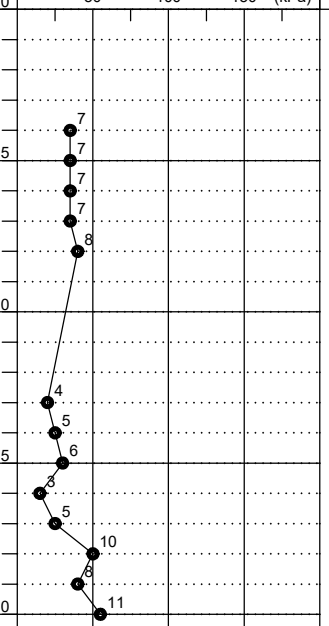
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	1.0m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to coarse sandy SILT, light grey, brown speckles, very stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
	0.5		fine to medium SAND, trace silt, light grey, orange, black, loose, moist fine to coarse SAND, medium dense yellow brown, black, white speckles	
	1.0		silty fine SAND, light grey, orange brown streaks, loose, wet silty fine to coarse SAND saturated	28/06/2023
	1.5		SILT minor clay, minor fine sand, minor clay, blue, orange mottles, very stiff, saturated, slightly plastic some clay	
	2.0		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH50

Sheet 1 of 1

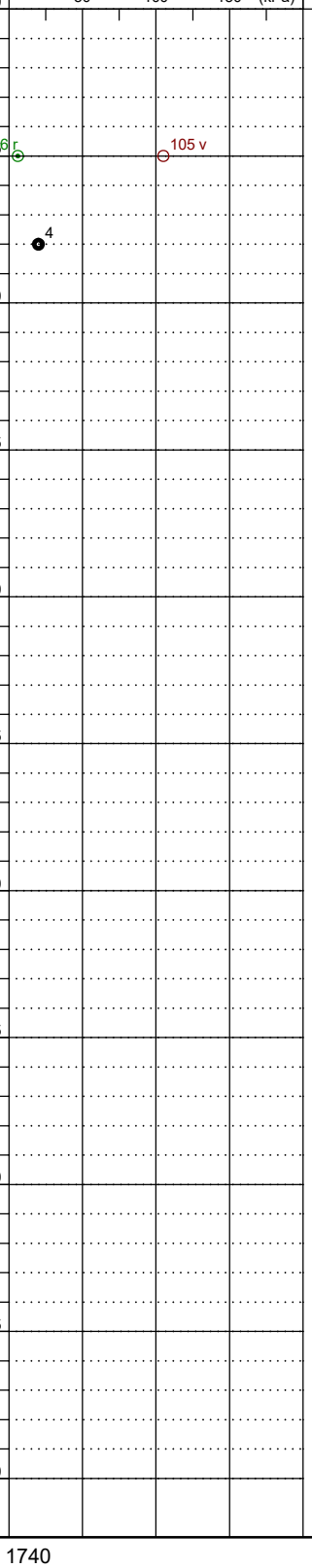
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	JN
Drilled By:	DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Slightly Sloping, Grass
Date Finished:	27/6/23	Water Level:	0.6m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
HINUERA FORMATION			SILT minor clay, minor fine sand, brown, firm, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			grey brown, yellow brown	
	0.5		light grey, light brown orange	
			saturated	27/06/2023
			fine to coarse angular GRAVEL, some fine to coarse sand, some silt, grey, brown, medium dense, saturated	
	1.0		END OF BORE. 0.80 METRES. (GRAVEL OBSTRUCTION)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m) 0.0



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH51

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	1.0m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
	0.0		TOPSOIL	
FILL	0.5		SILT minor fine sand, minor clay, light grey, orange brown mottles, stiff, moist, slightly plastic (FILL)	
H.FORMATION			SILT minor fine sand, minor clay, light grey, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			some fine sand, wet	
			fine to medium sandy SILT, trace clay, light grey, stiff, wet, non plastic	
	1.0		silty, fine to medium SAND, light grey, loose, wet saturated	28/06/2023
			no recovery	
			END OF BORE. 1.15 METRES. (NO RECOVERY)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m) 0.0

0.5: 15 r, 79 v

1.0: 2, 2, 2, 2

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH52

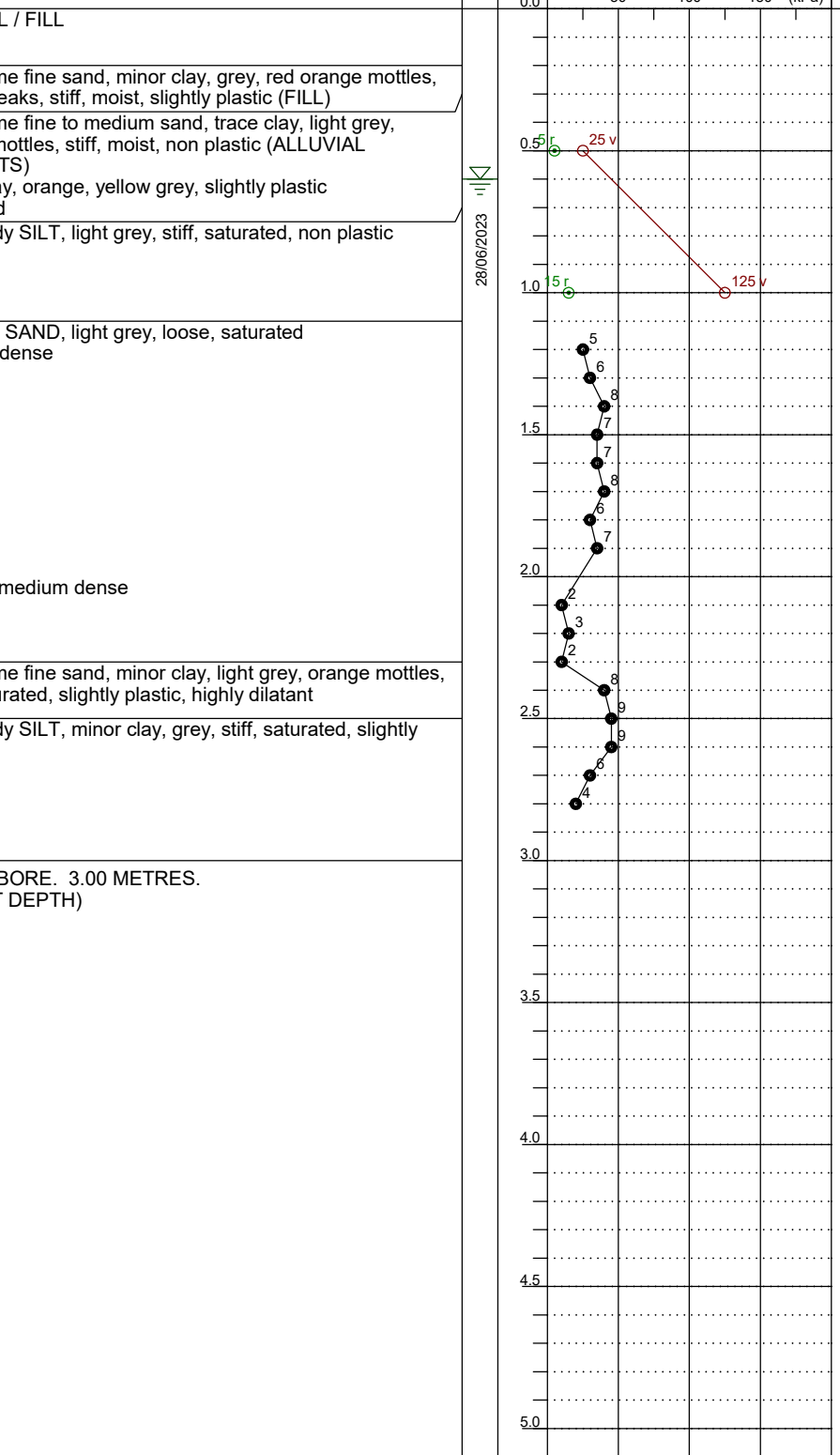
Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	28/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	28/6/23	Water Level:	0.6m 28/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
FILL	0.0		TOPSOIL / FILL	
			SILT some fine sand, minor clay, grey, red orange mottles, black streaks, stiff, moist, slightly plastic (FILL)	
HINUERA FORMATION	0.5		SILT some fine to medium sand, trace clay, light grey, orange mottles, stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
			some clay, orange, yellow grey, slightly plastic saturated	28/06/2023
	1.0		fine sandy SILT, light grey, stiff, saturated, non plastic	
			silty, fine SAND, light grey, loose, saturated medium dense	
	1.5			
	2.0		loose to medium dense	
	2.5		SILT some fine sand, minor clay, light grey, orange mottles, stiff, saturated, slightly plastic, highly dilatant	
			fine sandy SILT, minor clay, grey, stiff, saturated, slightly plastic	
	3.0		END OF BORE. 3.00 METRES. (TARGET DEPTH)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH53

Sheet 1 of 1

Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	1.0m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine SAND, some silt, trace clay, light grey, orange brown mottles, very loose, moist (ALLUVIAL DEPOSITS)	
			SILT some fine to medium sand, minor clay, light grey, stiff, wet	
			some fine to coarse sand	
			some fine sand, no medium to coarse sand	
	1.0		saturated	27/06/2023
			some fine to coarse sand	
			fine to coarse sandy SILT, minor clay, light grey, stiff, saturated, slightly plastic	
	1.5		SILT some fine sand, minor clay, light grey, stiff, saturated, slightly plastic	
			fine sandy SILT, trace clay, light grey, stiff, saturated, non plastic	
	2.0		SILT some fine sand, minor clay, light grey, stiff, saturated, slightly plastic	
			fine sandy SILT, trace clay, light grey, stiff, saturated, non plastic	
	2.5		very stiff	
			fine to coarse sandy SILT	
			END OF BORE. 2.70 METRES. (TOO HARD TO AUGER)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.0	3
	2
0.5	2
	4
	4
	1.33
1.0	0.66
	1
	3
	7
	5
1.5	6
	4
	4
	4
	4
2.0	4
	3
	4
	6
	6
2.5	8
	9
	7
3.0	
3.5	
4.0	
4.5	
5.0	

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH54

Sheet 1 of 1

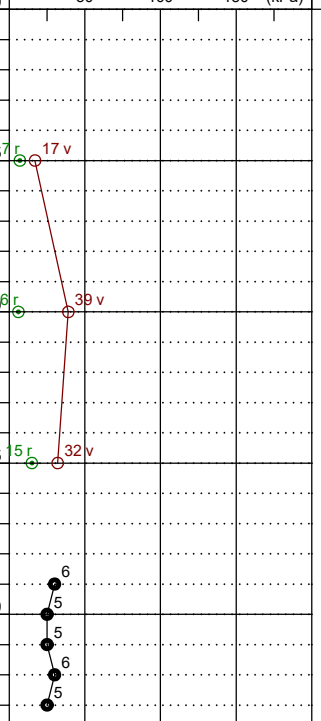
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	KMAC
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	0.7m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT some fine sand, minor clay, orange, firm, moist, slightly plastic (ALLUVIAL DEPOSITS) some fine to medium sand, light grey, black
	1.0		fine to medium sandy SILT, minor clay, light grey, light orange streaks, firm, moist, slightly plastic wet light yellow grey, saturated
	1.5		SILT some fine to medium sand, minor clay, light yellow grey, orange streaks, firm, saturated, slightly plastic fine sandy SILT, minor clay, light grey yellow, stiff, moist, slightly plastic
	2.0		SILT some fine to medium sand, minor clay, trace hard SILT inclusions to 2mm diameter, light blue grey, orange mottles, firm, saturated, slightly plastic fine to coarse SAND, trace silt, yellow grey, black, orange speckles, medium dense, saturated light grey, white, orange speckles no recovery
	2.5		END OF BORE. 2.30 METRES. (NO RECOVERY)
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 27/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Haupatu, 195 Swayne Road, Cambridge

Auger Hole No: AH55

Sheet 1 of 1

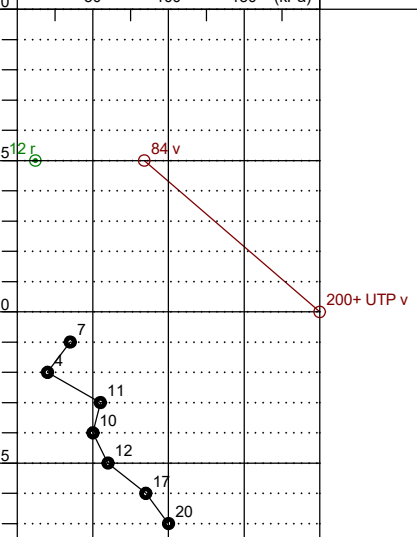
Drill Type:	50mmØ Hand Auger	Project No:	230322	Logged By:	ZP
Drilled By:	KMAC	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	27/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	27/6/23	Water Level:	1.6m 27/06/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT minor clay, orange brown, brown, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)
			some clay, dark grey, orange brown
			light grey, wet
			trace fine to coarse sand
	1.0		for 50mm; fine to coarse sandy SILT, trace clay, light grey, hard, wet, non plastic
			silty, fine to coarse SAND, light grey, medium dense, wet
			dense
	1.5		very dense, saturated
			no sample recovery
	2.0		END OF BORE. 1.80 METRES. (NO RECOVERY)
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 27/06/2023

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 230322 - AH10-55 - 195 SWAYNE RD - 2023-06-26.GPJ S+R_2013.GDT 18/8/23

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	PZ01	Cont'd	PZ02	PZ03	Cont'd	PZ04	Cont'd	PZ05	Cont'd	PZ06	PZ07	Cont'd
DEPTH START[m]	1.10	3.10	2.70	2.30	4.30	2.00	4.00	2.00	4.00	3.40	3.00	5.00
50 mm	1	2	6	3	4	2	2	2	3	0.5	4	3
100	2	3	6	2	4	2	1	2	4	0.5	3	3
150	3	2	8	1	2	2	2	4	4	1	4	5
200	2	3	7	1	2	2	1	4	4	1	2	4
250	2	5	7	2	2	2	1	5	2	1	2	3
300	2	7	6	2	3	7	2	5	2	1	0.5	3
350	2	7	5	3	3	2	1	5	3	2	0.5	4
400	2	8	4	4	4	1	1	5	4	2	2	4
450	3	6	4	3	5	1	0.5	3	2	2	2	2
500	4	7	4	4	6	1	0.5	3	1	2	2	4
550	0.5	6	2	4	6	1	1	2	1	2	4	3
600	0.5	7	4	5	8	2	2	3	2	2	4	3
650	1	7	8	5	4	1	2	2	2	2	4	3
700	2	7	8	6	7	1	2	2	1	2	4	4
750	2		14	5	6	2	3	0.5	2	2	3	5
800	2		10	5	5	2	3	0.5	1	3	3	4
850	1		12	5	5	2	3	1	2	3	4	5
900	0.33		15	5	4	2	4	1	2	3	3	8
950	0.33		11	2	4	2		0.5	2	3	3	
1000	0.33			5	6	2		0.5	3	4	4	
1050	1			4	5	1		1		3	3	
1100	1			3	3	1		1		4	4	
1150	1			2	3	1		3		4	3	
1200	2			1	3	1		3		4	5	
1250	1			1	3	1		3		4	5	
1300	1			1	4	1		2		5	6	
1350	3			2	3	2		3		4	4	
1400	4			3	4	2		4		5	4	
1450	4			2	5	2		4		5	5	
1500	3			3	5	2		3		5	3	
1550	4			2	6	3		2		5	4	
1600	2			3	6	3		3		5	3	
1650	4			3	6	2		3			3	
1700	5			4	7	1		3			2	
1750	4			3		1		4			3	
1800	5			4		3		3			2	
1850	4			3		2		3			1	
1900	5			3		3		5			1	
1950	7			3		3		5			3	
2000	2			3		1		3			5	
DEPTH END [m]		3.80	3.65		6.00		4.90		5.00	5.00		5.90

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	PZ08	Cont'd	PZ09	Cont'd								
DEPTH START[m]	3.00	5.00	1.90	3.90								
50 mm	1	3	1	2								
100	2	3	0.3	1								
150	2	3	0.3	2								
200	2	2	0.3	2								
250	2	1	0.5	2								
300	2	1	0.5	3								
350	2	2	1	2								
400	1	2	1	2								
450	0.33	2	1	3								
500	0.33	2	1	3								
550	0.33	3	1	2								
600	0.25	3	1	3								
650	0.25	5	1	4								
700	0.25	6	1	4								
750	0.25	6	1	3								
800	0.25	4	2	3								
850	0.25	5	1	4								
900	0.25	6	1	4								
950	0.25	5	1	4								
1000	1	6	1	4								
1050	2		1	2								
1100	2		1	3								
1150	1		1									
1200	1		2									
1250	2		2									
1300	2		1									
1350	3		1									
1400	4		2									
1450	3		2									
1500	3		2									
1550	3		2									
1600	3		2									
1650	3		2									
1700	4		2									
1750	4		2									
1800	2		3									
1850	4		2									
1900	5		3									
1950	3		3									
2000	3		3									
DEPTH END [m]		6.00		5.00								

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	AH10	AH11	Cont…	AH12	AH13	Cont…	AH14	AH15	Cont…	AH16	AH17	
DEPTH START[m]	3.35	0.90	2.90	4.20	2.00	4.00	3.00	1.50	3.50	3.40	4.05	
50 mm	11	3	5	4	1	8	3	3	6	4	8	
100	3	4	7	6	1	7	5	4	5	3	6	
150	2	5	6	4	1	6	10	5	6	6	6	
200	1	3	6	6	1	6	7	4	5	9	5	
250	2	3	6	5	1	6	8	2	4	9	4	
300	3	6	7	6	1	6	6	4	4	9	6	
350	3	7	6	6	1	6	7	6	5	8	6	
400	3	7	7	3	1	5	7	6	6	6	7	
450	4	5	7	1	1	6	6	4	7	6	5	
500	4	3	7	3	1	6	5	6	7	6	6	
550	2	3	7	6	1	4	7	10	7	4	6	
600	4	3	7	5	1	6	8	7	8	5	5	
650	5	5	7	5	2	6	7	5	8	4	6	
700	5	5	7	5	1	4	8	4	6	0.5	5	
750	5	7	7	6	2	4	10	3	6	0.5	8	
800	4	6	6	5	1	4	10	3	7	2	8	
850	4	4	7		2	5	11	2	5	3	8	
900	4	7	8		2	6	11	5	4	4	10	
950	4	2	6		2	4	10	5	3	8	7	
1000	3	2	4		2	4		6	4	12		
1050	5	4	6		2			4	4	11		
1100	3	5	5		2			4	4	9		
1150	2	5	6		3			4	4	7		
1200	1	6	7		3			5	4	10		
1250	1	7	8		2			4	3	8		
1300	1	7	7		4			6	5	9		
1350	2	6	5		3			6	5	10		
1400	2	6	6		2			6	6	10		
1450	4	7	7		2			7	5	10		
1500	4	5	7		4			6	6	10		
1550	4	4	8		2			8		10		
1600	3	7	9		2			8				
1650	3	6	8		2			6				
1700		6	9		3			6				
1750		6	9		2			6				
1800		5	10		2			6				
1850		6	10		2			5				
1900		5	10		3			6				
1950		6	10		3			6				
2000		5	10		3			4				
DEPTH END [m]	5.00		4.90	5.00		5.00	3.95		5.00	4.95	5.00	

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	AH18	Cont…	AH19	AH20	AH21	AH22	Cont…	AH23	Cont…	AH24	AH25	AH27
DEPTH START[m]	2.00	4.00	3.40	3.20	3.00	2.20	4.20	1.10	3.10	3.20	3.15	1.60
50 mm	4	5	3	3	2	0.5	4	3	3	3	2	2
100	3	5	4	4	2	0.5	5	2	3	2	6	4
150	2	5	4	3	1	1	5	2	3	4	4	4
200	0.5	6	6	3	2	4	6	2	3	3	5	2
250	0.5	5	5	2	2	2	6	1	3	3	6	3
300	1	4	6	1	2	1	7	2	4	3	4	3
350	1	4	6	1	2	4	10	2	5	2	5	3
400	2	5	6	1	2	5	10	1	4	3	2	4
450	2	7	4	1	2	3	7	3	5	3	2	4
500	2	8	4	1	2	4	5	2	5	3	2	3
550	2	7	4	1	2	4	5	3	3	4	2	2
600	2	5	3	1	2	3	5	2	1	3	2	3
650	2	6	3	2	2	1	5	2	4	4	4	2
700	4	7	4	2	2	0.5	7	4	3	3	5	2
750	2	7	4	2	0.5	0.5	6	4	3	3	3	3
800	0.5	6	4	1	0.5	1	6	2	2	4	4	4
850	0.5	9	1	2	1	1		3	2	6	3	3
900	6	8	0.5	4	1	4		4	3	6	2	3
950	5	8	0.5	2	2	2		10	3	6	2	3
1000	2	8	2	1	2	2		8	3	6	3	3
1050	2		1	1	2	3		5	3	4	6	3
1100	2		2	1	3	2		5	2	4	7	2
1150	4		2	2	3	1		6	3	4	6	3
1200	4		5	1	3	2		5	4	8	4	3
1250	5		6	2	3	6		5	4	5	5	3
1300	4		5	2	3	5		6	5	3	7	2
1350	4		4	2	3	4		5	5	4	5	1
1400	6		5	3	3	7		5	2	4	6	2
1450	4		5	2	3	5		4	3	4	5	
1500	1		5	3	3	2		3	4	4	4	
1550	2		5	3	4	3		3	4	6	7	
1600	1		5	3	5	2		7	5	4	5	
1650	2			1	5	3		4	4	5	7	
1700	2			3	3	2		4	3	8	4	
1750	1			2	2	2		4	4	4	6	
1800	2			2	2	3		4	4	4	5	
1850	2				2	3		4	2		5	
1900	3				2	2		3	3			
1950	4				2	3		3				
2000	3				2	3		3				
DEPTH END [m]		5.00	5.00	5.00	5.00		5.00		5.00	5.00	5.00	3.00

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	AH28	AH29	AH30	AH32	AH33	AH34	AH36	AH37	AH38	AH40	AH41	AH42
DEPTH START[m]	2.50	1.80	1.40	1.90	2.00	1.20	2.10	2.00	2.60	2.40	1.30	1.40
50 mm	0.5	3	1	2	1	1	4	0.5	3	0.5	3	1
100	1	3	2	2	3	0.5	4	1	1	0.5	2	1
150	1	3	1	1	3	0.5	2	1	3	3	2	2
200	2	0.5	1	1	3	1	3	2	2	4	2	2
250	0.5	0.5	2	1	1	0.5	3	1	2	7	2	2
300	0.5	3	2	1	2	0.5	4	0.5	2	10	0.5	2
350	1	3	4	3	0.5	0.5	3	0.5	2	14	0.5	1
400	2	2	2	3	0.5	0.5	3	0.5	2	10	0.5	1
450	1	1	2	0.5	0.5	0.5	3	0.5		10	0.5	3
500	1	1	1	0.5	0.5	0.5	3	0.5		10	1	2
550		0.5	5	2	1	0.5	2	0.5			1	2
600		0.5	5	2	1	0.5	3	1			10	5
650		3	4	2	1	0.5	3	4			7	3
700		1	5	3	3	0.5	3	5			7	2
750		0.5	5	4	3	2	3	1			8	2
800		0.5	4	5	3	1	3	1			6	4
850		1	5	3	3	1	3	1			8	4
900		3	4	3	3	1	3	3			6	3
950		1	4	5	3	2		2			7	2
1000		1	4	5	3	1		2			6	2
1050		2	2	2		1					6	1
1100		1	4	1		1					5	2
1150		1	5			1					6	2
1200		1	3			1					8	1
1250			2			3					10	1
1300			2			1					10	2
1350			3			2					12	1
1400			6			2					11	2
1450			5			1					12	2
1500			6			1						3
1550			5			3						2
1600			6			3						3
1650						2						
1700						2						
1750						2						
1800						2						
1850												
1900												
1950												
2000												
DEPTH END [m]	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.90	2.75	3.00

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	AH43	AH44	AH45	AH46	AH47	AH48	AH49	AH50	Cont…	AH51	AH53	AH54
DEPTH START[m]	2.00	1.25	1.20	2.60	2.80	1.30	2.00	0.80	2.80	1.15	2.70	2.30
50 mm	SUNK	6	0.5	4	1	1	4	2	8	1	4	2
100		9	0.5	2	1	0.33	7	2	5	2	3	3
150	1	5	0.2	3	1	0.33	17	0.5	5	2	6	2
200	3	4	0.2	2	1	0.33	14	0.5	5	2	6	3
250	3	3	0.2	2		0.33	15	1		3	6	2
300	4	2	0.2	3		0.33	11	1		3	6	1
350	3	3	0.2	2		0.33	7	1		3		2
400	3	2	0.33	2		0.5	4	2		4		2
450	5	3	0.33			0.5	5	1		3		3
500	8	4	0.33			1	5	2		2		3
550	7	6	0.5			1	5	2		2		3
600	5	2	0.5			1	4	4		2		3
650	9	2	0.5			1	8	4		2		3
700	8	2	0.5			2	8	5		2		3
750	6	1	1			3	11	4		2		
800	6	2	0.5			8	12	4		3		
850	6	2	0.5			6	11	3		2		
900	6	2	1			2	14	4		3		
950	6	2	1			3		6		3		
1000	6	3	1			4		5		3		
1050		2	1			3		7		3		
1100		2	1			4		7		3		
1150		2	3			3		7		2		
1200		3	3			1		10		2		
1250		4	3			1		8		4		
1300		3	4			1		8		3		
1350		4	4			3		10		2		
1400		5	5			3		8		3		
1450		3	6			4		8		4		
1500		4	9			3		7		5		
1550		5	14			3		8		4		
1600		5	16			5		8		3		
1650		4	18			5		8		3		
1700		5	10			5		10		5		
1750		4	13					10		6		
1800								11		6		
1850								10		6		
1900								8				
1950								5				
2000								8				
DEPTH END [m]	3.00	3.00	3.00	3.00	3.00	3.00	3.00		3.00	3.00	3.00	3.00

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 230322 **TESTED BY:** JN, ZP, KMAC, DEG

JOB NAME: Fonterra Hautapu, 195 Swayne Road, Cambridge **DATE:** 26-30/06/2023

Depth of Penetration [mm]	AH55											
DEPTH START[m]	1.80											
50 mm	6											
100	5											
150	6											
200	8											
250	6											
300	6											
350	4											
400	2											
450	1											
500	3											
550	7											
600	4											
650	4											
700	7											
750	9											
800	8											
850	5											
900	4											
950	8											
1000	5											
1050	7											
1100	8											
1150	8											
1200	8											
1250												
1300												
1350												
1400												
1450												
1500												
1550												
1600												
1650												
1700												
1750												
1800												
1850												
1900												
1950												
2000												
DEPTH END [m]	3.00											

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP01

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS/DEG
Drilled By:	TDS/DEG	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	Groundwater in Base of Pit		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORM.	0.5		SILT, minor clay, some fine to medium sand, minor fine to medium angular gravel, brown yellow, orange mottles, stiff, moist, slightly plastic (ALLUVIAL DEPOSITS)	
			fine to medium sandy SILT, minor clay, grey, orange mottles, very stiff, moist, slightly plastic	
	1.0		fine SAND, some fine angular gravel, trace silt, grey, orange streaks, loose, saturated, non plastic	
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)	

DEPTH (m)

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

TEST PIT FULL PAGE 230322 - TP01-09 - 195 SWAYNE RD - 2023-06-29.GPJ S+R_2013.GDT 19/7/23

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP02

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS/DEG
Drilled By:	TDS/DEG	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:	Groundwater in Base of Pit		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
TAURANGA GROUP			fine to coarse sandy SILT, light grey, brown speckles, very stiff, moist, non plastic (ALLUVIAL DEPOSITS)	
	0.5		fine to medium SAND, trace silt, light grey, orange, black, loose, moist fine to coarse SAND, medium dense yellow brown, black, white speckles	
	1.0		silty fine SAND, light grey, orange brown streaks, loose, wet saturated	
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)	

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)
SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP03

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS/DEG
Drilled By:	TDS/DEG	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		fine to coarse SAND,some silt, dark orange, loose, moist (ALLUVIAL DEPOSITS)
	1.0		medium to coarse SAND, trace fine to coarse gravel, orange brown, loose, moist
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)

WATER LEVEL (m)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)
SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP04

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	JP
Drilled By:	JP	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION	0.5		fine to medium sandy SILT, brown, grey brown, stiff, wet, non plastic (ALLUVIAL DEPOSITS) minor clay, slightly plastic
	1.0		END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)
	1.5		
	2.0		
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP05

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS/DEG
Drilled By:	TDS/DEG	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT some fine to coarse sand, trace fine to medium rounded gravel, orange, stiff, moist, non plastic (ALLUVIAL DEPOSITS)
	1.0		fine to coarse SAND, minor fine to medium angular gravel, grey, orange, black speckles, loose, moist
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)

WATER LEVEL (m)

DEPTH (m)

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP06

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	JP
Drilled By:	JP	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORM.	0.5		clayey SILT, dark brown, stiff, wet, moderately plastic (ALLUVIAL DEPOSITS)
			SILT some clay, some fine to medium sand, orange, brown, very stiff, wet, slightly plastic
	1.0		clayey SILT, trace fine sand, grey, very stiff, saturated, moderately plastic
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)

WATER LEVEL (m)

DEPTH (m)

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP07

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TOPSOIL	0.0		TOPSOIL fine sandy SILT, brown, stiff, moist (ALLUVIAL DEPOSITS)		0.0		
HINUERA FORMATION	0.5		fine to medium SAND, some silt, dark orange, loose, moist		0.5		
			fine to coarse SAND, trace silt, trace fine to coarse subangular gravel				
	1.0		no fine sand, reddish brown		1.0		
			END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)				
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP08

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION			SILT, some fine to coarse rounded gravel, minor fine sand, brown, stiff, moist, non plastic (ALLUVIAL DEPOSITS)				
	0.5		fine to coarse SAND, some fine rounded gravel, minor silt, brown, loose, moist		0.5		
			no silt				
	1.0		END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Hautapu, 195 Swayne Road, Cambridge

Test Pit No: TP09

Sheet 1 of 1

Drill Type:	Machine Testpit	Project No:	230322	Logged By:	JP
Drilled By:	JP	Coordinates:		Shear Vane No - Calibration Date:	GEO3564 - 2/05/2023
Date Started:	29/6/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	29/6/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
HINUERA FORMATION	0.0		TOPSOIL		0.0		
			fine sandy SILT, minor clay, brown, firm, moist, slightly plastic (ALLUVIAL DEPOSITS)				
			some clay, dark orange				
			medium to coarse SAND, minor silt, orange, light grey, very loose, saturated				
	0.5		fine sandy SILT, minor clay, light grey, orange, very stiff, wet, slightly plastic		0.5		
			fine to coarse sandy SILT				
	1.0		END OF TEST PIT. 1.00 METRES. (TARGET DEPTH)		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

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Appendix C

CPT and Liquefaction Analysis Results

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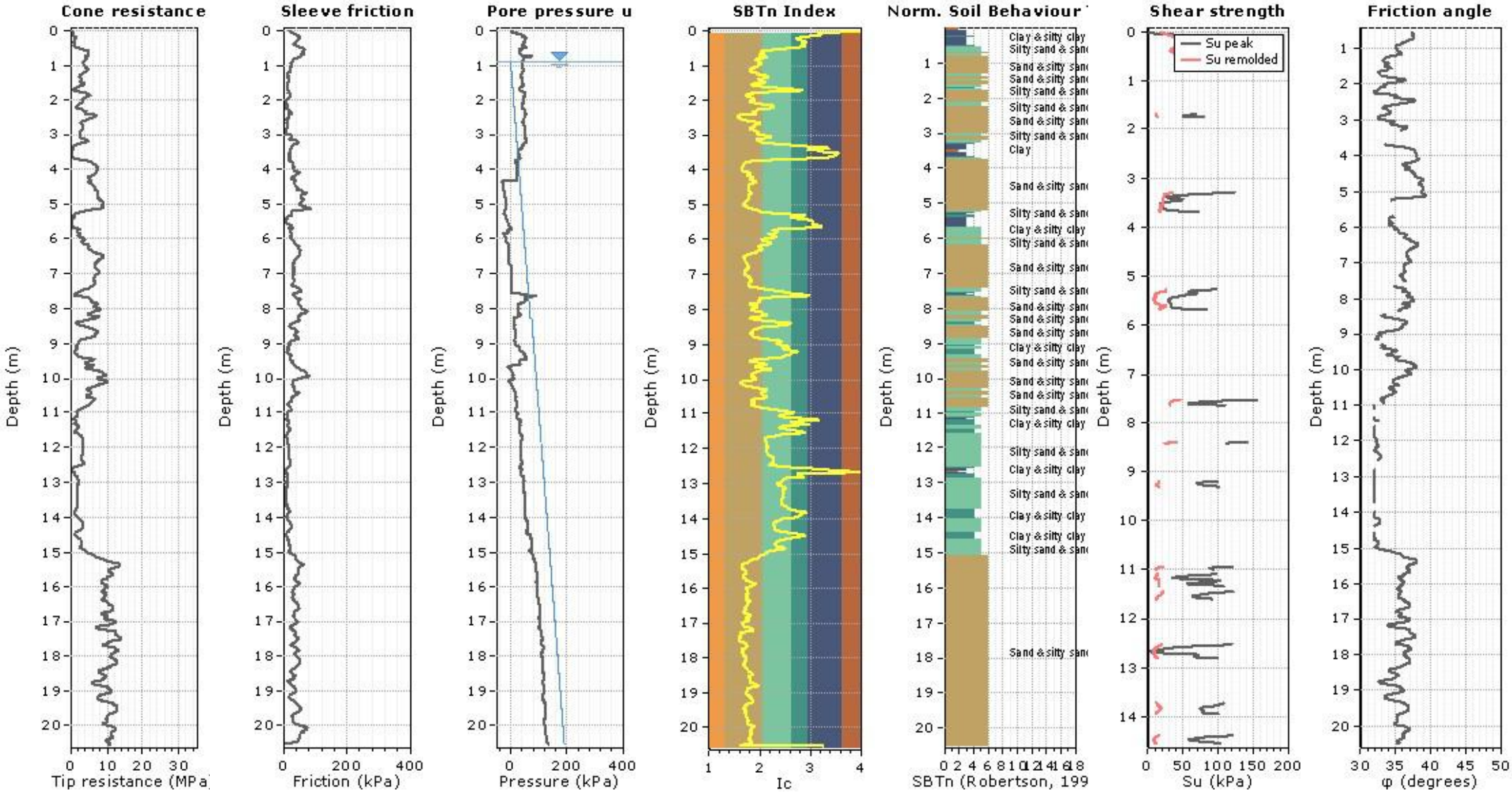
CPT: CPT01
Total depth: 20.55 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



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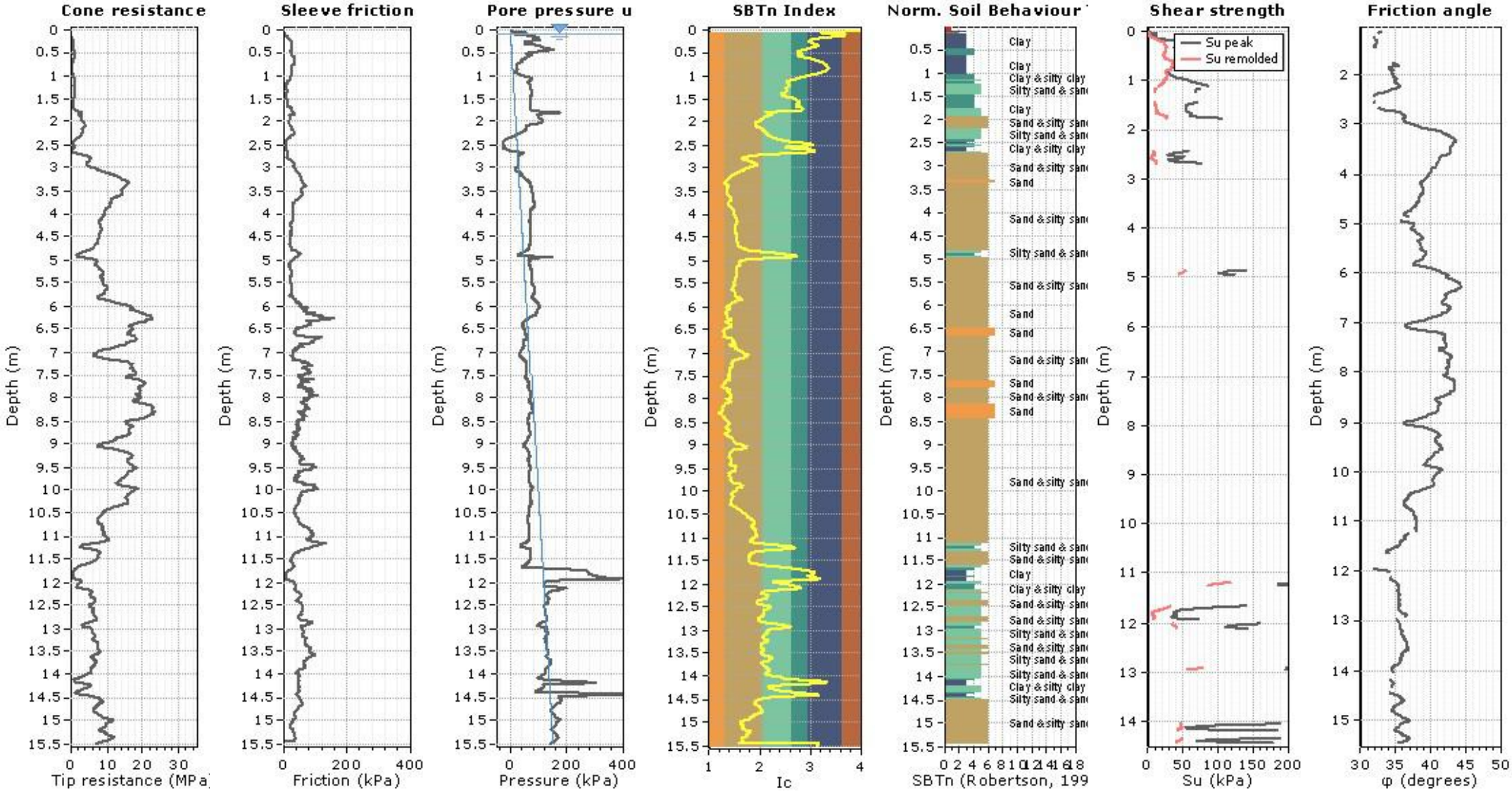
CPT: CPT02
Total depth: 15.51 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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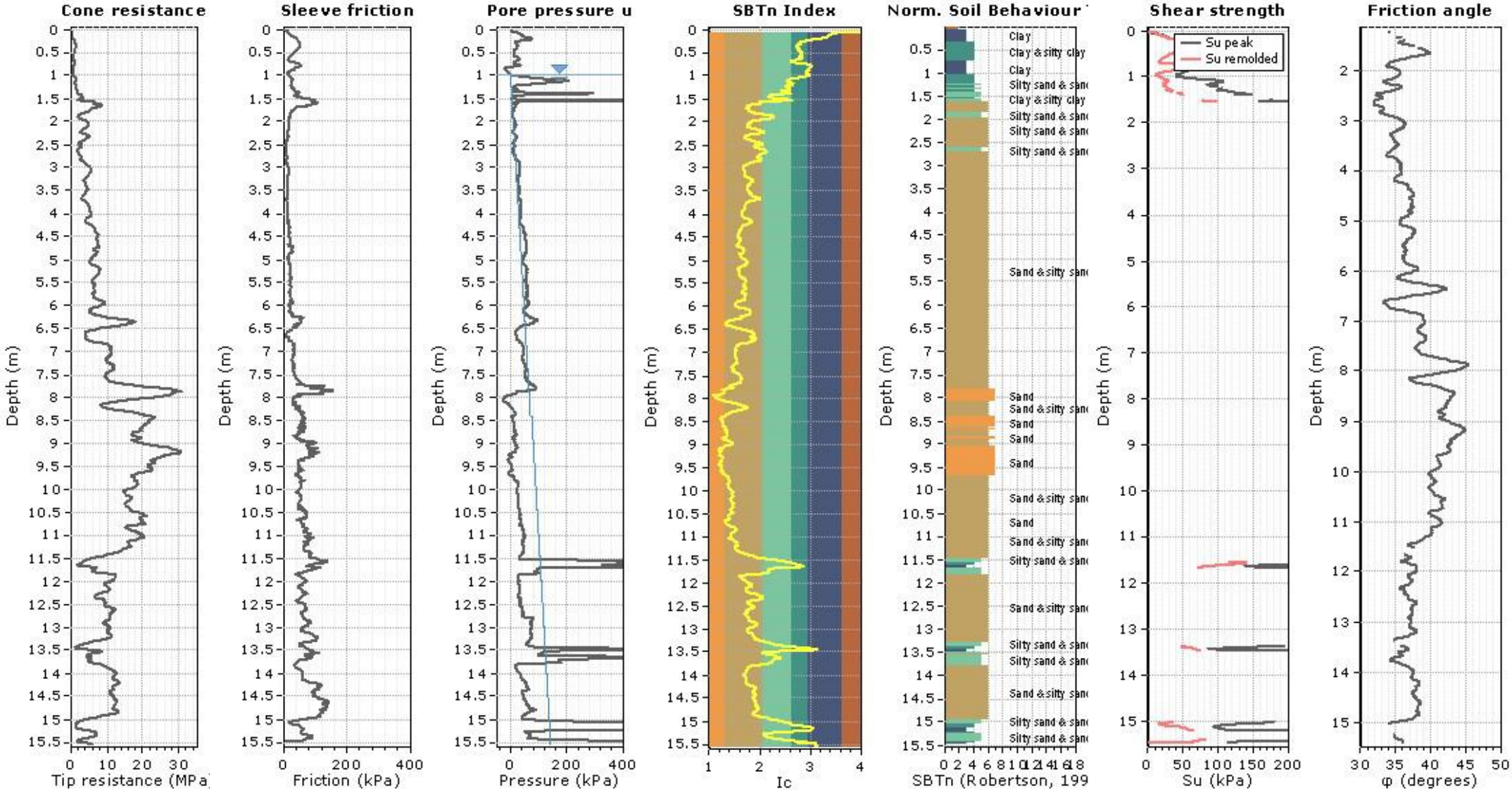
CPT: CPT03
Total depth: 15.53 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

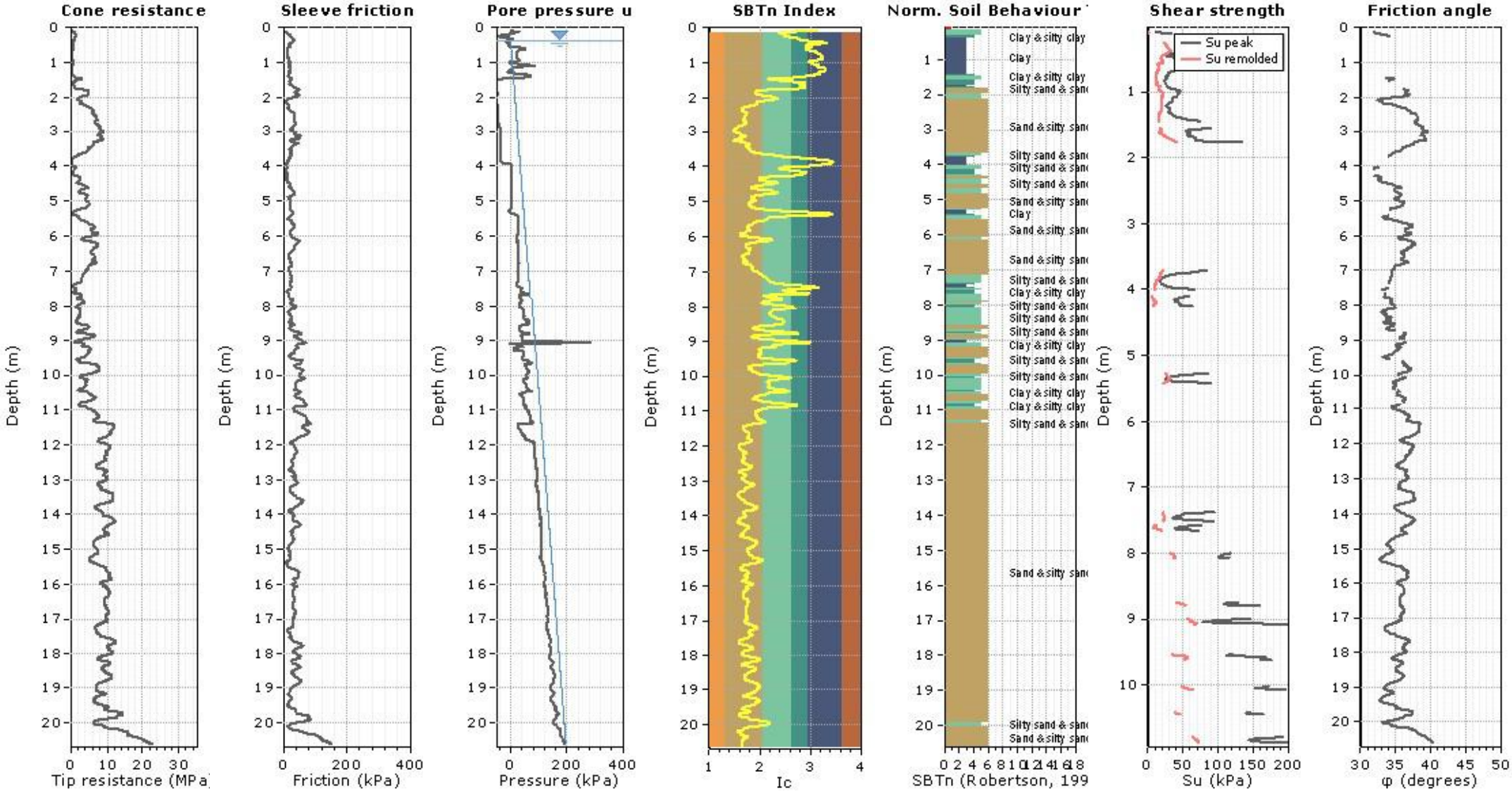
Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge

CPT: CPT04
Total depth: 20.59 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting



