



Preliminary Geotechnical Assessment Report

Brymer Farms, 584 Whatawhata Road, Hamilton

Prepared for
Brymer Farms Ltd

Prepared by
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1 Introduction

Tonkin & Taylor Ltd (T+T) was engaged by Brymer Farms Ltd to conduct geotechnical investigations and provide a high-level geotechnical assessment for a proposed large (2000 lot) residential subdivision development at the Brymer Farms site located at 584 Whatawhata Road, Hamilton.

This report was prepared in accordance with our letter of engagement, dated 22 April 2021, specifically for the Stage 1 (Geotechnical Constraints Reporting) scope of works. The purpose of this report is to provide an outline of the geotechnical risks at the site and comment on preliminary foundation recommendations for a residential development.

This report has been prepared as a high-level assessment for due diligence purposes and is not considered suitable as supporting a resource consent application.

2 Scope of work

Geotechnical services in accordance with our engagement (Stage 1 only) are provided below.

- Project management and administration, health and safety paperwork.
- Review of existing information including available geotechnical information and contour data.
- Underground service location to identify buried services.
- Engineering geologist site walkover and fieldwork supervision / logging.
- Fieldwork: 16 to 20 No. cone penetration tests (CPTs), 3 No. machine boreholes, 10 No. trial pits.
- Processing of fieldwork data and preparation of representative geological sections.
- Preliminary geotechnical analyses to include liquefaction susceptibility, static settlements, slope stability assessment.
- Geotechnical report and plan outlining geotechnical constraints on the development and work out where additional testing is required for subsequent stages.

3 Site description

3.1 General

The subject site is a large rural plot of land, approximately 81 hectares (810,650 m²) in area, located within the Waikato District, immediately west of the Hamilton City Council boundary line.

The site can be accessed from Whatawhata Road to the south and Brymer Road to the north and is generally bound by rural pasture, but residential development bounds the site to the north-east.

The site comprises the following key characteristics:

- The southern portion of the site, to the immediate north of Whatawhata Road, comprises an isolated raised knoll, which forms part of the rolling hill topography observed across much of the Hamilton basin. Ground levels vary from approximately RL34 m from road level up to RL50 m (16 m elevation change). The slopes are gentle to moderately steep.
- To the north of the knoll, and within the central portions of the site, the topography is typically level at an elevation of approximately RL25 m. A series of farm drains run both north to south, and east to west across the low-lying areas, where a series of culvert and bridge crossings provide access around these areas.

- The northern portions of the site comprise gully incised, rolling hill topography, which is typical for the area. Elevations change from approximately RL25 m in the low-lying regions, up to RL55 m in the elevated portions of the site, with slope gradients ranging from moderate (approximately 20 degrees) to moderately steep (approximately 50 degrees). A series of gully fed ephemeral (rainfall triggered) streams also appear to be present on the site with a pond observed in aerial photographs around RL31 m, which is likely fed by the gully borne streams.
- A lower-lying area to the north of the site lies at a relatively level gradient at an elevation around RL30 m.

The existing site layout and key site features are presented on Figure 01, which is appended to this report.

3.2 Historic site use

A brief history of the site is summarised below based on available historic aerial photography^{1,2}:

- 1943: majority of the site is in pasture, with dense patches of vegetation within the gully heads. Some isolated farm buildings are present across the site, with the structures particularly prevalent adjacent to Whatawhata Road within the southern portion of the site.
- 1979: increase in residential development to the east of the site as part of Hamilton City expansion.
- 2008: Increased residential development observed at the northwest boundary of the site.

The site is likely to have undergone minor earthworks as part of historical rural developments, which may comprise fill pits, drains, and fill piles.

4 Proposed development

Due to the high-level nature of the report and the early stages of the development no concept plans or sketches are currently available for the project.

Based on phone conversations with yourself, the client, we understand that the proposed development will comprise up to 2000 residential lots with associated access roads, and parking. In addition, a wastewater treatment plant is also proposed to be located on the site.

For assessment purposes the residential developments are standard lightweight, one or two-storey dwellings.

5 Ground conditions

5.1 Geology and faulting

The published geological information³ indicates the site is predominantly underlain by the following two units:

- Lower lying plains: Swamp deposits consisting of soft, dark brown to black, organic-rich mud, muddy peat and woody peat (Q1a) of the Piako Subgroup of the Holocene age (<12 ka).

¹ Retrolens Website, Historical Image Resource, <https://retrolens.co.nz/map>.

² Google Earth Pro, Historic Aerial Image Tool

³ Edbrooke, S.W. (compiler) 2005: Geology of the Waikato area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 4. 1 sheet + 68 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

- Elevated Landform: Pumiceous alluvium and colluvium dominated by primary and reworked, non-welded ignimbrite (eQa), of the early Pleistocene era (.128 ka to 1.8 ma).

The site location with respect to the published geological information is presented on Figure 5.1 below.

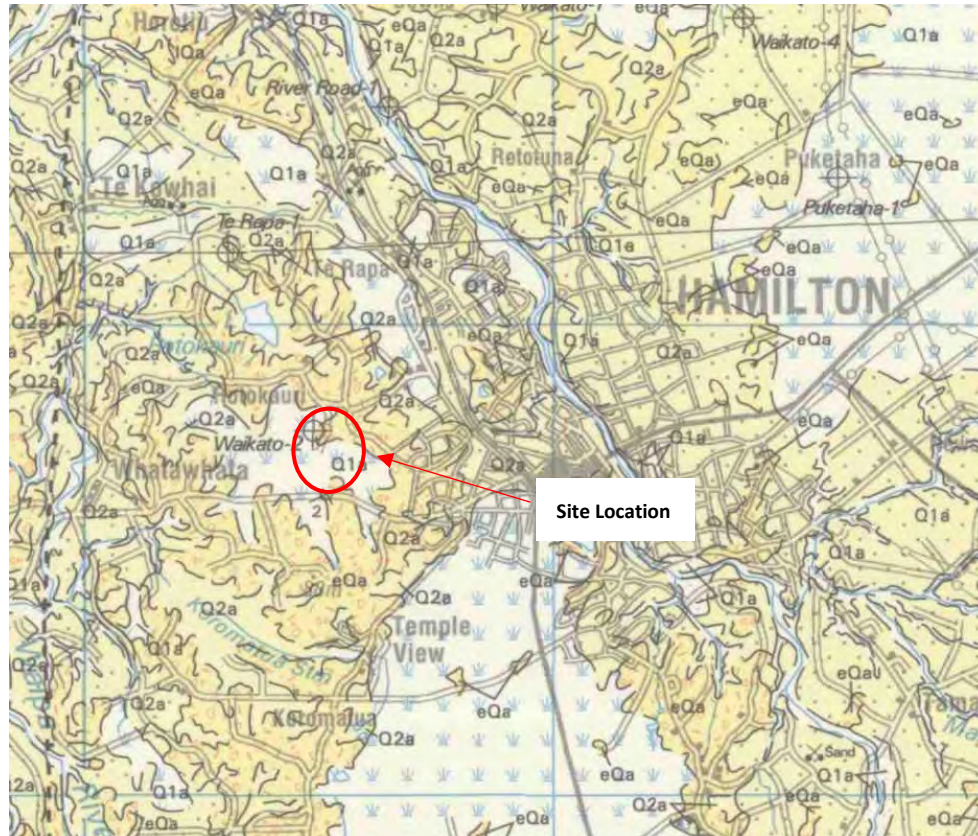


Figure 5.1: Published geology of the site and surrounding area³

5.2 Geomorphology

5.2.1 Regional setting

The Hamilton basin is a large tectonic depression (down-thrown block or graben), approximately 2,000 km² in area, centred on Hamilton³. The basin is bound to the west and east by up-thrown Mesozoic basement rocks⁴ which form the 400 m high hills of the Hakarimata and Pakaroa Ranges. The Hamilton basin is infilled with a sequence of younger Pleistocene volcanically derived sediments of the Tauranga Group sediments deposited by a pre-existing form of the Waikato River. These basin sediments thicken as a wedge from east to west with maximum thicknesses ranging between 1,000 m and 1,500 m.

5.2.2 Subject site area setting

The landforms across the site can be split into the three main areas, as described below:

- **Landform Zone 1:** Low-lying plains at RL 25m, with minor undulations and hummocky ground observed. These low-lying landforms are likely to comprise recent alluvial and fluvial / colluvial derived deposits.

- **Landform Zone 2:** Elevated portions comprise rolling hill topography, with slope gradients up to approximately 50 degrees, however were typically around 15 to 35 degrees. Erosional gully features were observed with crests typically between 20 m and 30 m in length. Very shallow instability features were observed as terrace sets, which may have been exaggerated through cattle grazing within the elevated portions of the site. No large-scale historical slips or evidence of other shallow rotational features were observed during the site walkover or from historical aerial photographs.
- **Landform Zone 3:** this represents the transition between the elevated portions of the site and the lower-lying plains. This area is likely to have been formed from sediments being transported from the erosional gully heads to the low-lying portions of the site. This area of the site is very gently graded, forming a gently sloping fan of deposits from the toe of the Landform 1 towards Landform Zone 2.

5.3 Geotechnical investigations

Geotechnical investigations were carried out between 17 May 2021 and 1 June 2021 under the direction of T+T to specifically address the objectives and scope defined in this report. The investigation included:

- Ten trial pits, denoted TP101-TP110 were undertaken using an 8-tonne excavator to assess shallow ground conditions. The trial pits were advanced to between 1.8 m and 4.4 m below ground level (bgl) where they were terminated at either the machine limit or upon reaching target stratum below the peat.
- Fourteen Cone Penetration Tests (CPT), denoted CPT101 to CPT114 pushed to depths of between 7.12 m and 29 mbgl to assess deeper soil units and liquefaction susceptibility below the site.
- Three machine boreholes (BHs) were drilled using a tractor mounted rotary machine borehole rig with samples collected using triple tube HQ barrels down to depths between 15.0 m and 27.45 m.

The CPTs and machine boreholes were carried out by Drillcore Ltd under T+T's instruction. The trial pits and the machine borehole logs were logged by a T+T geotechnical engineer. The investigation locations were surveyed using a handheld GPS. Test locations are presented on Figure 01 in Appendix A. The logs from the site investigation are presented in Appendix B.

The logging has been undertaken in accordance with the NZGS Soil and Rock logging guidelines⁴ (2005).

5.4 Soil stratigraphy

The soil stratigraphy has been derived from the CPT, machine borehole and trial pit logs, the published geological maps, and experience with similar soils, and are summarised on Figure 02 in Appendix A with further descriptions provided in Table 5.1 and Table 5.2 below.

In general, the site comprises recent alluvial and swamp deposits within the low-lying areas (Landform Zone 1), older ash and fluvially re-worked deposits of the Walton Subgroup within the elevated regions of the site (Landform Zone 2), and a transition zone where colluvial and recent

⁴ Field Description of Soil and Rock – Guideline for the field classification and description of soil and rock for engineering purposes, NZ Geotechnical Society Inc, December 2005.

deposits have been eroded from the elevated areas and transported to the toe of the slopes (Landform Zone 3).

Table 5.1: Landform Zone 1 and 3 (low-lying recent deposits)

Unit No.	Inferred Soil Description	Depth to top of layer (mbgl)	Layer thickness (m)	Cone Resistance q_c (MPa)
1	SILT with varying subordinates of clay and sand; firm. [Topsoil]	0.0	0.1 to 0.4	-
2	Silty CLAY/Clayey SILT; firm. [Colluvium] *	0.1 to 0.4	1.5 to 5.0	0.3 to 1.0
3	PEAT (Fibrous and Amorphous); soft. [Piako Subgroup]	0.1 to 0.4	0.4 to 2.3	0.1 to 0.2
4	Estuarine SILT with varying subordinates of sands, peat and gravels; soft to firm. [Piako Subgroup]	0.8 to 2.5	7.1 to 12	0.1 to 2.0
5	Medium dense to dense SAND with varying subordinates of silts and gravels [Hinuera Fm] **	12.3 to 14.5	3.0 +	3 to 14

* Only present in boundary areas between Landform Zone 1 and Landform Zone 2.

** Bottom of layer not encountered in these investigations.

Table 5.2: Landform Zone 2 (elevated deposits)

Unit No.	Inferred Soil Description	Depth to top of layer (mbgl)	Layer thickness (m)	Cone Resistance q_c (MPa)
1	SILT with varying subordinates of clay and sand; firm. [Topsoil]	0.0	0.3	-
2	Silty CLAY/Clayey SILT; firm to very stiff. [Hamilton Ash]	0.3	5	1.3 to 4.5
3	Silty CLAY/Clayey SILT with varying subordinates of silt, sand and peat; firm to very stiff. [Walton Subgroup]*	4.5	20 +	1 to 4
4	Medium dense to dense SAND (Walton Subgroup) – not encountered in CPT-1	10 to 12	5+	8 to 28

* Bottom of layer not encountered in these investigations.

These Landform Zones are presented on Figure 02 in Appendix A, which should be referred to in conjunction with this report text.

The thickness of soft soil deposits encountered within Landform Zone 1, has been presented on the soft soil contour plan appended to this report - Figure 03 (Appendix A).

5.5 Groundwater

5.5.1 Landform Zone 1 & 3

Groundwater levels were measured following the drilling of the boreholes, during the trial pit excavations and were dipped after withdrawal of the CPT cones. Groundwater was typically measured within the low-lying portions of the site to be between 0.4 m and 0.7 mbgl, which is at an equivalent elevation of between 24.5 m and 24.8 m RL.

Artesian groundwater was also encountered within the low-lying areas of the site during drilling and advancement of the CPTs. This artesian pressure was encountered in CPT103, BH 102 and BH103, at depths of between 15 m and 18 mbgl.

The groundwater measurements results have been summarised for each investigation location and presented in Appendix C.

5.5.2 Landform Zone 2

Groundwater information within the CPTs was difficult to assess due to the holes collapsing dry upon withdrawal of the cone. Groundwater was however dipped within BH101 at a depth of 15 mbgl, which is equivalent to an elevation of RL30.5 m. Due to the sloping nature of the site, we would anticipate that the groundwater table grades towards the low-lying plains to reflect the change in landform at ground surface.

Groundwater seepages were not encountered in this zone during our site visit, however aerial photographs clearly show ponding water and ephemeral streams, which are likely to have formed the gully head features observed within the elevated terraces. Perched groundwater tables should therefore be anticipated within the elevated portions of the site.

The groundwater measurements results have been summarised for each investigation location and are presented in Appendix C.

6 Seismic shaking hazard

6.1 Seismic site subsoil class

The following seismic subsoil classes in accordance with NZS 1170.5:2004 Section 3.1.3 are recommended based on our site investigation results, published geological information, and experience on projects within this area:

- Subsoil Class E: for developments in and adjacent to CPT102, CPT103, CPT104 within the low-lying recent alluvial deposits, where soft soils were encountered to be at least 10 m thick and estimated shear wave velocities less than 150 m/s based on Robertson (2009)⁵.
- Subsoil Class D: for the remainder of the site where soft soils were less than 10 m thick, and although depth to rock was not proven during the geotechnical investigations, published geology³ indicates depth to bedrock exceeds the limits for site subsoil Class C – Shallow Soil.

For preliminary assessment purposes we would recommend a Subsoil Class E for Landform Zone 1 and 3, and a Subsoil Class D for Landform Zone 2 as shown on Figure 02 in Appendix A.

⁵ Robertson, PK (2009). Interpretation of cone penetration tests – a unified approach, Canadian Geotech. J., 46(11):1337=1355

Additional investigations to further assess the extent of the subsoil class should be undertaken as part of the resource consenting phase to further refine these zones, which are subject to change.

6.2 Ground shaking hazard

New Zealand Standard, NZS1170.5:2004 Structural Design Actions Part 5 Earthquake Actions, clause 2.1.4 specifies that to meet the requirements of the New Zealand Building Code, design of structures must allow for two earthquake scenarios:

- 1 (ULS) "Ultimate limit state for earthquake loading shall provide for... avoidance of collapse of the structural system... or loss of support to parts... damage to non-structural systems necessary for emergency building evacuation that renders them inoperative."
- 2 (SLS) "Serviceability limit states for earthquake loading are to avoid damage to... the structure and non-structural components that would prevent the structure from being used as originally intended without repair after the SLS earthquake..."

The seismic hazard in terms of peak ground acceleration (PGA) for the site has been assessed based on Bridge Manual SP/M/022 Third Edition. Table 6.1 presents the return periods for earthquakes with various 'unweighted' peak ground accelerations (PGA) with a corresponding earthquake magnitude. The seismic hazard determined below is for geotechnical design purposes only (liquefaction, slope stability). Structural design may require determination of the seismic hazard (PGA, M) using other standards or methods.

As the proposed development could comprise both residential dwellings and a wastewater treatment plant, the ULS seismic event has been considered for both IL2 and IL3 return periods.

Table 6.1: Ground seismic hazard

NZS 1170.5 Limit State	PGA (g)	Effective magnitude M_{eff}	Return period (years)
Ultimate limit state (ULS – IL3)	0.280	5.9	500
Ultimate limit state (ULS – IL2)	0.215	5.9	500
Serviceability limit state (SLS)	0.054	5.9	25

Note:

PGA and effective magnitude have been assessed based on Bridge Manual SP/M/022 Third Edition for the following:

Building design life	50 years – assumed
Building importance level	3 & 2 (NZS 1170.0:2004, Table 3.2)
Return period factor, R_u	1.3 for 1000 yr, 1.0 for 500 yr and 0.25 for 25yr return period (NZS 1170.5:2004, Table 3.5)
Subsoil class	D (deep soil) & E (soft soil) – refer Section 3.4.1
Return period PGA coefficient, $C_{0,1000}$	0.28 (Bridge Manual Table 6A.1)
Site subsoil class factor, f	1.0 (Bridge Manual Section 6.2)
PGA	$C_{0,1000} \times R_u / 1.3 \times f \times g$ (Bridge Manual Section 6.2)
Effective Magnitude, M_{eff}	5.9 for 1000yr, 500 yr and 25 yr return period (Bridge Manual Table 6A.1)

7 Liquefaction assessment

7.1 General

Liquefaction occurs when loose granular soils below groundwater level experience strength loss in response to an applied cyclic load, such as those generated from earthquake shaking. Liquefaction can cause damage to land, buildings and infrastructure.

Soils which are susceptible to liquefaction require a certain level of earthquake shaking (trigger) to cause them to liquefy. Liquefaction trigger analyses were completed using the simplified method outlined by Boulanger & Idriss (2014)⁶. Analyses have been undertaken utilising CPT data with design ground water level as per Section 5.5. A sensitivity check on the groundwater levels with respect to liquefaction susceptibility / triggering, has also been undertaken.

The liquefaction assessment has been completed for both SLS and ULS design seismic events previously summarised in Table 6.1, and as per MBIE Guidance in relation to the soil fabric, age, and following considerations:

- Non-liquefied crust thickness;
- Liquefaction induced settlements; and
- Liquefaction Severity Number (LSN).

7.2 Assessment results

The results of the analyses indicate that liquefaction is not triggered under an SLS event and therefore the effects of liquefiable soils for the proposed development are negligible for this seismic case. Liquefaction is expected in some areas of the site following a ULS seismic event (both IL2 and IL3) with the results of the analyses presented in Table 7.1 below.

The PGA sensitivity analysis indicated that liquefaction triggering is expected to begin at a PGA range between 0.08 g to 0.15 g. Full liquefaction triggering is likely to develop at a range between 0.25 g and 0.3 g.

Numerical liquefaction analysis has not been carried out on CPTs located within elevated portions of the site (Landform Zone 2). Given the depth to groundwater and therefore the non-liquefiable crust thickness, and the age of the soils with respect to the geomorphology of the site (i.e. no observed evidence of past lateral spread events with respect to the return period interval), we anticipate the effects of liquefaction within these areas to be negligible for at least the 1,000 year return period considered.

⁶ Boulanger, R.W. & Idriss, I.M (2014) "CPT and SPT Based Liquefaction Triggering Procedures" UCD/CGM-14/01

Table 7.1: Summary of CPT-based ULS liquefaction analysis

Landform Zone	Test Location	Crust thickness (m) ¹		Liquefaction Severity Number (LSN)		Free-field surface settlement (mm) - 15% exceedance probability	
		ULS (IL2)	ULS (IL3)	ULS (IL2)	ULS (IL3)	ULS (IL2)	ULS (IL3)
1	CPT103	7.2	7.2	11	11	130	130
	CPT104	2.5	2.5	13	13	97	101
	CPT106	1.2	1.2	42	45	179	202
	CPT107	3.5	3.5	27	37	74	88
	CPT108	1.1	1.1	20	24	42	54
	CPT109	0.9	0.9	38	38	103	105
	CPT110	5	5	21	22	99	107
	CPT111	4.5	4.5	13	22	32	43
3	CPT102	29	29	31	32	221	241
	CPT105	10.5	6.7	28	29	89	90

7.2.1 Landform Zone 1 Results

The results of the analyses indicate that the silty sand / sand layers within the recent low-lying Piako Subgroup deposits are susceptible to liquefaction, where encountered below the groundwater table. The estuarine silts and peat soils are not considered susceptible to liquefaction.

Between 30 mm and 180 mm of liquefaction-induced settlement was predicted for an IL2 event (500 yr return period), and 40 mm to 200 mm predicted for an IL3 event (1,000 yr return period).

The non-liquefiable crust across the lower lying landform has varying thicknesses from 0.9 m thick to 10 m thick.

Liquefiable layers for CPT103 and CPT104 were also predominantly below 10 m depth, so the effects of liquefaction manifestation or damage at ground surface is likely to be negligible.

Foundation recommendations to address the liquefaction-induced settlements are provided in section 10.

7.2.2 Landform Zone 3 Results

The CPTs undertaken within this unit generally indicate settlements to be between 90 and 220 mm for an IL2 event and 90 to 240 mm for an IL3 event, with crust thicknesses between 6.7 and 29 m. Most of the settlement would be anticipated to be below 10 m and therefore the effects of liquefaction at surface are likely negligible.

Further global settlement may occur on a regional scale, which will have negligible effect on the structural integrity of the building.

Foundation recommendations to address the liquefaction-induced settlements are provided in section Table 10.1.

7.3 Lateral spread

Lateral spread has not been assessed at this stage due to the preliminary nature of the development. As the risk from liquefaction for the elevated portions of the site is considered to be low, particularly with reference to the current geomorphology and lack of evidence to suggest large future seismic displacement, then the risk of lateral spread is also likely to be low.

Due consideration will however be required for the following and may require:

- Distance of development to open drains or channels.
- Displacement of fill batters within the low-lying portions of the site.

8 Static settlement

8.1 General

Application of a load, such as from building foundations or fill placement, onto the ground surface will cause the underlying soils to vertically displace as the volume between the soil particles decreases. The degree of settlement will depend on the magnitude and extent of the applied load, as well as the stiffness and fabric of the underlying soils.

Static settlement has been assessed at the site using the CPET-IT analysis software, with the constrained modulus (stiffness) parameters derived from the CPT traces. Foundation loads are not currently known for the site as the project is still in the early stages, however the following simplistic residential foundation systems have been assessed:

- 5 kPa widespread load over a 10 x 15 m footprint (flexible foundation).
- 7.5 kPa widespread load over a 10 x 15 m footprint (flexible foundation).
- 75 kPa strip footing (0.3 m wide and 15 m long).
- 100 kPa strip footing (0.3 m wide and 15 m long).

The results of the static settlement for the above foundation design scenarios are summarised in Table 8.1 below.

Table 8.1: Settlement prediction summary

Landform Zone	Total Primary Consolidation (mm)				
	CPT #	5 kPa UDL (10 m x 15 m)	7.5 kPa UDL (10 m x 15 m)	75 kPa strip (0.3 m wide and 15 m long)	100 kPa strip (0.3 m wide and 15 m long)
1	CPT103	150	225	160	215
	CPT104	90	135	85	115
	CPT106	<10	10	30	35
	CPT107	<5	<5	<5	<5
	CPT108	<5	<5	<5	10
	CPT109	<5	<5	15	25
	CPT110	20	30	45	60
	CPT111	<5	<5	<5	<5

Landform Zone	Total Primary Consolidation (mm)				
	CPT #	5 kPa UDL (10 m x 15 m)	7.5 kPa UDL (10 m x 15 m)	75 kPa strip (0.3 m wide and 15 m long)	100 kPa strip (0.3 m wide and 15 m long)
2	CPT101	< 5	<5	<5	<5
	CPT112	<5	<5	<5	<5
	CPT113	<5	<5	<5	<5
	CPT114	<5	<5	<5	<5
3	CPT102	<20	35	25	35
	CPT105	<5	<5	<5	10

The table above only considers immediate and primary settlement as an indicator of likely total settlements at the site. It is however likely that creep settlement will occur within the peat deposits within Landform Zone 1 and will be in addition to the totals given above. Creep settlement will need to be considered in future stages should it remain in-situ, and has been considered as part of the foundation recommendations presented in section 10.1.

8.2 Foundation Performance

The results summarised in Table 8.1 above indicate that the static settlements within the elevated portions of the site (Landform Zone 2) are generally considered to be within Building Code guidelines and likely not governing the foundation recommendations, provided that only minor filling is undertaken.

Shallow building foundations, such as those stipulated by NZ3604:2011, are not likely to be suitable within the lower-lying portions of the site (Landform Zone 1), without some form of remediation being required. This is particularly prevalent for future buildings located around CPT102, CPT103, CPT106, and CPT110, where the deeper soft soils are present. Suitable remedial strategies are likely to vary due to the varying nature of the soil conditions across this portion of the site, with preliminary foundation recommendations presented in Section 10 below.

8.2.1 Fill Placement

The above settlements presented within Table 5.1 are considered suitable where foundations are constructed at-grade. Placement of fill, particularly within the low-lying areas could significantly affect settlement of the foundations and will need to be carefully considered and is likely to require preloading particularly in the areas where the deeper soft soils are present.

For a guide, placement of 500 mm of additional filling on the low-lying portions of the site (Landform Zone 1) would incur an additional 35 mm to 300 mm of primary settlement for the worst case CPTs (CPT103, CPT104, CPT110). Elsewhere in this zone (CPT106, CPT107, CPT108, CPT109, CPT111), primary settlements would be anticipated to be approximately 10 mm to 20 mm. Creep settlements will also need to be considered for fills placed over peat soils.

Further information will be required to assess the fill-induced settlements at the site.

9 Slope stability

During the site walkover only very shallow surface creep movements within the elevated regions (Landform Zone 2), in the form of terrace-sets, were observed. No evidence of rotational slips was observed during the site walkover or following a review of aerial photography.

As no scheme has been provided at this stage, detailed numerical analyses are not considered appropriate, and so a qualitative approach has been taken to assess the global stability risk at the site.

The gully crests are constantly being undermined because of erosion caused by ephemeral springs / streams and therefore construction of buildings adjacent to these steeper gully escarpment slopes will likely require detailed investigations and assessment. Conservatively, slopes greater than 25 degrees have been selected as generally being unsuitable for residential development without further investigation and specific design considerations.

In general, where light-weight buildings are proposed, slope stability issues are not likely to require significant setbacks, particularly where the slope gradients are less than 25 degrees (1 v : 2 h), which is based on walkover observations and previous work undertaken within the rolling hill topography of the Waikato Basin. This assumes that only minor modifications to the landform are required to form suitable building platforms.

Any significant cuts and fills (generally greater than 0.5 m to 1.0 m) to the existing landform will however require further assessment on account of potential global and local stability issues even in areas where the slopes are less than 25 degrees.

Sloping topography greater than 25 degrees has been presented on the Figure 04 in Appendix A.

10 Geotechnical constraints and foundation recommendations

10.1 Residential foundations

Table 10.1 summarises the key geotechnical risks for the site and presents some preliminary foundation options for the relevant areas. This is not considered to document all ground risk in relation to the development. However, it is considered to identify the risks unique and most important to this site. The areas to which this table refers to are presented on Figure 04 in Appendix A, and should be viewed in conjunction with this report.

Table 10.1: Geotechnical risks for the site

Designated Area	Landform	Risks	Mitigation / preliminary foundation recommendation
A (orange)	1 and 3	Deep compressible soils and highly liquefiable soils under a ULS event.	1 Preload (with wick drains) to mitigate the soft compressible soils and construct a TC2^{Note 1} type slab at the ground surface to mitigate liquefaction issues. OR 2 Deep piled / ground improvement solution with specifically designed raft foundation. Ground improvement likely to extend at least 15 m bgl with piles 20 m to 25 m.

Designated Area	Landform	Risks	Mitigation / preliminary foundation recommendation
B (blue)	1 and 2	Localised compressible peat and silts with potentially liquefiable soils under a ULS event.	1 Undercut this area by up to 2 m and replace with compacted engineered fill and construct a TC2 ^{Note 1} or equivalent foundation at surface. Residual risks for this include the effect of dewatering on neighbouring properties, which will require careful consideration.
C (green)	3	Possible liquefiable soils and static settlement risk.	Shallow ground improvement not likely to be required however a TC2 ^{Note 1} type raft system should be adopted to accommodate the ULS seismic settlements. A reduced ultimate bearing capacity is recommended for this area and a preliminary Geotechnical Ultimate Bearing Capacity 210 kPa for strip and pads or 5 kPa for uniformly loaded slabs should be adopted.
D (no colour)	2	Low risk of liquefaction and soft soil settlement, however slope stability will need to be addressed, particularly in areas where the slopes are greater than 25 degrees (marked pale blue on plan).	Standard NZS:3604 2011 foundation systems or a proprietary raft. Building platform to be confirmed following scheme development. Deepening of foundations should be allowed for in line with section 10.4 below to reflect the possible nature of expansive soils at the site.

Note 1: 'TC2' refers to the Technical Category 2 concrete slab foundation options (1-4) presented within the MBIE Canterbury Guidance Documents.

The units presented in Table 10.1 above and on Figure 04 in Appendix A represent our best estimate of the geotechnical risks at the site based on the limited data. The boundaries provided are subject to change following the results of additional investigations.

10.2 Wastewater treatment plant foundations

It is proposed to construct a wastewater treatment plant on the site, which will involve cutting into the existing landform and installing buried tanks (say 2 m deep) as well as associated buildings and infrastructure.

The wastewater treatment plant foundations are subject to the same geotechnical constraints as the residential foundations presented in Table 10.1, and therefore given the importance level of the structure (IL3), should not be constructed within Landform Zone 1 or 3 due to the high groundwater table and possible settlement and liquefaction issues, without consideration to deeper piled foundations.

Two locations for the wastewater treatment plant have been suggested solely from a geotechnical perspective and presented on Figure 04 in Appendix A, which appear to be geotechnically suitable. These areas are at the toe of the gently sloping elevated regions (Landform Zone 2), where the risk of liquefaction, high-groundwater table, and soft compressible soils is low.

These locations do not preclude the use of a wastewater treatment plant elsewhere on the site, however more specific investigations and recommendations will be required to advise on this.

10.3 Non-residential areas

The geotechnical constraints map (Figure 04 in Appendix A) has been primarily prepared to accommodate the proposed residential development and wastewater treatment plant. However, areas that are less suitable for residential development may be suitable for other types of lower risk development, such as landscape areas, parks and greenspaces, or car parking.

10.4 Expansive soils

Published literature⁷ has shown that Hamilton Ash soils generally contain Halloysite and Allophane dominated clays. These clays generally have little to no swelling potential when compacted well. However, Halloysite rich soils indicate to exhibit some shrinkage potential when dehydrated.

Based on this and the results of our site investigations, the risk of soil expansivity impacting our foundations has been classified as 'low'.

To account for potential shrinkage behaviour in the soils encountered, and without the availability of laboratory testing, we conservatively recommend adopting at least a 450 mm embedment for foundations.

Further laboratory testing is recommended to confirm the assumptions made above.

11 Further work

As discussed above, this report is suitable only to provide preliminary recommendations and apprise a concept design for the proposed development. As such, the following work is required to support a resource consent application:

- Additional ground investigations comprising CPTs, machine boreholes, and trial pits to refine the foundation areas presented on Figure 04 in Appendix A and refine our assessment for a proposed scheme. The investigations will be targeted to suit specific areas of development.
- Laboratory testing to include 1D consolidation tests to assess settlement parameters and linear shrinkage / Atterberg limit testing to address soil expansivity.
- Update analyses based on scheme development including quantitative slope stability assessment.
- Preparation of a geotechnical investigation report addressing the geotechnical risks at the site suitable for a resource consent application.

Following the receipt of a successful resource consent application bid, additional design and reporting will be required for building consent. In addition, construction observations, certification, and provision of a PS4 will also be required as part of future stages.

⁷ Kuman D. University of Waikato 2015. Determination of Optimum Moisture Content and degradation of shear strength overtime for Hamilton ash materials

12 Applicability

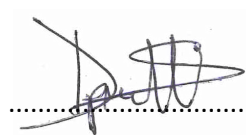
This report has been prepared for the exclusive use of our client Brymer Farms Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on data from discrete investigation locations. The nature and continuity of subsoil away from these locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:



Daniel Mills
Senior Geotechnical Engineer



Craig Davanna
Project Director

Technical review by:



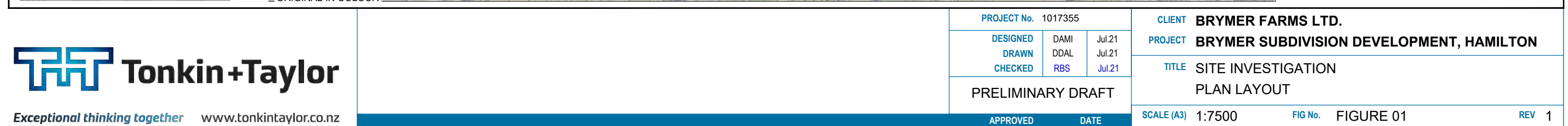
Guy McDougall
Senior Geotechnical Engineer

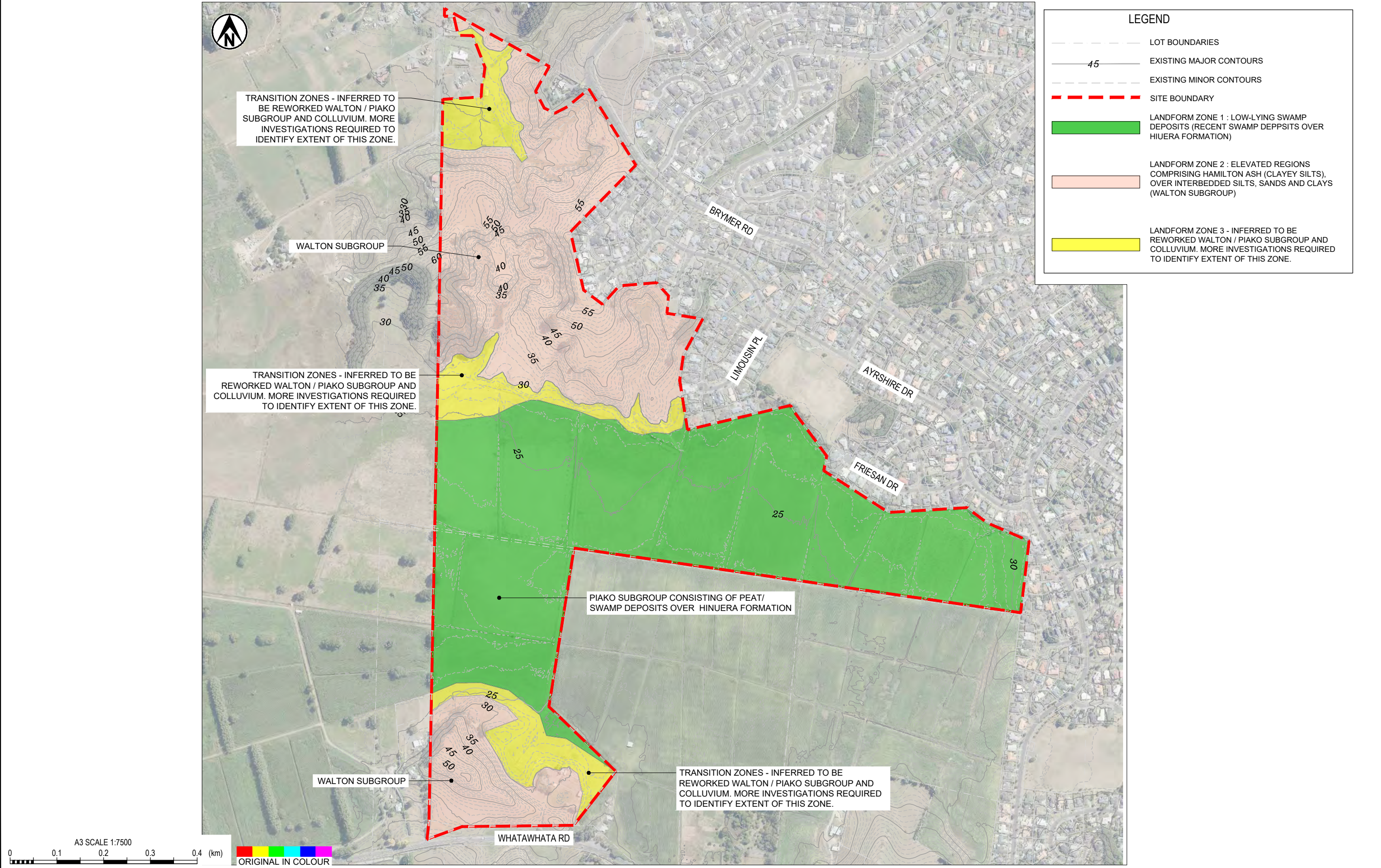
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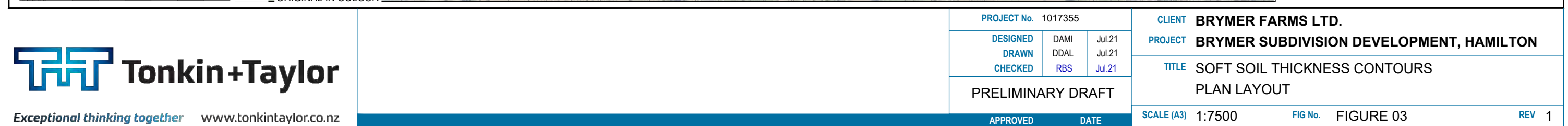
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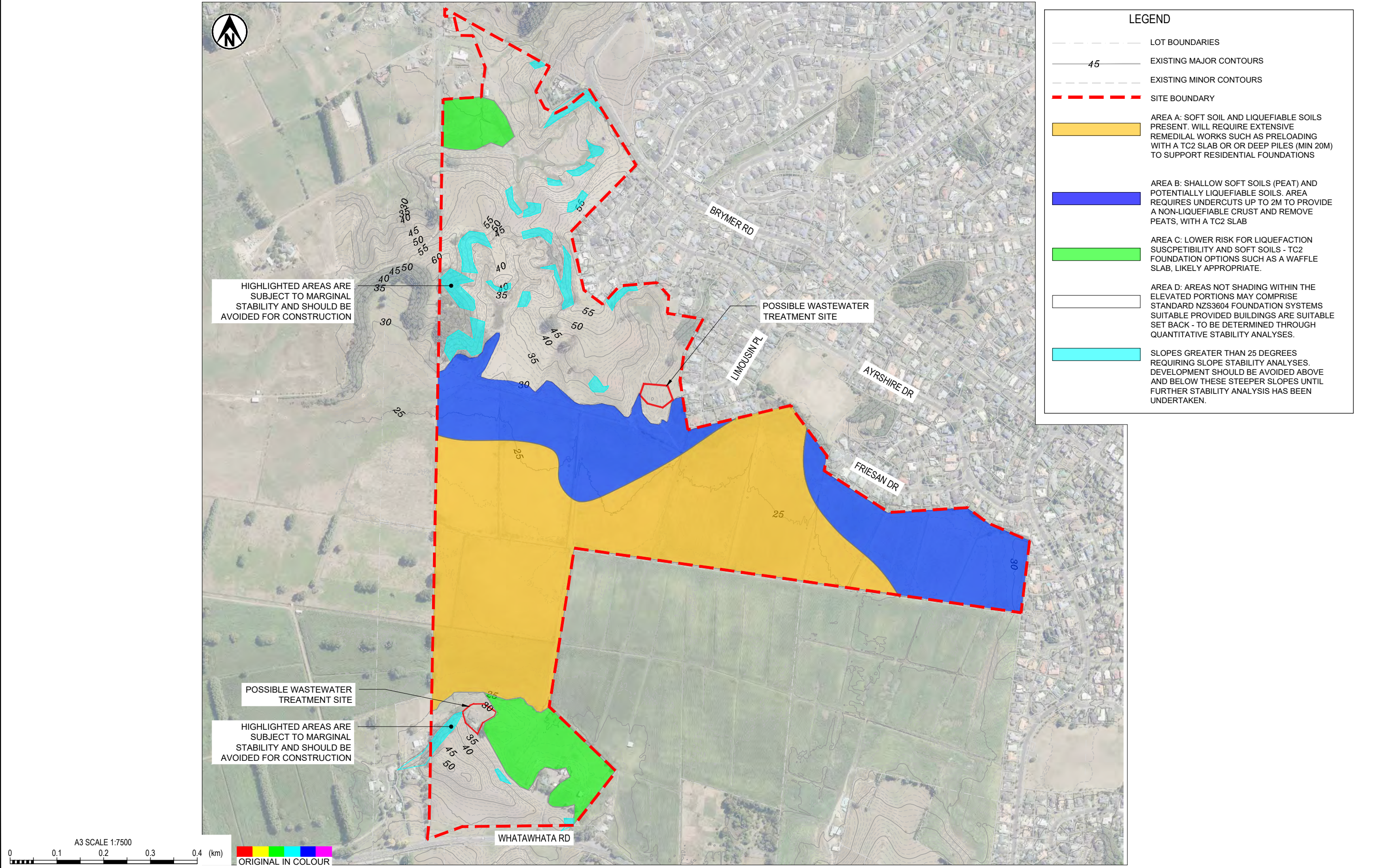
Appendix A: Figures

- **Figure 01 – Site Investigation Plan**
- **Figure 02 – Landform Zone Plan**
- **Figure 03 – Soft Soil Contour Plan**
- **Figure 04 – Geotechnical Constraints Plan**









Appendix B: Ground investigation results

- **Machine Boreholes (MHs)**
- **Cone Penetration Tests (CPTs)**
- **Trial Pits (TPs)**

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 1 OF 6

PROJECT: Brymer Farms Subdivision						LOCATION: 584 Whatawhata Rd, Temple View						JOB No.: 1017355.0000															
CO-ORDINATES:		5814995.96 mN (NZTM2000) 1795095.18 mE				DRILL TYPE: Tractor Rig		HOLE STARTED: 18/05/2021																			
R.L.:		45.24m				DRILL METHOD: RC		HOLE FINISHED: 19/05/2021																			
DATUM:		NZVD2016				DRILL FLUID: WATER		DRILLED BY: Drillcore			LOGGED BY: CAND			CHECKED: RWOT													
GEOLOGICAL						ENGINEERING DESCRIPTION																					
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.						FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (kPa)	DEFECT SPACING (cm)	Description and Additional Observations						
Weathered Volcanic Ash (HAMILTON ASH)						0.00		100	HQTT		● 86/39 kPa 1/2 2/2 N=8		45		TS	M	F					0.00m: Clayey SILT, trace organics and trace sand; dark brown. Firm, moist, low plasticity. Sand, fine, organics, rootlets. Topsoil.					
						0.30											0.5			St					0.30m: Clayey SILT; brown. Stiff, moist, low plasticity. Suspected small fragments of charcoal.		
						1.00											1.0								1.00m: Silty CLAY; brown. Stiff, moist, medium plasticity.		
						1.60		100	SPT								1.5									1.60m: Clayey SILT; brown. Stiff, moist, low plasticity. Silt, slow dilatancy.	
						1.95											2.0									1.95m: CORE LOSS. 1.95 - 2.25.	
						2.25		80	HQTT									2.5									2.25m: Clayey SILT; brown. Stiff, moist, low plasticity.
						2.60												3.0			VSt						2.60m: Clayey SILT; yellowish brown. Very stiff, moist, low to medium plasticity.
						3.30		100	SPT									3.5									3.30m: Clayey SILT; light brown. Very stiff, moist, medium plasticity. Suspected small fragments of charcoal.
						4.00		100	HQTT									4.0									
						4.50												4.5				F					4.50m: Silty CLAY; light brown mottled black. Firm, moist, medium plasticity. Suspected small fragments of charcoal.
Walton Subgroup																											
COMMENTS: Hole backfilled with bentonite																											
Hole Depth		27.45m																									

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 2 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL										ENGINEERING DESCRIPTION																																			
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION										Description and Additional Observations																																			
										FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (kPa)		DEFECT SPACING (mm)									
										25 50 75 100		100		100		100																													
Walton Subgroup														100		HQTT						● 75/25 kPa 1/1 1/1 1/2 N=5				40				M		Fr								5.00m: Silty CLAY; light brown mottled black. Firm, moist, medium plasticity. Suspected small fragments of charcoal.					
														100		SPT										39				5.5				St								5.30 - 5.40m: Minor sand, fine to coarse.			
														100		SPT												6.0														5.40m: Silty CLAY; reddish brown mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.			
														100		SPT												6.5														5.70 - 5.90m: Becomes wet, very soft. light greyish brown. Grades to stiff.			
														100		HQTT												7.0														6.40m: Silty CLAY; brownish orange mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.			
														100		SPT												7.5						S-F								7.50m: Clayey SILT; yellowish brown mottled black. Soft to firm, moist, low plasticity. Suspected small fragments of charcoal.			
														100		HQTT												8.0																8.50m: Sandy SILT, minor clay; light brown mottled black. Firm, moist, low plasticity.	
														100		HQTT												8.5																8.90m: Clayey SILT; light brown mixed with some black. Stiff, moist, low plasticity. Suspected small fragments of charcoal.	
														100		PT												9.0								St								9.00m: Pushtube. Material observed as Clayey SILT as above.	
														100		SPT												9.5																9.50m: Silty CLAY; light yellowish brown. Stiff, moist, high plasticity.	

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 3 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																		
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)		WATER	CORE RECOVERY (%)		METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations																																																																																																																																																																																																																																																																																																																																																																																																		
	50 100 150	200 300 400					10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200												1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500																																																																																																																																																																																																																																																																																																																																																																																																
Walton Subgroup	Box 3, 7.1-11.4m			100	100	HQTT		● 56/28 kPa 1/1 1/1 0/2 N=4		35	10.5		M	St				10.00m: Silty CLAY; light brown. Stiff, moist, high plasticity.																																																																																																																																																																																																																																																																																																																																																																																																		
				100	100	SPT												34	11.0		F	10.95m: Silty CLAY; light brown mottled orange. Firm, moist, medium plasticity.																																																																																																																																																																																																																																																																																																																																																																																														
				100	HQTT	33																	11.5		St	11.70m: Clayey SILT; light brown mottled orange. Firm, moist, medium plasticity.																																																																																																																																																																																																																																																																																																																																																																																										
				100	SPT																						32	12.0		MD	12.00m: SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.																																																																																																																																																																																																																																																																																																																																																																																					
				66	HQTT																											31	12.5		St	12.45m: CORE LOSS. 12.45 - 12.80.																																																																																																																																																																																																																																																																																																																																																																																
				100	PT																																14.0		VS	12.80m: SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.																																																																																																																																																																																																																																																																																																																																																																												
				77	SPT																																				14.5		St	13.40m: Sandy SILT; dark brown. Medium dense, moist, dilatant - rapid. Sand, fine to coarse. 13.50m: Pushtube, Material observed to be Sandy SILT as above.																																																																																																																																																																																																																																																																																																																																																																								
				100	HQTT																																								18/05/2021																																																																																																																																																																																																																																																																																																																																																																							

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 4 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION														
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (kPa)	DEFECT SPACING (mm)	Description and Additional Observations
Walton Subgroup	Box 4, 11.4-16.3m		100	PT		1/1 0/1 2/2 N=5		30								15.00m: Pushtube, Material observed to be SILT, some clay, minor sand; light brown mottled black. Moist, low plasticity.
			100	SPT						15.5	W	F			15.50m: SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal.	
			100	HQTT						16.0						
			100							16.5					16.50m: CORE LOSS. 16.5 - 16.9m.	
		11	SPT						17.0	L				16.90m: SILT, minor sand; light brown mottled black. Loose, wet, dilatant - rapid. Sand, fine. Suspected small fragments of charcoal.		
		100	HQTT						17.5							
								● 39/6 kPa 0/0 0/0 0/0 N=0	18.0	F				17.70m: SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal. 17.80m: Clayey SILT; greyish white mottled black. Firm, wet, medium plasticity. Silt, slow dilatancy.		
		100	SPT						18.5	S-F				18.10m: SILT, some clay, minor sand; brown. Soft to firm, wet, medium plasticity. Sand, fine to coarse. Pumiceous.		
									19.0							
		100	HQTT						19.5	St				19.40m: Clayey SILT; greyish white mottled black. Stiff, wet, medium plasticity.		
					● 98/25 kPa 1/2 2/2 2/5 N=11				MD			19.60m: SILT, some clay, minor sand; light brown mottled black. Medium dense, wet, dilatant - rapid. Sand, fine to coarse, pumiceous.				

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 5 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)		WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (kPa)	DEFECT SPACING (cm)	Description and Additional Observations
	25 15 5	15 5															
Walton Subgroup				100	HQTT		● 64/11 kPa 2/3 2/3 5/7 N=17			25		W	St				20.00m: SILT, some clay, trace sand; greyish white mottled black. Stiff, wet, low plasticity. Sand, fine to coarse. Pumiceous.
										20.5			F				20.40m: SILT, some clay; greyish white mottled with some black. Firm, wet, low plasticity.
				100	SPT					21.0			St				21.00m: SILT, some clay; grey. Stiff, wet, low plasticity.
										21.5							
				100	HQTT					22.0							
							● 84/14 kPa 1/1 0/0 0/0 N=0			22.5			M				22.10m: SILT, minor sand; light brown mottled orange. Stiff, moist, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous.
				100	SPT					23.0							22.50m: CORE LOSS. 22.5 - 22.8m.
										23.5			W	VS			22.80m: SILT, minor sand and minor gravel; light brown mottled orange. Very soft, wet, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous; gravel, fine, sub-rounded to sub-angular.
				85	HQTT					24.0							22.95m: CORE LOSS. 22.95 - 23.1m.
										24.5				F			23.10m: SILT, trace sand; light brown mottled orange. Very soft, wet, low plasticity. Silt, rapid dilatancy; sand, fine, pumiceous.
			100	SPT		1/0 0/0 0/0 N=0			21							23.50m: SILT, minor sand, trace gravel; light brown mottled orange. Firm, wet, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous; gravel, fine, sub-rounded to sub-angular.	
																	24.50 - 24.70m: Becomes sandy.