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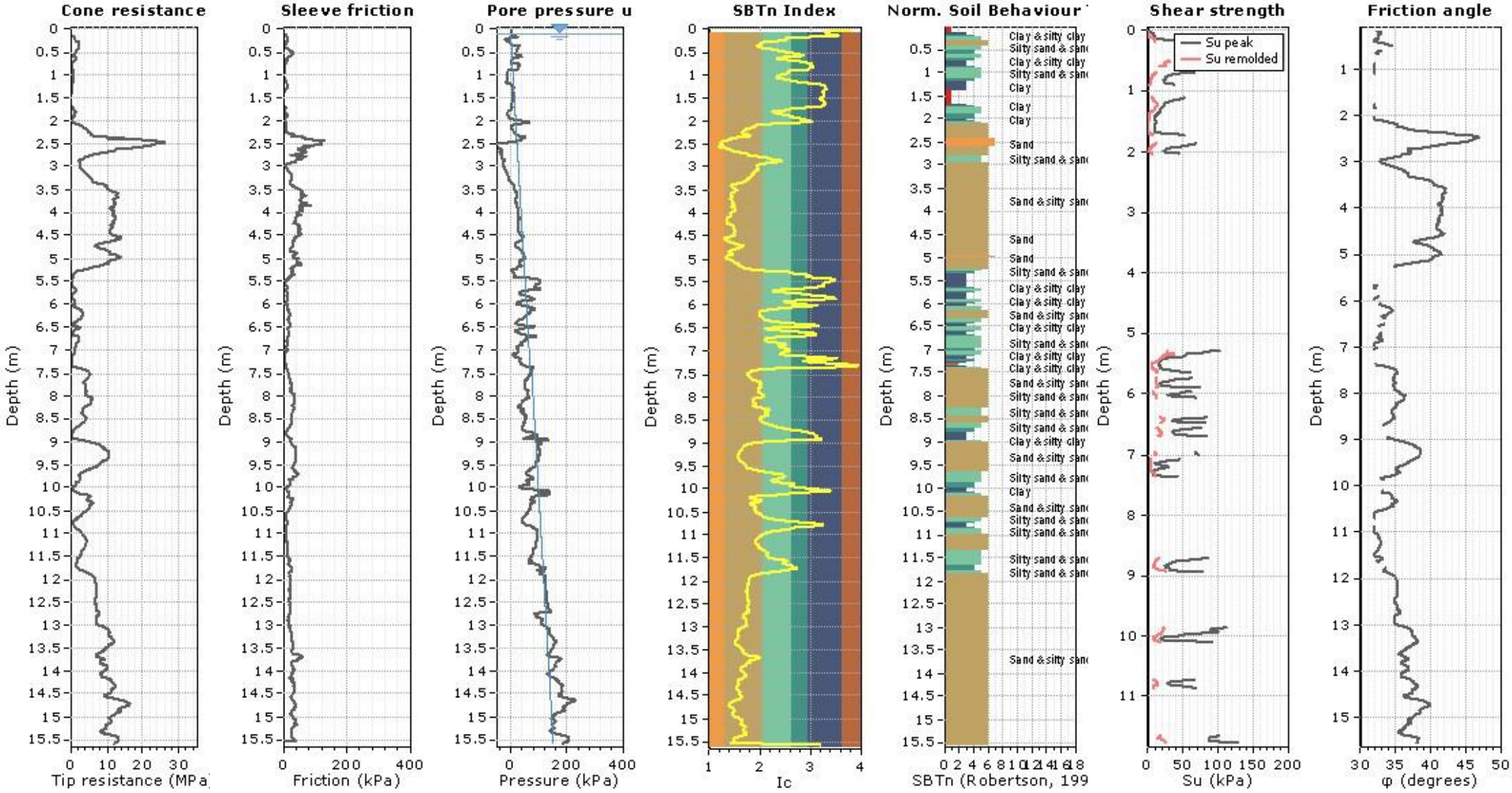
CPT: CPT05
Total depth: 15.59 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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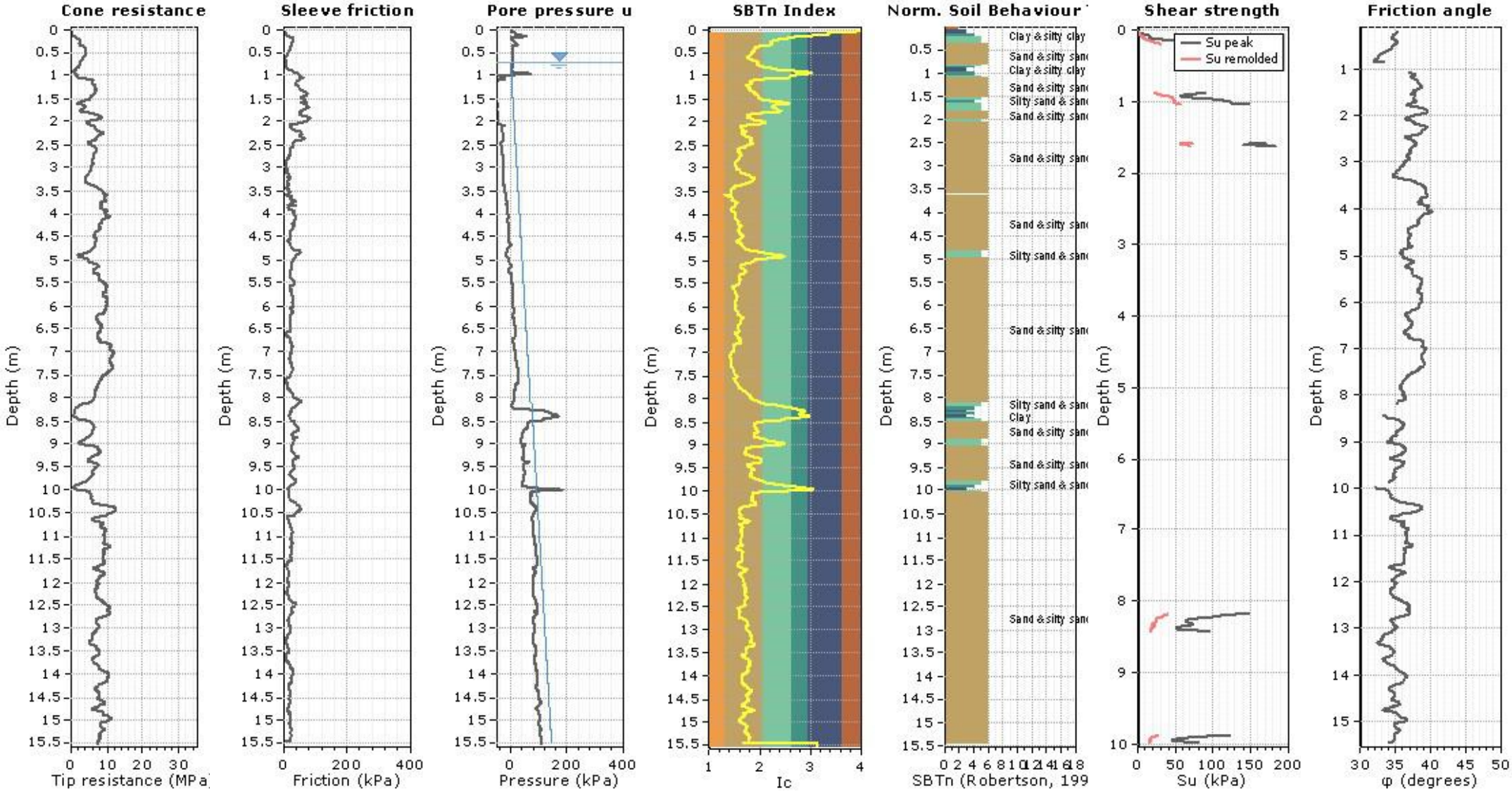
CPT: CPT06
Total depth: 15.52 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



Soil & Rock Consultants
289 Lincoln Road, Henderson
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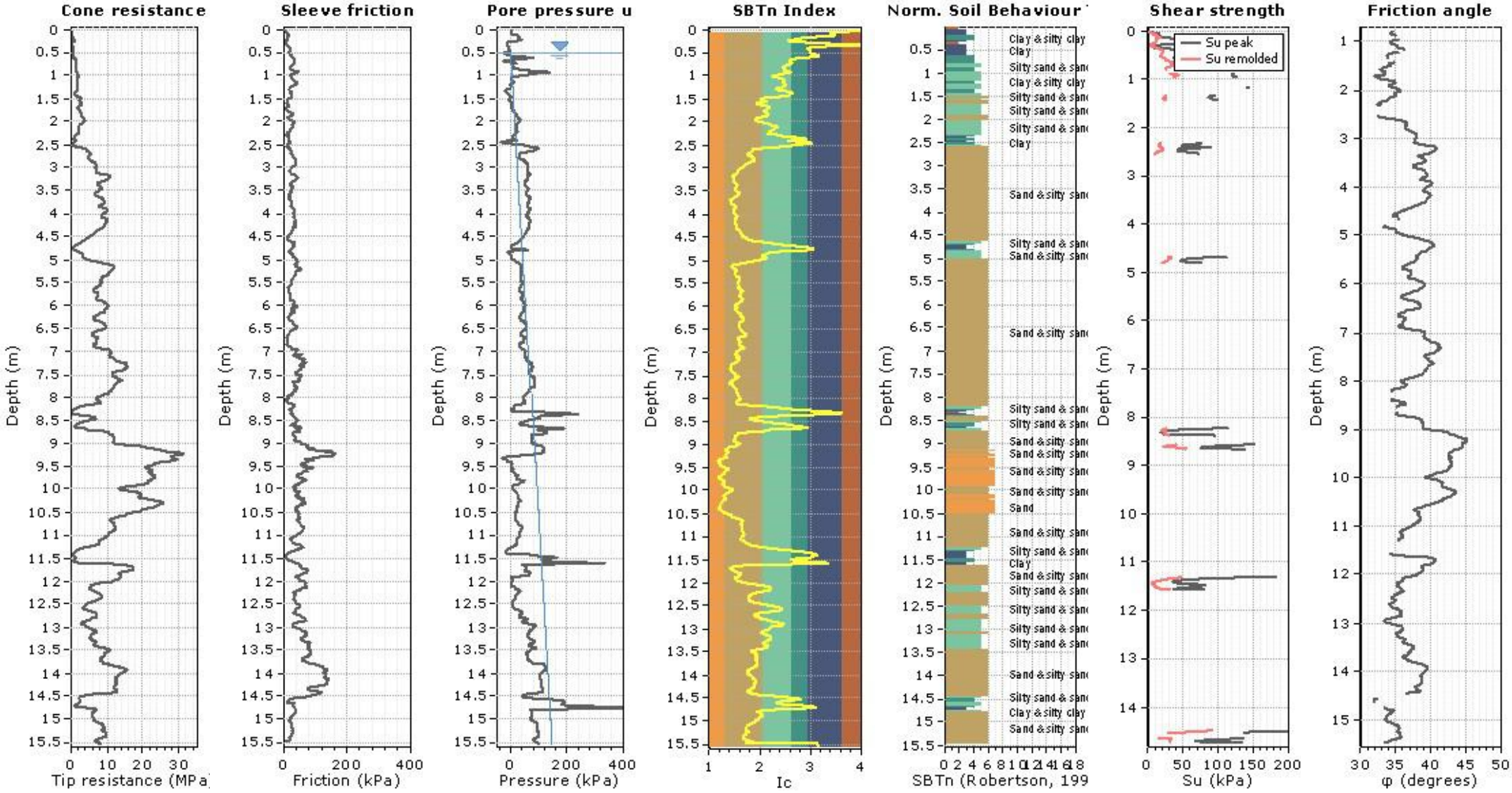
CPT: CPT07
Total depth: 15.54 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
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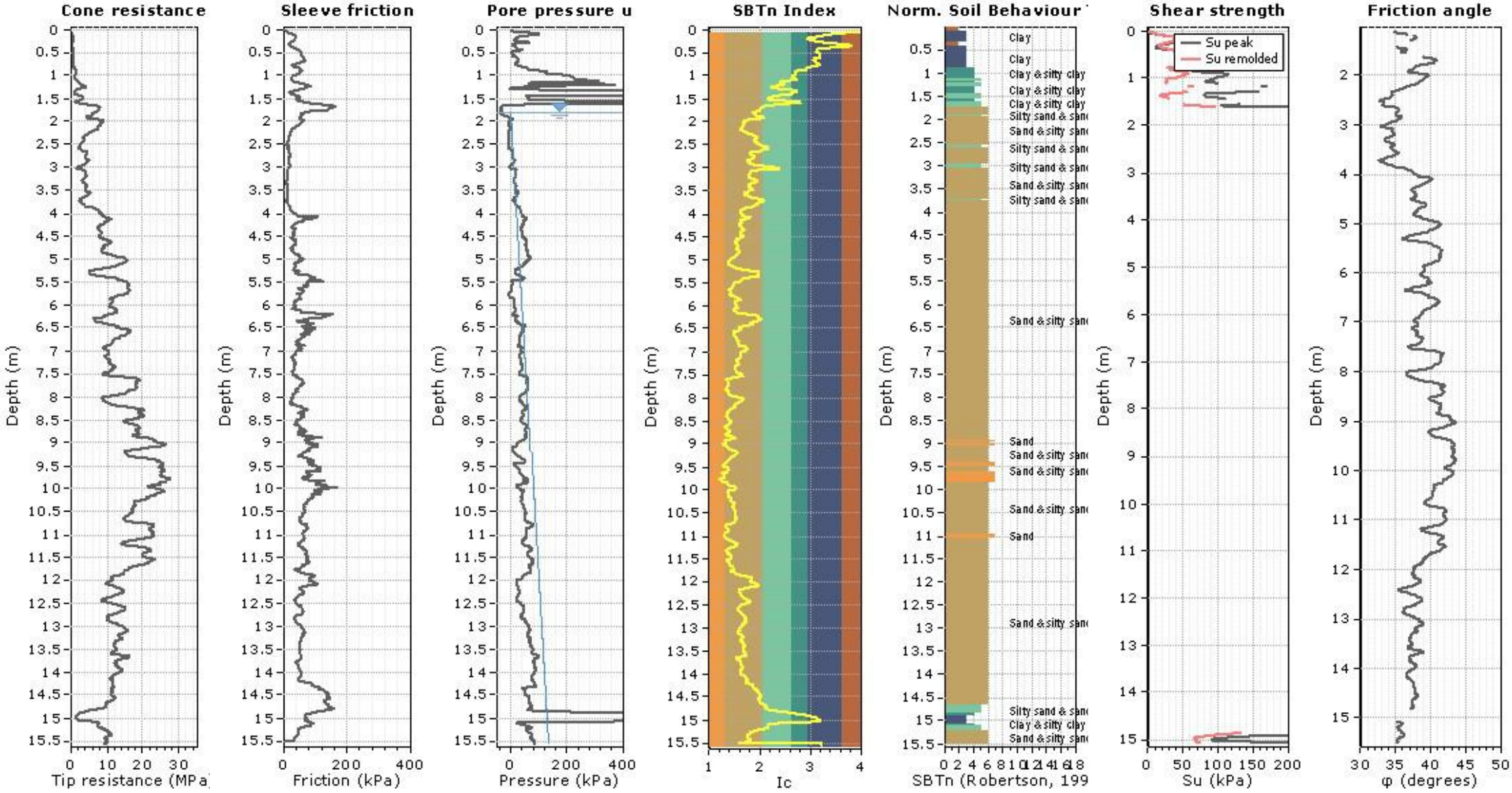
CPT: CPT08
Total depth: 15.56 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



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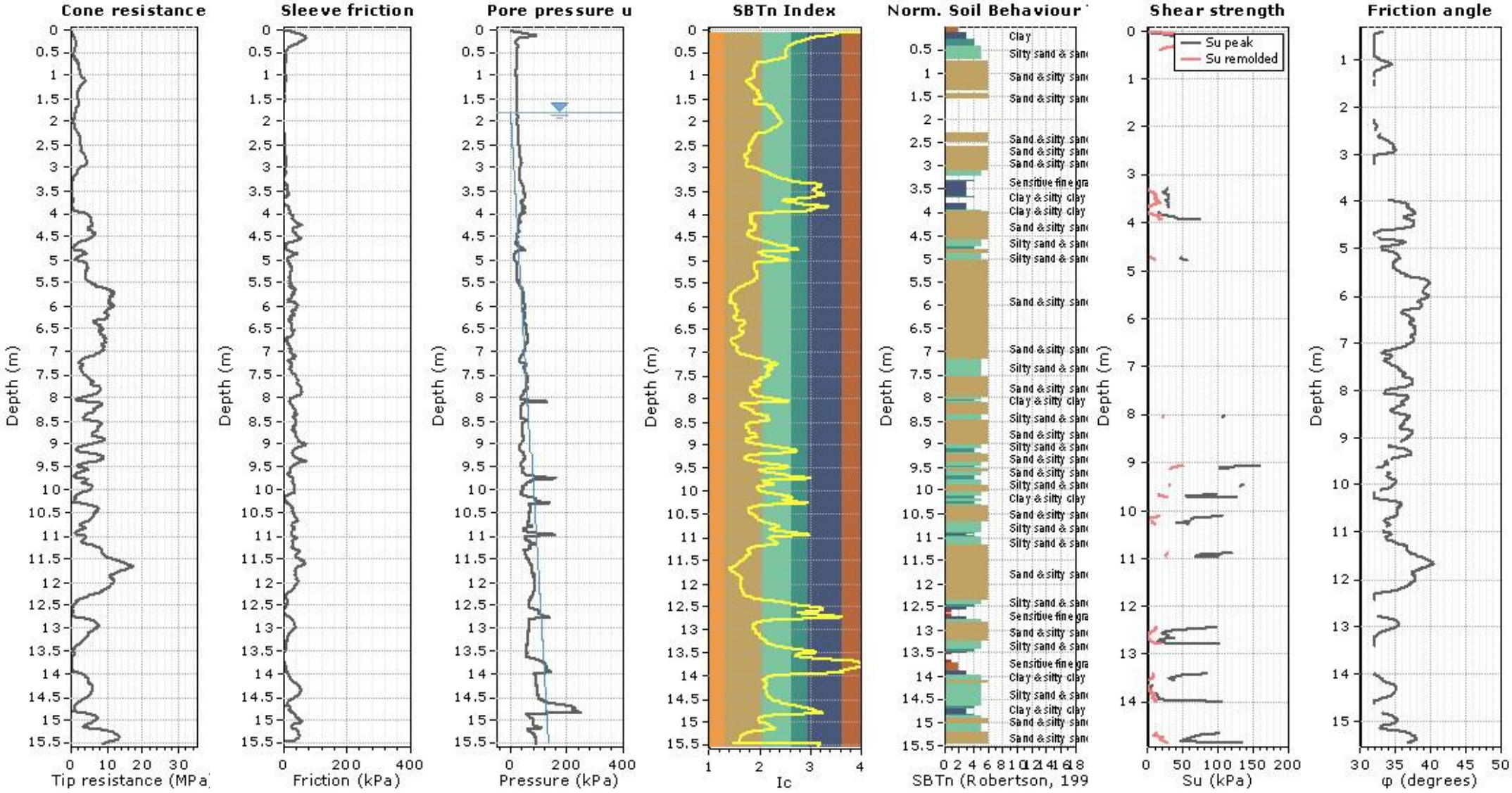
CPT: CPT09
Total depth: 15.52 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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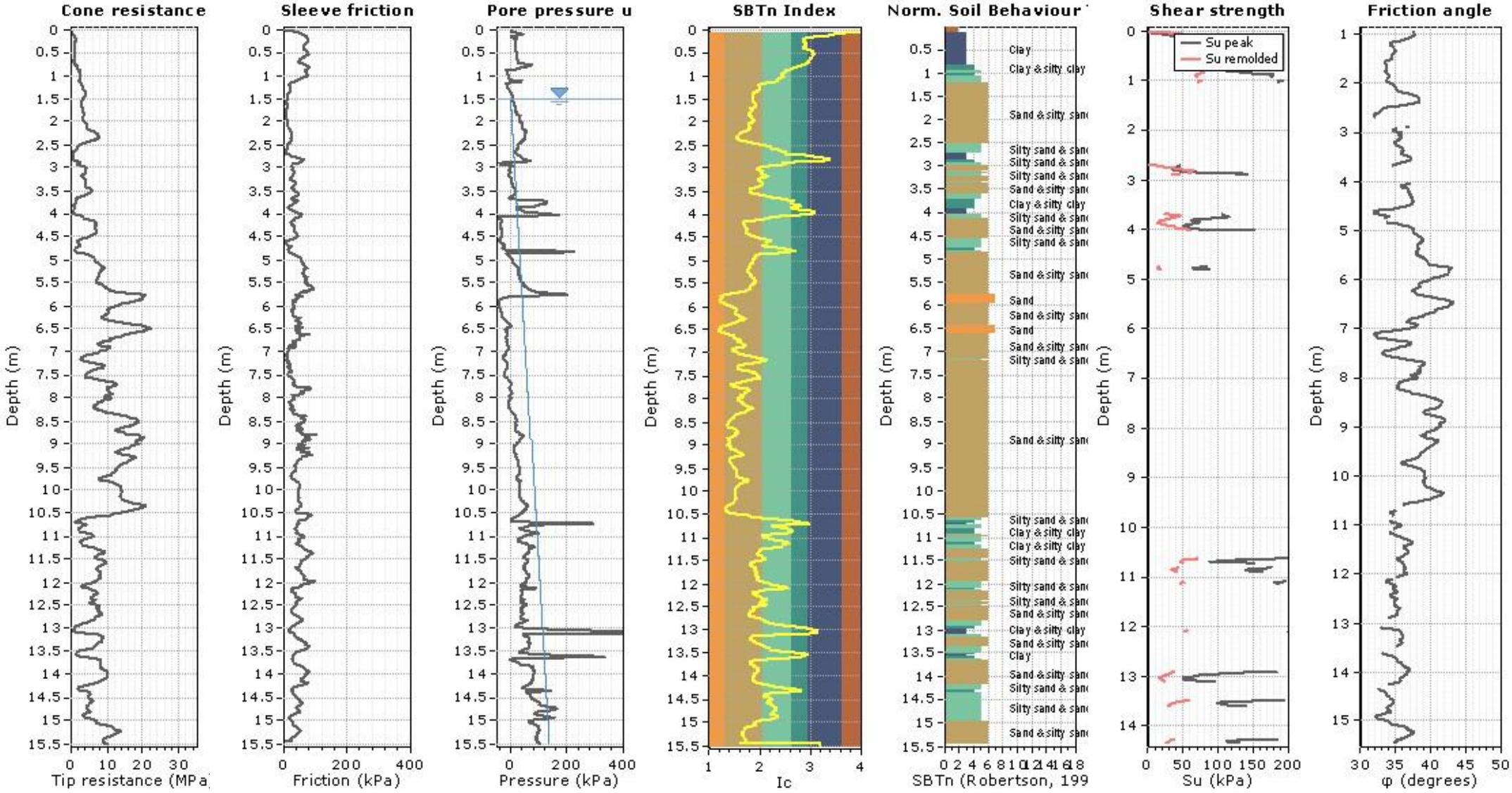
CPT: CPT10
Total depth: 15.51 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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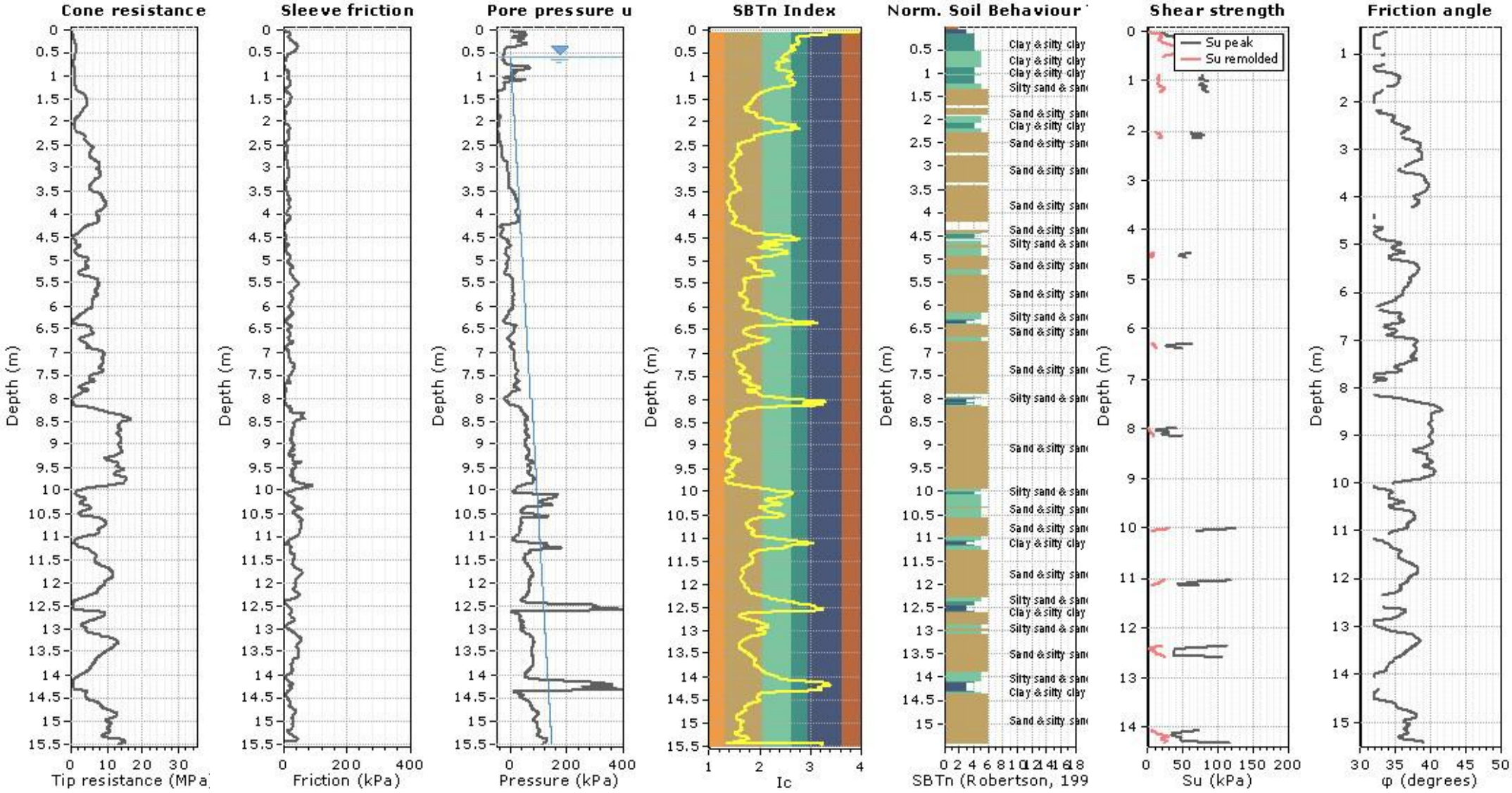
CPT: CPT11
Total depth: 15.50 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
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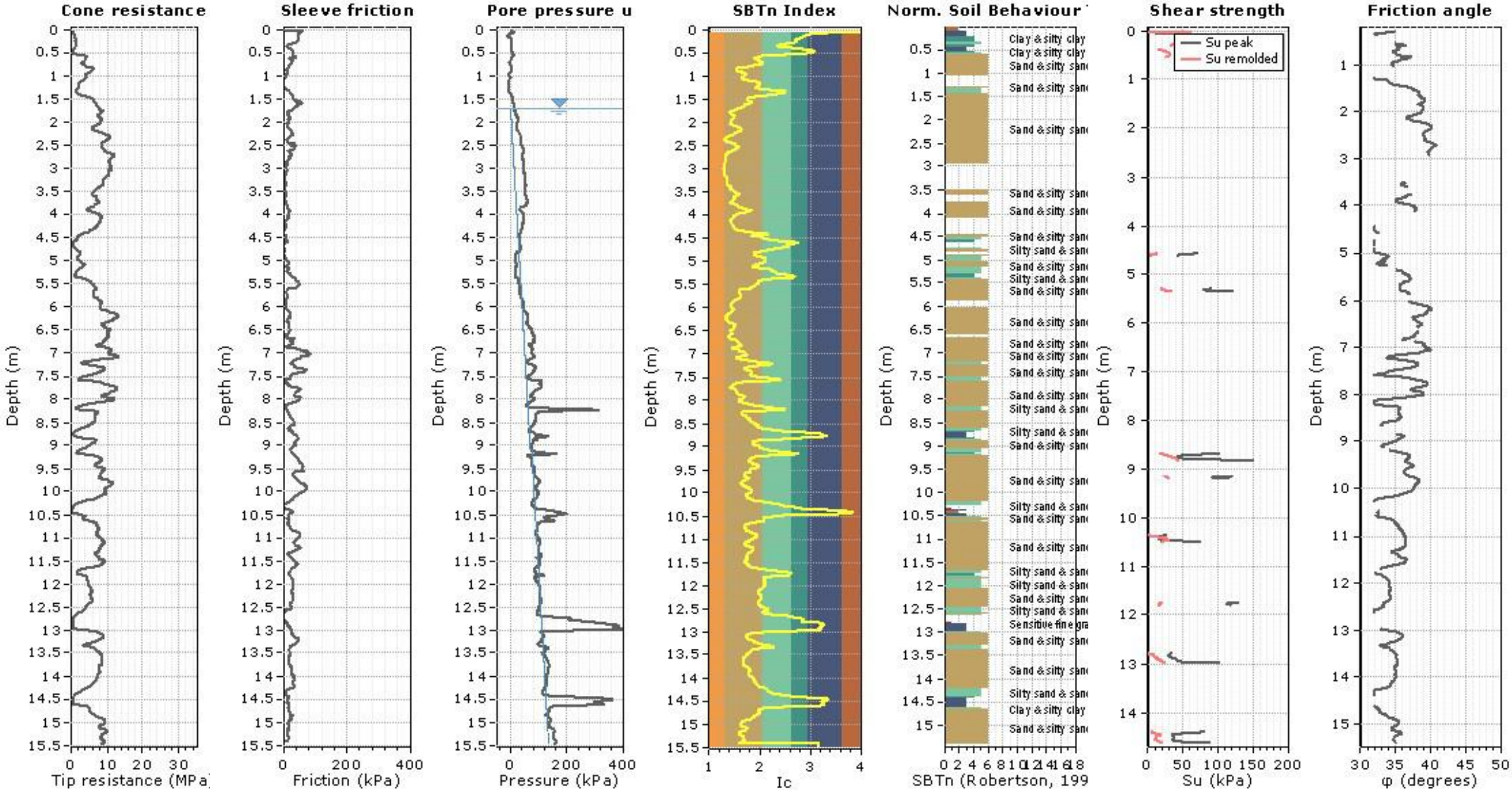
CPT: CPT12
Total depth: 15.46 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
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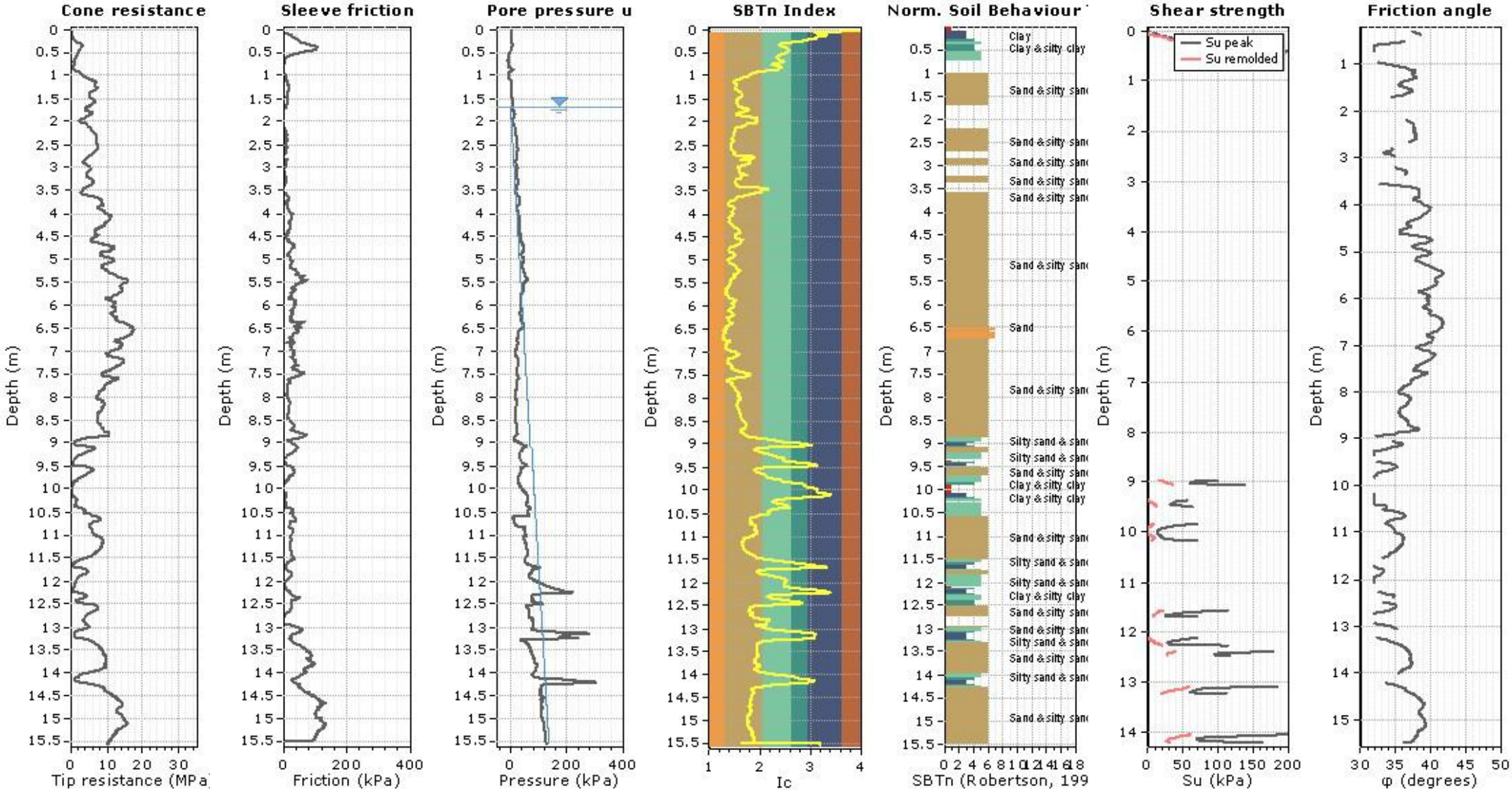
CPT: CPT13
Total depth: 15.55 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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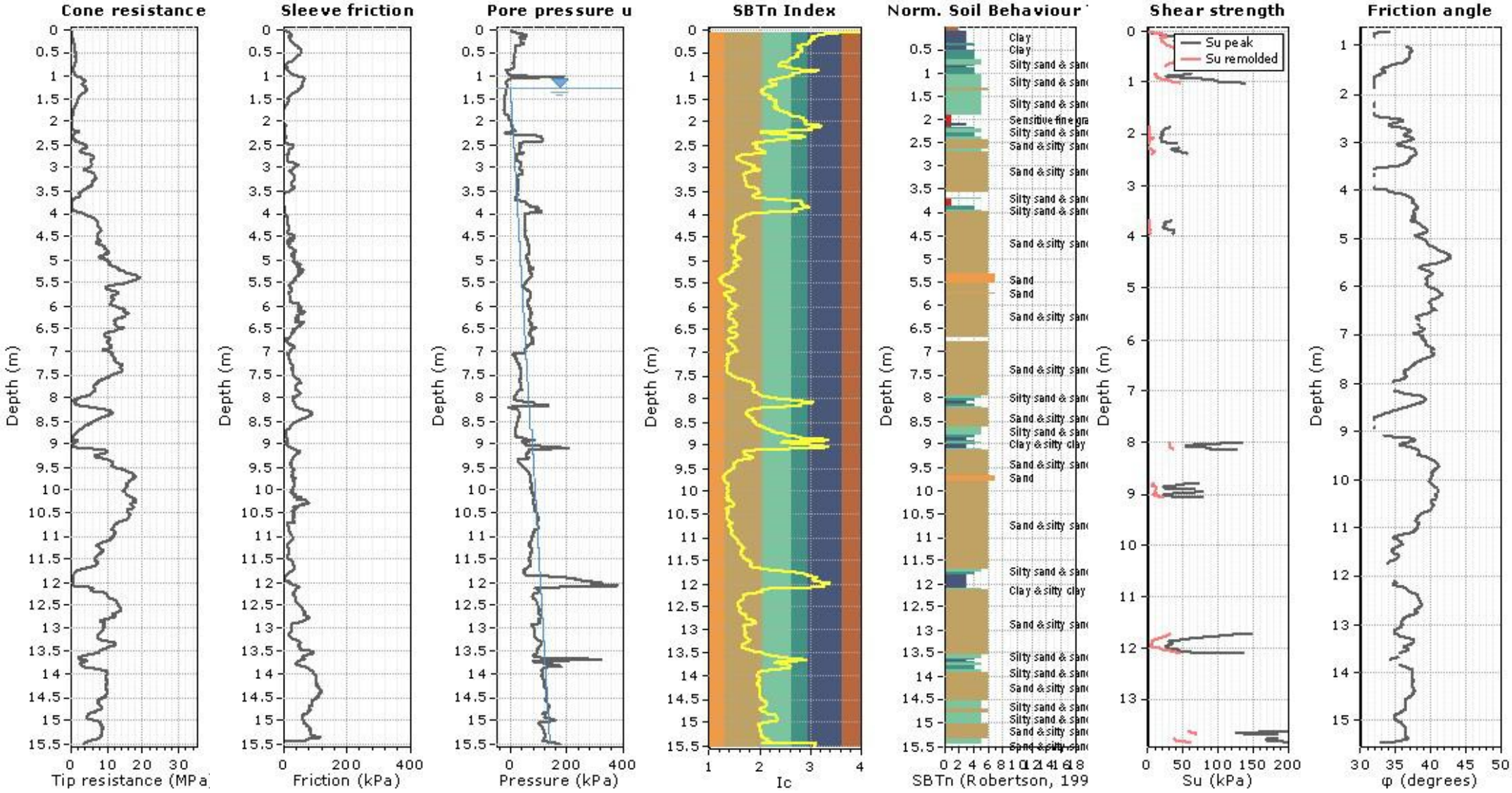
CPT: CPT14
Total depth: 15.51 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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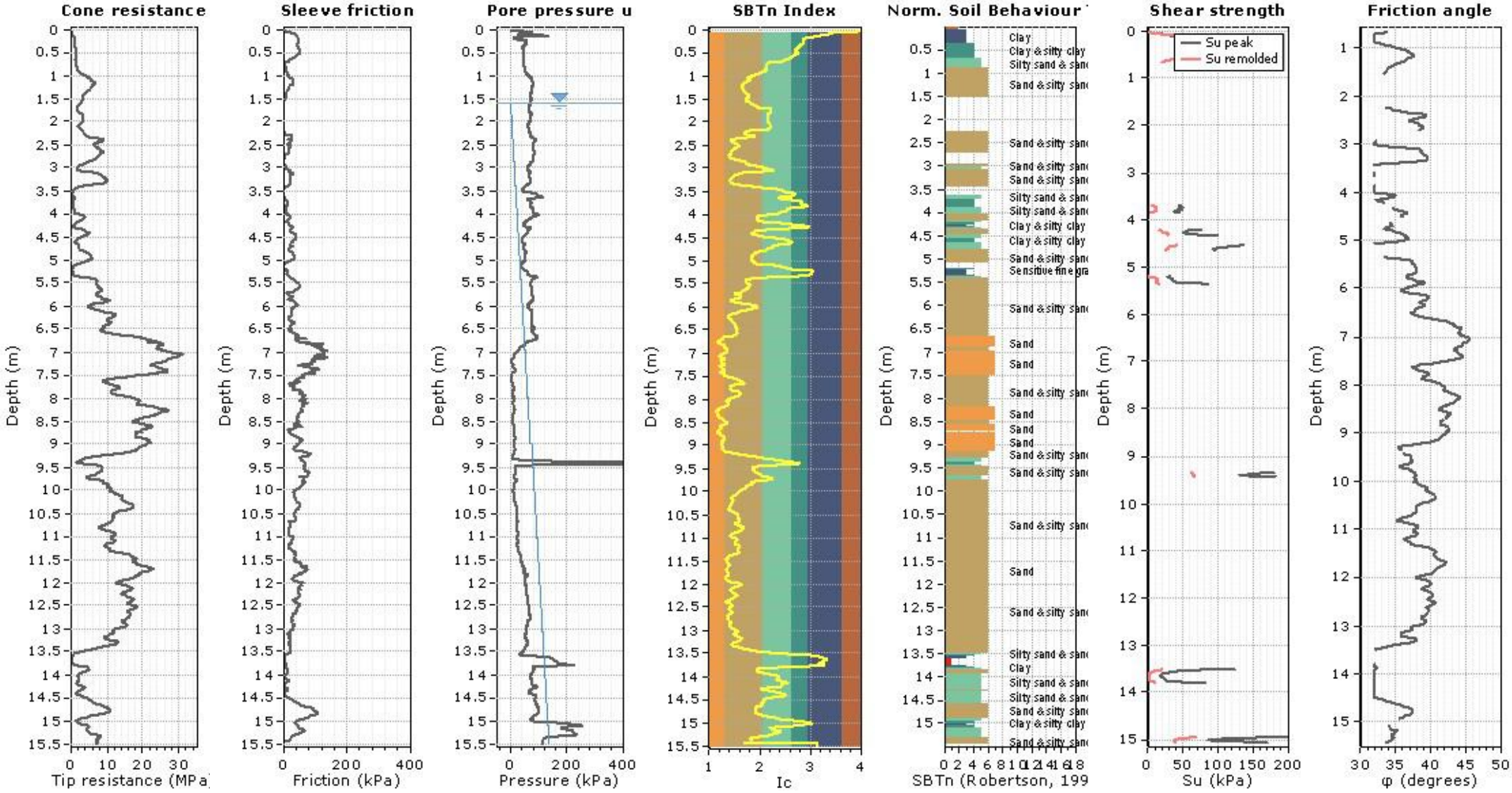
CPT: CPT15
Total depth: 15.50 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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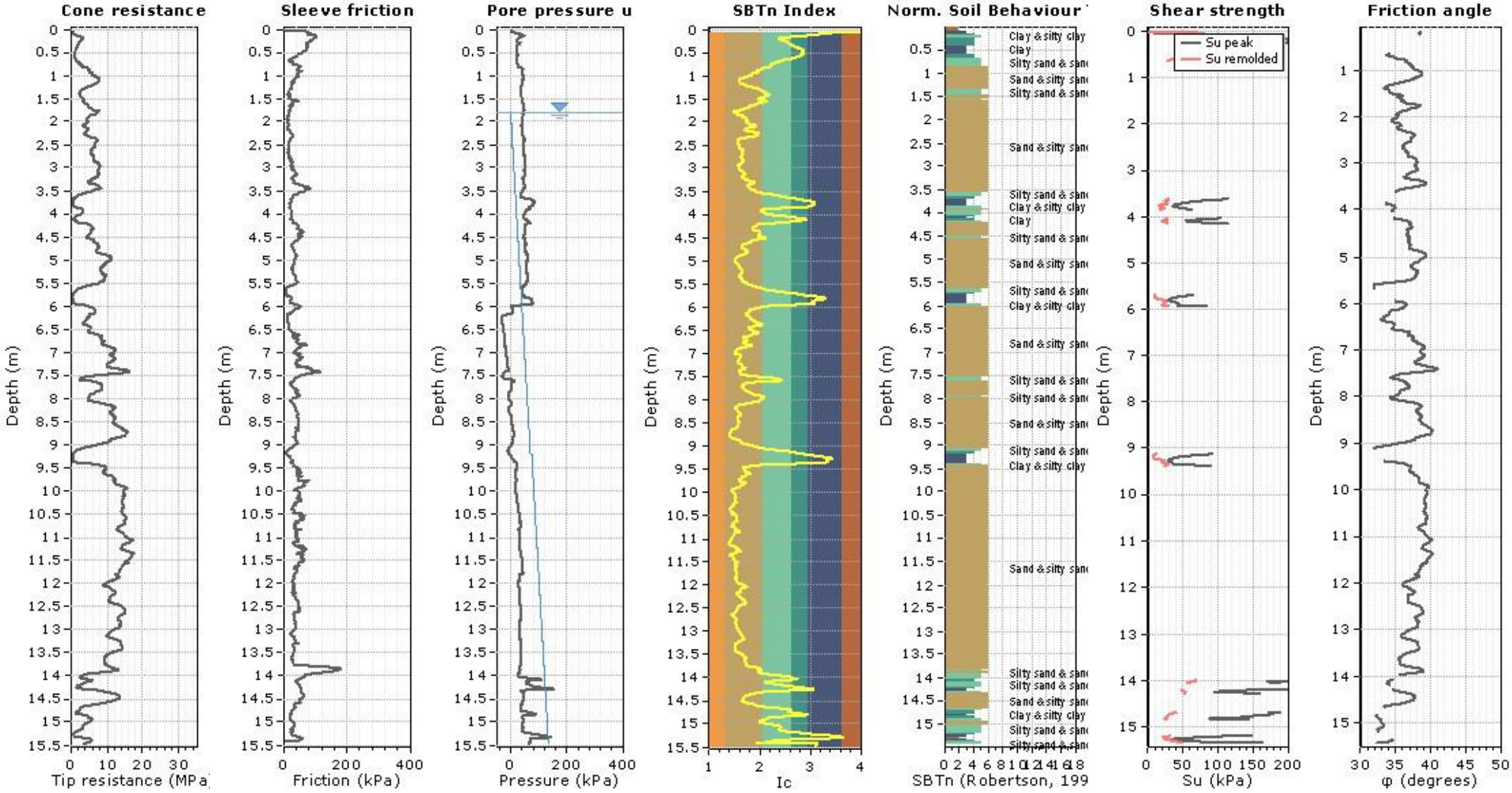
CPT: CPT16
Total depth: 15.48 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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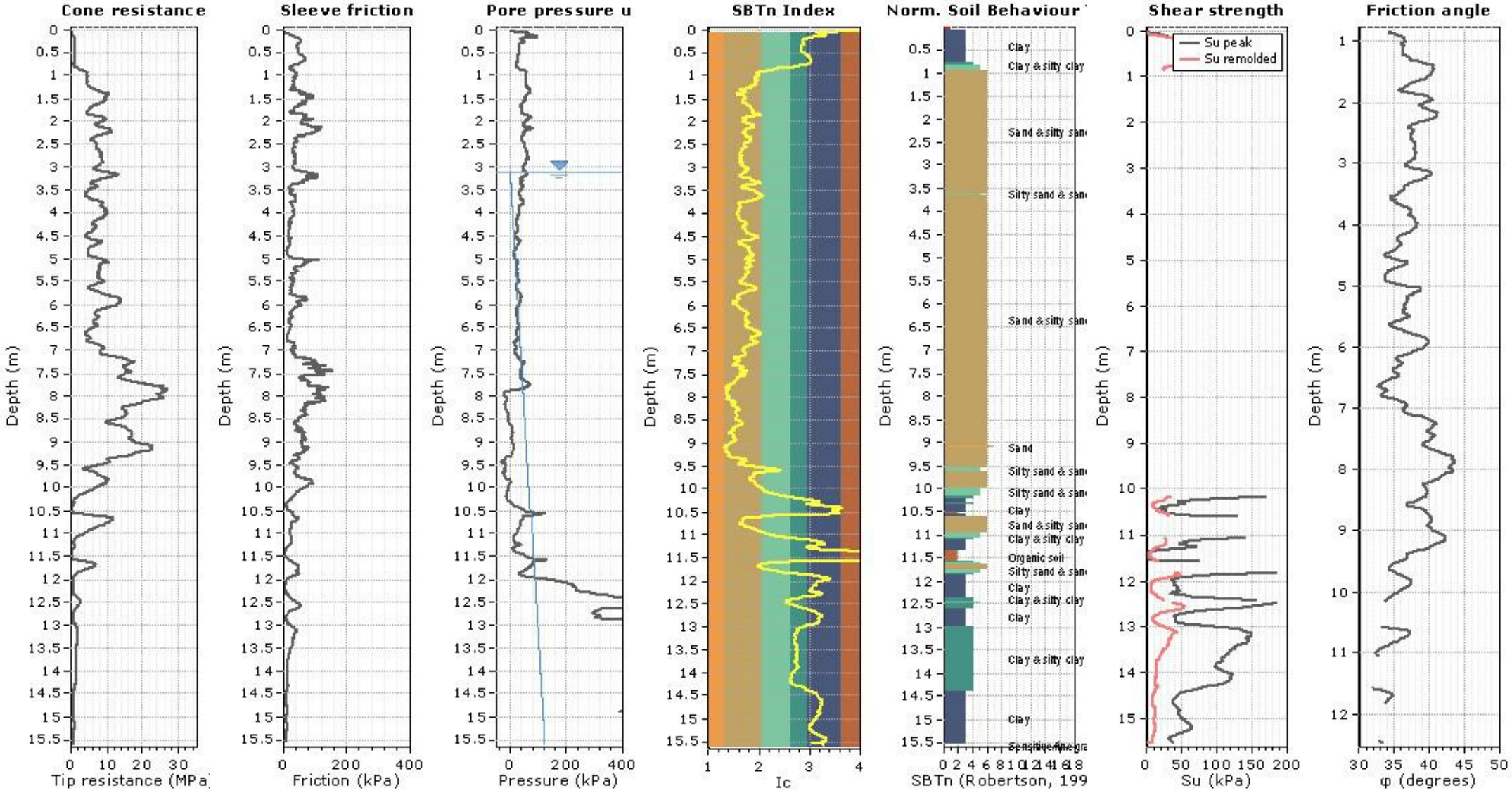
CPT: CPT17
Total depth: 15.59 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