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 6 OF 6

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000																															
CO-ORDINATES:		5814995.96 mN (NZTM2000) 1795095.18 mE		DRILL TYPE: Tractor Rig		HOLE STARTED: 18/05/2021																																	
R.L.:		45.24m		DRILL METHOD: RC		HOLE FINISHED: 19/05/2021																																	
DATUM:		NZVD2016		DRILL FLUID: WATER		LOGGED BY: CAND		CHECKED: RWOT																															
GEOLOGICAL						ENGINEERING DESCRIPTION																																	
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (MPa)		DEFECT SPACING (cm)		Description and Additional Observations					
Walton Subgroup		Box 7, 23.5-27.0m		100		HQTT		44		SPT		4/6 6/4 5/5 N=20		20		25.5		26.0		19		26.5		27.0		18		27.5		28.0		28.5		29.0		29.5		27.45m: Target depth	

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

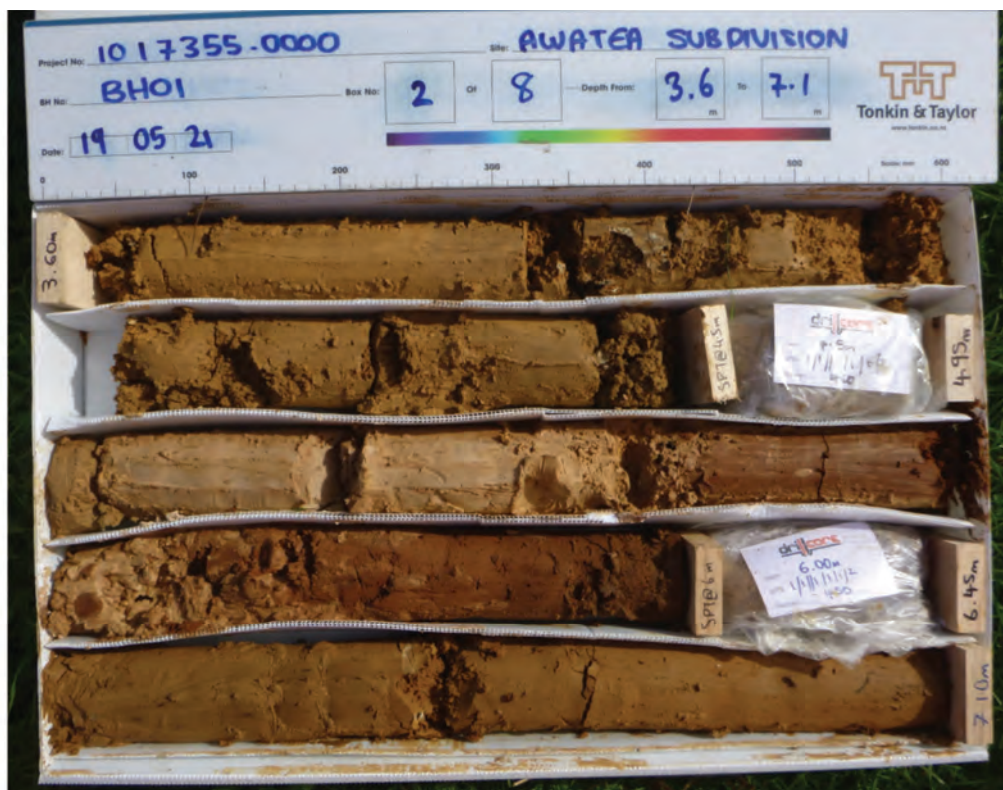
CORE PHOTOS

BOREHOLE No.: BH101
Hole Location: Southern hill
SHEET: 1 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



0.00-3.60m



3.60-7.10m

CORE PHOTOS

BOREHOLE No.: BH101
Hole Location: Southern hill
SHEET: 2 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



7.10-11.40m



11.40-16.30m

CORE PHOTOS

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 3 OF 4

PROJECT: Brymer Farms Subdivision		LOCATION: 584 Whatawhata Rd, Temple View		JOB No.: 1017355.0000	
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE		DRILL TYPE: Tractor Rig		HOLE STARTED: 18/05/2021	
R.L.: 45.24m		DRILL METHOD: RC		HOLE FINISHED: 19/05/2021	
DATUM: NZVD2016		DRILL FLUID: WATER		DRILLED BY: Drillcore	
				LOGGED BY: CAND	
				CHECKED: RWOT	



16.30-19.50m

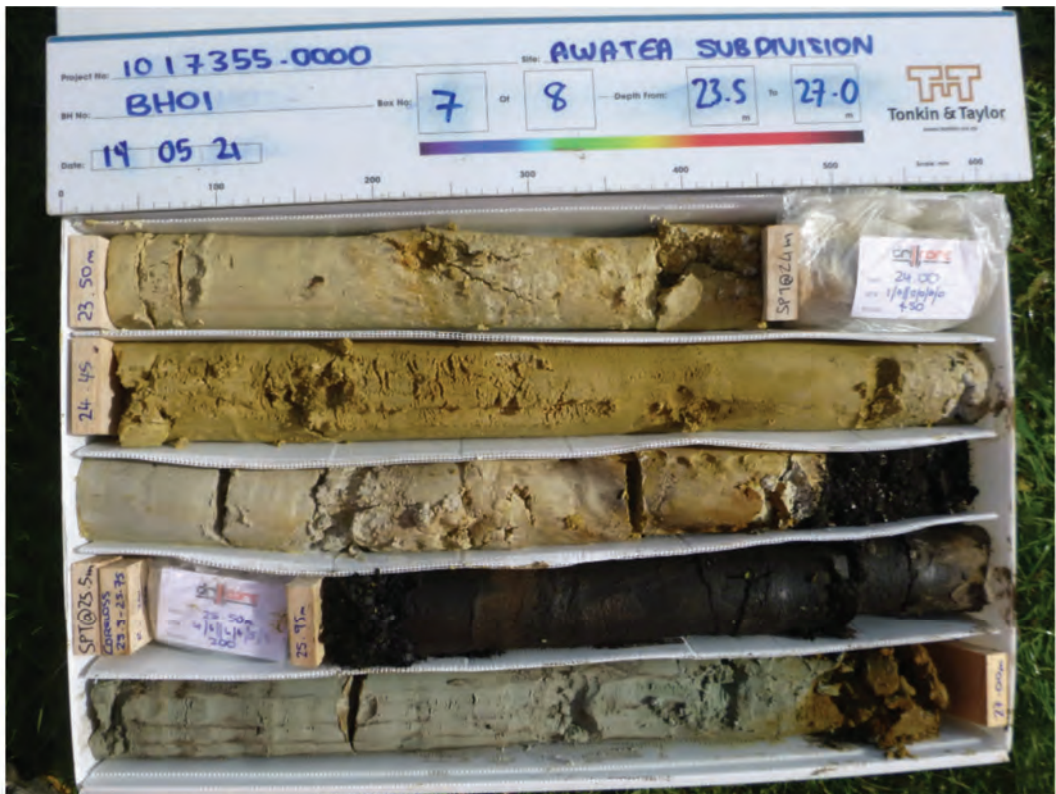


19.50-23.50m

CORE PHOTOS

BOREHOLE No.: BH101
Hole Location: Southern hill
SHEET: 4 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



23.50-27.00m



27.00-27.45m

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 1 OF 4

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000							
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE				DRILL TYPE: Tractor Rig				HOLE STARTED: 17/05/2021							
R.L.: 26.99m				DRILL METHOD: RC				HOLE FINISHED: 18/05/2021							
DATUM: NZVD2016				DRILL FLUID: WATER				DRILLED BY: Drillcore							
								LOGGED BY: CAND							
								CHECKED: RWOT							
GEOLOGICAL				ENGINEERING DESCRIPTION											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.				Description and Additional Observations											
Piako Subgroup															

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 2 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																																	
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (MPa)		DEFECT SPACING (cm)		Description and Additional Observations			
Piako Subgroup	Box 1, 0.0-5.5m	0.5		0.5		100		HQTT				● 86/25 kPa				5.5						W		VSt								5.00m: Clayey SILT; light greenish grey. Very stiff, wet, medium to high plasticity.			
						100		HQTT						21		6.0								MD								5.50m: SILT, minor sand; light greenish grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.			
						100		SPT				3/6 7/8 8/7 N=30				6.5																6.60m: Fine to coarse SAND, minor silt; light greenish grey. Medium dense to dense, wet. Sand, well graded.			
						100		HQTT						20		7.0								VSt								7.00m: SILT, minor sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.			
												7/11 11/11 11/11 N=44				7.5								MD								7.10m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments.			
						66		SPT								19		8.0								D								7.30m: SILT, trace sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.	
																18		8.5								VSt								7.50m: CORE LOSS. 7.5 - 7.65m.	
						100		HQTT										9.0						M		D								7.65m: SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.	
														4/6 10/10 10/10 N=40				9.5						W		VSt								8.10m: Clayey SILT, minor organics; dark brownish black. Very stiff, wet, low to medium plasticity. Organics, wood fragments. Amorphous.	
																										D								8.50m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Fine to coarse sand observed at top and bottom of layer. Brown in colour.	
Hinuera Formation						100		SPT																M		VSt								8.70m: SILT, minor sand; light grey. Dense, moist, dilatant - rapid. Sand, fine.	
																																9.00m: SILT, some organics, minor sand; dark brownish black. Dense, wet, dilatant - rapid. Sand, fine to medium; organics, wood fragments. Amorphous.			
																								D								9.30m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments. F-C Sand observed at top and bottom of layer. Brown.			
																																9.50m: SILT, minor sand; light grey. Dense, wet, non-plastic. Silt, rapid dilatancy; sand, fine.			
																																9.70m: Clayey SILT; light greenish grey. Very stiff, moist, medium plasticity.			

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.

Hole Depth
18.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 3 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																		
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)		WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOSTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations		
Hinuera Formation	Box 3, 8 & 12.5m	0.5											W	D	10	1	20		10.00m: SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.	
		1.5			100	HQTT		1/5 4/6 5/7 N=22		10.5			VSt		25	5	100		10.40m: Clayey SILT; light grey. Very stiff, wet, medium plasticity.	
		2.5			100	SPT							D		30	10	200		10.50m: Sandy SILT; light grey. Dense, wet, dilatant - rapid. Sand, fine.	
		3.5								16	11.0					40	20	300		11.10 - 11.50m: Minor sand, fine.
		4.5			100	HQTT								VSt		50	30	400		11.50m: SILT, some clay; light grey. Very stiff, wet, medium plasticity.
		5.5						● 195/31 kPa 2/3 3/4 6/6 N=19		15	12.0					60	40	500		
		6.5			100	SPT										70	50	600		12.45m: CORE LOSS. 12.45 - 12.70m.
		7.5			76	HQTT					14	13.0		MD		80	60	700		12.70m: Fine to coarse SAND, minor silt. Medium dense, wet. Sand, well graded.
		8.5						2/1 1/3 4/6 N=14								90	70	800		13.95m: Silty fine to coarse SAND. Medium dense, wet. Sand, well graded.
		9.5			100	SPT					13	14.0				100	80	900		14.20 - 14.50m: Sand grades to fine. Poorly graded.
Walton Subgroup		10.5												St					14.50m: Clayey SILT; light grey. Stiff, wet, medium plasticity.	
		11.5																	14.90 - 15.00m: Colour changes to greyish black, organics, wood fragments (decomposed).	

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.

Hole Depth
18.45m

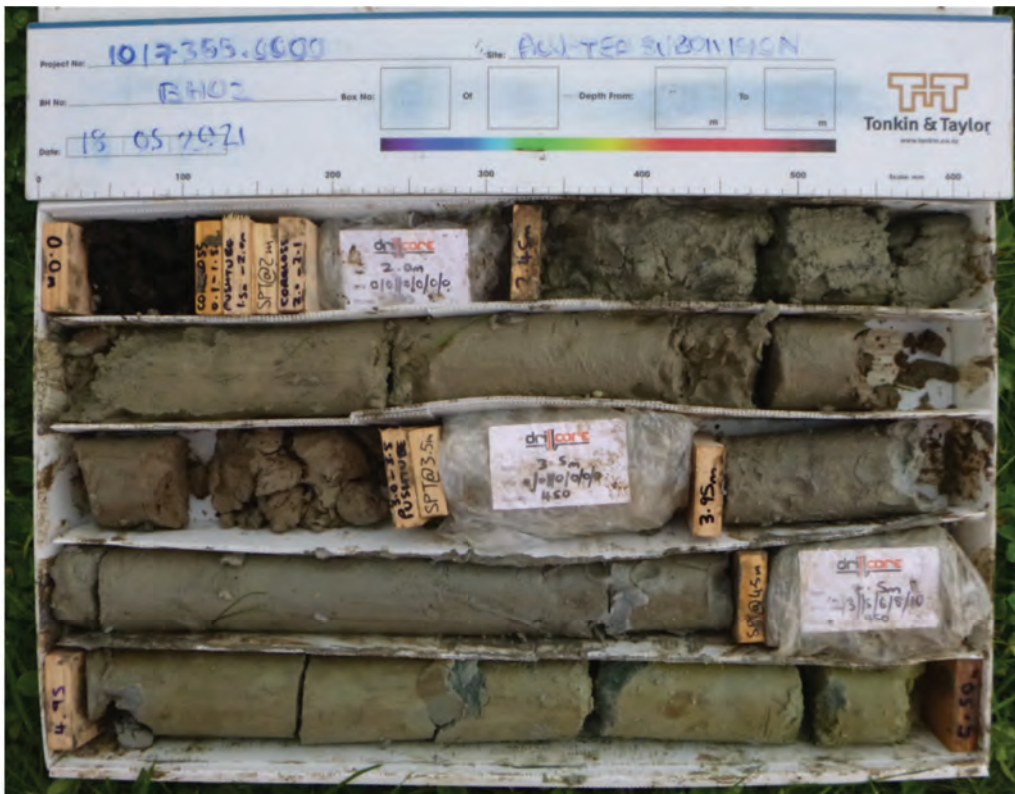
Scale 1:25

Rev.: A

CORE PHOTOS

BOREHOLE No.: BH102
Hole Location: Central lying low lands
SHEET: 1 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



0.00-5.50m



5.50-8.80m

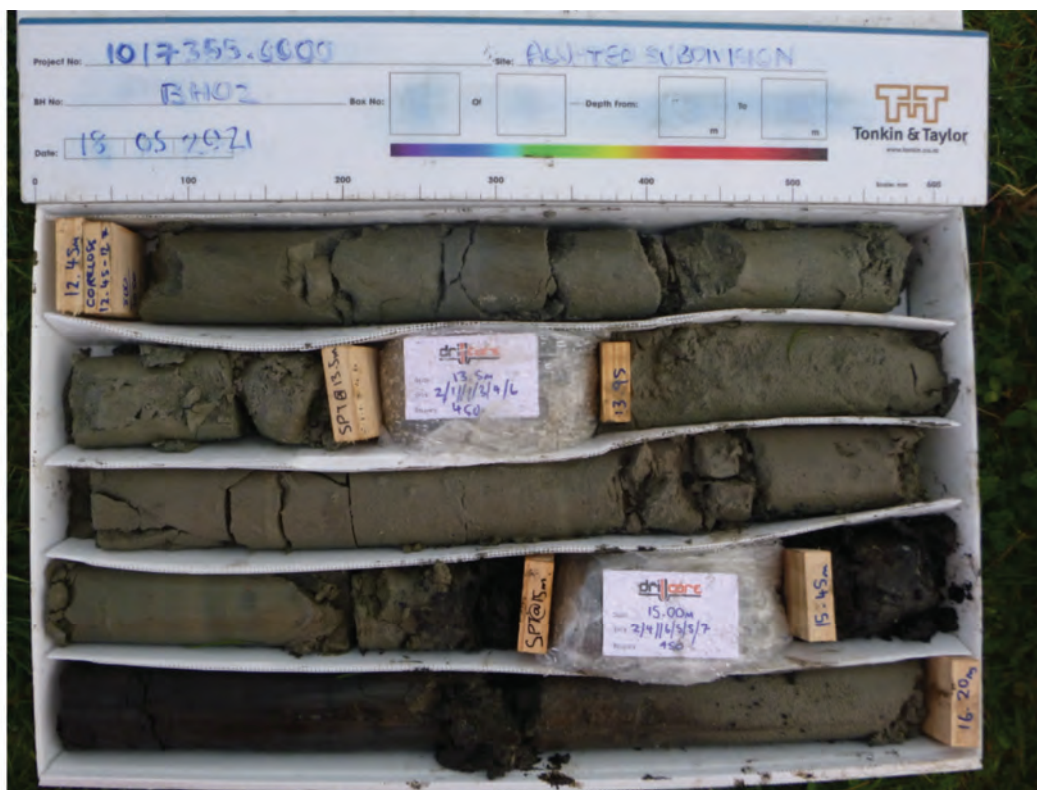
CORE PHOTOS

BOREHOLE No.: BH102
Hole Location: Central lying low lands
SHEET: 2 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



8.80-12.45m



12.45-16.20m

CORE PHOTOS

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 3 OF 3

PROJECT: Brymer Farms Subdivision		LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: (NZTM2000)	5815510.15 mN 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.:	26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
			LOGGED BY: CAND
			CHECKED: RWOT



16.20-18.45m

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 1 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																													
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION		FLUID LOSS (%)		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (kPa)		DEFECT SPACING (cm)		Description and Additional Observations	
Colluvium Deposits		25		100		HQTT								0.5		TS		M		FI										0.00m: Clayey SILT, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets.	
		25		100		HQTT						30																		0.30m: Clayey SILT, minor sand, trace gravel; brown. Firm, moist, medium plasticity. Sand, fine to coarse; gravel, fine.	
		25		100		HQTT																								0.70m: Silty CLAY; brown mottled grey. Firm, moist, high plasticity.	
		25		100		HQTT																								0.80 - 1.50m: Grades to low plasticity, some sand. Sand is fine to coarse.	
		25		100		PT																								1.40 - 1.50m: Observed as minor clay, wet, rapid dilatancy. Grades to very soft.	
		25		100		SPT																								1.50m: Pushtube. Material observed as Silty CLAY as above.	
		25		100		SPT																								1.80m: CORE LOSS. 1.8m - 2.0m.	
		25		100		SPT																								2.00m: Clayey SILT, minor sand; grey. Very soft, wet, medium plasticity. Sand, fine to medium.	
		25		100		HQTT																								2.60 - 2.80m: Grades to greenish grey.	
		25		100		SPT																								2.80m: Clayey SILT, trace sand; greenish grey. Firm, wet, low to medium plasticity. Sand, fine to coarse.	
		25		100		HQTT																								3.80m: Silty CLAY; greenish grey. Firm, moist, medium to high plasticity.	
		25		100		SPT																								4.50 - 5.00m: Becomes stiff.	
		25		100		SPT																									

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.

Hole Depth
15m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 2 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (m)	Description and Additional Observations		
Piako Subgroup			100	HQTT		1/1 3/4 3/5 N=15			5.5		W	VL				5.00m: Sandy SILT; light greenish grey. Very loose, wet. Silt, rapid dilatancy; sand, fine to medium.		
			100	SPT				MD					6.00m: Becomes medium dense.					
			100	HQTT								6.20m: Fine to coarse SAND, trace silt; light greenish grey. Medium dense, wet. Sand, well graded.						
Hinuera Formation			100	SPT		3/6 8/8 14/15 N=45			7.5			D				7.20m: Sandy SILT; greenish grey. Dense, wet. Silt, rapid dilatancy; sand, fine to coarse, well graded.		
			100	HQTT									8.00m: Sandy fine GRAVEL; light greenish grey. Dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse.					
													8.80 - 9.00m: Becomes brown, pumiceous.					
			77	SPT			4/5 6/5 5/6 N=22						9.0			MD		9.00m: CORE LOSS. 9.0m - 9.1m.
													9.5				9.10m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.	
															9.45m: CORE LOSS. 9.45m - 9.7m.			
															9.70m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.			

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.

Hole Depth
15m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 3 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL				ENGINEERING DESCRIPTION													
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Hinuera Formation			76	HQTT		4/7 8/8 8/8 N=32			10.5		W	MD					10.00m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
			100	SPT					20			D					10.50 - 10.90m: Becomes Dense.
									11.0			VSt					10.90m: SILT, some clay; green. Very stiff, wet, low plasticity.
																	10.95m: CORE LOSS. 10.95m - 11.2m.
			76	HQTT					11.5		M	D					11.20m: SILT, some clay; green. Very stiff, wet, low plasticity.
									12.0			MD					11.40m: SILT; light grey. Dense, moist, dilatant - rapid. Weakly cemented.
			100	SPT		1/2 6/6 7/7 N=26			19								12.00m: Becomes medium dense.
									12.5		W						12.30m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
																	12.45m: CORE LOSS. 12.45m - 12.65m.
			80	HQTT					13.0								12.65m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
									13.5			D					12.85m: Fine to coarse SAND, some gravel; brown. Medium dense, wet. Gravel, fine to medium, sub-rounded to sub-angular. Pumiceous.
			100	SPT		4/4 6/7 8/10 N=31			17								13.50 - 13.95m: Becomes dense.
									14.0								13.95m: CORE LOSS. 13.95m - 15.00m.
			0	HQTT					14.5								15m: Target depth

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.

Hole Depth
15m

Scale 1:25

Rev.: A

CORE PHOTOS

BOREHOLE No.: BH103
Hole Location: Northern end of site
SHEET: 1 OF 2

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



0.00-3.00m

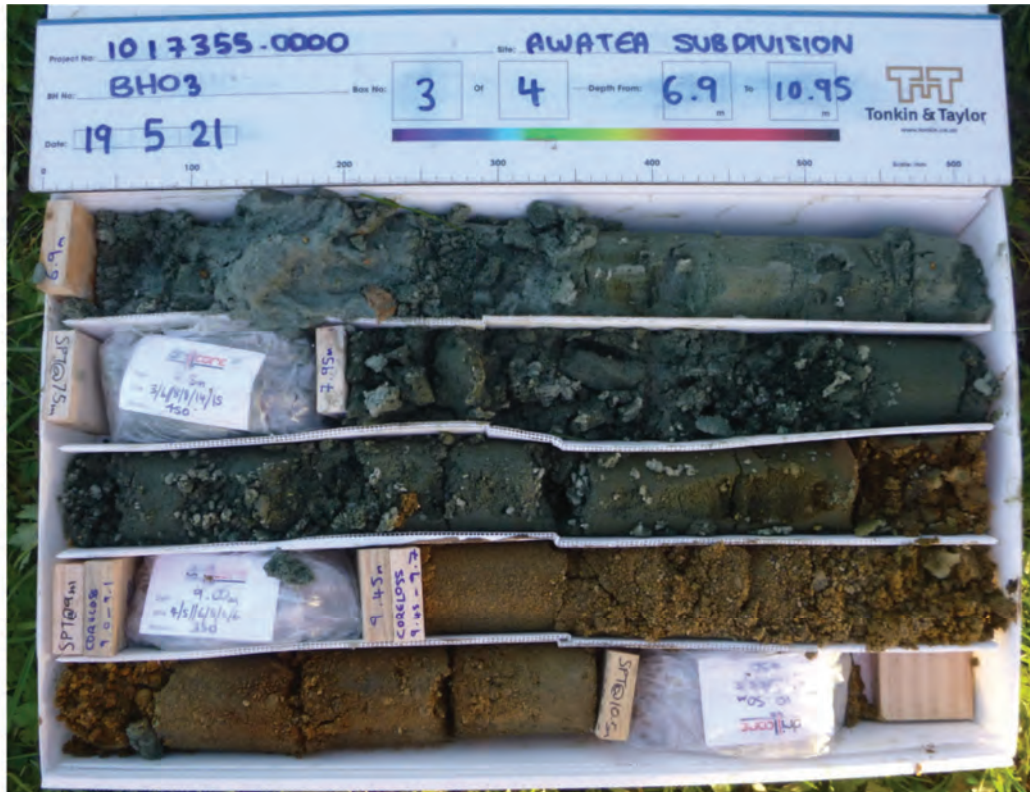


3.00-6.90m

CORE PHOTOS

BOREHOLE No.: BH103
Hole Location: Northern end of site
SHEET: 2 OF 2

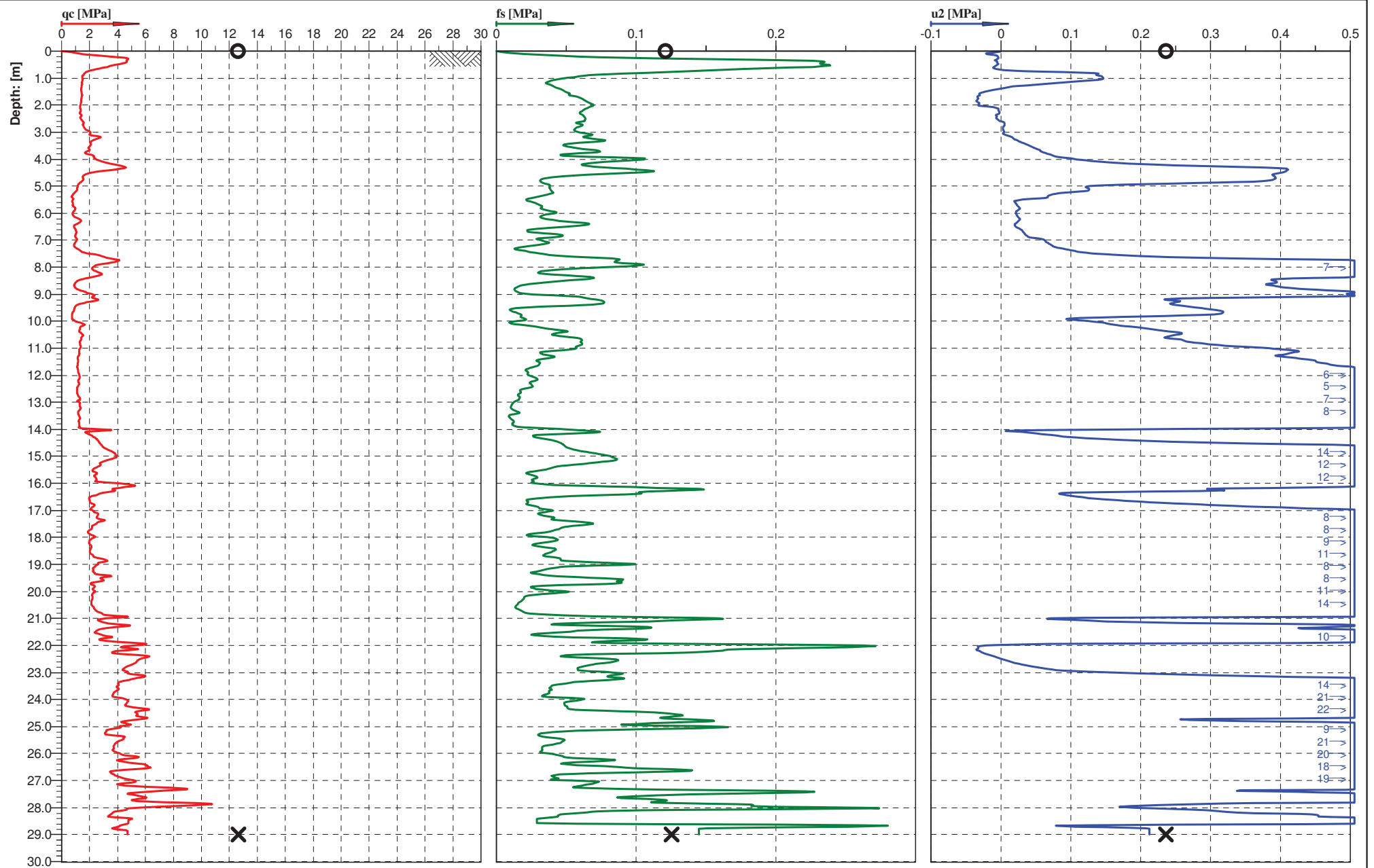
PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



6.90-10.95m



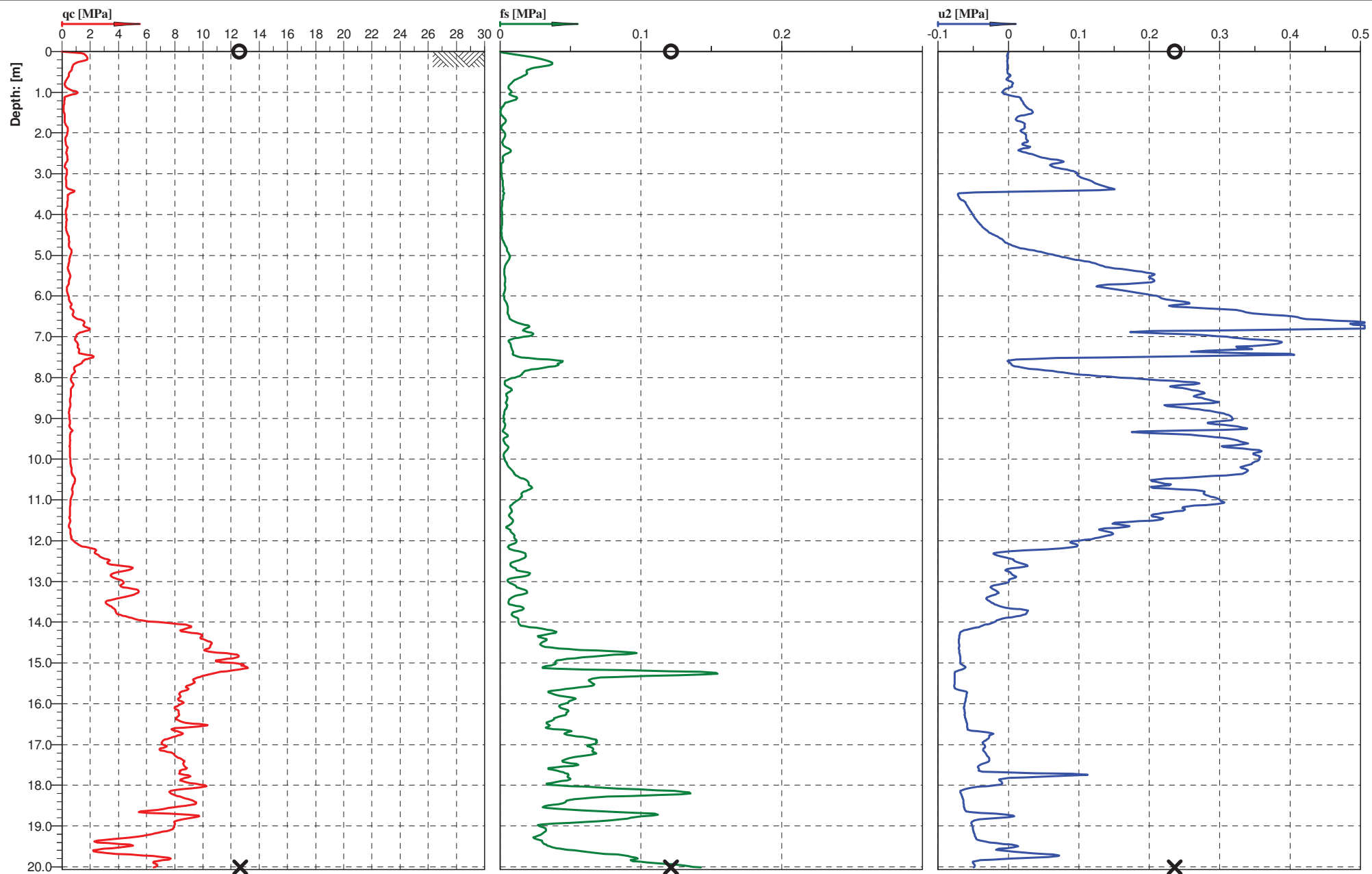
10.95-15.00m



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150



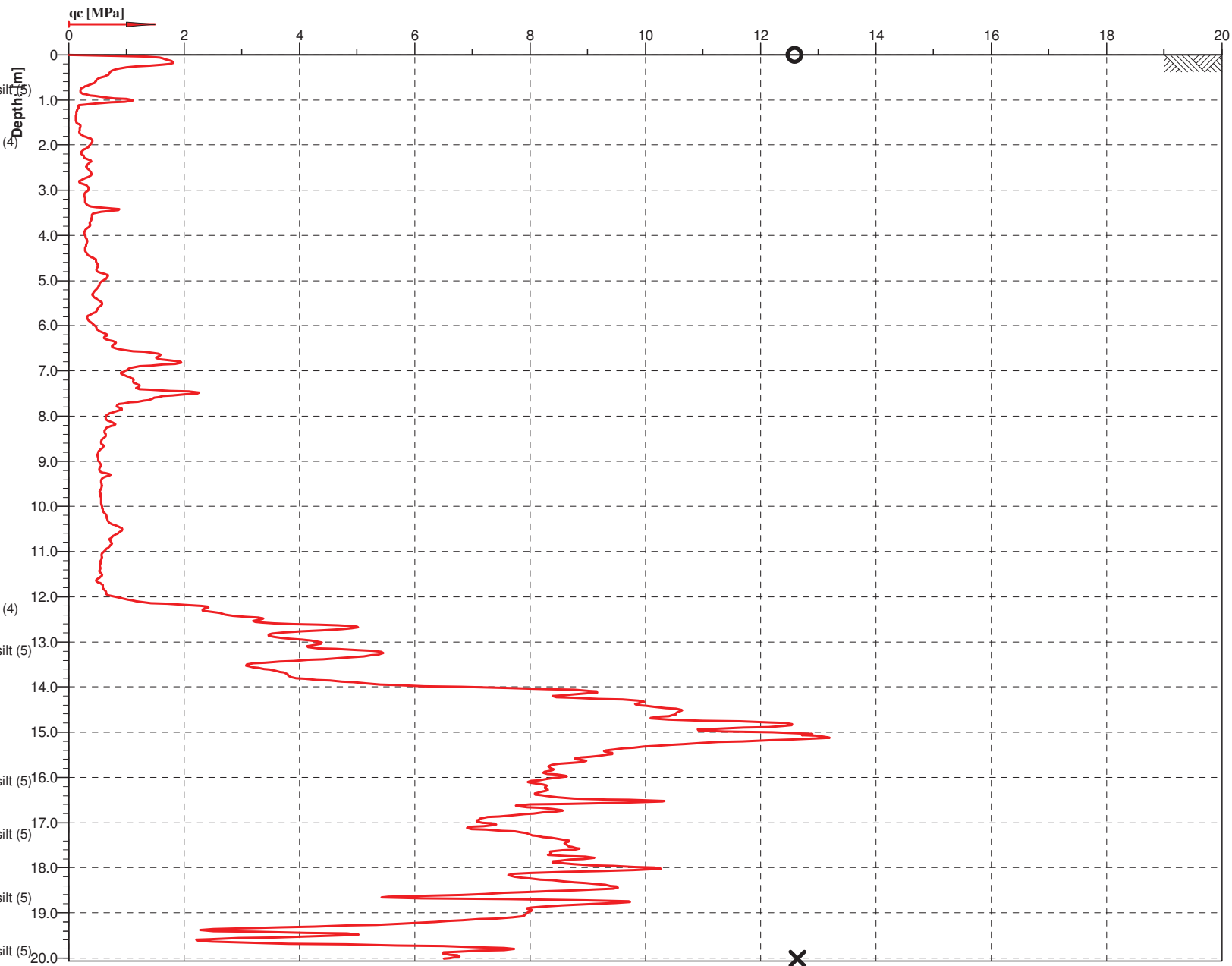
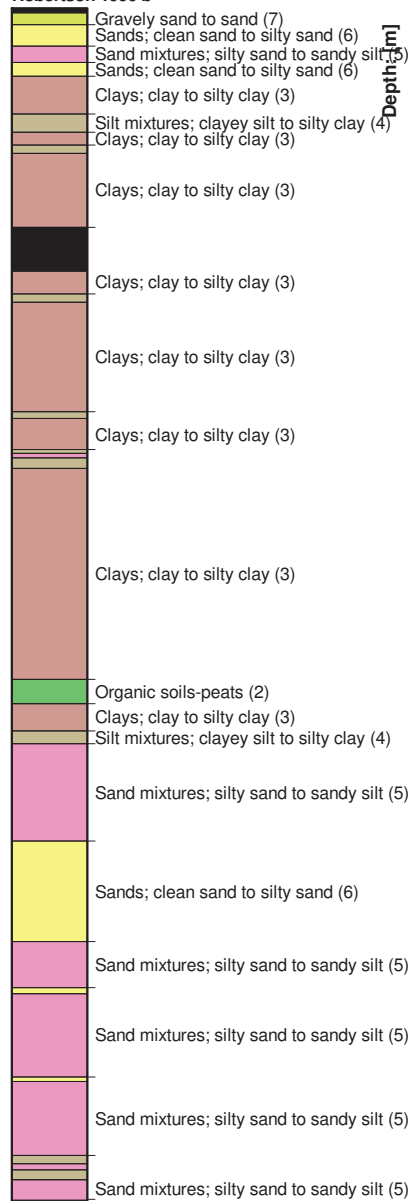
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Project ID:	E1795111 N5814959	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 190
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Tilt out at 27m. Lost signal at 29m. hole dipped and collapsed back to 0.25m.					File: CPT101 .cpt		



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

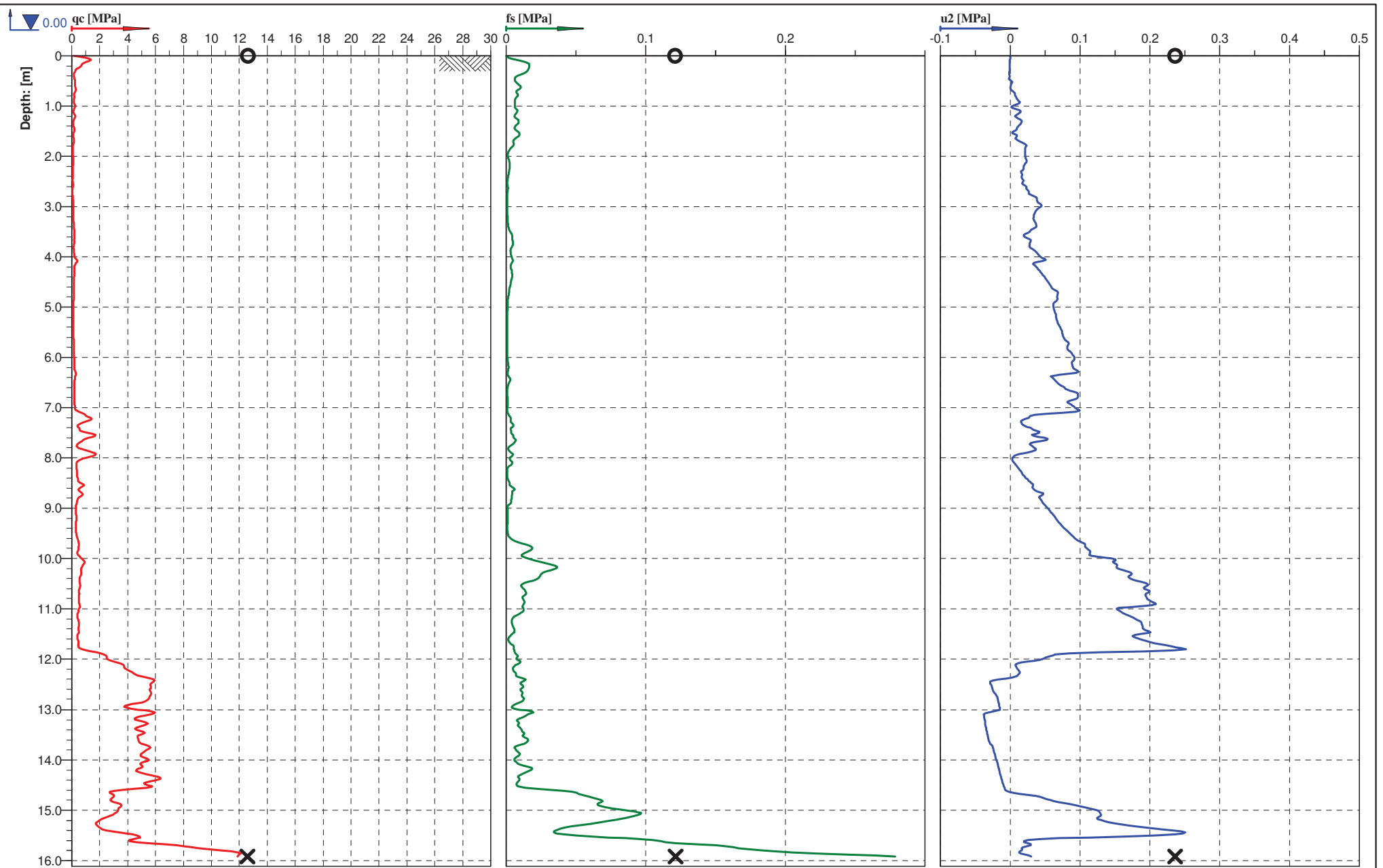
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Project ID:	E1795217 N5814969	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 127
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m. Hole dipped and collapsed back to 0.35m.				File:	CPT102 .cpt		

Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT102
Project ID:	E1795217 N5814969	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 127
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Hole dipped and collapsed back to 0.35m.					File:	CPT102 .cpt	



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

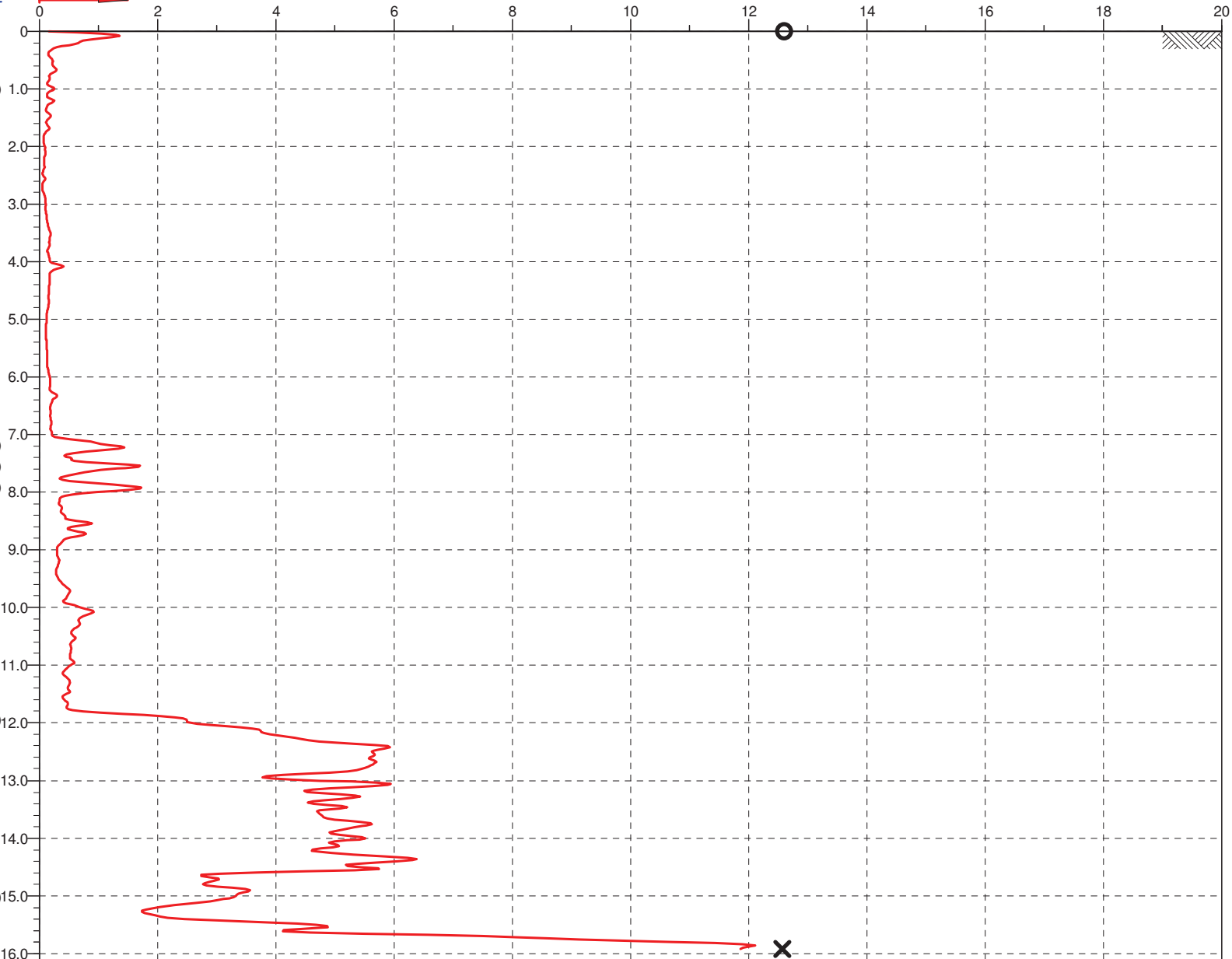
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Project ID:	E1795134 N5815377	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 102
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m. Refused 15.92m. Water level at ground level due to Artesian.				File:	CPT103 .cpt		

Classification by
Robertson 1990 b



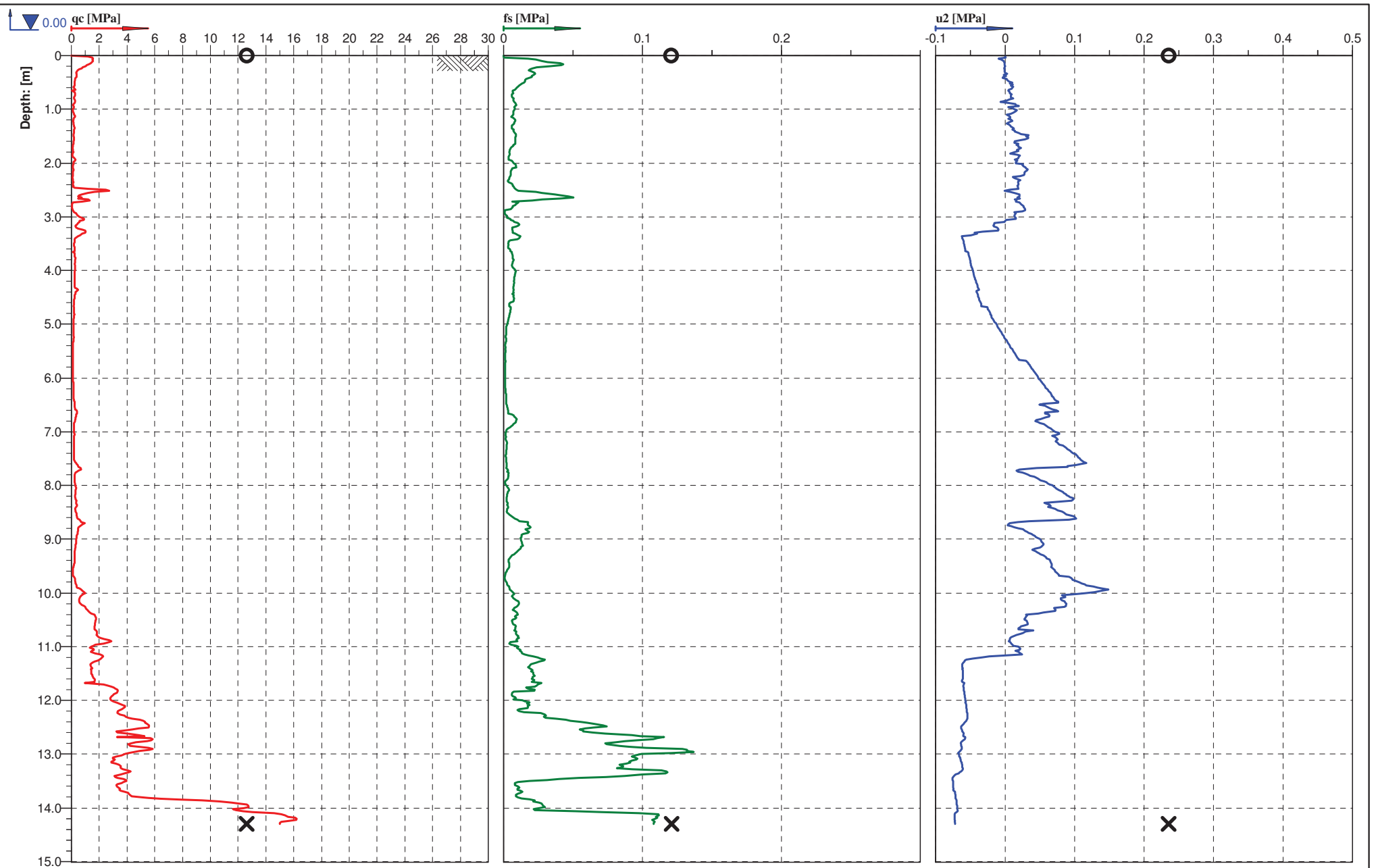
0.00 q_c [MPa]

Depth: [m]



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

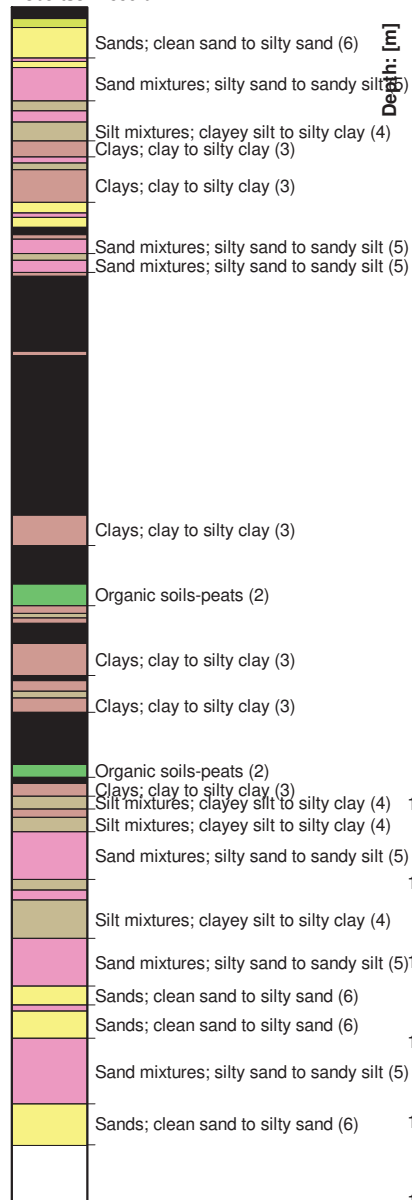
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT103
Project ID:	E1795134 N5815377	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 102
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 15.92m. Water level at ground level due to Artesian.					File:	CPT103 .cpt	



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

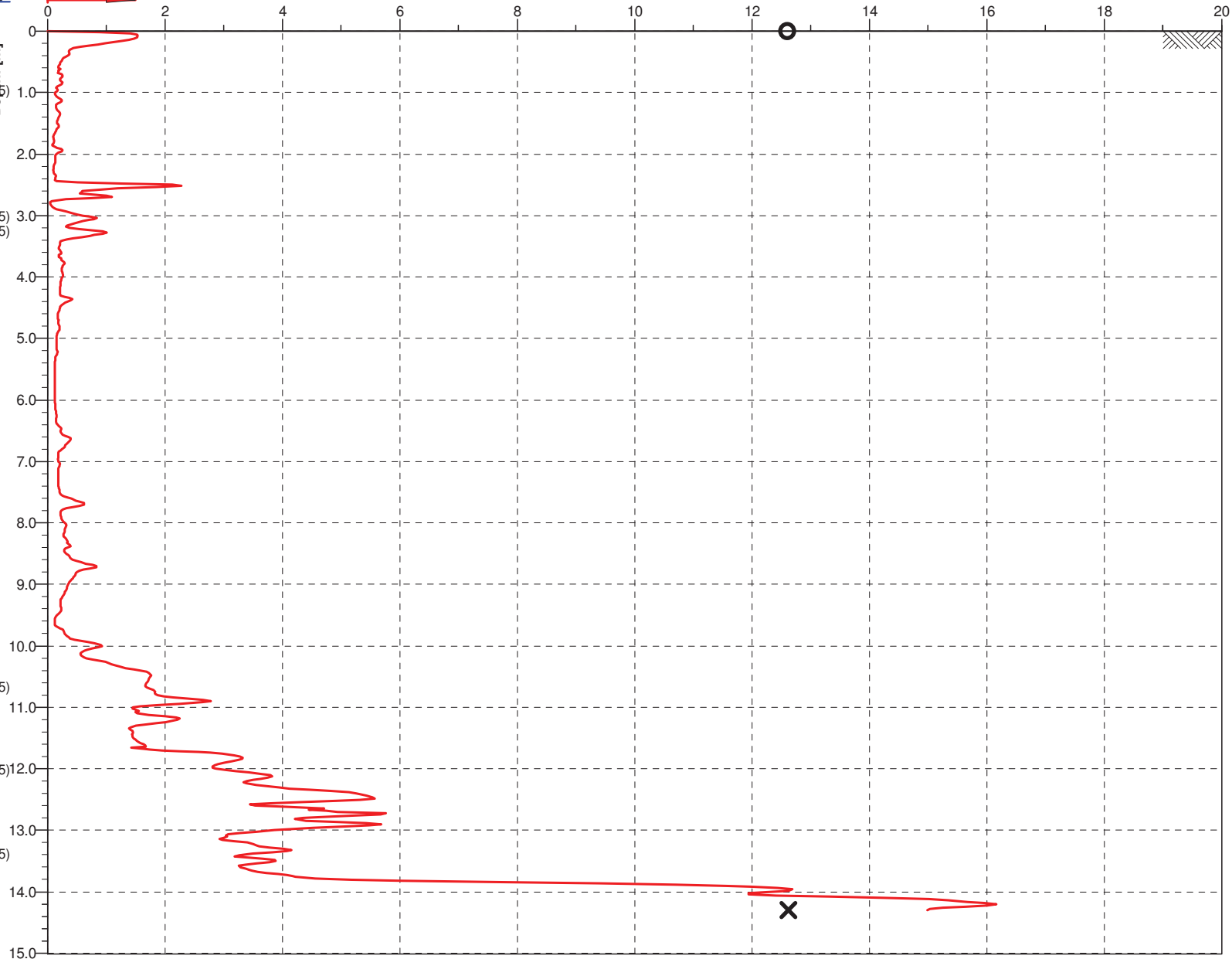
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT104
Project ID:	E1795312 N5815433	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 95
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m. Refused 14.30m. Water at Ground Level due to Artesian.				File:	CPT104 .cpt		

Classification by
Robertson 1990 b



0.00 qc [MPa]

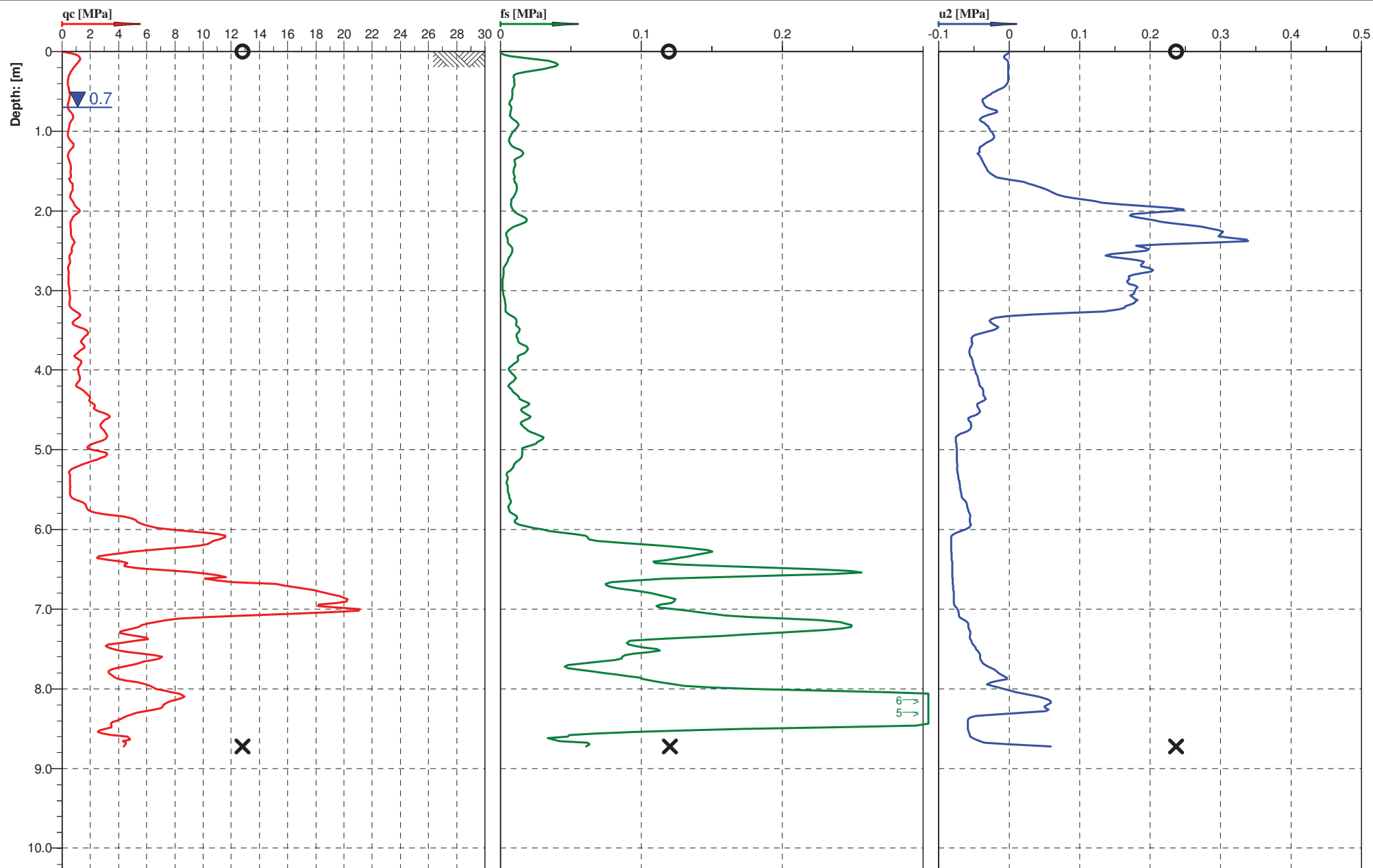
Depth: [m]