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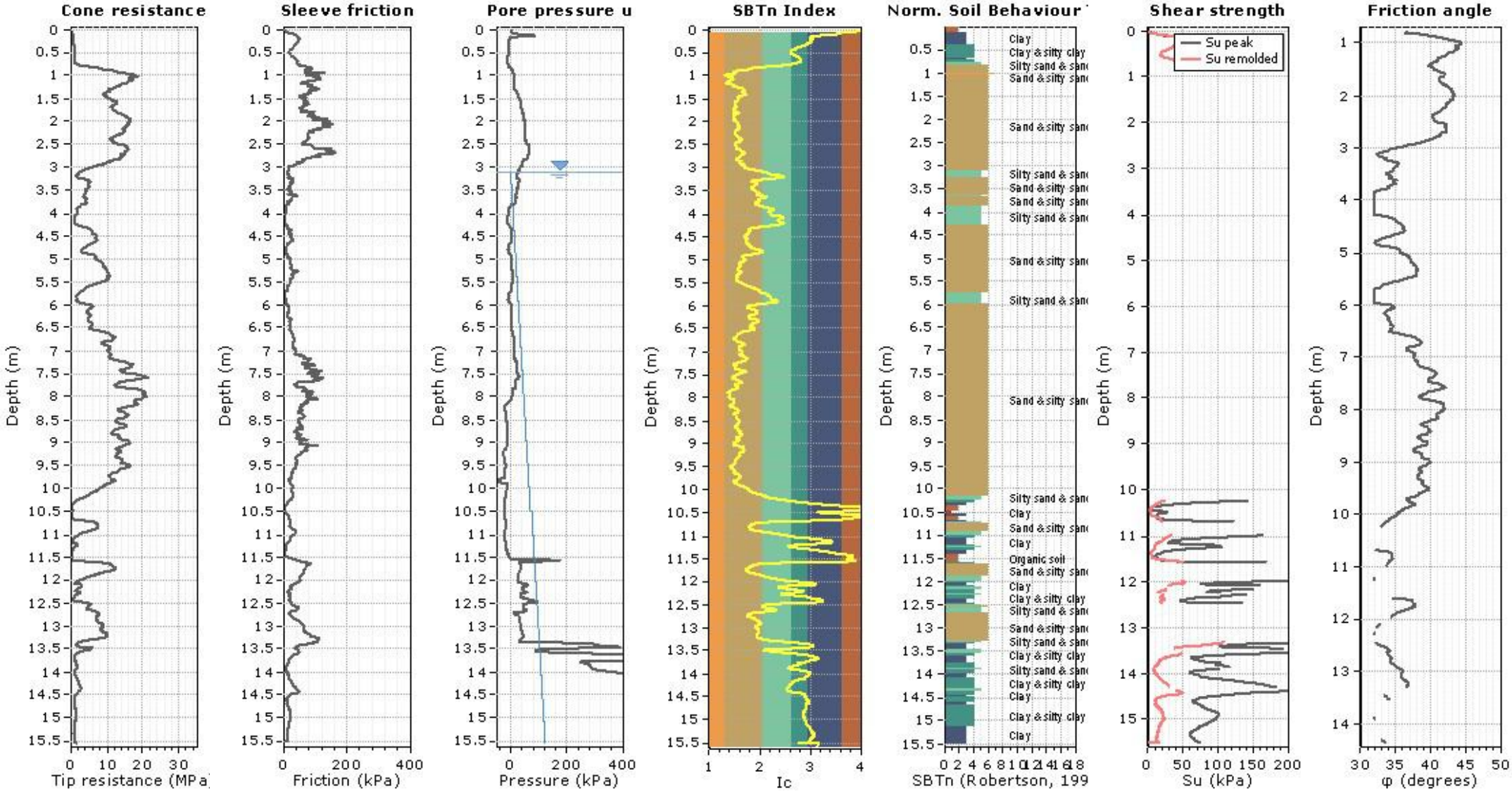
CPT: CPT18
Total depth: 15.57 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
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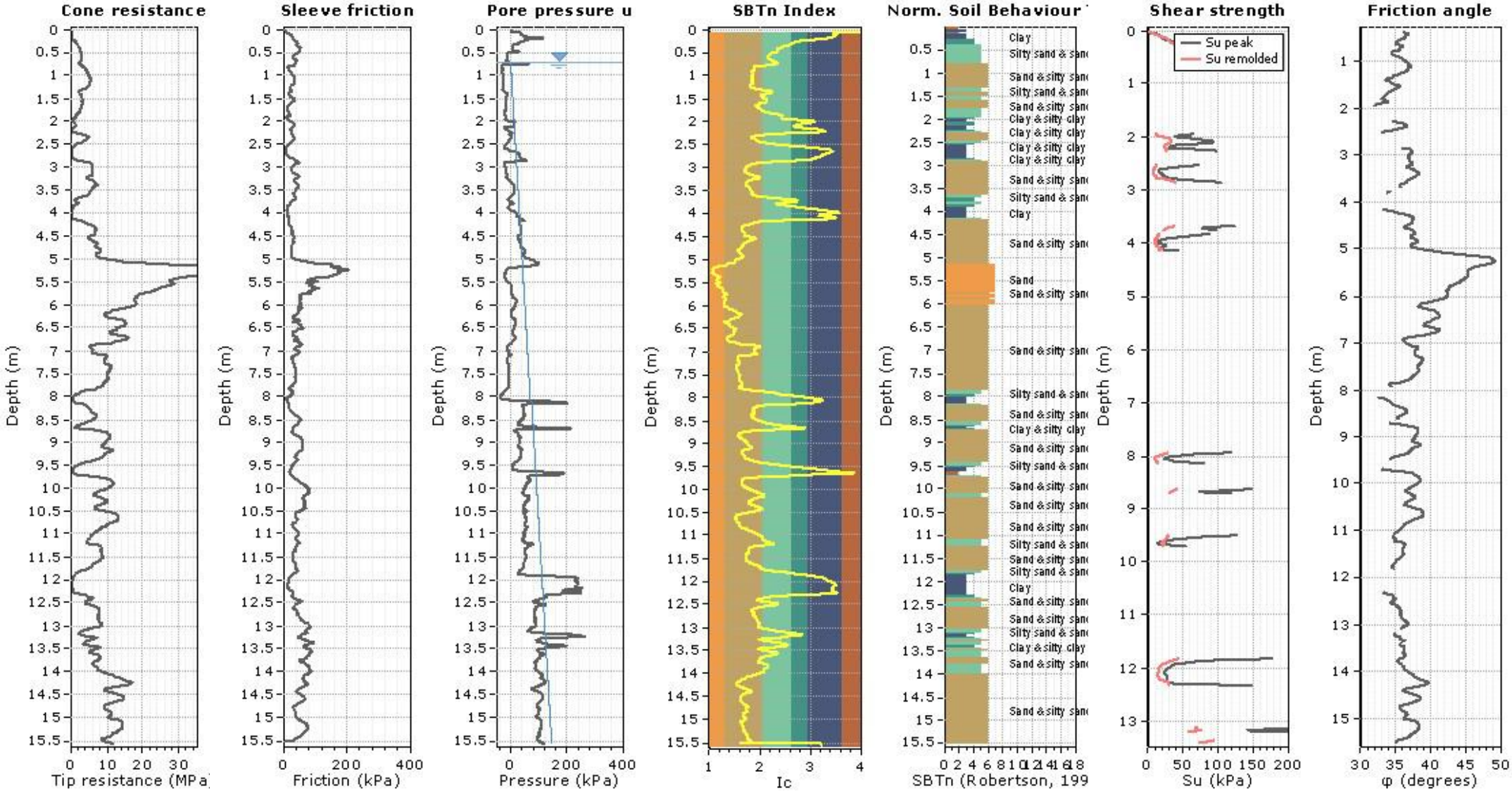
CPT: CPT19
Total depth: 15.58 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
289 Lincoln Road, Henderson
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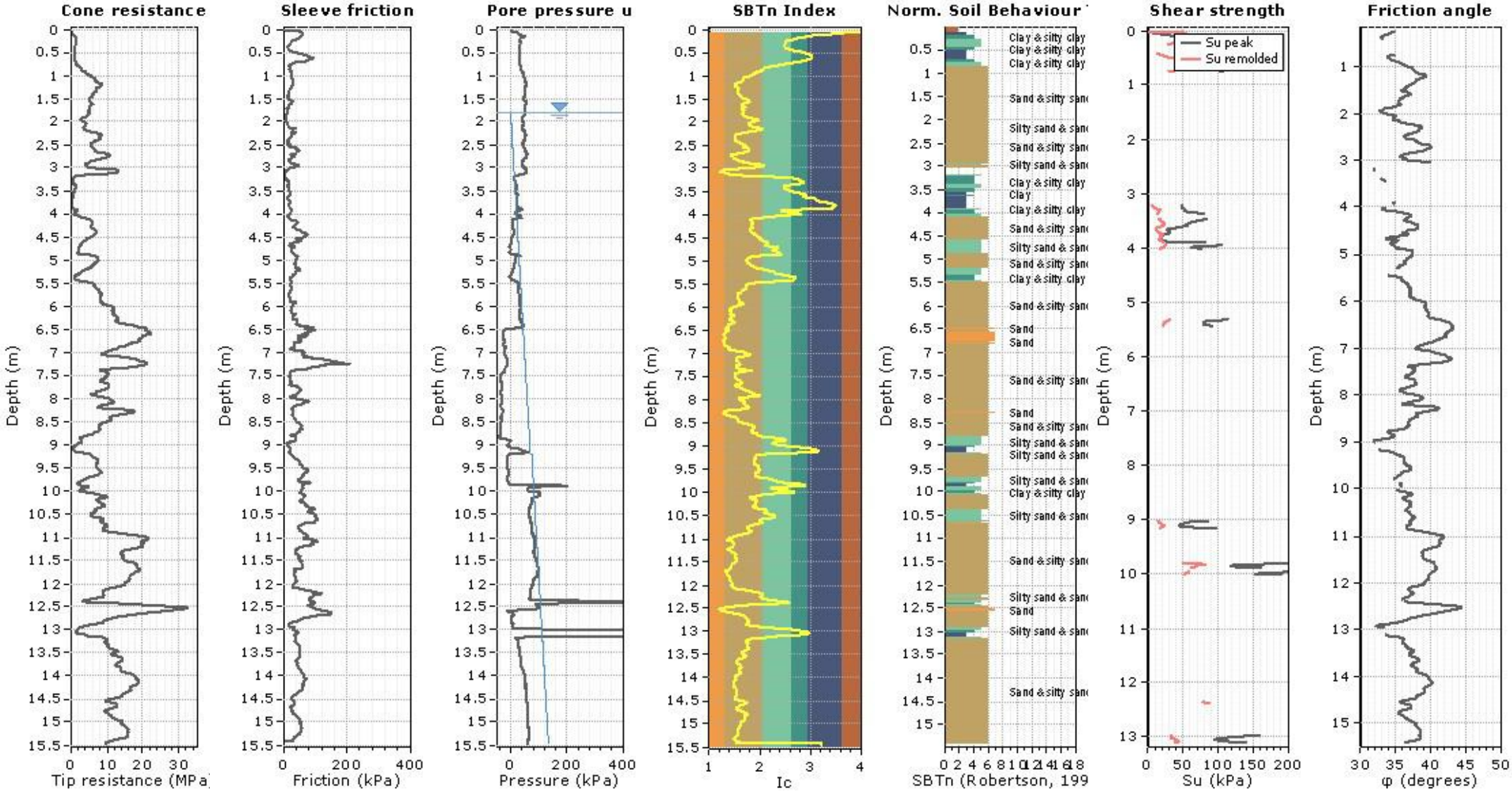
CPT: CPT20
Total depth: 15.48 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Soil & Rock Consultants
289 Lincoln Road, Henderson
PO Box 21-424, Henderson
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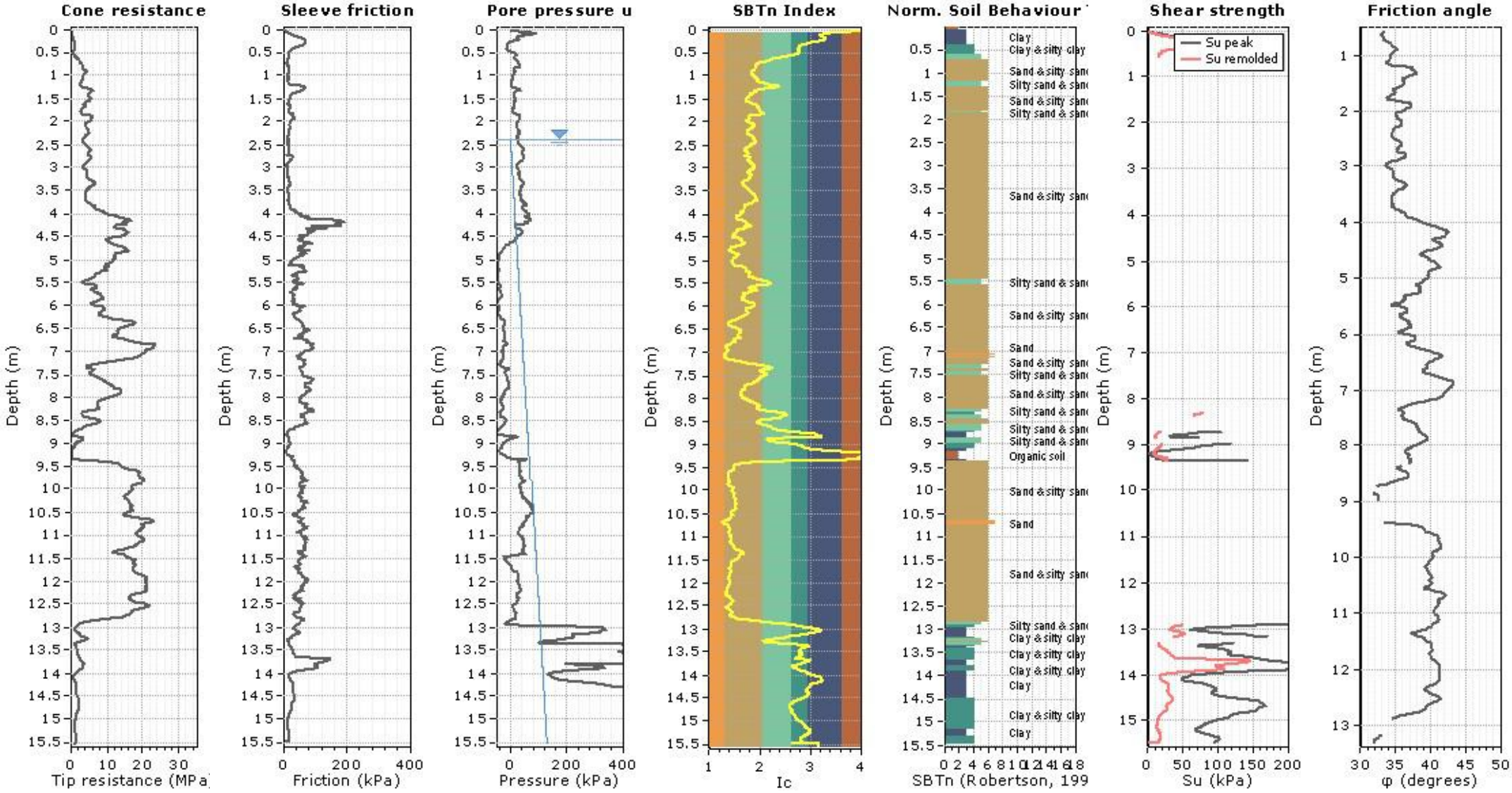
CPT: CPT21
Total depth: 15.54 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



Soil & Rock Consultants
289 Lincoln Road, Henderson
PO Box 21-424, Henderson
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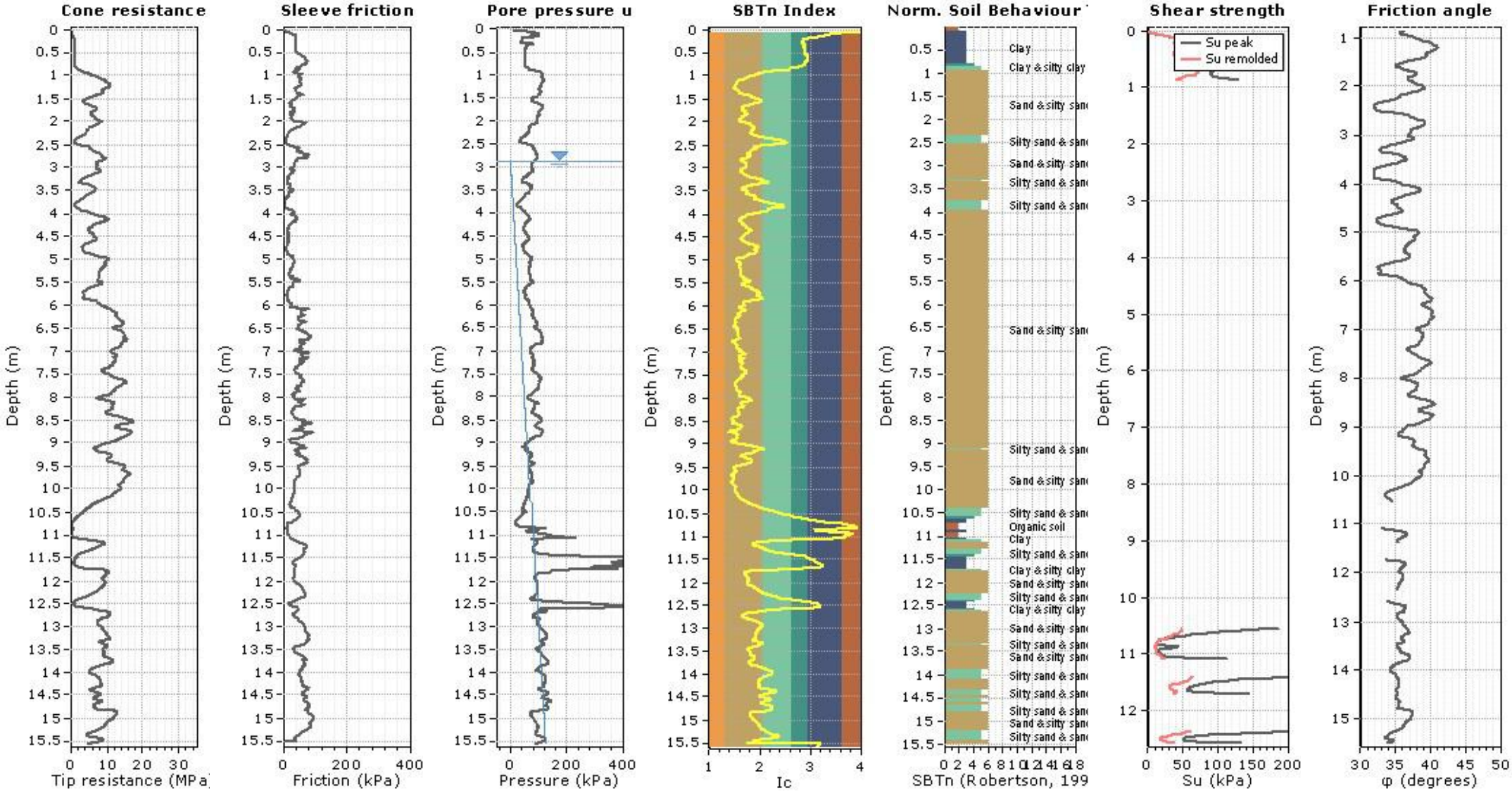
CPT: CPT22
Total depth: 15.55 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



Soil & Rock Consultants
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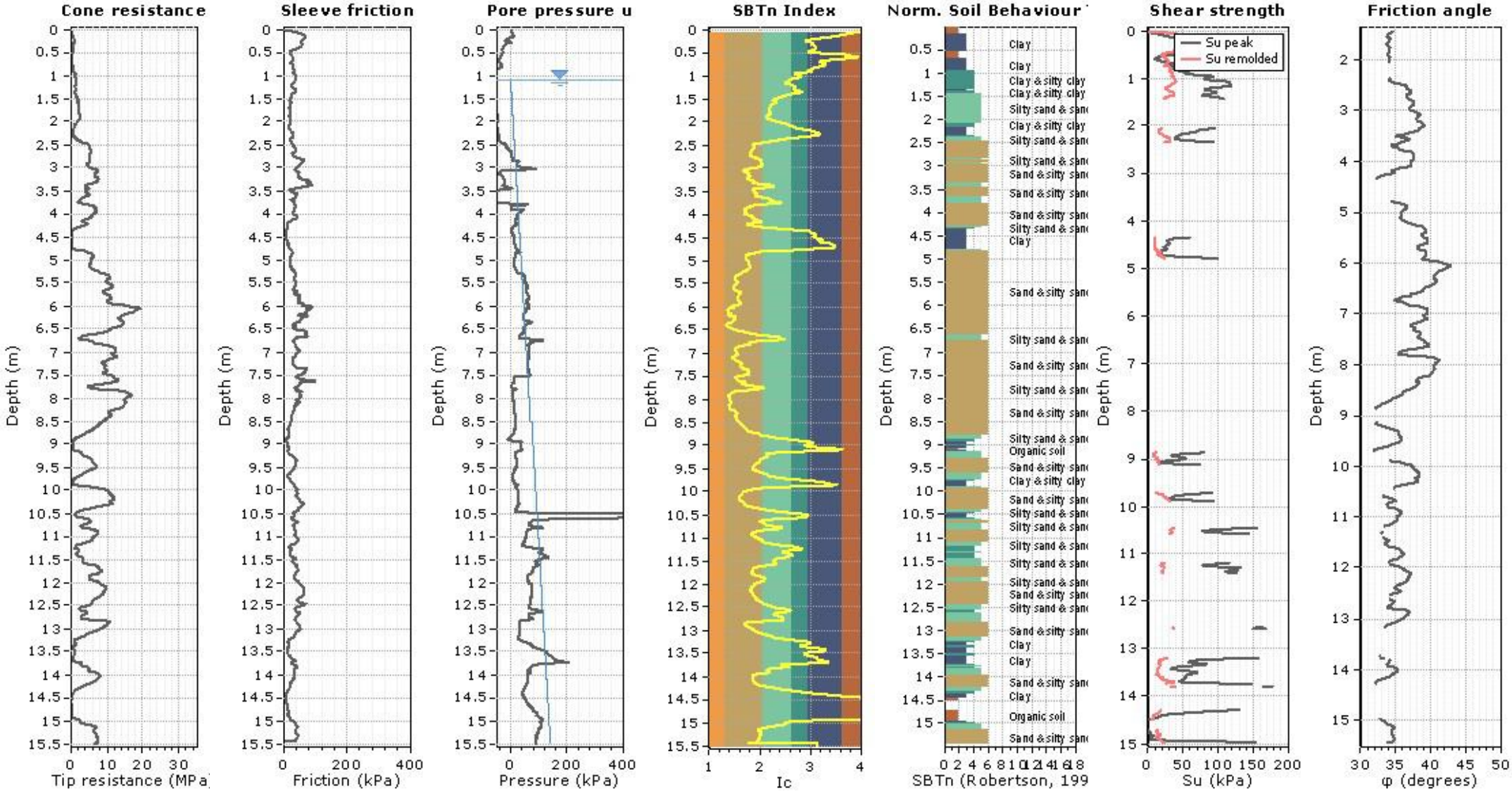
CPT: CPT23
Total depth: 15.50 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: 230322
Location: Fonterra Hautapu, 195 Swayne Rd, Cambridge



Soil & Rock Consultants
289 Lincoln Road, Henderson
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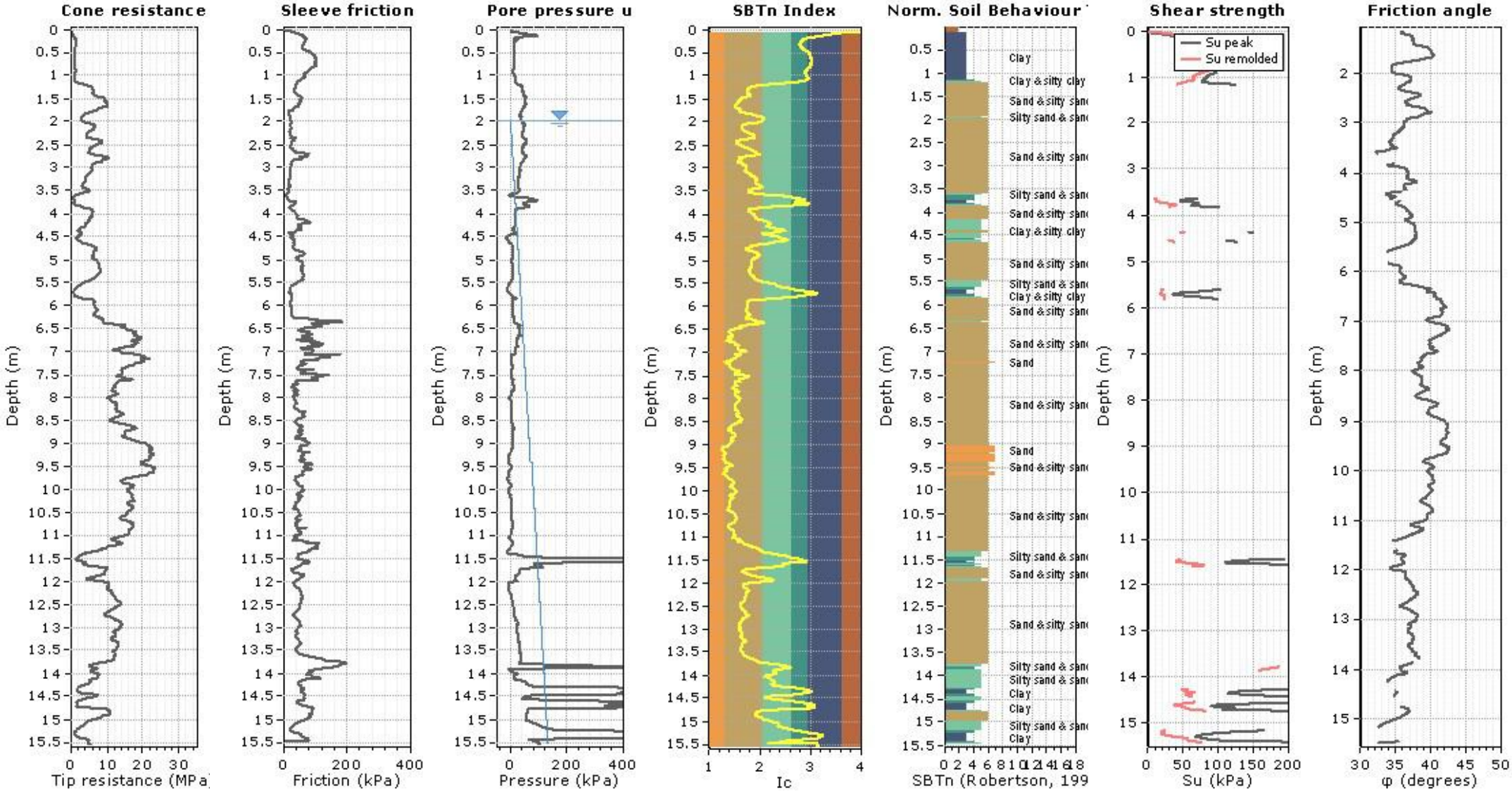
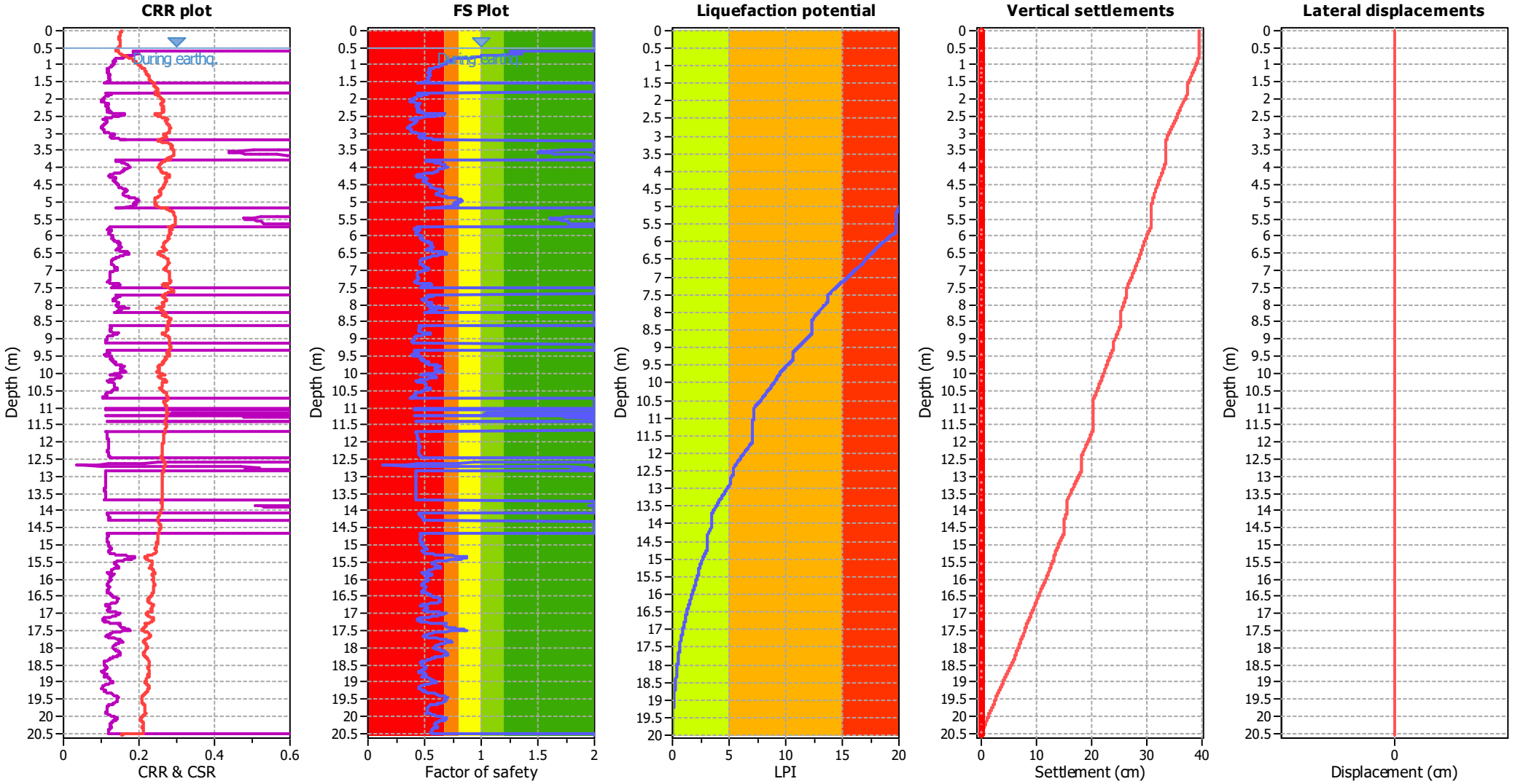
http://www.soilandrock.co.nz

CPT: CPT24
Total depth: 15.53 m, Date: 15/08/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: PC
Cone Operator: Landtech Consulting

Project: **230322**
Location: **Fonterra Hautapu, 195 Swayne Rd, Cambridge**



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

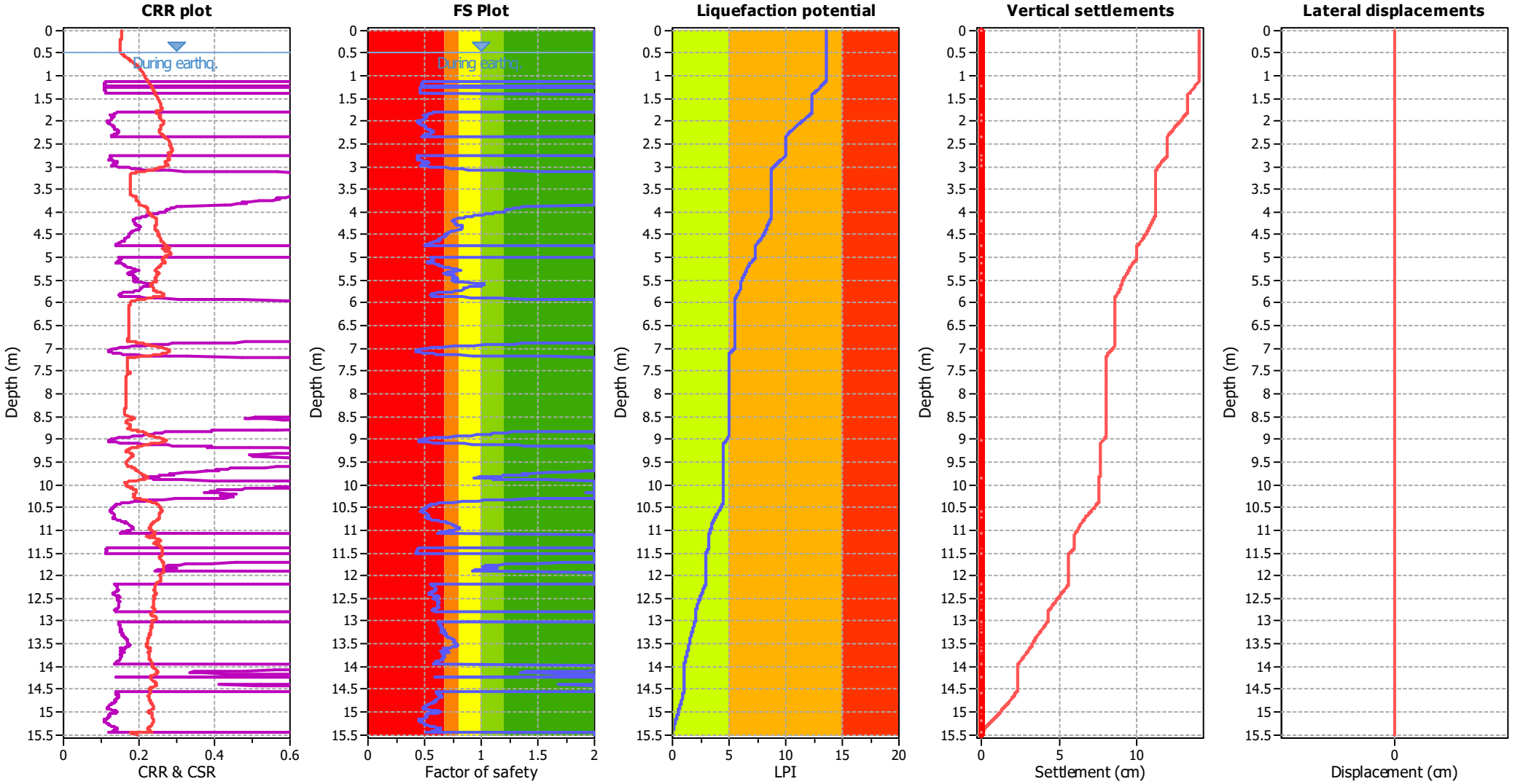
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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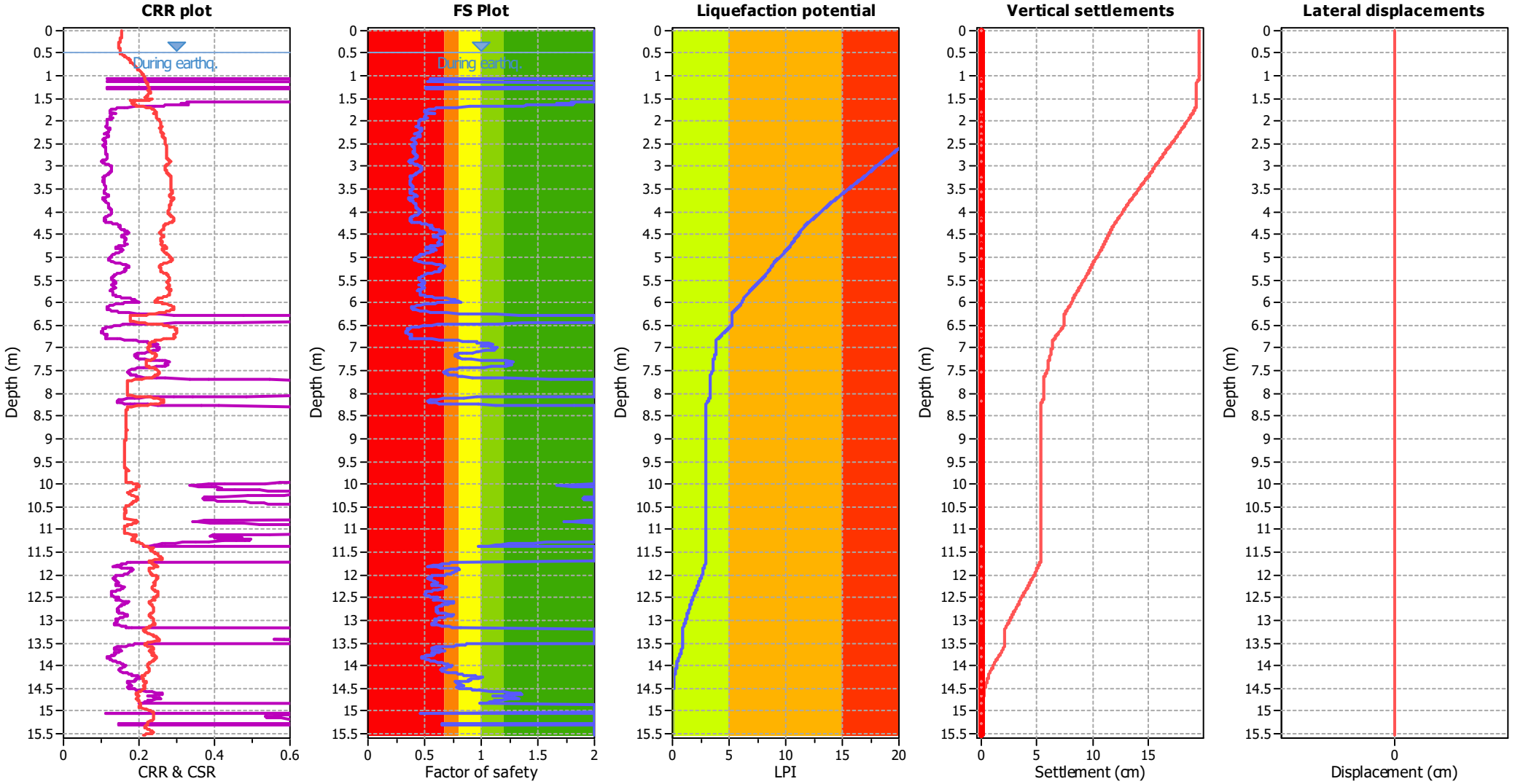
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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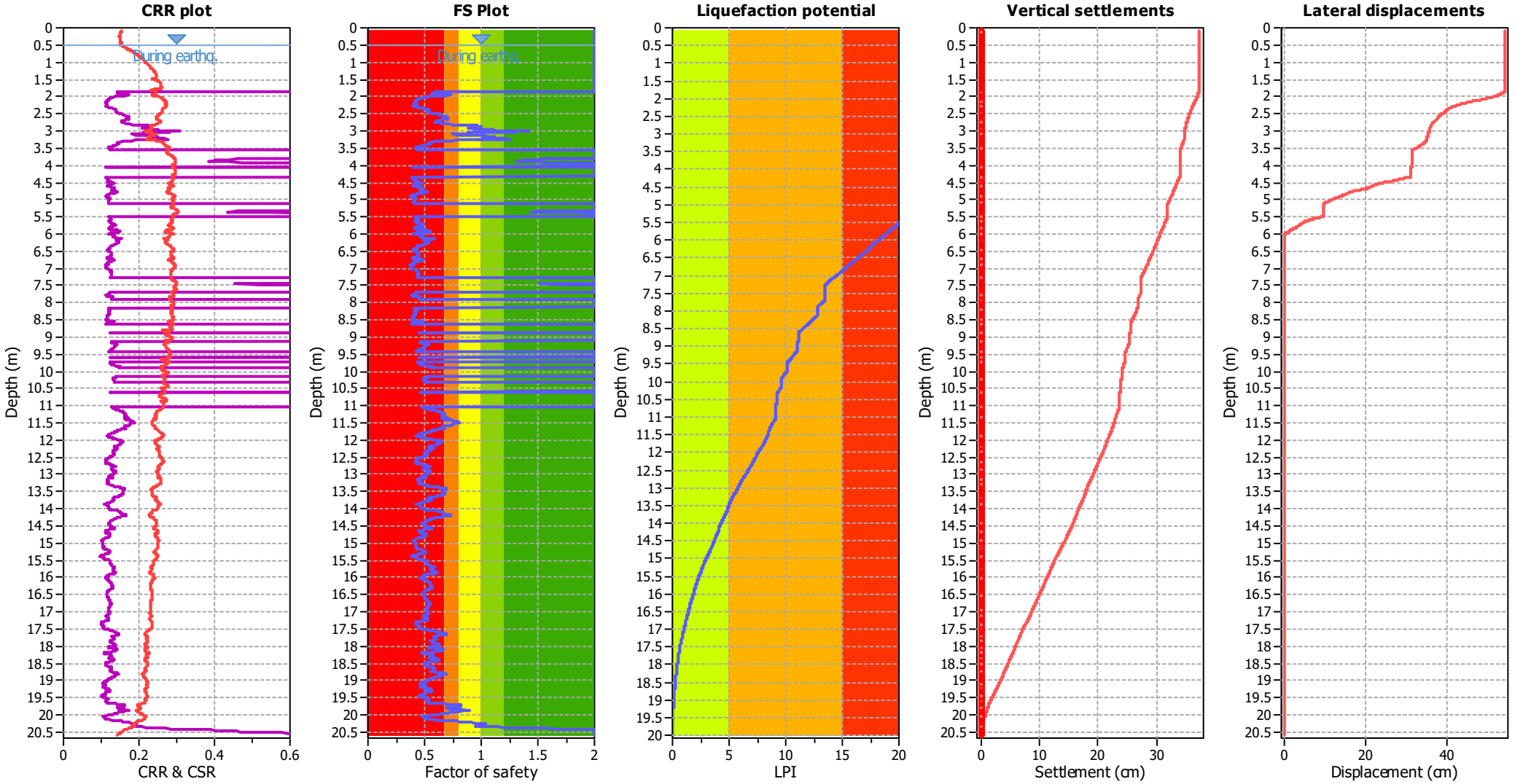
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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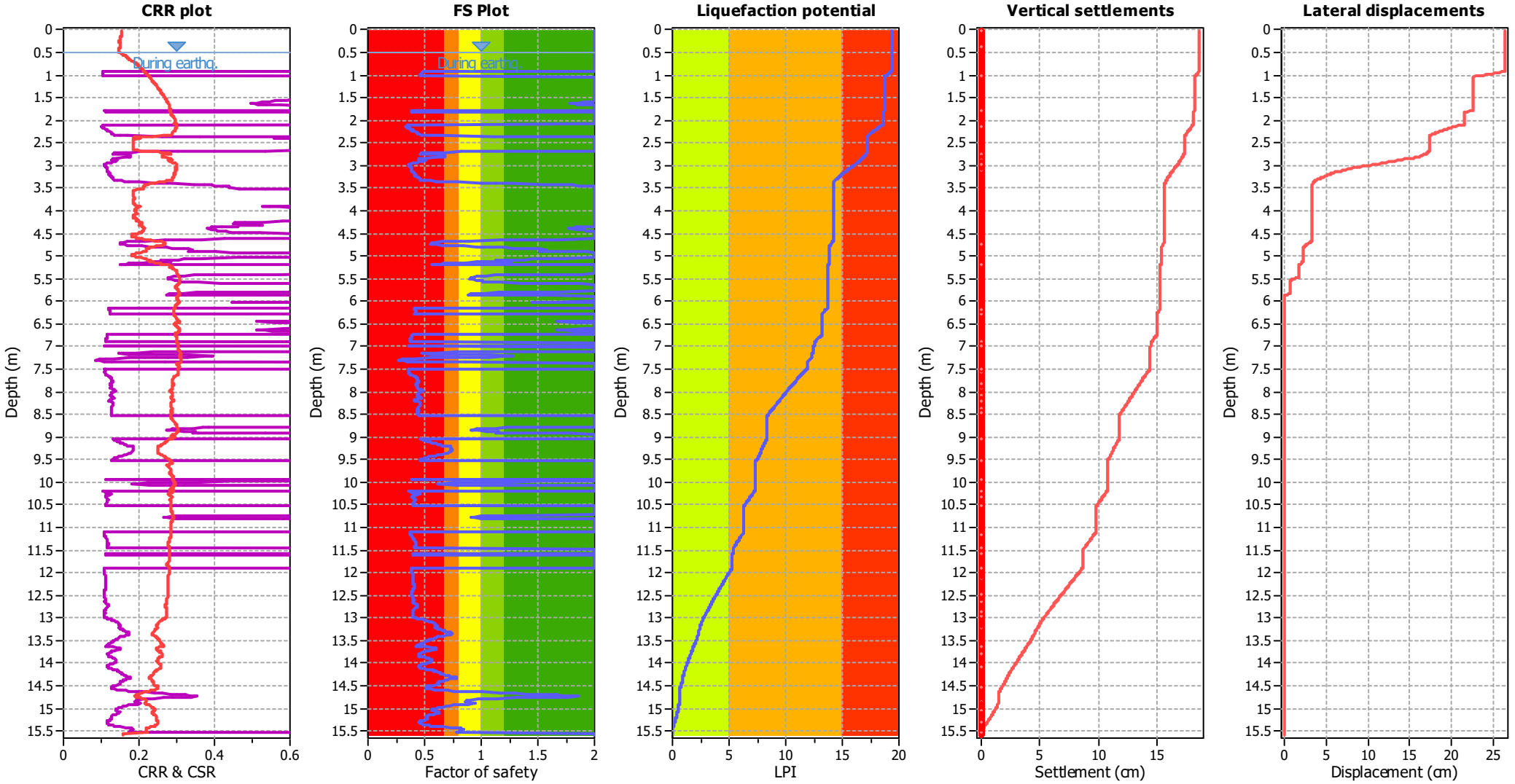
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

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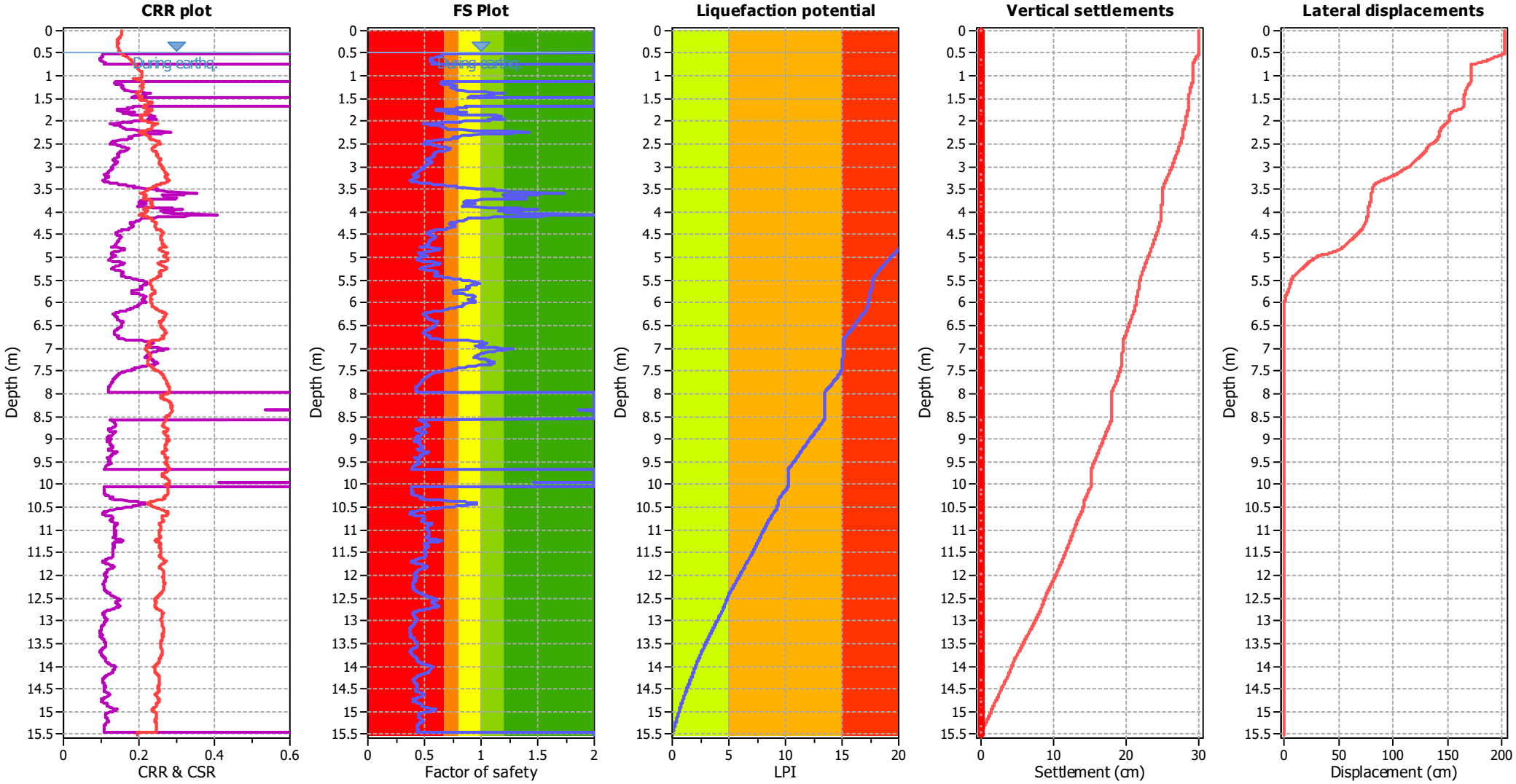
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.28	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