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150



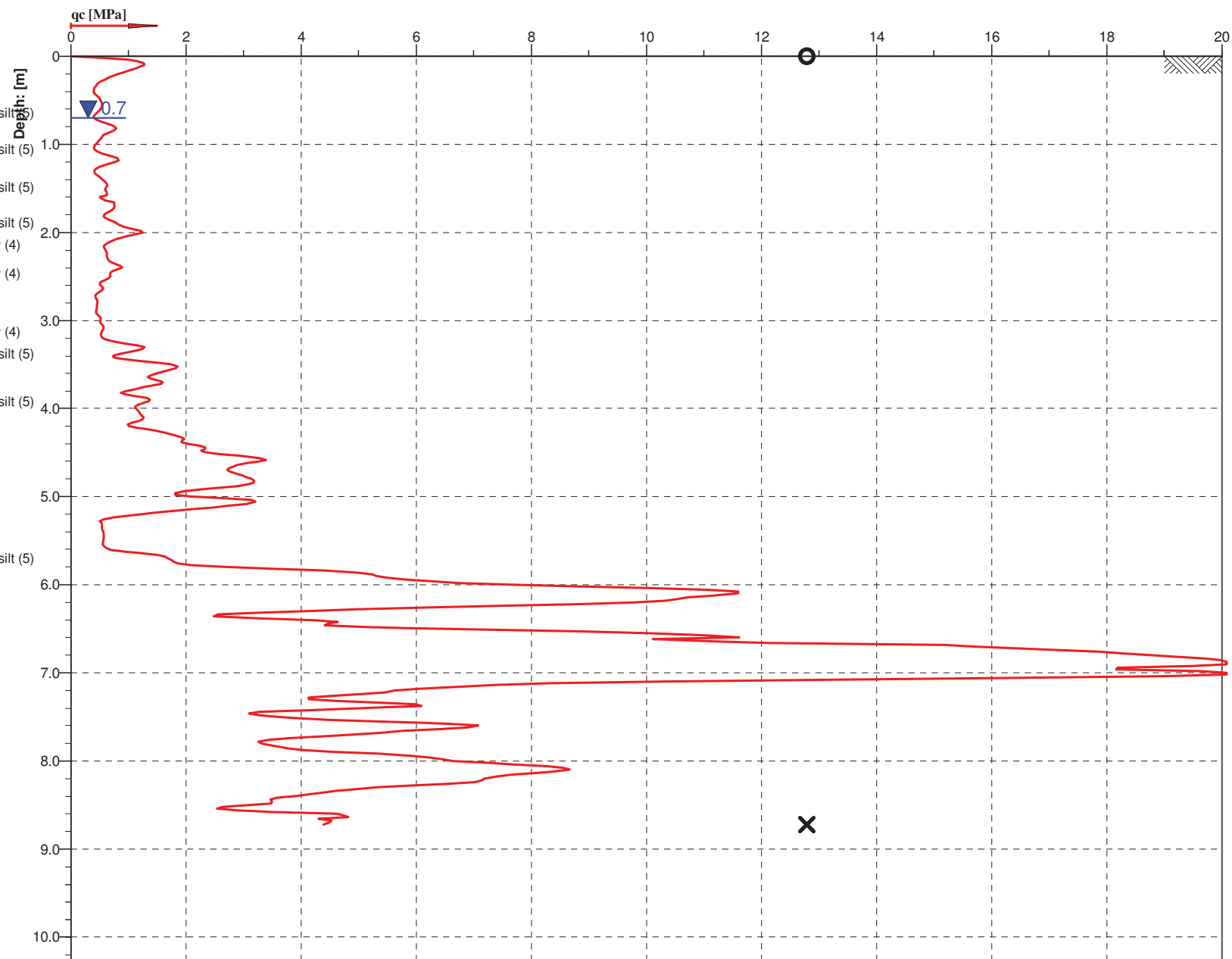
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT104
Project ID:	E1795312 N5815433	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 95
Project:	584 WHATAWHATA ROAD			Page:	2/2	Fig.:	
Target depth 20m. Refused 14.30m. Water at Ground Level due to Artesian.				File:	CPT104 .cpt		



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

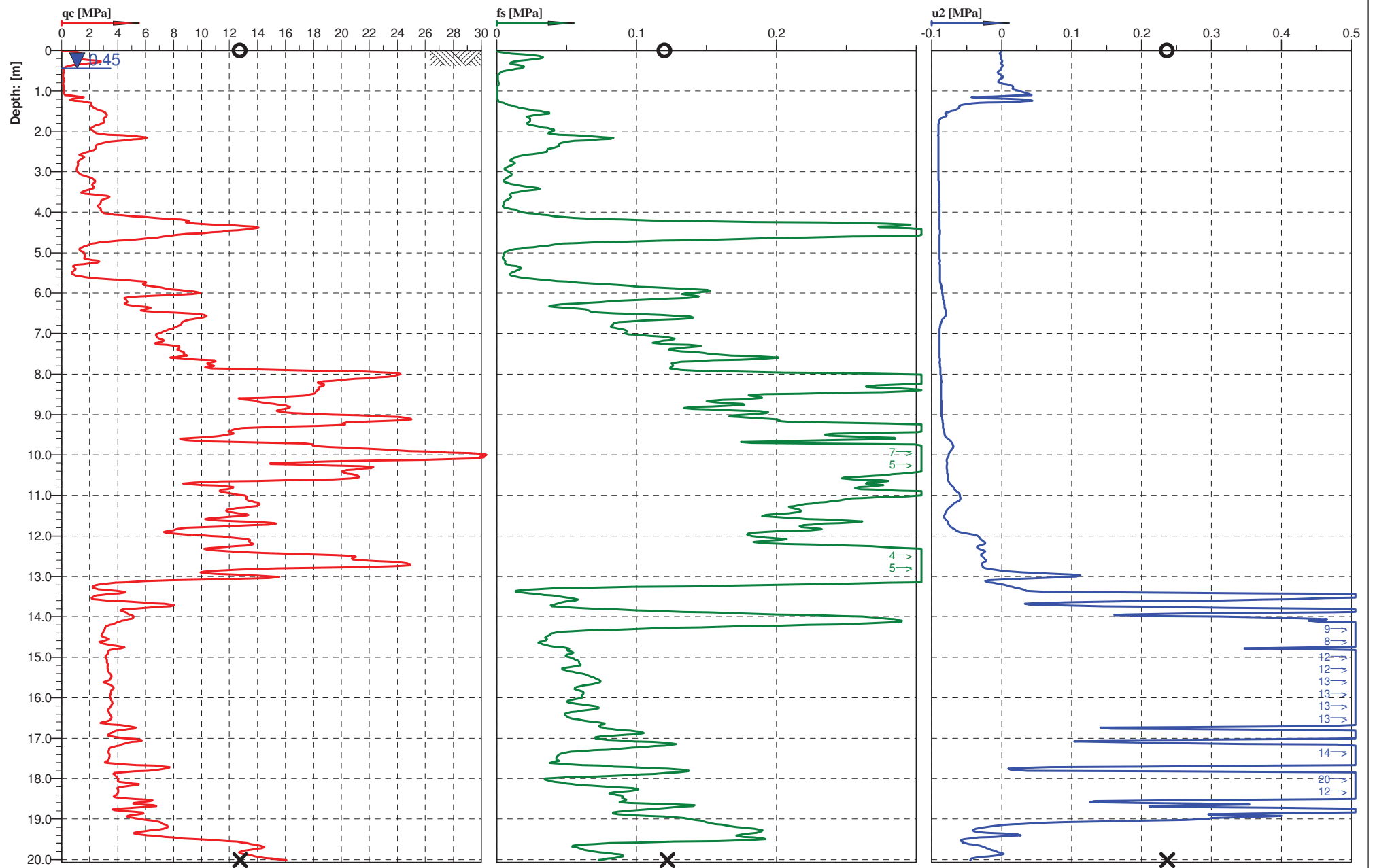
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT105
Project ID:	E1795079 N5815738	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Refused 8.72m.					File:	CPT105 .cpt	

**Classification by
Robertson 1990 b**



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

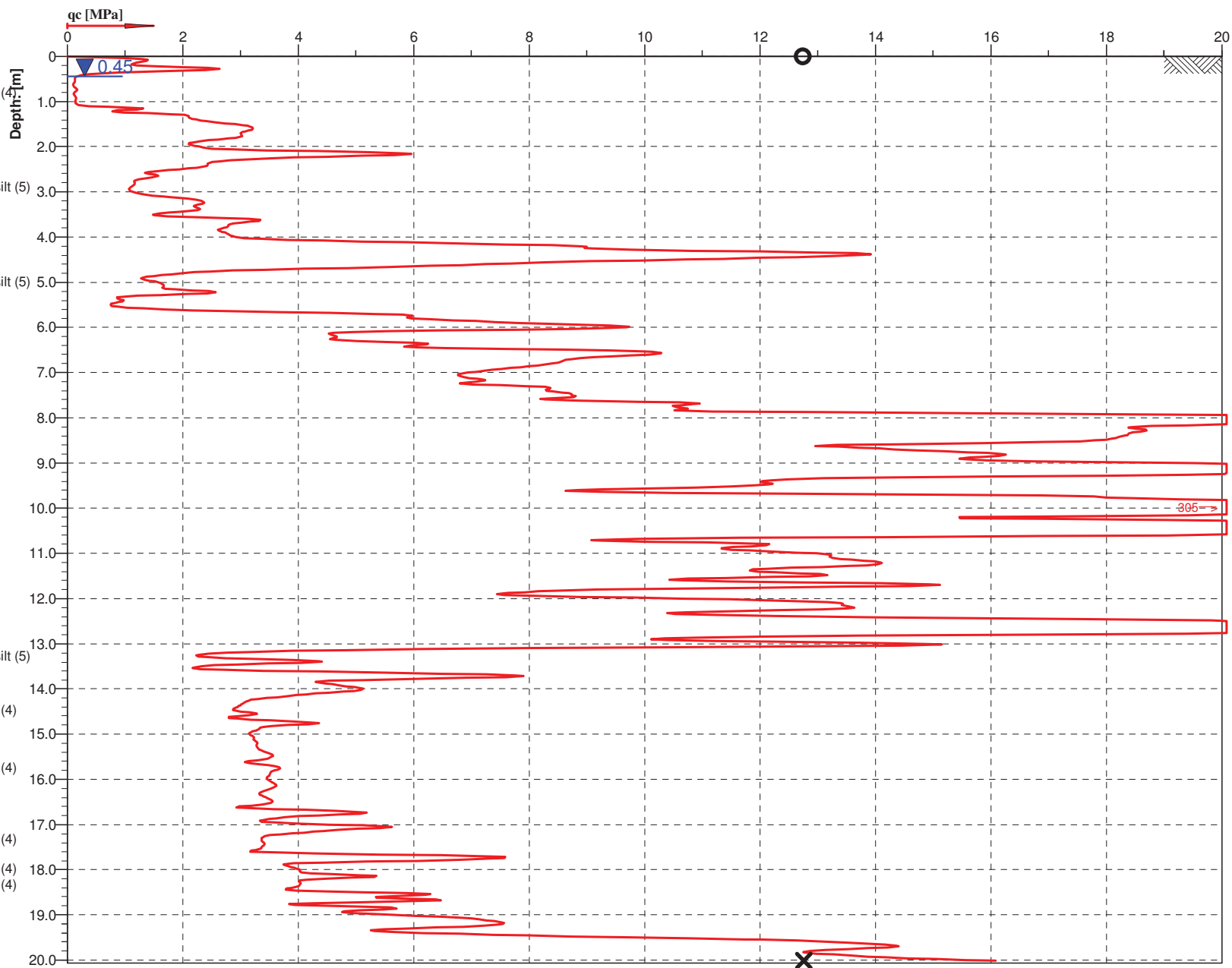
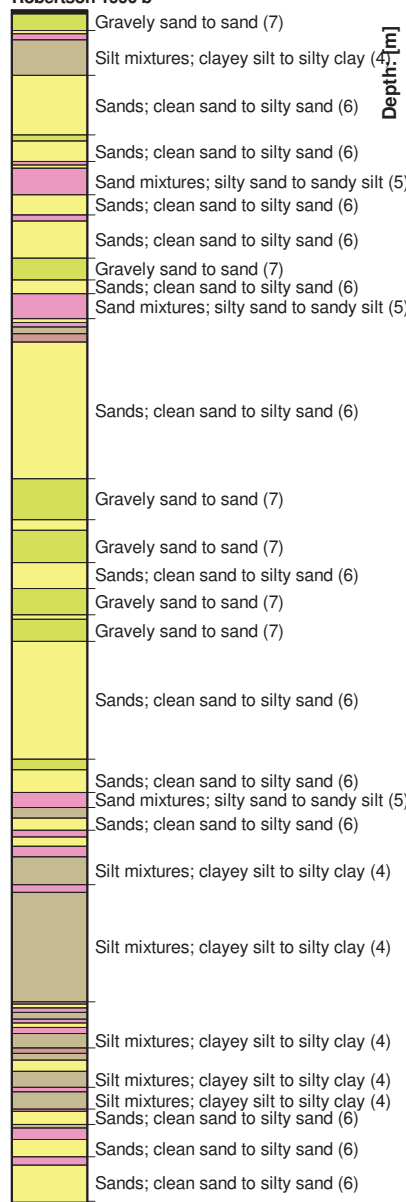
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT105
Project ID:	E1795079 N5815738	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 8.72m.					File:	CPT105 .cpt	



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT106
Project ID:	E1795345 N5815691	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 127
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m.				File:	CPT106 .cpt		

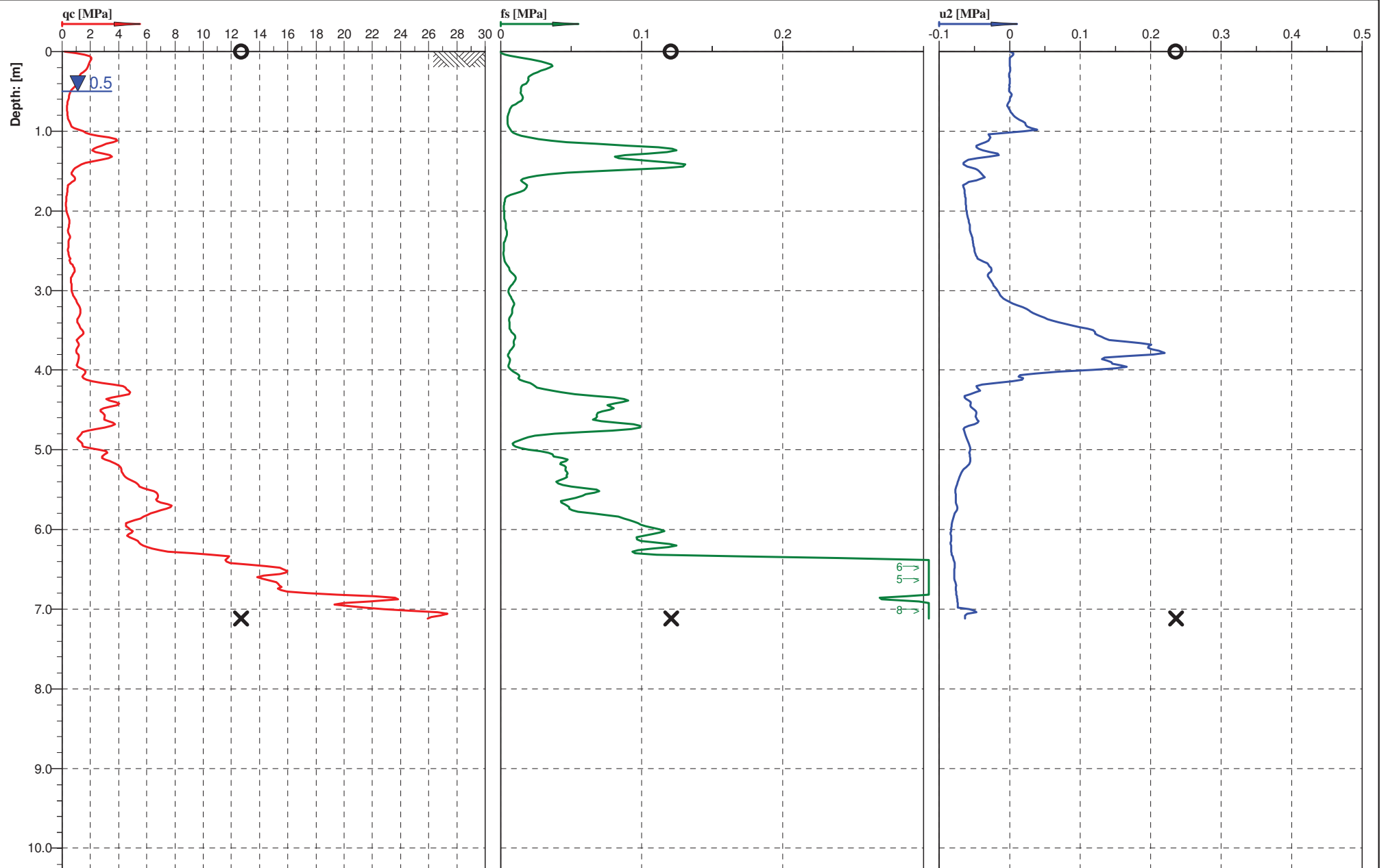
Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150



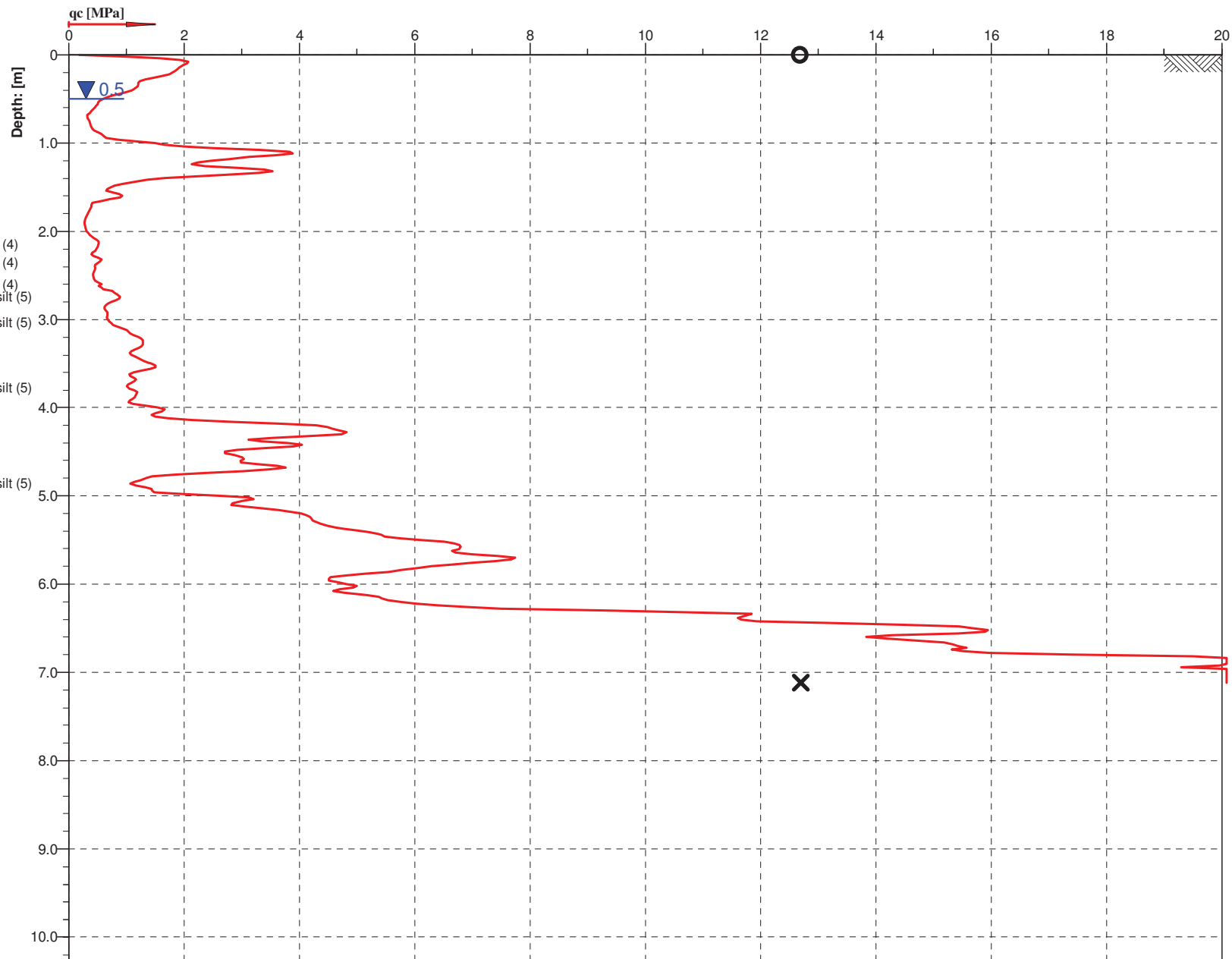
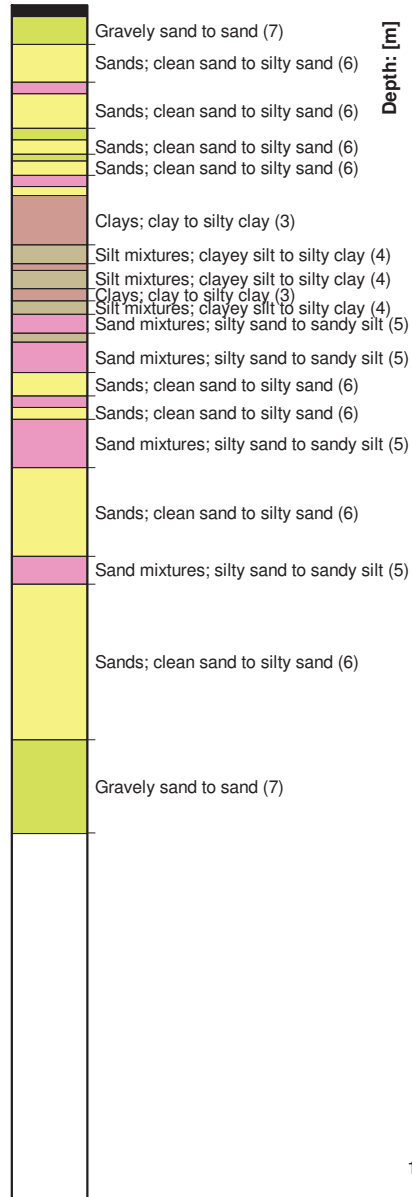
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT106
Project ID:	E1795345 N5815691	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 127
Project:	584 WHATAWHATA ROAD			Page:	2/2	Fig.:	
Target depth 20m.				File:	CPT106 .cpt		



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

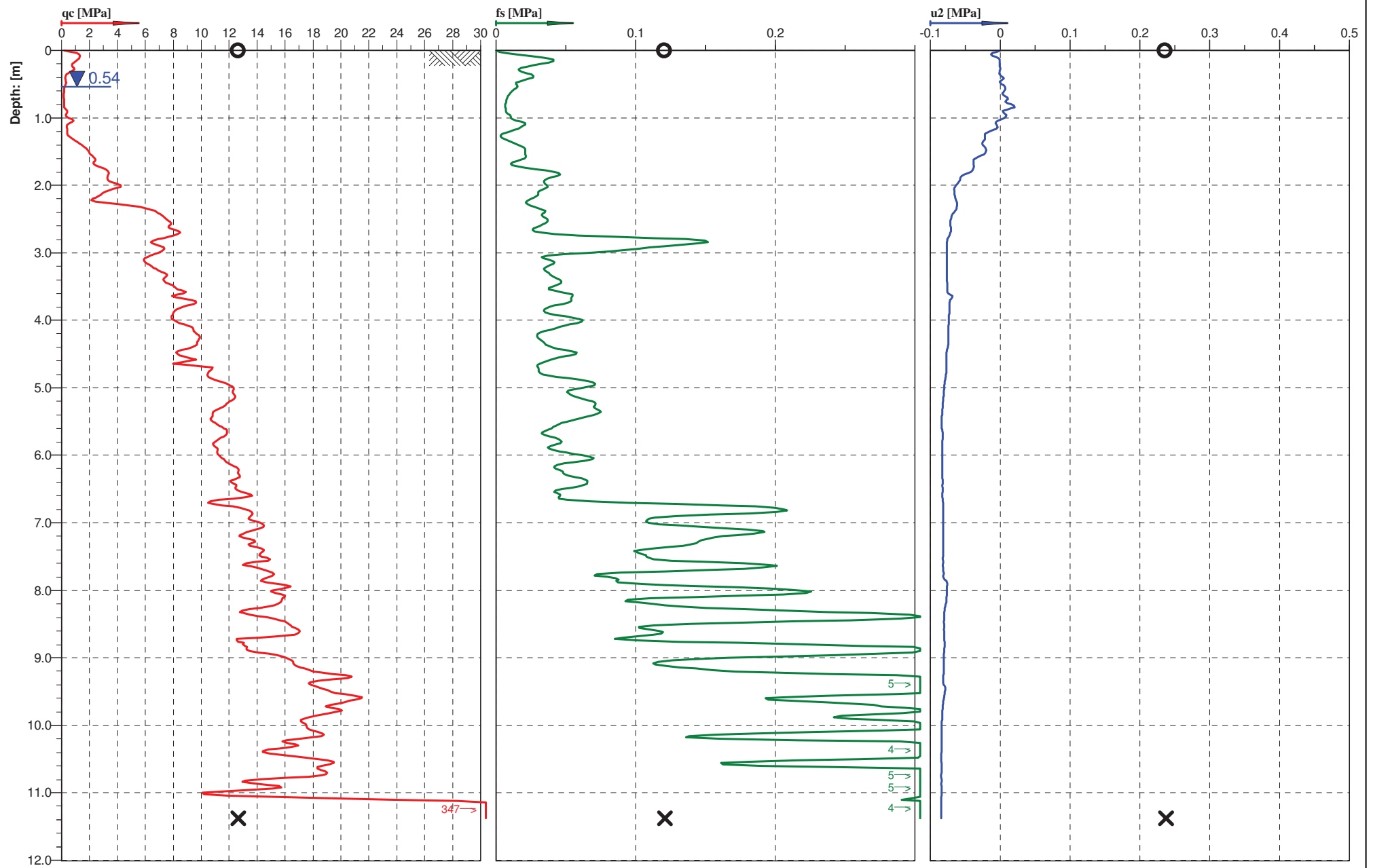
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT107
Project ID:	E1795800 N5815725	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Refused 7.12m.					File: CPT107 .cpt		

Classification by
Robertson 1990 b



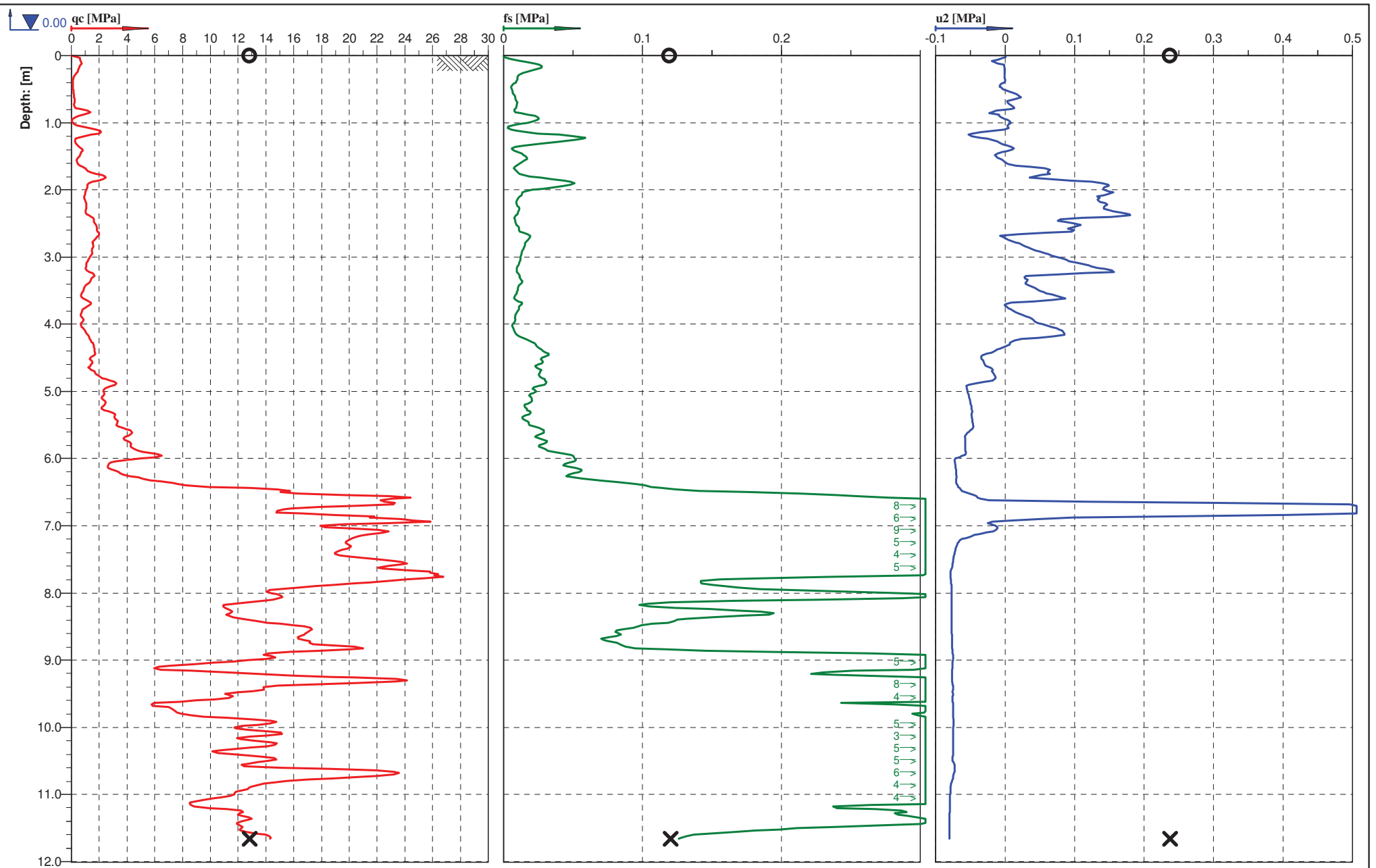
Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT107
Project ID:	E1795800 N5815725	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 7.12m.					File:	CPT107 .cpt	




 Cone No: 5465
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

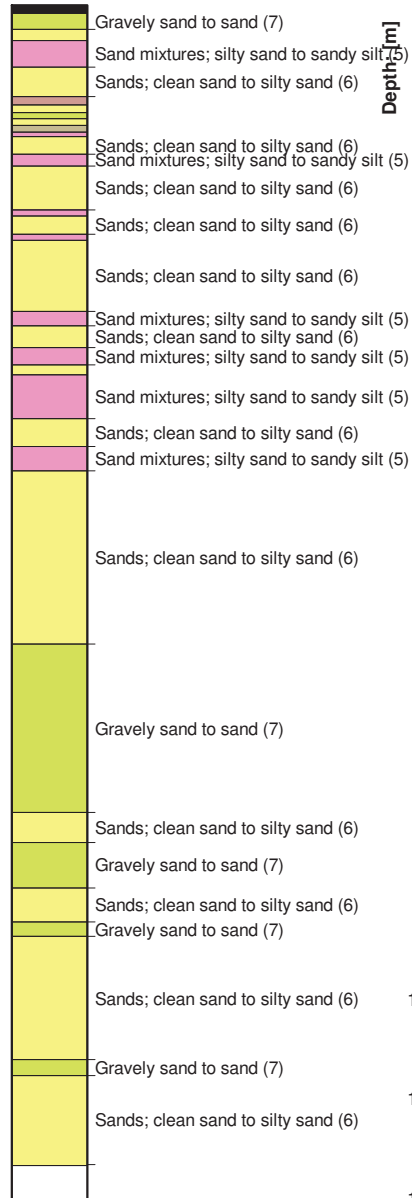
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:	E1795895 N5815575	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 76
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m. Refused 11.38m.				File: CPT08.cpt			



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

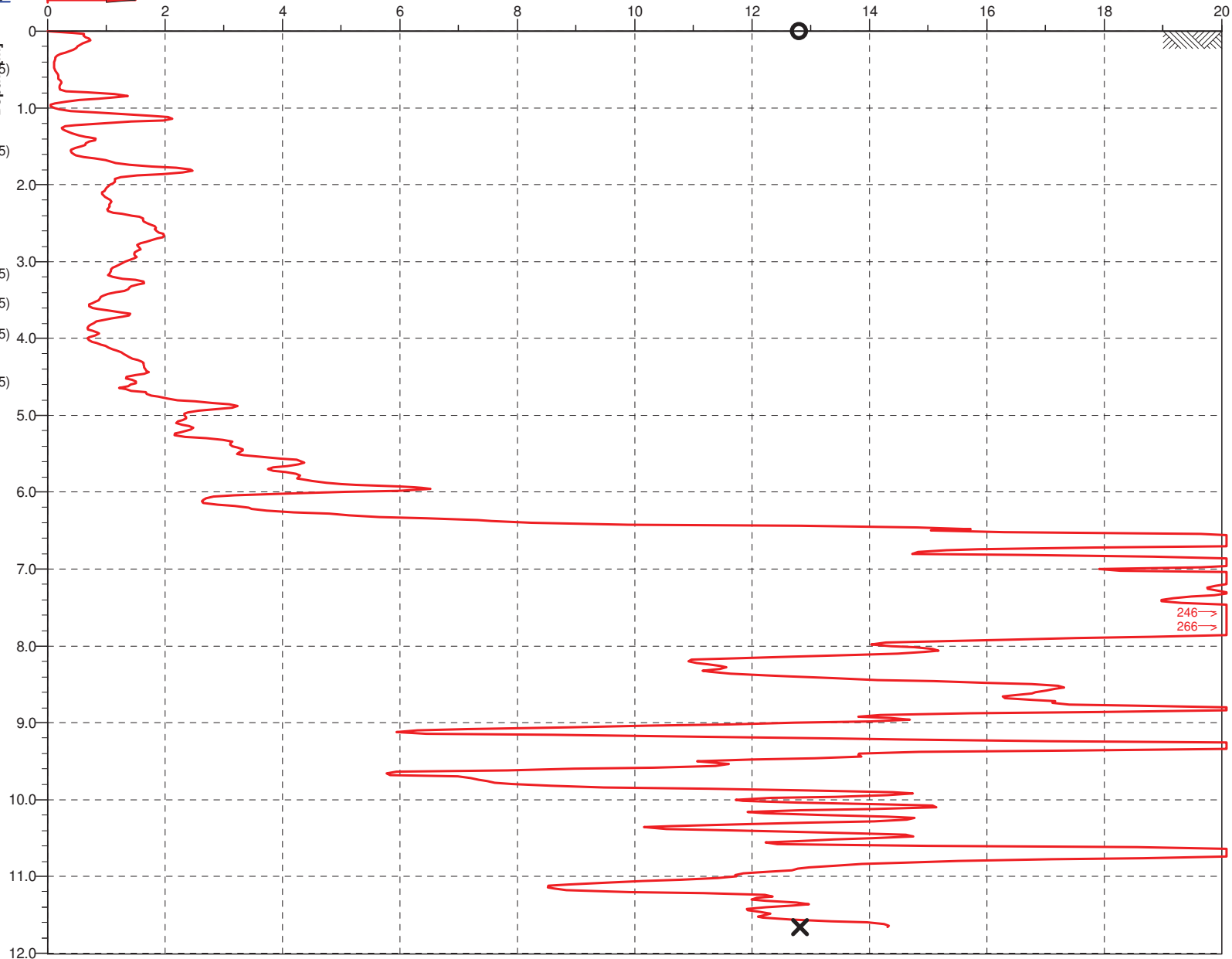
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT109
Project ID:	E1796127 N5815399	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 76
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Refused 11.66m.					File: CPT109 .cpt		

**Classification by
Robertson 1990 b**



0.00 q_c [MPa]

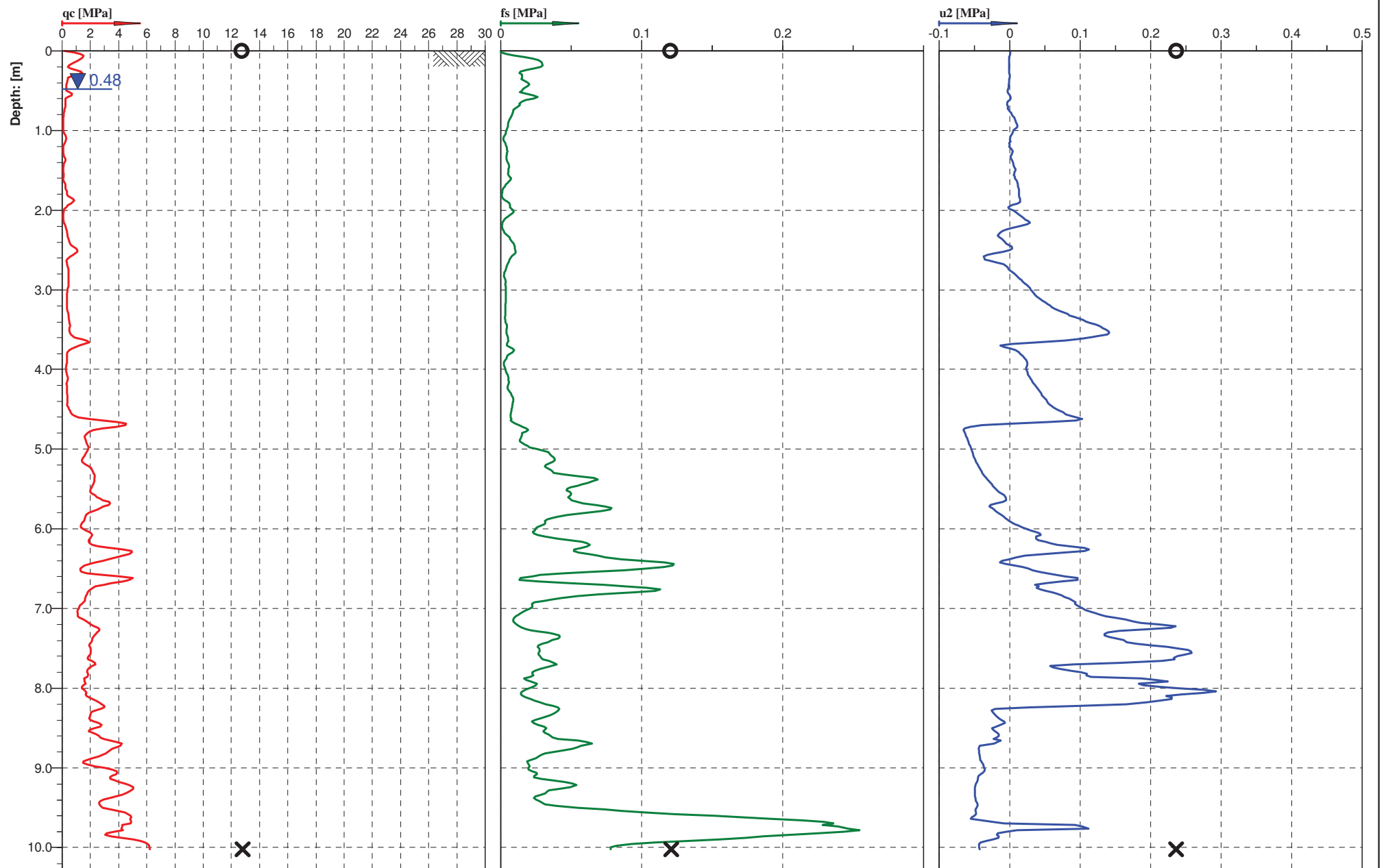
Depth [m]



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150



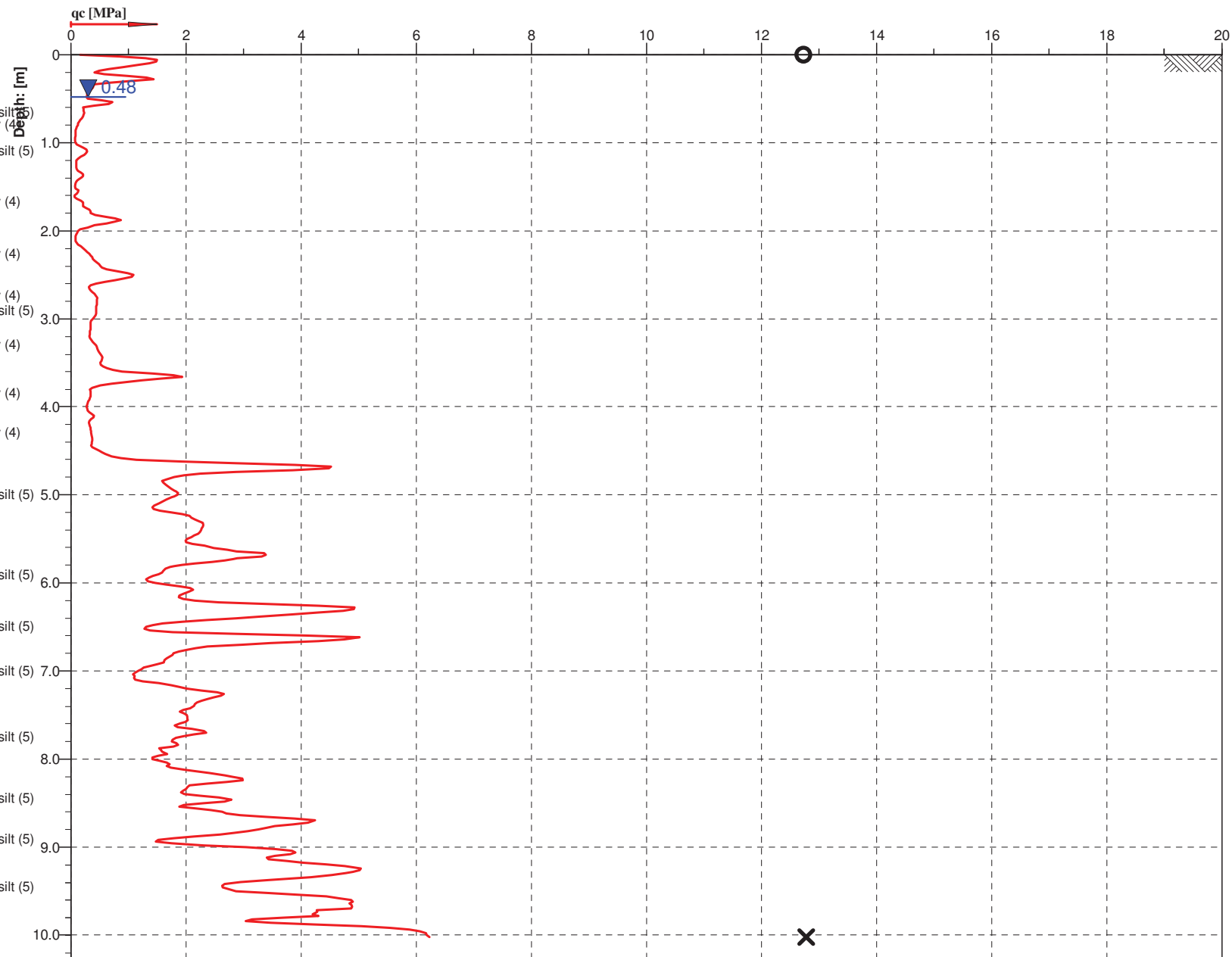
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT109
Project ID:	E1796127 N5815399	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 76
Project:	584 WHATAWHATA ROAD			Page:	2/2	Fig.:	
Target depth 20m. Refused 11.66m.				File:	CPT109 .cpt		



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

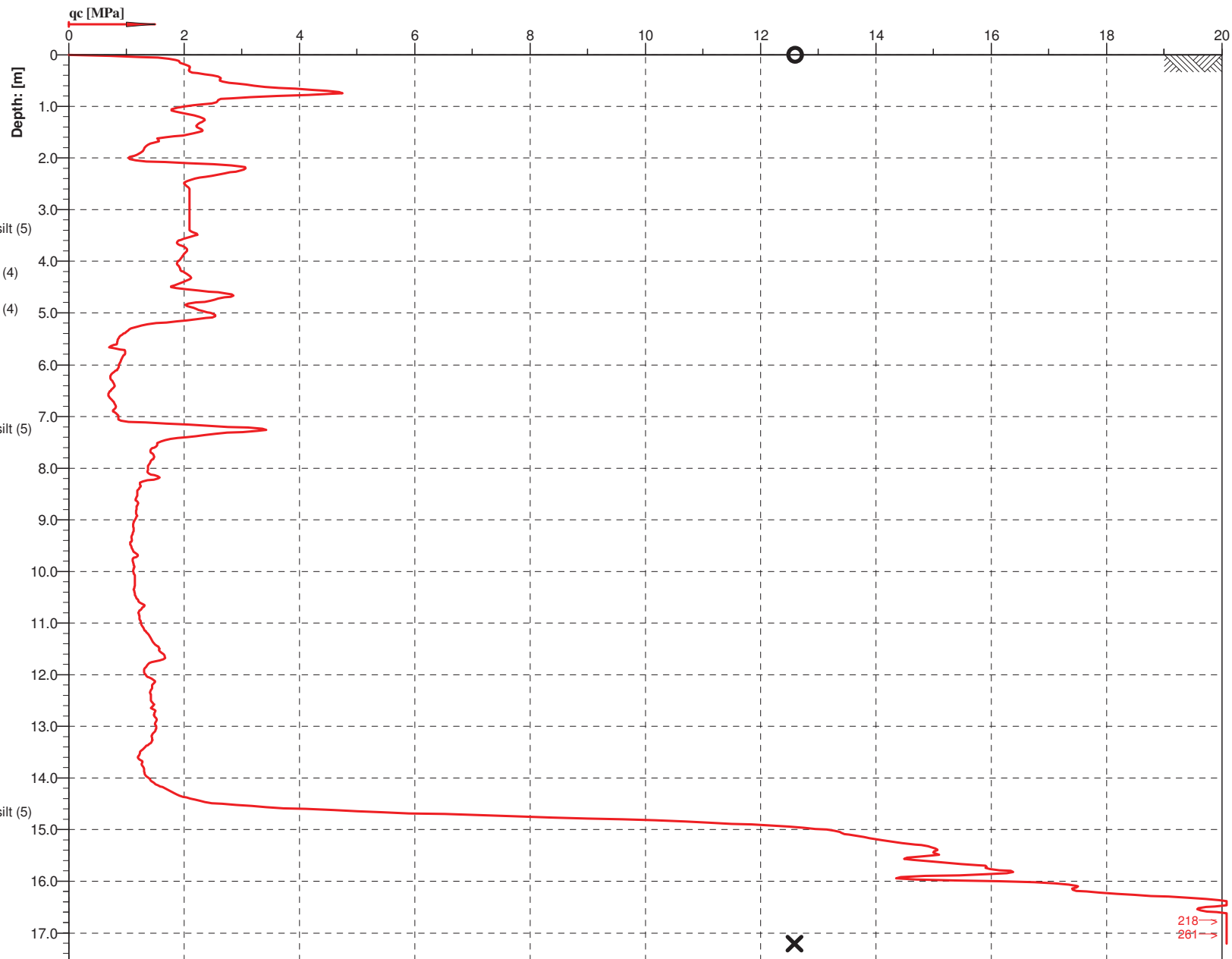
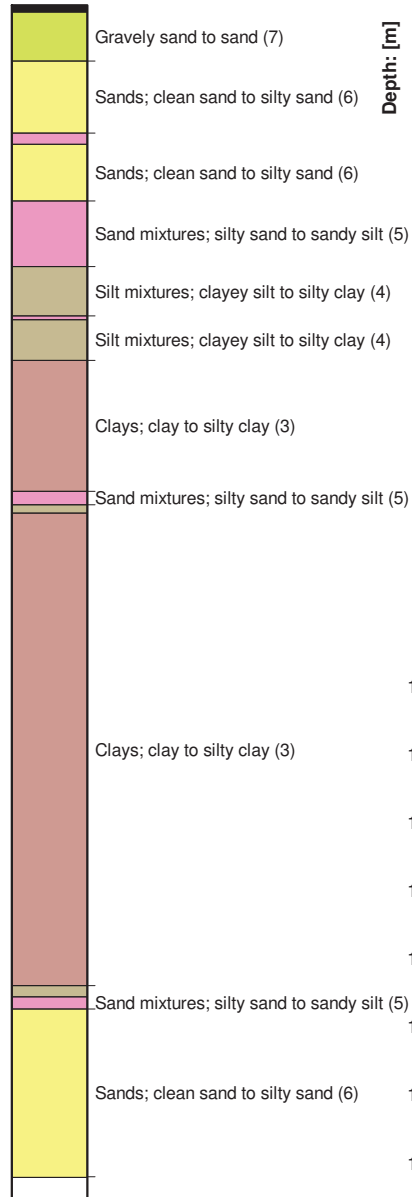
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT110
Project ID:	E1795560 N5815509	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Refused 10.02m. Poor Anchoring.					File: CPT110 .cpt		

**Classification by
Robertson 1990 b**



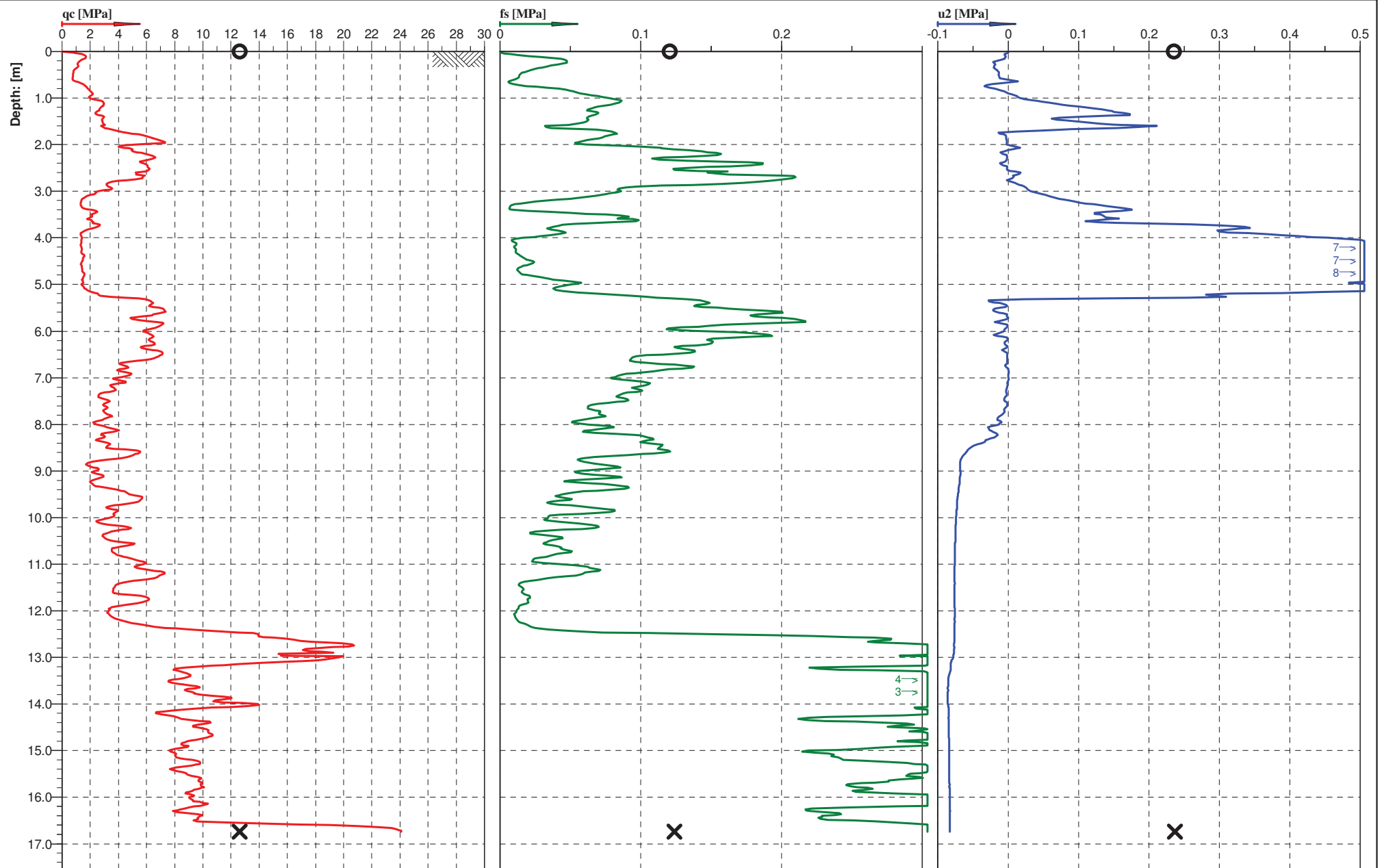
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT110
Project ID:	E1795560 N5815509	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 65
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 10.02m. Poor Anchoring.					File:	CPT110 .cpt	

Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

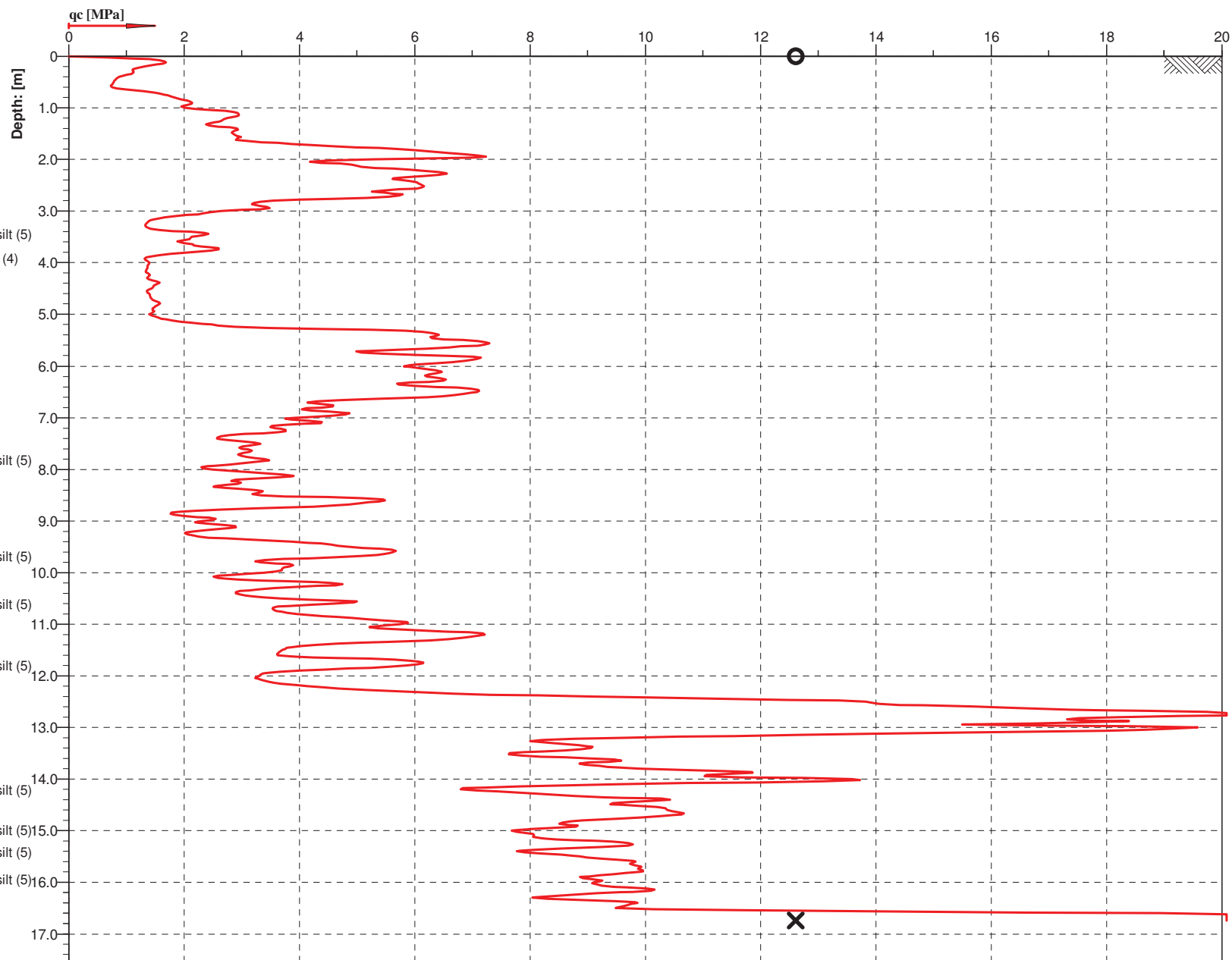
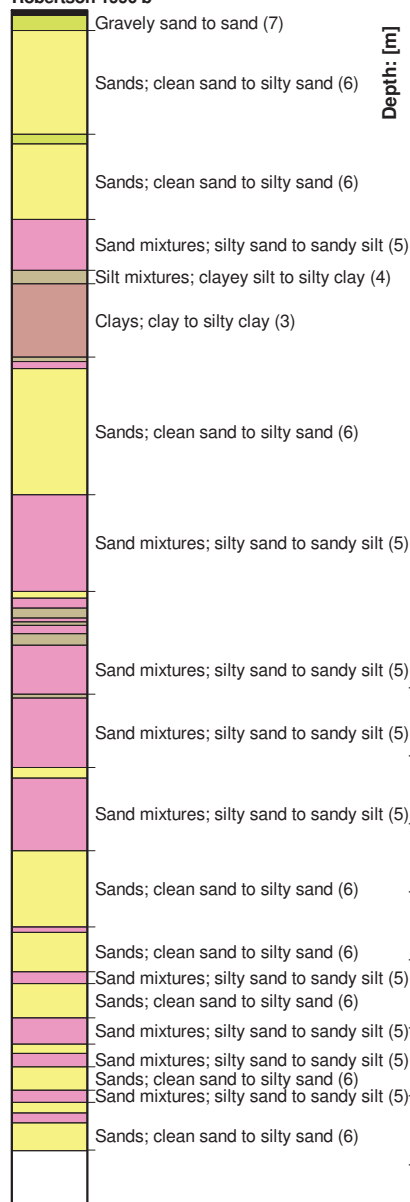
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT111
Project ID:	E1795368 N5815597	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 111
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 17.20m. Hole dipped and collapsed back to 12.80m.					File:	CPT111 .cpt	



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

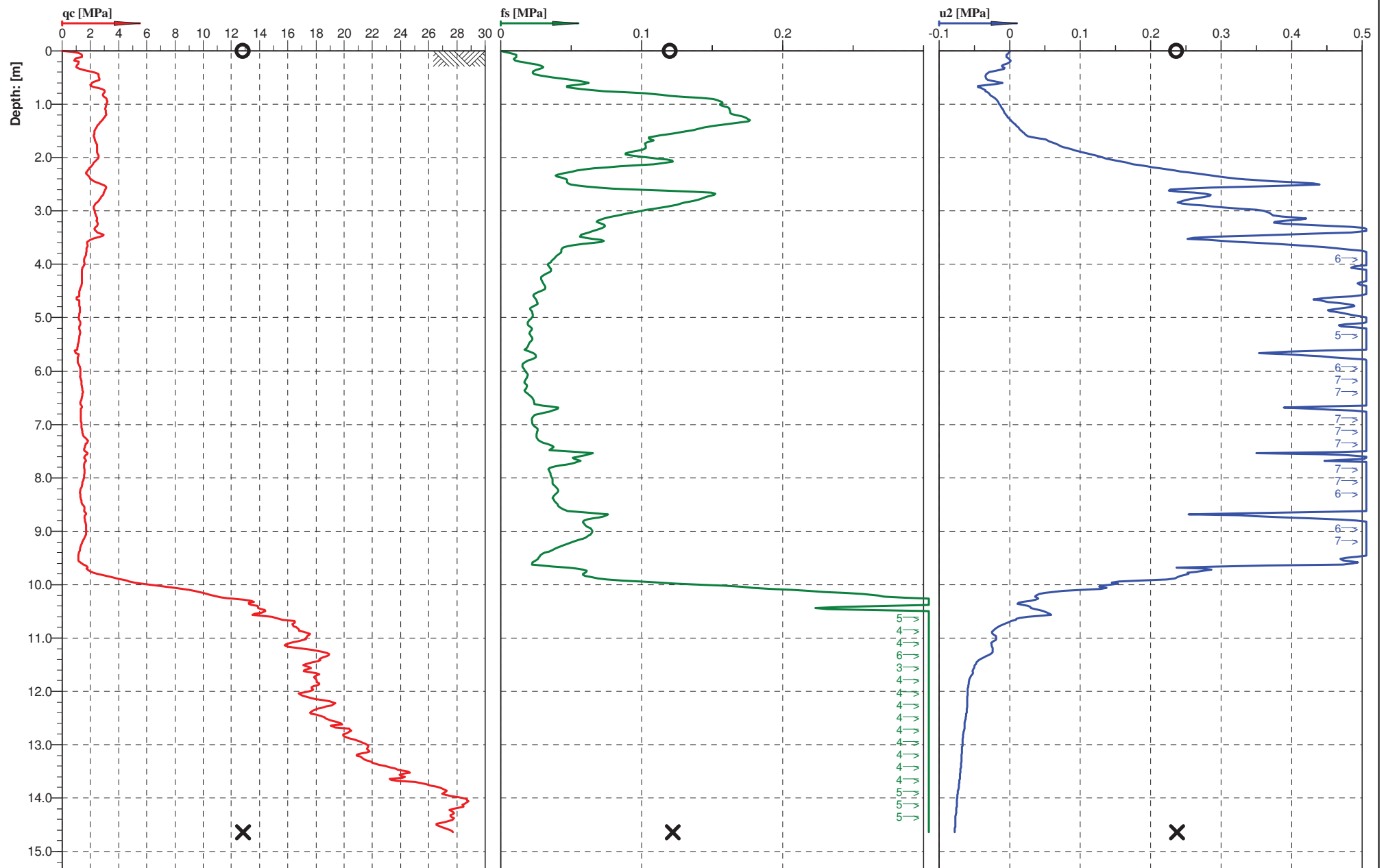
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT112
Project ID:	E1795295 N5815842	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 111
Project:	584 WHATAWHATA ROAD			Page:	1/2	Fig.:	
Target depth 20m. Refused 16.74m. Hole dipped and collapsed back to 1.80m.				File:	CPT112 .cpt		

Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

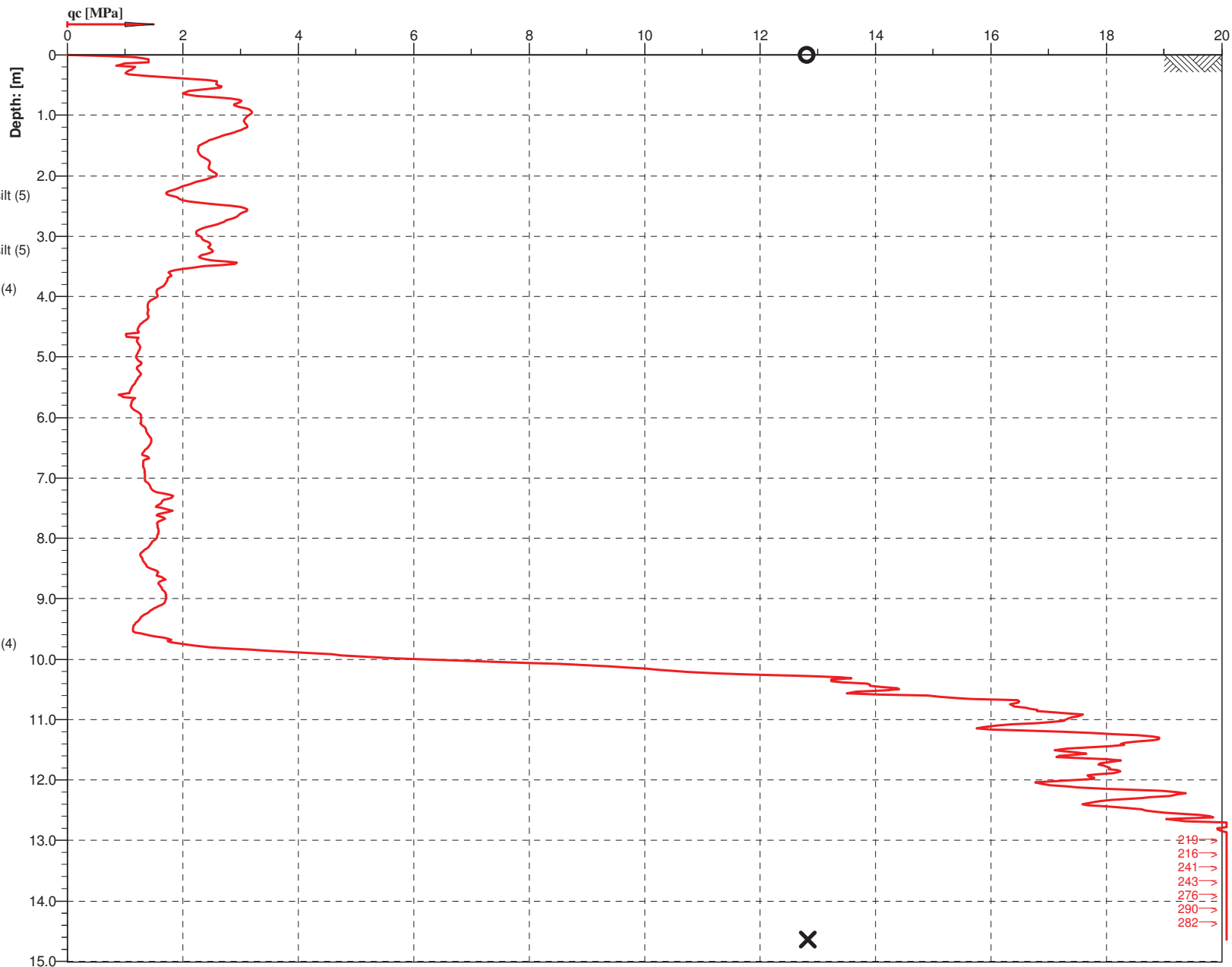
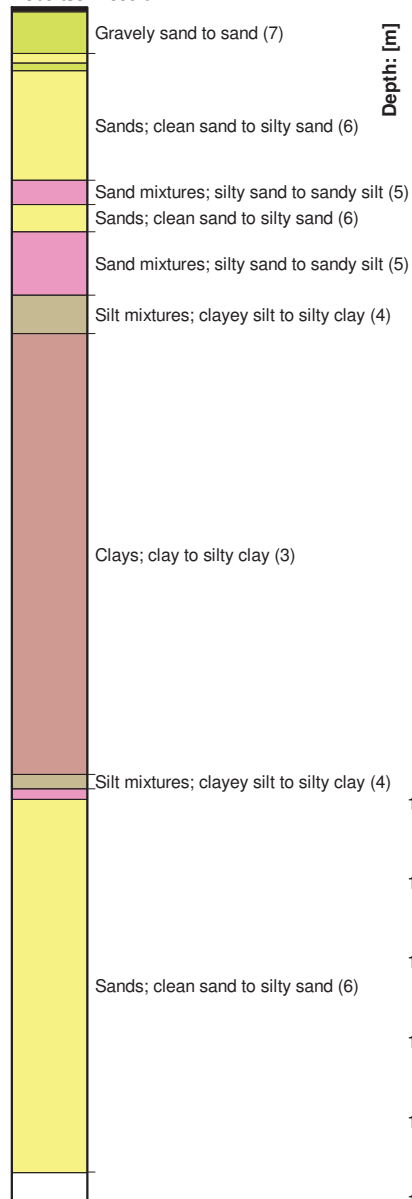
Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT112
Project ID:	E1795295 N5815842	Client:	Tonkin & Taylor	Date:	17/05/2021	Scale:	1 : 111
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 16.74m. Hole dipped and collapsed back to 1.80m.					File:	CPT112 .cpt	



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT113
Project ID:	E1795326 N5816127	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 97
Project:	584 WHATAWHATA ROAD				Page:	1/2	Fig.:
Target depth 20m. Refused 14.64m. Hole dipped and collapsed back to 0.67m.					File: CPT113 .cpt		

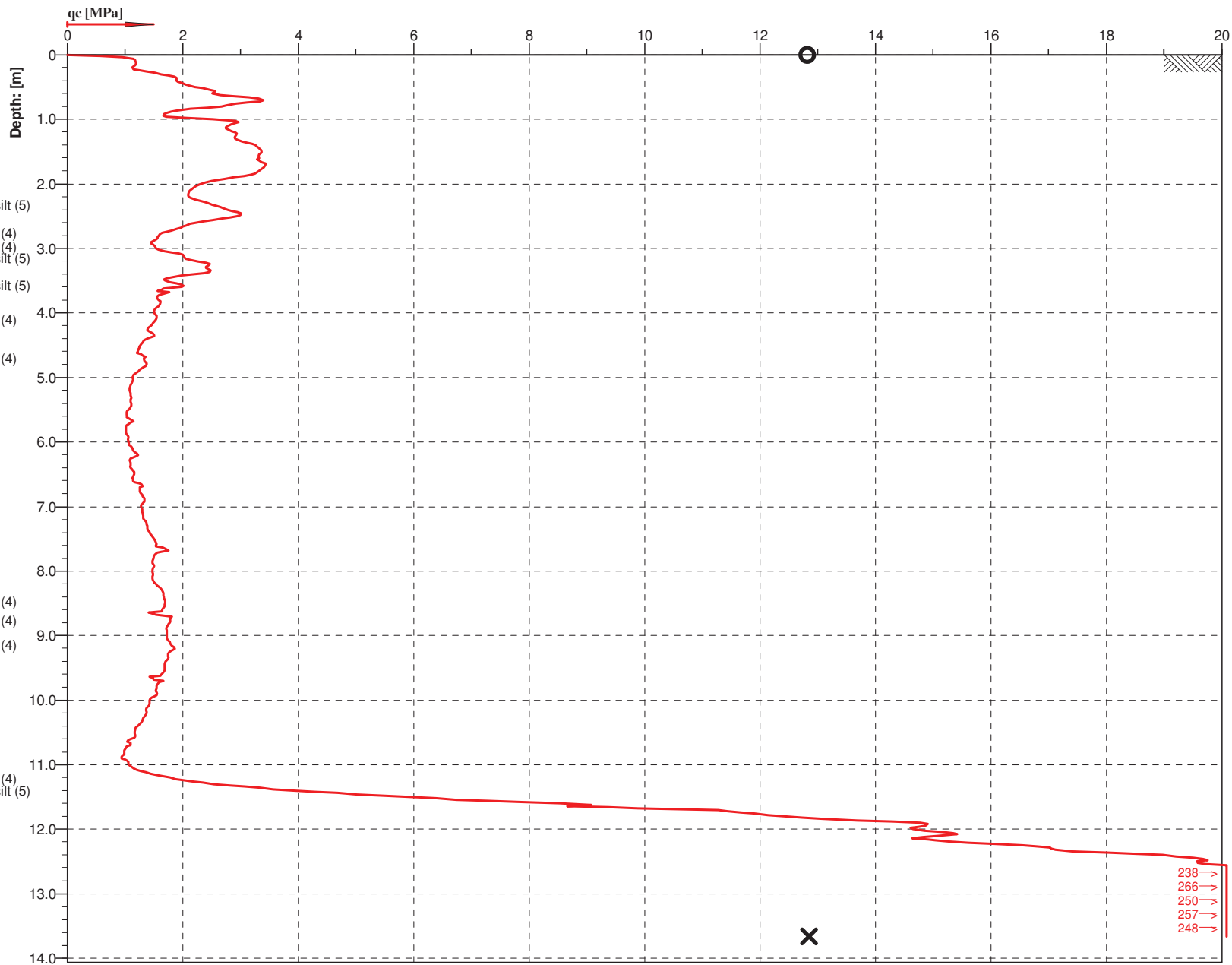
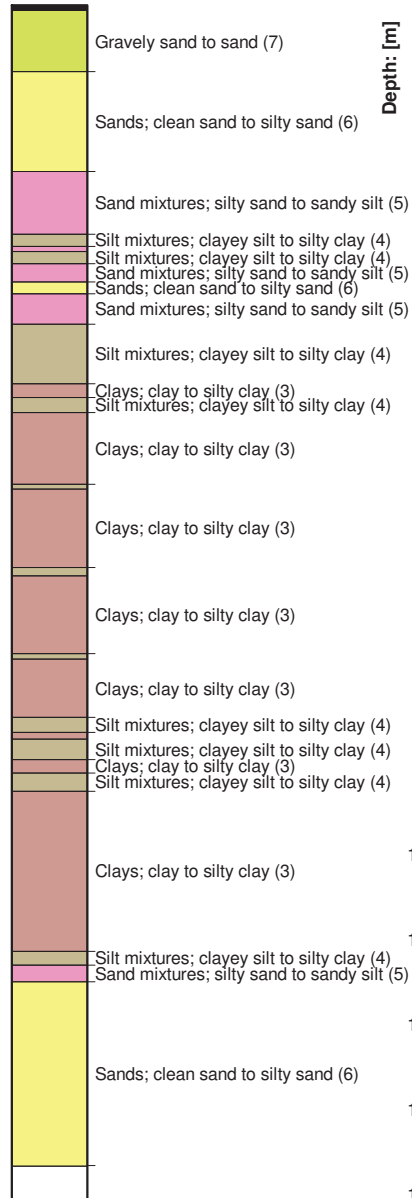
Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT113
Project ID:	E1795326 N5816127	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 95
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 14.64m. Hole dipped anc ollapsed back to 0.67m.					File:	CPT113 .cpt	

Classification by
Robertson 1990 b



Cone No: 5465
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	Hamilton	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT114
Project ID:	E1795161 N5816165	Client:	Tonkin & Taylor	Date:	18/05/2021	Scale:	1 : 89
Project:	584 WHATAWHATA ROAD				Page:	2/2	Fig.:
Target depth 20m. Refused 13.66m. Hole dipped and collapsed back to 2.4m.					File:	CPT114 .cpt	

EXCAVATION LOG

Excavation Id.: **TP101**

Hole Location: Southern foot hills

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000

CO-ORDINATES: 5814947.62 mN EXPOSURE METHOD: TP EXCAV. STARTED: 28/05/2021
(NZTM2000) 1795230.76 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 28/05/2021
R.L.: 28.14m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP102**

Hole Location: Southern foot hills

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000

CO-ORDINATES: 5815039.72 mN EXPOSURE METHOD: TP EXCAV. STARTED: 28/05/2021
(NZTM2000) 1795167.56 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 28/05/2021
R.L.: 28.14m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL					
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.4m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP103**
Hole Location: Central low lying lands
 SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision		LOCATION: 584 Whatawhata Rd, Temple View		JOB No.: 1017355.0000	
CO-ORDINATES: 5815393.95 mN (NZTM2000) 1795147.06 mE		EXPOSURE METHOD: TP		EXCAV. STARTED: 28/05/2021	
R.L.: 23.24m		EQUIPMENT: 8T Digger		EXCAV. FINISHED: 28/05/2021	
DATUM: NZVD2016		OPERATOR: Drillcore		LOGGED BY: CAND	
		DIMENSIONS: 4m by 1.9m		CHECKED BY: RWOT	

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS: Hole in danger of collapse. Excess water ponding at the base.

Hole Depth
3.4m

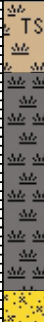
Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP105**
Hole Location: Central low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815685.10 mN (NZTM2000) 1795337.69 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 28/05/2021
R.L.: 25.84m	EQUIPMENT: 8T Digger	EXCAV. FINISHED: 28/05/2021
DATUM: NZVD2016	OPERATOR: Drillcore	LOGGED BY: CAND
	DIMENSIONS: 4m by 1.9m	CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING CLASSIFICATION	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3														
	No Support Required	8/05/2021	● 31/25 kPa		25	0.5		0.00m: Sandy SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Sand, fine; organics, rootlets. Topsoil. 0.40m: PEAT (FIBROUS AND AMORPHOUS); dark brownish black. Soft to firm, wet. Tree Branches up to 300mm in diameter. 1.60m: SILT, some sand, minor organics; light grey. Loosely packed, saturated, dilatant - rapid. Sand, fine to medium; organics, rootlets.	M	F				
			● 53/28 kPa		24	2.0		1.8m: Other - see notes	S	L			0.80m: , Rapid water seepage observed 1.10m: , Rapid water seepage observed.	Piako Subgroup
					21	4.5								

SKETCH / PHOTO:



COMMENTS: Target stratum reached. Excess water ponding at the base of hole.

Hole Depth
1.8m

Scale 1:42

Rev.: A

EXCAVATION LOG

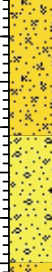
Excavation Id.: **TP106**

Hole Location: Central eastern low lying lands

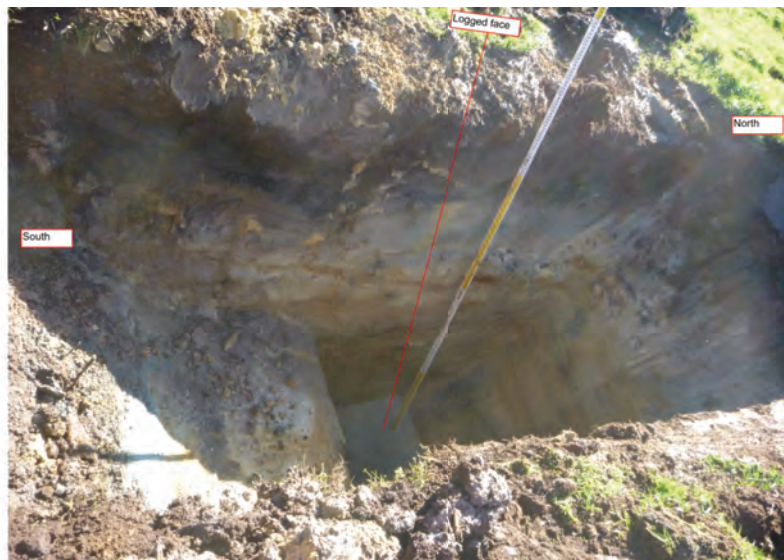
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000

CO-ORDINATES: 5815694.55 mN (NZTM2000) 1795552.22 mE EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
 EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
 R.L.: 27.24m OPERATOR: Drillcore LOGGED BY: CAND
 DATUM: NZVD2016 DIMENSIONS: 4.5m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3														
	No Support Required	01/06/2021 ▲	● 31/25 kPa		27			0.00m: SILT, some clay, minor organics. Firm, moist, low plasticity. Organics, rootlets. Topsoil.	M		F			
					0.5			0.40m: PEAT (FIBROUS AND AMORPHOUS); dark brown. Soft to firm, wet. Organics, wood fragments. Tree branches up to 300mm diameter.	W		S-F		0.50m: Visual assessment of PEAT indicated soft to firm.	
					1.0			0.80m: Sandy SILT, trace organics; light greenish grey. Loosely packed, wet, dilatant - rapid. Organics, rootlets.			L		0.80m: Water seepage observed.	
					26									
					1.5			1.70m: Minor gravelly, fine.						
					2.0			1.80m: Gravelly fine to coarse SAND, minor silt; light brown mottled orange. Loosely packed, wet. Sand, pumiceous; gravel, fine to coarse, sub-rounded to sub-angular.						
					25									
					2.5			2.50m: Sandy SILT; light brown mottled orange. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse. Interbedded silt lenses. Pumiceous.						
					3.0									
		01/06/2021 ▼			24									
					3.5			3.5m: Target depth						
					23									
					4.0									
					4.5									

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.5m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP107**
Hole Location: Eastern low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815568.47 mN (NZTM2000) 1795891.13 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 01/06/2021
R.L.: 26.64m	EQUIPMENT: 8T Digger	EXCAV. FINISHED: 01/06/2021
DATUM: NZVD2016	OPERATOR: Drillcore	LOGGED BY: CAND
	DIMENSIONS: 4.7m by 2m	CHECKED BY: RWOT

EXCAVATION TESTS					ENGINEERING DESCRIPTION					GEOLOGICAL					
PENETRATION		SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1	-2	-3													
										</					

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP108**
Hole Location: Eastern low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000
CO-ORDINATES: 5815403.99 mN EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
(NZTM2000) 1796130.68 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
R.L.: 26.99m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 2m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP110**
Hole Location: Northern foot hills
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000
CO-ORDINATES: 5815779.66 mN EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
(NZTM2000) 1795287.86 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
R.L.: 27.74m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.8m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS							ENGINEERING DESCRIPTION				GEOLOGICAL			
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3												10 25 50 100 200		
	No Support Required		● 94/38 kPa			0.5		0.00m: SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets.	M	F				
		● 113/44 kPa	27		0.30m: Silty CLAY, minor organics; light grey mottled orange. Stiff, moist, medium plasticity. Organics, wood fragments. Tree branches up to 50mm in diameter.		St							
		● 213/44 kPa			0.70 - 0.90m: Becomes brownish orange, very stiff.		VSt							
		● 169/32 kPa			0.90m: SILT, some clay, minor organics; grey mottled brown. Very stiff to hard, moist, low plasticity. Organics, wood fragments.		VSt-H							
						1.5		1.40m: Grades to very stiff.		VSt				
					26	2.0		1.50m: Sandy SILT; light greenish grey mottled brown. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, well graded.	W	L				
						2.5		2.00m: Colour changes to light brown mottled orange. Interbedded silt lenses.						2.50m: , Water seepage observed.
						3.0								
						3.5		3.10 - 3.60m: Colour changes to brown.						3.10m: , Water seepage observed.
					24	4.0								
						4.5		3.8m: Target depth						
					23									

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.8m

Scale 1:42

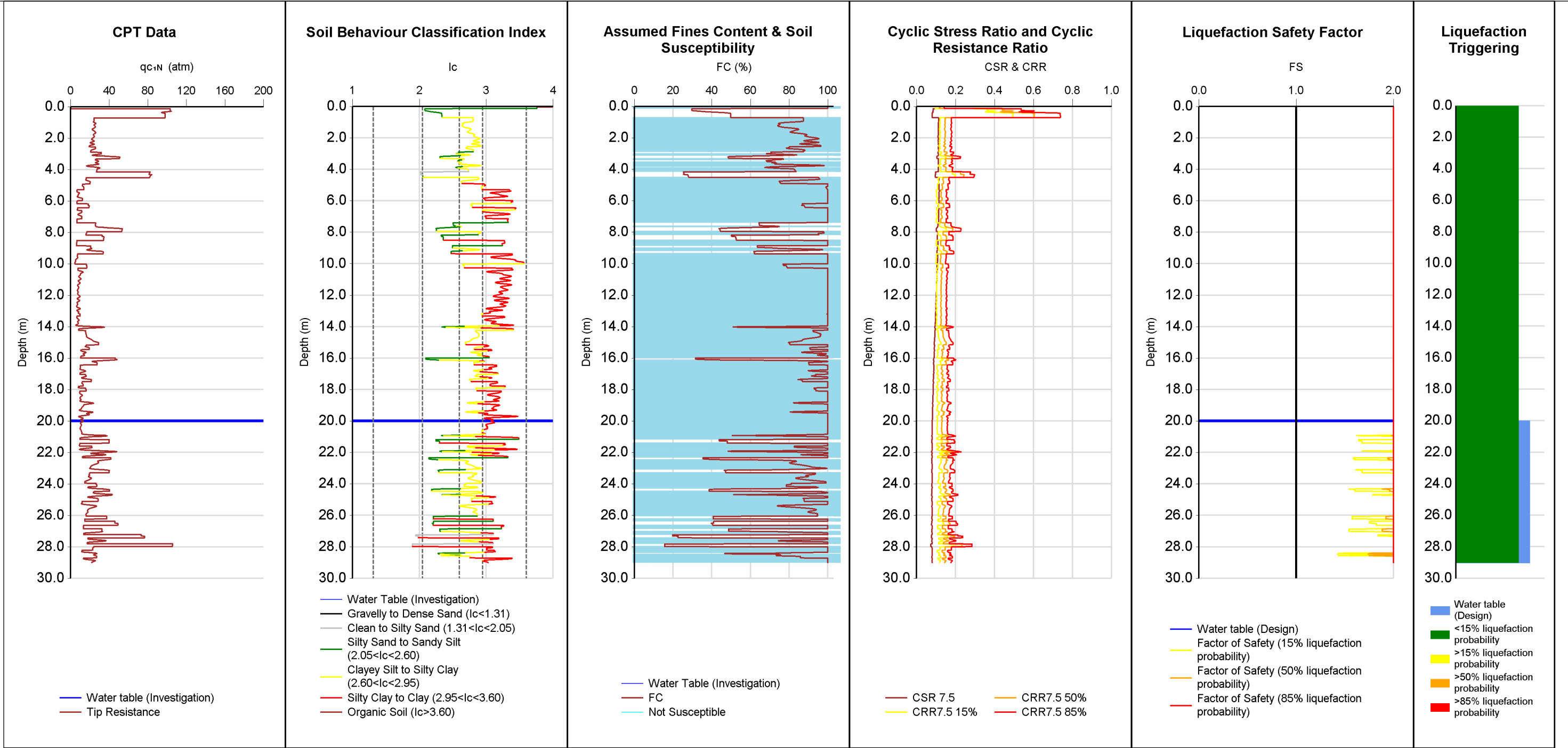
Rev.: A

Appendix C: Groundwater Summary

	Investigation ID	Investigation RL (Moturiki 1953)	Measured GWL (m bgl)	Measured GWL (m RL)
Low lying Landforms	CPT102	27.25	Collapsed 0.35	-
	CPT103	24	Artesian	-
	CPT104	24.5	Artesian	-
	CPT105	25.5	0.7	24.8
	CPT106	26	0.45	25.55
	CPT107	27.5	0.5	27
	CPT108	27	0.54	26.46
	CPT109	27	0	27
	CPT110	25	0.48	24.52
	CPT111	25.5	Collapsed 12.8	-
	BH102	27.25	Artesian	-
	BH103	31	Artesian	-
Elevated Landforms	BH101	45.5	15.01	30.49
	CPT101	50.5	Collapsed 0.25	-
	CPT112	36.5	Collapsed 1.8	-
	CPT113	57.8	Collapsed 0.67	-
	CPT114	56.5	Collapsed 2.4	

Appendix D: Analysis Results

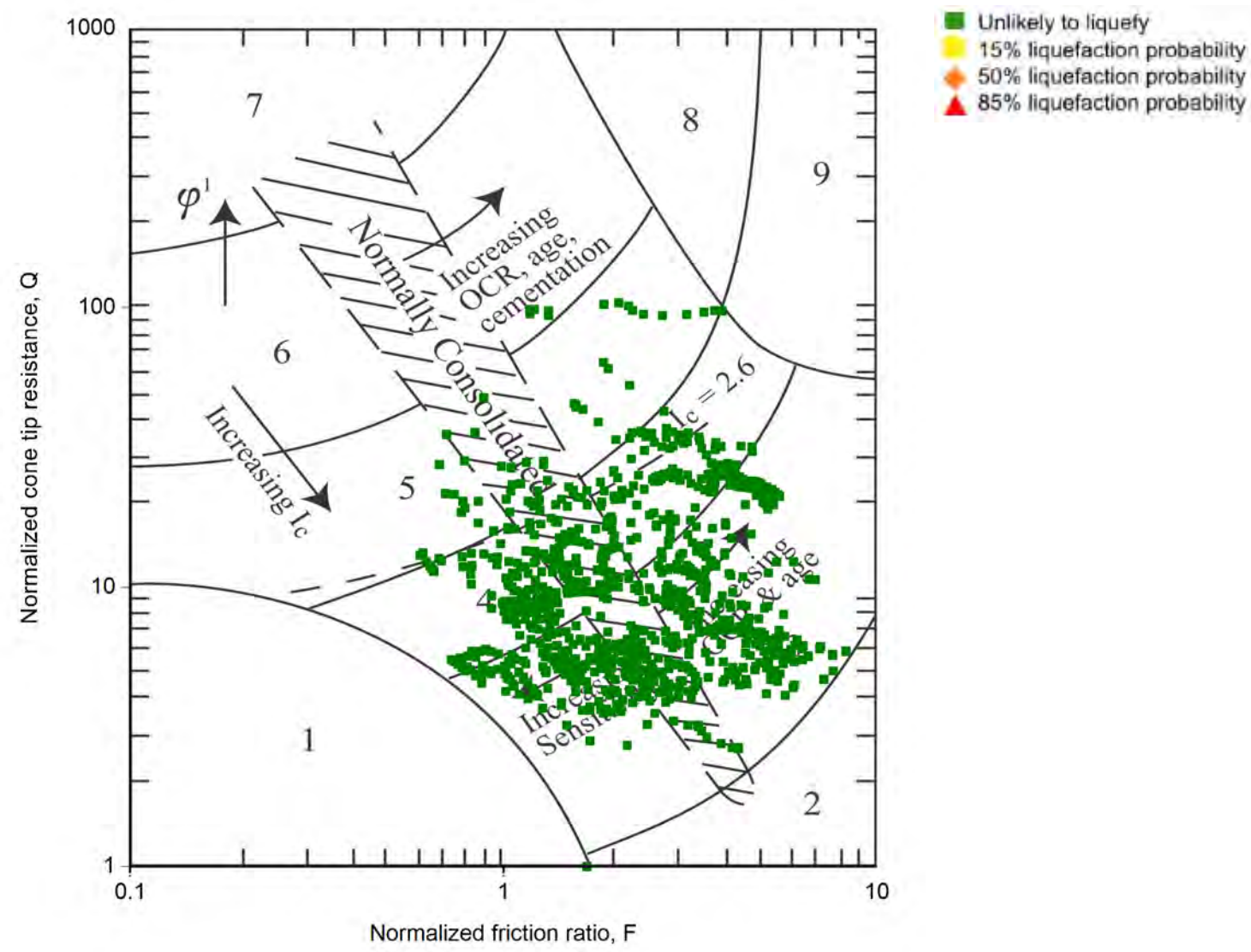
- Liquefaction assessment
- Static settlement predictions



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT101	178990	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	3	0	0	0	29	0					
		50%	0	0	0	0	29	0					
		85%	0	0	0	0	29	0					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



1. Sensitive, fine grained

2. Organic soils - peats

3. Clays - silty clay to clay

4. Silt mixtures - clayey silt to silty clay

5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand

7. Gravelly sand to dense sand

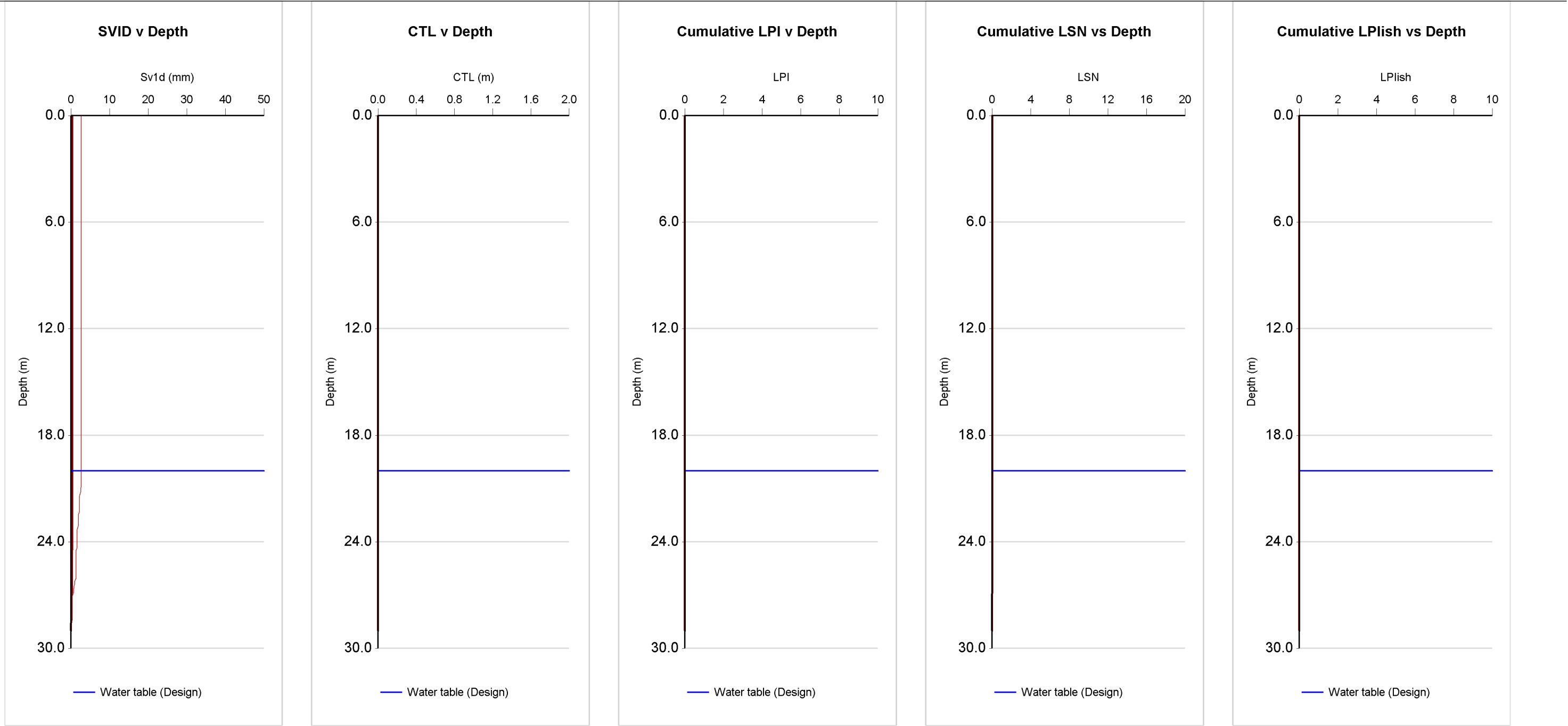
8. Very stiff sand to clayey sand *

9. Very stiff, fine grained *

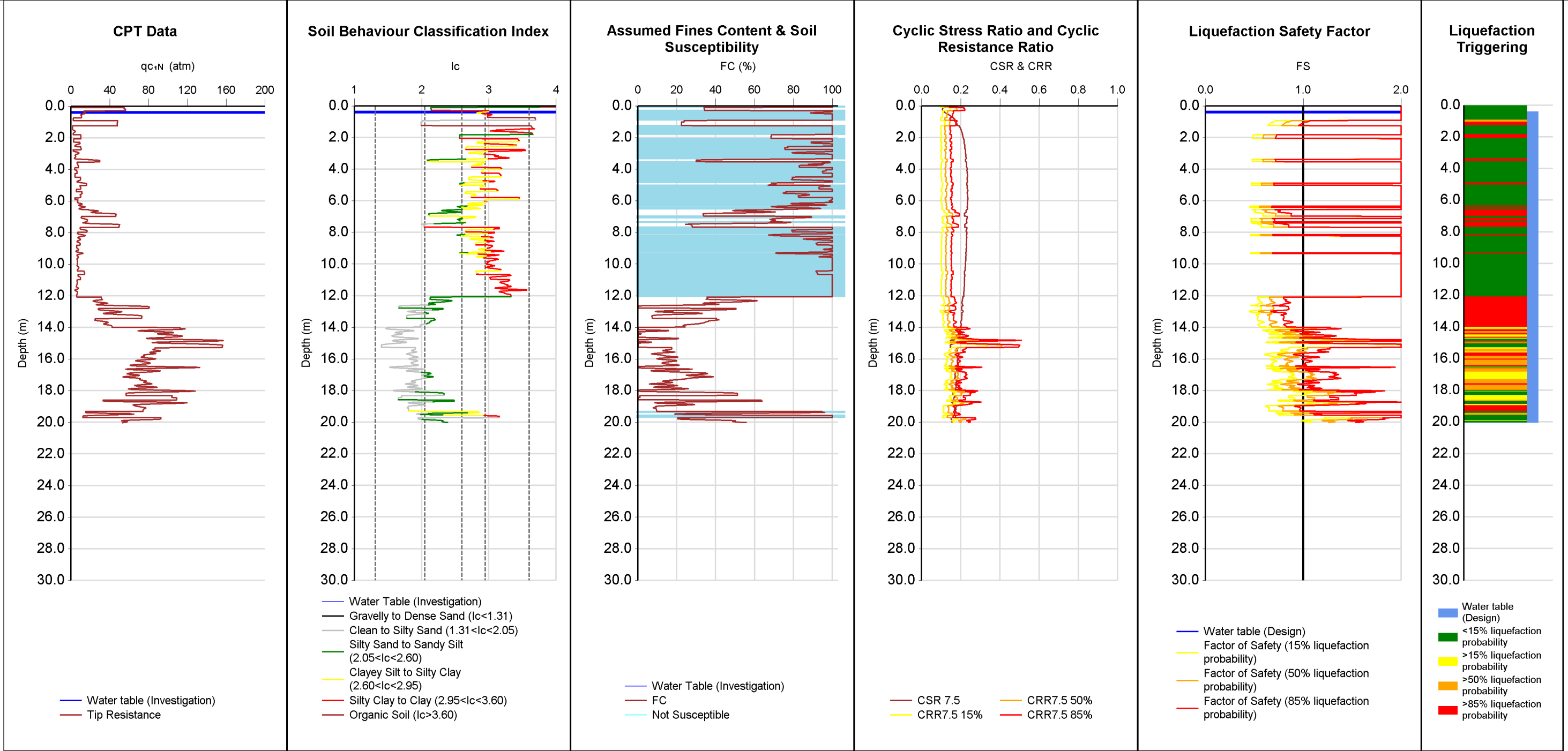
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION	24/06/2021	
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision	Hamilton	ANALYSED	cand
	together	TITLE	Liquefaction Analyses	JOB NUMBER	PAGE	2 of 47 pages
	V2.4.15	COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000		



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT101	178990	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

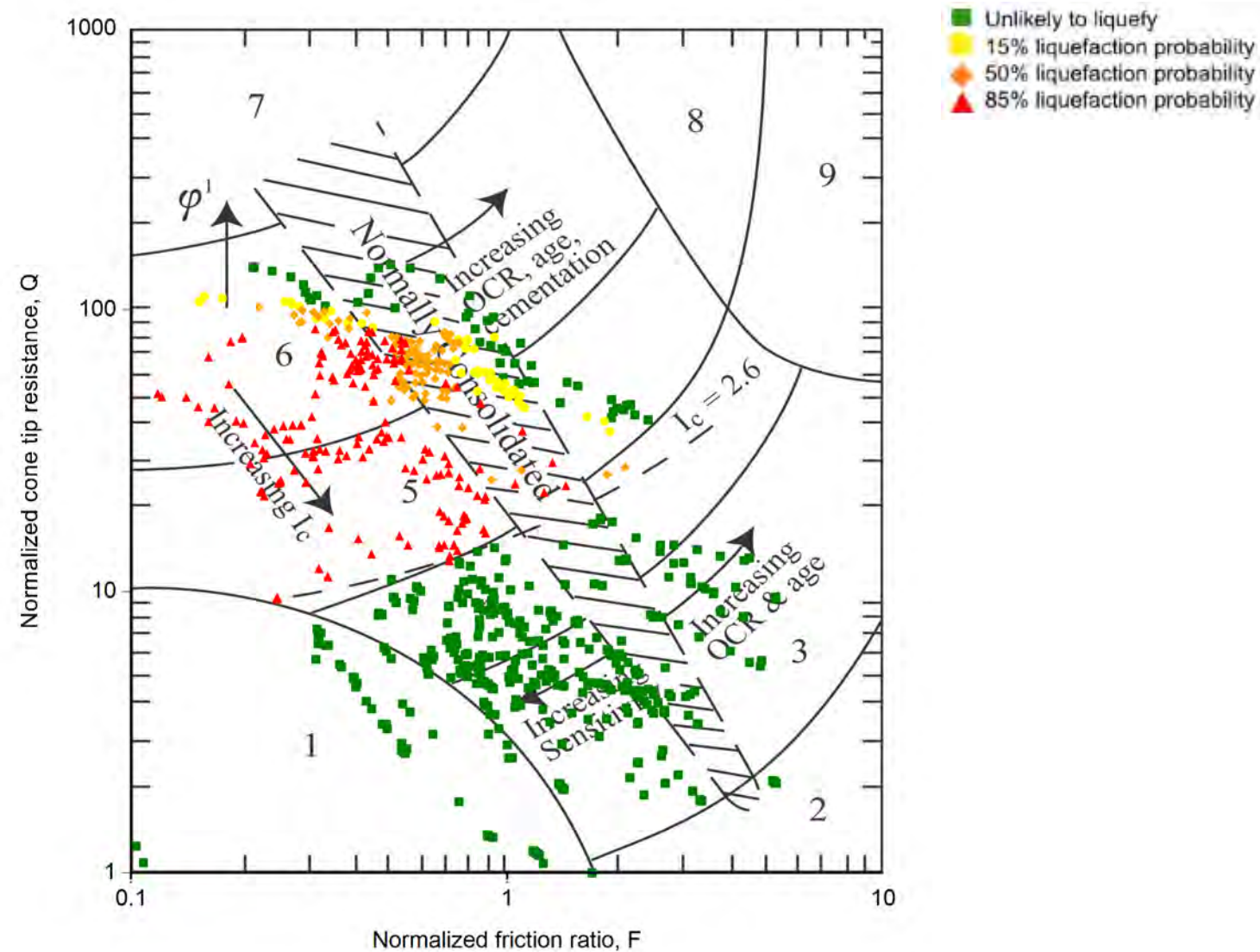


Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT102		178991	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	221	8.5	12	31	1	11						
	50%	192	7.1	8	28	1	7						
	85%	143	4.9	4	21	1.1	3						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

 Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd					LOCATION	Hamilton		DATE	24/06/2021
	PROJECT	Brymer Farms Subdivision								ANALYSED	cand
	TITLE	Liquefaction Analyses					JOB NUMBER	1017355.0000		PAGE	4 of 47 pages
	COMMENT	1 in 500 Year Event - ULS IL2									

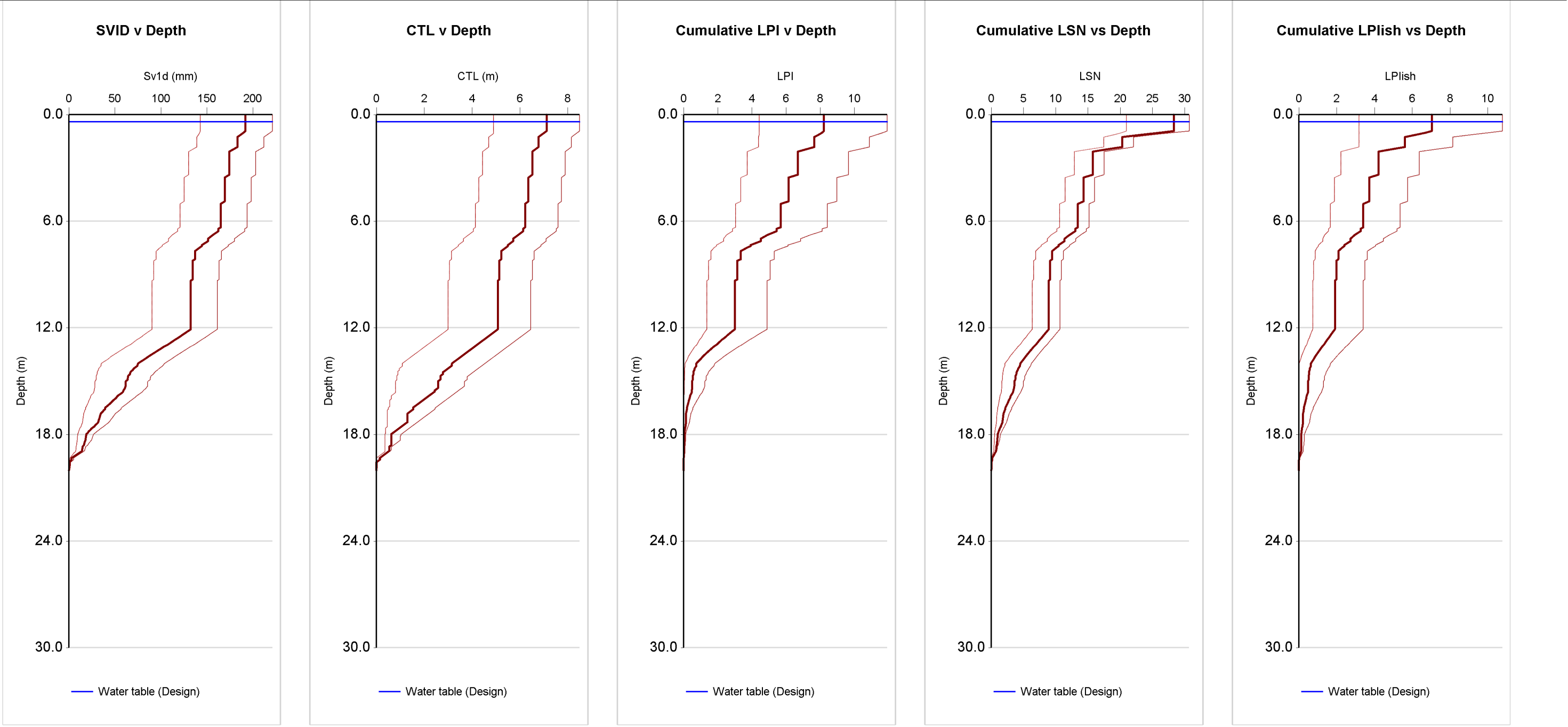


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	5 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2					



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT102	178991	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

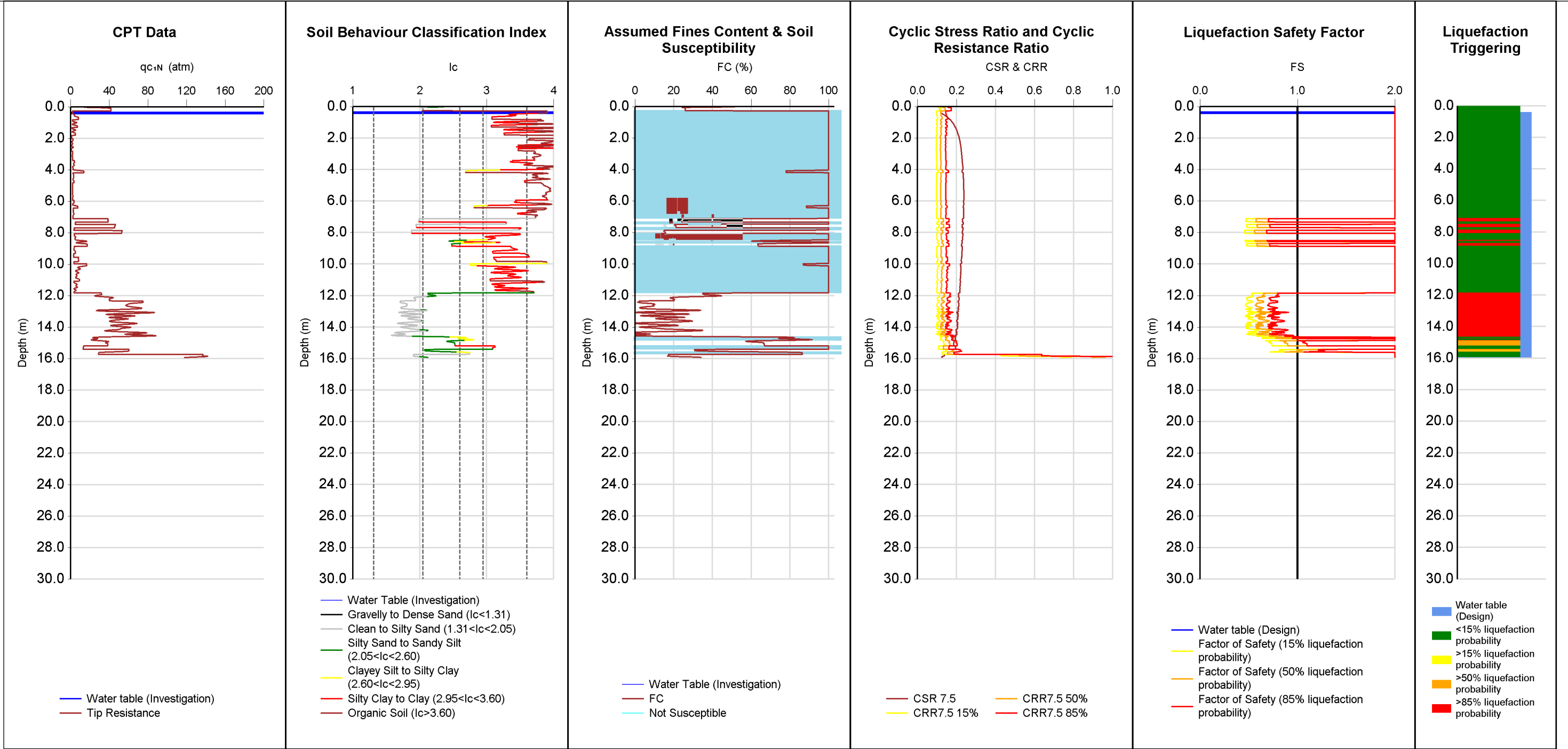


Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd
PROJECT	Brymer Farms Subdivision
TITLE	Liquefaction Analyses
COMMENT	1 in 500 Year Event - ULS IL2