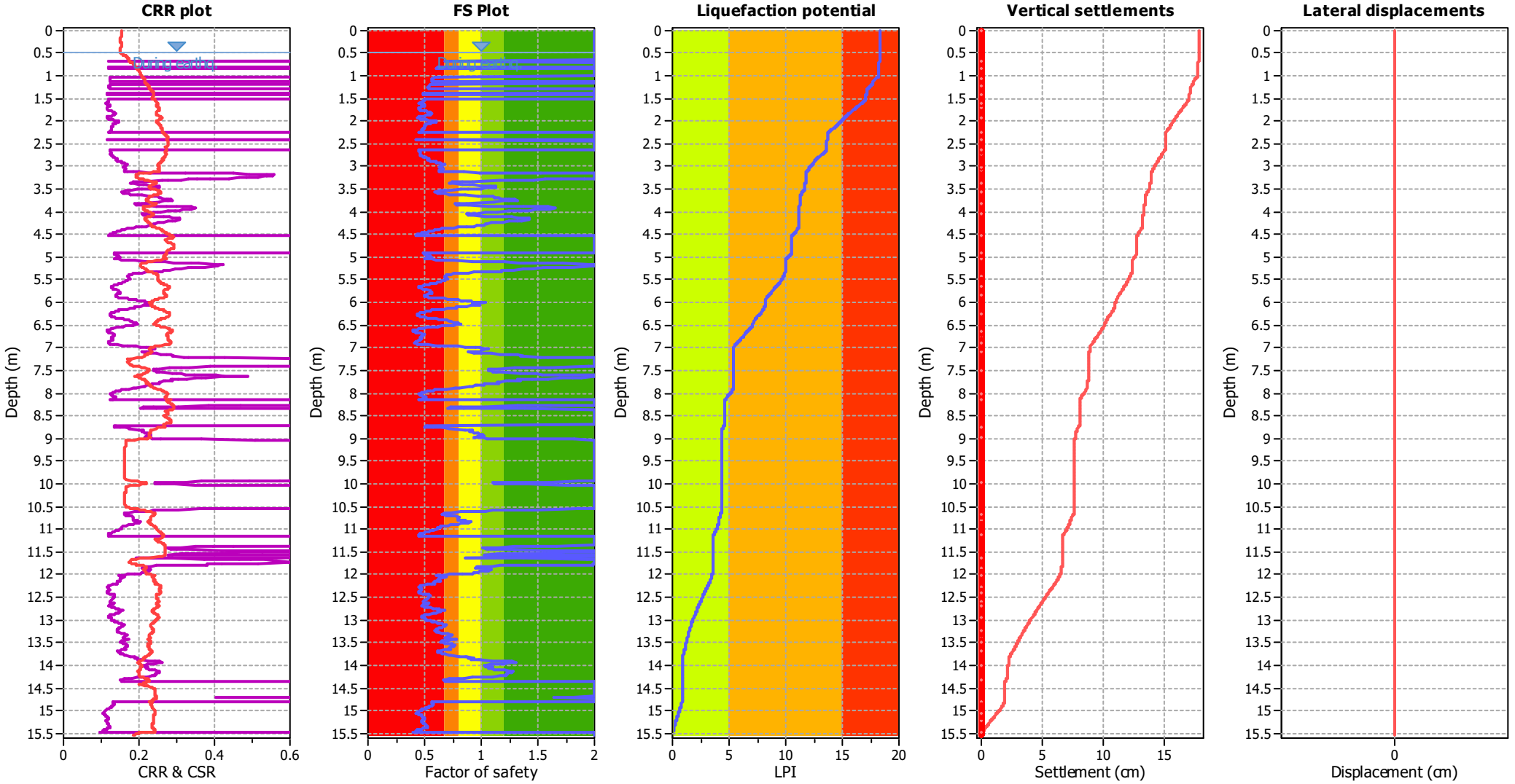
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
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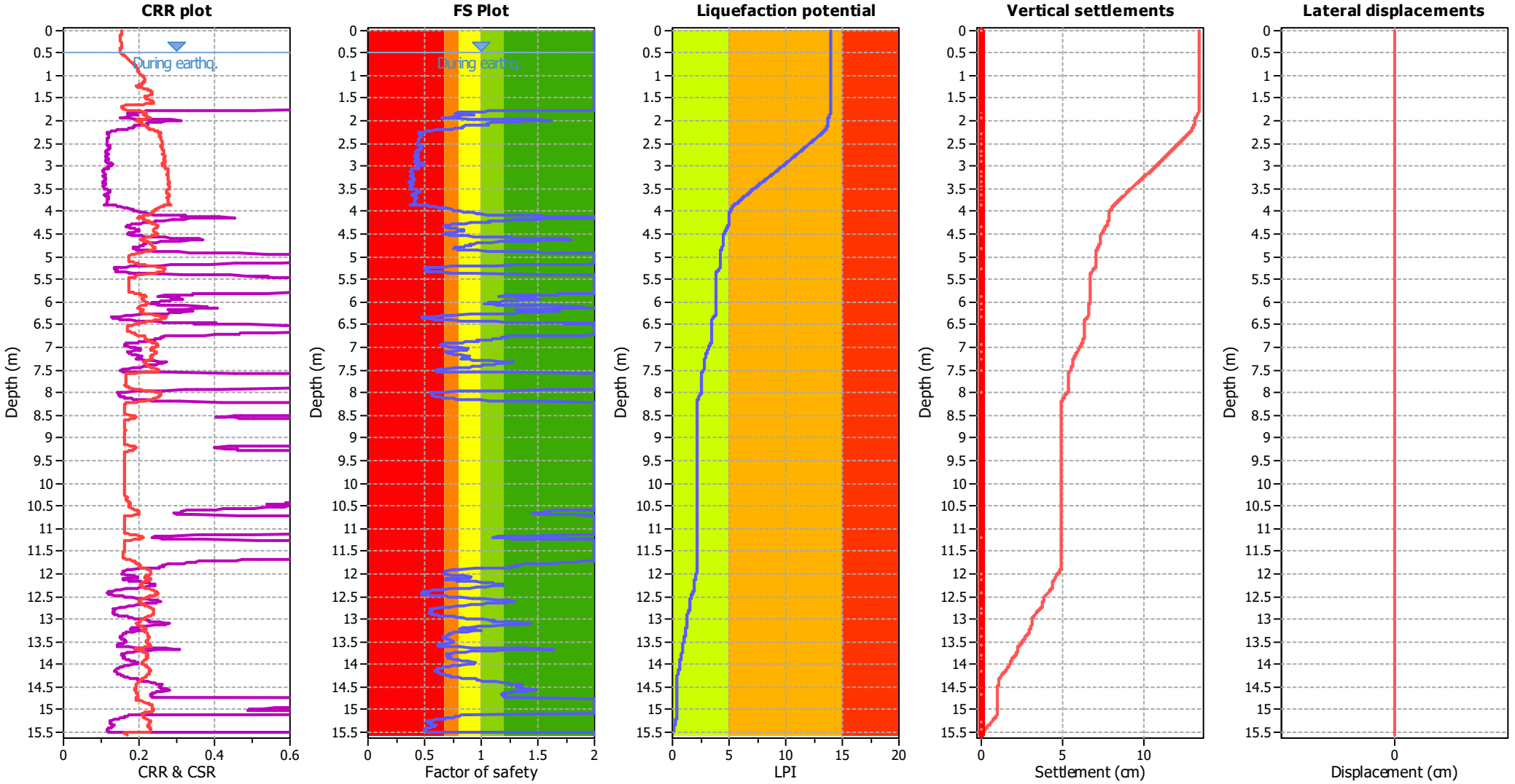

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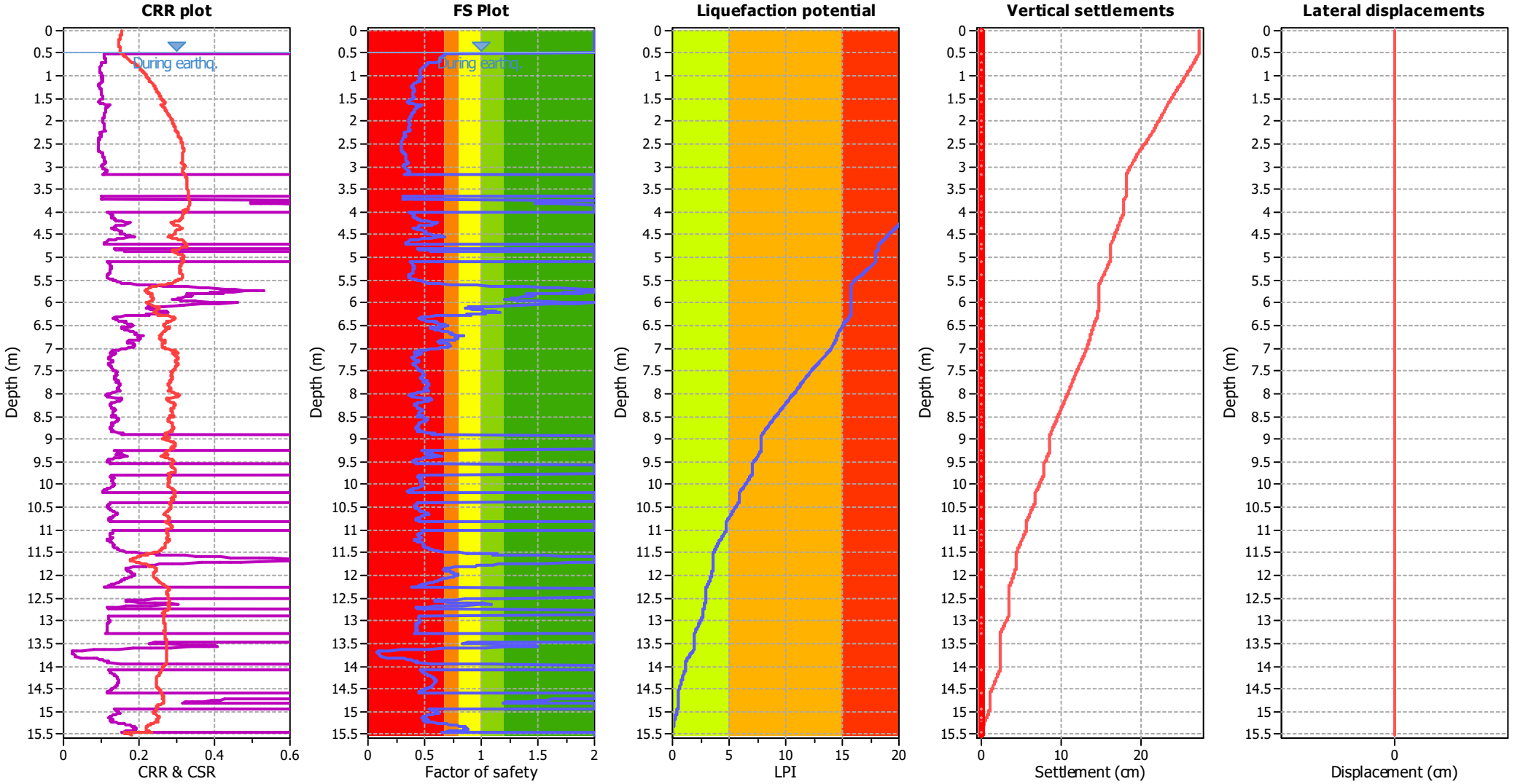

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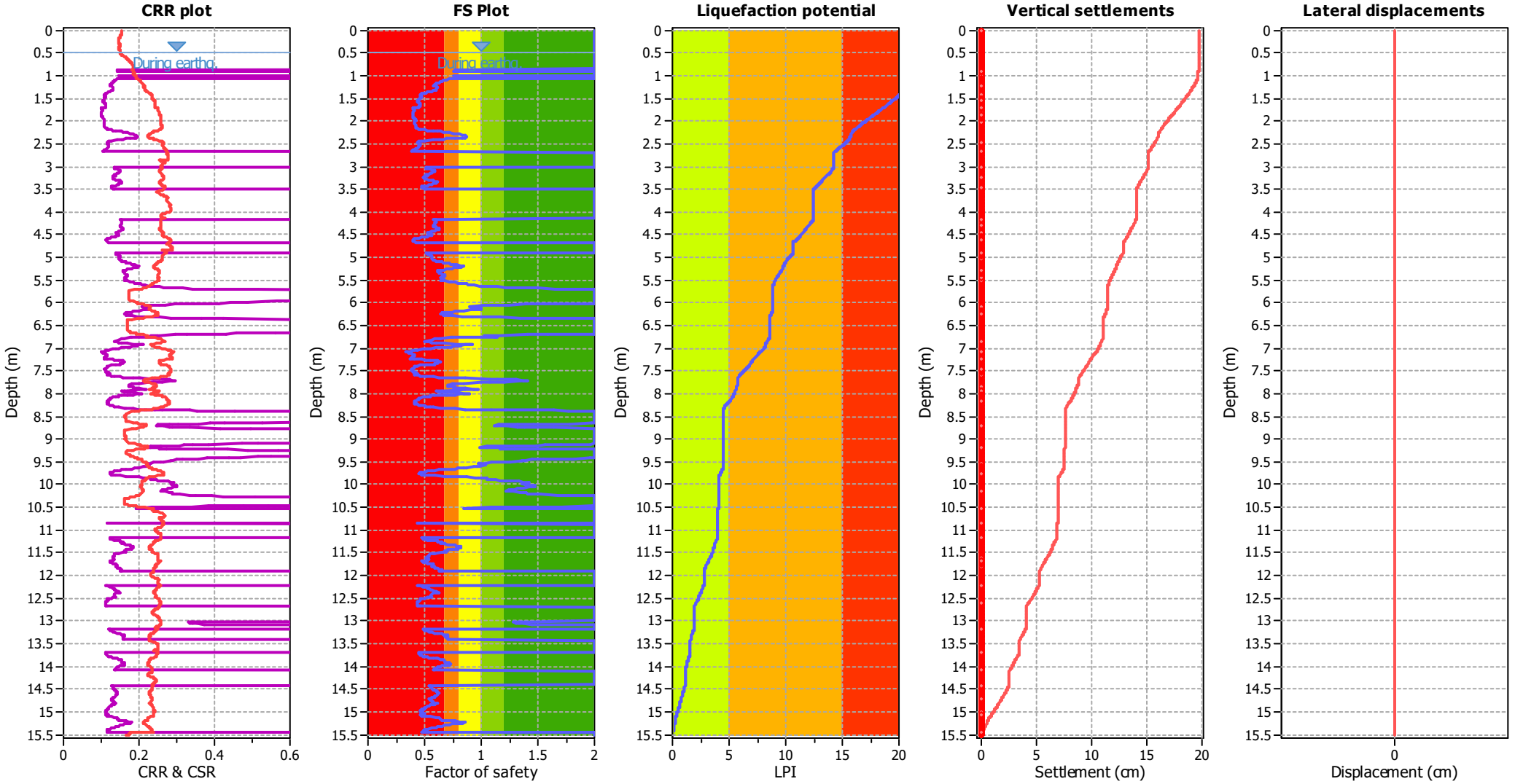

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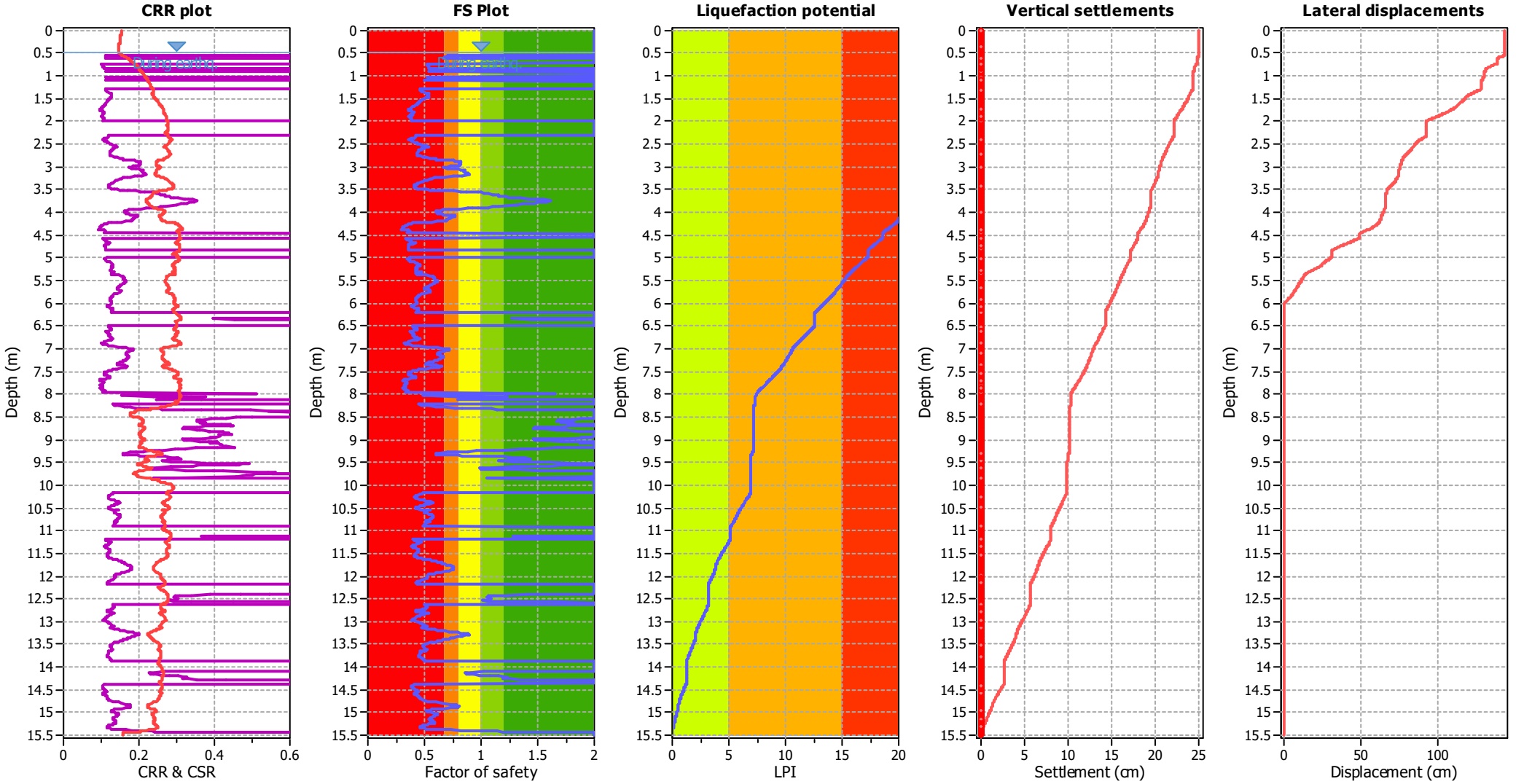

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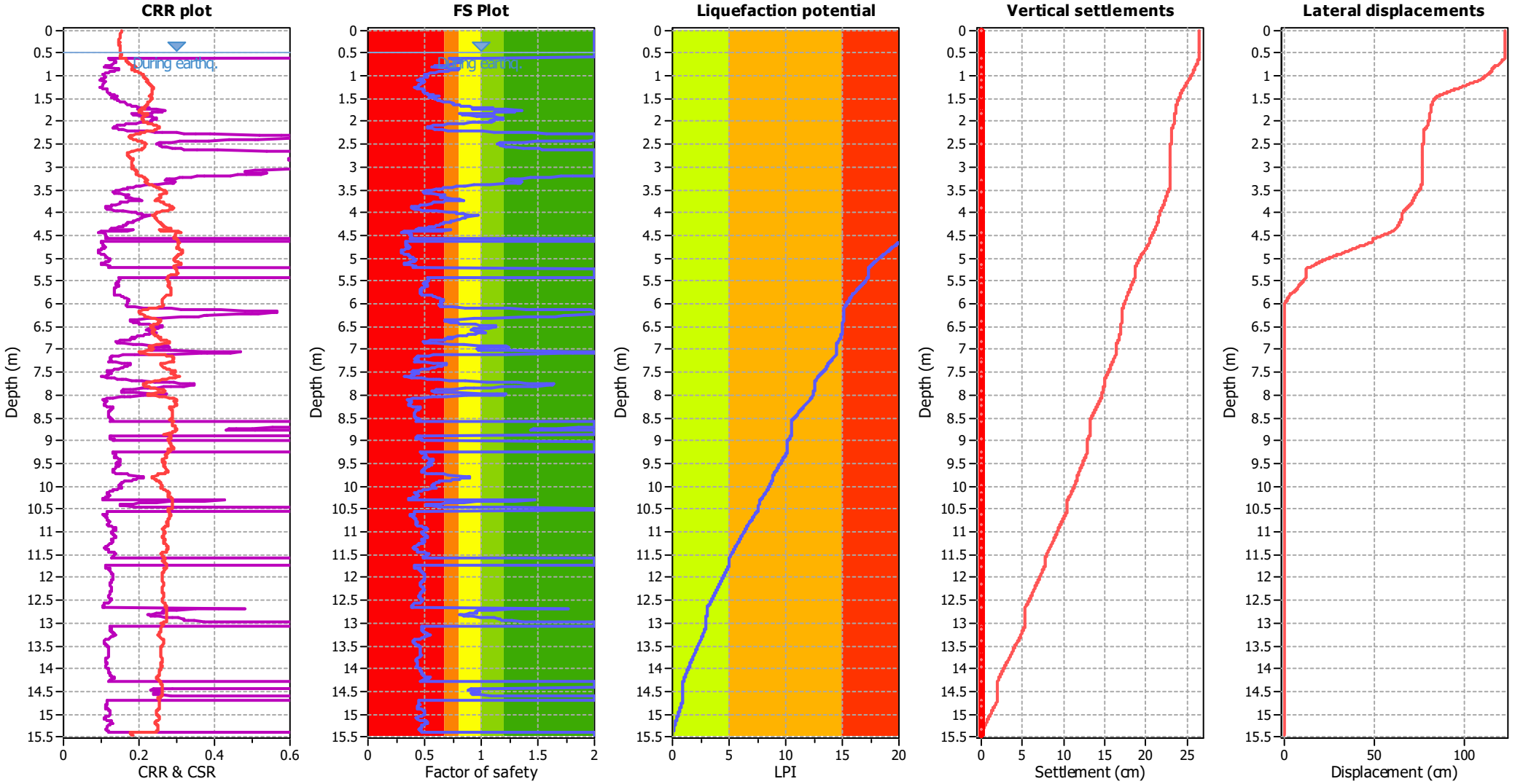

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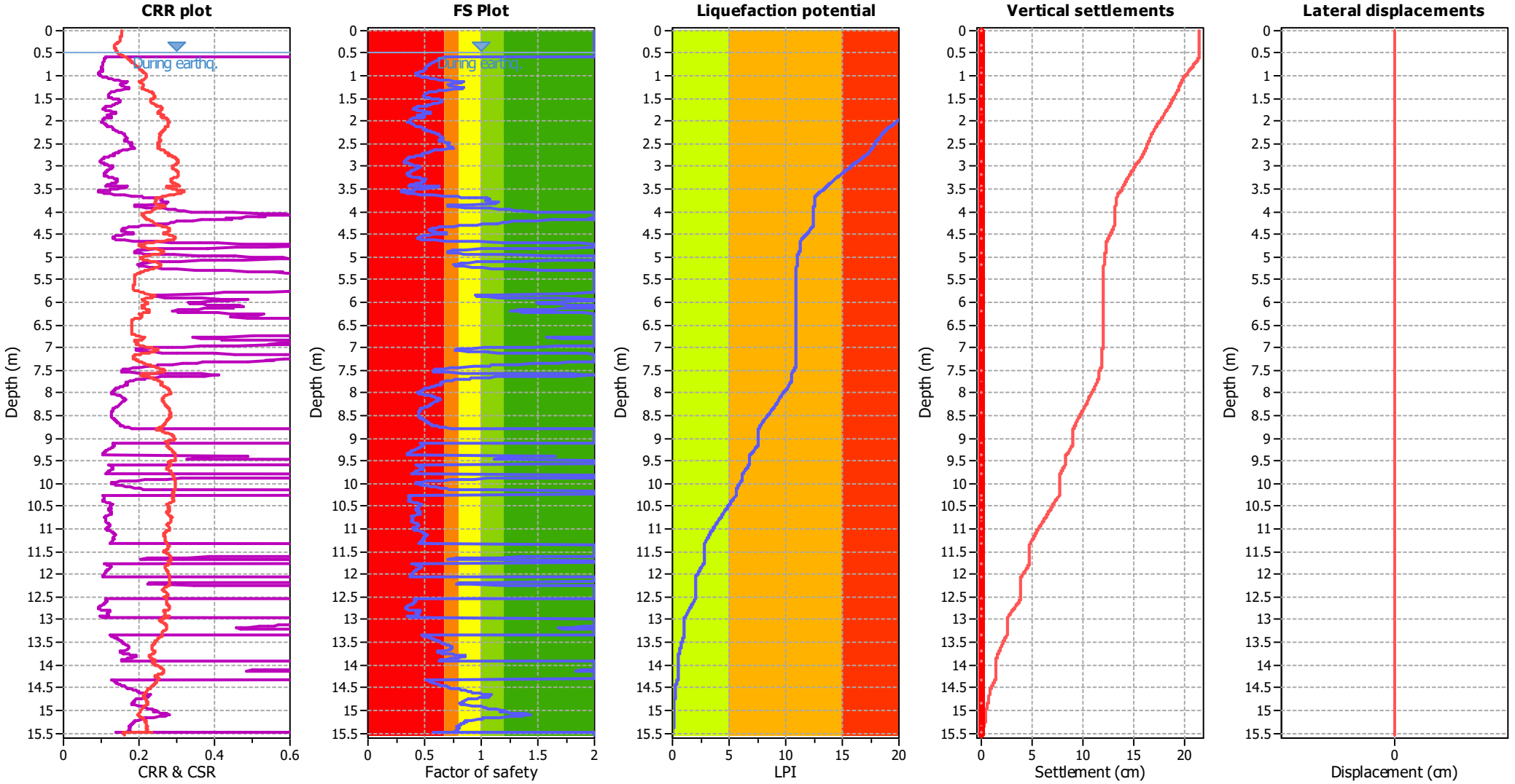

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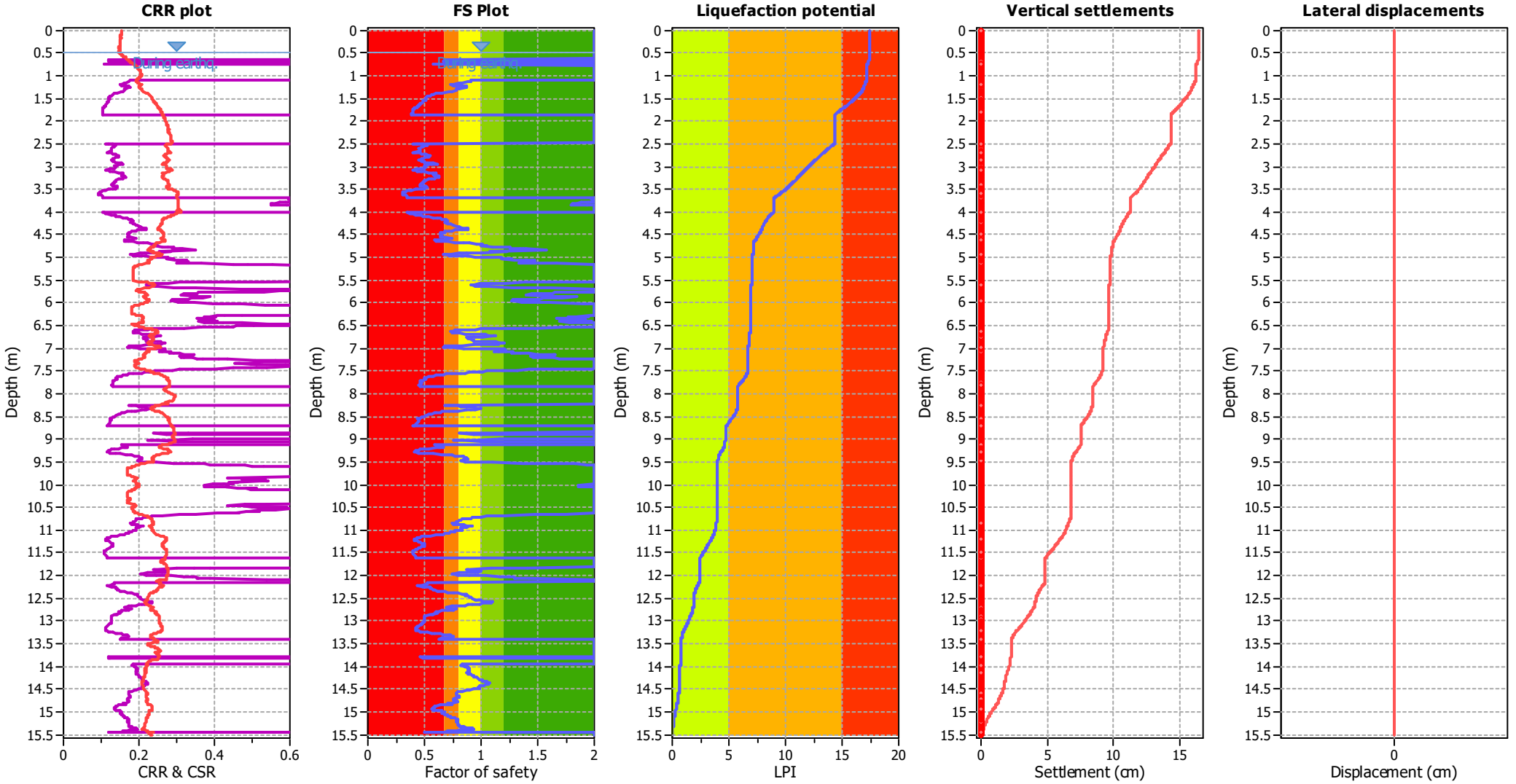

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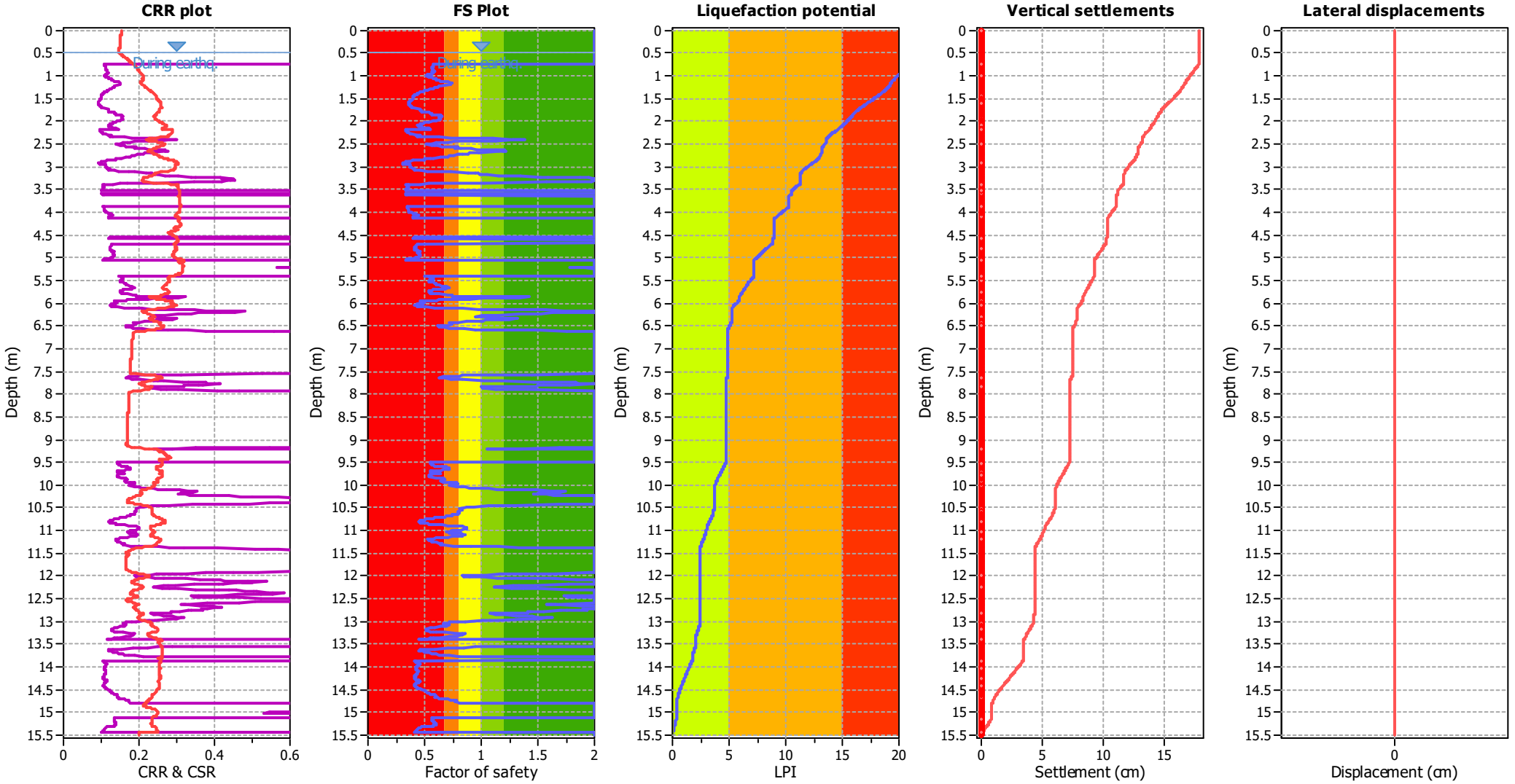

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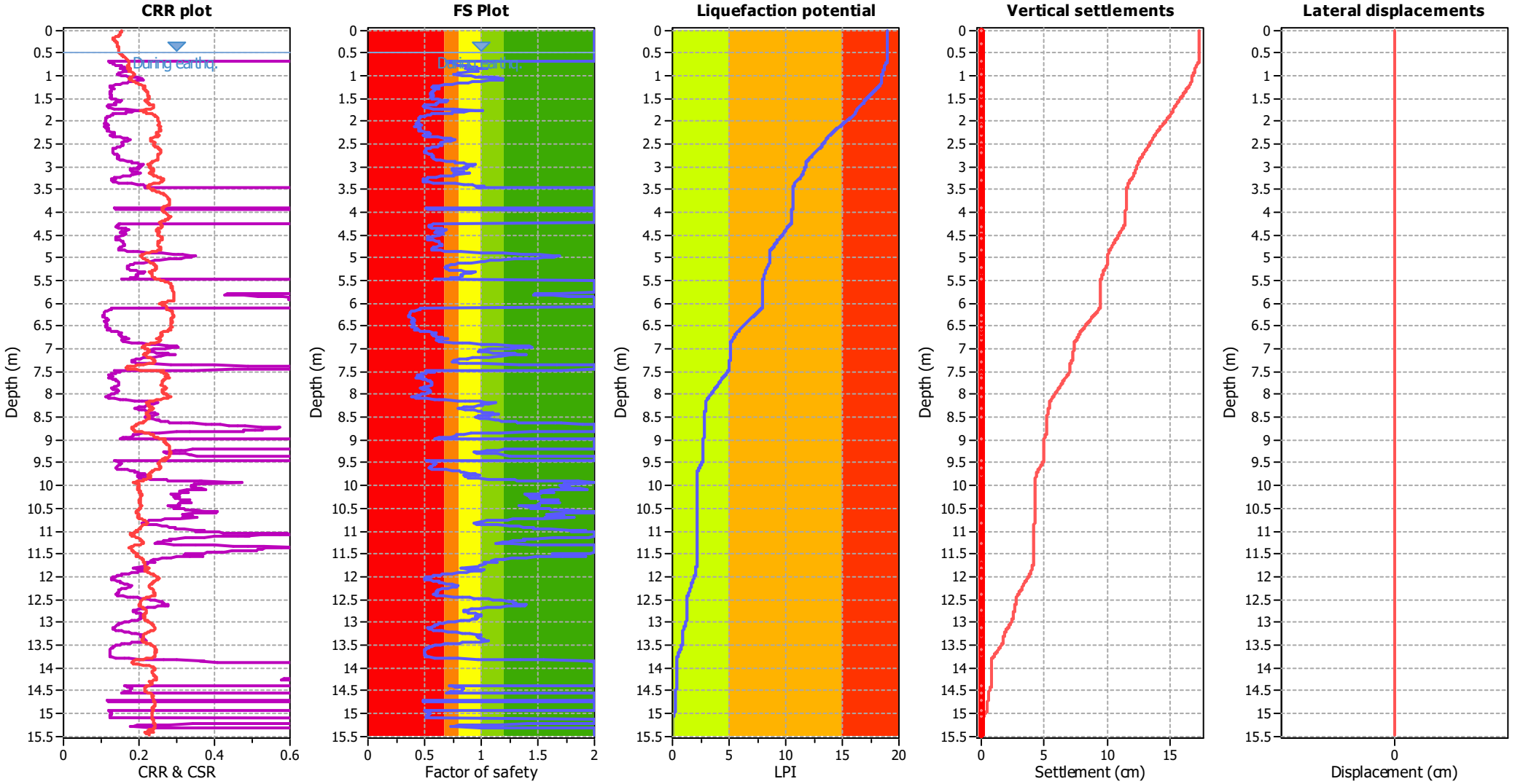

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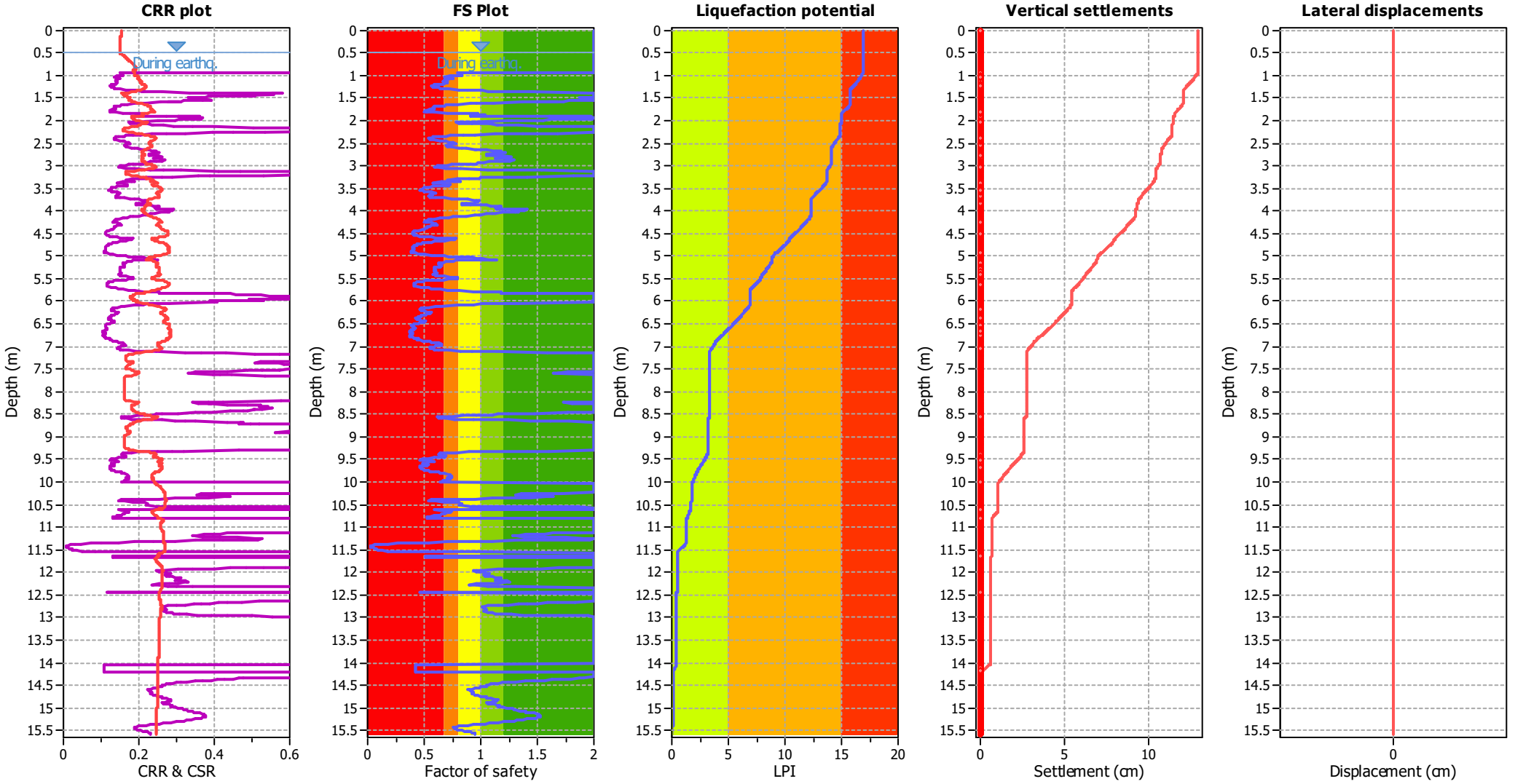

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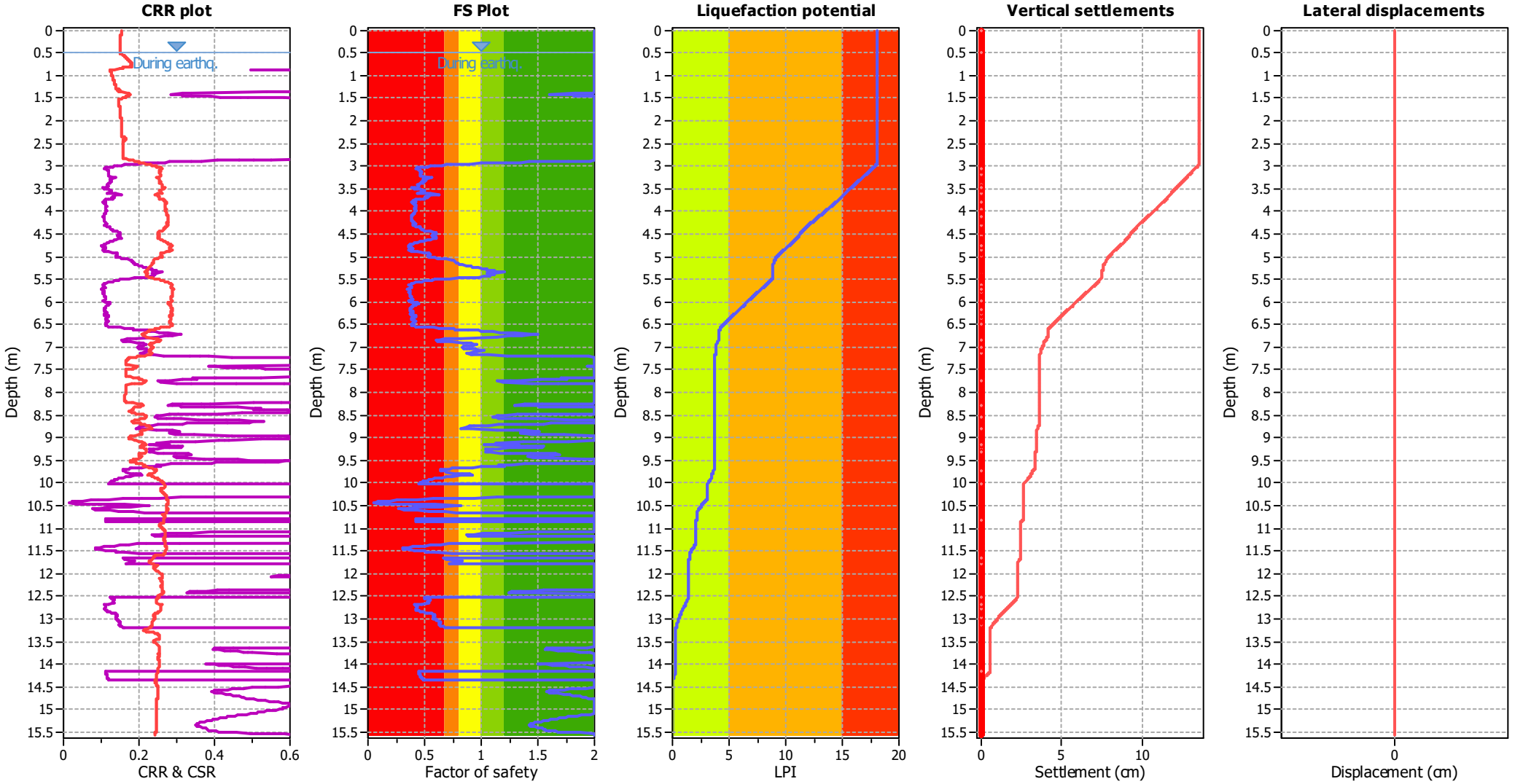

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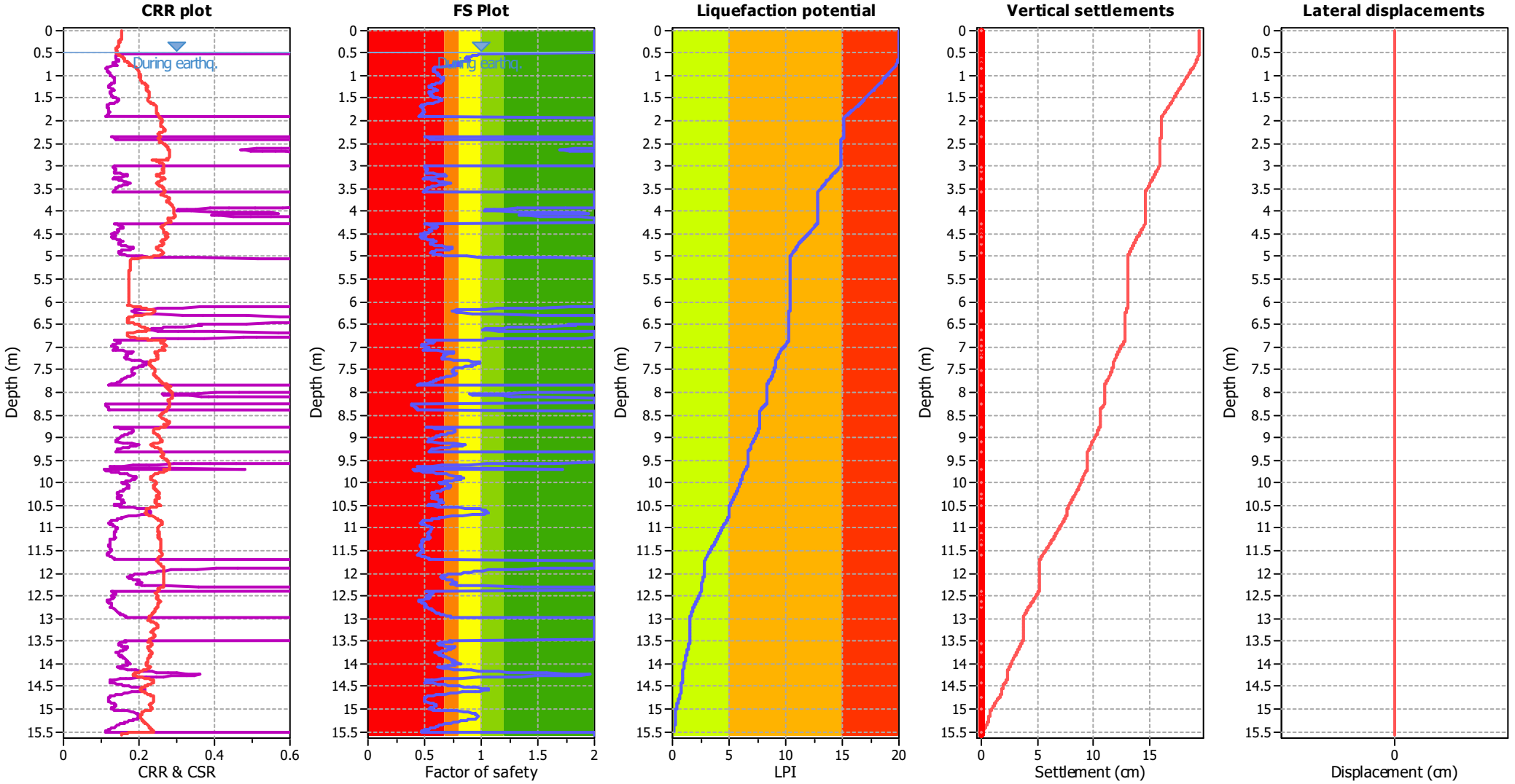

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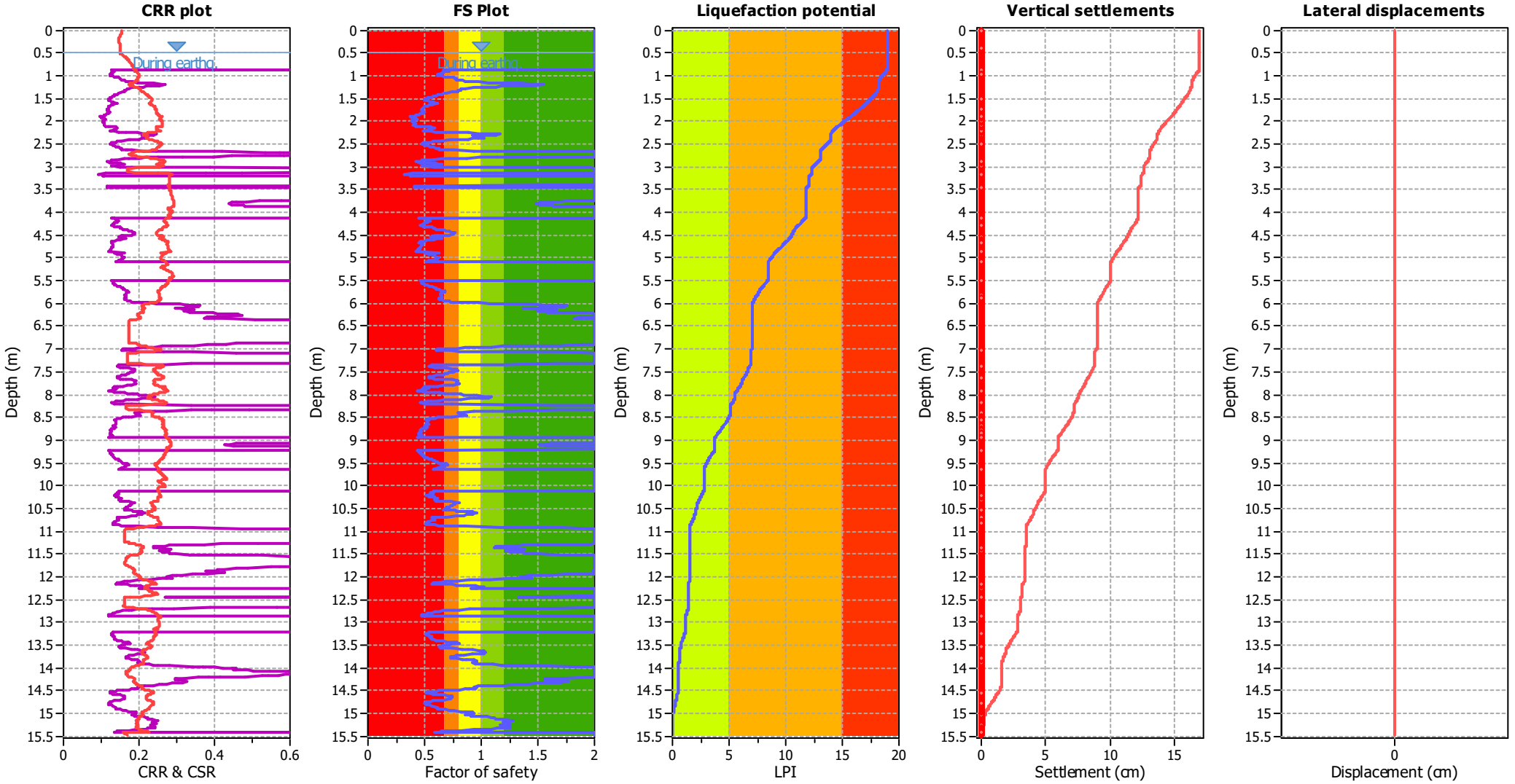