LOCATION	Hamilton
JOB NUMBER	1017355.0000

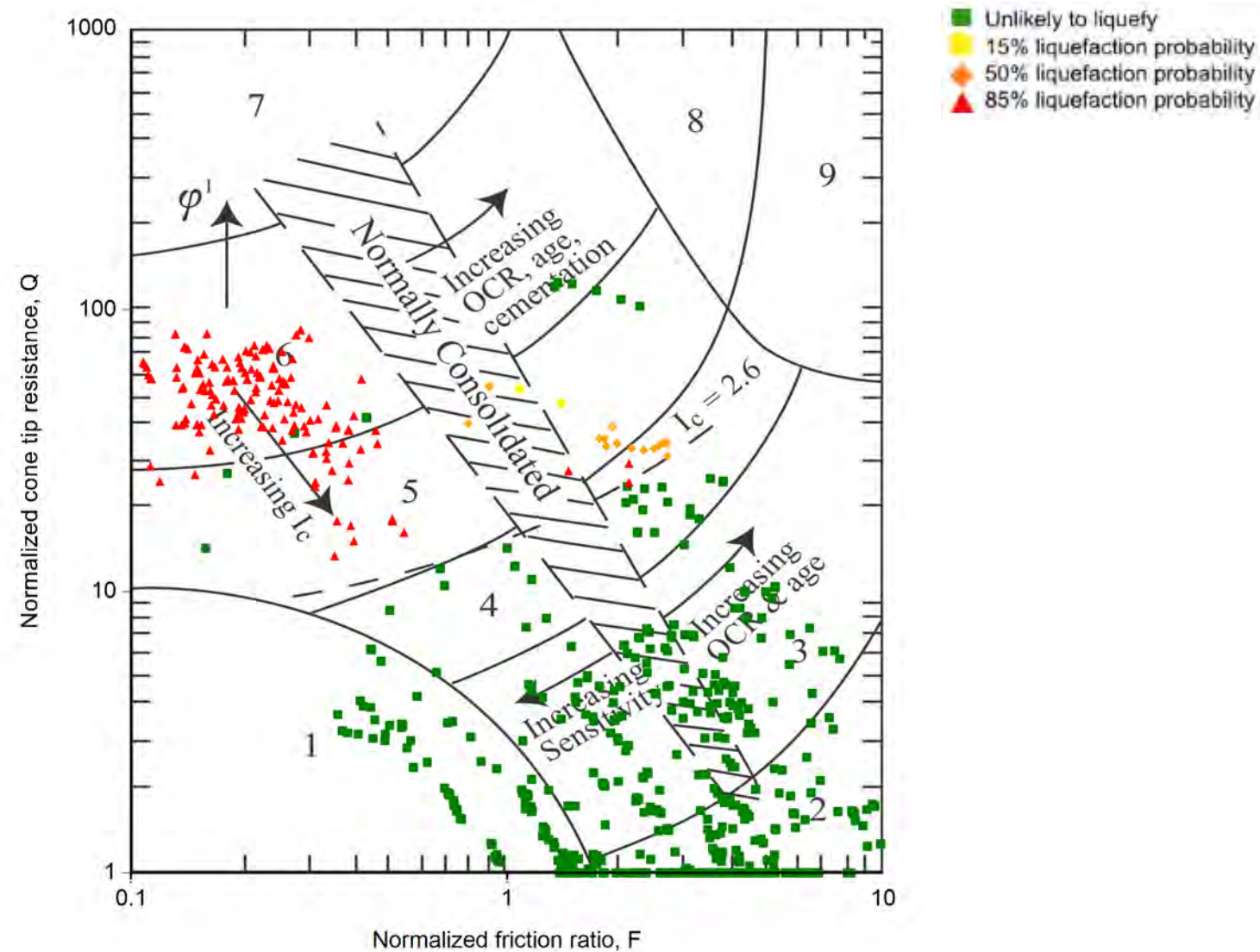
DATE	24/06/2021
ANALYSED	cand
PAGE	6 of 47 pages



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT103		178992	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	130	4.2	8	11	7.2	0						
	50%	126	4.2	6	11	7.2	0						
	85%	118	3.7	4	10	7.2	0						

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

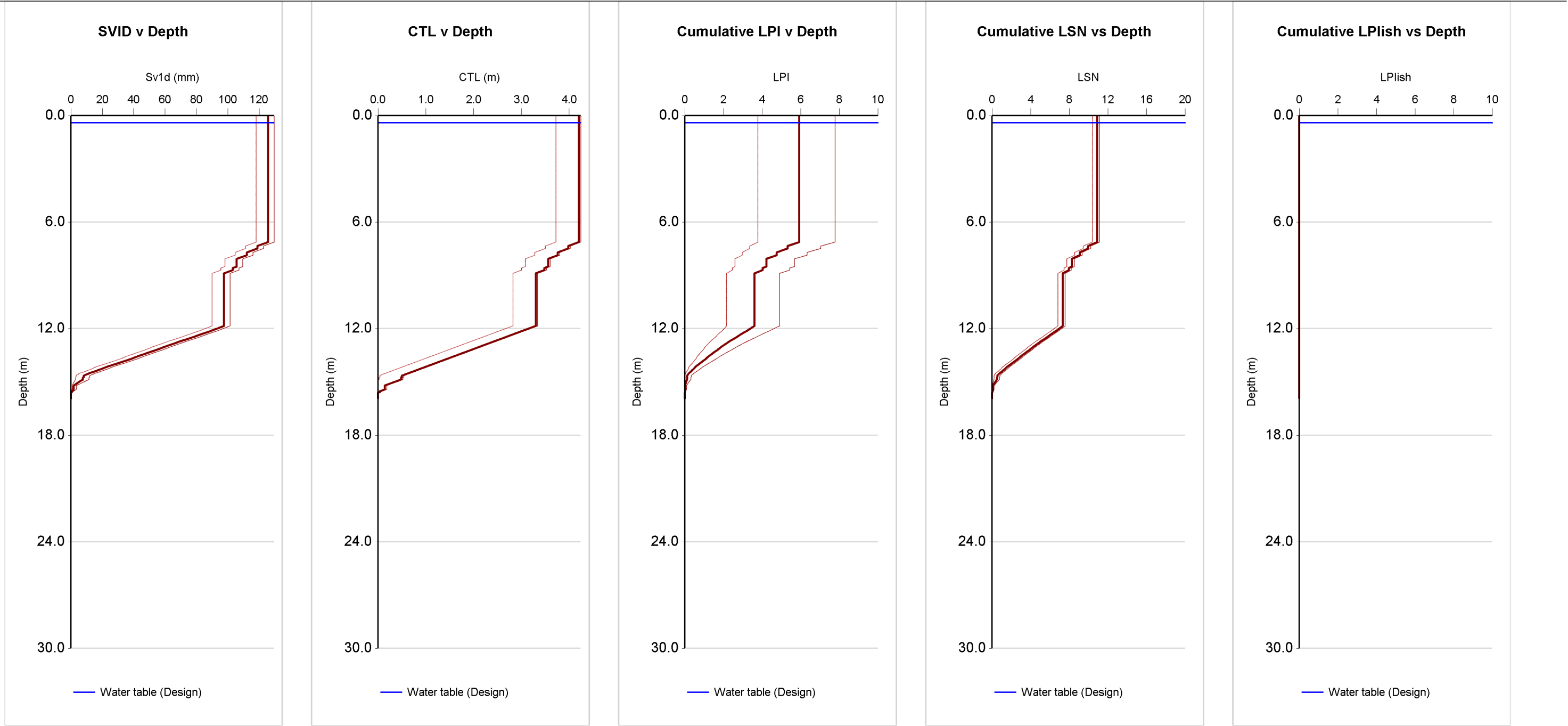


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

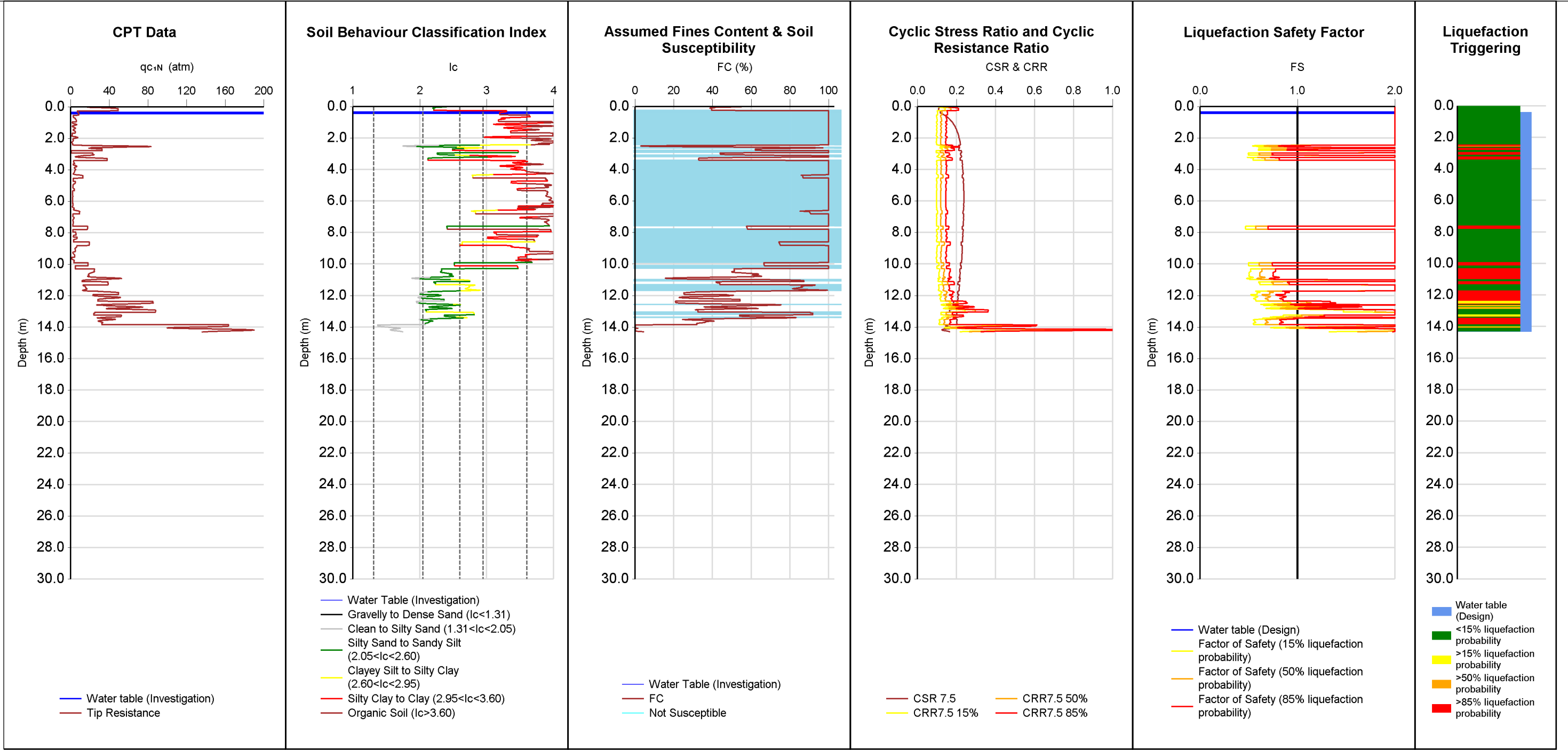
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	8 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2					



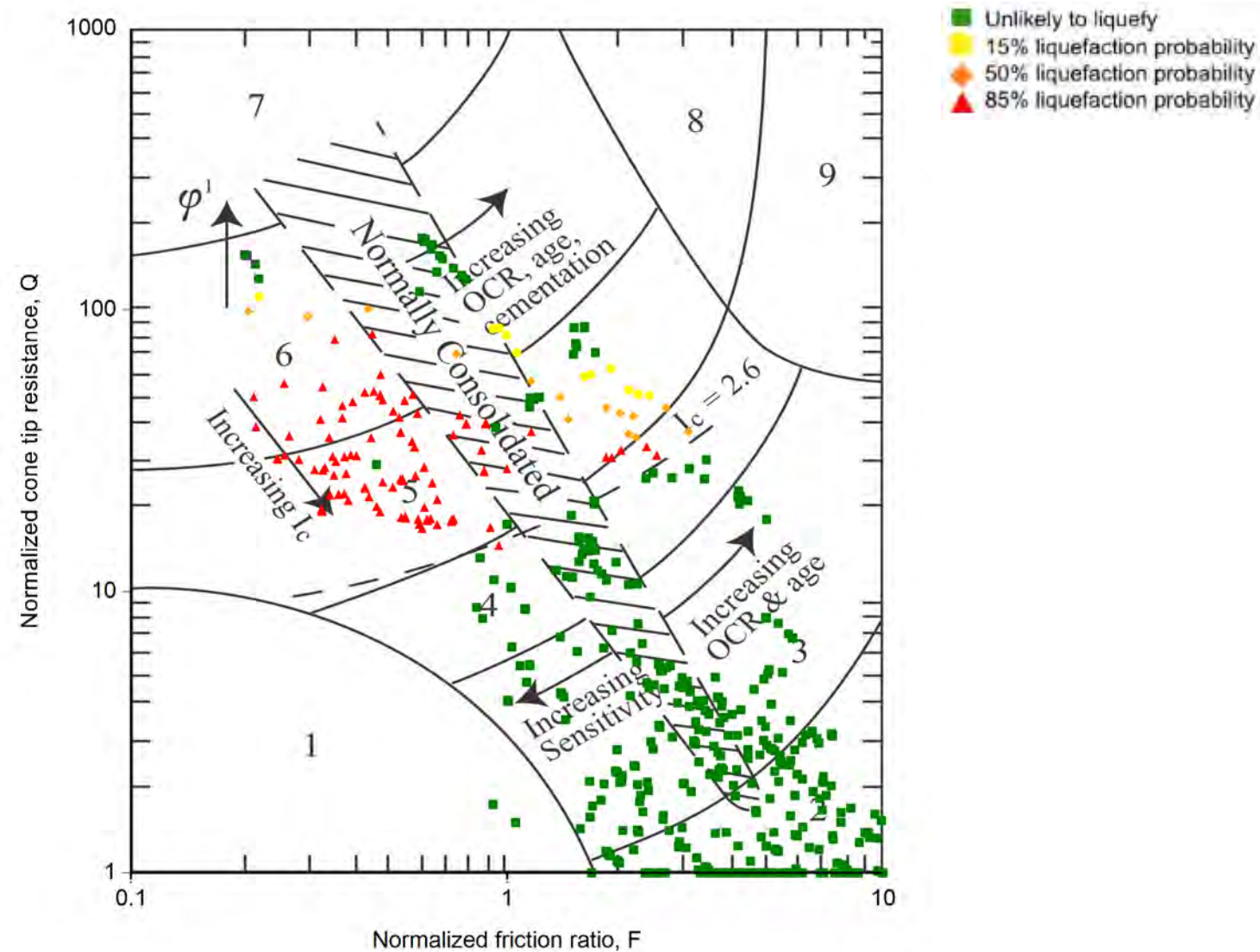
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INPUT	CPT103	178992	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT104		178993	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	97	3.6	8	13	2.5	5						
	50%	92	3.3	5	12	2.5	4						
	85%	81	3	3	11	2.6	2						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

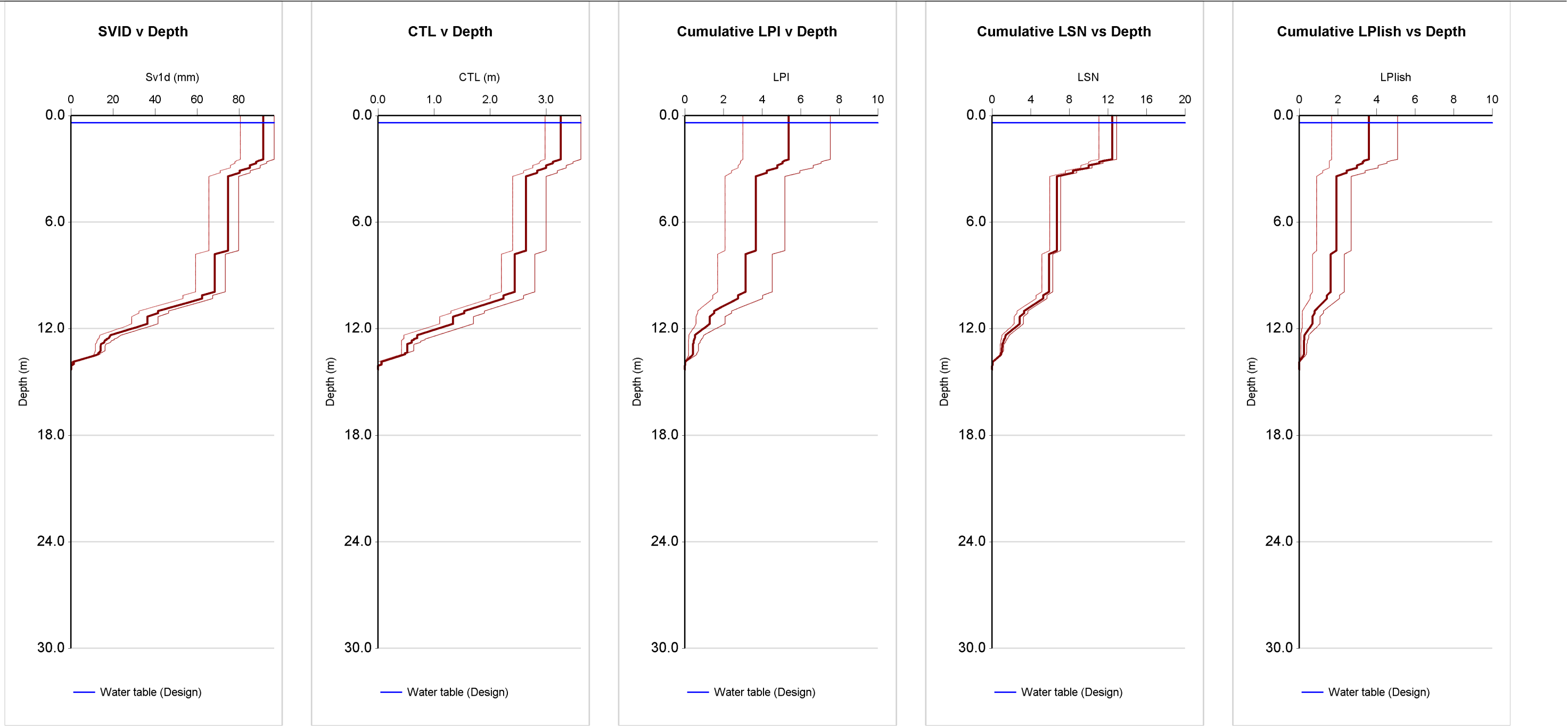


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

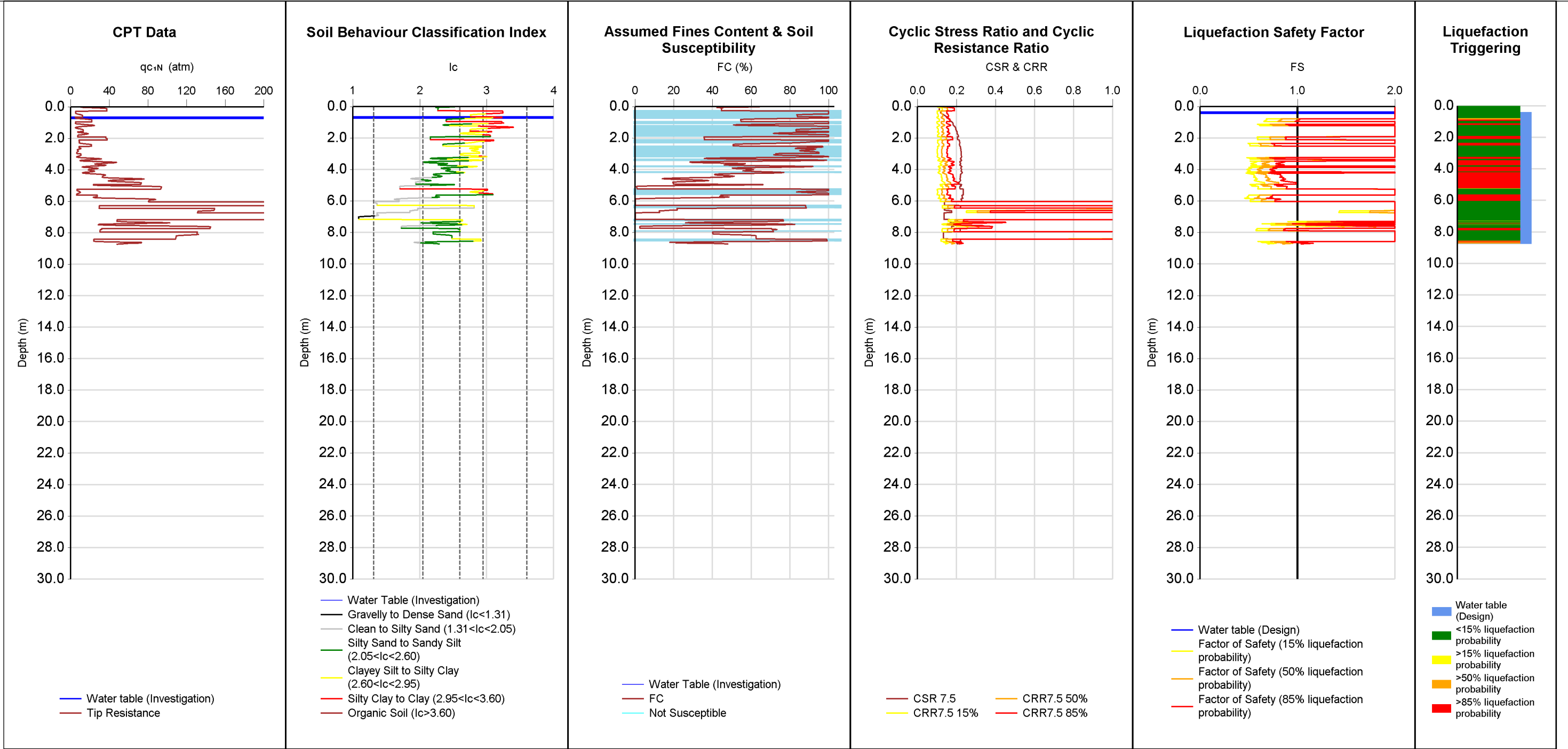
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	11 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2					



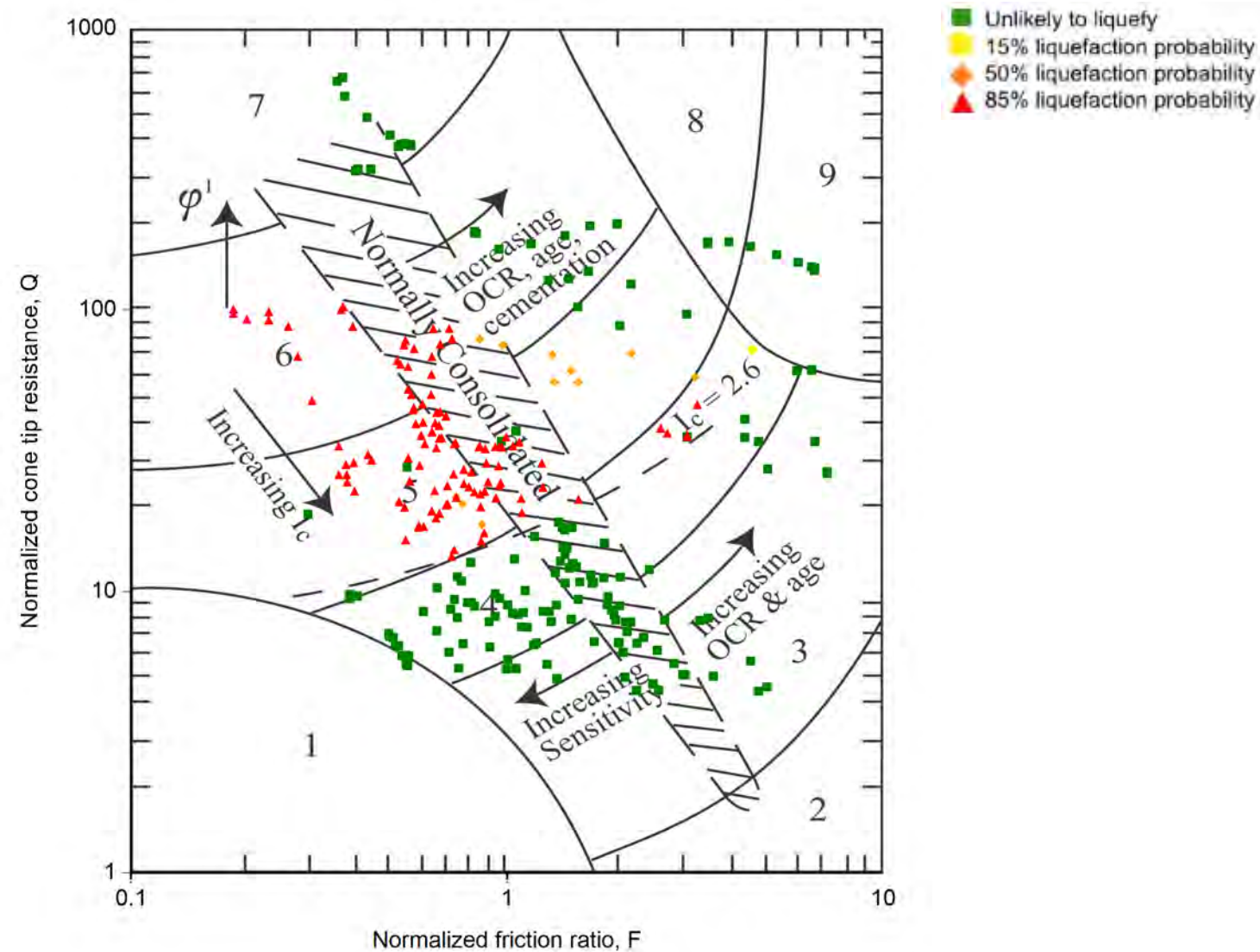
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INPUT	CPT104	178993	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT105		178994	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	89	3.3	11	28	0.9	11						
	50%	86	3.2	8	28	0.9	7						
	85%	72	3	4	21	1.1	3						

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

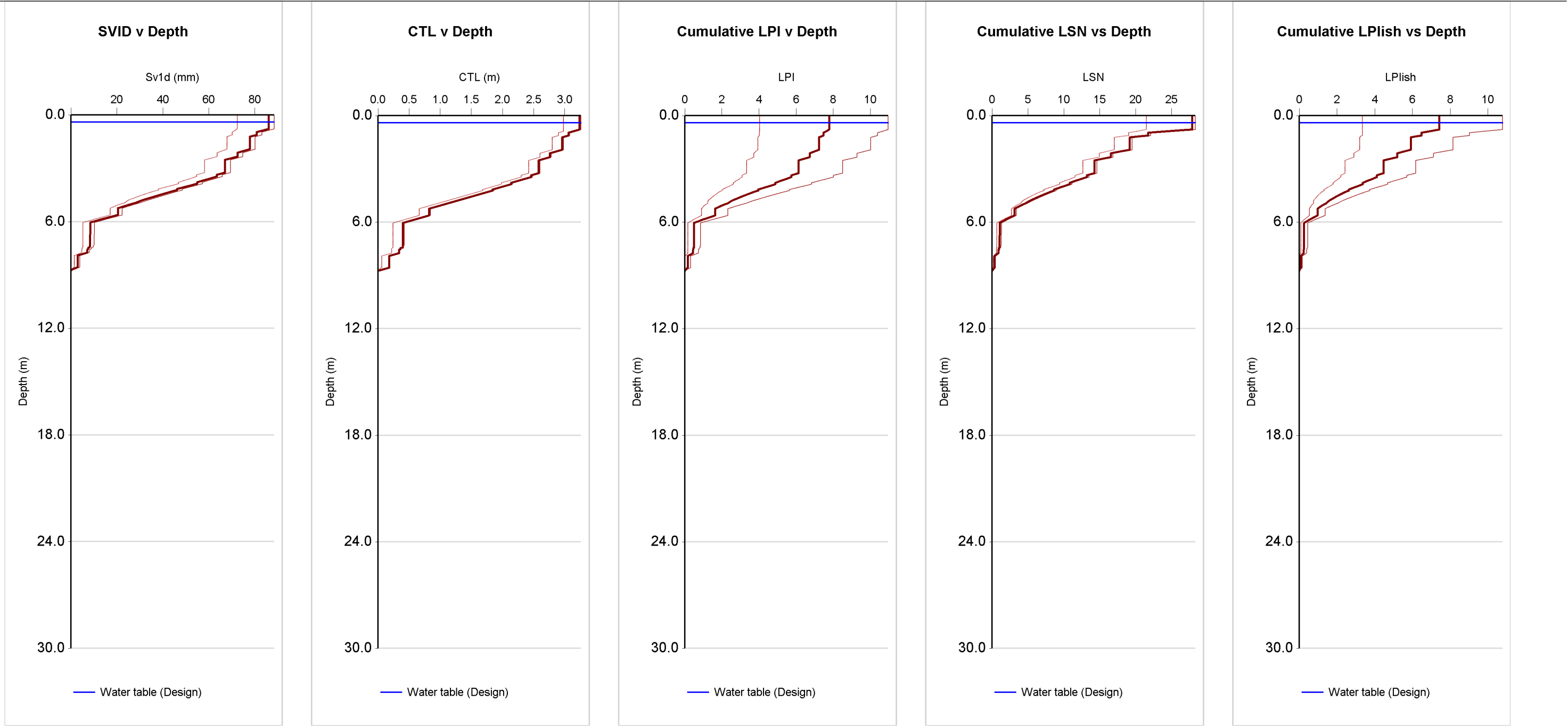


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

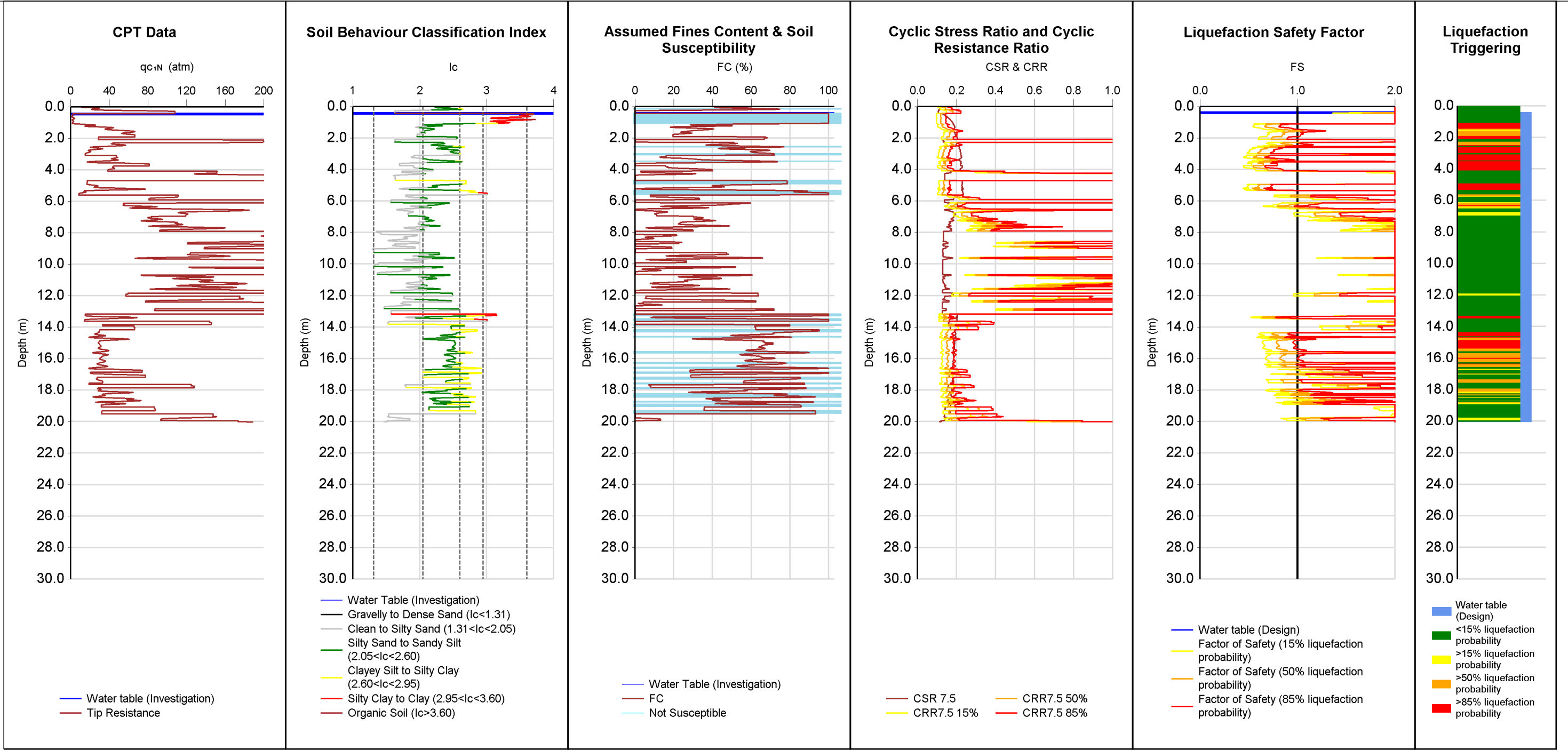
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	14 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT105	178994	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



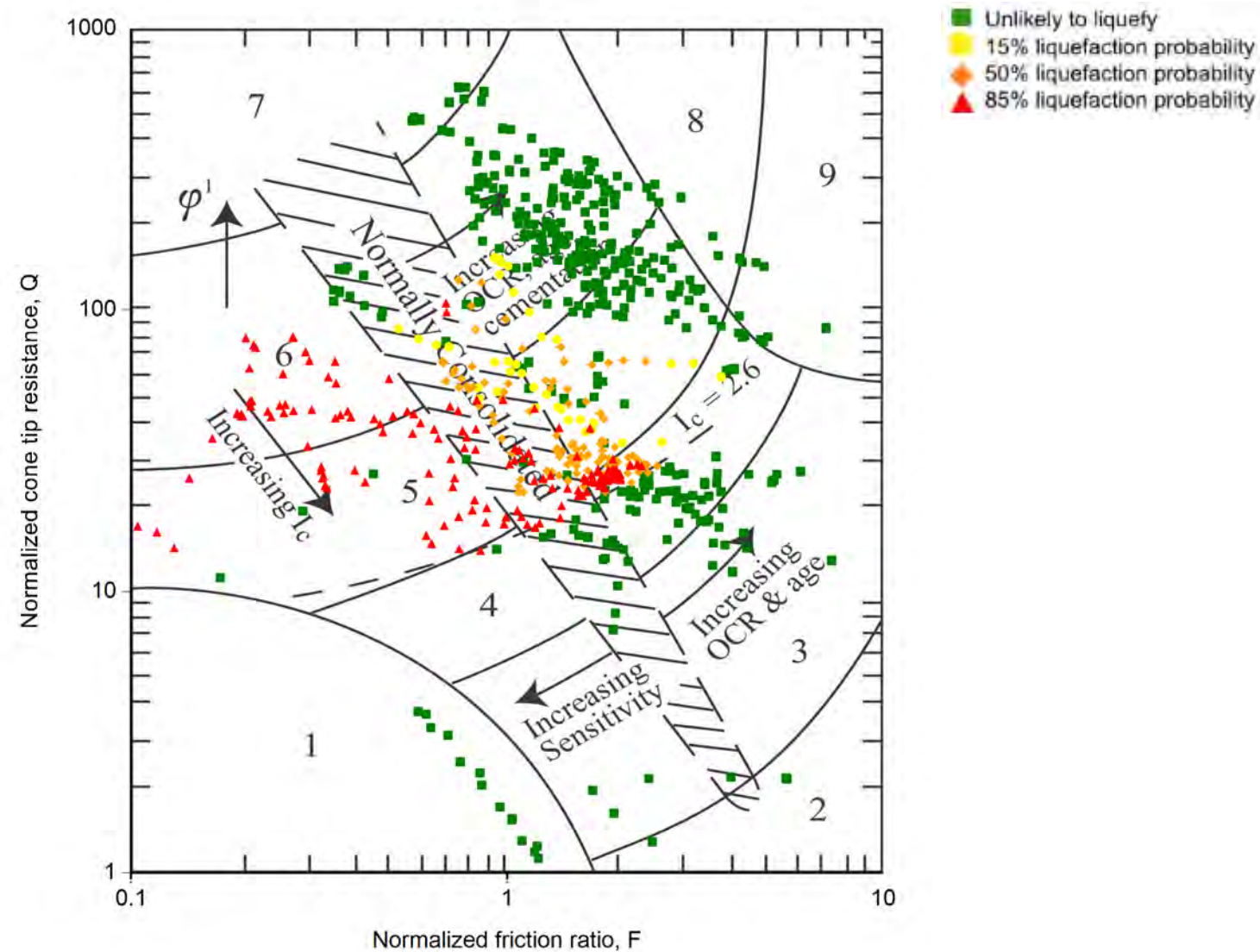
Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT106		178995	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	179	7.1	14	42	1.2	15	CPT Inversion					
	50%	151	6	9	37	1.2	9	Groundwater					
	85%	102	3.5	4	28	1.2	4	Susceptibility					



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd	LOCATION	DATE	24/06/2021
PROJECT	Brymer Farms Subdivision	Hamilton	ANALYSED	cand
TITLE	Liquefaction Analyses	JOB NUMBER	PAGE	16 of 47 pages
COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000		

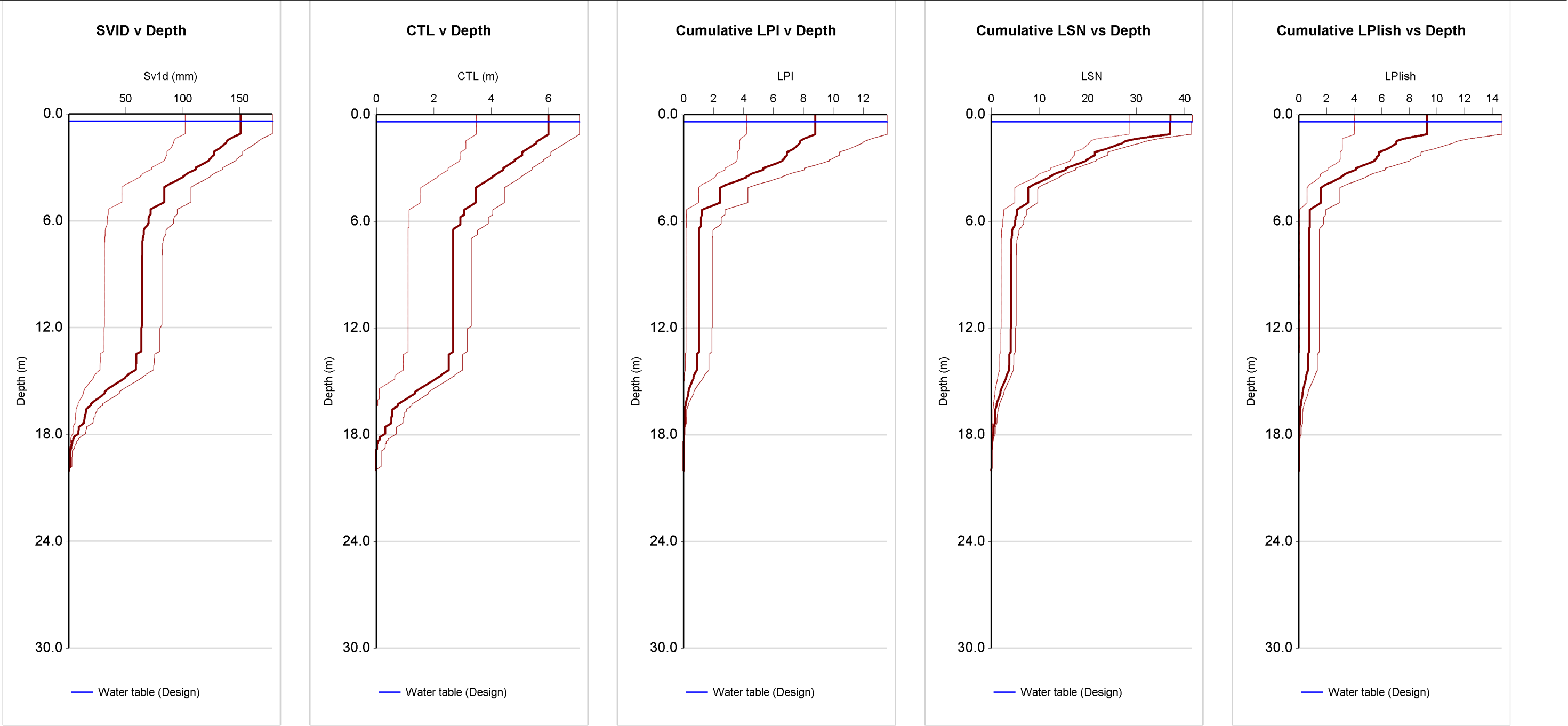


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

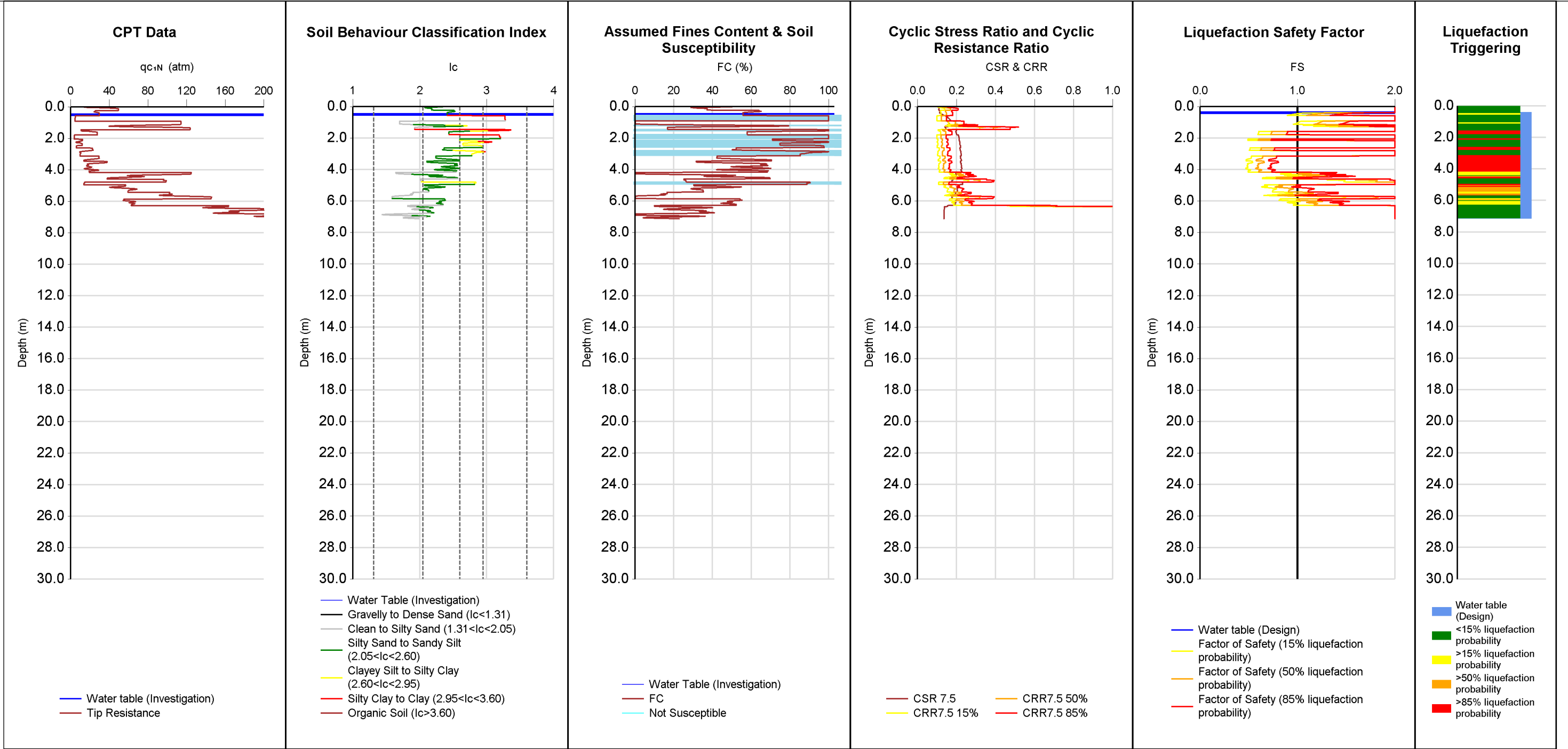
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	17 of 47 pages
	COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000				



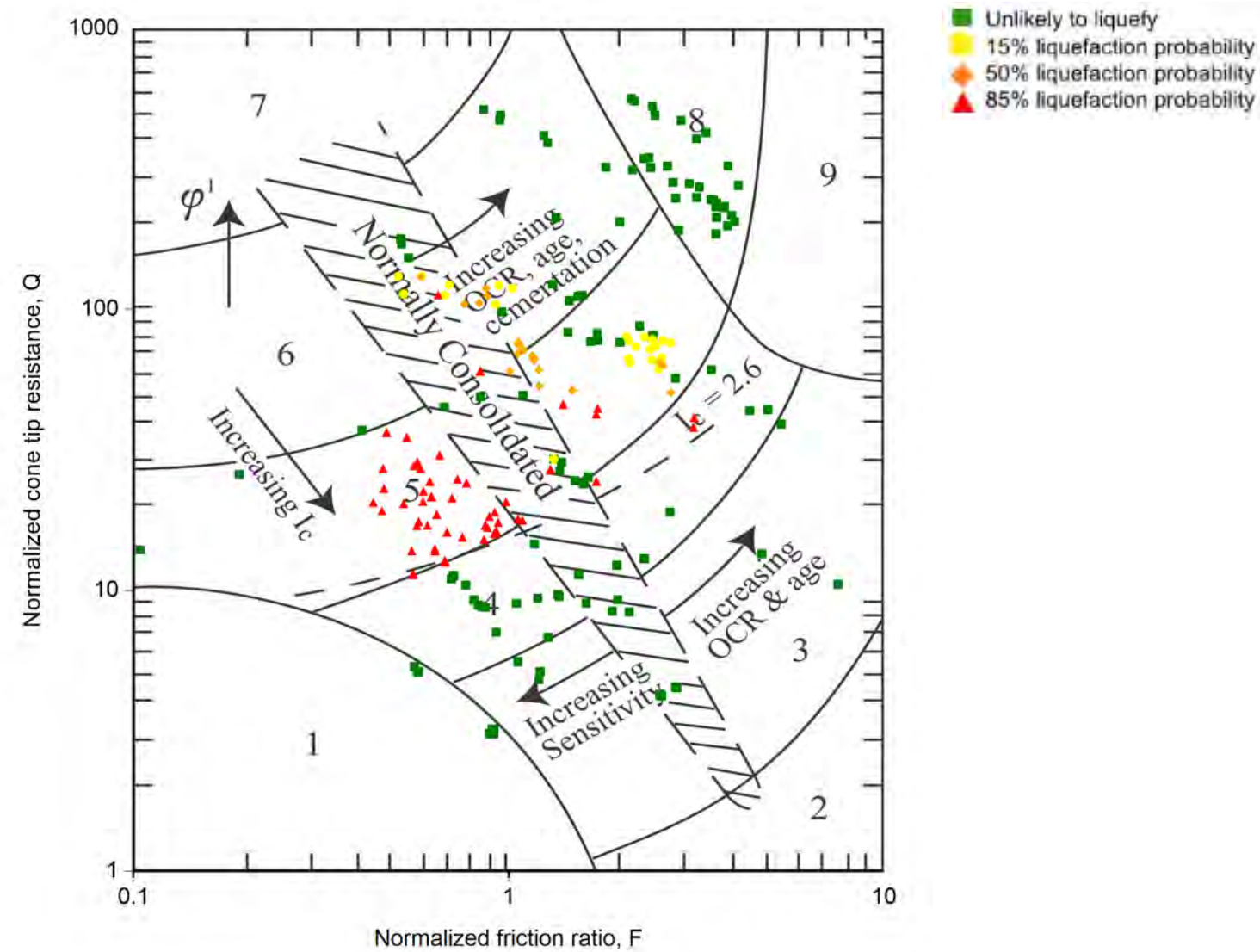
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT106	178995	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT107		178996	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	74	3.2	8	27	0.5	8						
	50%	63	2.3	5	21	1.7	5						
	85%	52	1.8	3	18	1.7	3						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

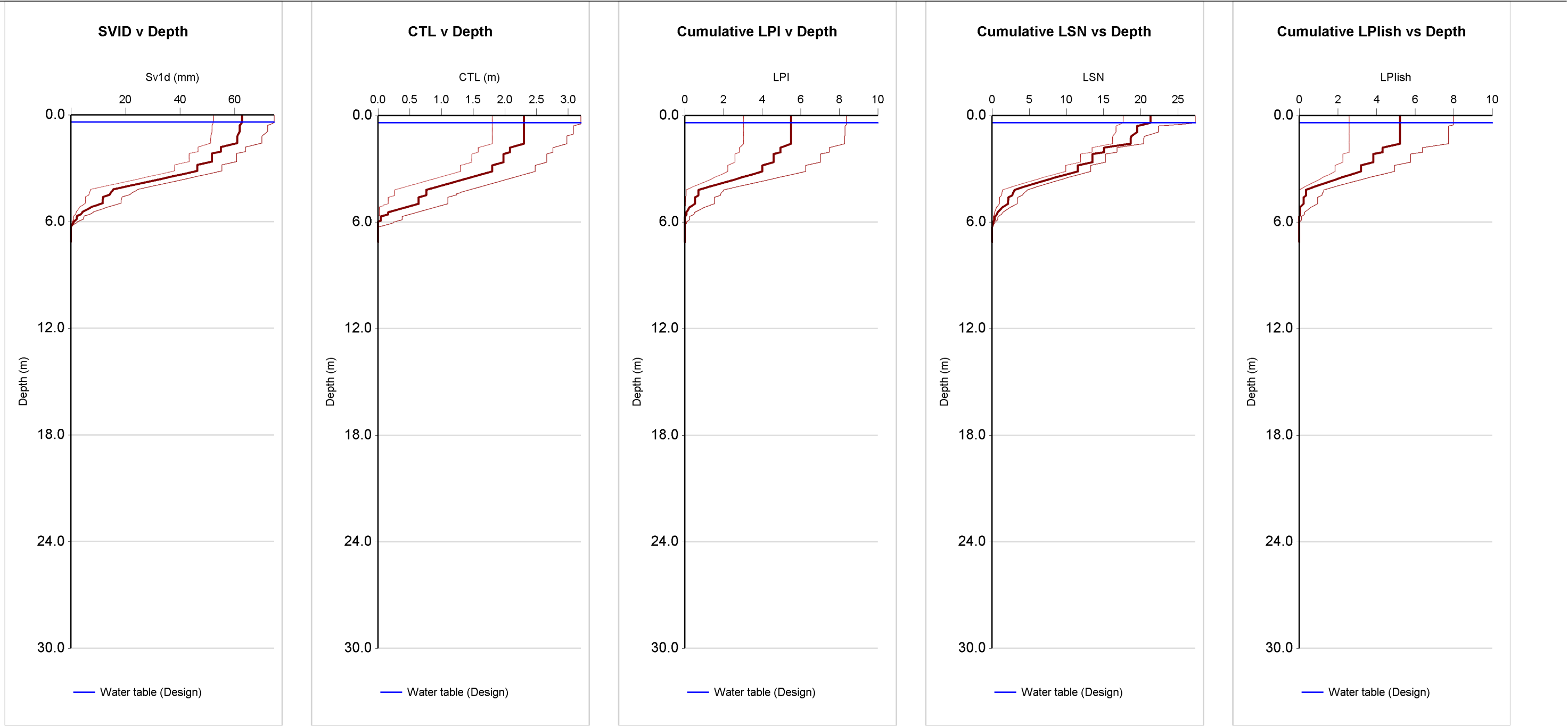


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

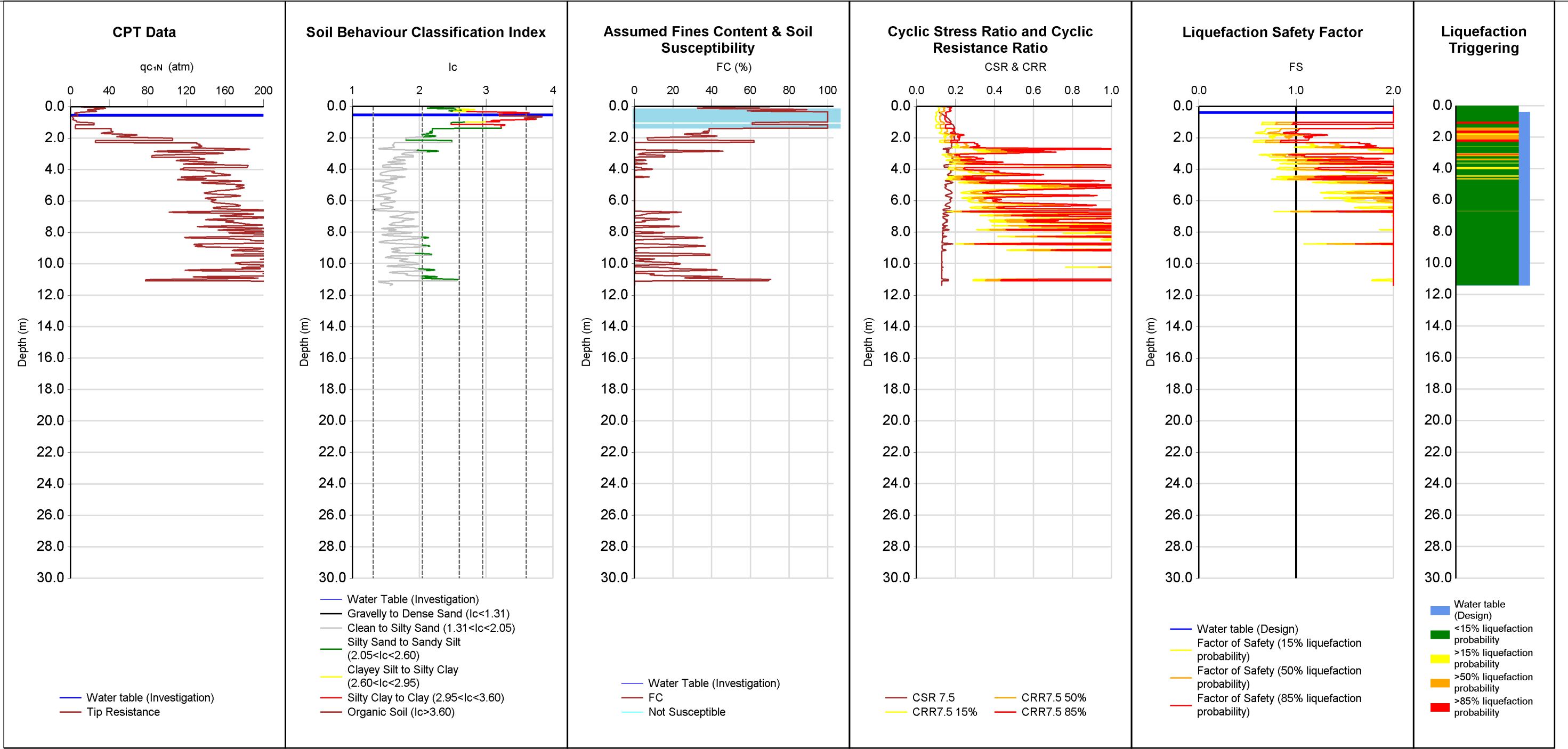
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	20 of 47 pages
	COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT107	178996	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

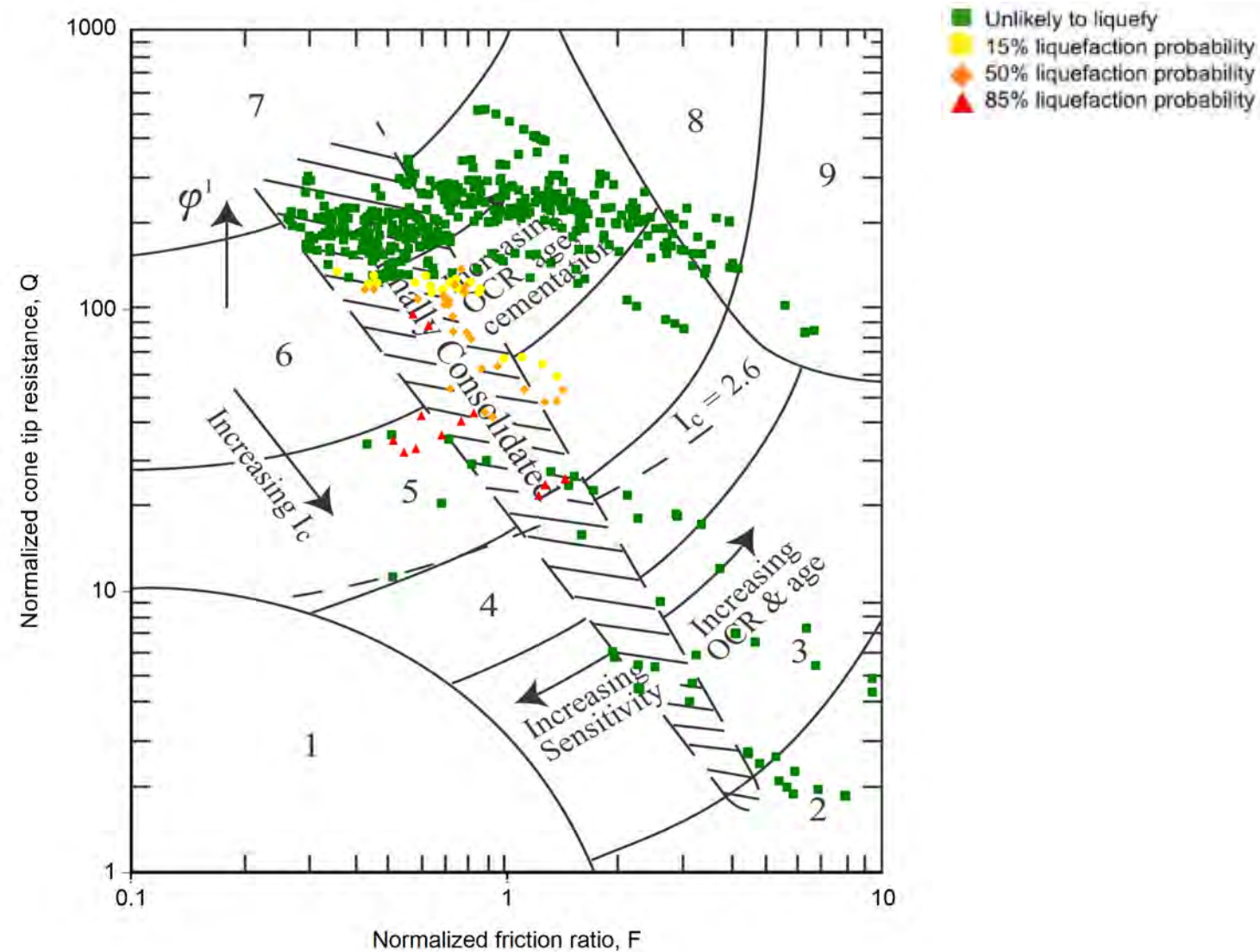


Note: Inverse filtered Q_c/F_s data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT108	178997	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	42	1.8	4	20	1.1	6					
		50%	30	1.3	2	16	1.1	3					
		85%	16	0.5	0	8	1.1	0					

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

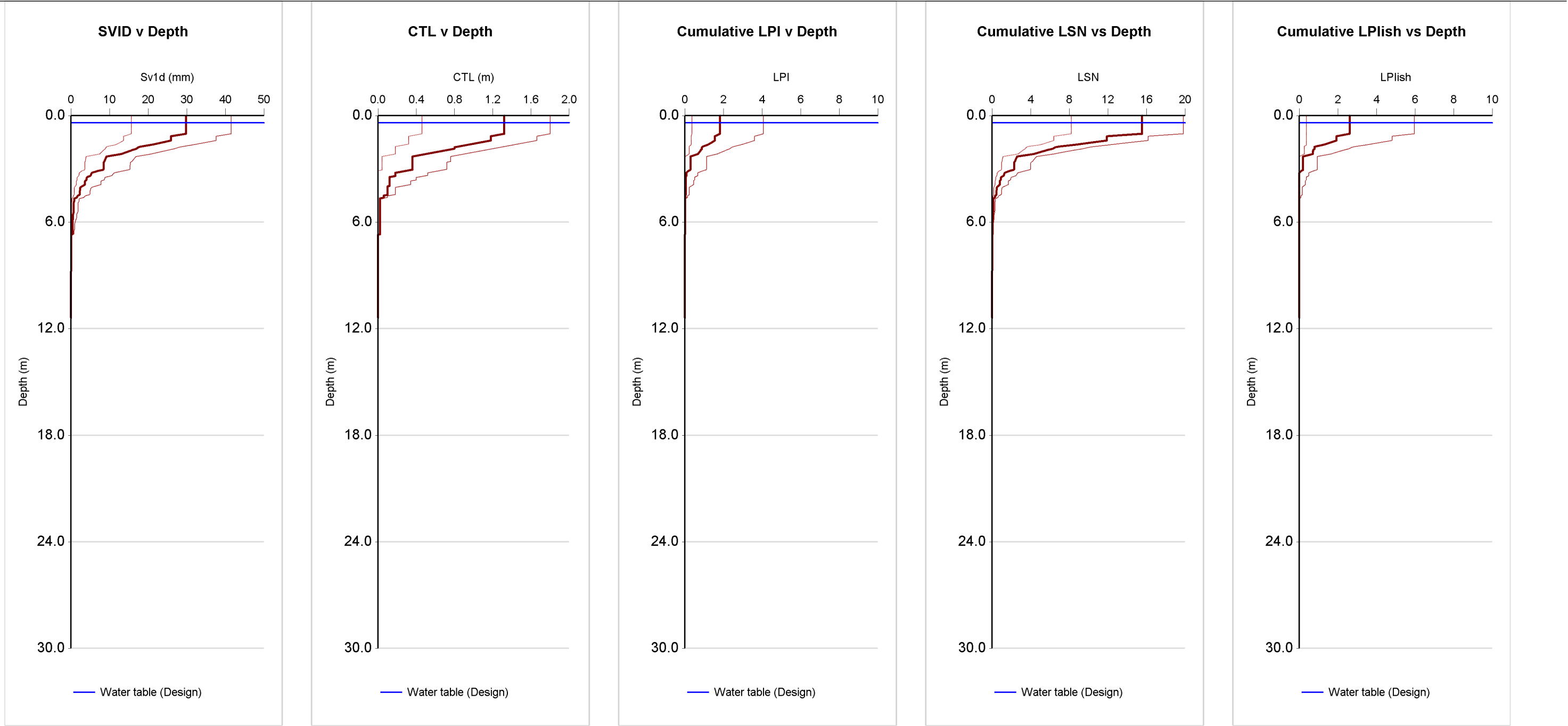


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

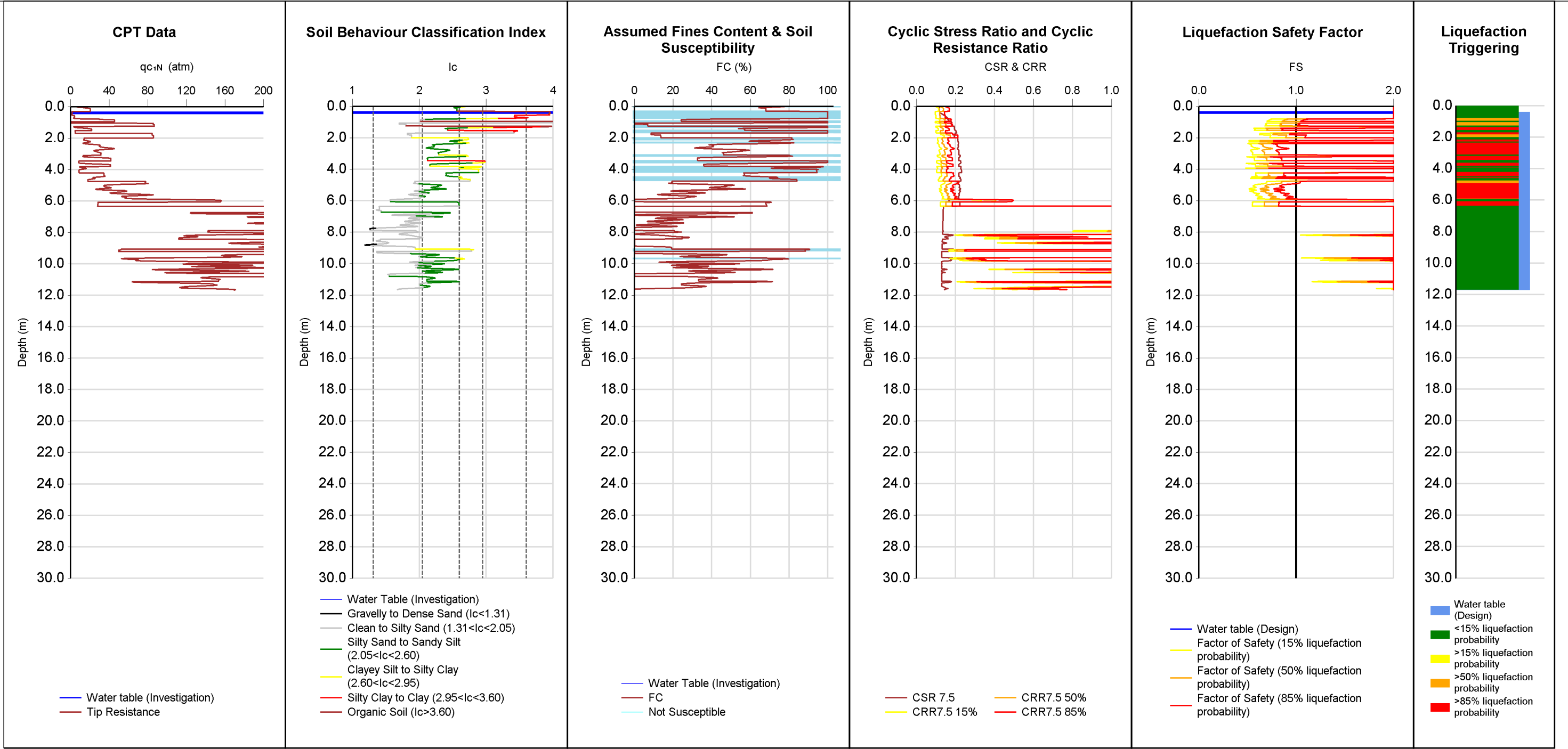
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	23 of 47 pages
	COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT108	178997	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT CPT109		178998	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
PL		SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
OUTPUT 15%		103	3.9	13	38	0.9	14					
50%		98	3.9	9	35	0.9	9					
85%		78	3.2	4	26	1.5	3					

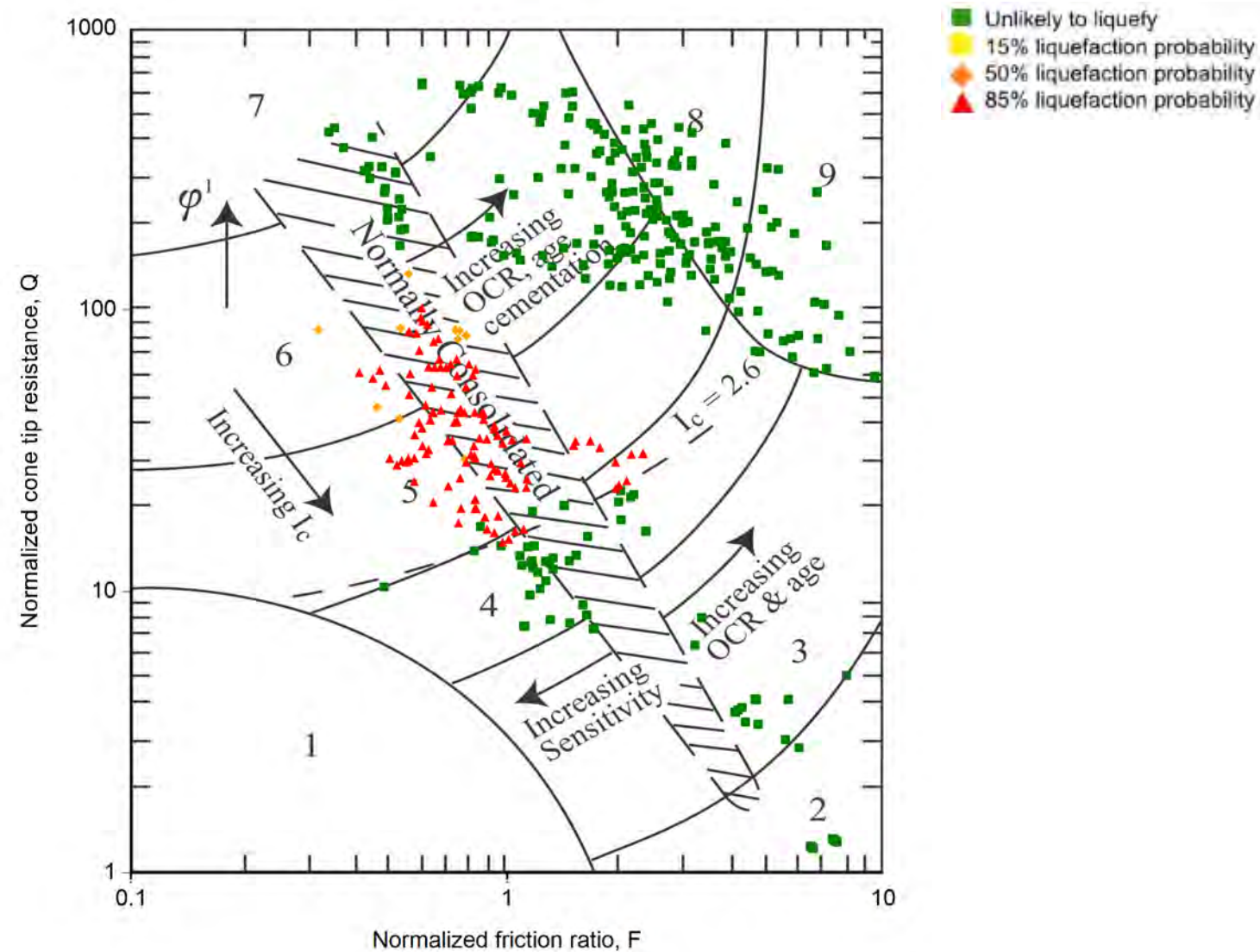
Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd	LOCATION	DATE	24/06/2021
PROJECT	Brymer Farms Subdivision	Hamilton	ANALYSED	cand
TITLE	Liquefaction Analyses	JOB NUMBER	PAGE	25 of 47 pages
COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000		

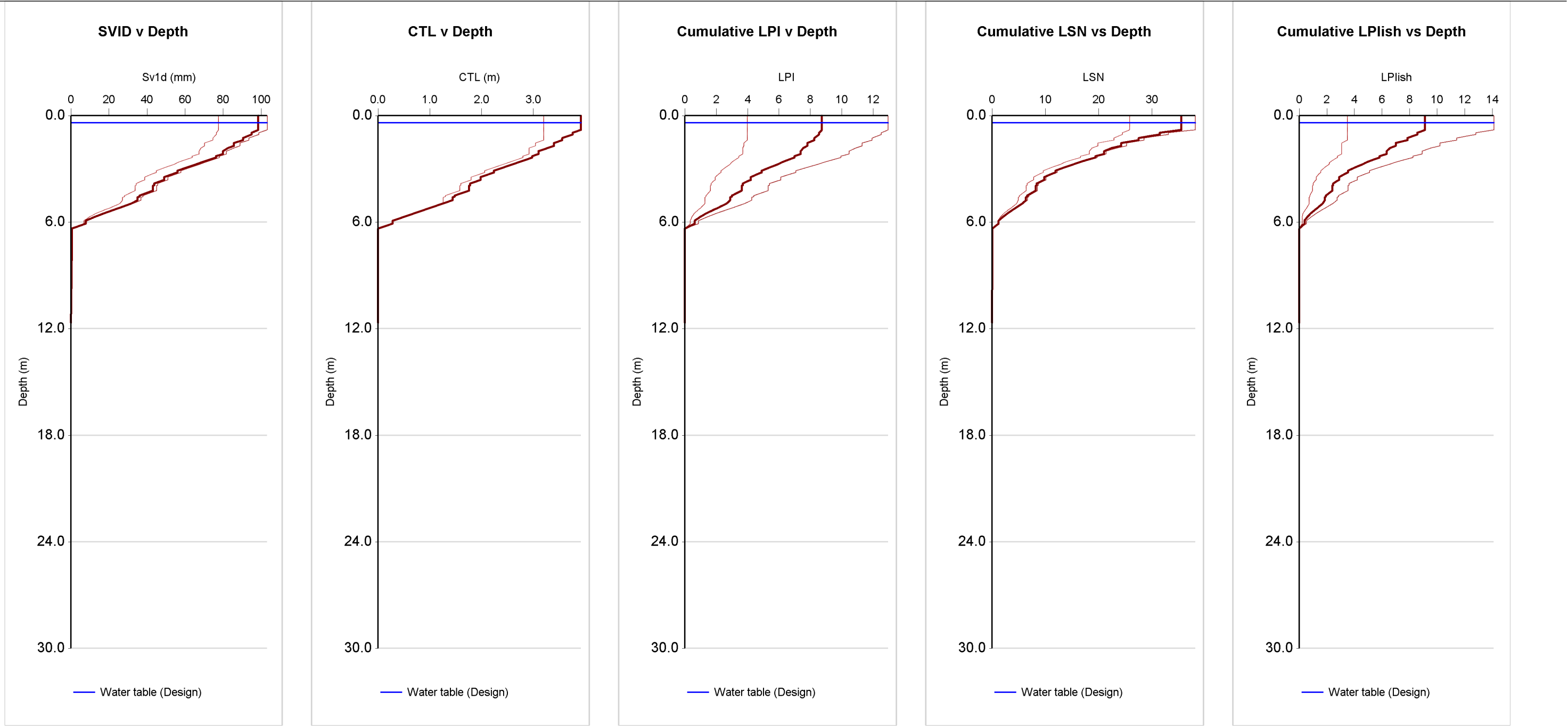


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

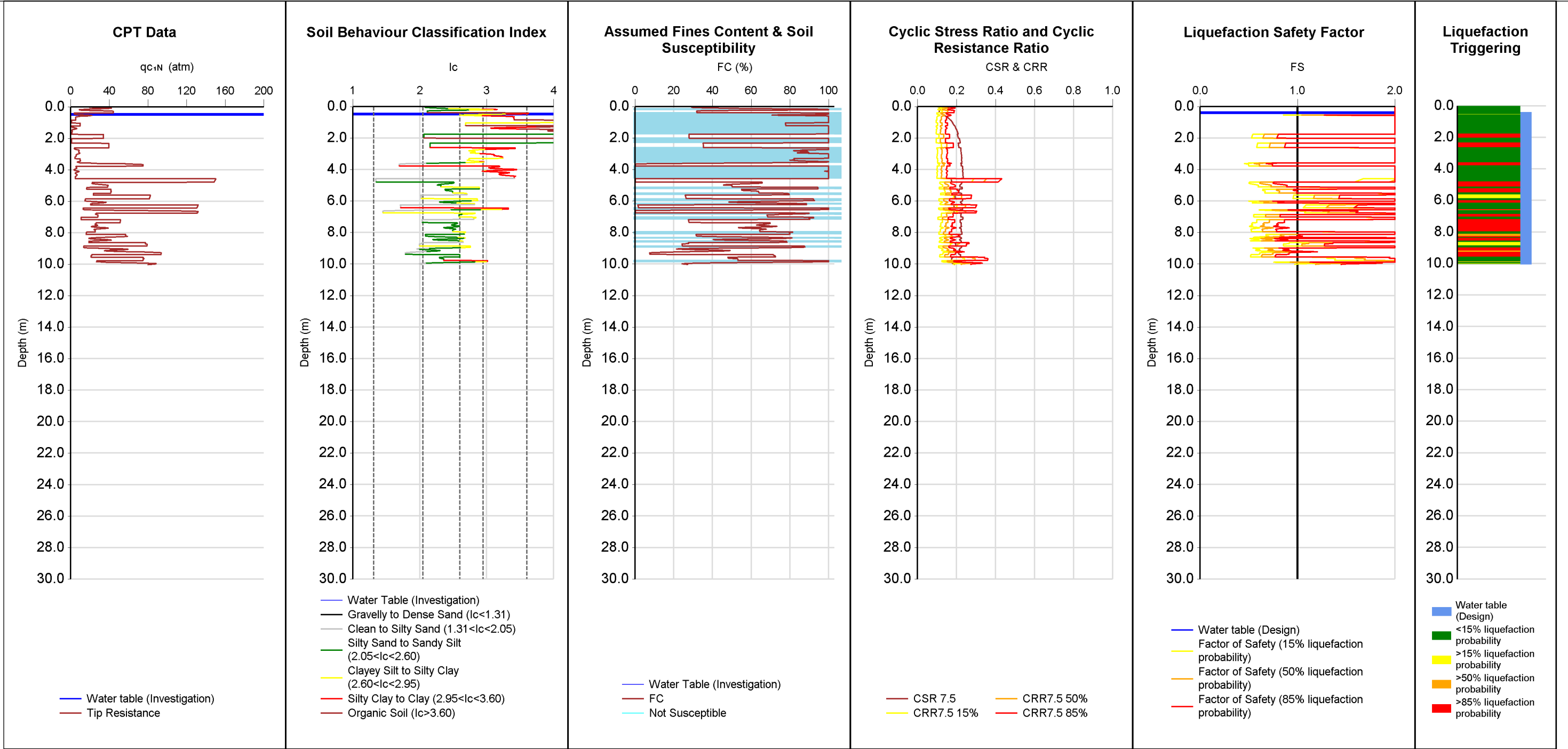
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	26 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2					



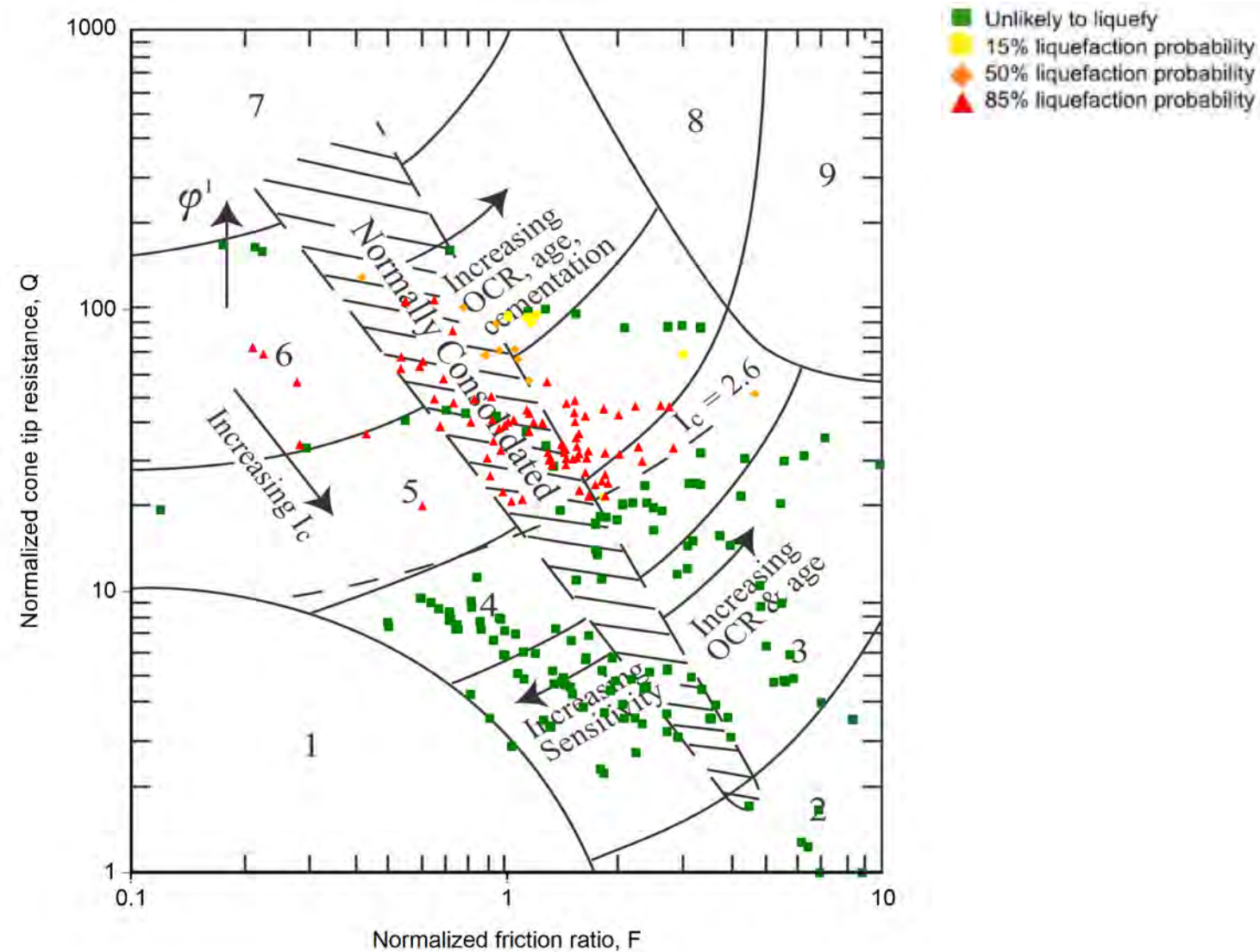
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT109	178998	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT110	178999	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	99	4	10	21	1.8	8					
		50%	91	3.4	7	19	1.8	5					
		85%	76	3.2	4	16	1.8	2					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

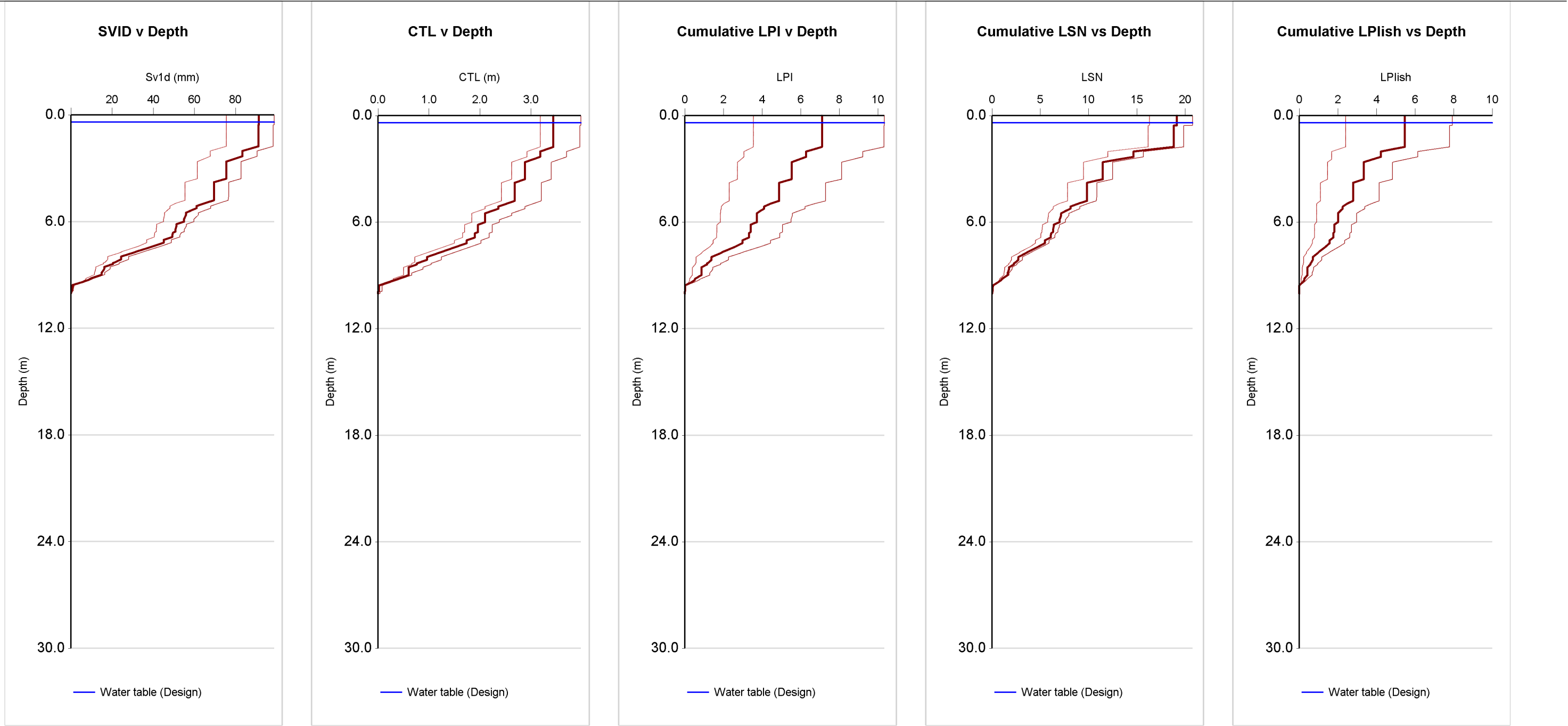


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

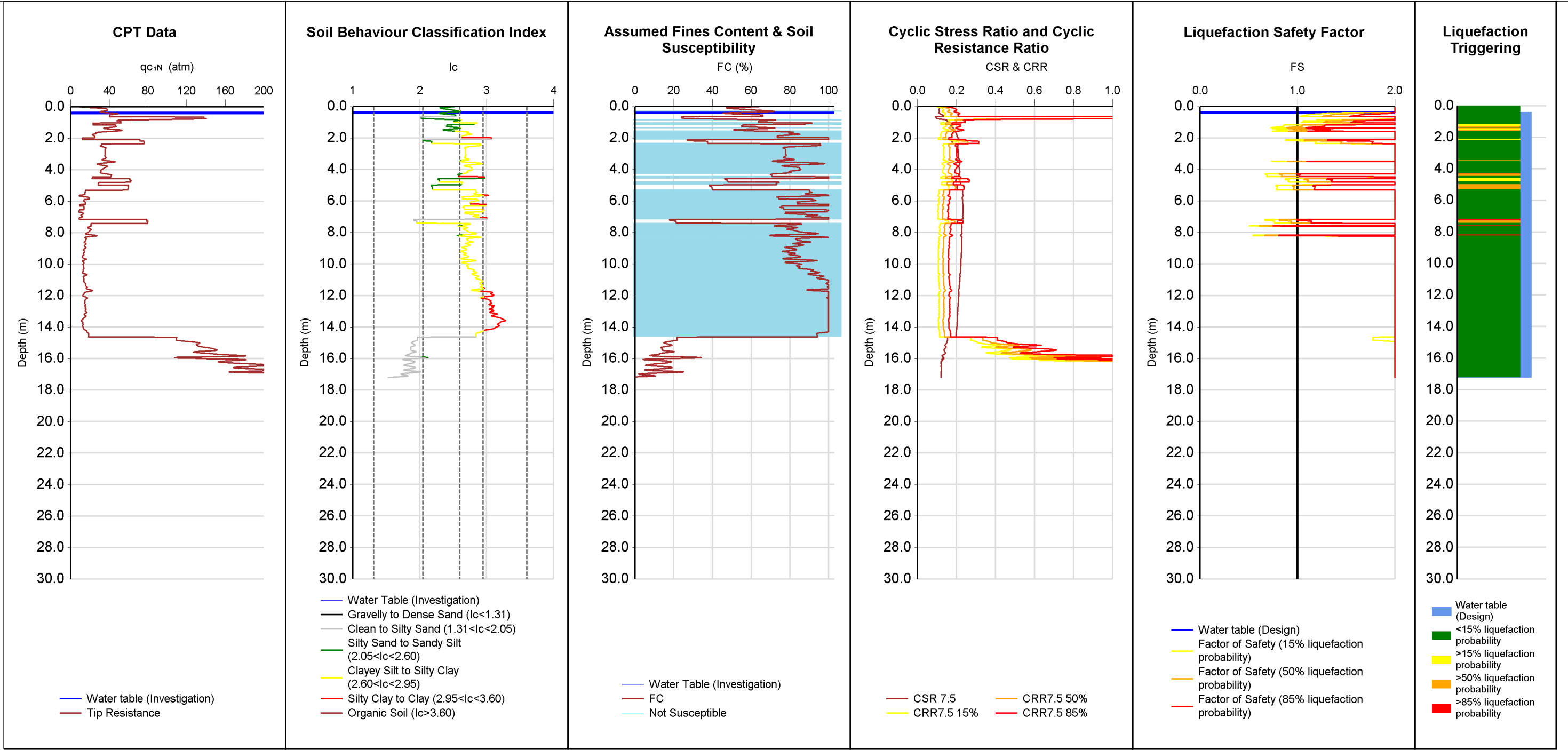
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	29 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT110	178999	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

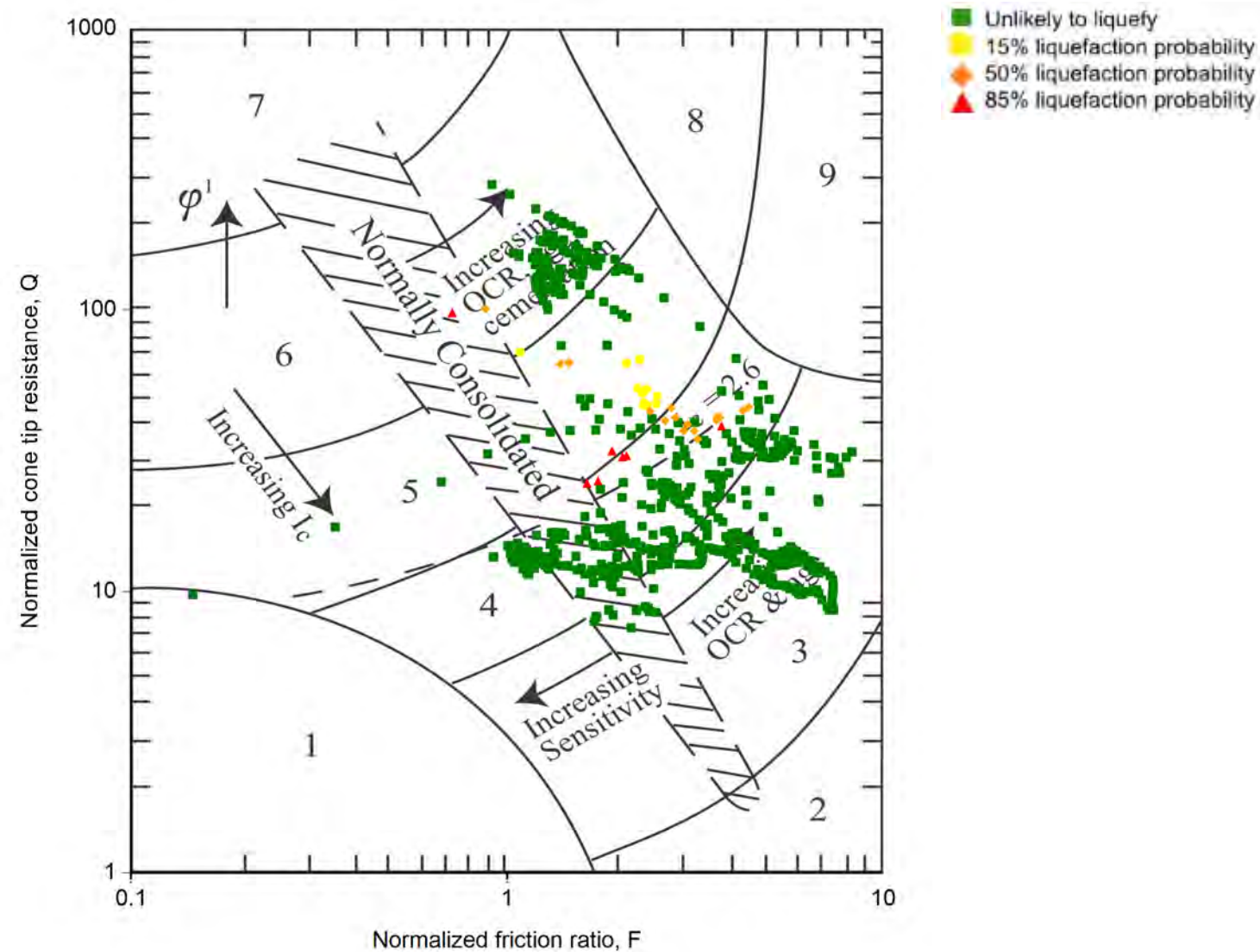


Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT CPT111		179000	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
PL		SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
15%		32	1.6	3	13	1.2	3					
50%		20	1.1	1	7	1.4	0					
85%		10	0.2	0	3	7.2	0					

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

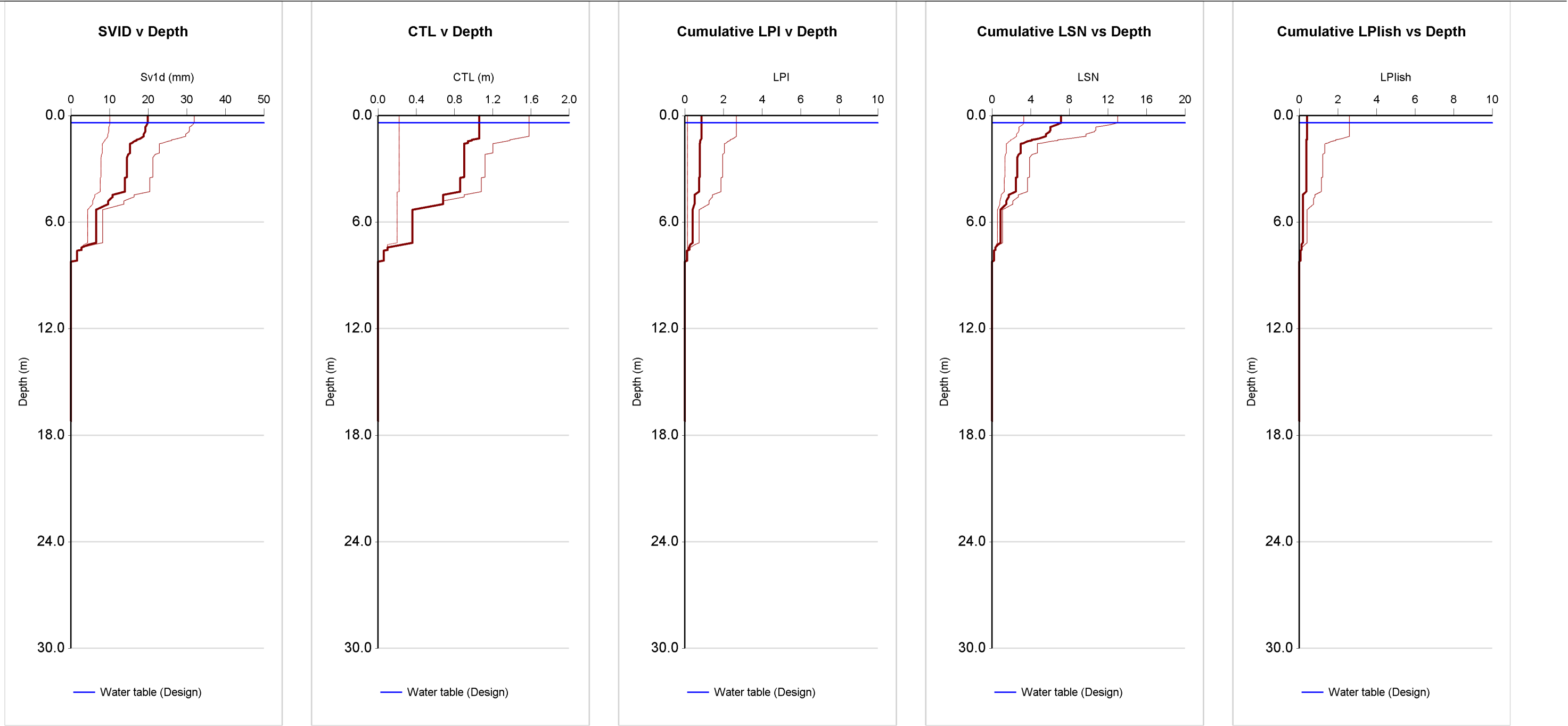


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

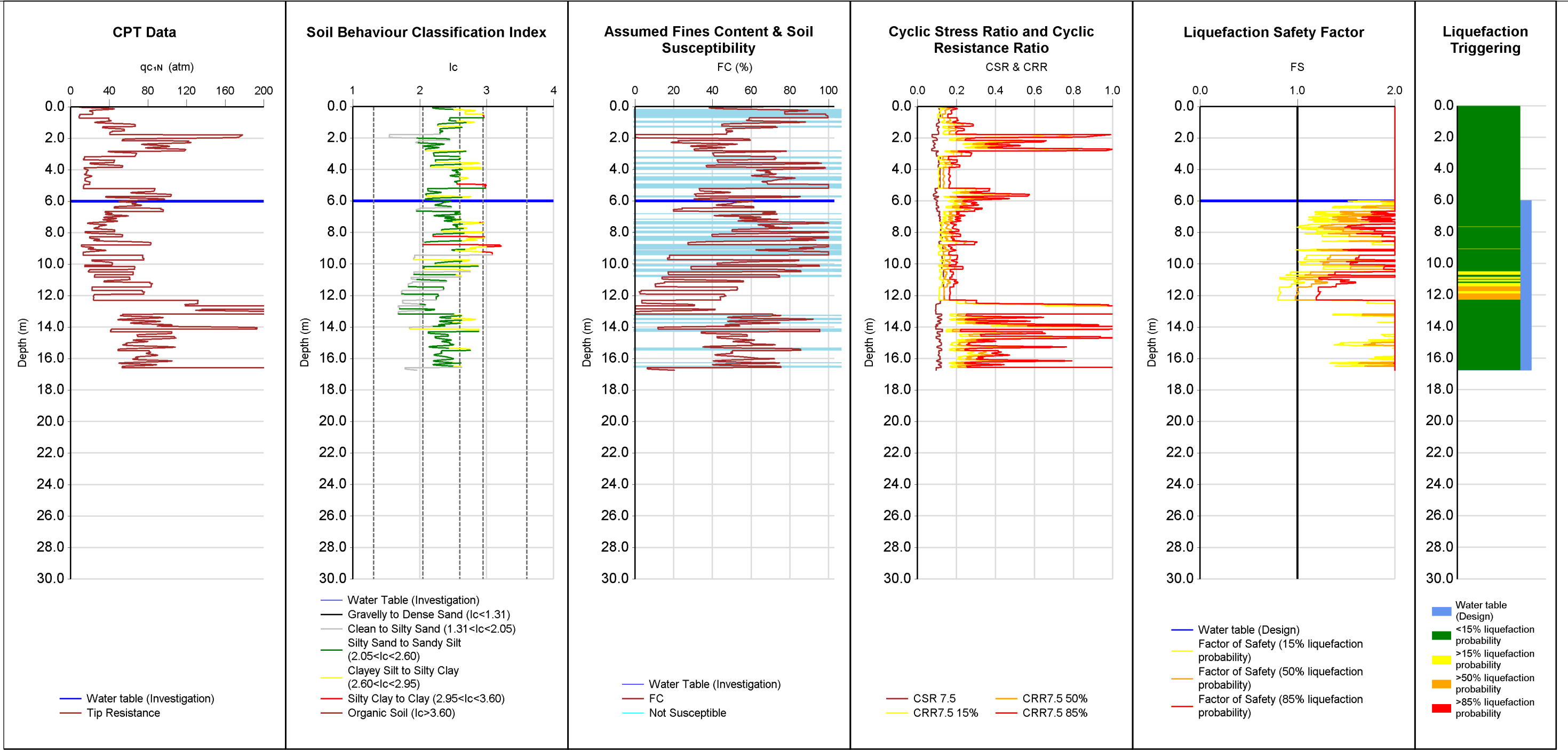
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	32 of 47 pages
		COMMENT	1 in 500 Year Event - ULS IL2				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT111	179000	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

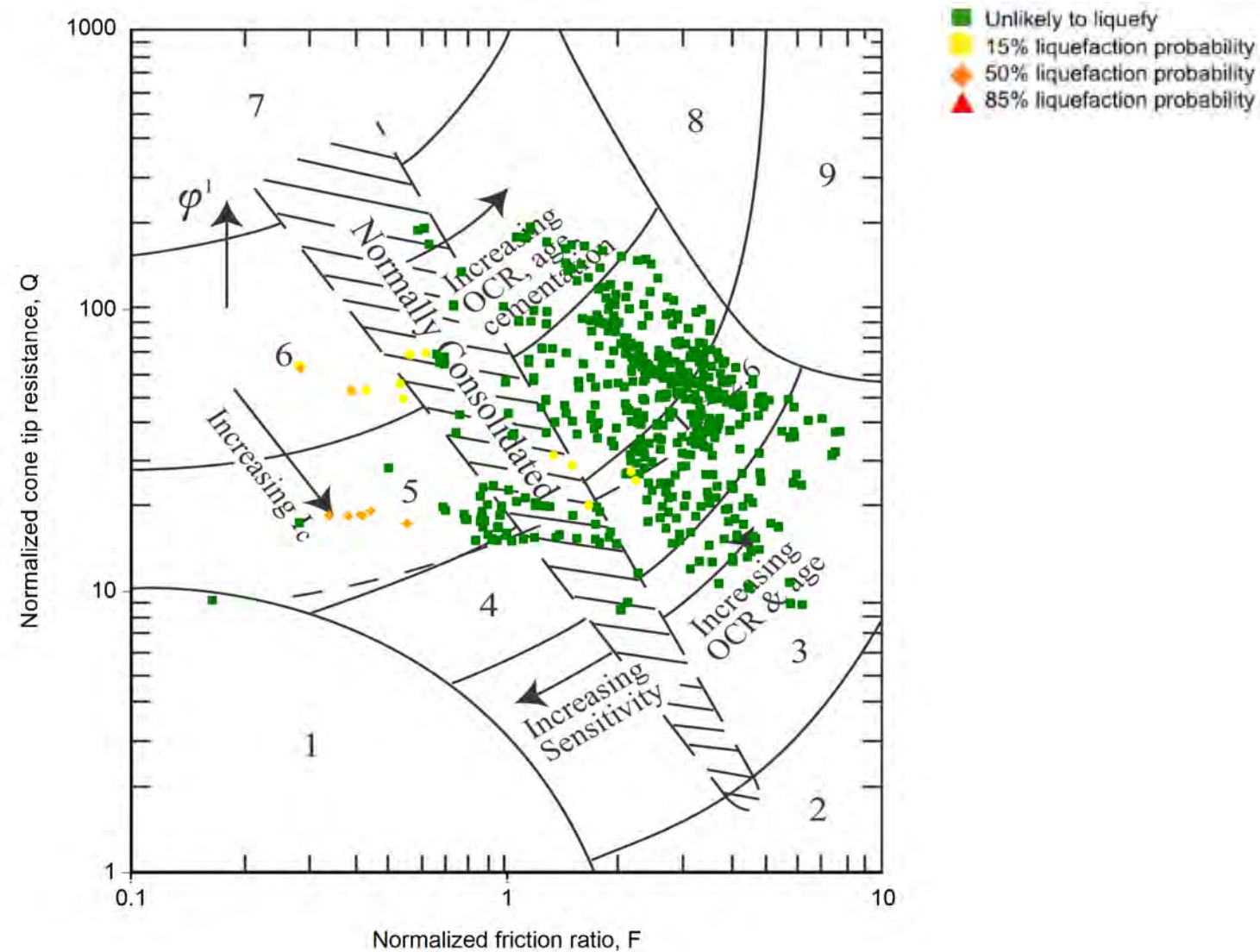


Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT112	179001	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	51	1.6	1	5	10.5	0					
		50%	21	0.7	0	2	11.5	0					
		85%	9	0	0	1	16.7	0					

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

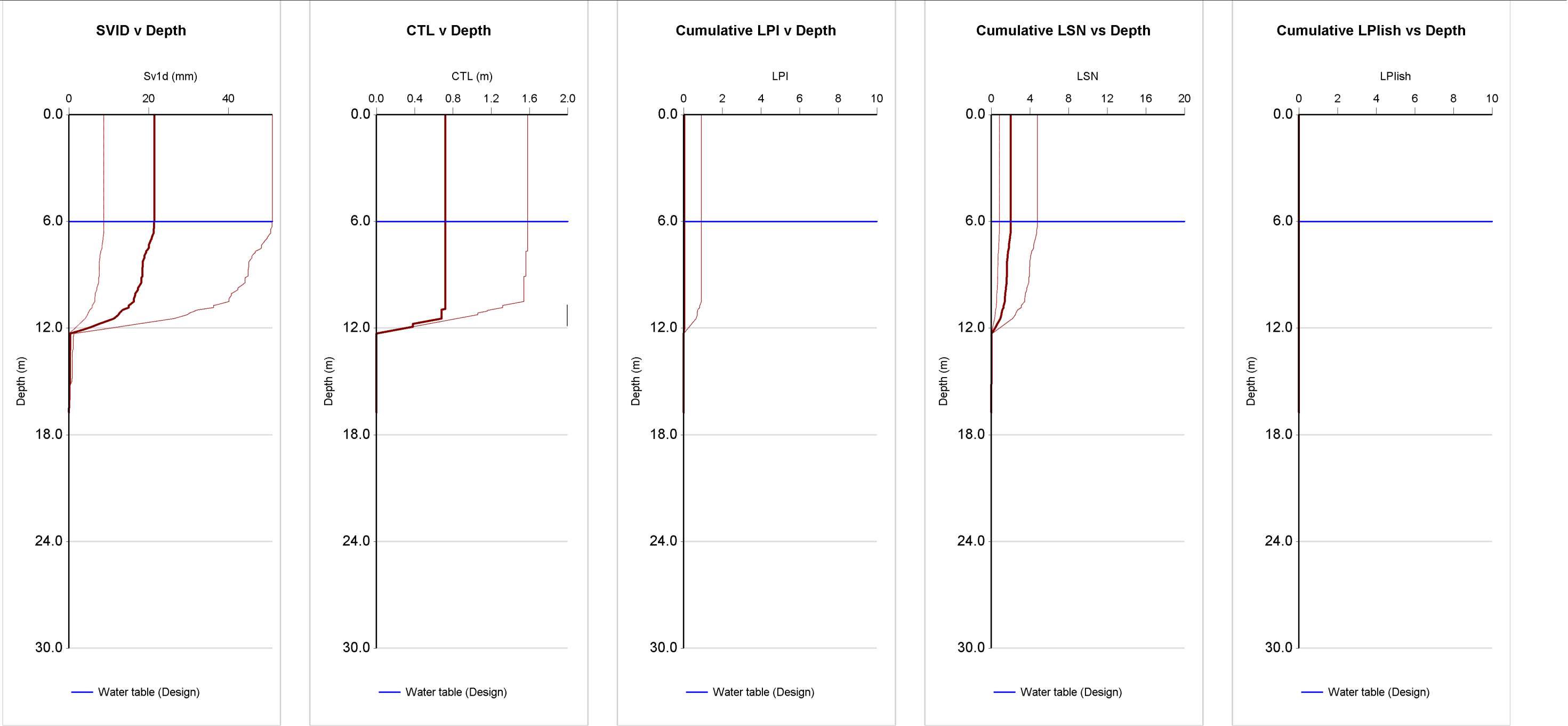


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

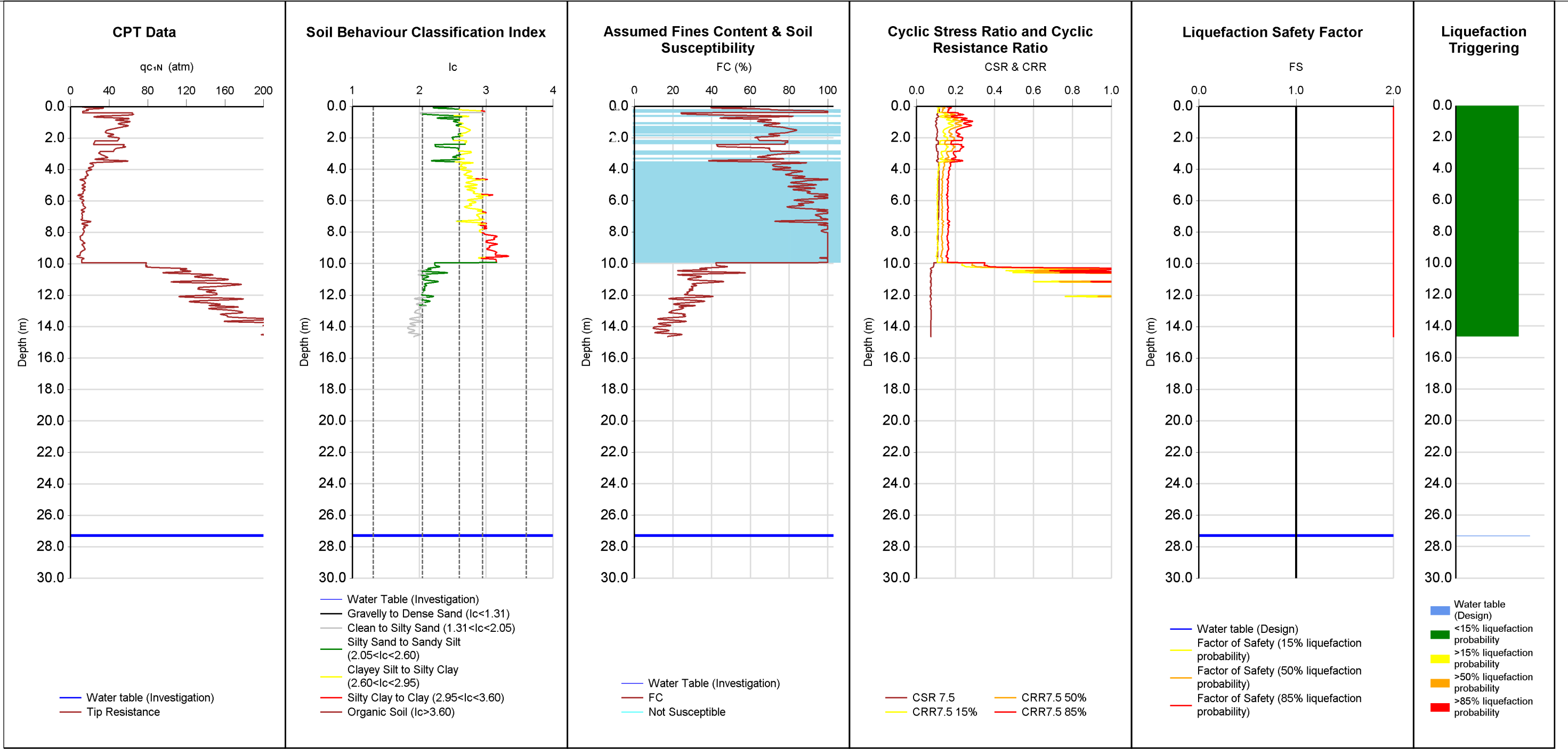
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision	JOB NUMBER	1017355.0000	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses			PAGE	35 of 47 pages
	COMMENT	1 in 500 Year Event - ULS IL2					