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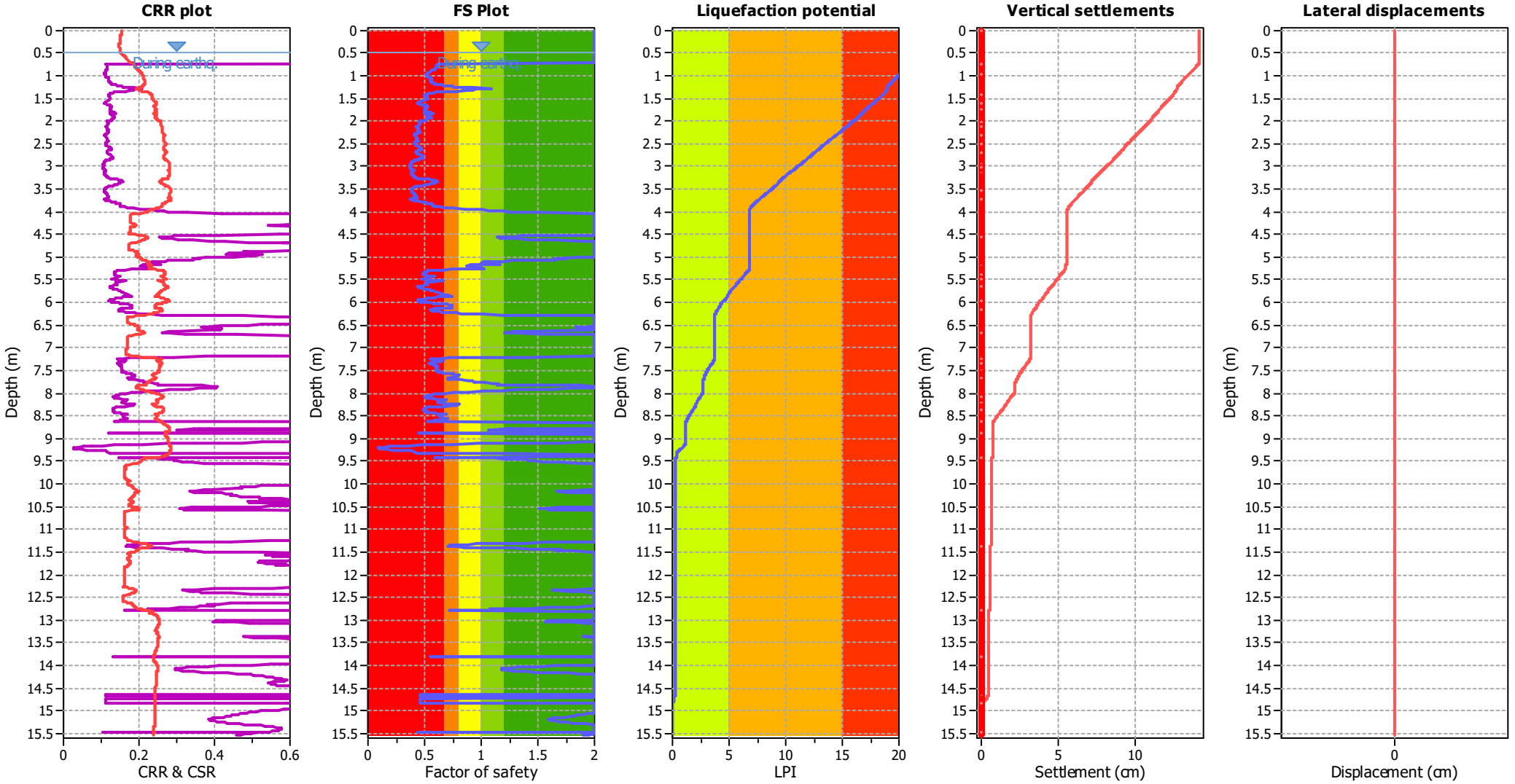

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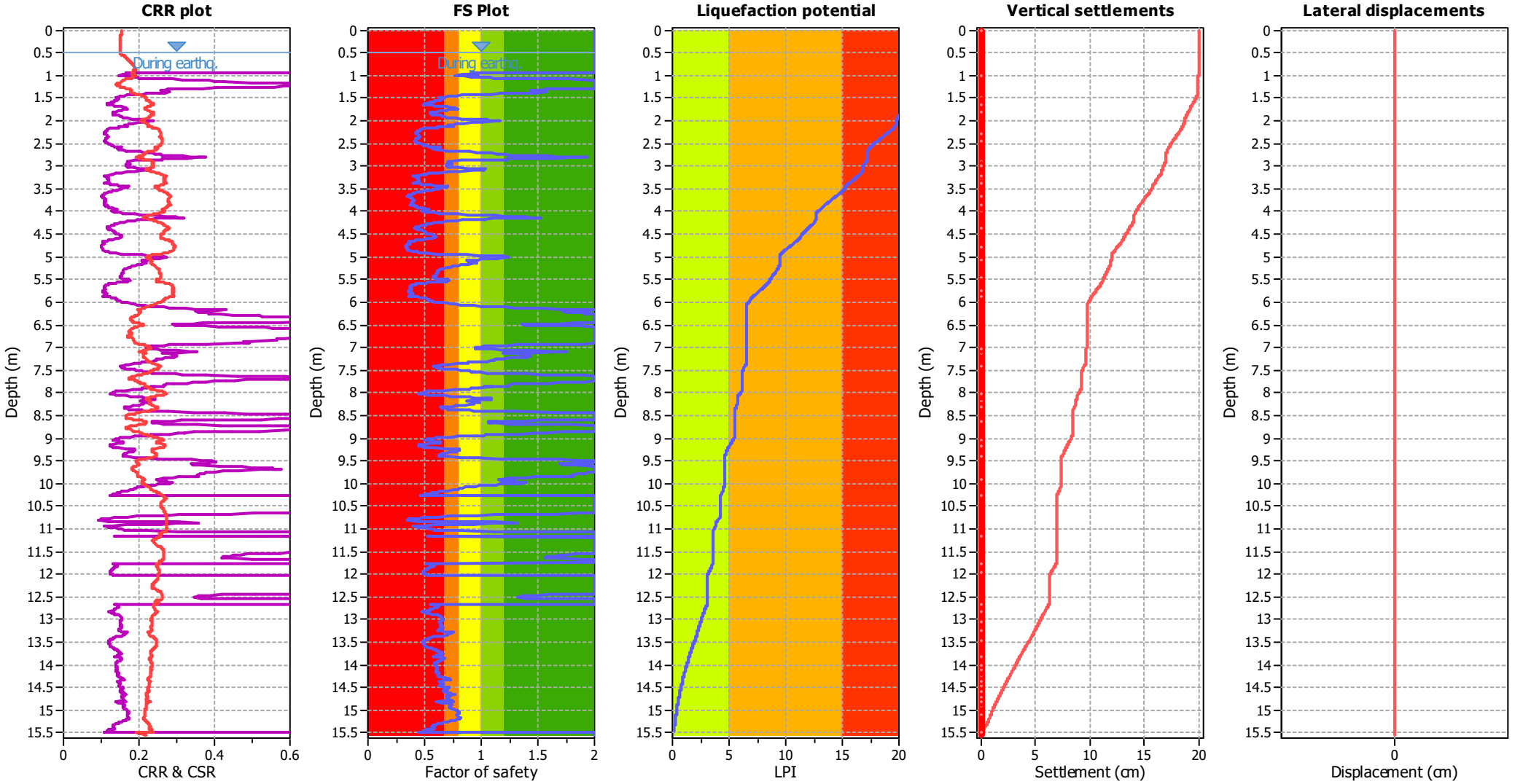

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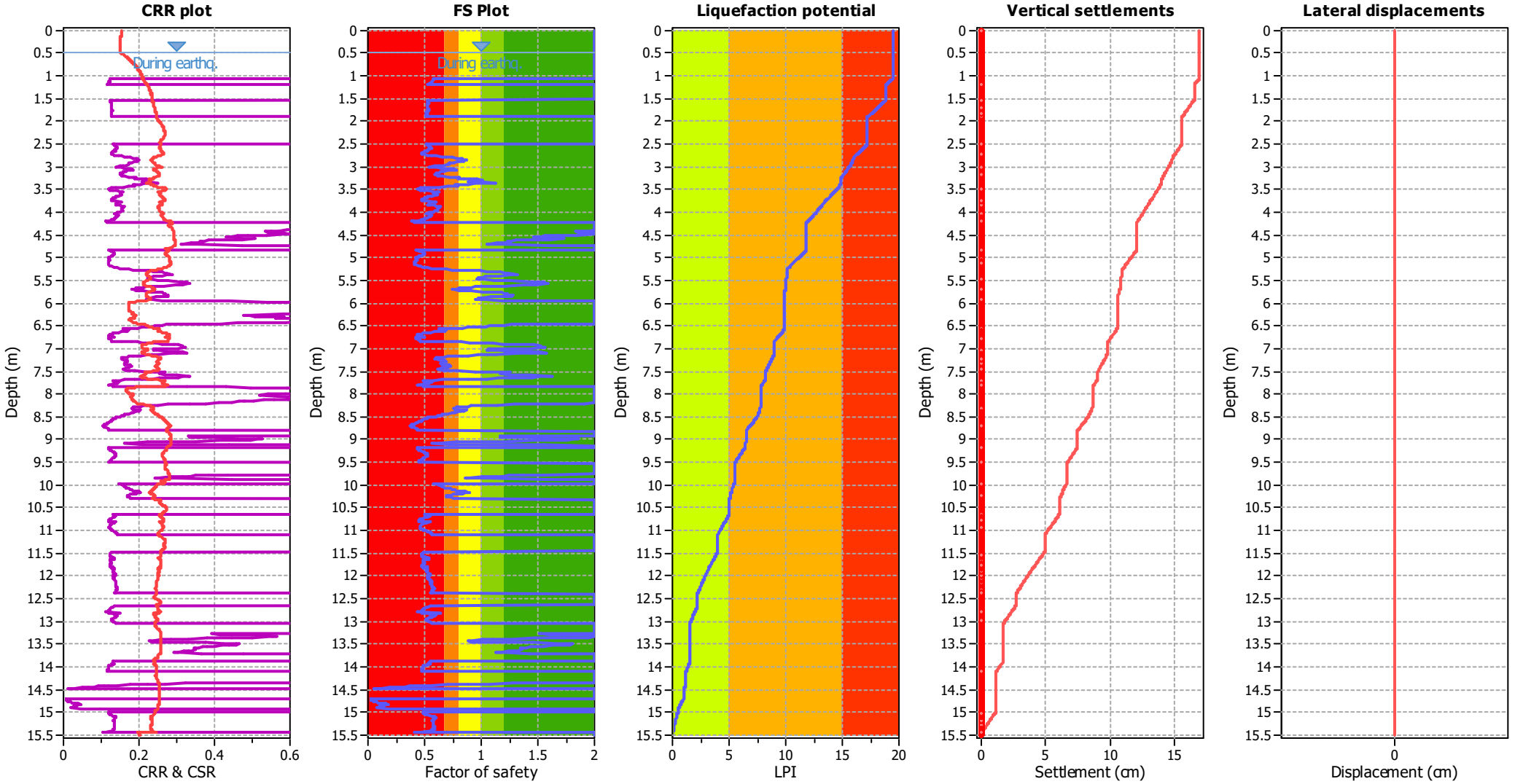

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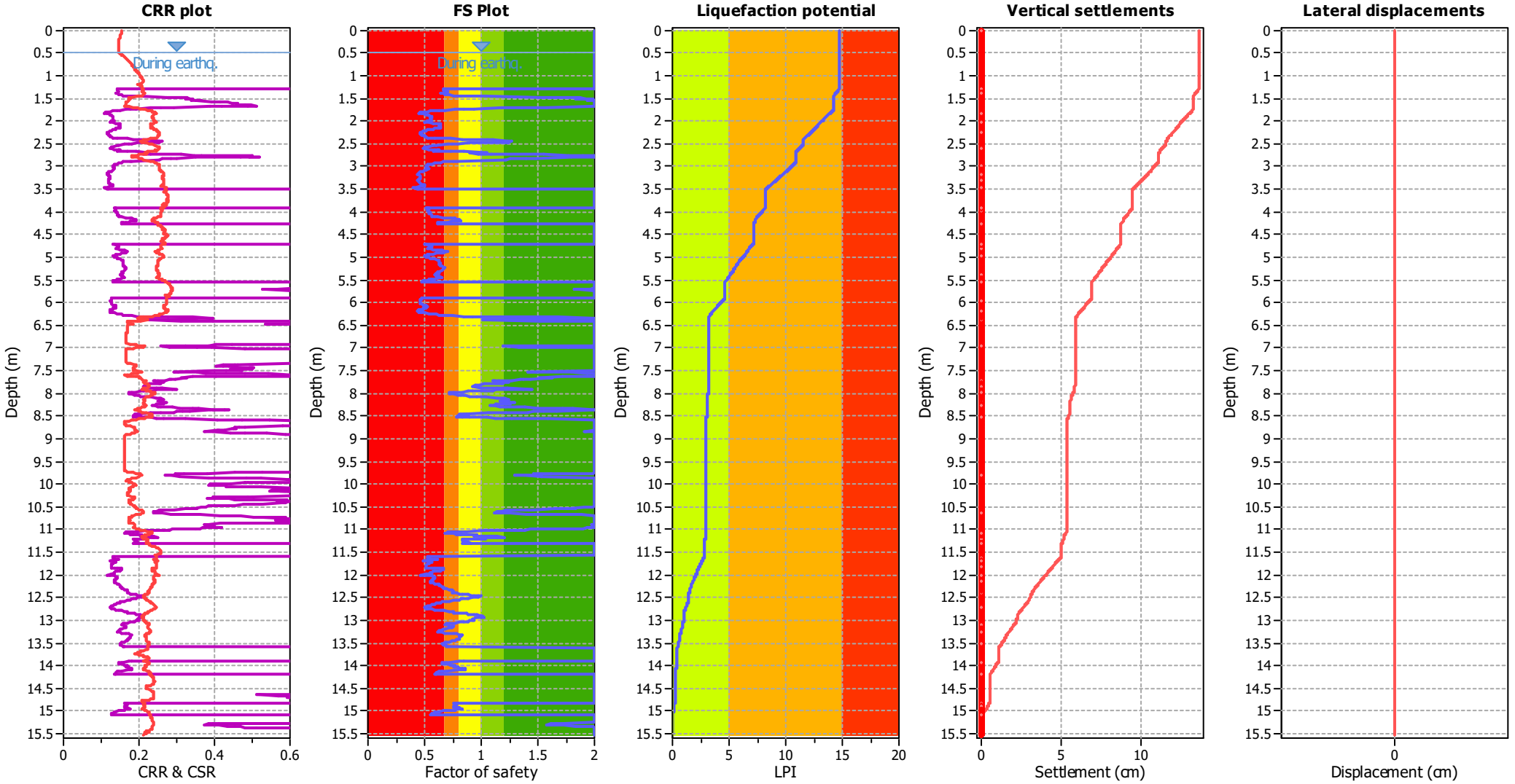

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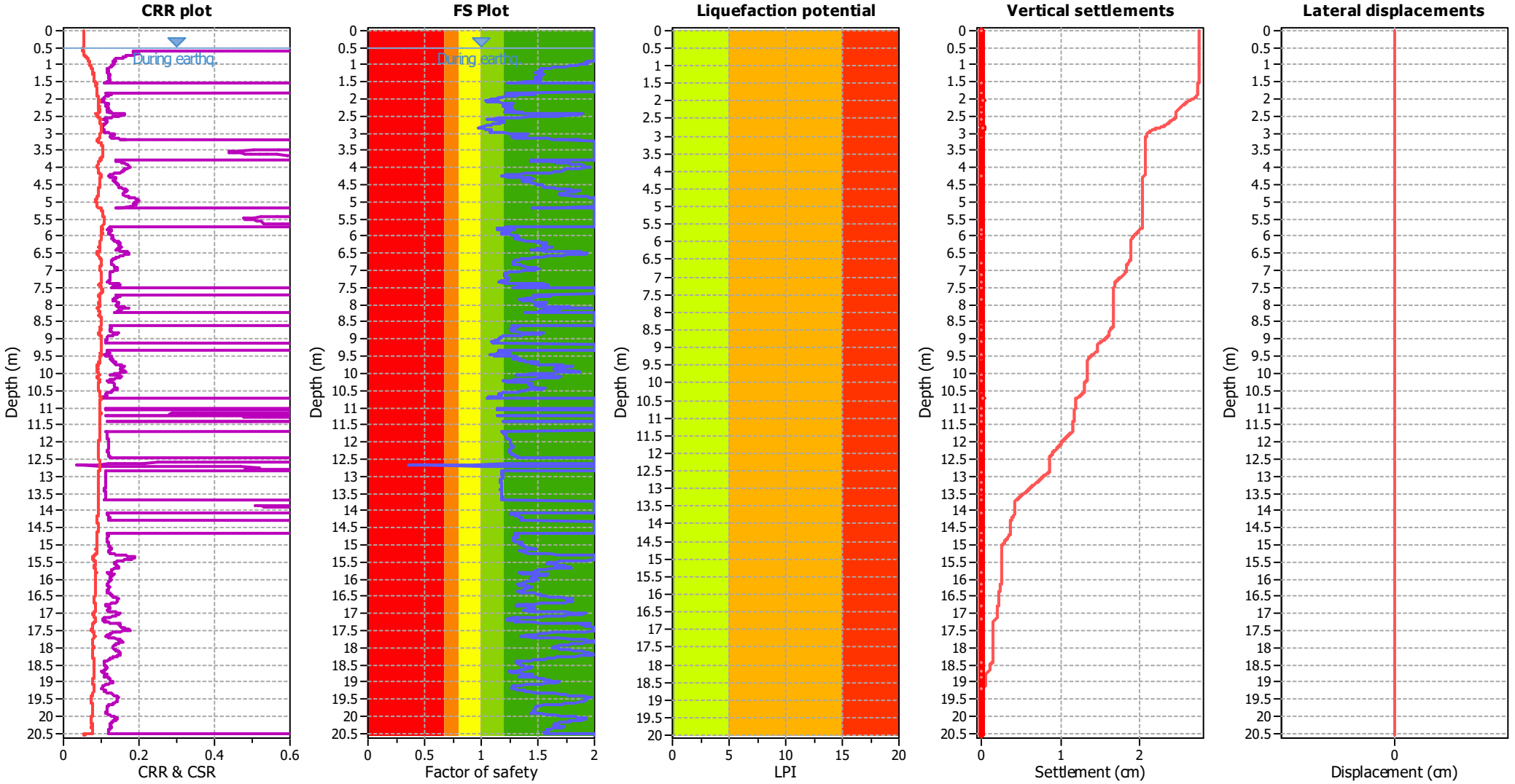

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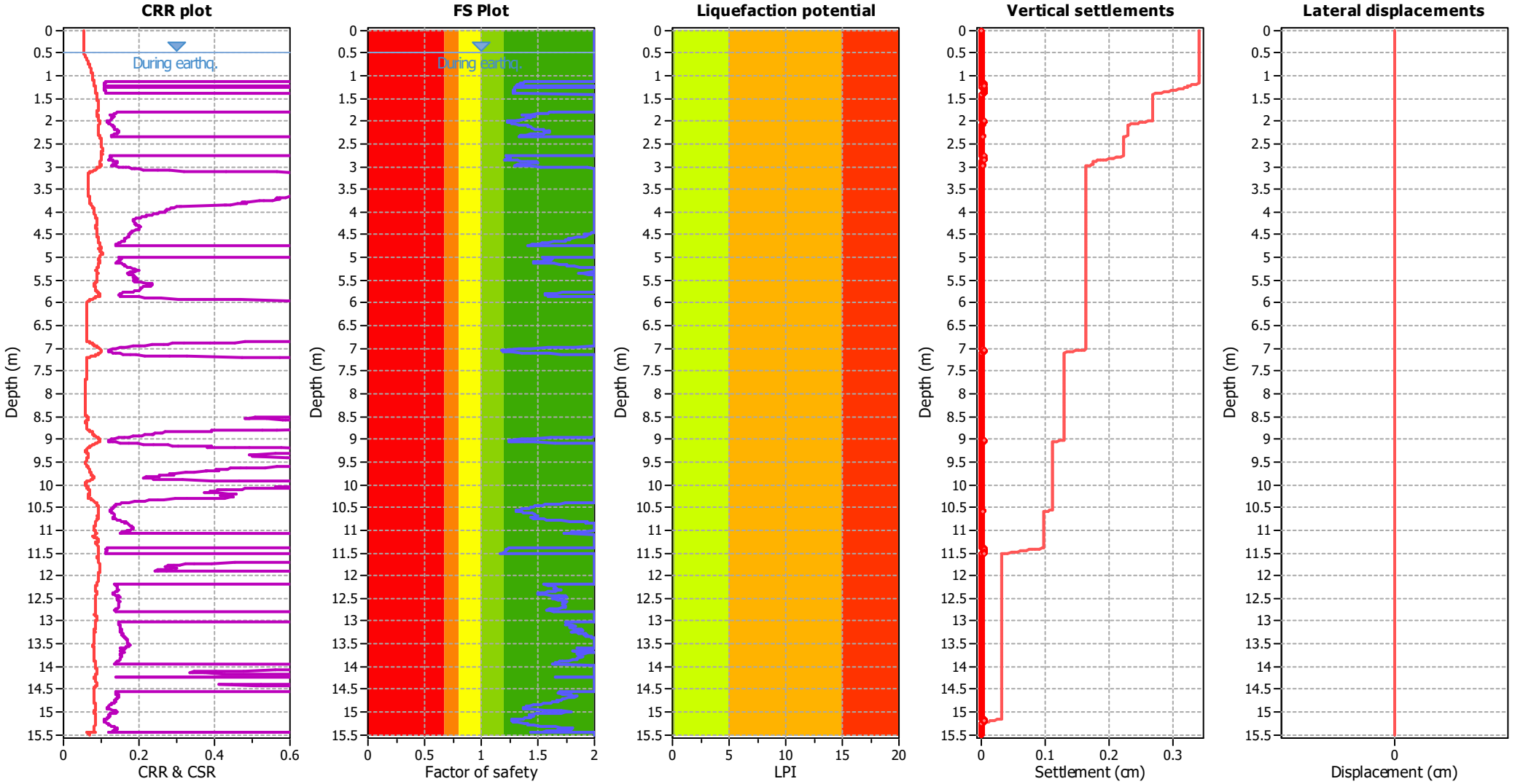

Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.10	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
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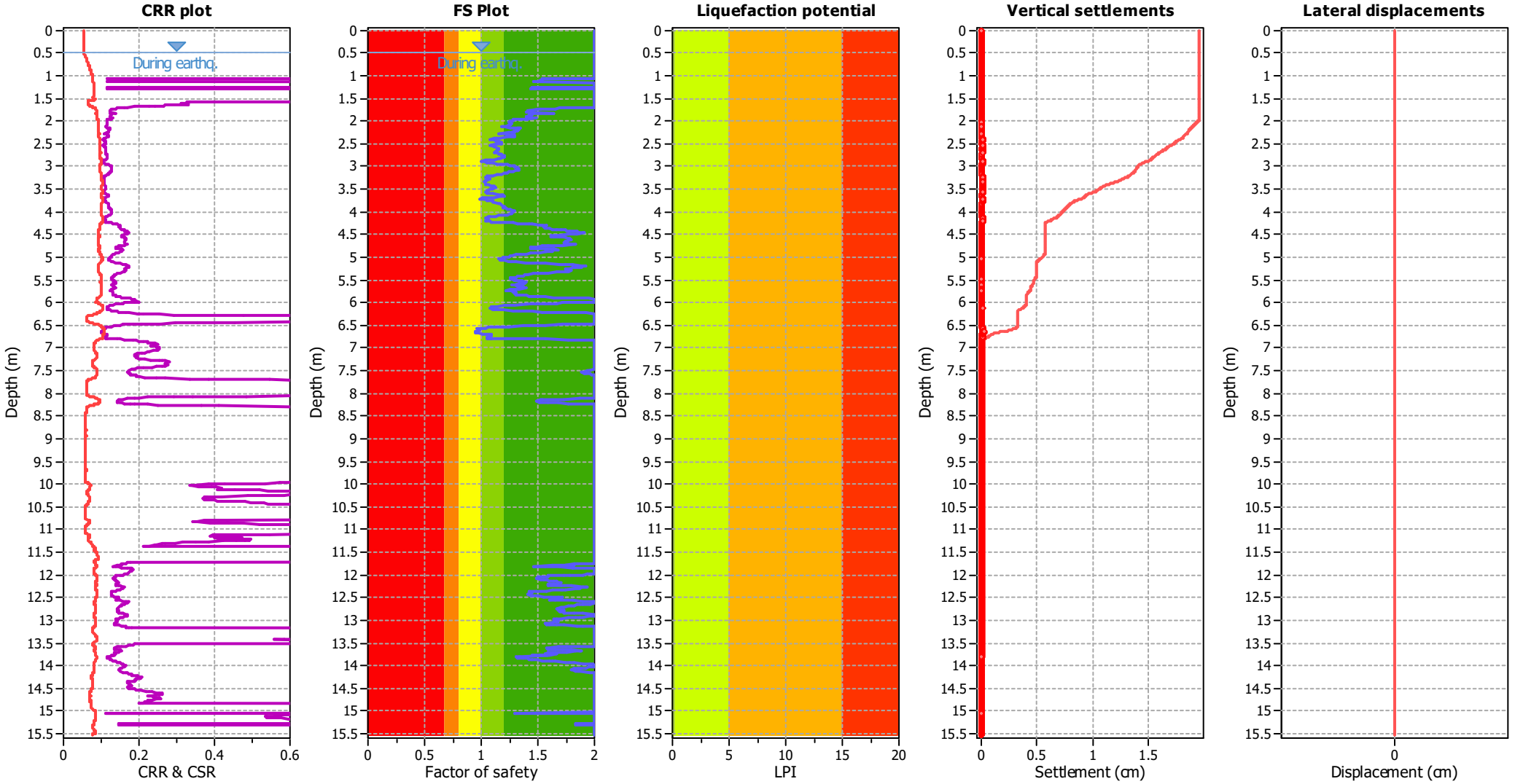

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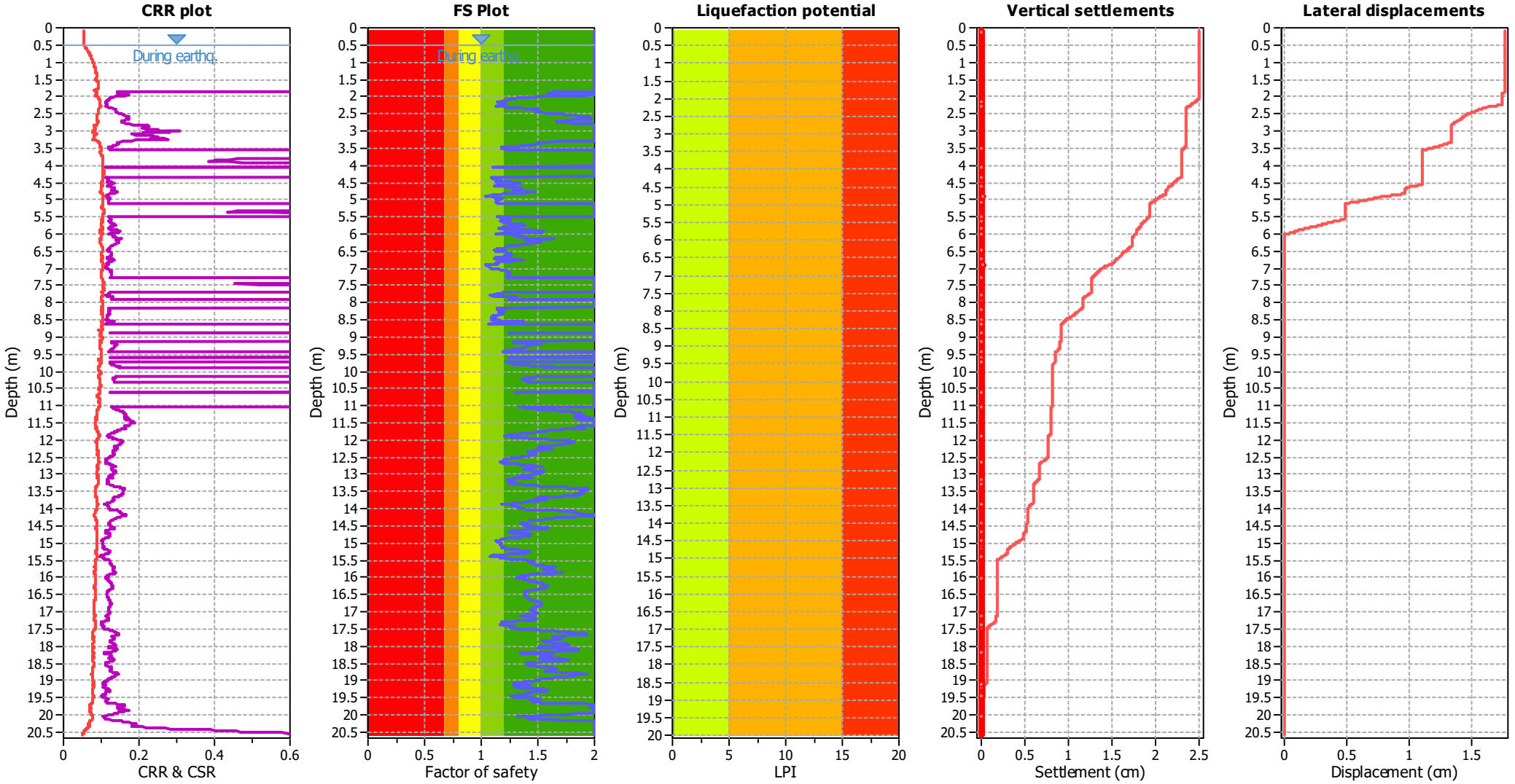

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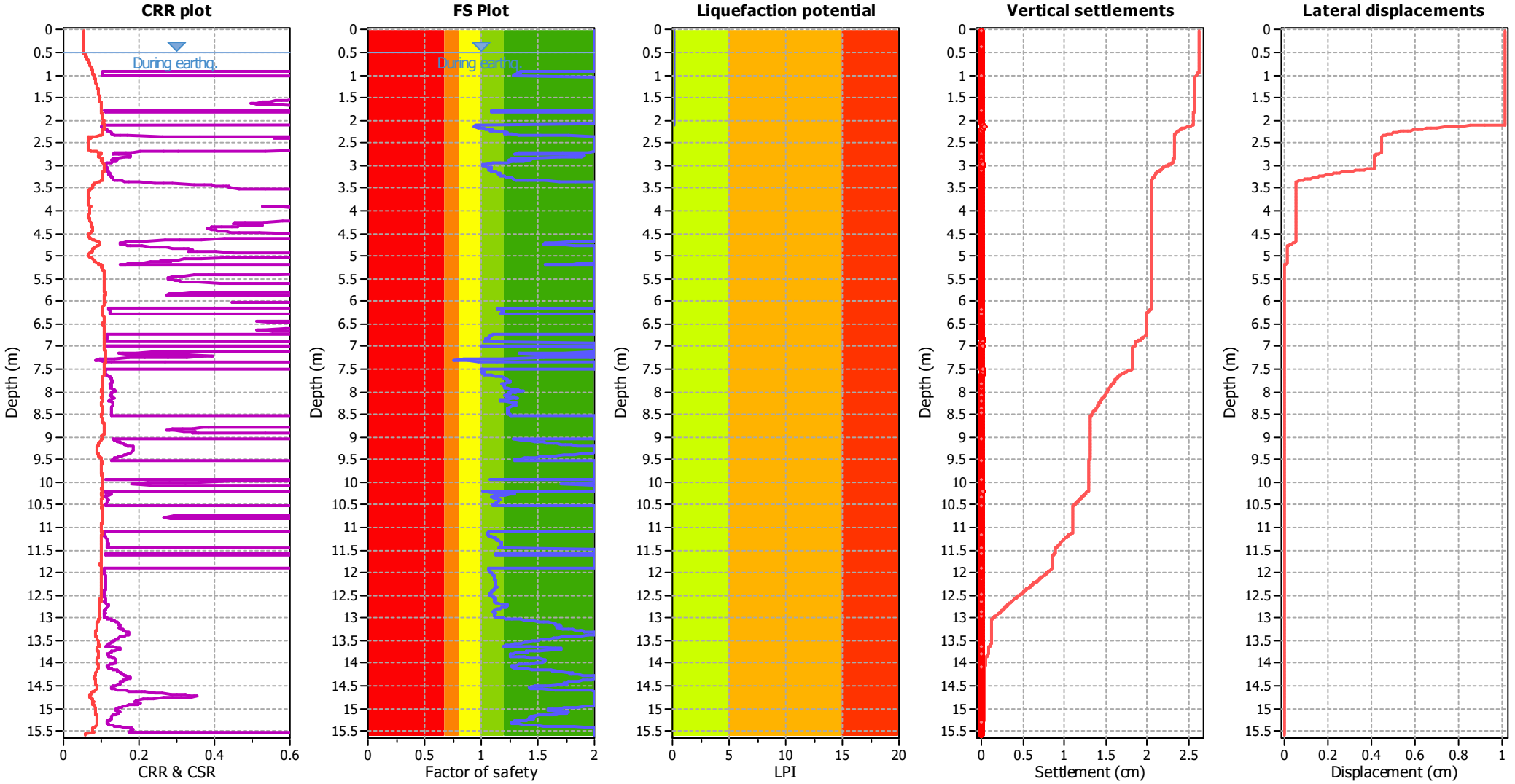

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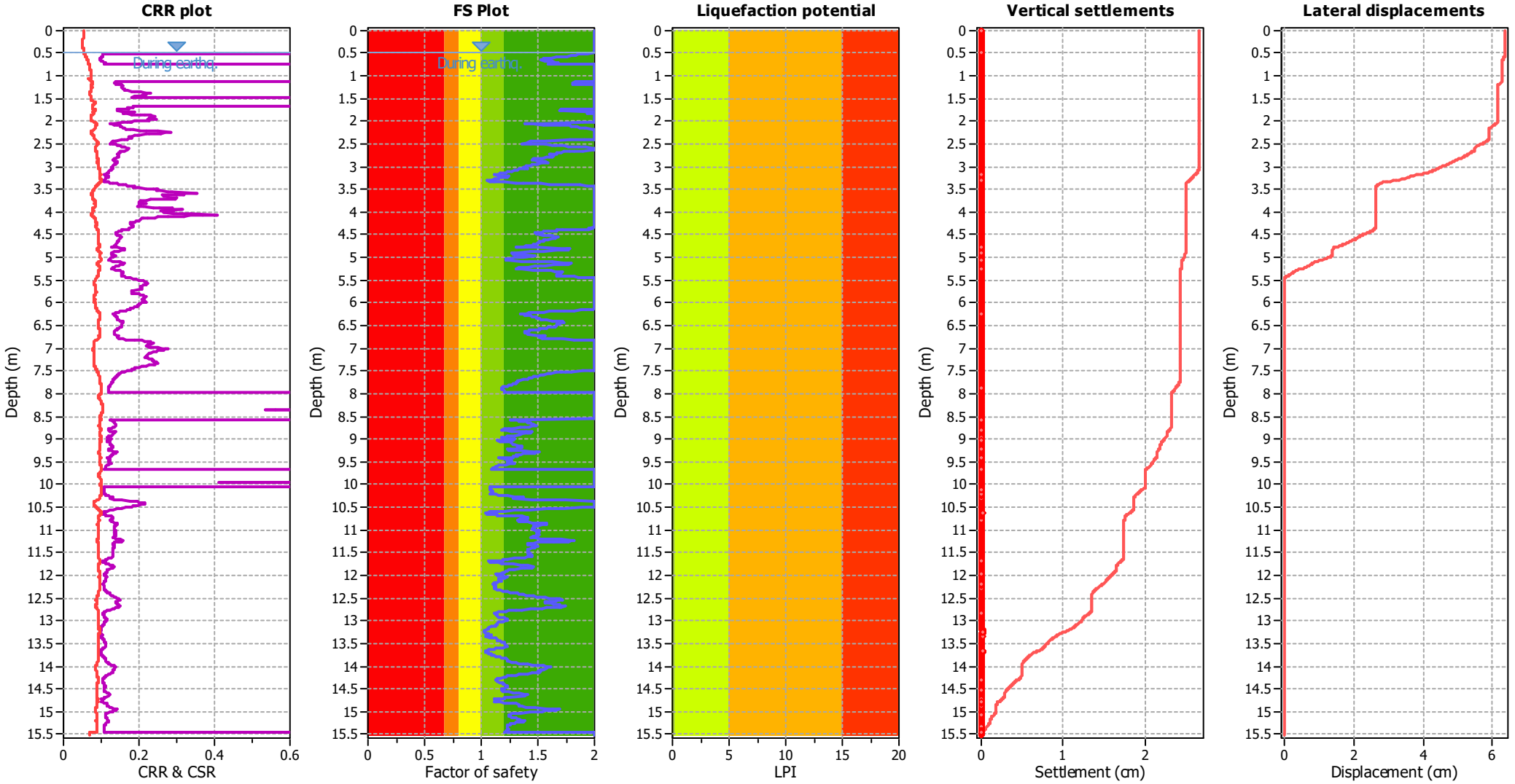

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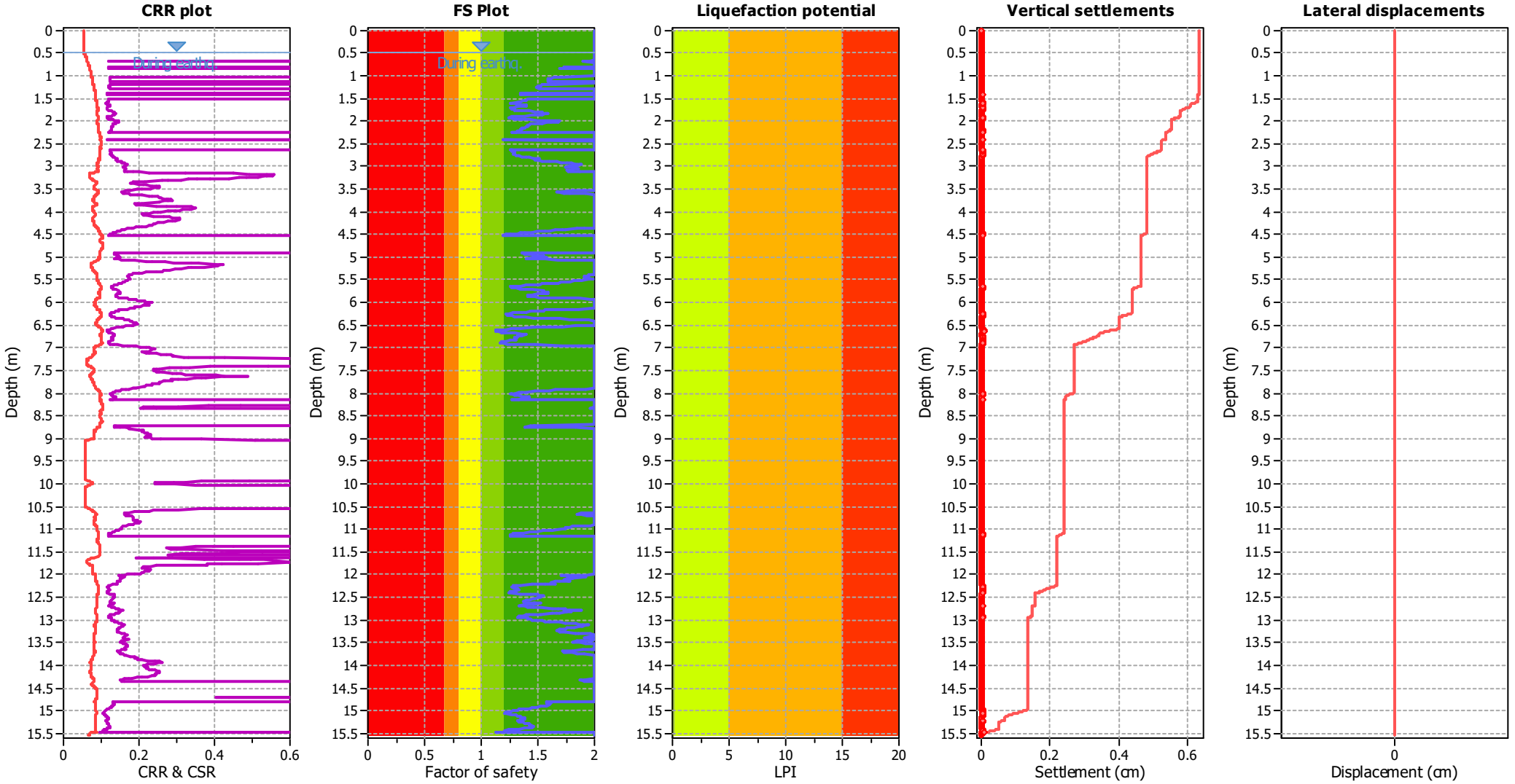

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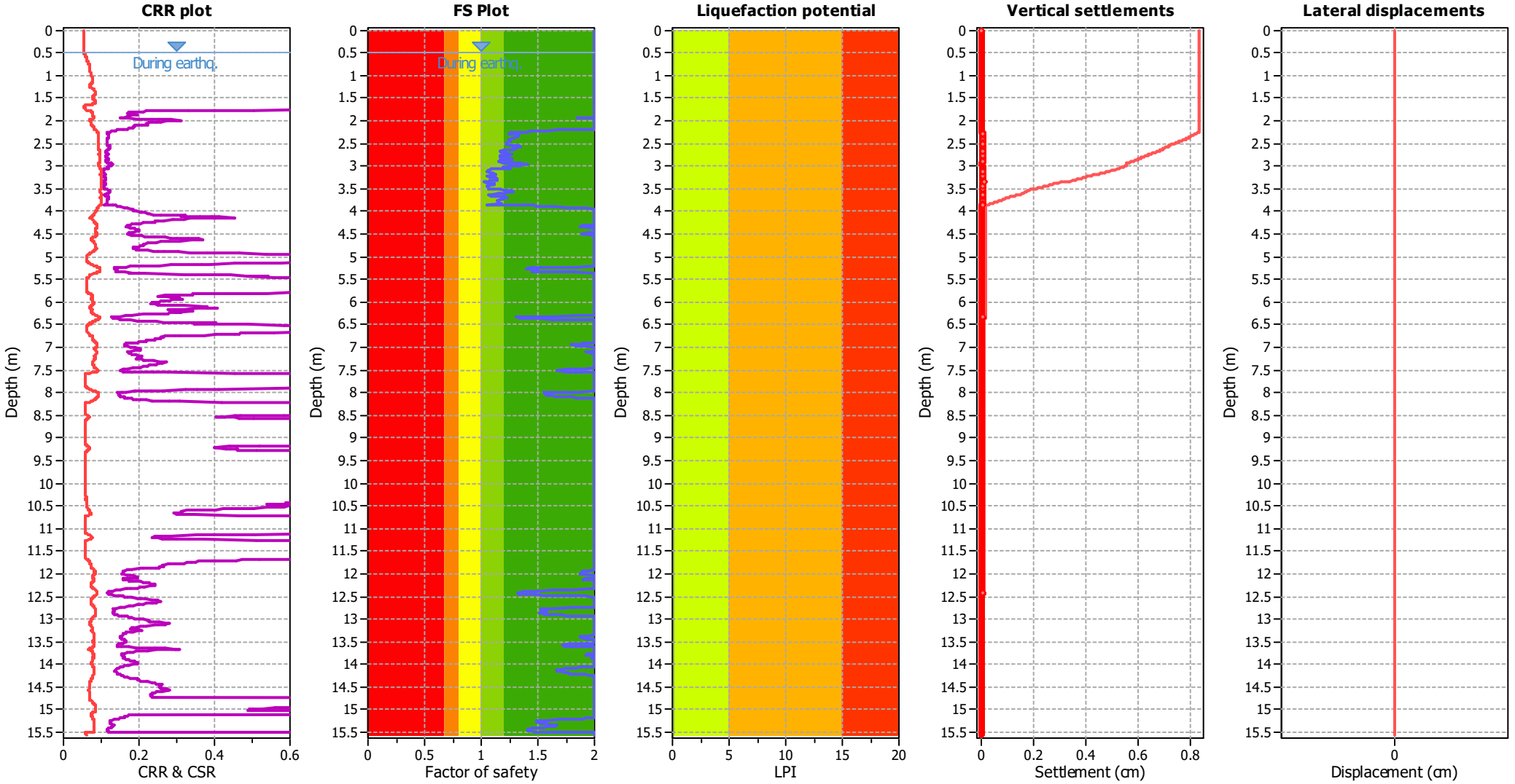

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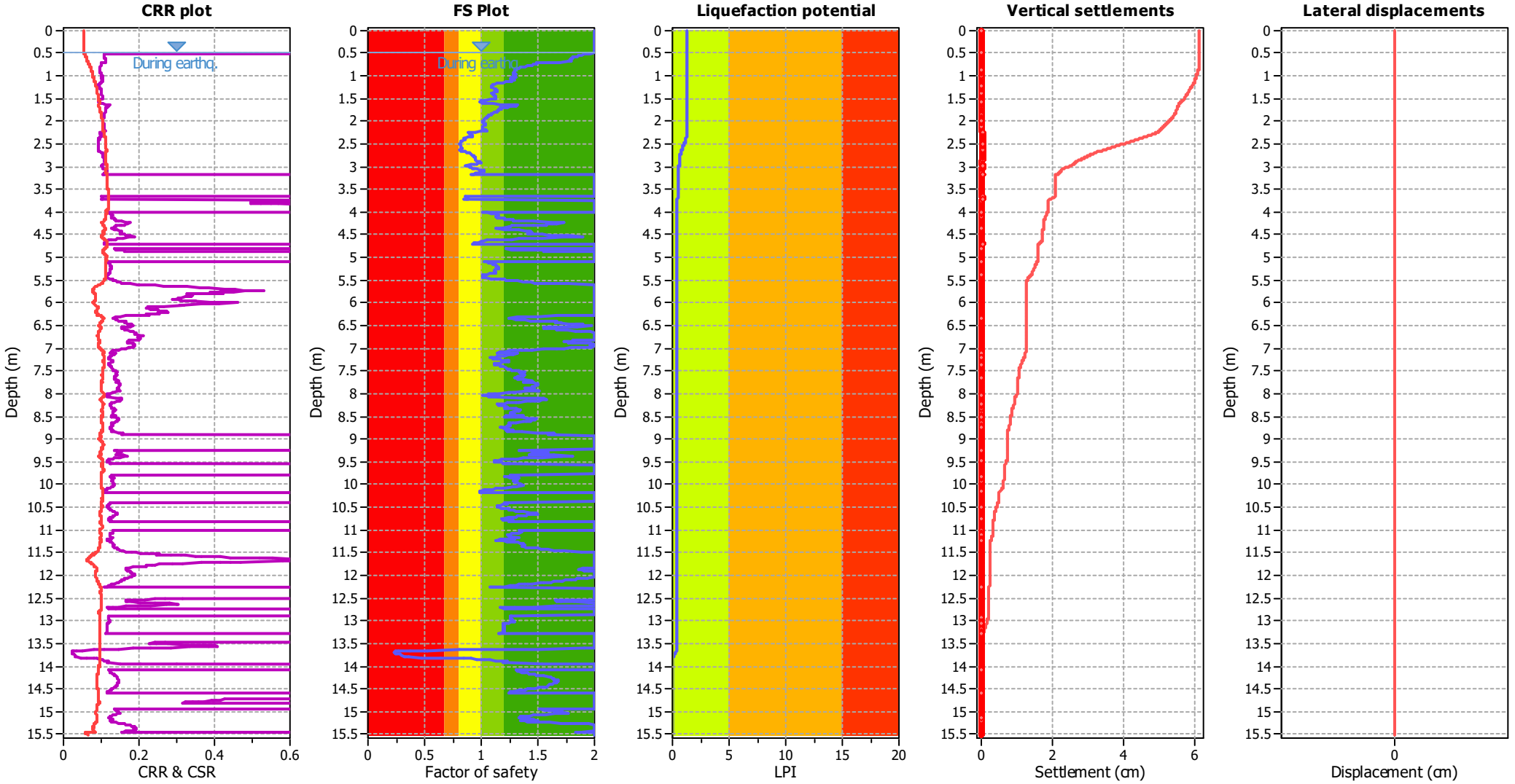