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT112	179001	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT CPT113		179002	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
PL		SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
15%		0	0	0	0	14.6	0					
50%		0	0	0	0	14.6	0					
85%		0	0	0	0	14.6	0					

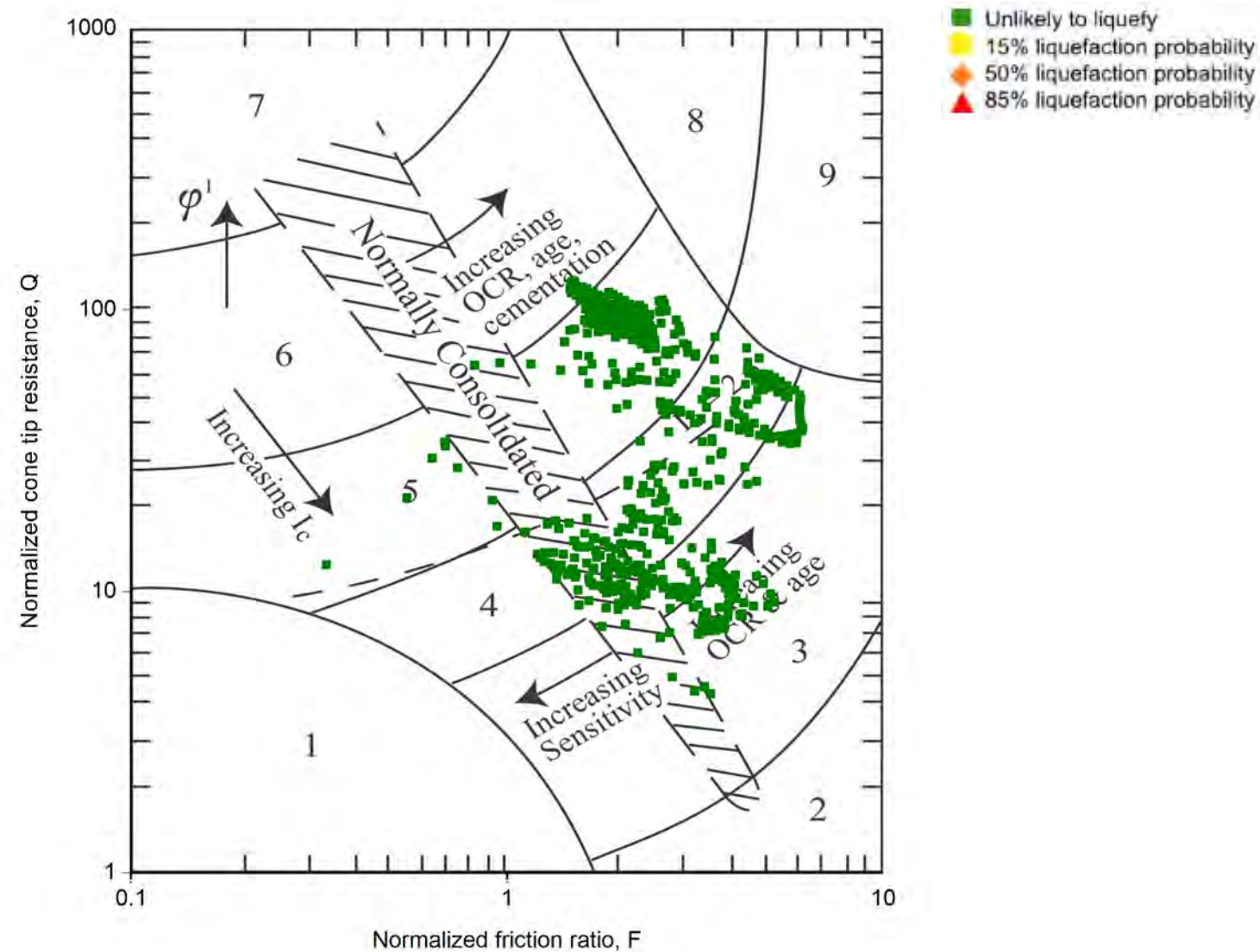
Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd	LOCATION	DATE	24/06/2021
PROJECT	Brymer Farms Subdivision	Hamilton	ANALYSED	cand
TITLE	Liquefaction Analyses	JOB NUMBER	PAGE	37 of 47 pages
COMMENT	1 in 500 Year Event - ULS IL2	1017355.0000		

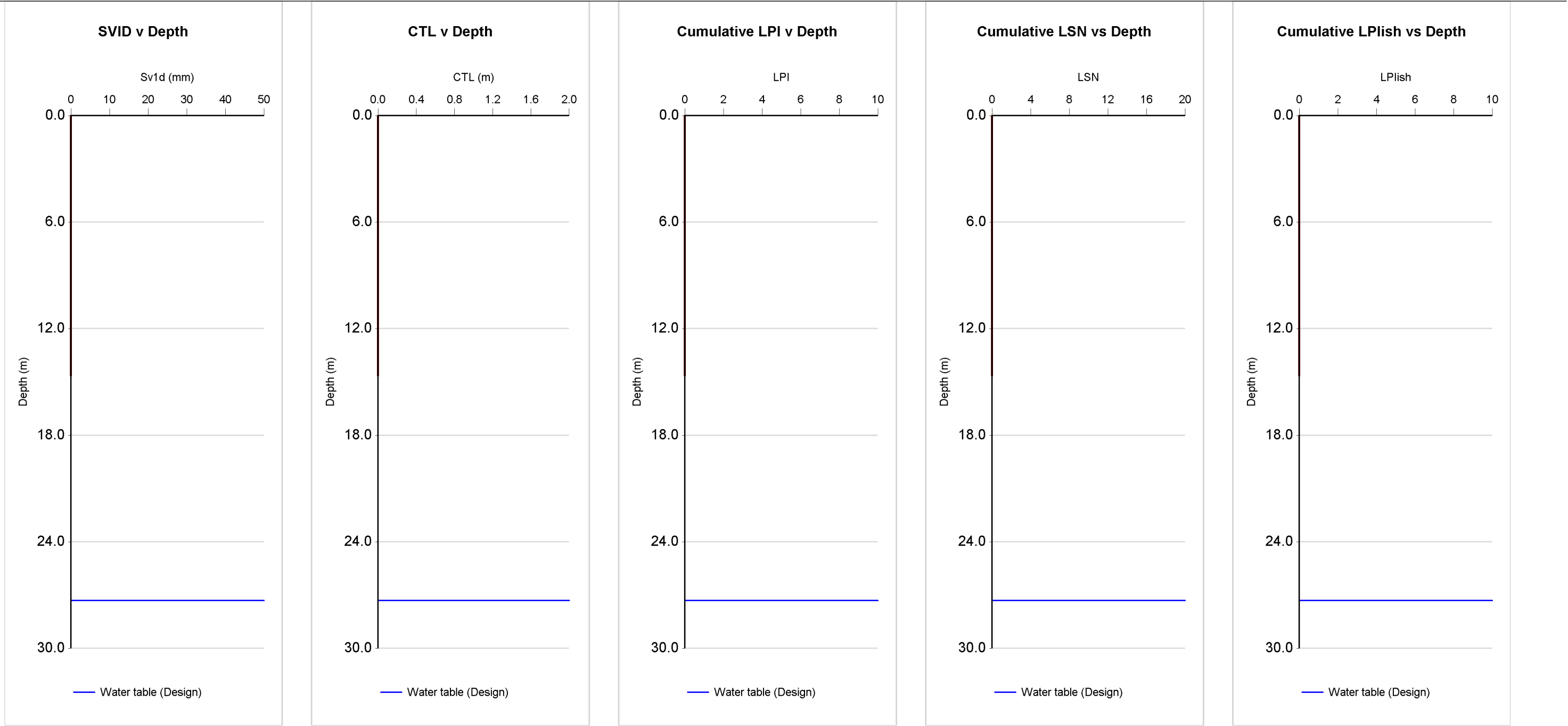


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

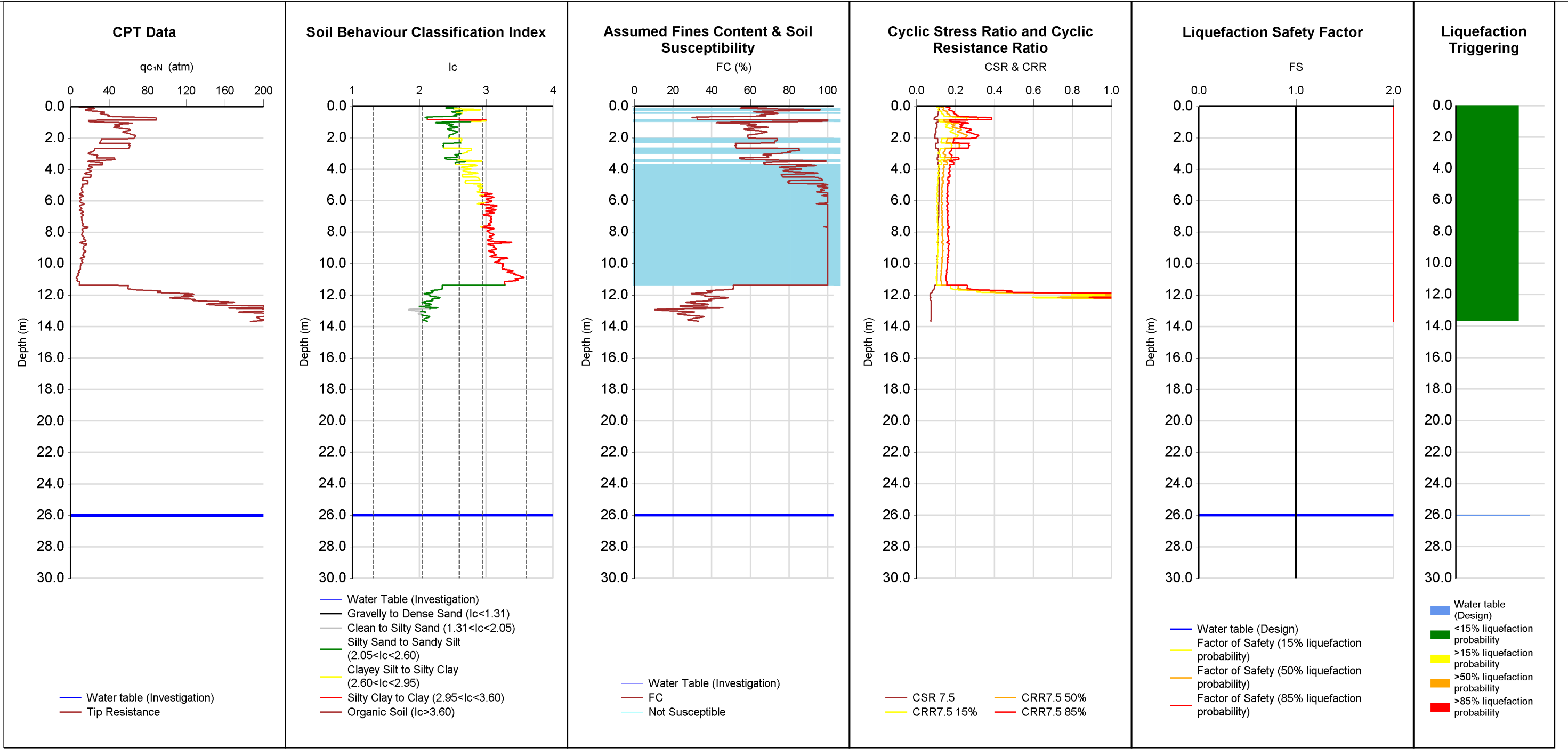
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER			
		COMMENT	1 in 500 Year Event - ULS IL2		1017355.0000	PAGE	38 of 47 pages



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT113	179002	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT CPT114		179003	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	
PL		SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
OUTPUT 15%		0	0	0	0	13.7	0					
50%		0	0	0	0	13.7	0					
85%		0	0	0	0	13.7	0					

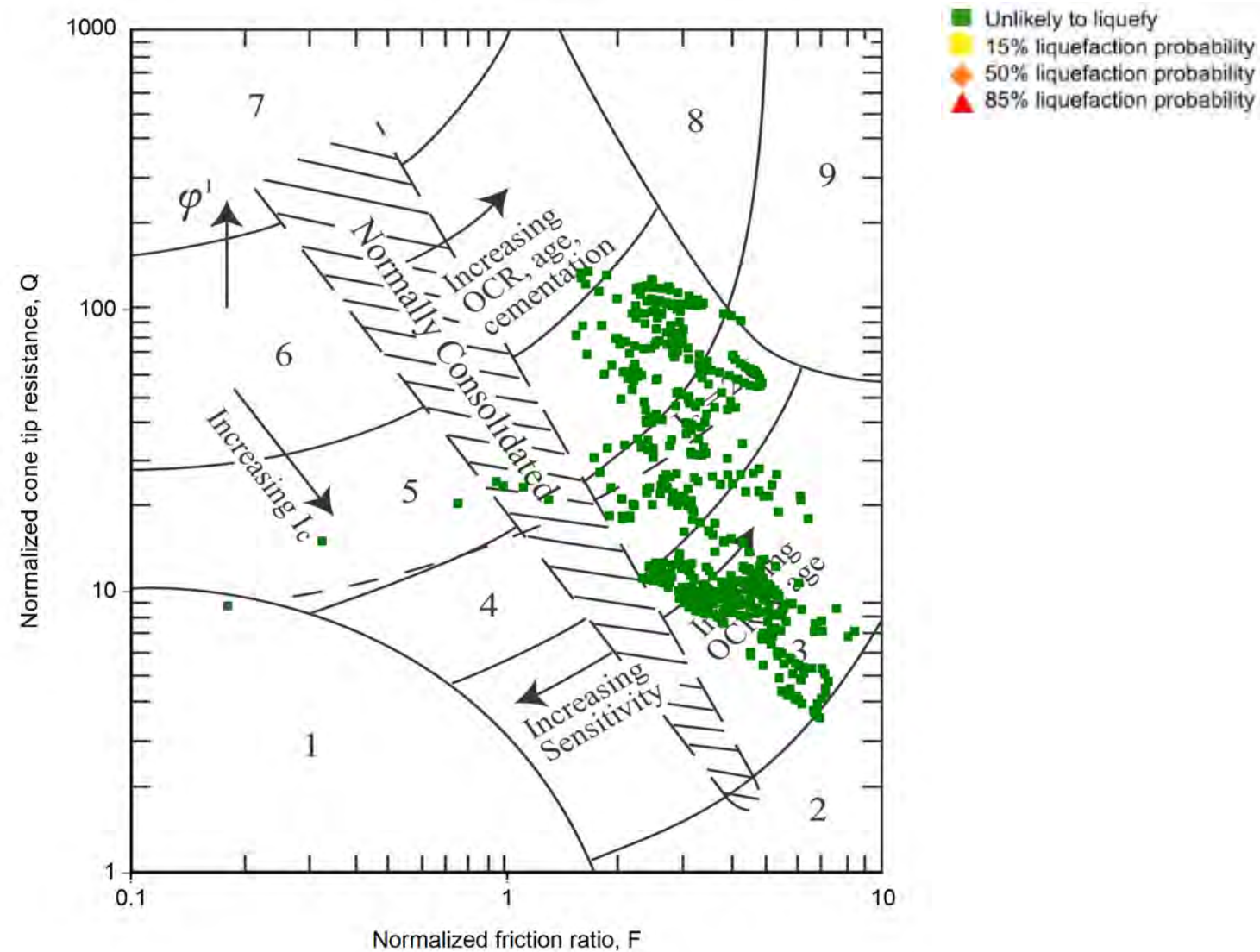
Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
PROJECT	Brymer Farms Subdivision			ANALYSED	cand
TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	40 of 47 pages
COMMENT	1 in 500 Year Event - ULS IL2				

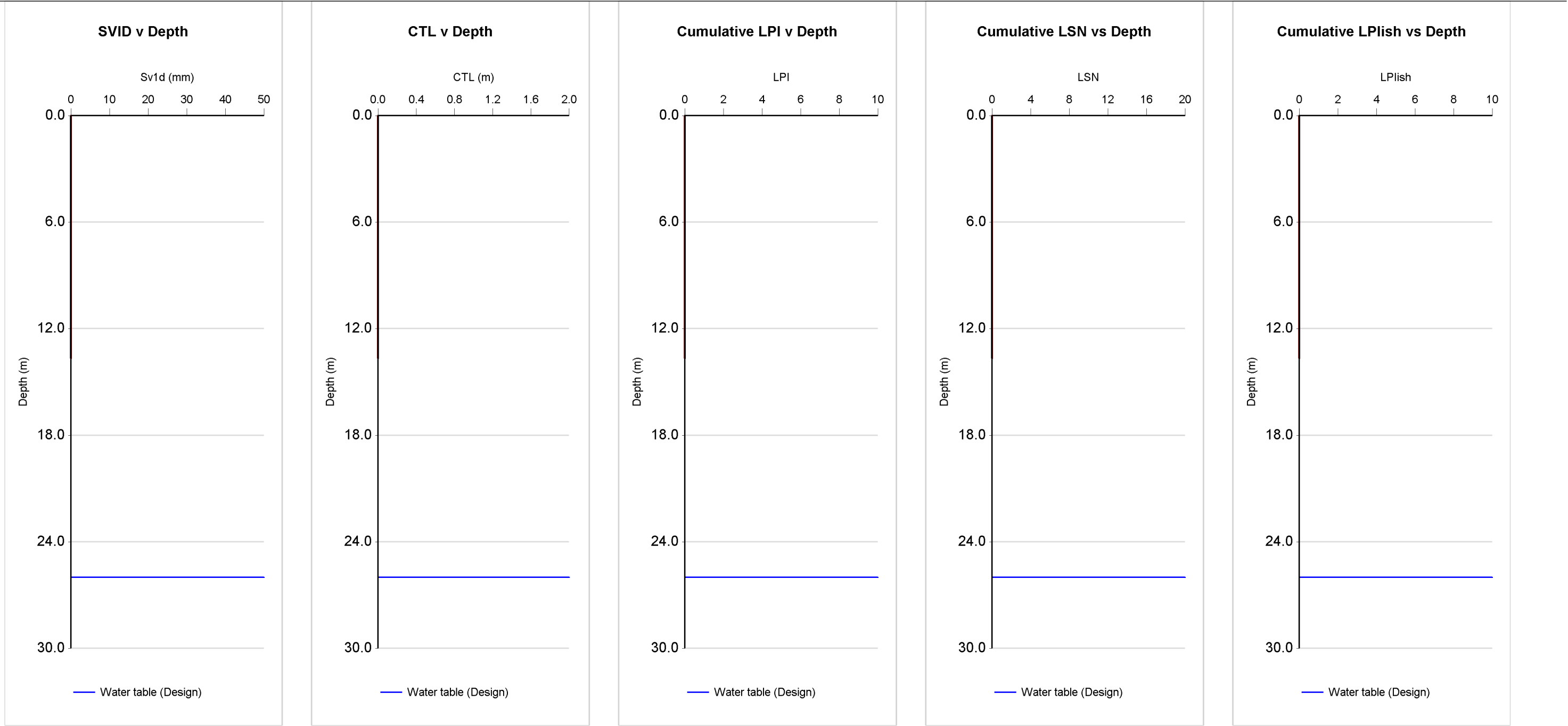


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER			
		COMMENT	1 in 500 Year Event - ULS IL2		1017355.0000	PAGE	41 of 47 pages



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT114	179003	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

Error: Subreport could not be shown.

The inputs listed in Table 1.1-1 below have been adopted for the liquefaction analysis.

Table 1.1-1 Summary of inputs for liquefaction analysis

ID	TTGD 178990	TTGD 178991	TTGD 178992	TTGD 178993	TTGD 178994	TTGD 178995
CPT Name	CPT01, 584 Whatawhata Road, Hamilton	CPT02, 584 Whatawhata Road, Hamilton	CPT03, 584 Whatawhata Road, Hamilton	CPT04, 584 Whatawhata Road, Hamilton	CPT05, 584 Whatawhata Road, Hamilton	CPT06, 584 Whatawhata Road, Hamilton
Run description	CPT101	CPT102	CPT103	CPT104	CPT105	CPT106
PGA	0.215g	0.215g	0.215g	0.215g	0.215g	0.215g
Magnitude	5.9	5.9	5.9	5.9	5.9	5.9
Depth to groundwater at time of Investigation (m)	20	0.4	0.4	0.4	0.7	0.45
Depth to groundwater for design (m)	20	0.4	0.4	0.4	0.4	0.4
Predrill depth (m)	0	0	0	0	0	0
Assumed predrill tip resistance and skin friction	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	29	20.02	15.92	14.3	8.72	20.02
Minimum depth of analysis (m)	0	0	0	0	0	0
Maximum depth of analysis (m)	30	30	30	30	30	30
Inverse Filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)

Table 1.1-2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 178990	CPT101	0	0	0
TTGD 178990	CPT101	0	0.01	0
TTGD 178990	CPT101	0.01	30	2.6
TTGD 178991	CPT102	0	0	0
TTGD 178991	CPT102	0	0.01	0
TTGD 178991	CPT102	0.01	30	2.6
TTGD 178992	CPT103	0	0	0
TTGD 178992	CPT103	0	0.01	0
TTGD 178992	CPT103	0.01	30	2.6
TTGD 178993	CPT104	0	0	0
TTGD 178993	CPT104	0	0.01	0
TTGD 178993	CPT104	0.01	30	2.6
TTGD 178994	CPT105	0	0	0
TTGD 178994	CPT105	0	0.01	0
TTGD 178994	CPT105	0.01	30	2.6
TTGD 178995	CPT106	0	0	0
TTGD 178995	CPT106	0	0.01	0
TTGD 178995	CPT106	0.01	30	2.6
TTGD 178996	CPT107	0	0	0
TTGD 178996	CPT107	0	0.01	0
TTGD 178996	CPT107	0.01	30	2.6
TTGD 178997	CPT108	0	0	0
TTGD 178997	CPT108	0	0.01	0
TTGD 178997	CPT108	0.01	30	2.6
TTGD 178998	CPT109	0	0	0

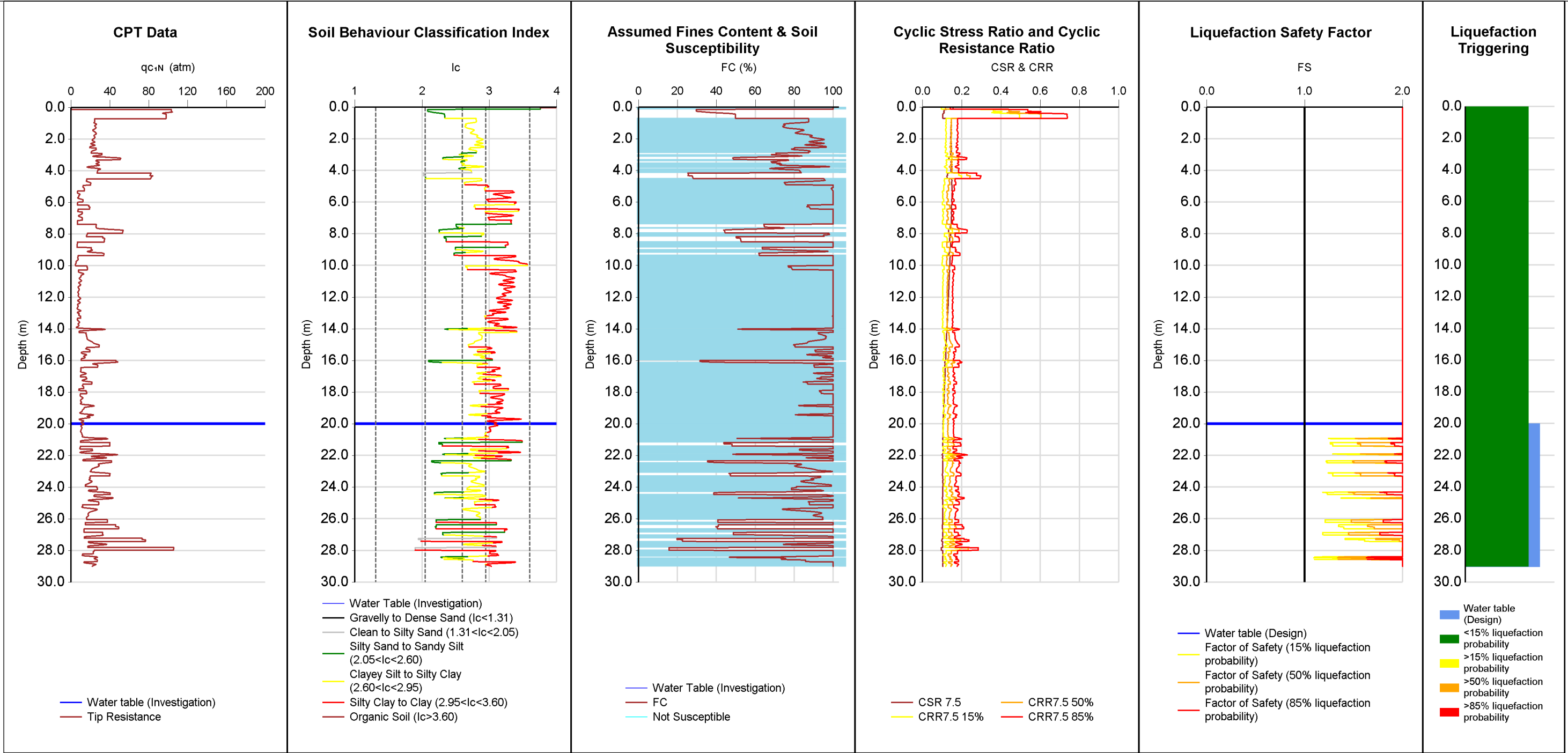
Table 1.1-3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 178990	CPT101	0.01	30	0 CFC
TTGD 178991	CPT102	0	30	0 CFC
TTGD 178992	CPT103	0	30	0 CFC
TTGD 178993	CPT104	0	30	0 CFC
TTGD 178994	CPT105	0	30	0 CFC
TTGD 178995	CPT106	0	30	0 CFC
TTGD 178996	CPT107	0	30	0 CFC
TTGD 178997	CPT108	0	30	0 CFC
TTGD 178998	CPT109	0	30	0 CFC
TTGD 178999	CPT110	0	30	0 CFC
TTGD 179000	CPT111	0	30	0 CFC
TTGD 179001	CPT112	0	30	0 CFC
TTGD 179002	CPT113	0	30	0 CFC
TTGD 179003	CPT114	0	30	0 CFC

TTGD 178996	TTGD 178997	TTGD 178998	TTGD 178999	TTGD 179000	TTGD 179001	TTGD 179002
CPT07, 584 Whatawhata Road, Hamilton	CPT08, 584 Whatawhata Road, Hamilton	CPT09, 584 Whatawhata Road, Hamilton	CPT10, 584 Whatawhata Road, Hamilton	CPT11, 584 Whatawhata Road, Hamilton	CPT12, 584 Whatawhata Road, Hamilton	CPT13, 584 Whatawhata Road, Hamilton
CPT107	CPT108	CPT109	CPT110	CPT111	CPT112	CPT113
0.215g	0.215g	0.215g	0.215g	0.215g	0.215g	0.215g
5.9	5.9	5.9	5.9	5.9	5.9	5.9
0.5	0.54	0.4	0.48	0.4	6	27.3
0.4	0.4	0.4	0.4	0.4	6	27.3
0	0	0	0	0	0	0
qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa
Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002
7.12	11.38	11.66	10.02	17.2	16.74	14.64
0	0	0	0	0	0	0
30	30	30	30	30	30	30
Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)

TTGD 179003
CPT14, 584 Whatawhata Road, Hamilton
CPT114
0.215g
5.9
26
26
0
qc= 2 MPa & Fs= 0.01 MPa
Boulanger & Idriss (2014)
ZRB-2002
13.66
0
30
Yes (10 cm^2)

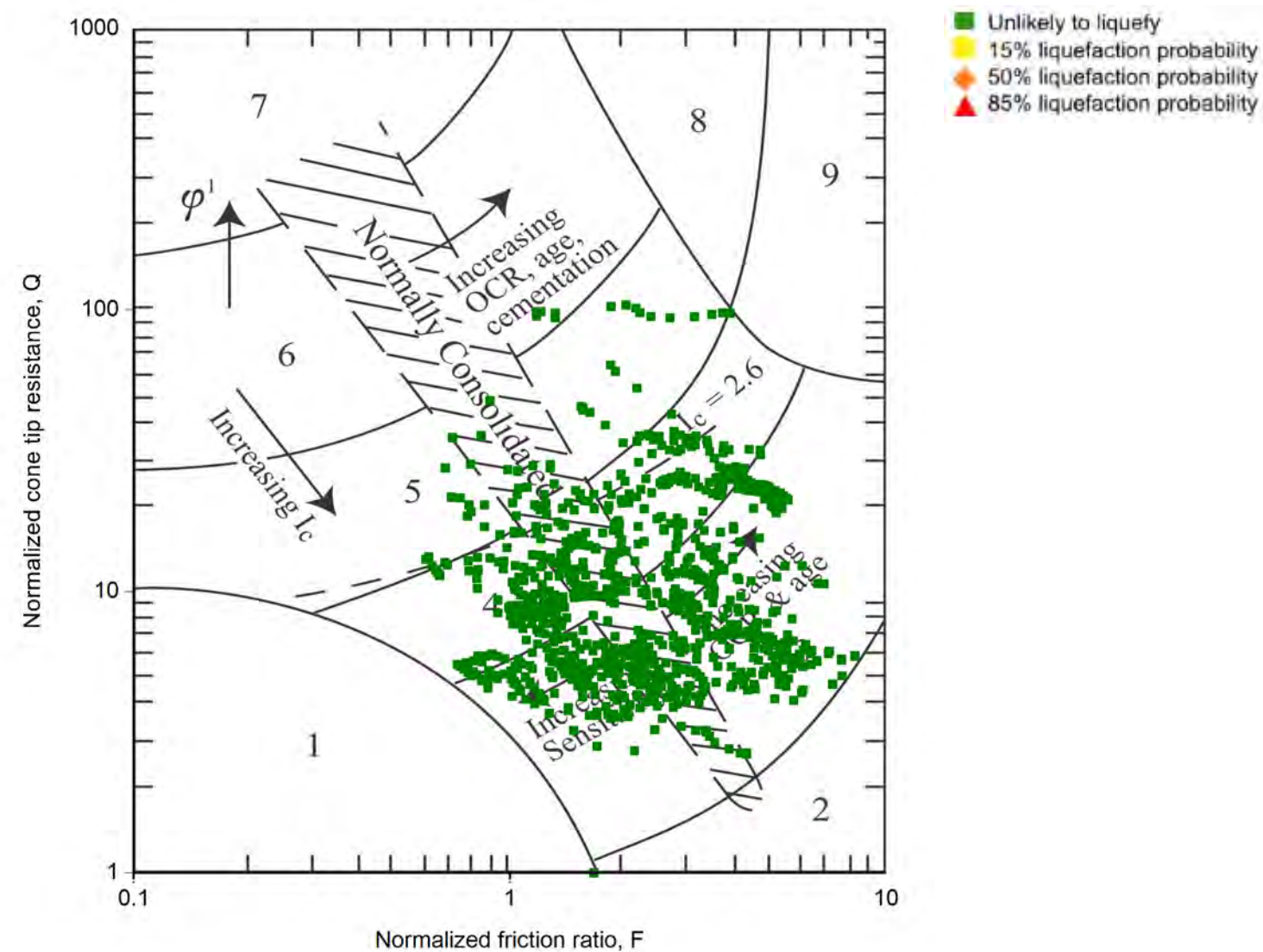
TTGD 178998	CPT109	0	0.01	0
TTGD 178998	CPT109	0.01	30	2.6
TTGD 178999	CPT110	0	0	0
TTGD 178999	CPT110	0	0.01	0
TTGD 178999	CPT110	0.01	30	2.6
TTGD 179000	CPT111	0	0	0
TTGD 179000	CPT111	0	0.01	0
TTGD 179000	CPT111	0.01	30	2.6
TTGD 179001	CPT112	0	0	0
TTGD 179001	CPT112	0	0.01	0
TTGD 179001	CPT112	0.01	30	2.6
TTGD 179002	CPT113	0	0	0
TTGD 179002	CPT113	0	0.01	0
TTGD 179002	CPT113	0.01	30	2.6
TTGD 179003	CPT114	0	0	0
TTGD 179003	CPT114	0	0.01	0
TTGD 179003	CPT114	0.01	30	2.6



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT101	178990	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	6	0	0	0	29	0					
		50%	3	0	0	0	29	0					
		85%	1	0	0	0	29	0					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

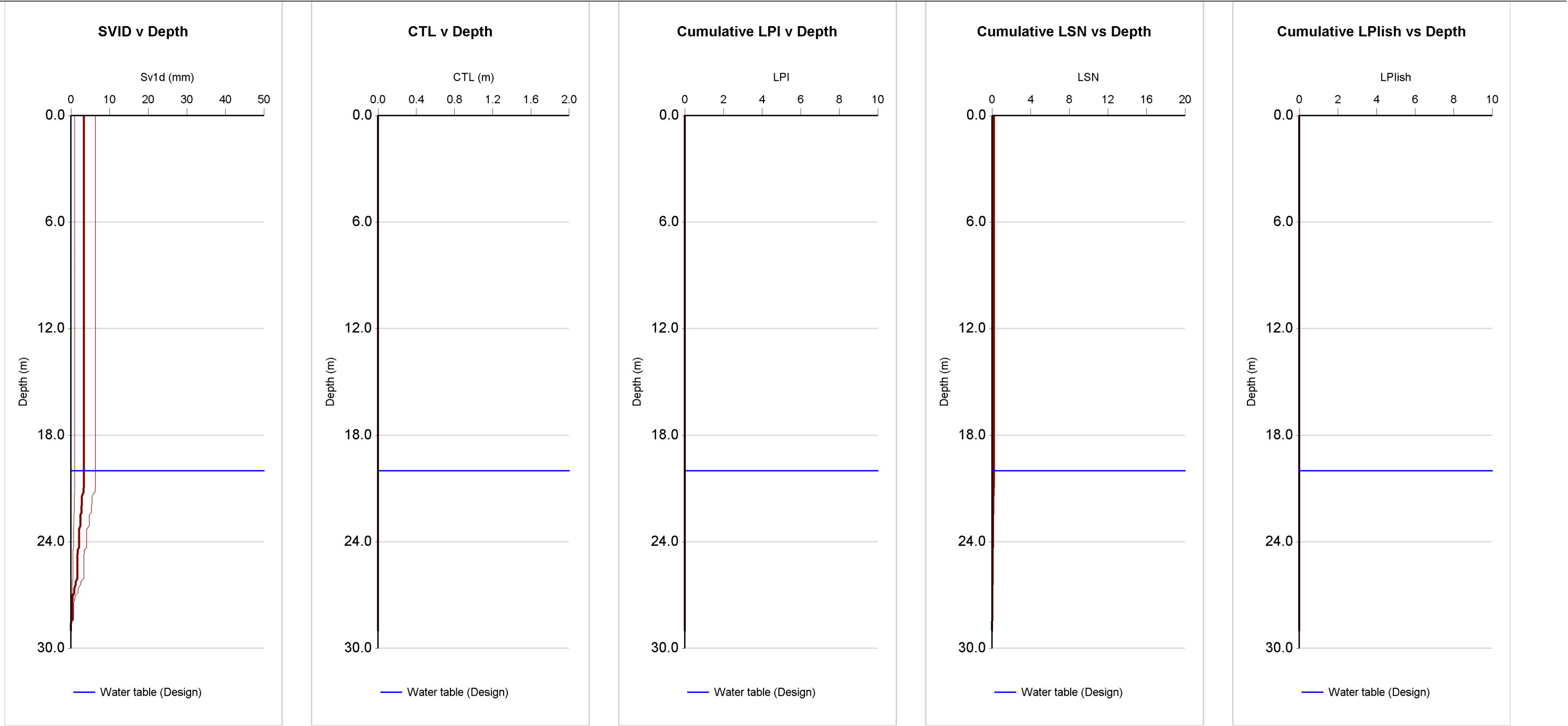


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

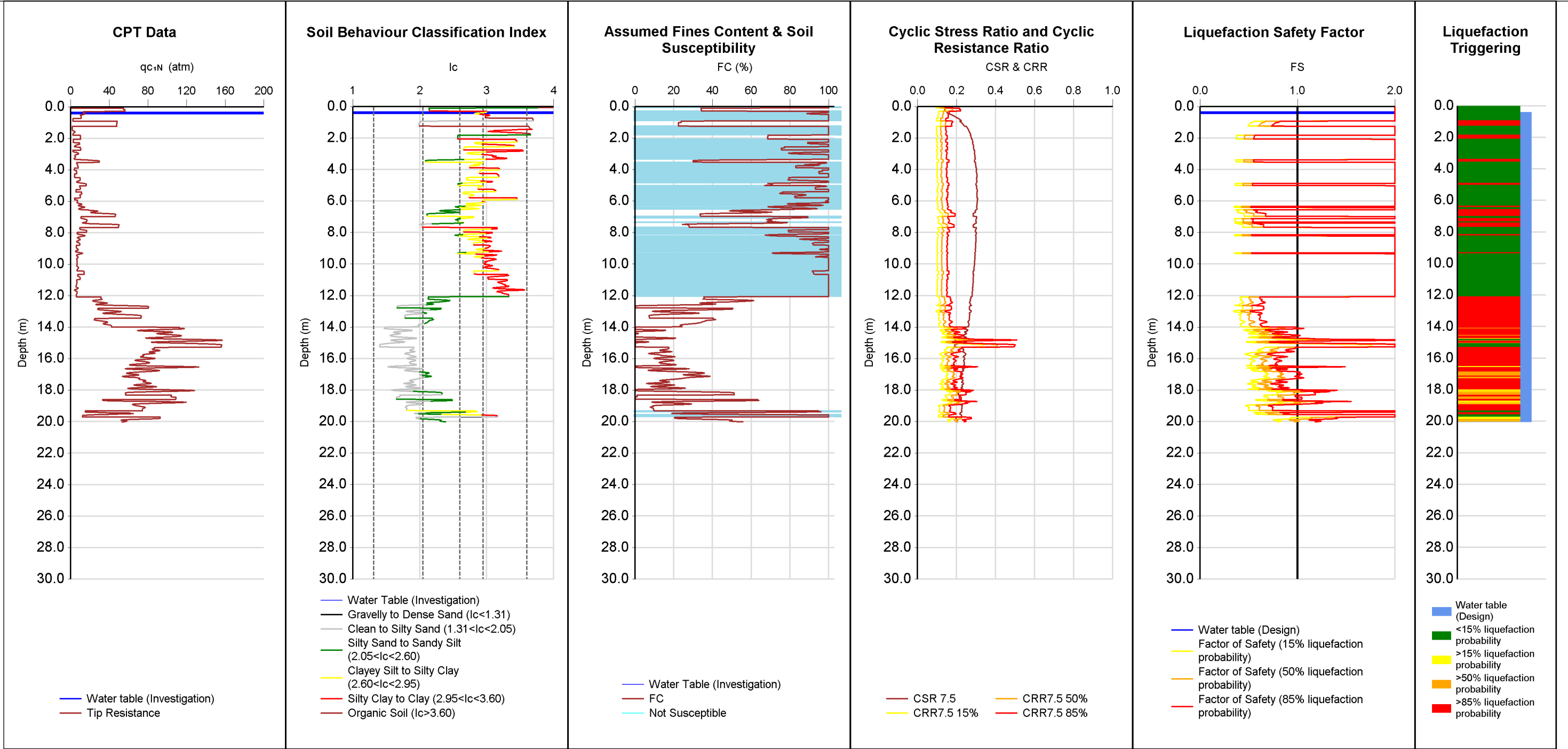
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor Exceptional thinking together V2.4.15	CLIENT Brymer Farms Ltd		LOCATION	DATE 24/06/2021
	PROJECT Brymer Farms Subdivision		Hamilton	ANALYSED cand
	TITLE Liquefaction Analyses		JOB NUMBER 1017355.0000	PAGE 2 of 47 pages
	COMMENT 1 in 1000 Year Event - ULS IL3			



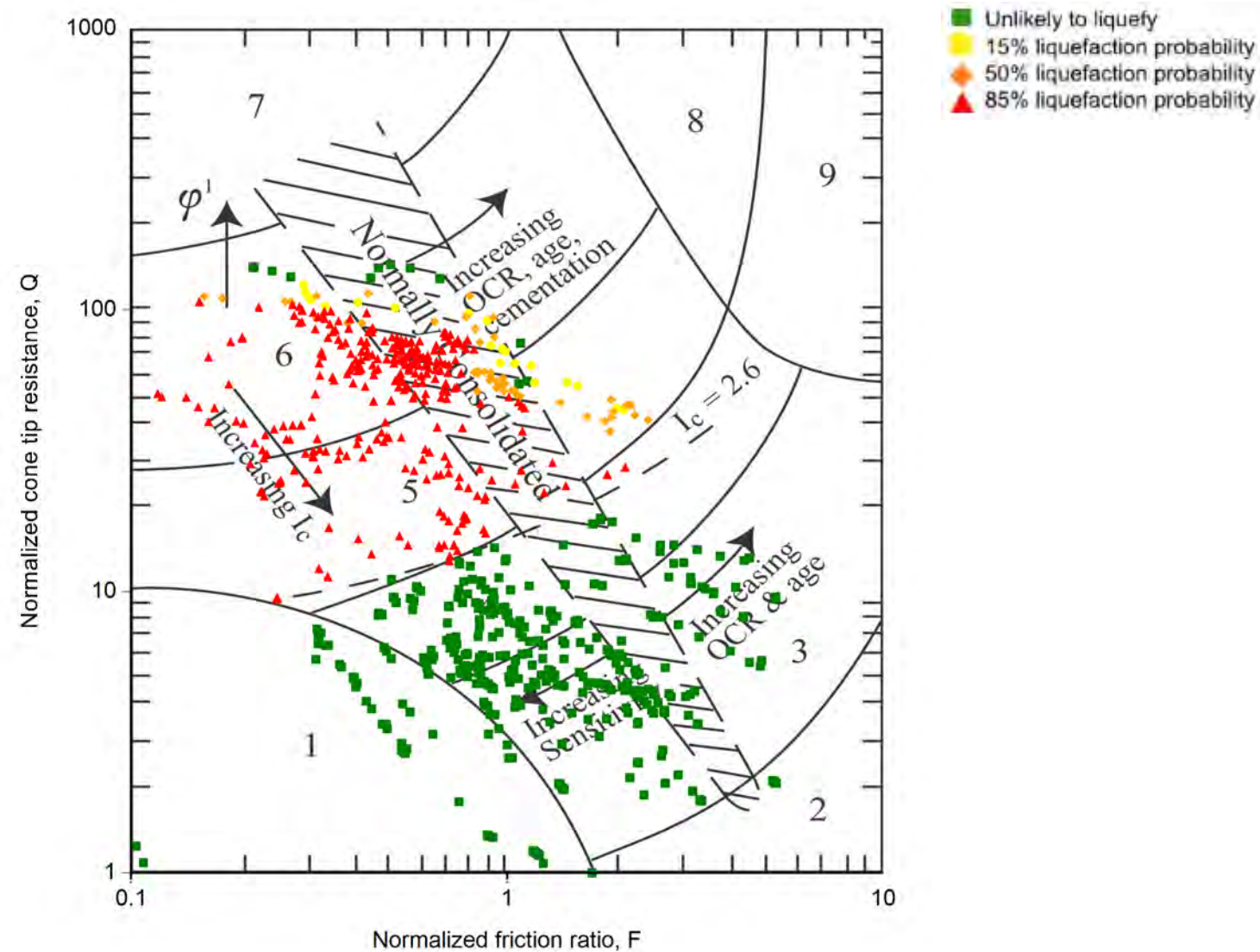
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT101	178990	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT102	178991	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	241	9.4	16	32	1	15					
		50%	227	8.9	13	31	1	12					
		85%	203	7.7	9	29	1	8					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

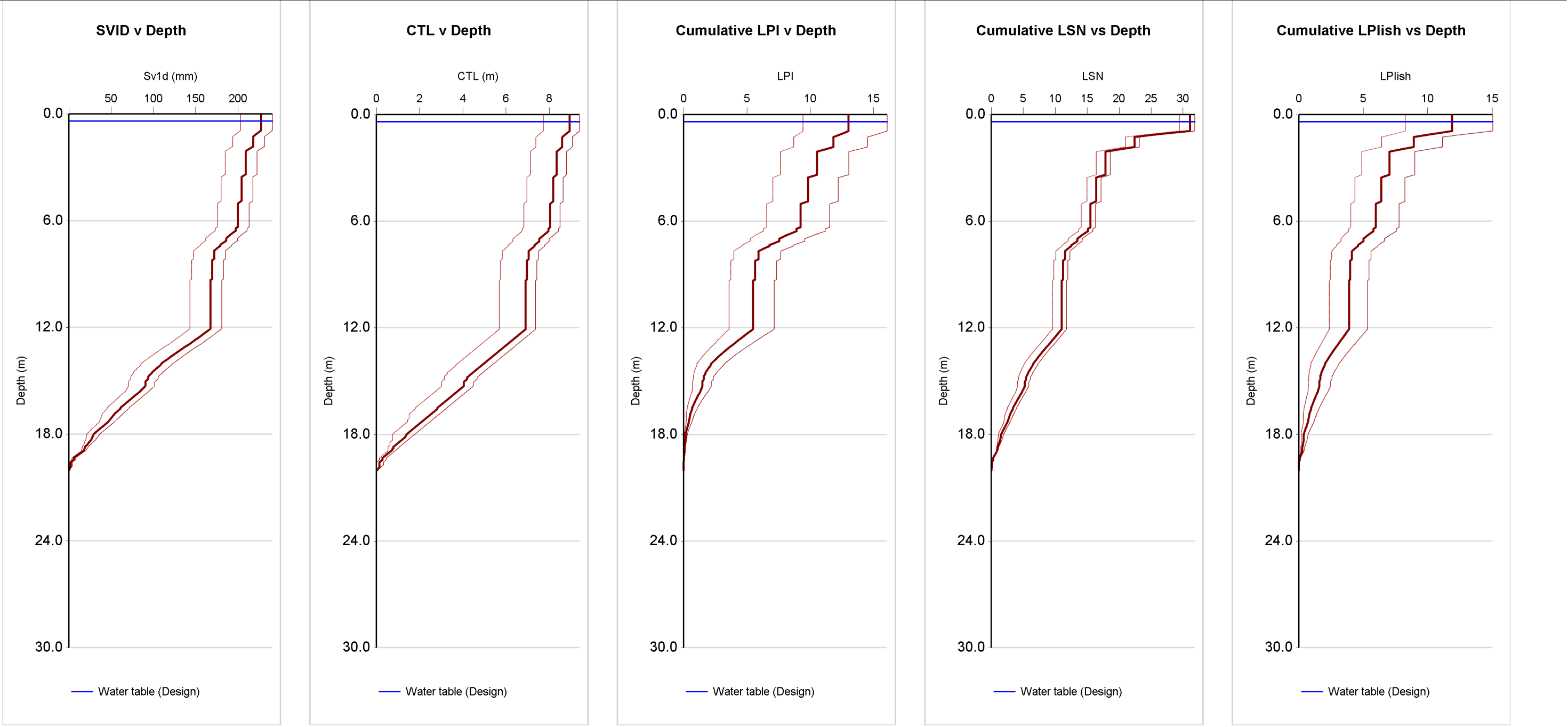


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	5 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3					



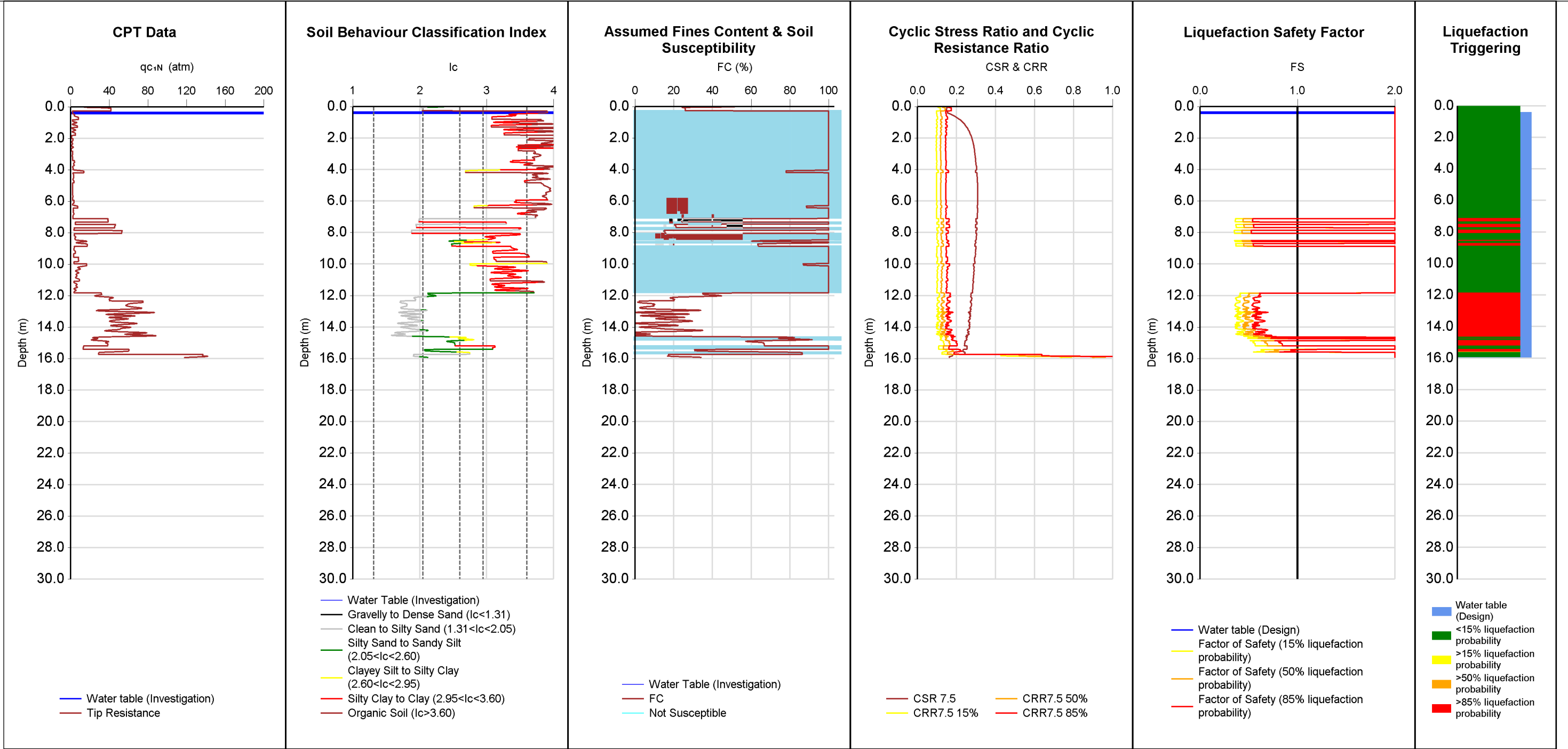
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT102	178991	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT	Brymer Farms Ltd
PROJECT	Brymer Farms Subdivision
TITLE	Liquefaction Analyses
COMMENT	1 in 1000 Year Event - ULS IL3