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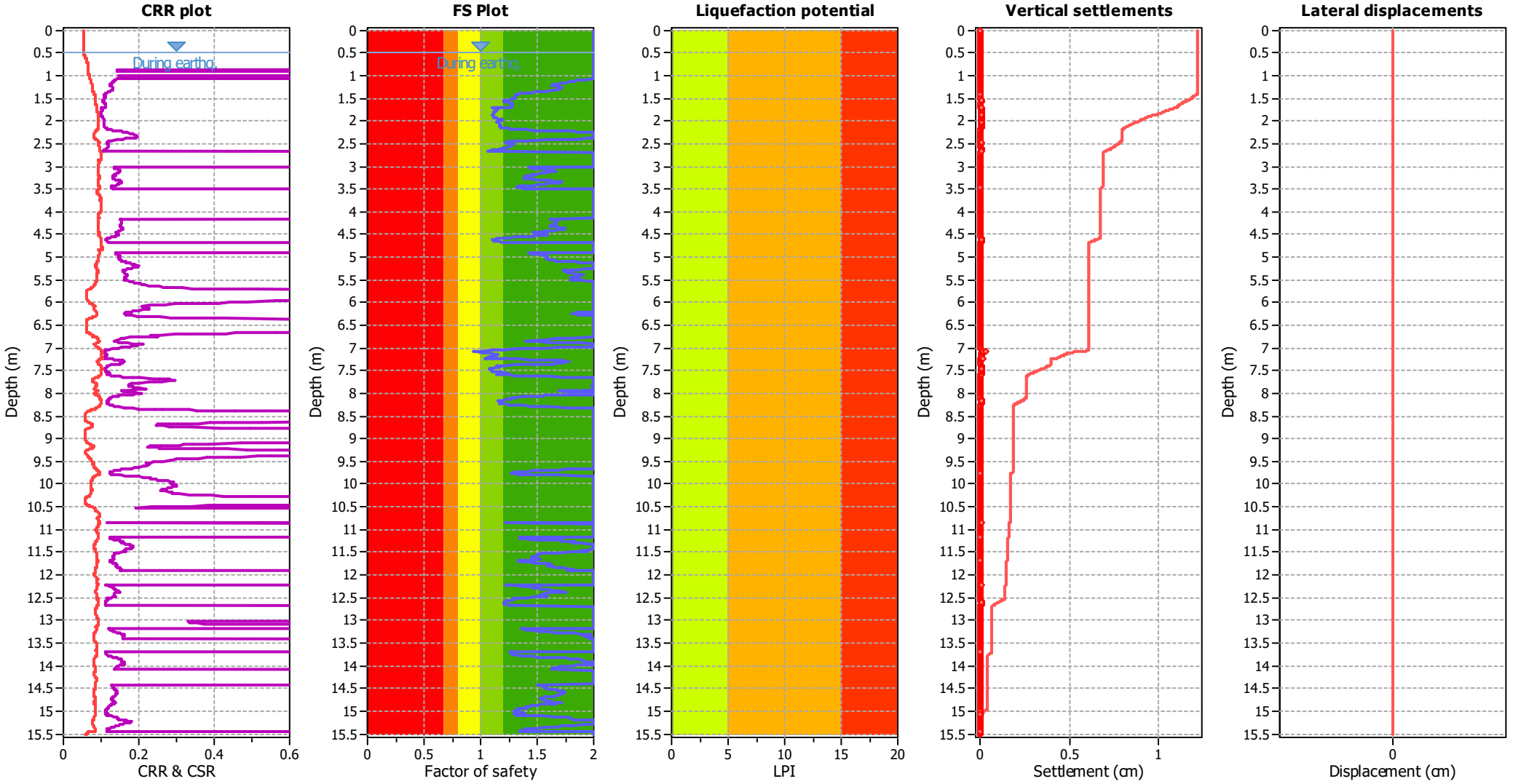

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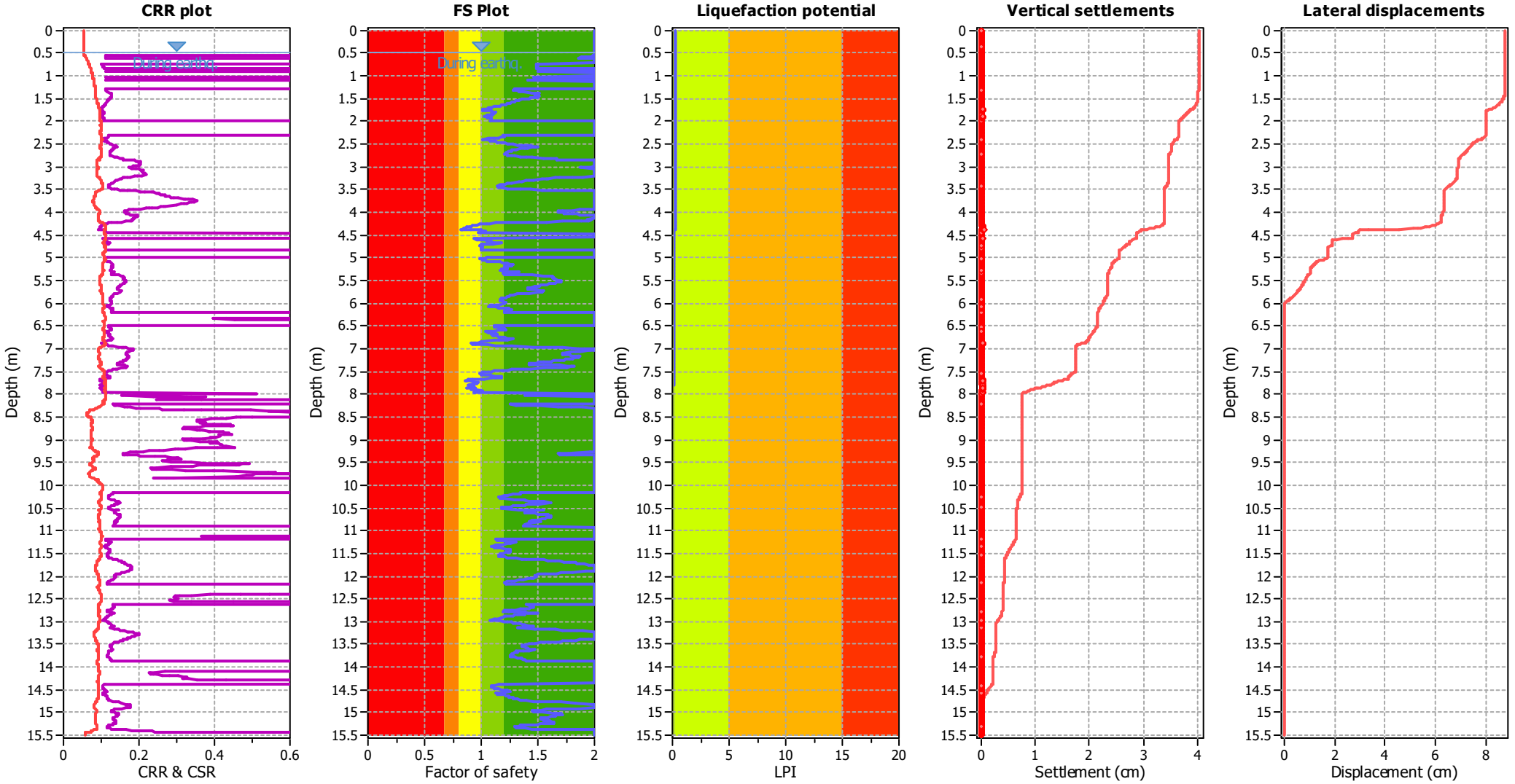

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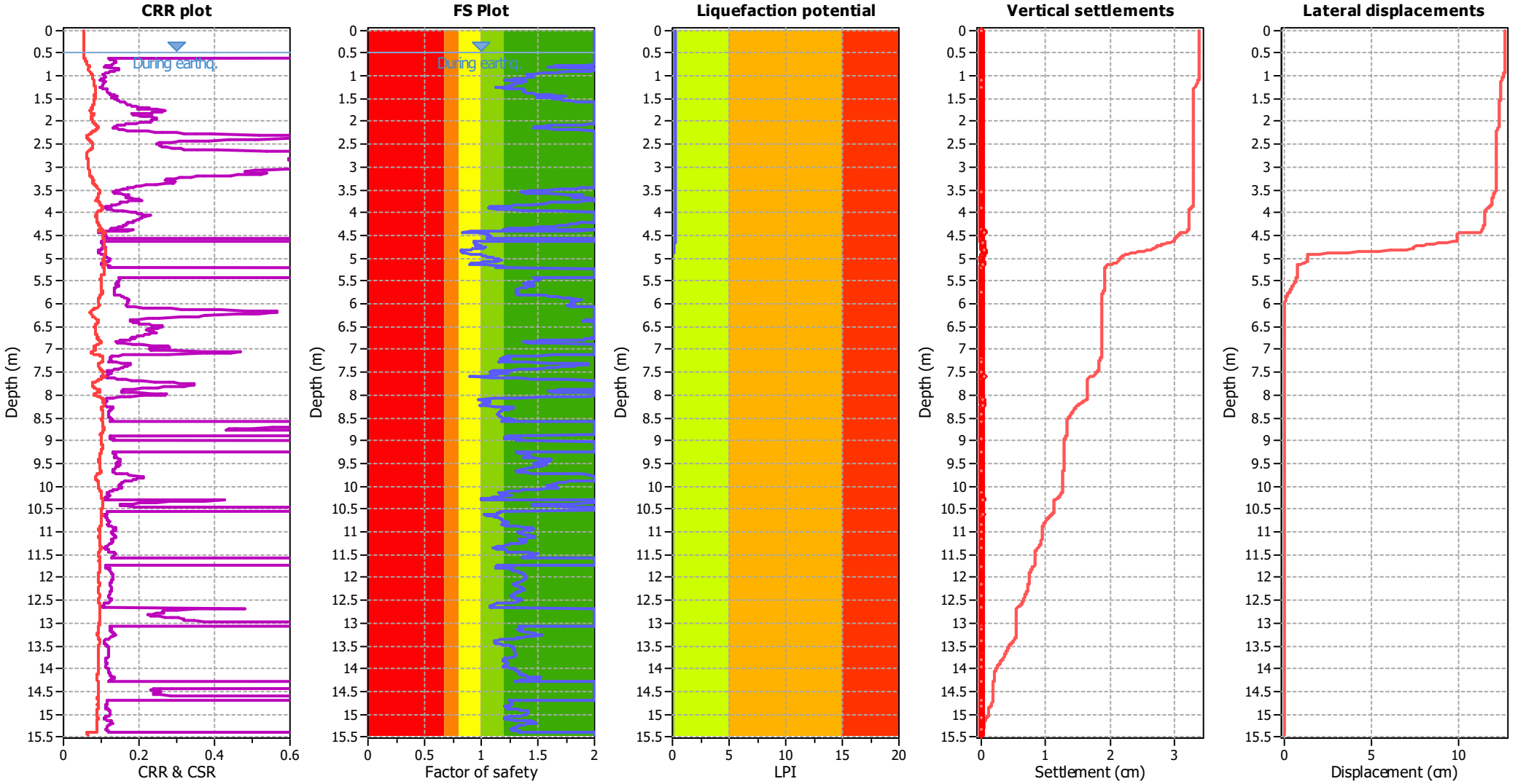

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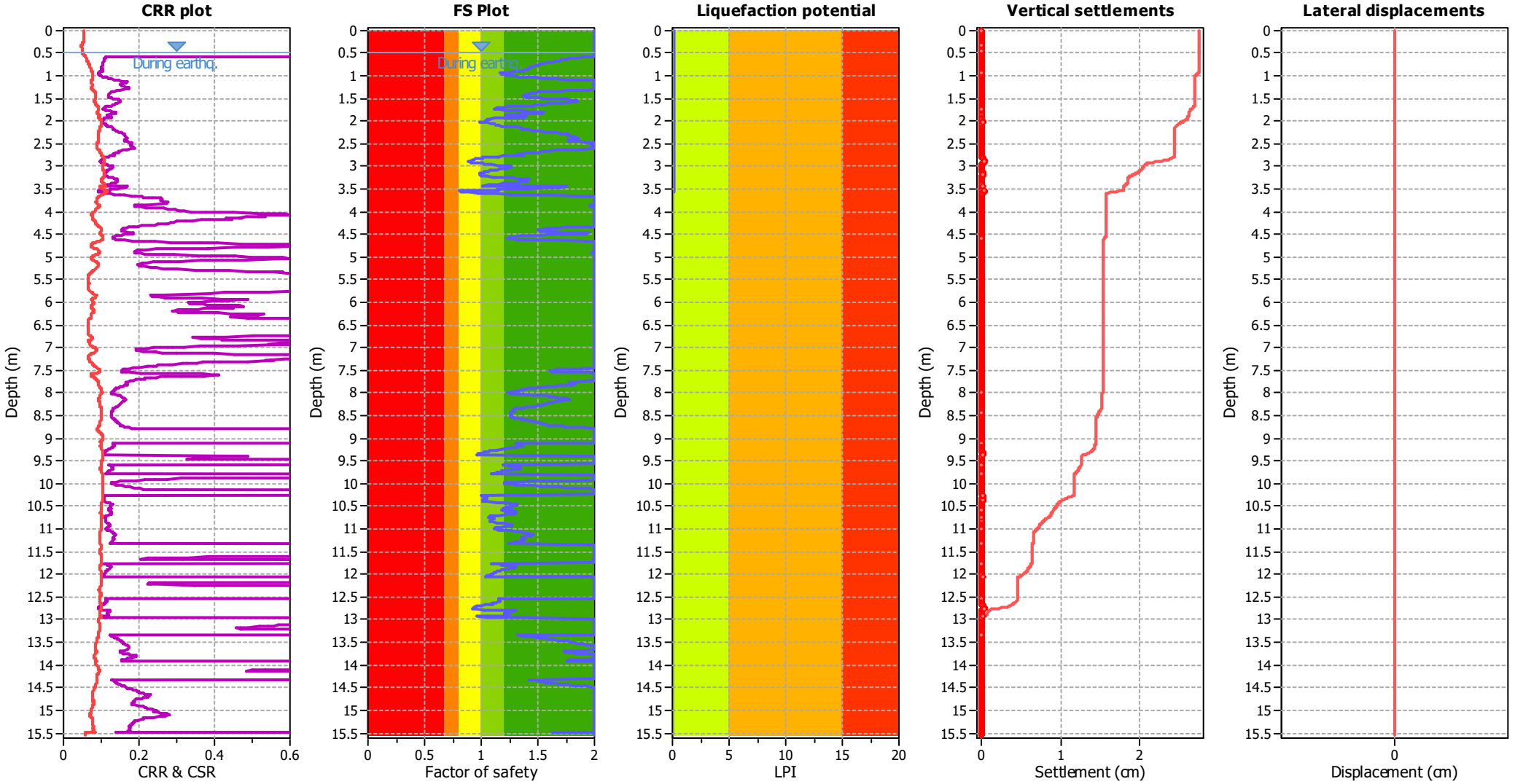

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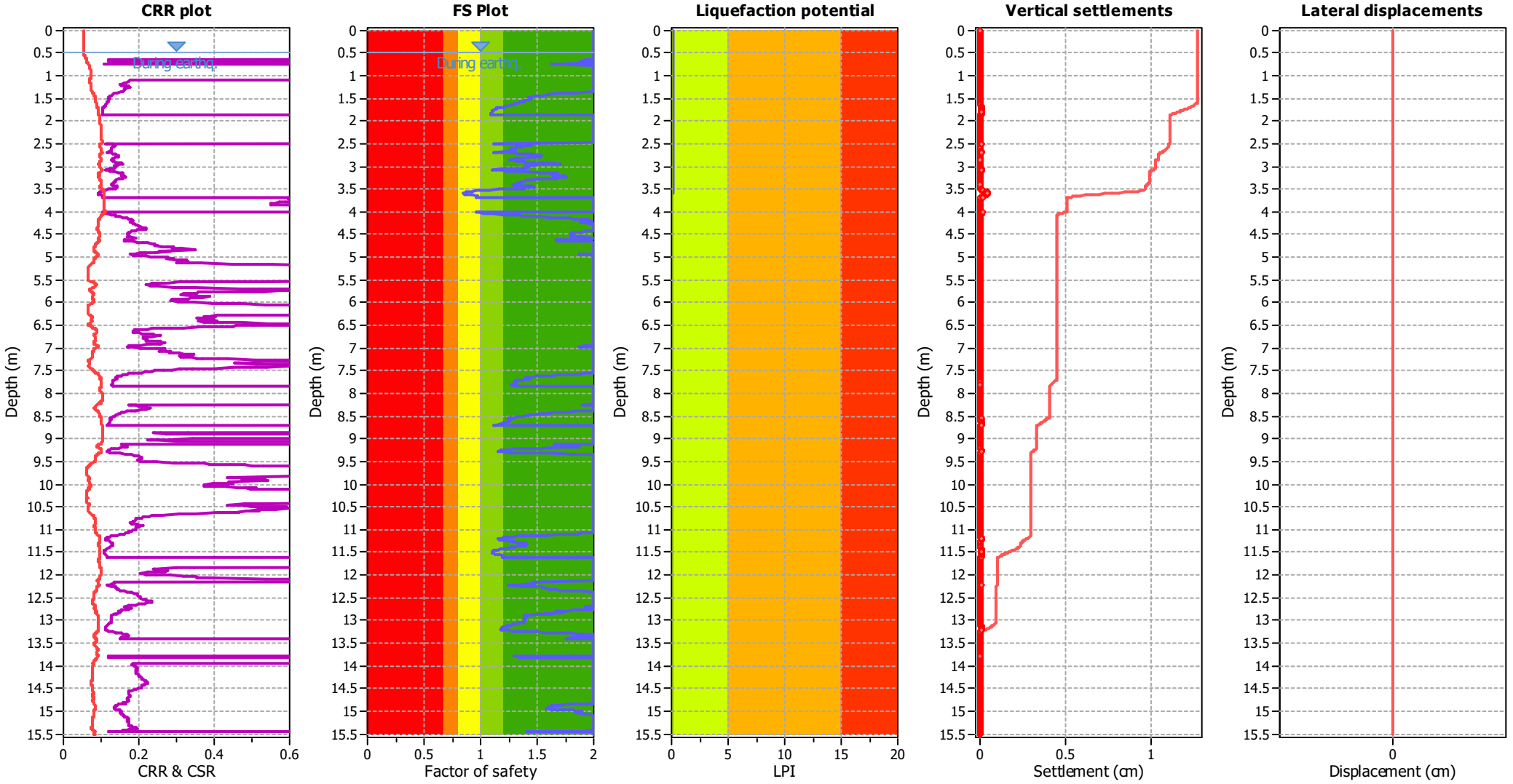

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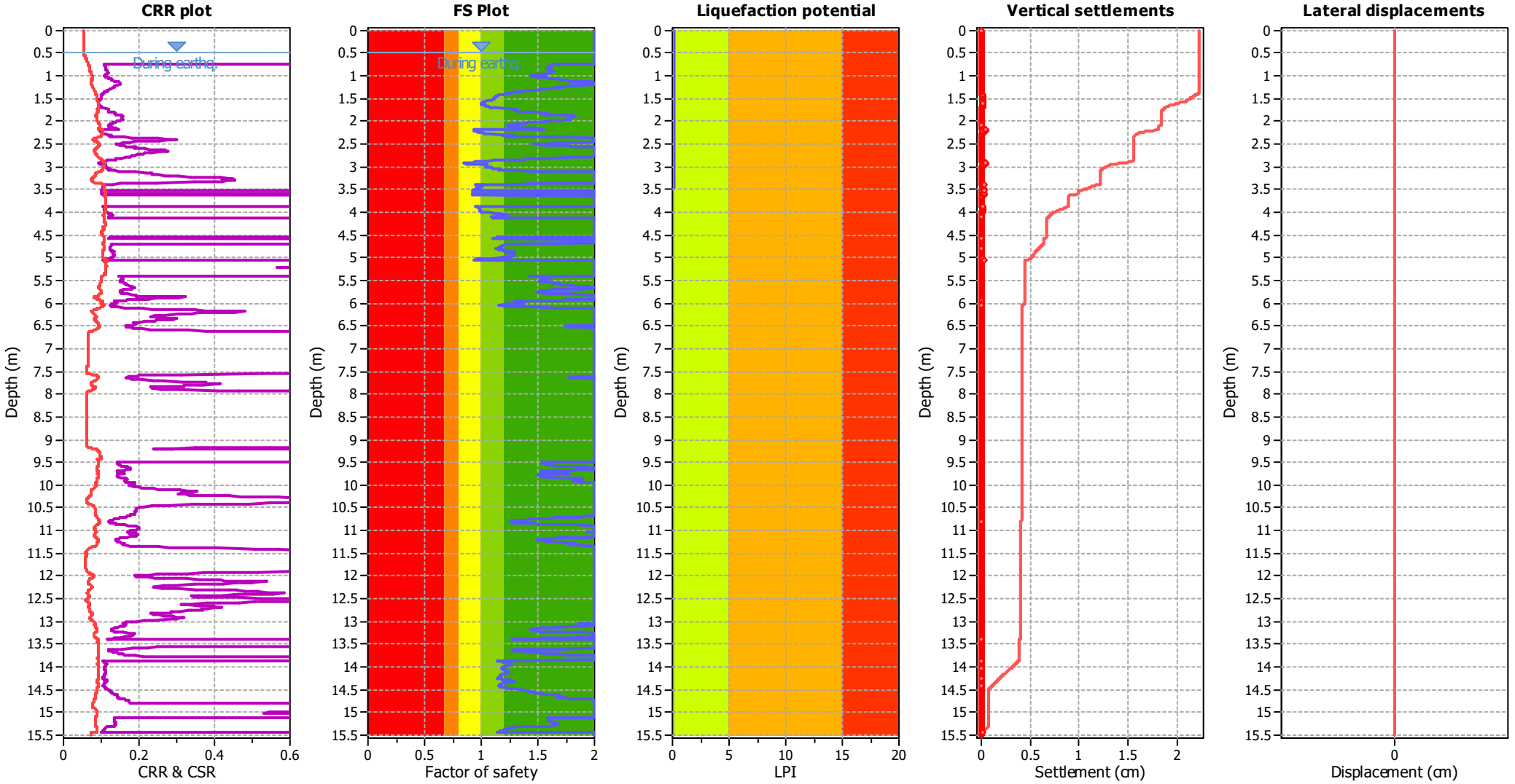

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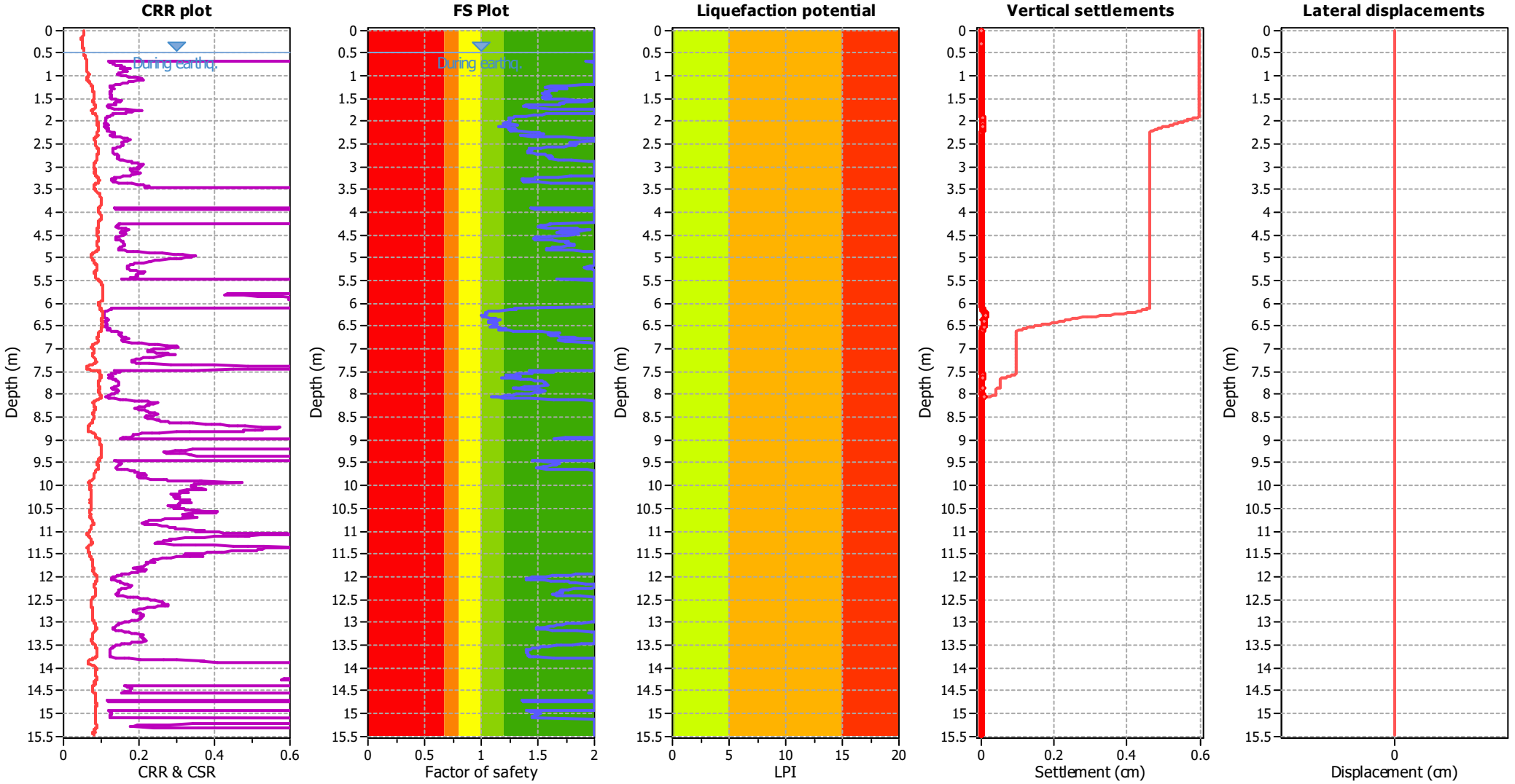

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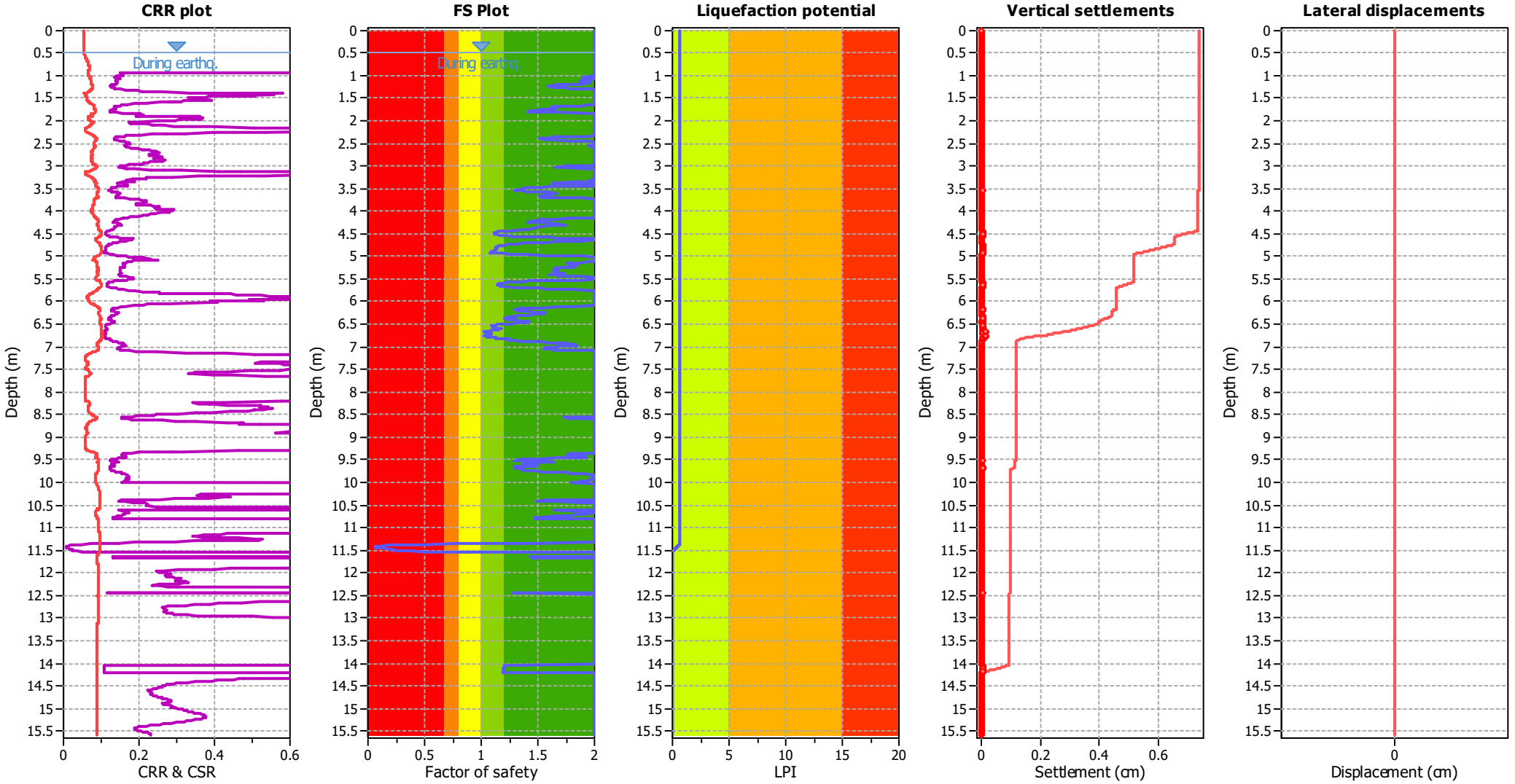

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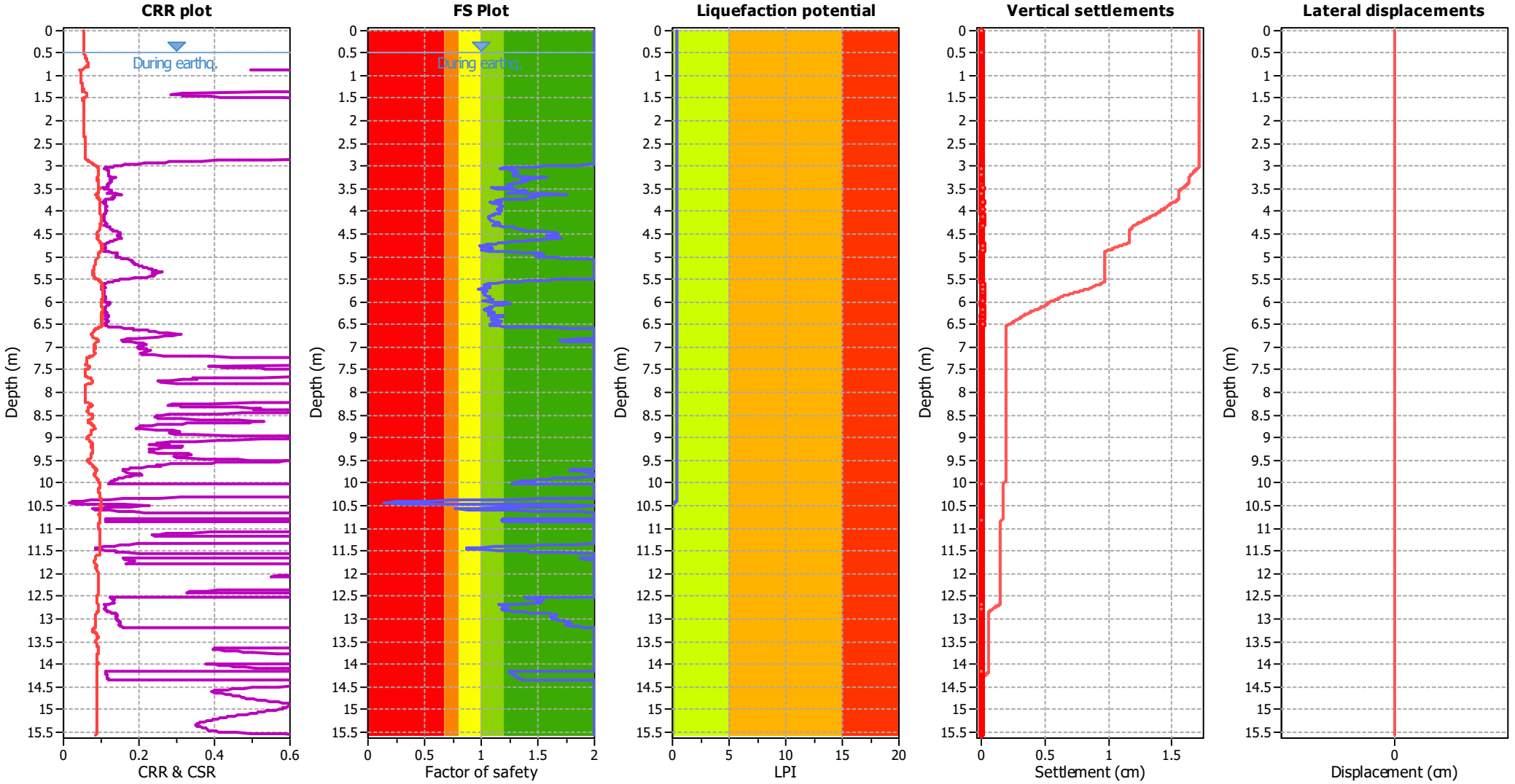

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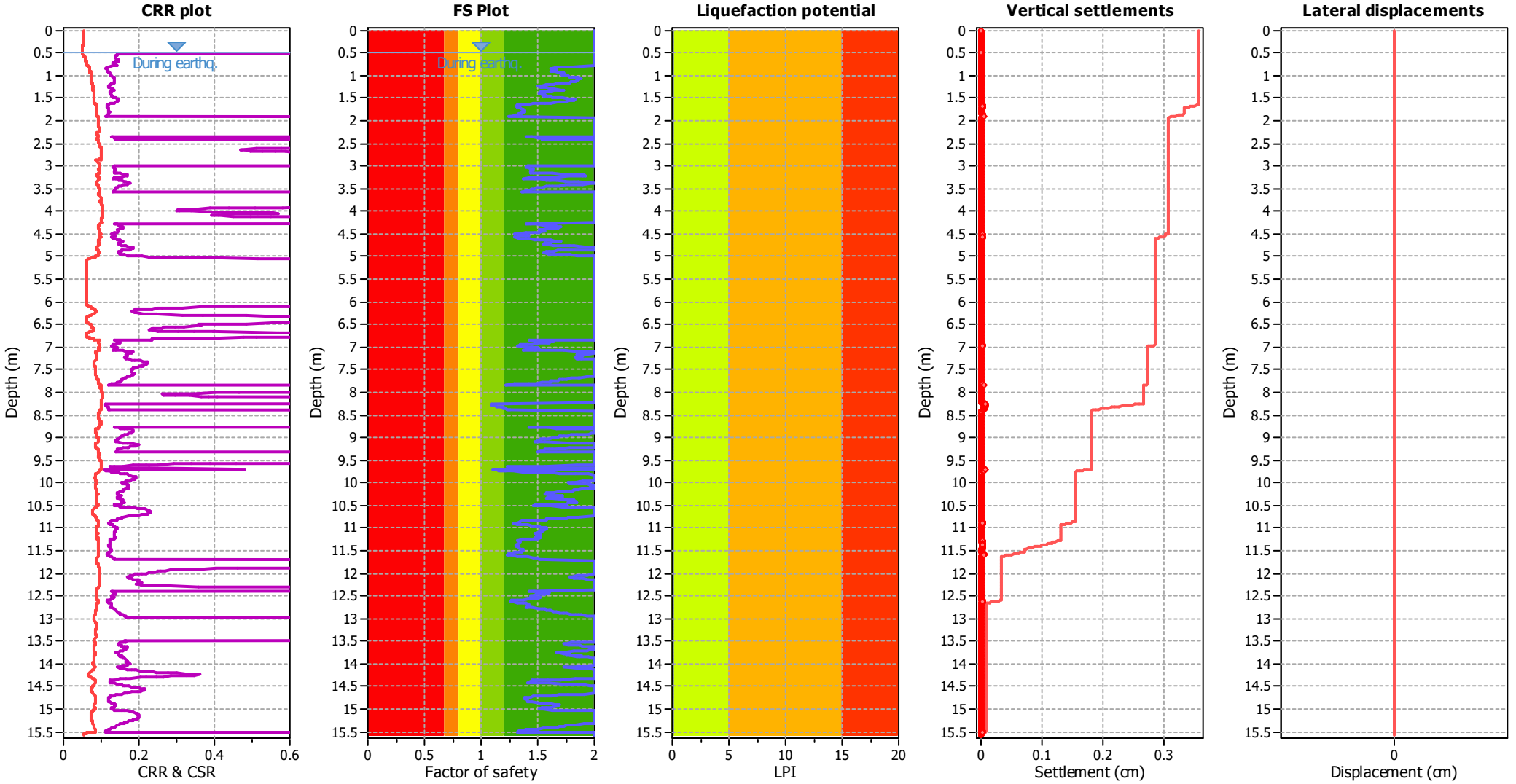

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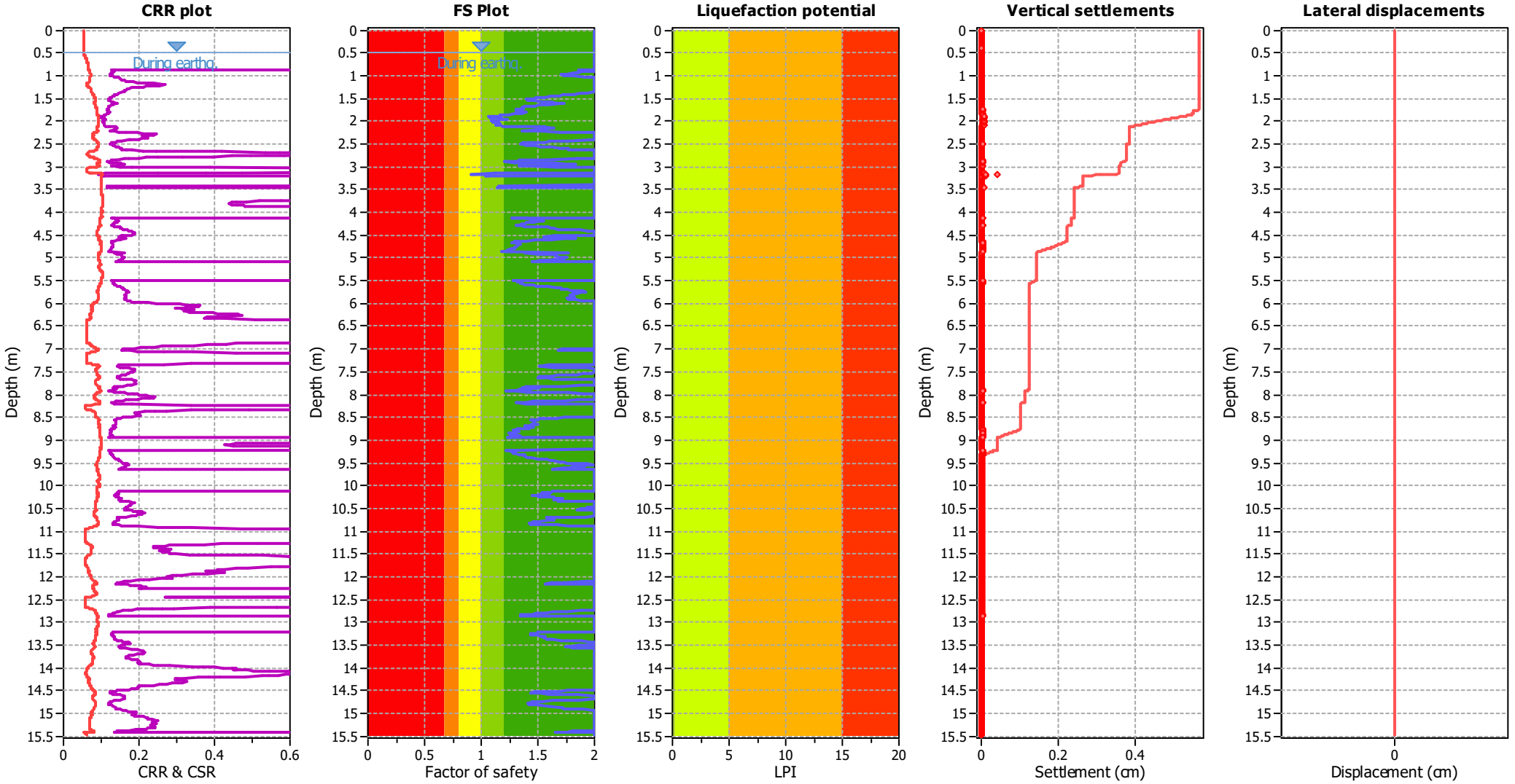

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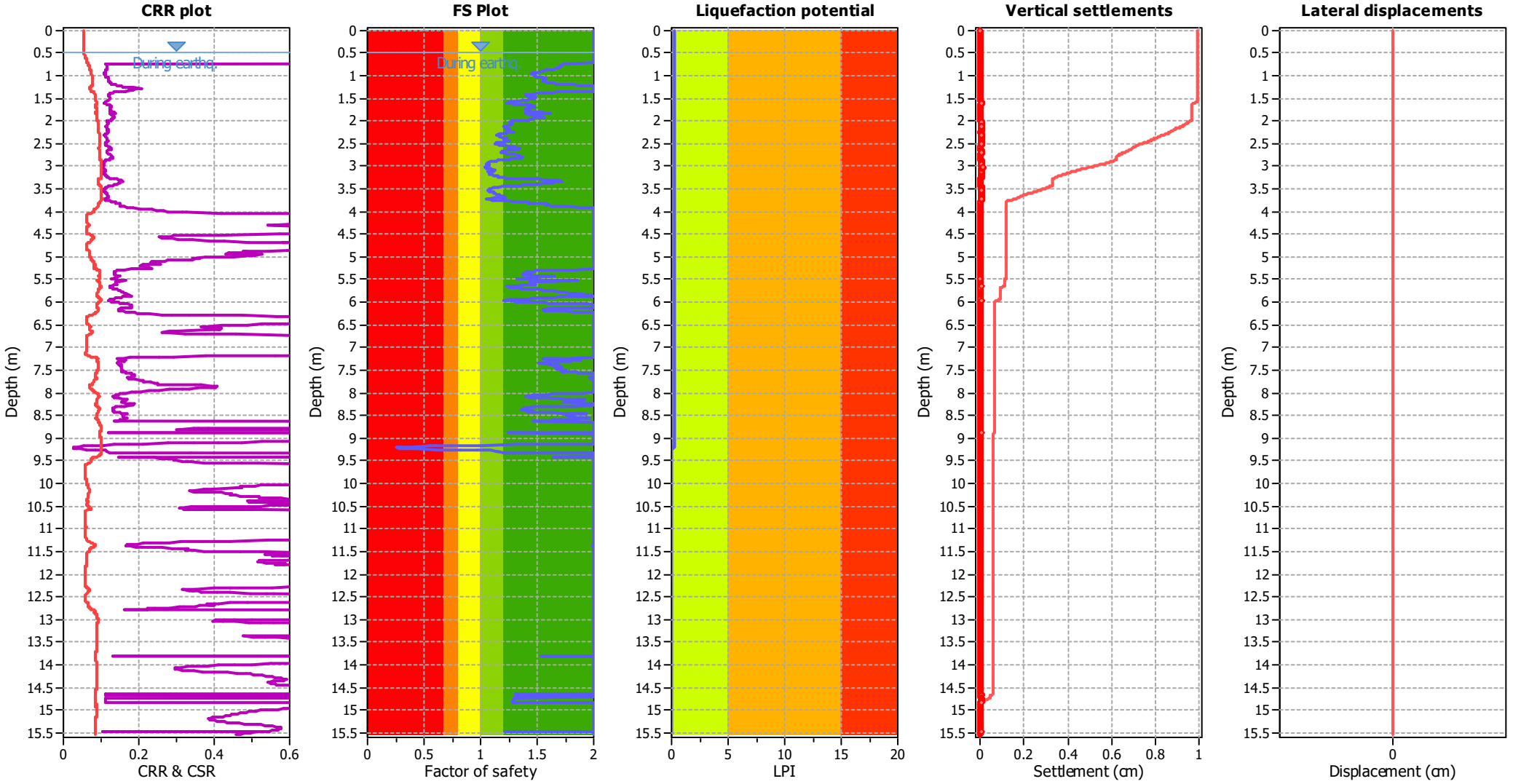

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.10	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

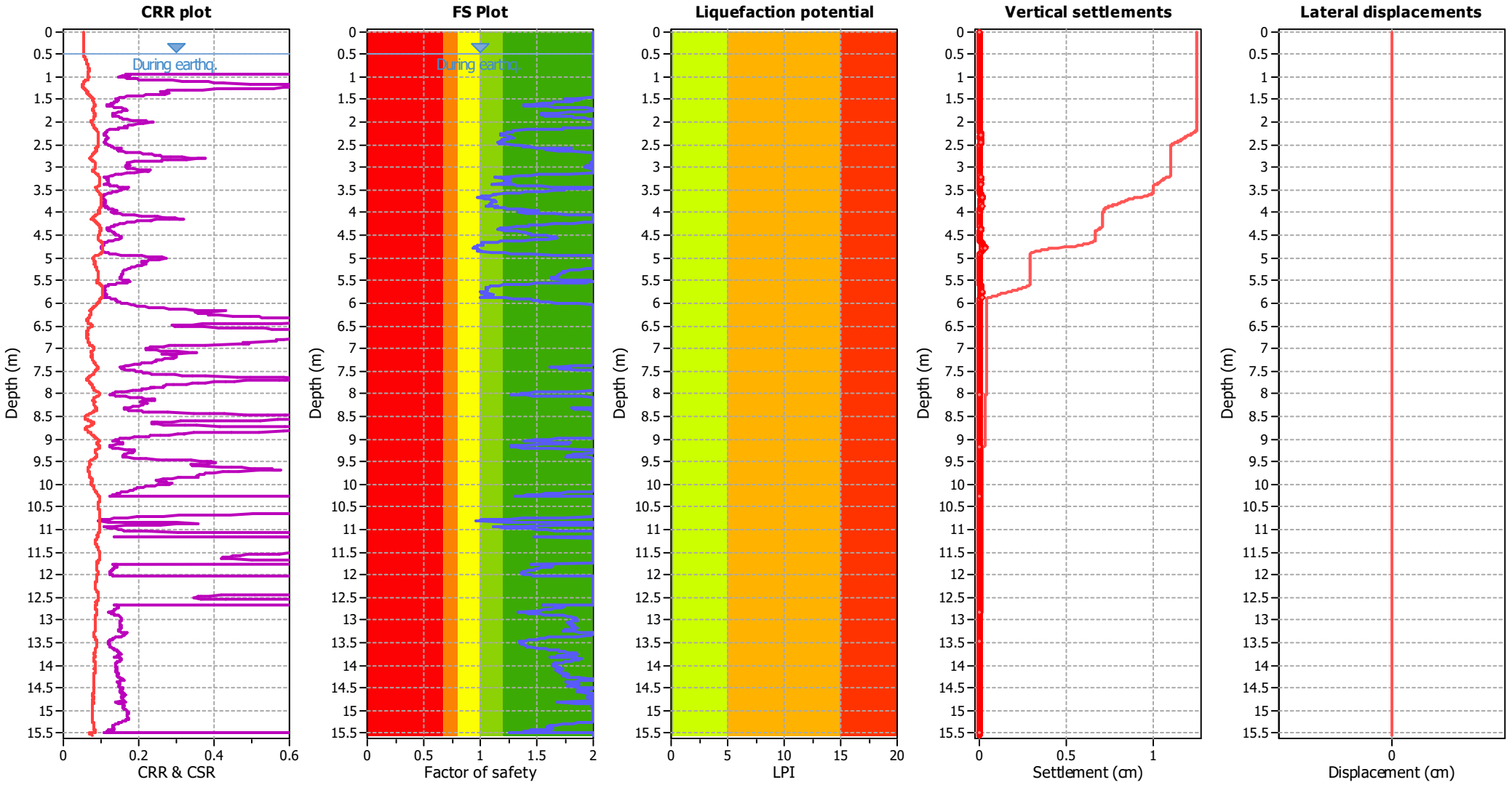
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.10	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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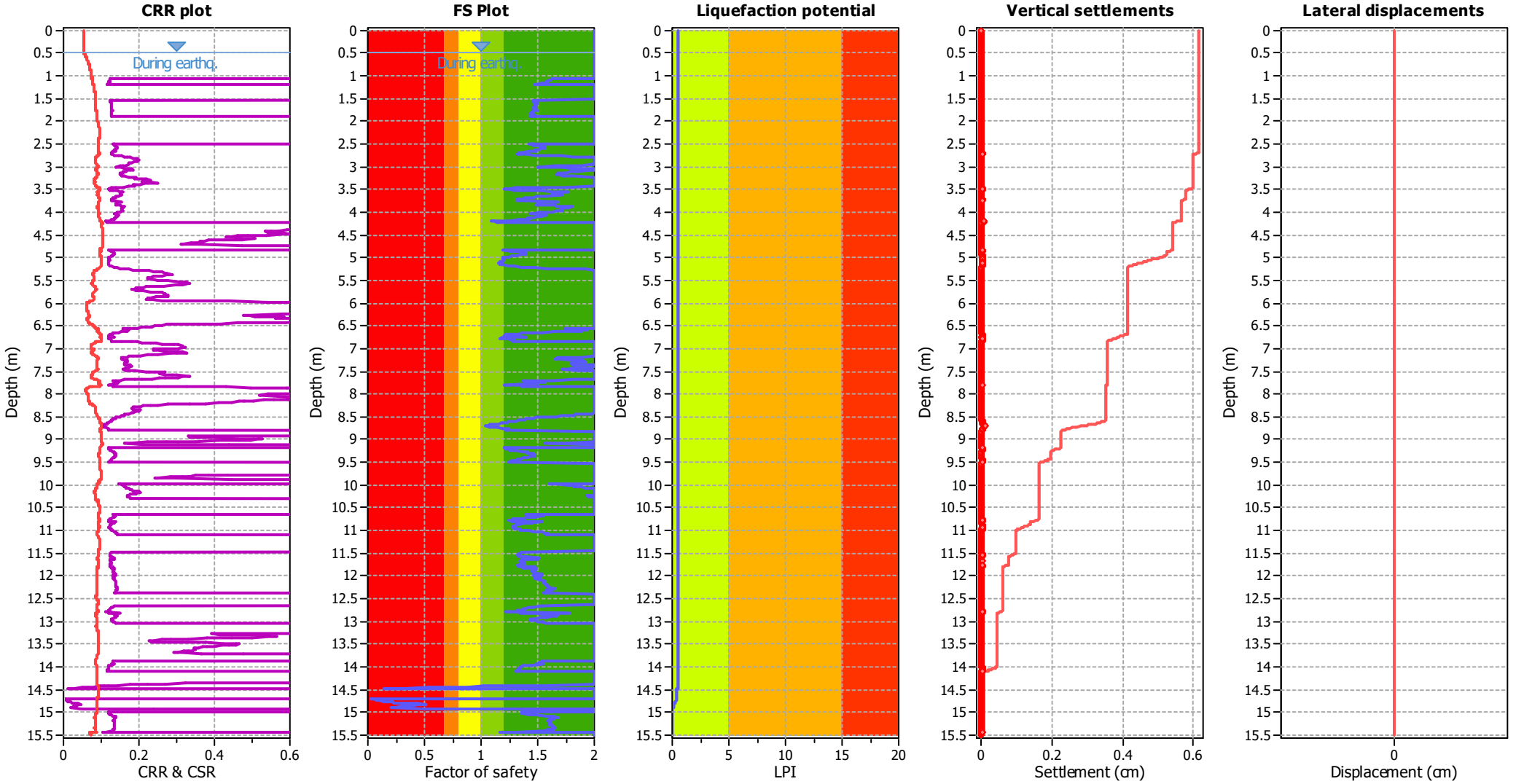
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.10	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
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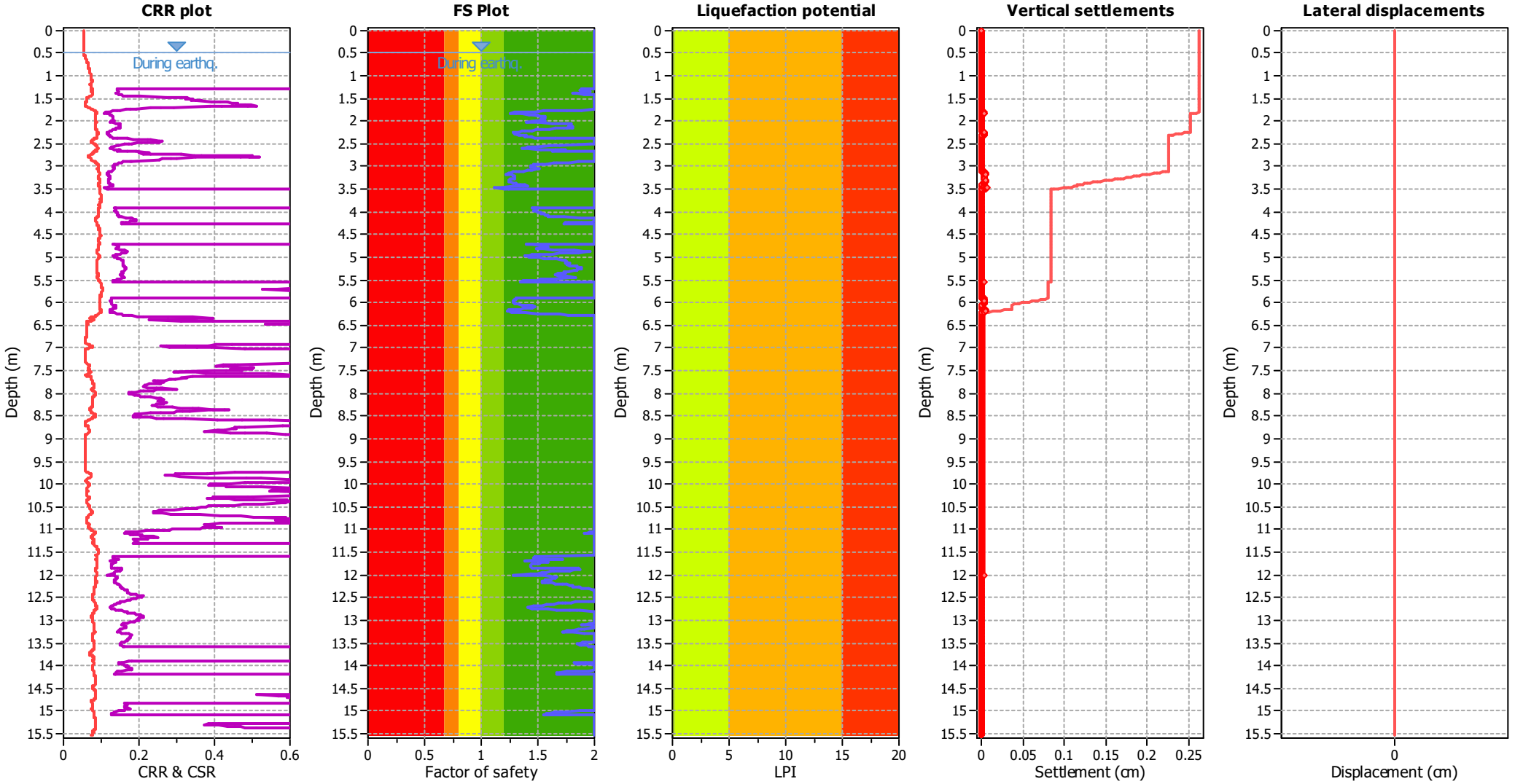
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.10	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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Appendix D

Soakage Testing Results

Double-Ring Infiltrometer Test Record & Analyses

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

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Project Number: 230322 Date: 29/06/2023 Time: 9am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR01 Test #: 1 of total 1 tests Test by: TDS/DEG
Position x: see plan Position y: mbgl 0.30
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*0.33*	*1.33*	*0*	*0*
5	5.6	5.6	0.0	0.0	0.03	0.03	1.6	0.5
10	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
15	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
20	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
	End of test due to no infiltration							

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Document Set ID: 11223917
Version: 1, Version Date: 13/05/2024

Double-Ring Infiltrometer Record Chart

SOIL & ROCK CONSULTANTS
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PO Box 21 424, Henderson Auckland 0650

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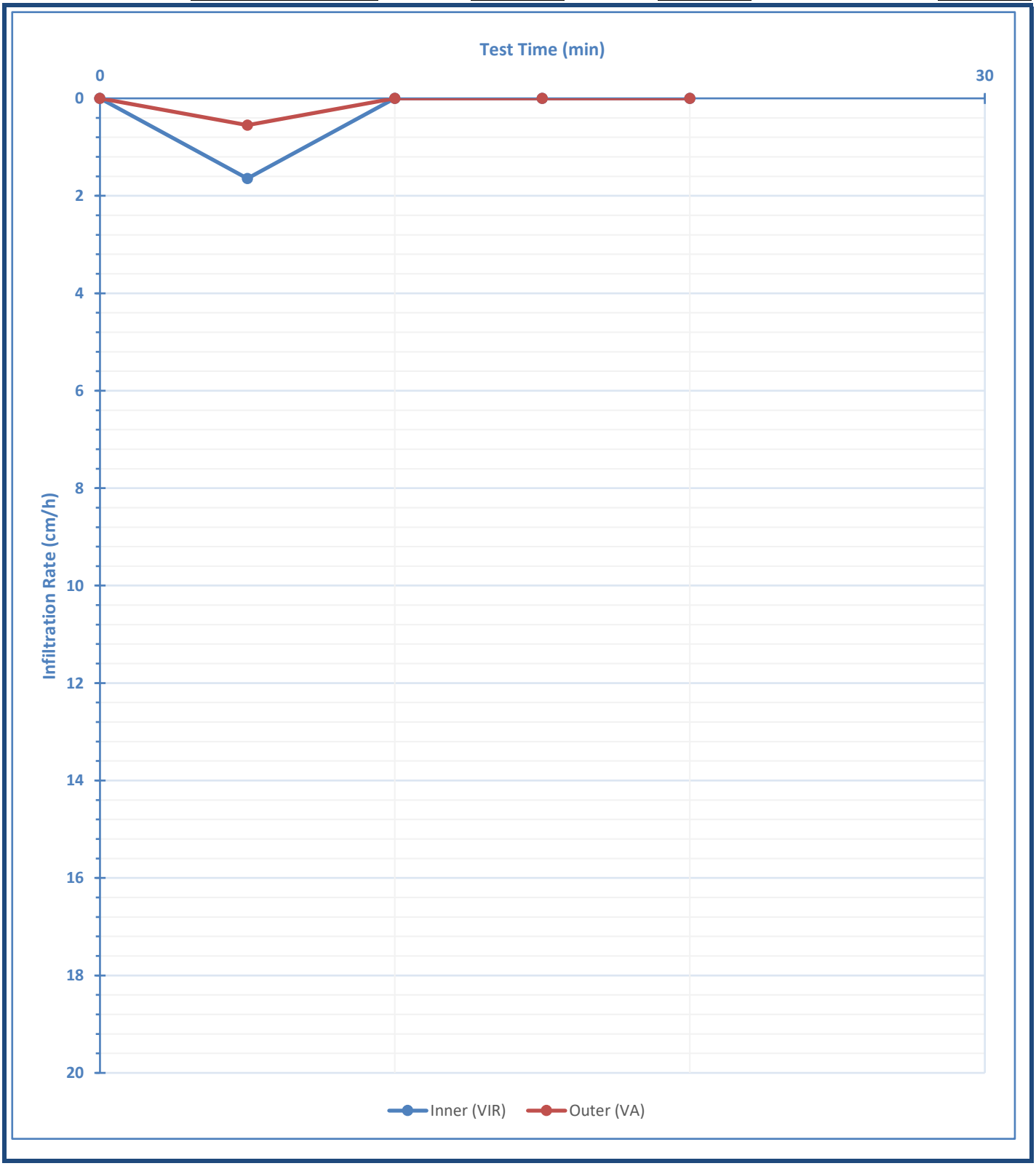
Project Number: 230322 Date: 29/06/2023 Time: 9am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR01 Test #: 1 of total 1 tests Test by: TDS/DEG



Double-Ring Infiltrometer Test Record & Analyses

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PO Box 21 424, Henderson Auckland 0650

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Project Number: 230322 Date: 29/06/2023 Time: 10am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR02 Test #: 1 of total 1 tests Test by: TDS/DEG
Position x: see plan Position y: mbgl 0.30
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*1*	*1*	*0*	*0*
5			5.6					
10	End of test due to no infiltration		Ground saturated and test pit filling with water					
15								

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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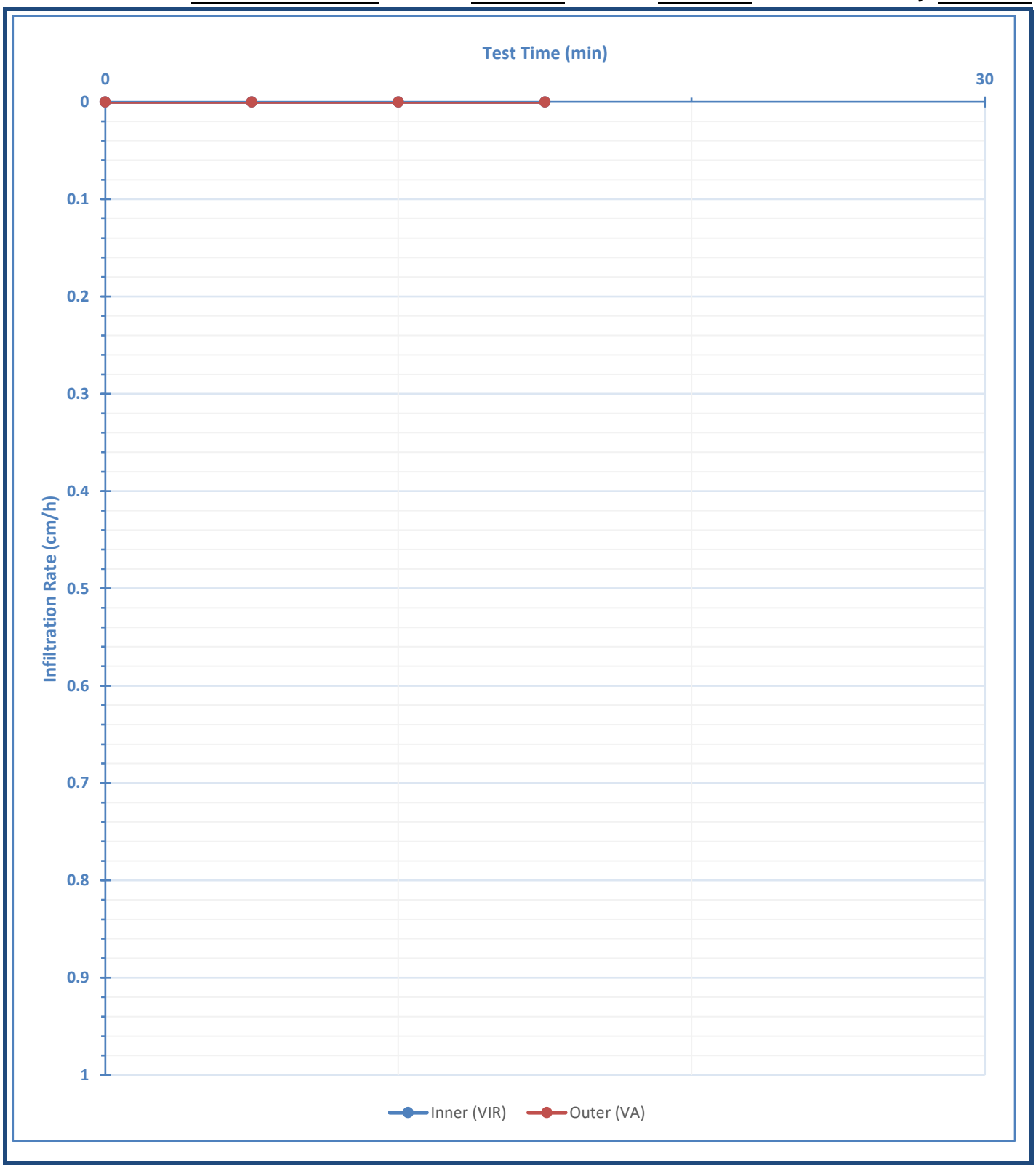
Project Number: 230322 Date: 29/06/2023 Time: 10am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR02 Test #: 1 of total 1 tests Test by: TDS/DEG



Double-Ring Infiltrometer Test Record & Analyses

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Project Number:	230322	Date:	29/06/2023	Time:	11am		
Site Address:	Fonterra Hautapu, 195 Swayne Rd, Cambridge						
Test Location ID:	DR03	Test #:	1	of total	1	tests	Test by: TDS/DEG
Position x:	see plan	Position y:		mbgl	1.00		
Other boreholes within influence distance (test simultaneously):							

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*NA*	*NA*	*0*	*0*
0.75		*0.0*		5.6		*3.06458*		448.0
1.18	0.0		5.6		*1.02153*		283.9	
1.42		*0.0*		5.6		*3.06458*		501.5
2.32	0.0		5.6		*1.02153*		296.5	
2.59		*0.0*		5.6		*3.06458*		288.0
3.70	0.0		5.6		*1.02153*		242.9	
3.62		*0.0*		5.6		*3.06458*		325.2
4.97	0.0		5.6		*1.02153*		265.3	
4.69		*0.0*		5.6		*3.06458*		315.0
6.40	0.0		5.6		*1.02153*		234.4	
5.59		*0.0*		5.6		*3.06458*		373.3
7.63	0.0		5.6		*1.02153*		272.4	
6.89		*0.0*		5.6		*3.06458*		258.5
9.32	0.0		5.6		*1.02153*		199.6	
8.22		0.0		5.6		*3.06458*		252.0
10.65	*0.0*		5.6		*1.02153*		252.0	
9.59		0.0		5.6		*3.06458*		245.9
12.02	*0.0*		5.6		*1.02153*		245.9	
11.24		0		5.6		*3.06458*		203.6
13.67	*0.0*		5.6		*1.02153*		203.6	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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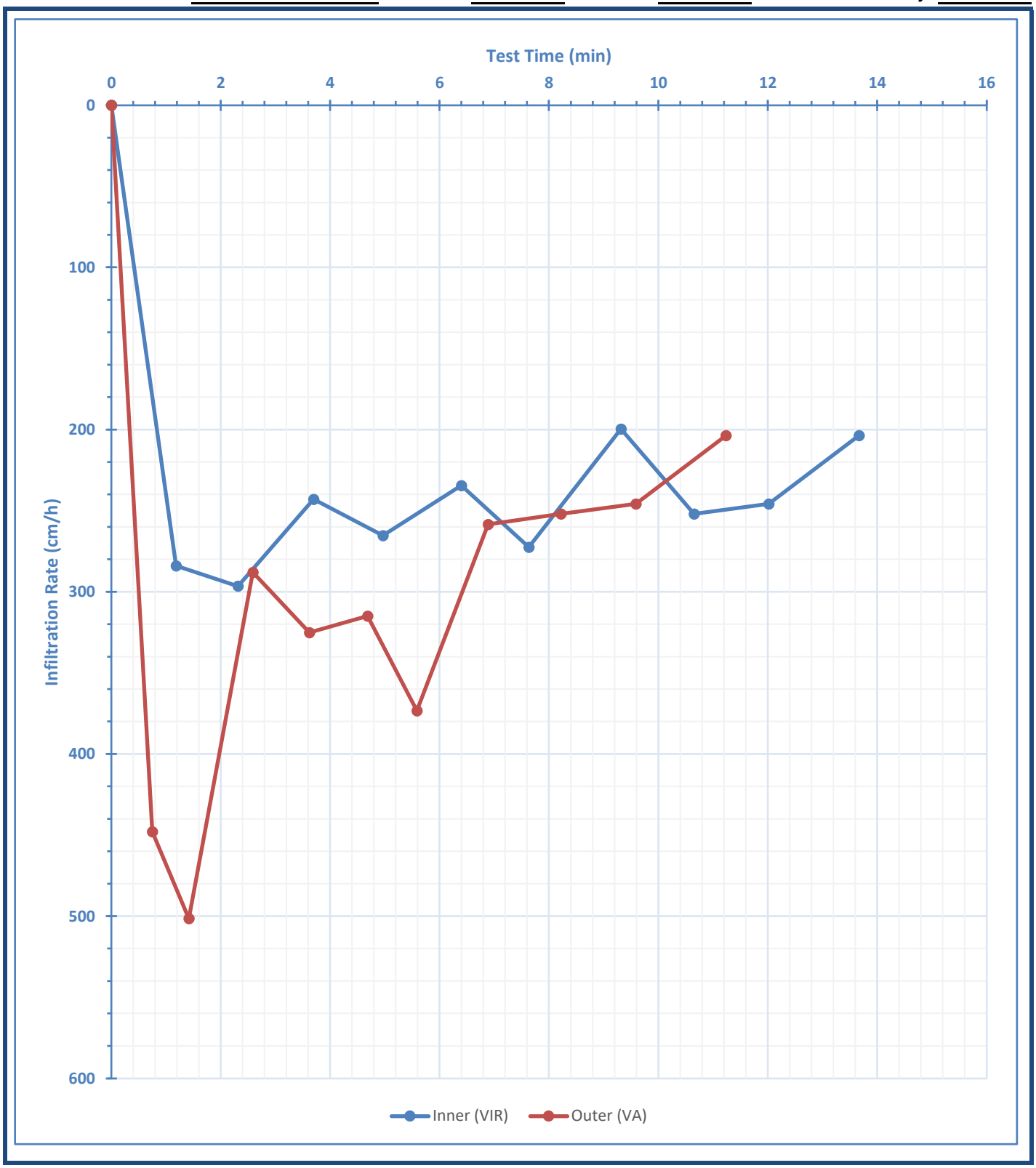
Project Number: 230322 Date: 29/06/2023 Time: 11am

Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge

Test Location ID: DR03 Test #: 1 of total 1 tests Test by: TDS/DEG



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230322 Date: 29/06/2023 Time: 12pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR04 Test #: 1 of total 1 tests Test by: JP
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	4.6	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	6.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*6.0*	*6.0*	*N/A*	*N/A*	*1*	*3*	*0*	*0*
5	6.0	5.6	0.0	0.4	0.00	0.22	0.0	4.8
10	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
15	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
20	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
25	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
30	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
35	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
	End of test due to no infiltration							

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 6.0 cm agl)

Double-Ring Infiltrometer Record Chart

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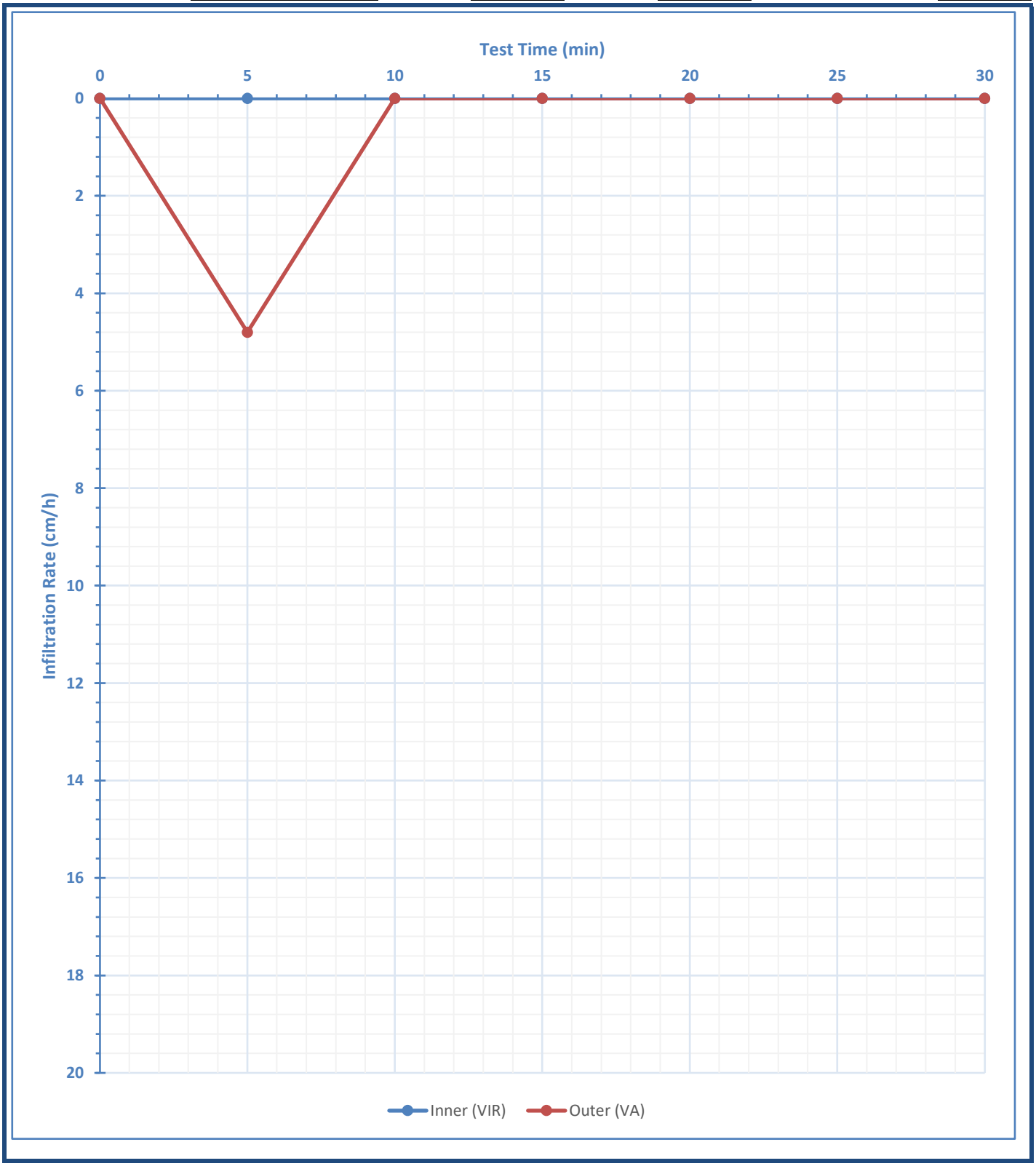
Project Number: 230322 Date: 29/06/2023 Time: 12pm

Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge

Test Location ID: DR04 Test #: 1 of total 1 tests Test by: JP



Double-Ring Infiltrometer Test Record & Analyses

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PO Box 21 424, Henderson Auckland 0650

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Project Number: 230322 Date: 29/06/2023 Time: 11am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR05 Test #: 1 of total 1 tests Test by: TDS/DEG
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	1.6	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	9.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*9.0*	*9.0*	*N/A*	*N/A*	*3*	*3*	*0*	*0*
2.83		0.0	9.0	9.0		*4.92522*		190.8
2.83	0.0		9.0	9.0	*1.64174*		190.8	
6.11		0.0	9.0	9.0		*4.92522*		164.6
6.91	0.0		9.0	9.0	*1.64174*		132.4	
11.13		0.0	9.0	9.0		*4.92522*		107.6
11.93	0.0		9.0	9.0	*1.64174*		107.6	
16.90		0.0	9.0	9.0		*4.92522*		93.6
17.65	0.0		9.0	9.0	*1.64174*		94.4	
22.90		0.0	9.0	9.0		*4.92522*		90.0
23.03	0.0		9.0	9.0	*1.64174*		100.4	
27.90		1.0	9.0	8.0		*4.37797*		96.0
28.03	0.0		9.0	9.0	*1.64174*		108.0	
32.90		2.0	9.0	7.0		*3.83072*		84.0
33.03	2.0		7.0	9.0	*1.27691*		84.0	
37.90		4.5	9.0	4.5		*2.46261*		54.0
38.03	4.5		4.5	9.0	*0.82087*		54.0	
42.90		3.6	9.0	5.4		*2.95513*		64.8
43.03	3.6		5.4	9.0	*0.98504*		64.8	
47.90		2.8	9.0	6.2		*3.39293*		74.4
48.03	2.8		6.2	9.0	*1.13098*		74.4	
52.90		3.0	9.0	6.0		*3.28348*		72.0
53.03	3.0		6.0	9.0	*1.09449*		72.0	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 9.0 cm agl)

Double-Ring Infiltrometer Record Chart

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

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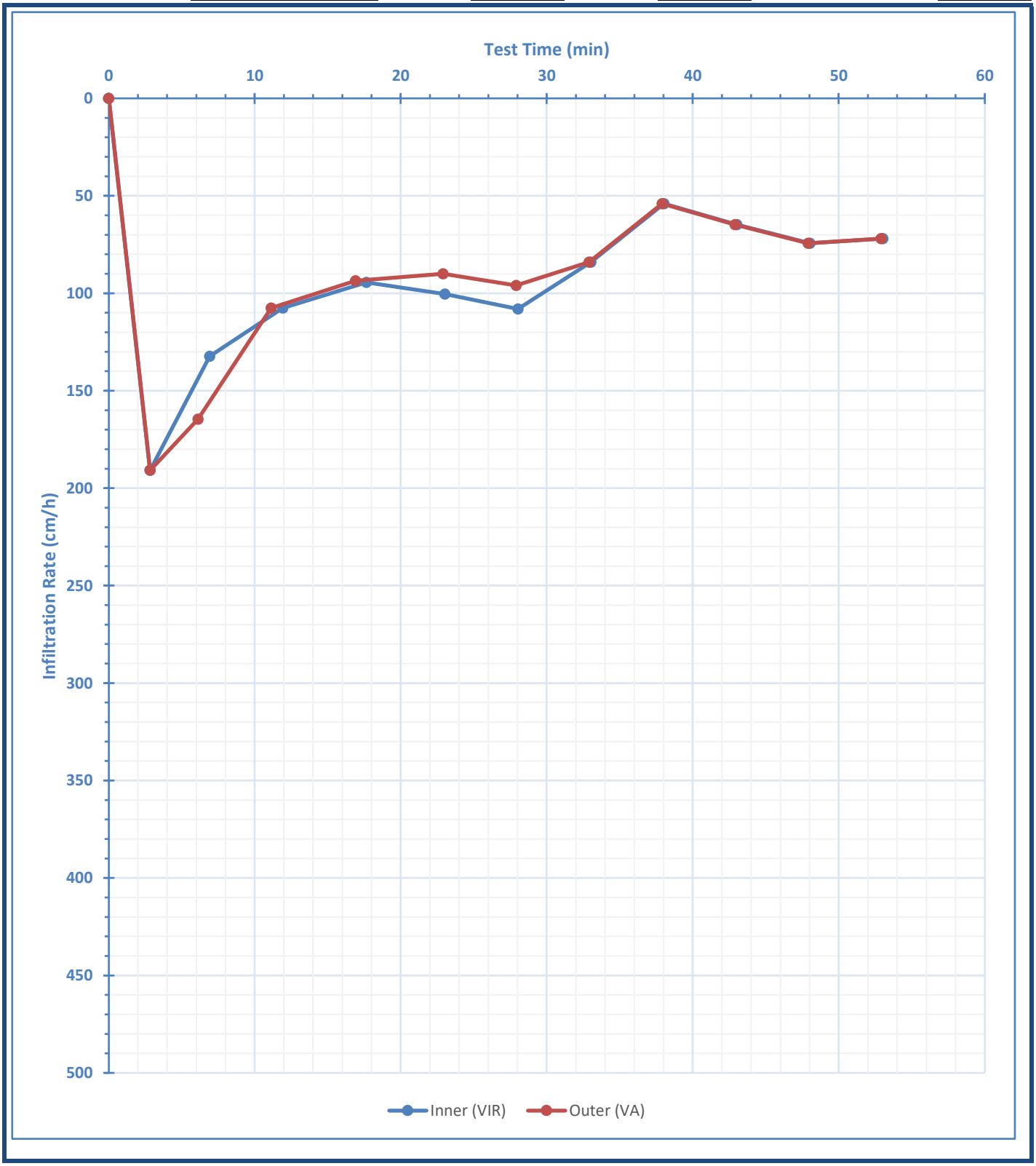
Project Number: 230322 Date: 29/06/2023 Time: 11am
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR05 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

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Project Number: 230322 Date: 29/06/2023 Time: 12pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR06 Test #: 1 of total 1 tests Test by: JP
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	4.6	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	6.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*6.0*	*6.0*	*N/A*	*N/A*	*1*	*1*	*0*	*0*
5	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
10	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
15	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
20	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
25	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
30	6.0	6.0	0.0	0.0	0.00	0.00	0.0	0.0
	End of test due to no infiltration							

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 6.0 cm agl)

Double-Ring Infiltrometer Record Chart

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289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

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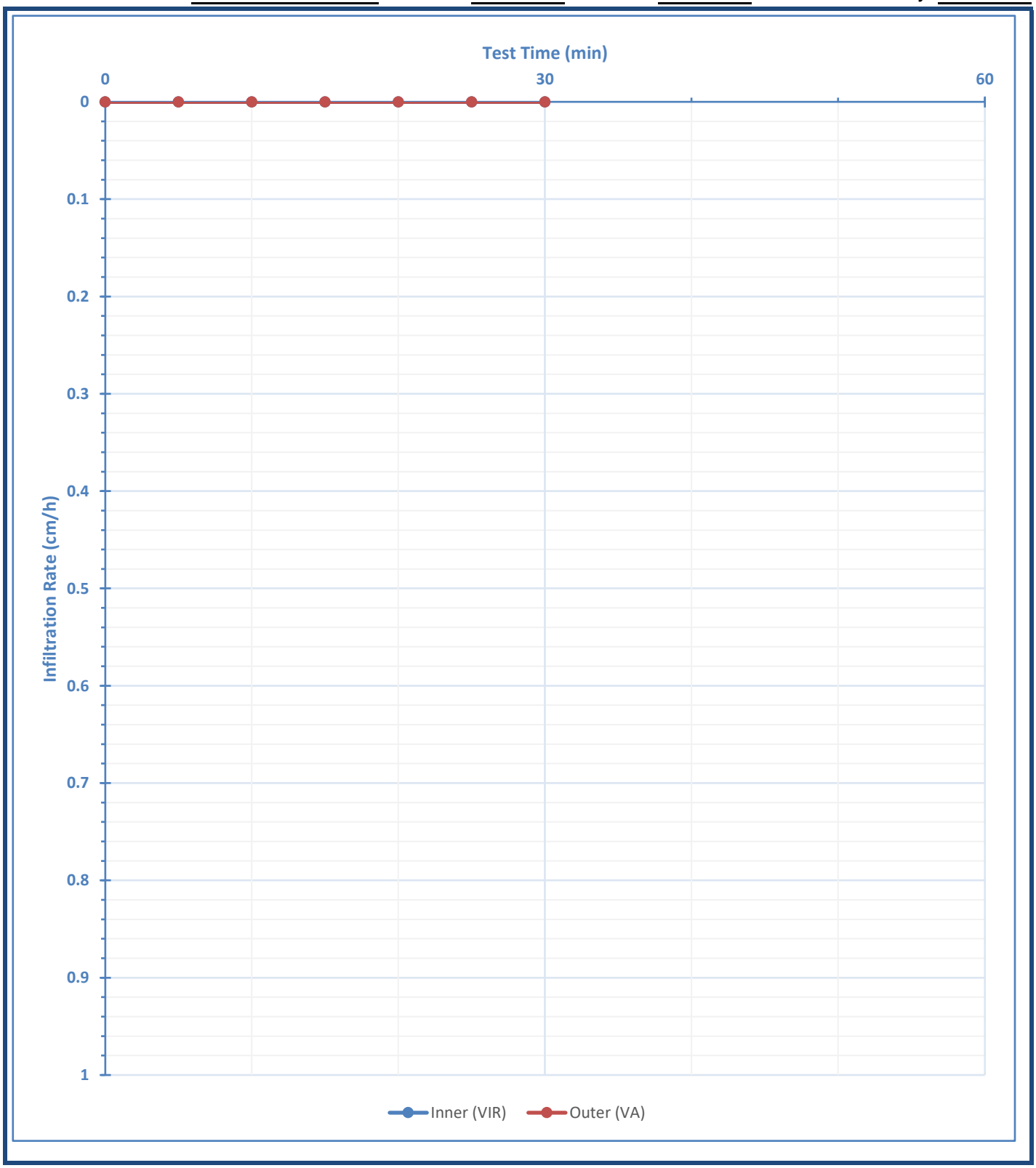
Project Number: 230322 Date: 29/06/2023 Time: 12pm

Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge

Test Location ID: DR06 Test #: 1 of total 1 tests Test by: TDS/DEG



Double-Ring Infiltrometer Test Record & Analyses

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PO Box 21 424, Henderson Auckland 0650

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Project Number:	230322	Date:	29/06/2023	Time:	1pm		
Site Address:	Fonterra Hautapu, 195 Swayne Rd, Cambridge						
Test Location ID:	DR07	Test #:	1	of total	1	tests	Test by: TDS
Position x:	see plan	Position y:		mbgl	1.00		
Other boreholes within influence distance (test simultaneously):							

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*NA*	*NA*	*0*	*0*
0.90		0.0		5.6		3.06		373.3
0.97	0.0		5.6		1.02		346.4	
1.80		0.0		5.6		3.06		373.3
1.93	0.0		5.6		1.02		350.0	
2.97		0.0		5.6		3.06		288.0
3.10	0.0		5.6		1.02		287.2	
3.87		0.0		5.6		3.06		373.3
4.10	0.0		5.6		1.02		336.0	
4.98		0.0		5.6		3.06		300.9
5.22	0.0		5.6		1.02		300.0	
6.13		0.0		5.6		3.06		292.2
6.37	0.0		5.6		1.02		292.2	
7.17		0.0		5.6		3.06		325.2
7.40	0.0		5.6		1.02		326.2	
8.25		0.0		5.6		3.06		310.2
8.48	0.0		5.6		1.02		311.1	
9.35		0.0		5.6		3.06		305.5
9.58	0.0		5.6		1.02		305.5	
10.48		0.0		5.6		3.06		296.5
10.72	0.0		5.6		1.02		294.7	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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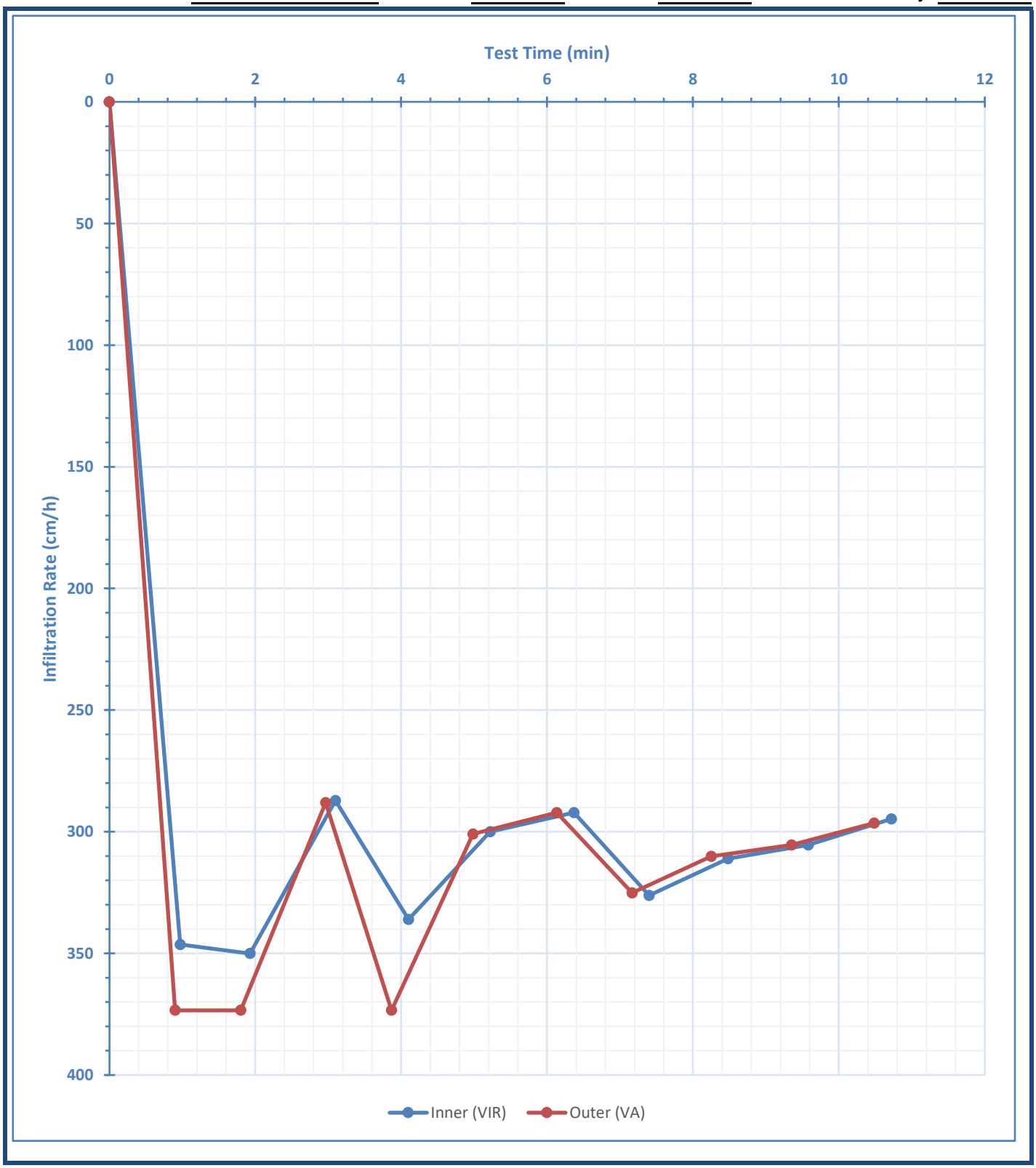
Project Number: 230322 Date: 29/06/2023 Time: 1pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR07 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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PO Box 21 424, Henderson Auckland 0650

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Project Number:	230322	Date:	29/06/2023	Time:	2pm		
Site Address:	Fonterra Hautapu, 195 Swayne Rd, Cambridge						
Test Location ID:	DR08	Test #:	1	of total	1	tests	Test by: TDS
Position x:	see plan	Position y:		mbgl	1.00		
Other boreholes within influence distance (test simultaneously):							

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*NA*	*NA*	*0*	*0*
1.77		0.0		5.6		3.06		190.2
2.77	0.0		5.6		1.02		121.3	
3.93		0.0		5.6		3.06		155.1
4.93	0.0		5.6		1.02		155.6	
6.07		0.0		5.6		3.06		157.5
7.07	0.0		5.6		1.02		157.0	
8.18		0.0		5.6		3.06		158.7
9.18	0.0		5.6		1.02		159.2	
10.53		0.0		5.6		3.06		143.0
11.53	0.0		5.6		1.02		143.0	
13.13		0.0		5.6		3.06		129.2
14.13	0.0		5.6		1.02		129.2	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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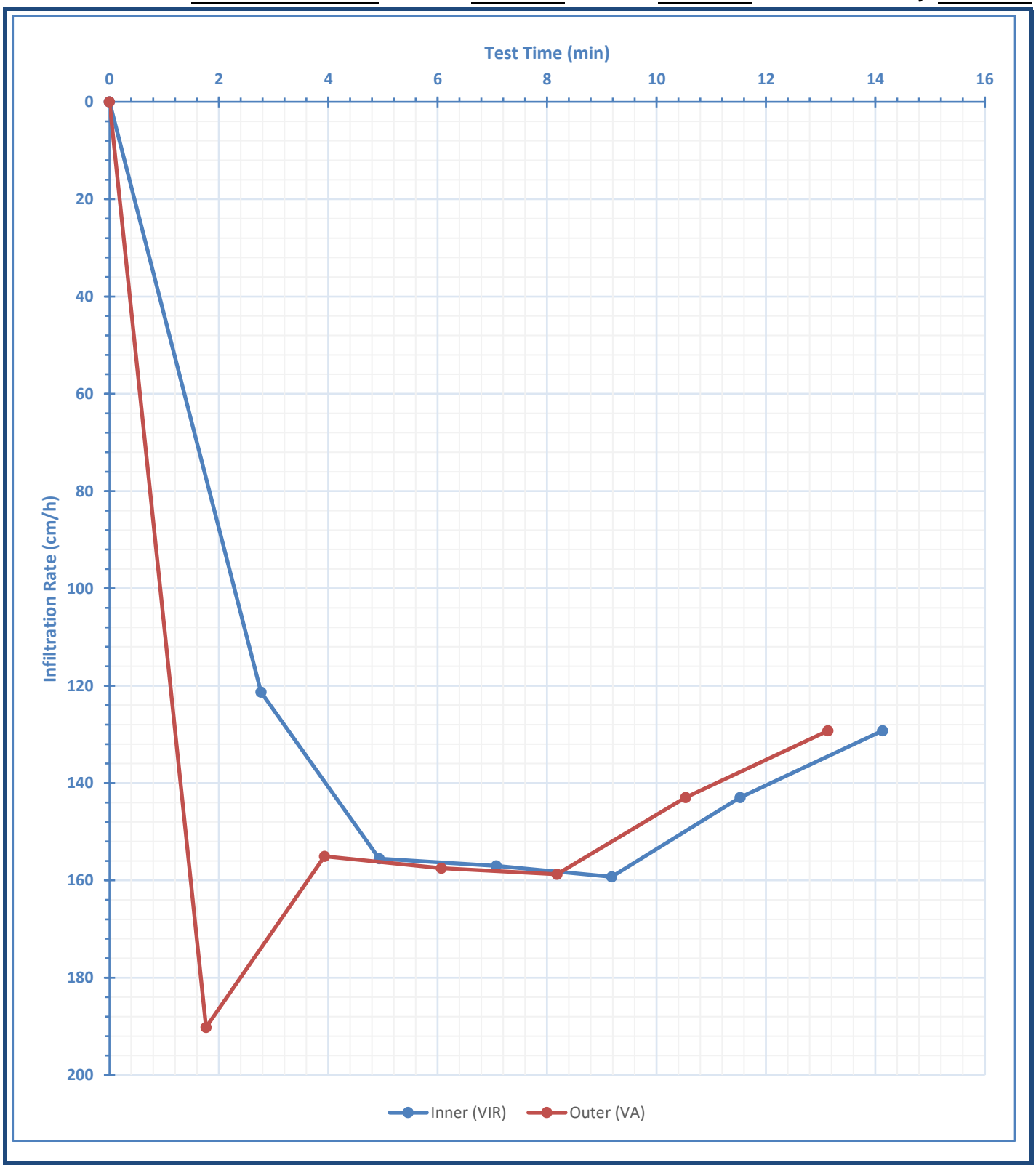
Project Number: 230322 Date: 29/06/2023 Time: 2pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR08 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230322 Date: 29/06/2023 Time: 2:45pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR09 Test #: 1 of total 1 tests Test by: JP
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	4.6	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	6.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*6.0*	*6.0*	*N/A*	*N/A*	*2.5*	*2.5*	*0*	*0*
1.00		0.0		6.0		*3.28348*		360.0
0.87	0.0		6.0		*1.09449*		413.8	
2.40		0.0		6.0		*3.28348*		257.1
2.10	0.0		6.0		*1.09449*		292.7	
3.48		0.0		6.0		*3.28348*		332.3
2.98	0.0		6.0		*1.09449*		409.1	
4.65		0.0		6.0		*3.28348*		308.6
3.82	0.0		6.0		*1.09449*		428.6	
6.10		0.0		6.0		*3.28348*		248.3
4.75	0.0		6.0		*1.09449*		387.1	
7.27		0.0		6.0		*3.28348*		308.6
5.83	0.0		6.0		*1.09449*		333.3	
8.52		0.0		6.0		*3.28348*		288.0
7.07	0.0		6.0		*1.09449*		290.3	
9.72		0.0		6.0		*3.28348*		300.0
8.15	0.0		6.0		*1.09449*		333.3	
10.88		0.0		6.0		*3.28348*		308.6
9.08	0.0		6.0		*1.09449*		387.1	
12.15		0.0		6.0		*3.28348*		284.2
10.15	0.0		6.0		*1.09449*		336.4	
13.18		0.0		6.0		*3.28348*		348.4
11.13	0.0		6.0		*1.09449*		367.3	
14.47		0.0		6.0		*3.28348*		280.5
12.17	0.0		6.0		*1.09449*		346.2	
15.67		0.0		6.0		*3.28348*		300.0
13.37	0.0		6.0		*1.09449*		300.0	
16.92		0.0		6.0		*3.28348*		288.0
14.62	0.0		6.0		*1.09449*		288.0	
18.15		0.0		6.0		*3.28348*		291.9
15.85	0.0		6.0		*1.09449*		292.7	
19.40		0.0		6.0		*3.28348*		288.0
17.10	0.0		6.0		*1.09449*		288.0	
20.78		0.0		6.0		*3.28348*		260.2
18.48	0.0		6.0		*1.09449*		260.9	
22.02		0.0		6.0		*3.28348*		291.9
19.72	0.0		6.0		*1.09449*		290.3	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 6.0 cm agl)

Double-Ring Infiltrometer Record Chart

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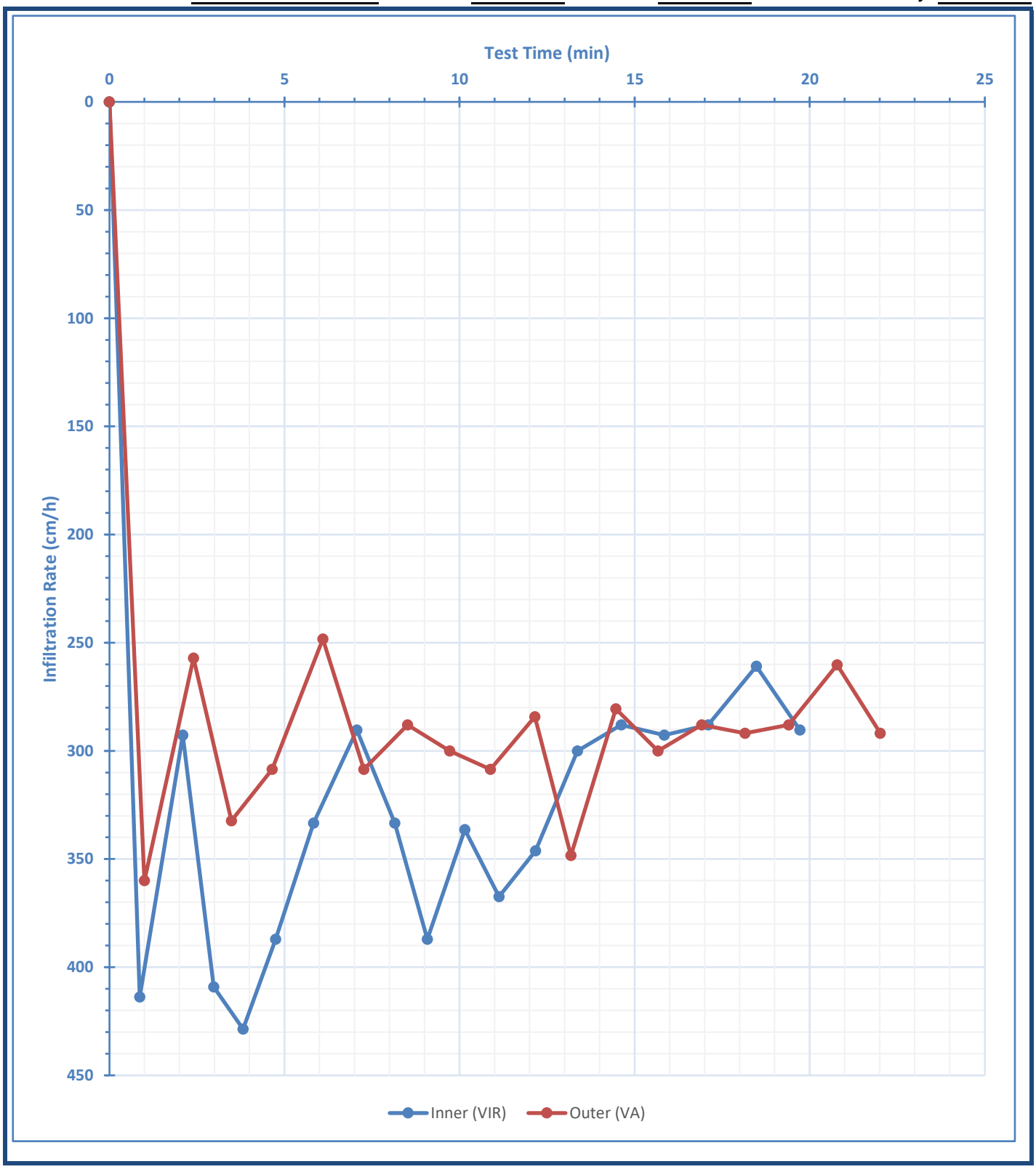
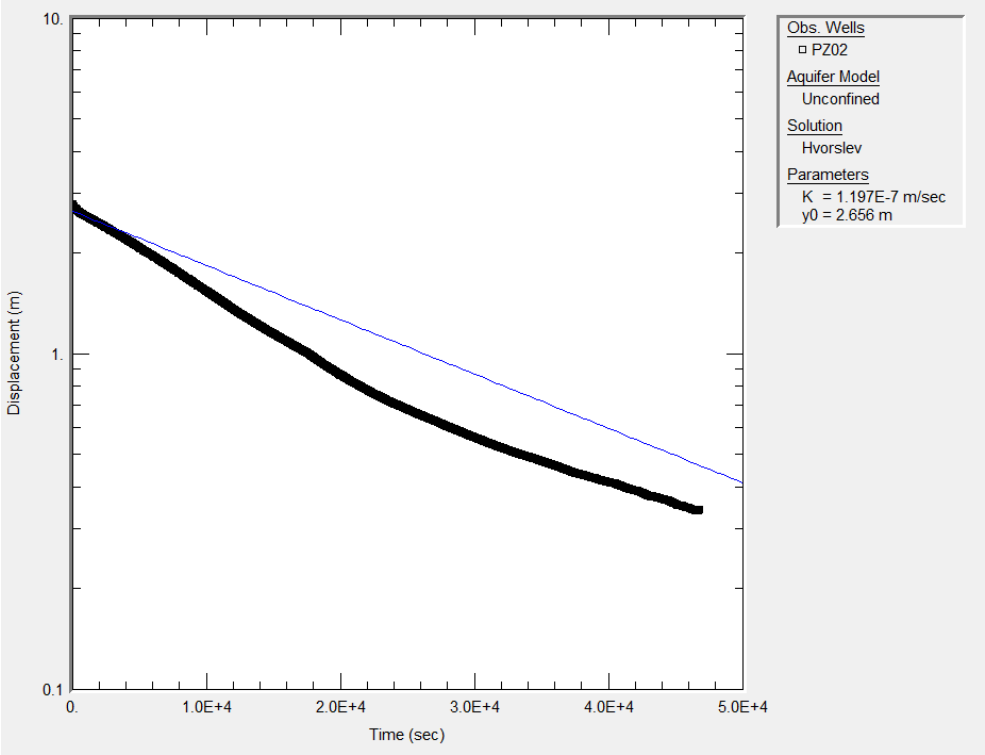
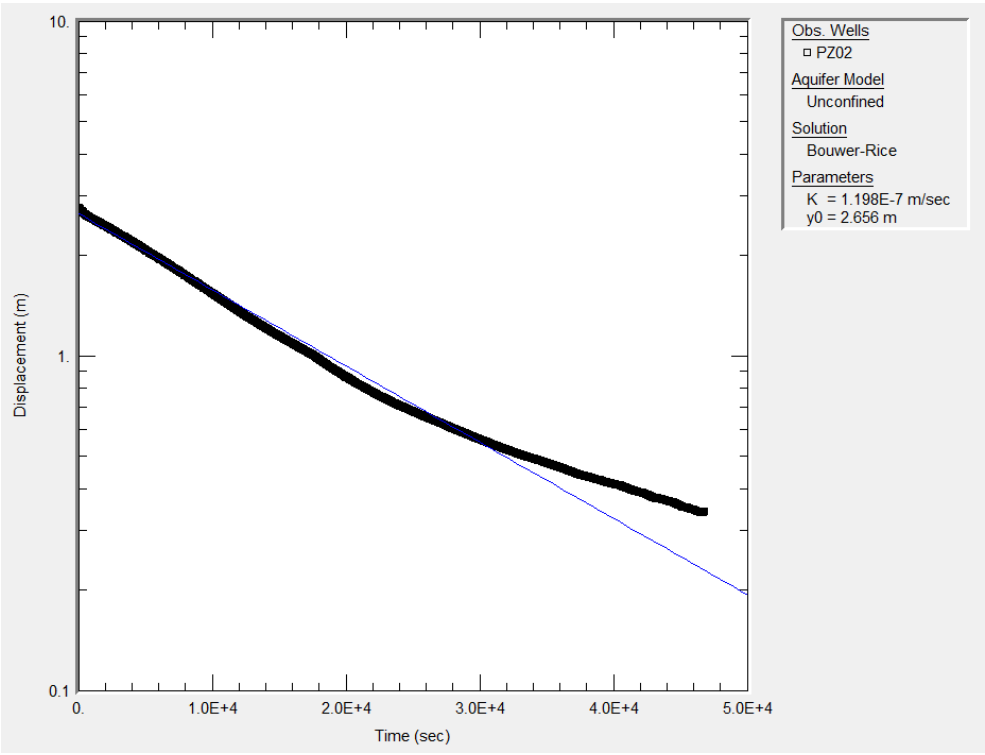
Project Number: 230322 Date: 29/06/2023 Time: 2:45pm
Site Address: Fonterra Hautapu, 195 Swayne Rd, Cambridge
Test Location ID: DR09 Test #: 1 of total 1 tests Test by: JP

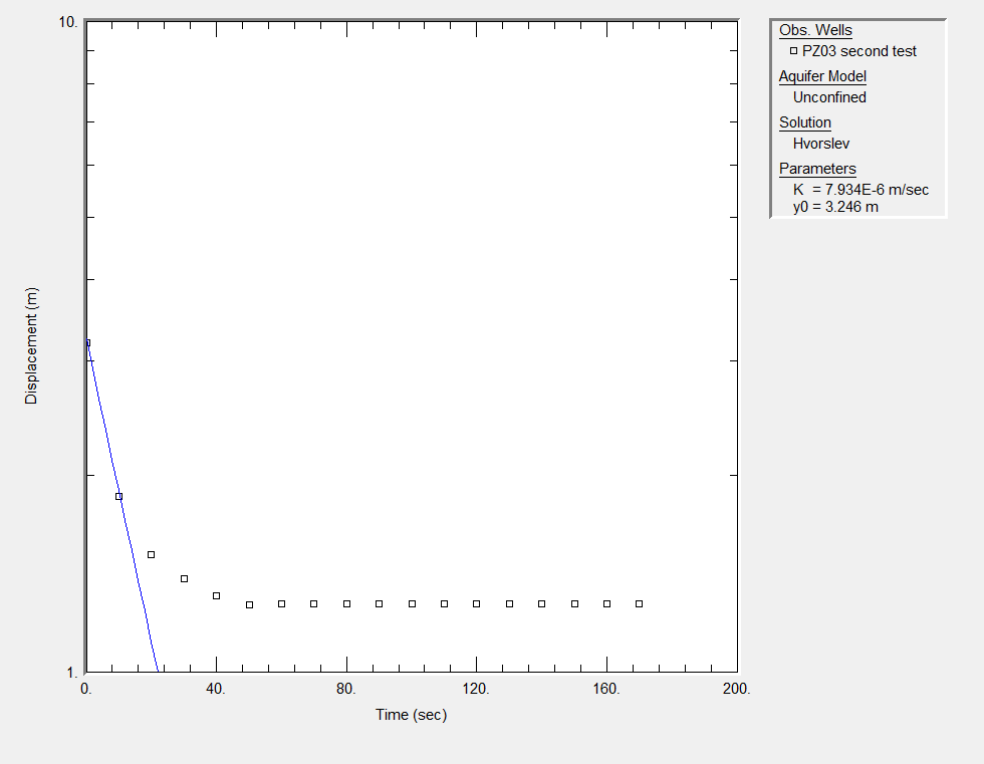




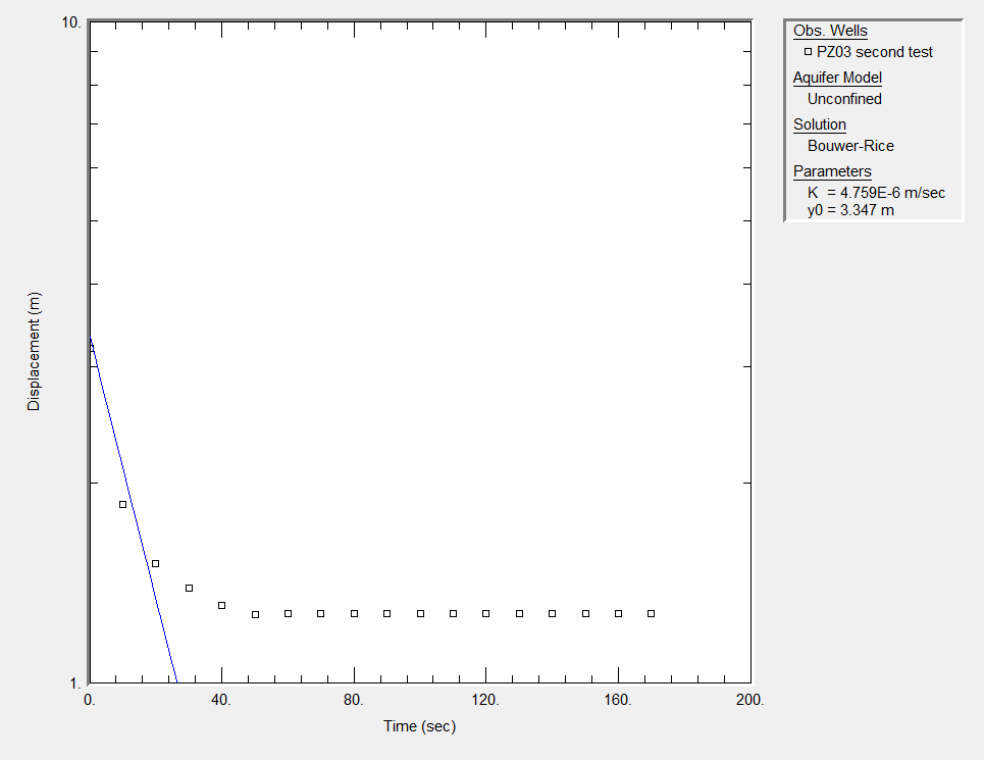
PZ02 – Rising Head Test - HV



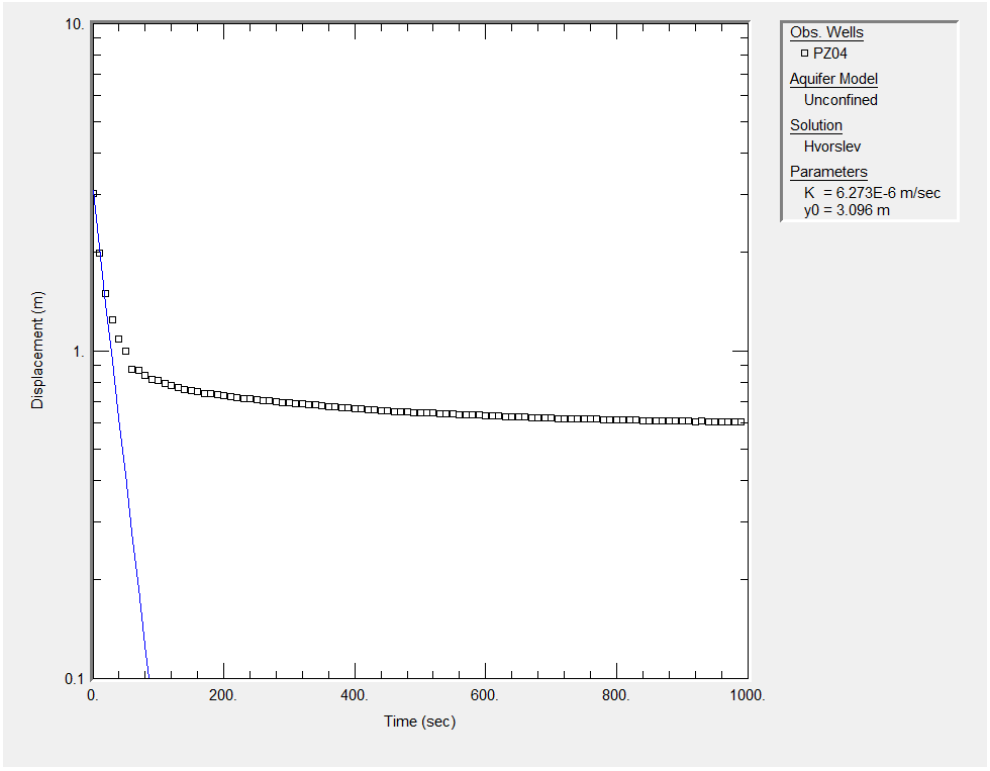
PZ02 – Rising Head Test – Bouwer Rice



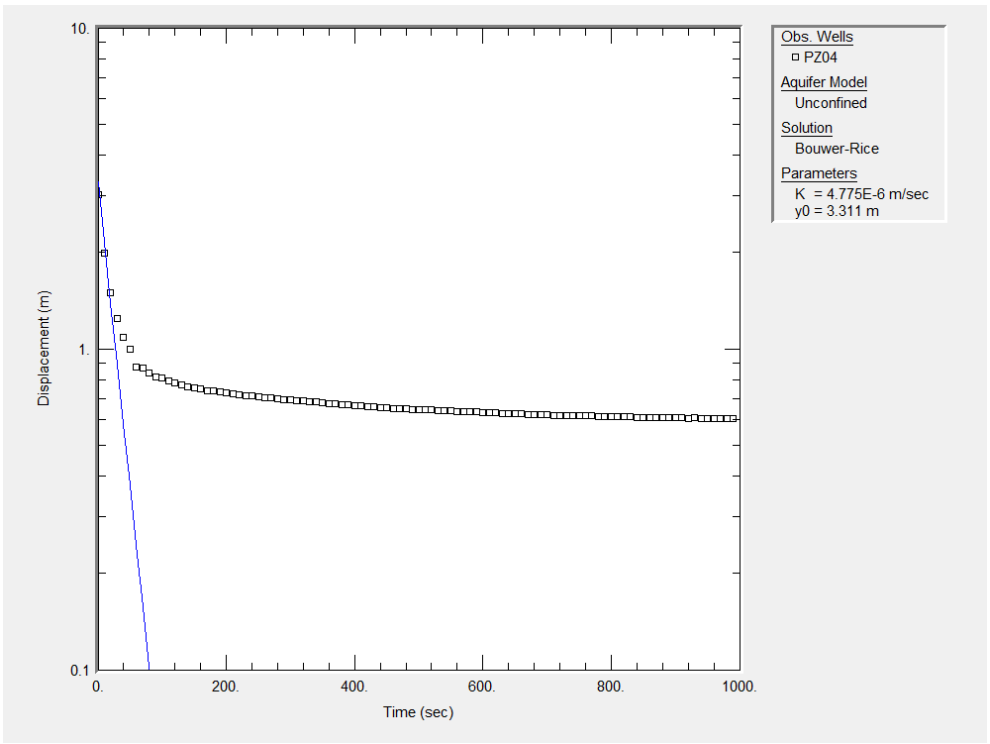
PZ03 – Falling Head Test - HV



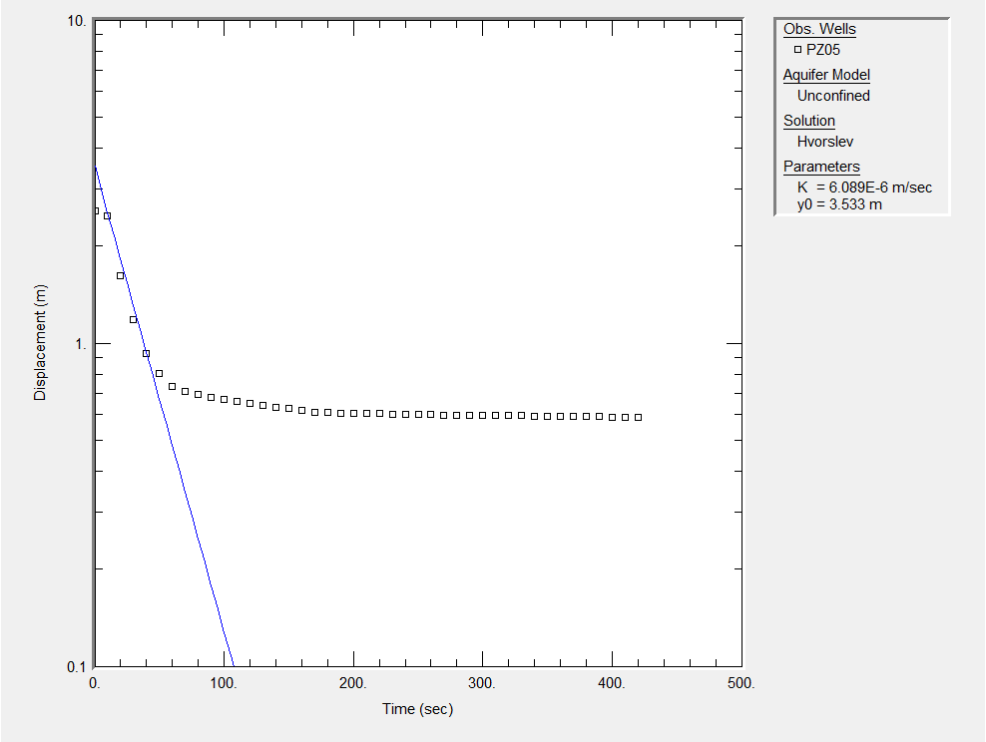
PZ03 – Falling Head Test – Bouwer Rice



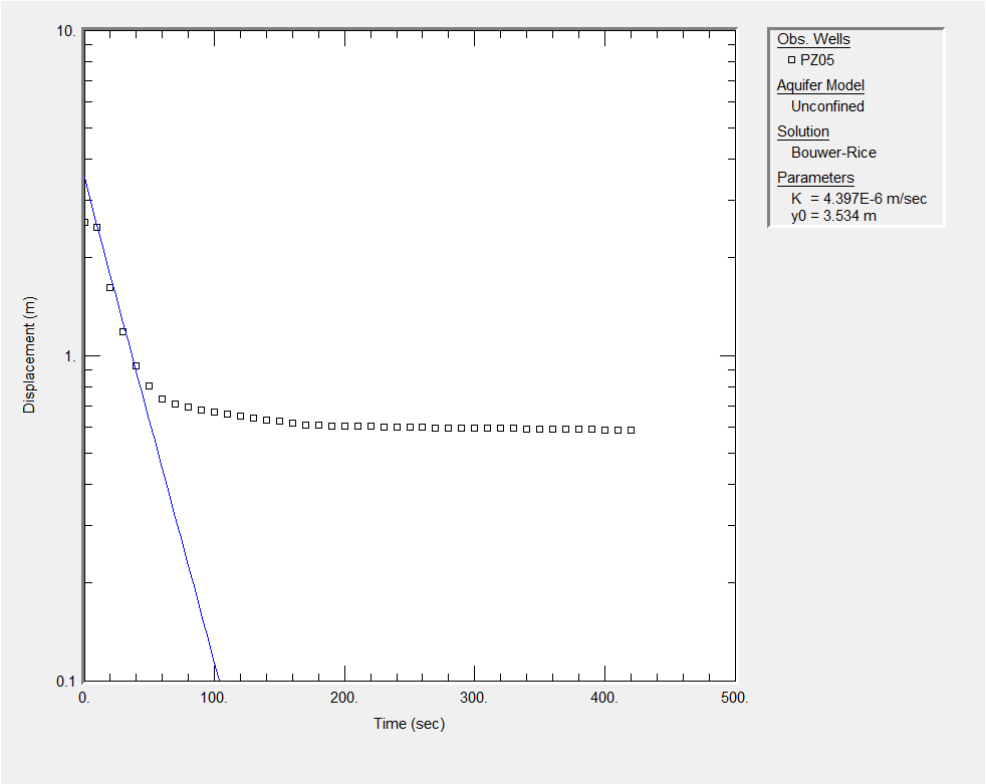
PZ04 – Falling Head Test – HV



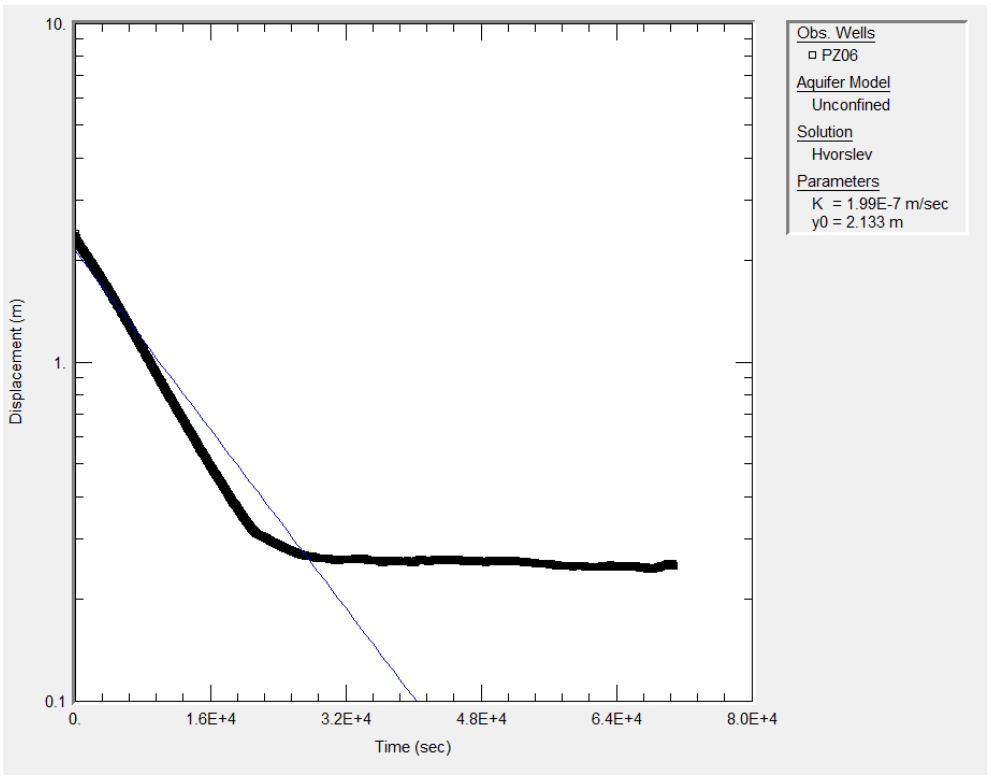
PZ04 – Falling Head Test – Bouwer Rice



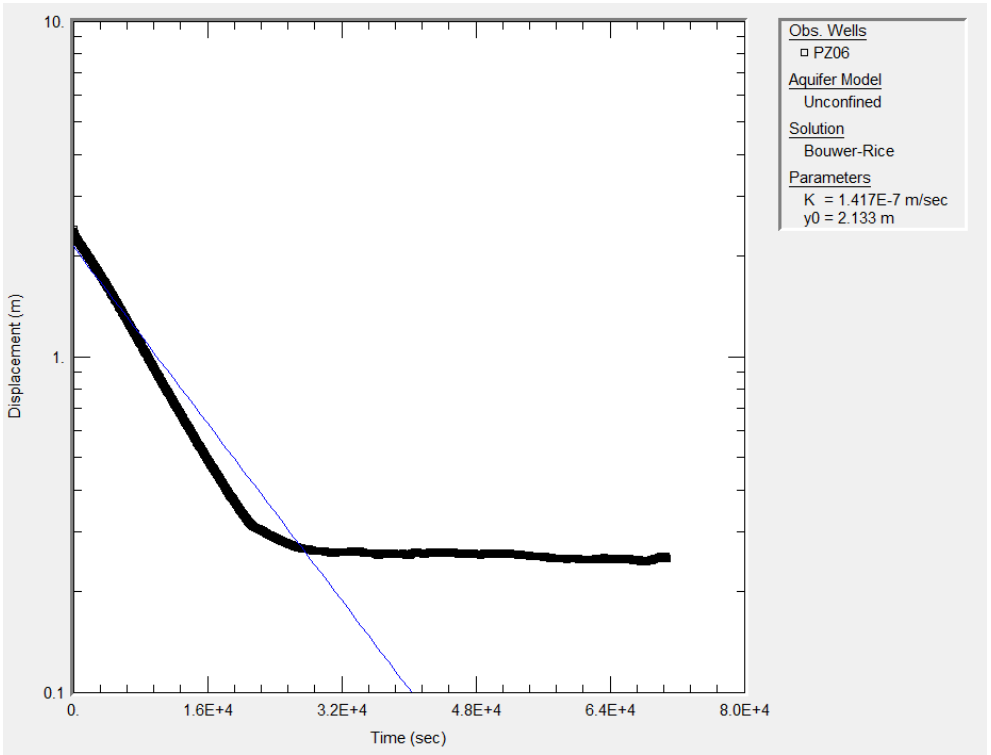
PZ05 – Falling Head Test – HV



PZ05 – Falling Head Test – Bouwer Rice



PZ06 – Rising Head Test – HV



PZ06 – Rising Head Test

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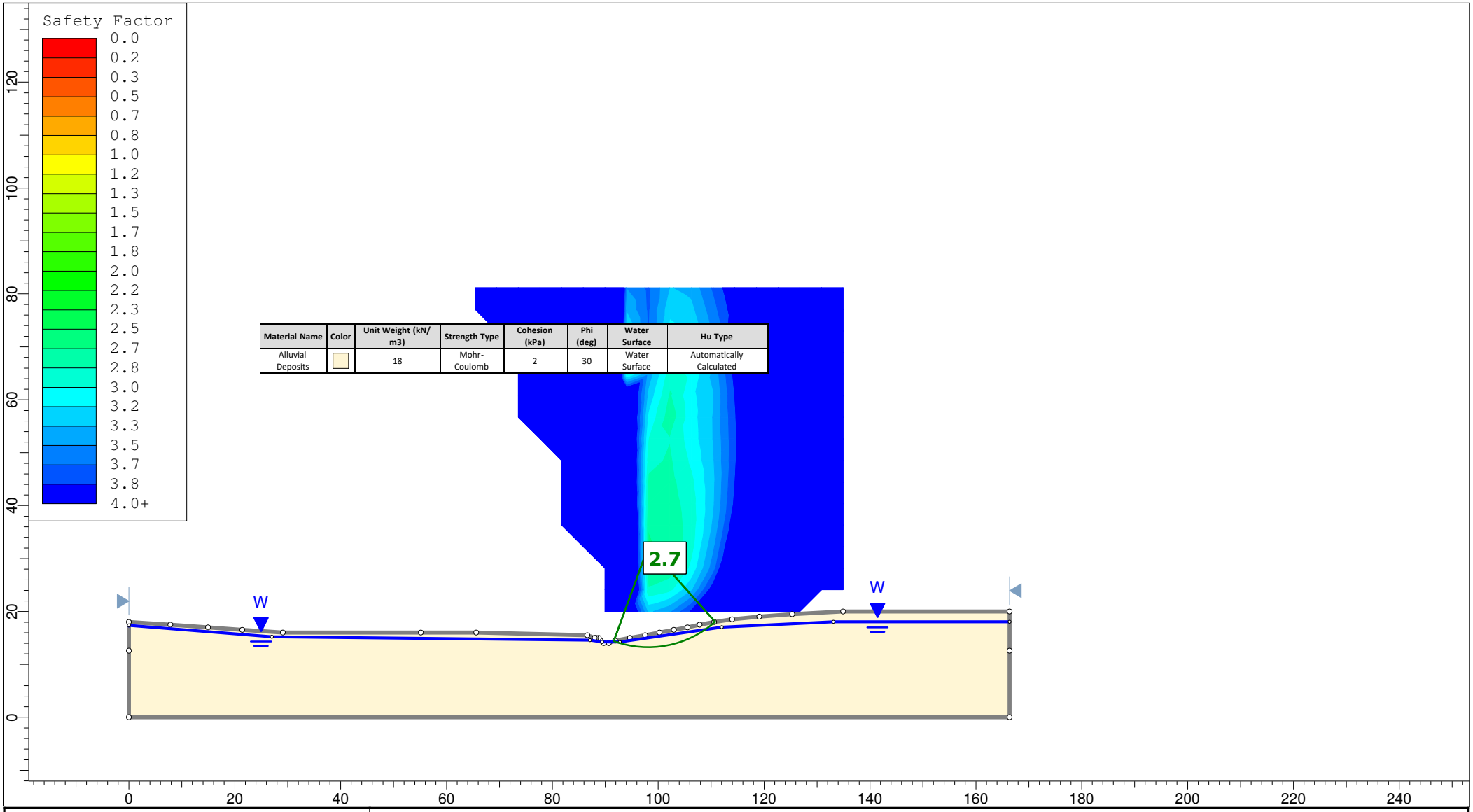
Appendix E

Stability Analysis Results



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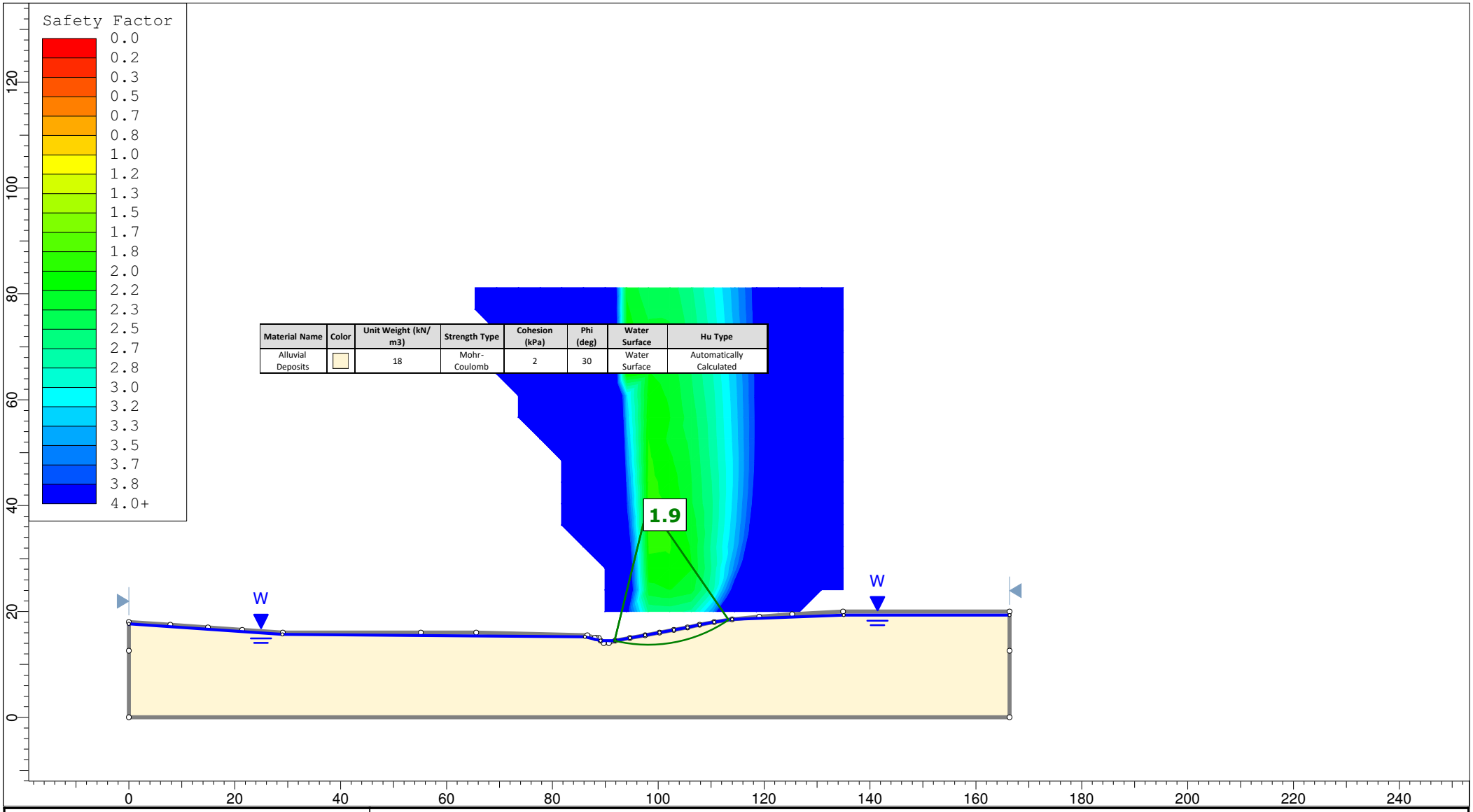
SLIDEINTERPRET 9.014

Project	Fonterra Hautapu, 195 Swayne Rd, Cambridge		
Group	230322 - A-A'	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Aug 2023	*Scale*	1:1000



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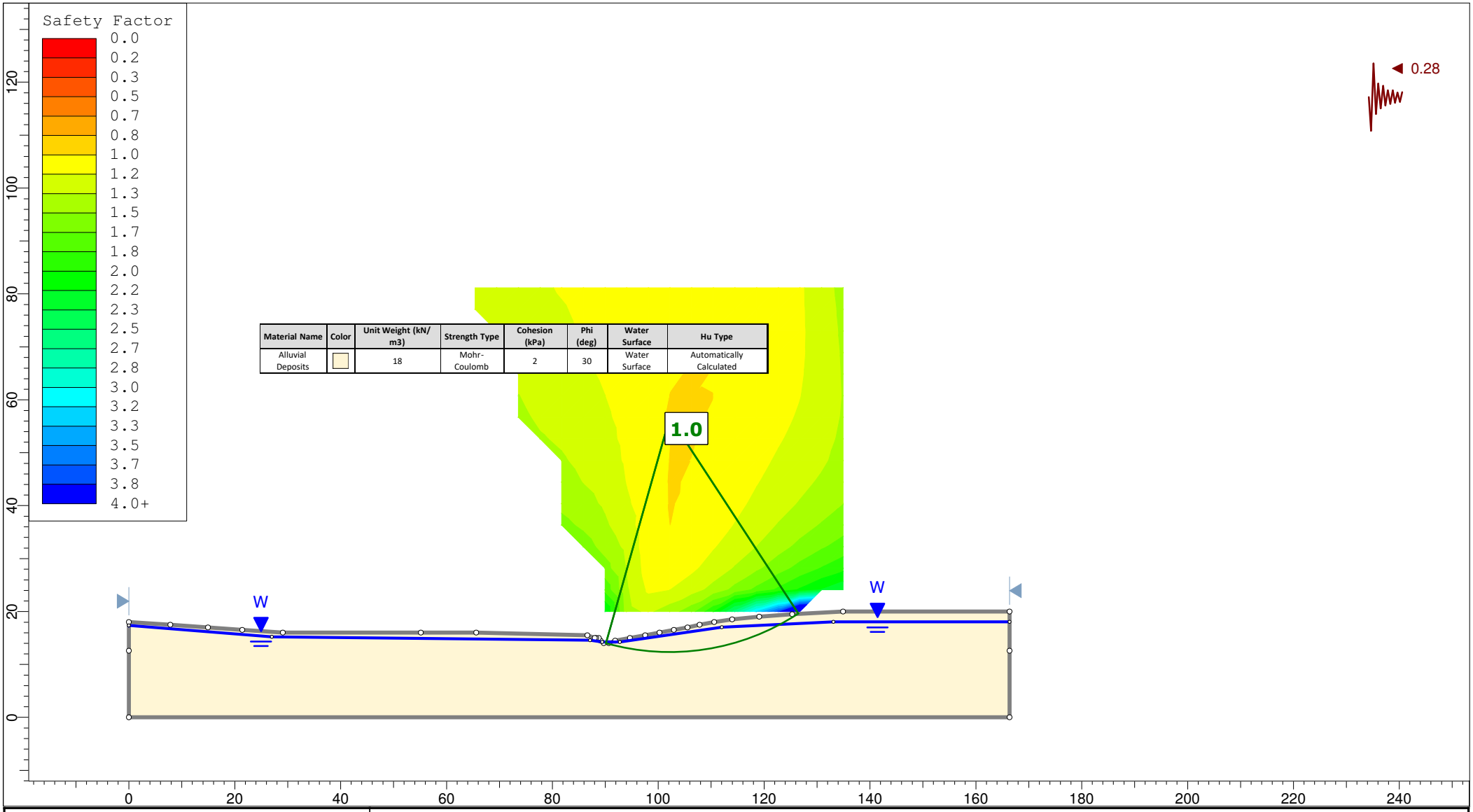
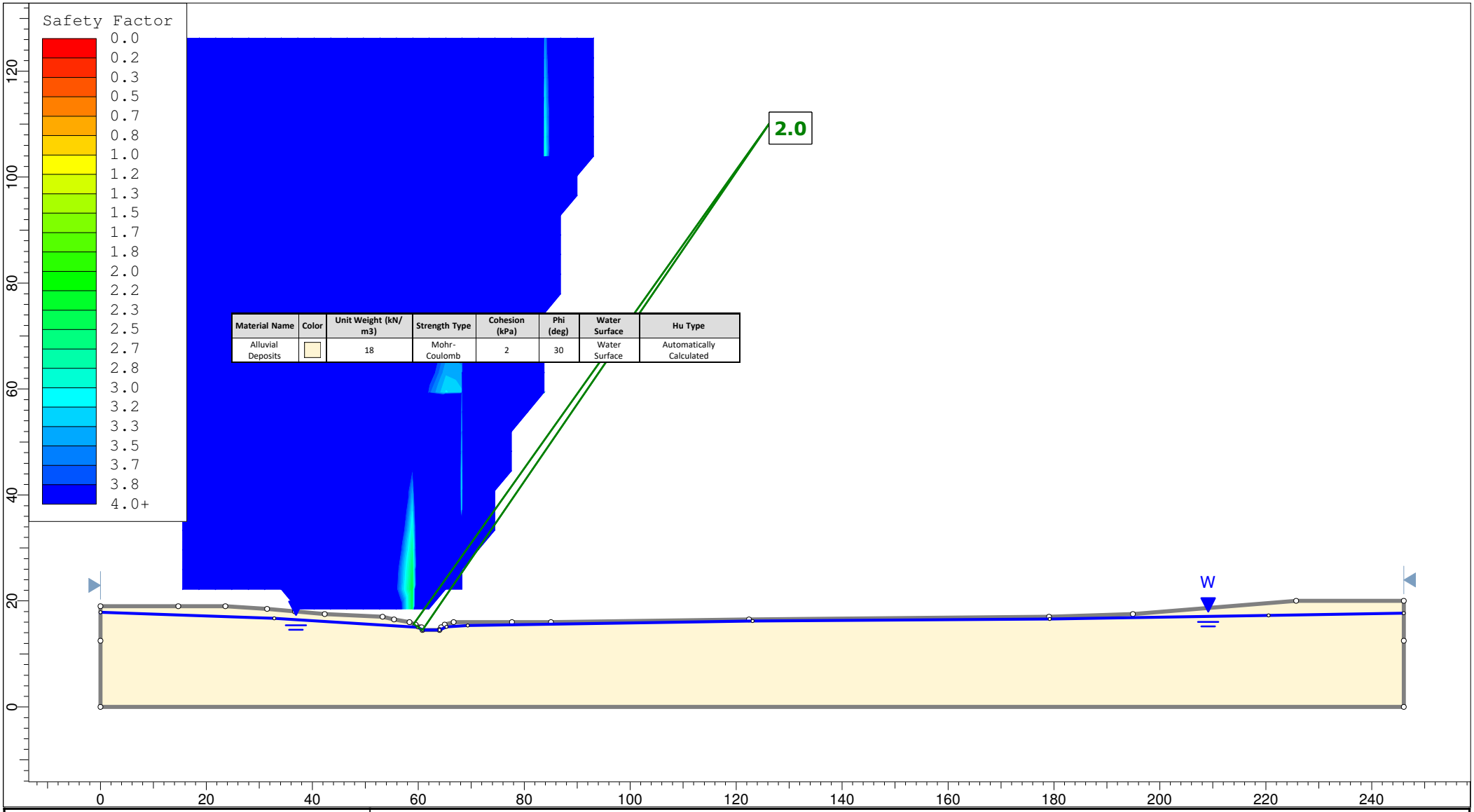
SLIDEINTERPRET 9.014

Project	Fonterra Hautapu, 195 Swayne Rd, Cambridge		
Group	230322 - A-A'	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Aug 2023	*Scale*	1:1000



Soil&Rock Consultants *Your responsive & cost-effective engineers*	*Project*	Fonterra Hautapu, 195 Swayne Rd, Cambridge	
	Group	230322 - A-A'	*Scenario* Seismic Condition
	Drawn By	B.SMITH	*Company* Soil & Rock Consultants
	Date	Aug 2023	*Scale* 1:1000

SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Automatically Calculated

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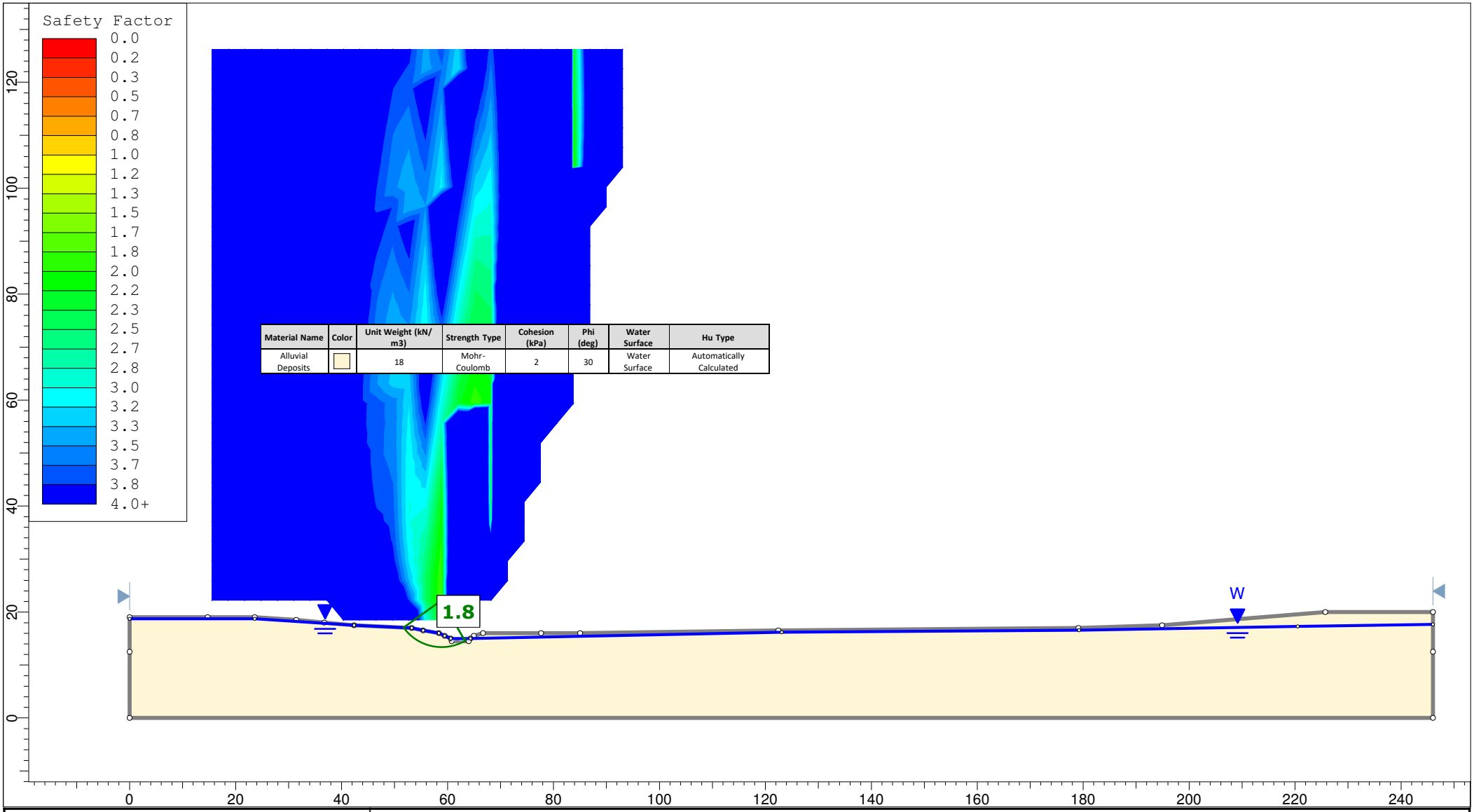
SLIDEINTERPRET 9.014

Project	Fonterra Hautapu, 195 Swayne Rd, Cambridge		
Group	230322 - B-B'	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Aug 2023	*Scale*	1:1000



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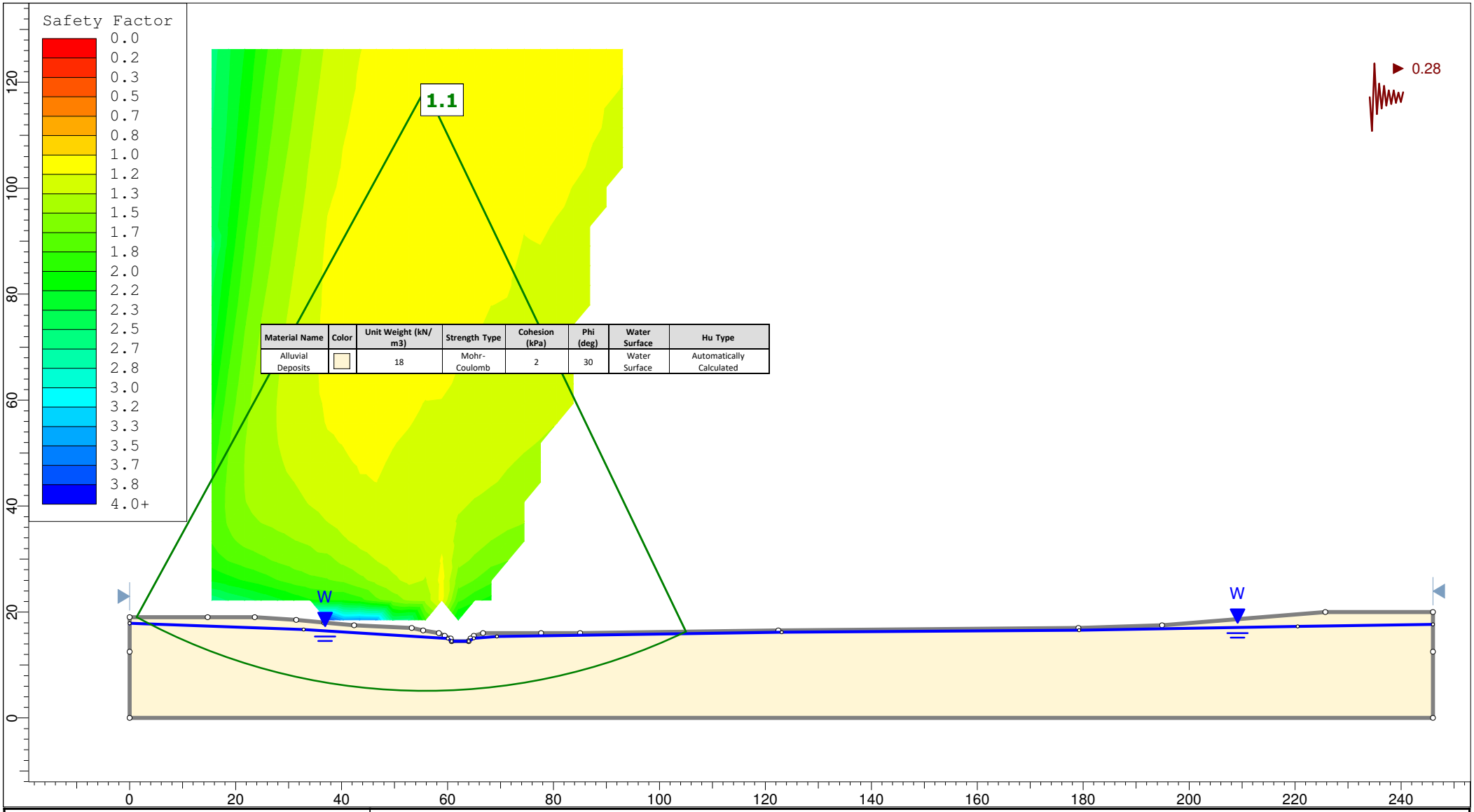
SLIDEINTERPRET 9.014

Project	Fonterra Hautapu, 195 Swayne Rd, Cambridge		
Group	230322 - B-B'	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Aug 2023	*Scale*	1:1000



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SLIDEINTERPRET 9.014

Project	Fonterra Hautapu, 195 Swayne Rd, Cambridge		
Group	230322 - B-B'	*Scenario*	Seismic Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Aug 2023	*Scale*	1:1000