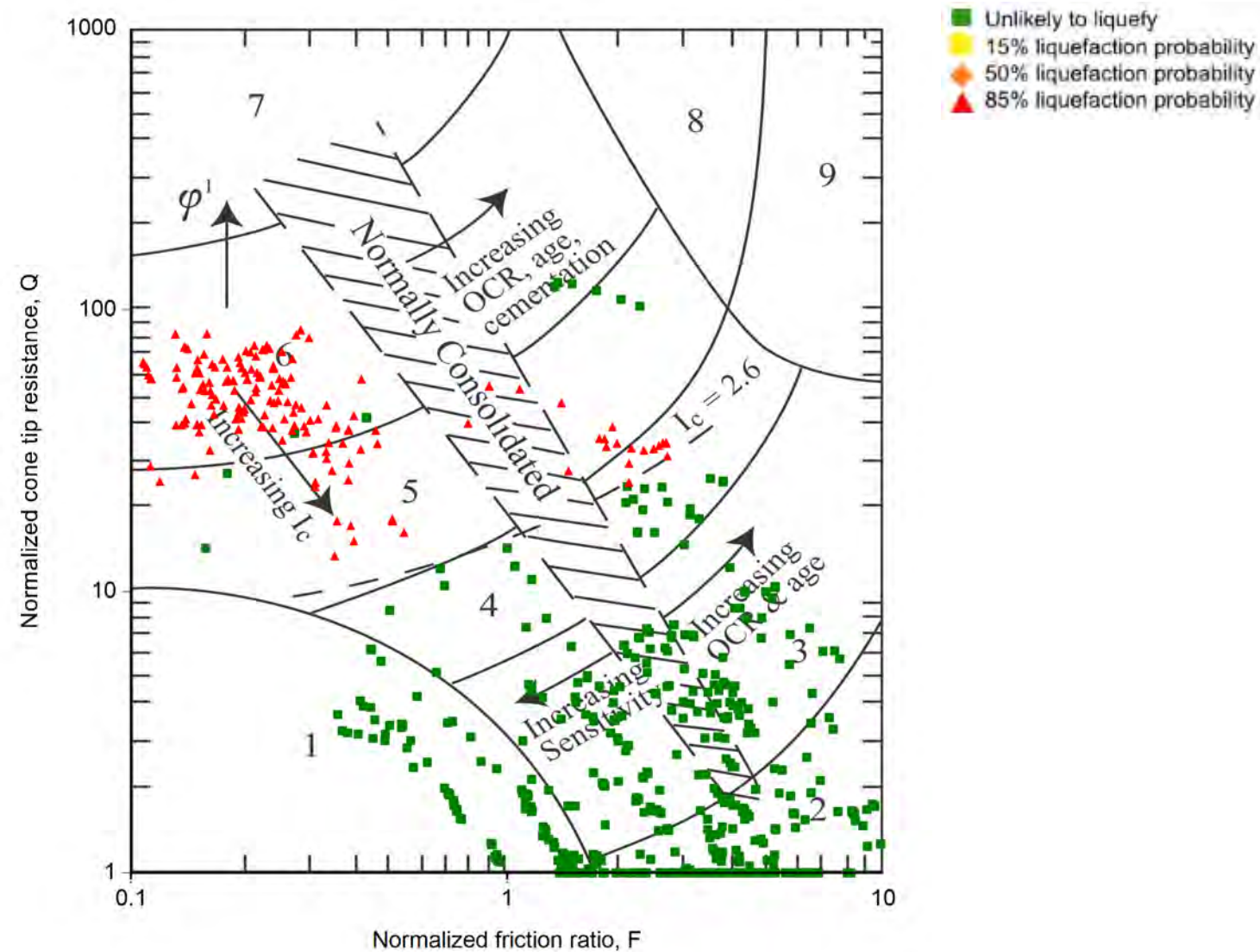
LOCATION	Hamilton	DATE	24/06/2021
		ANALYSED	cand
JOB NUMBER	1017355.0000	PAGE	6 of 47 pages



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT103		178992	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	130	4.2	10	11	7.2	0						
	50%	130	4.2	8	11	7.2	0						
	85%	127	4.2	7	11	7.2	0						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

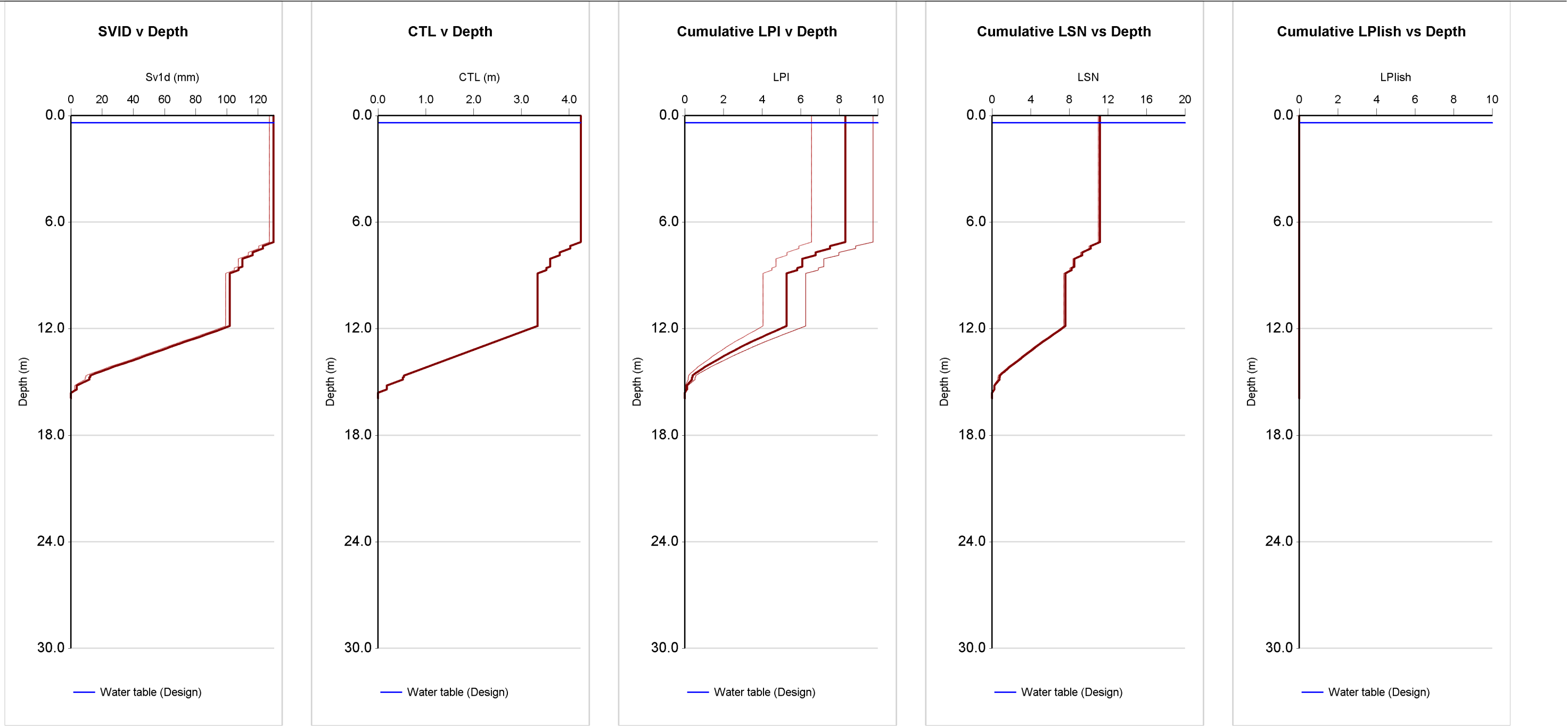


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

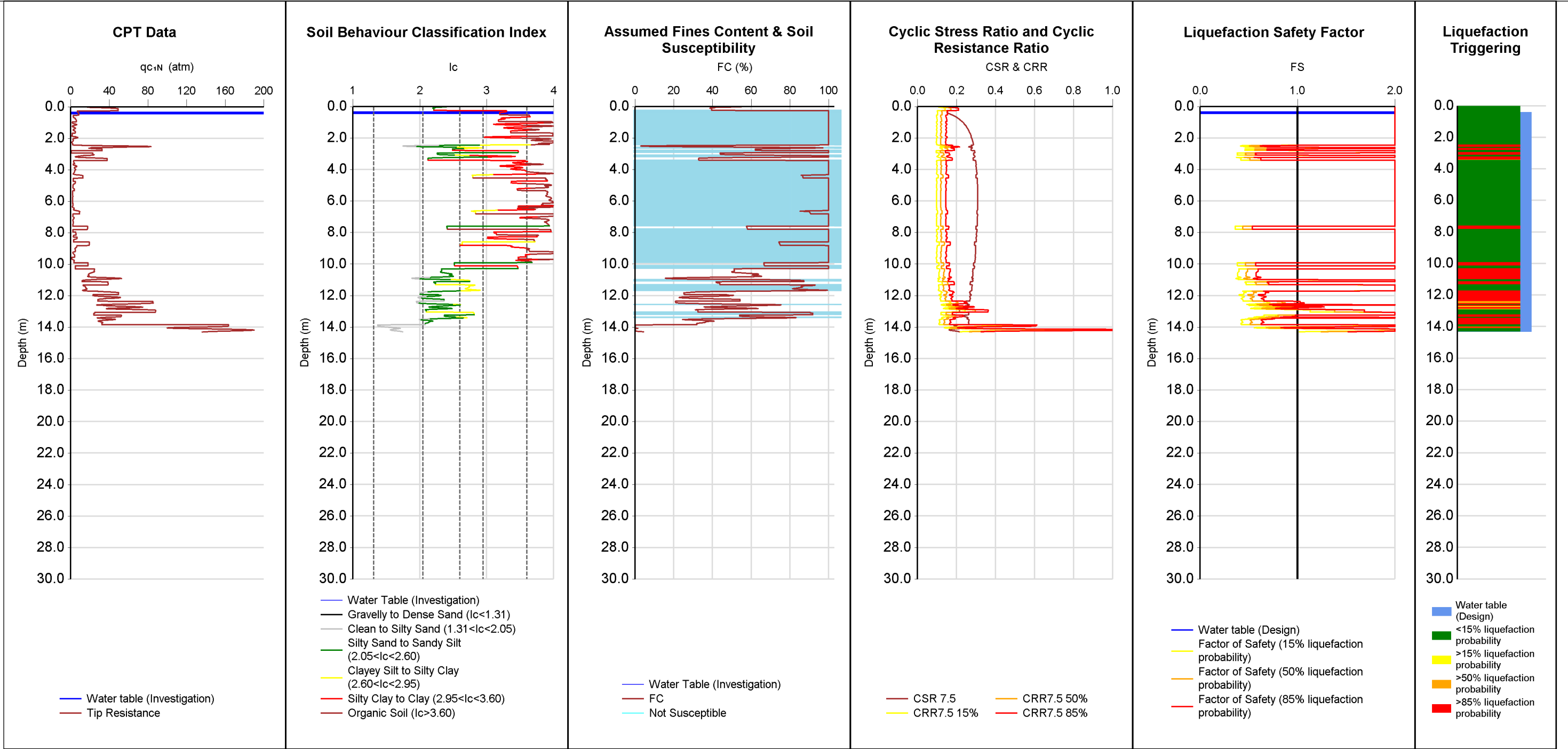
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	8 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3					



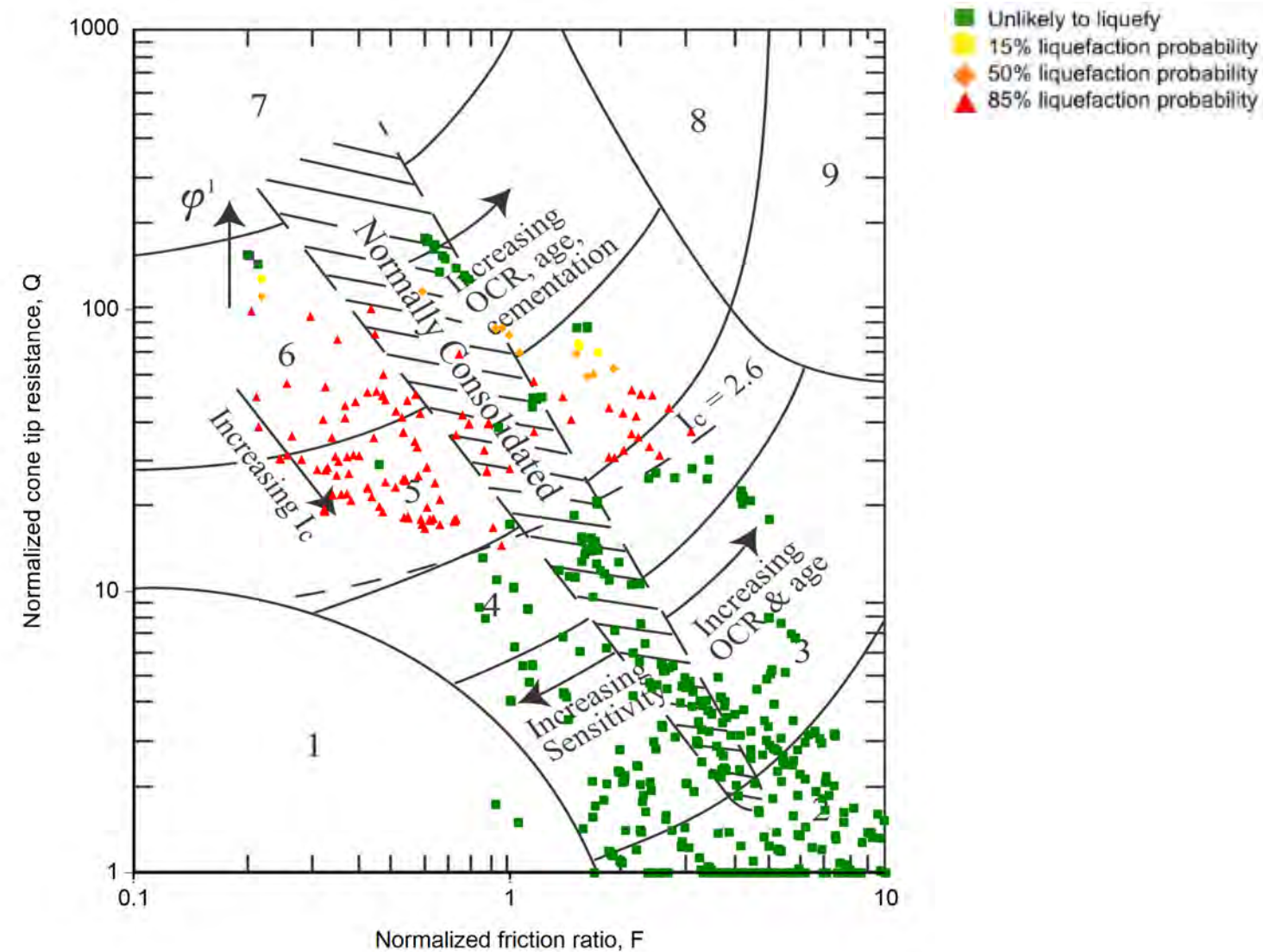
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT103	178992	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT104	178993	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	101	3.7	10	13	2.5	7					
		50%	98	3.7	8	13	2.5	6					
		85%	93	3.4	6	13	2.5	4					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

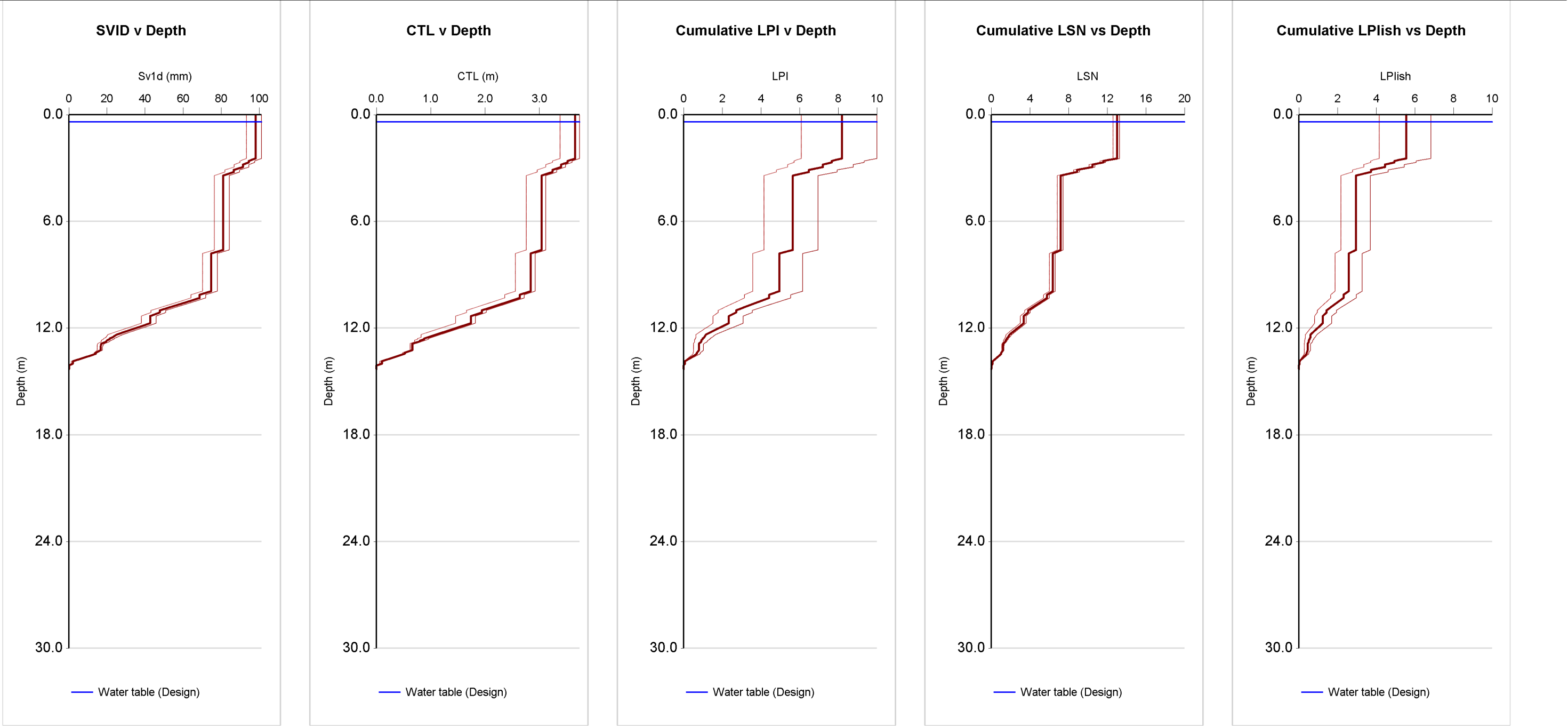


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

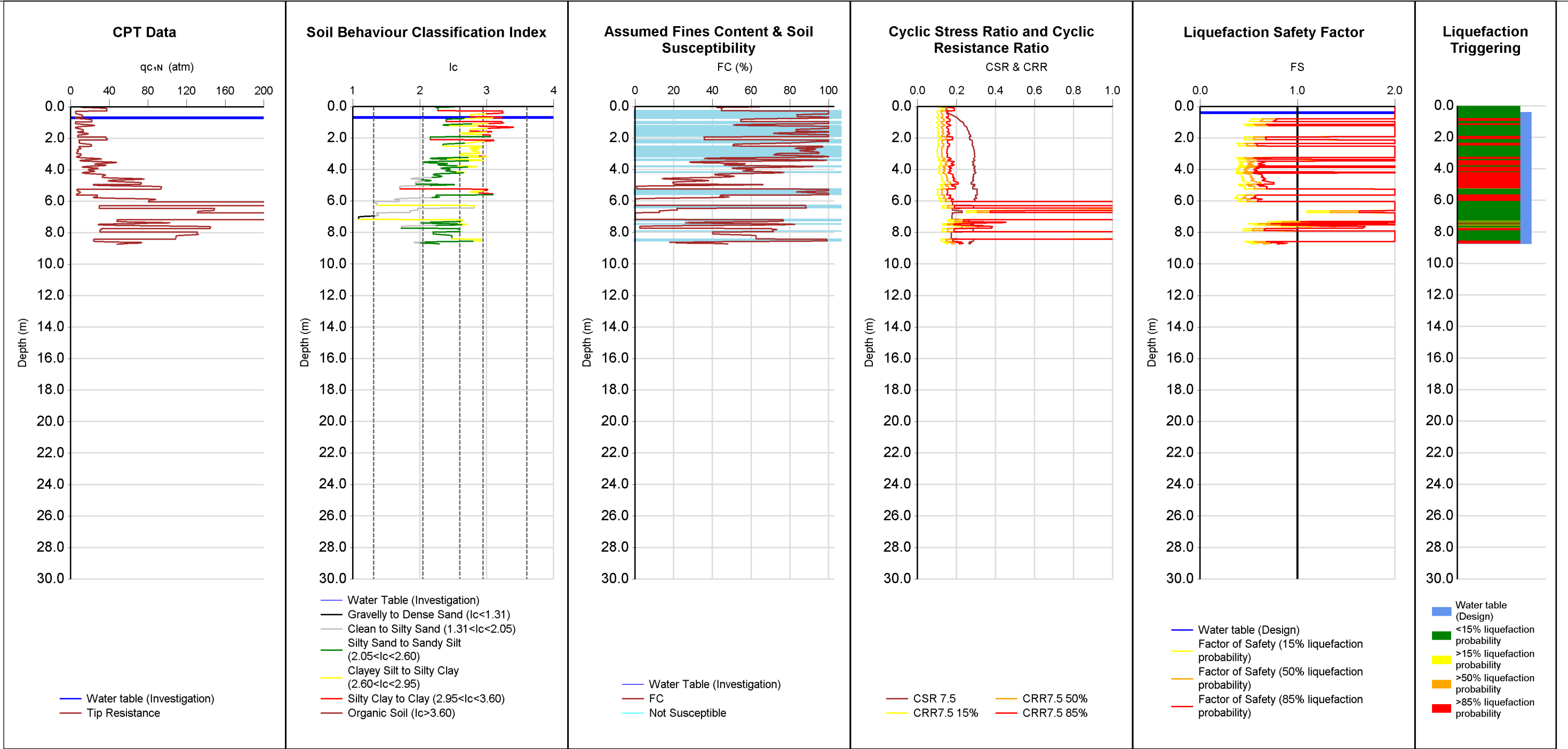
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	11 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3					



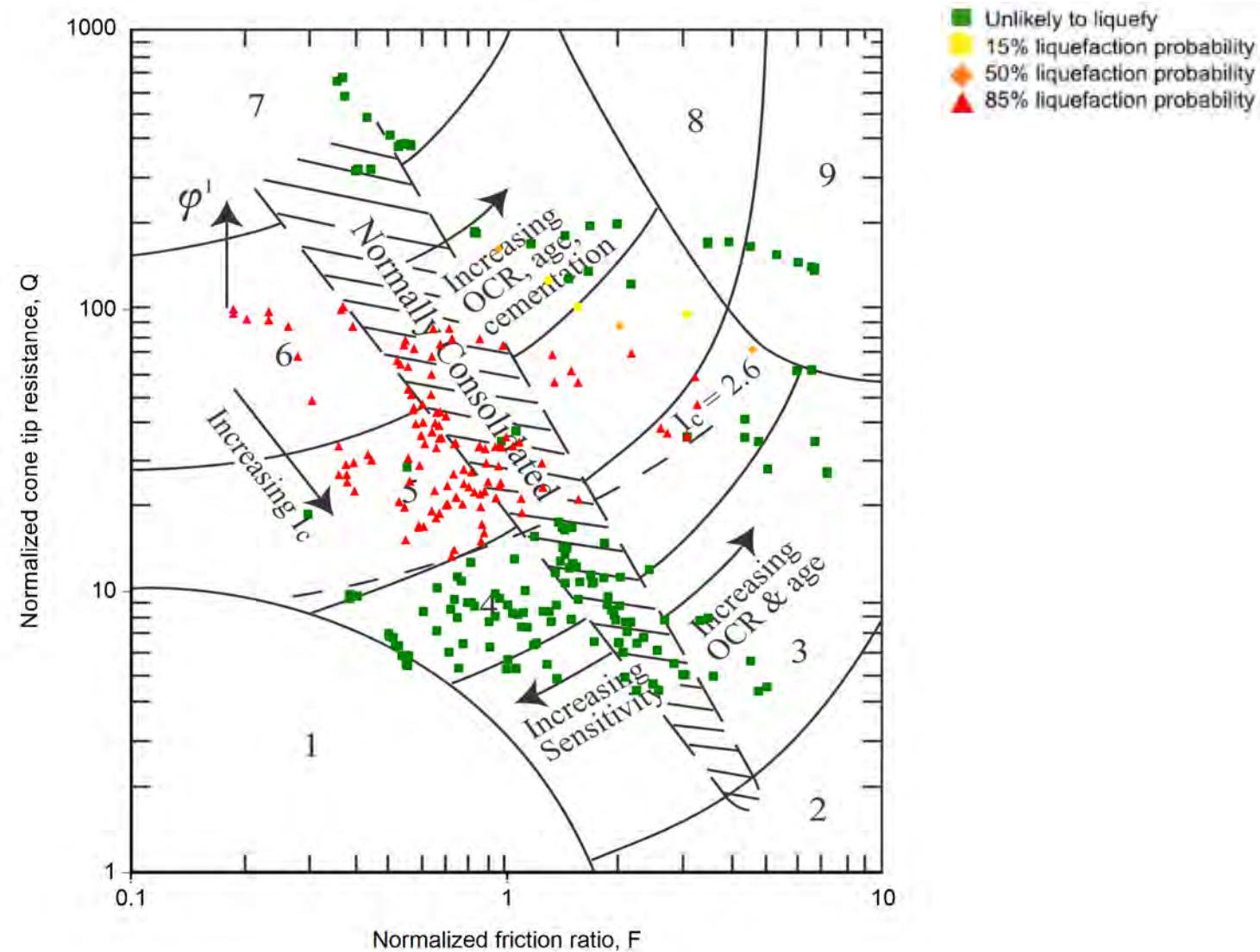
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT104	178993	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm²) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT105		178994	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	90	3.4	14	29	0.9	14						
	50%	89	3.3	12	28	0.9	12						
	85%	87	3.2	9	28	0.9	9						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

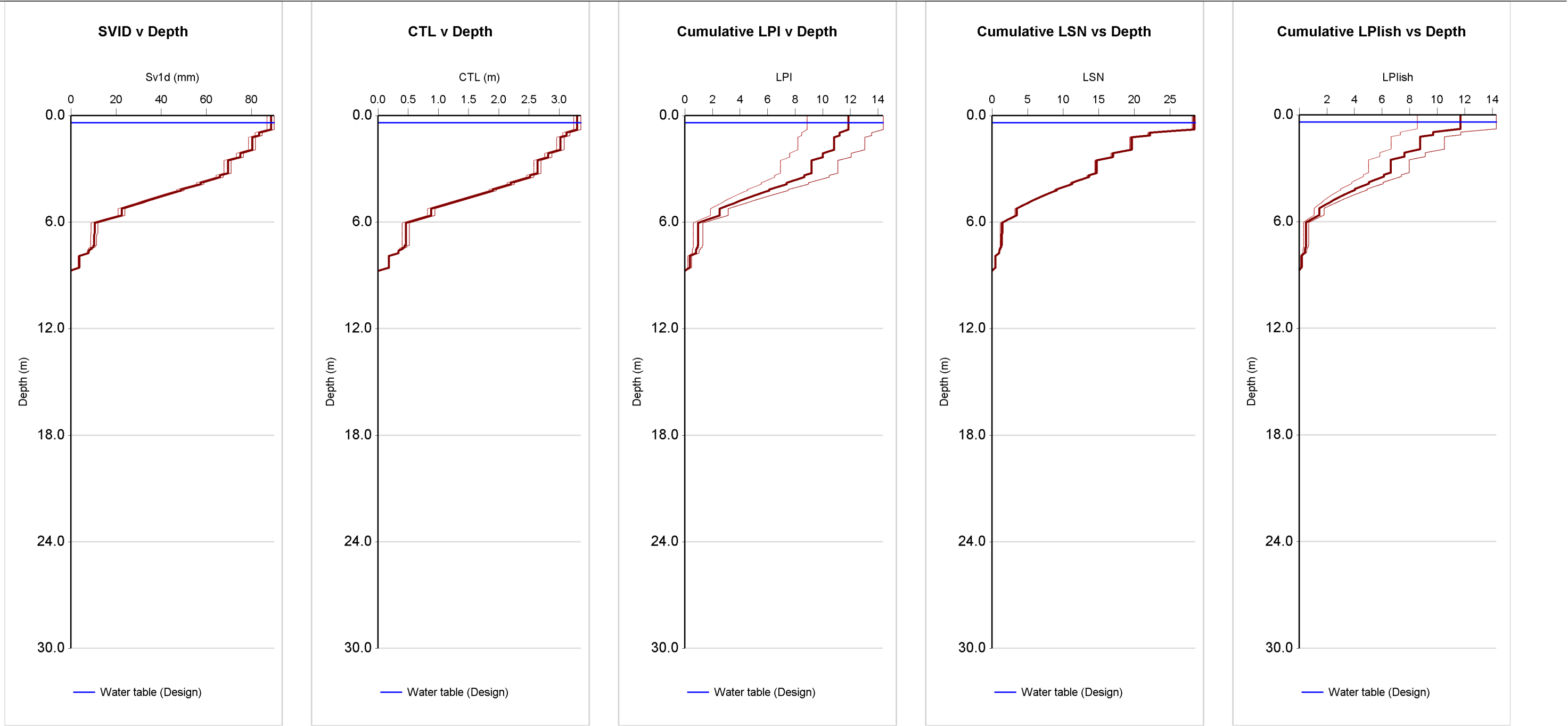


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

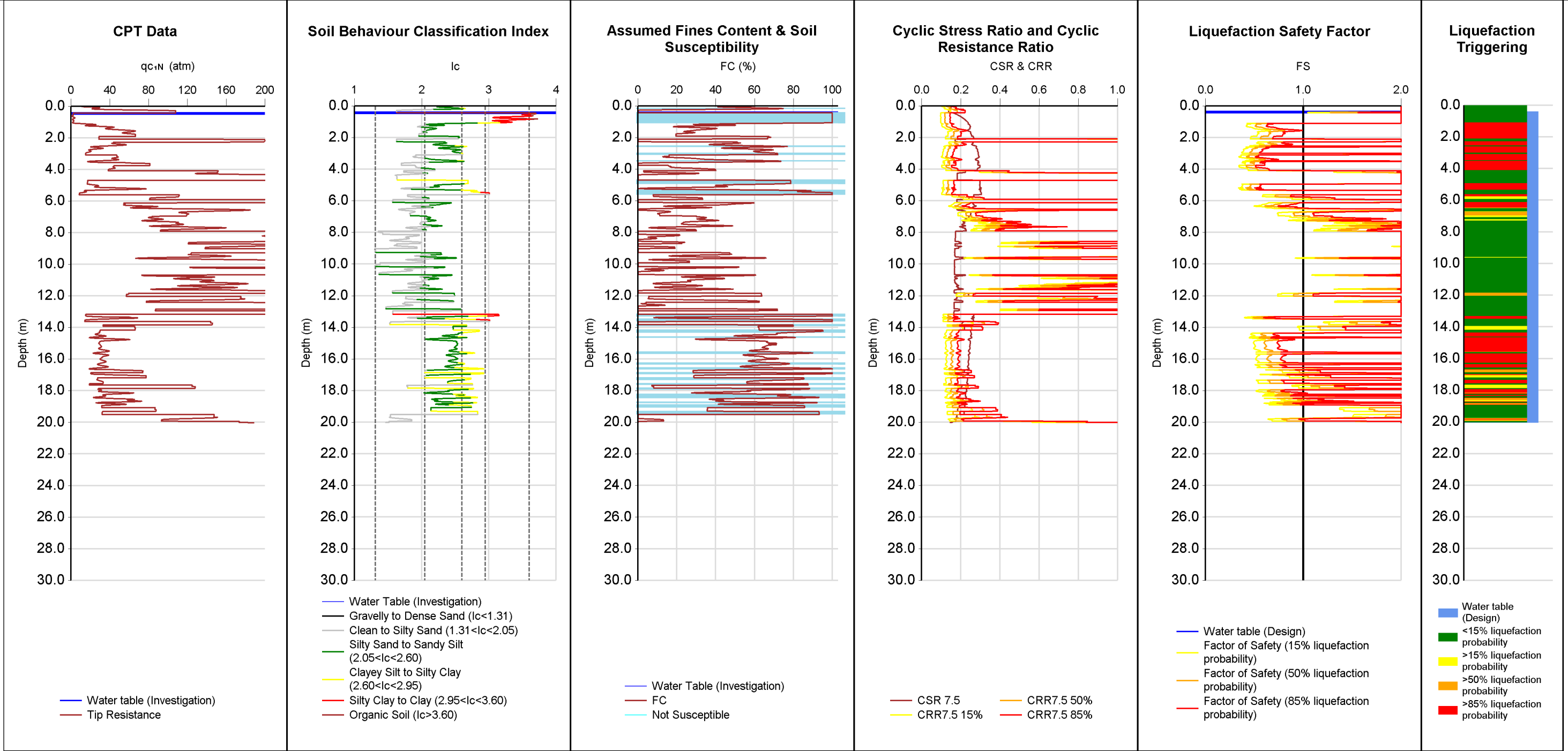
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	14 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3					



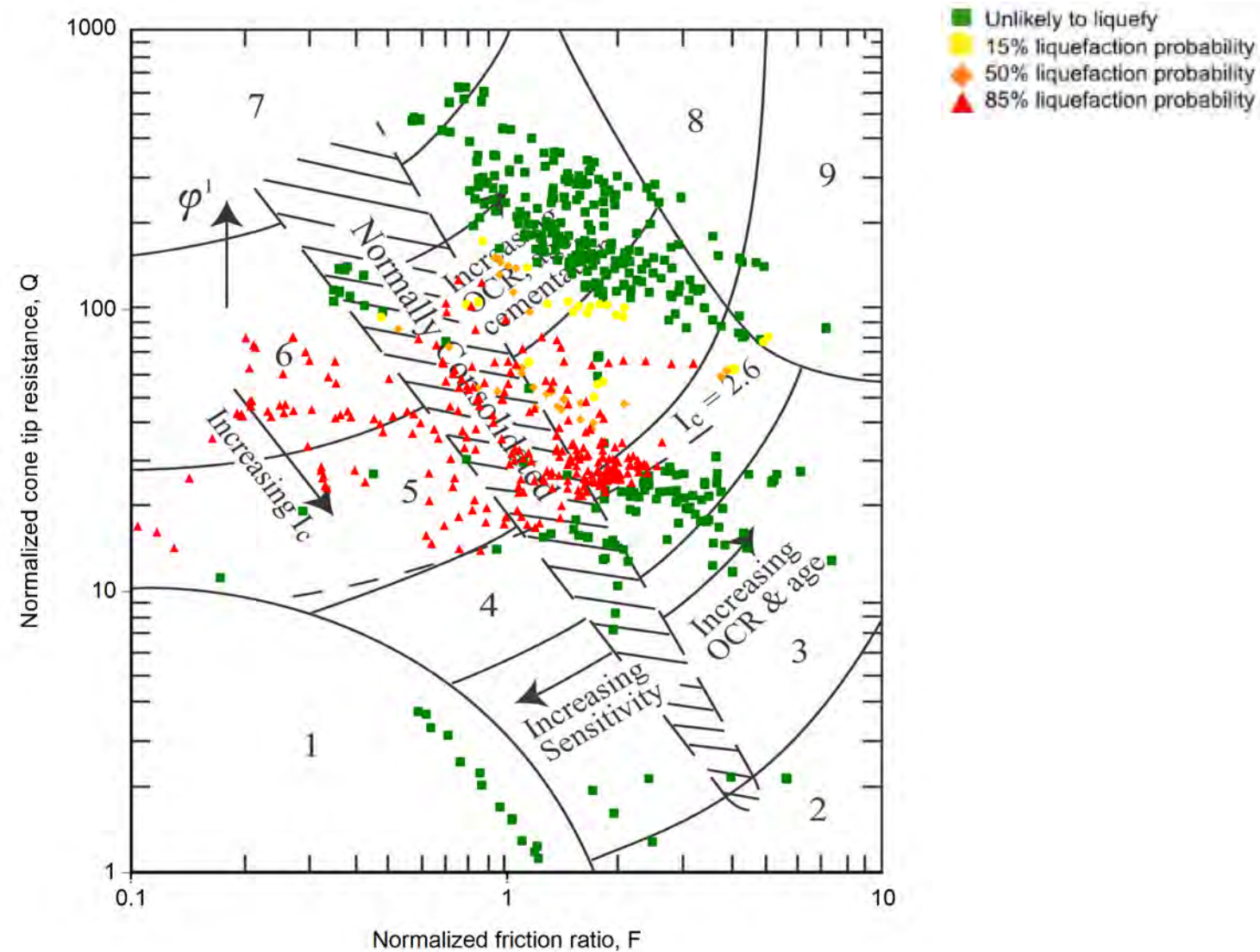
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT105	178994	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT106		178995	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	202	8.5	20	45	1.2	21						
	50%	185	7.4	15	42	1.2	16						
	85%	162	6.3	10	39	1.2	11						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

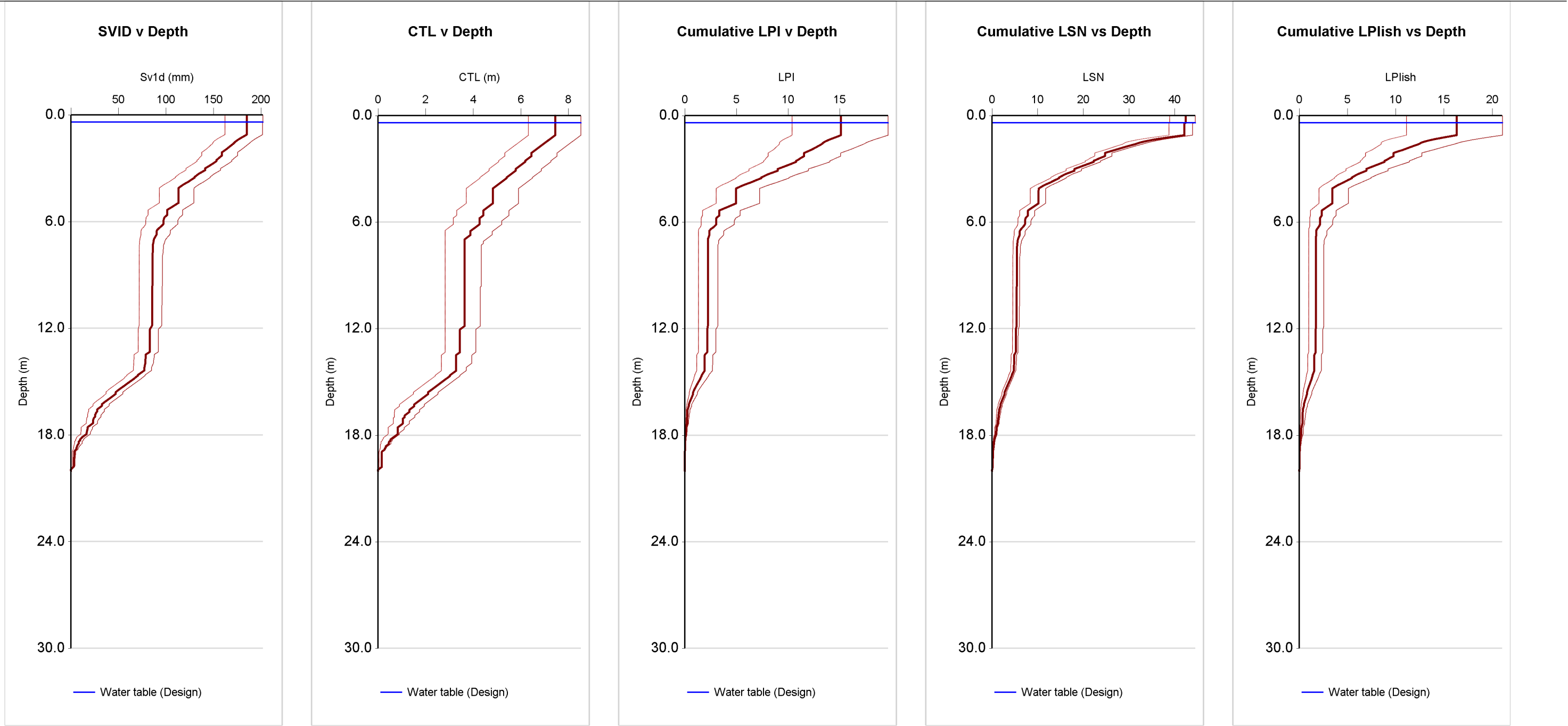


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

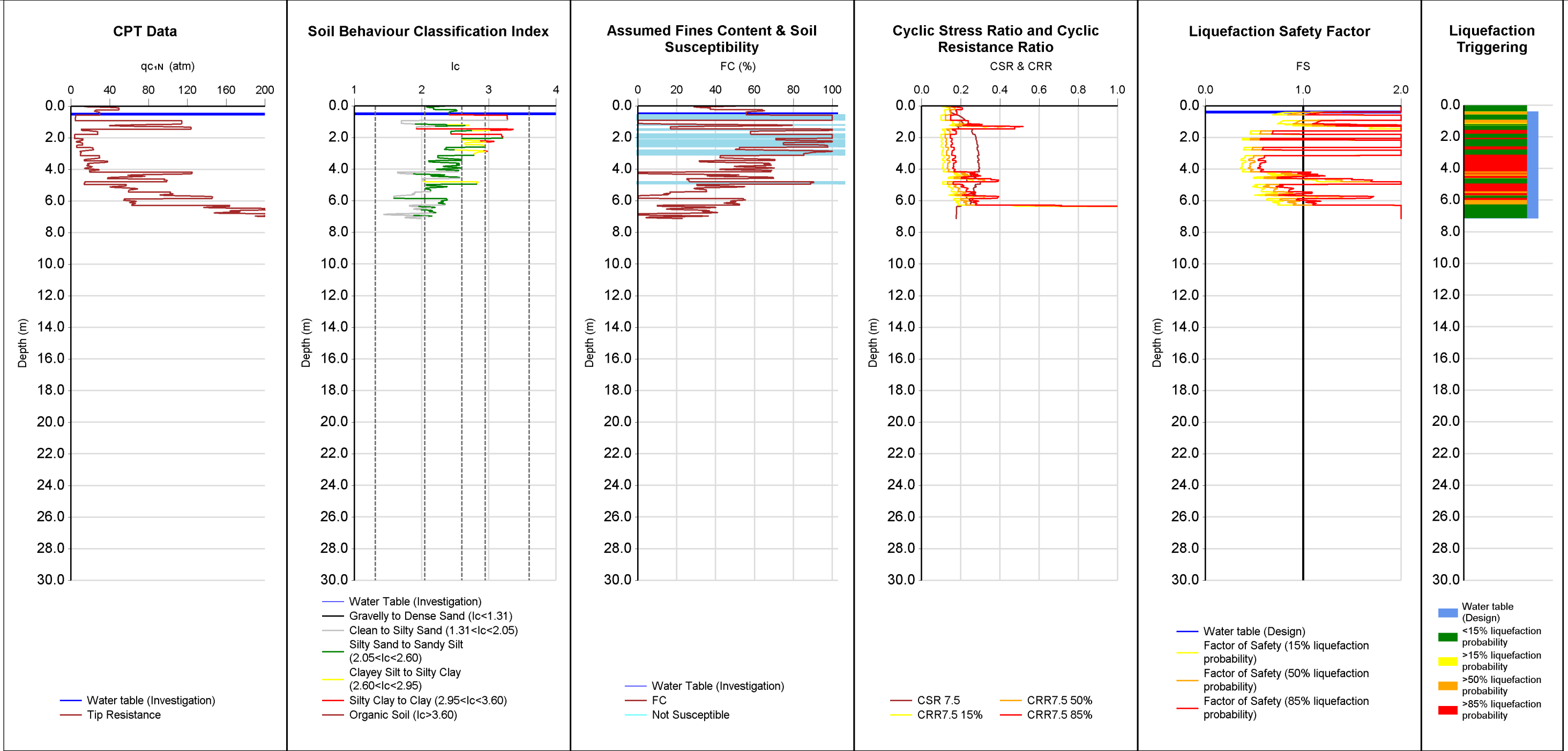
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	17 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3	1017355.0000				



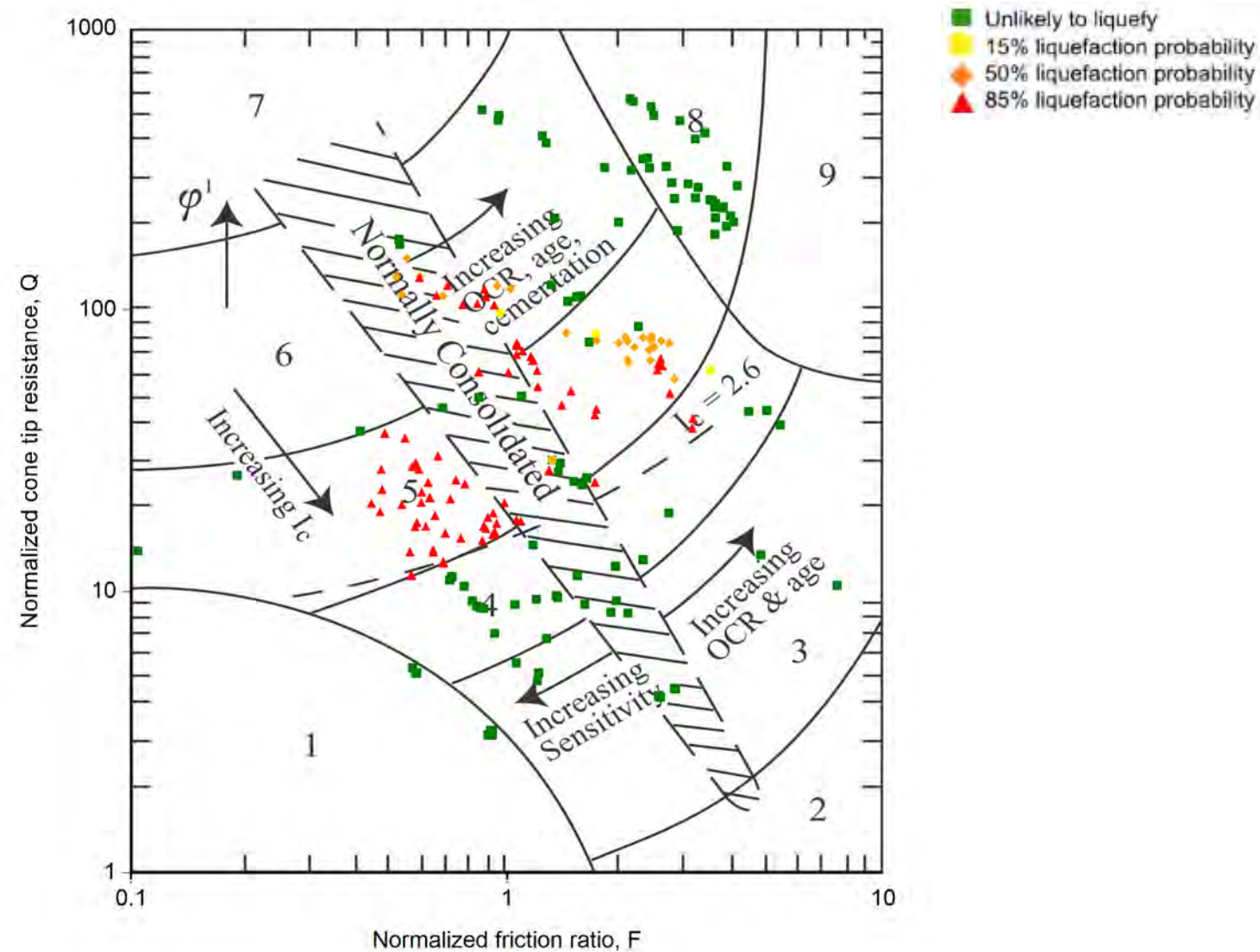
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT106	178995	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT107	178996	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	88	3.6	13	37	0.5	15					
		50%	79	3.5	10	30	0.5	10					
		85%	66	2.4	6	23	1.7	6					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

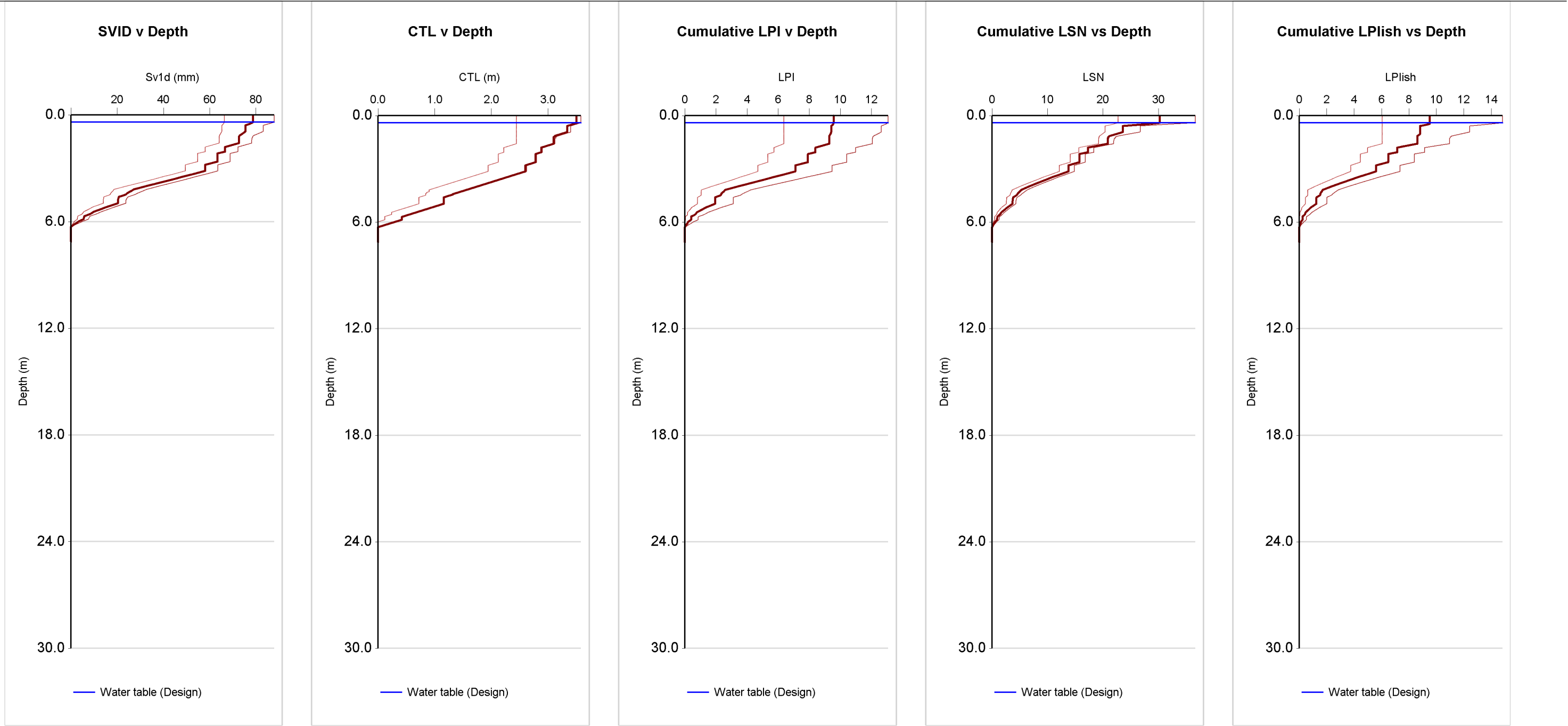


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

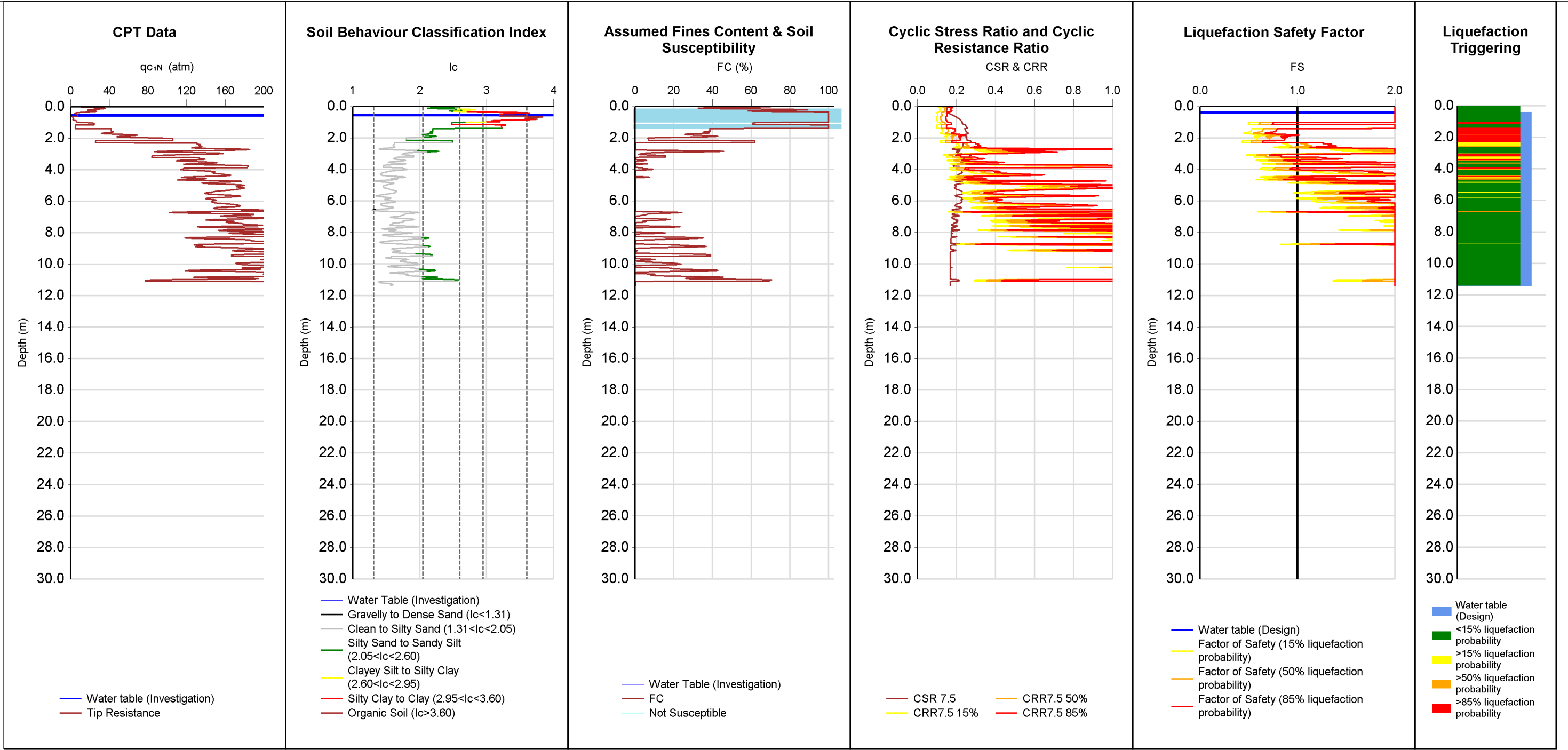
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	20 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3	1017355.0000				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT107	178996	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



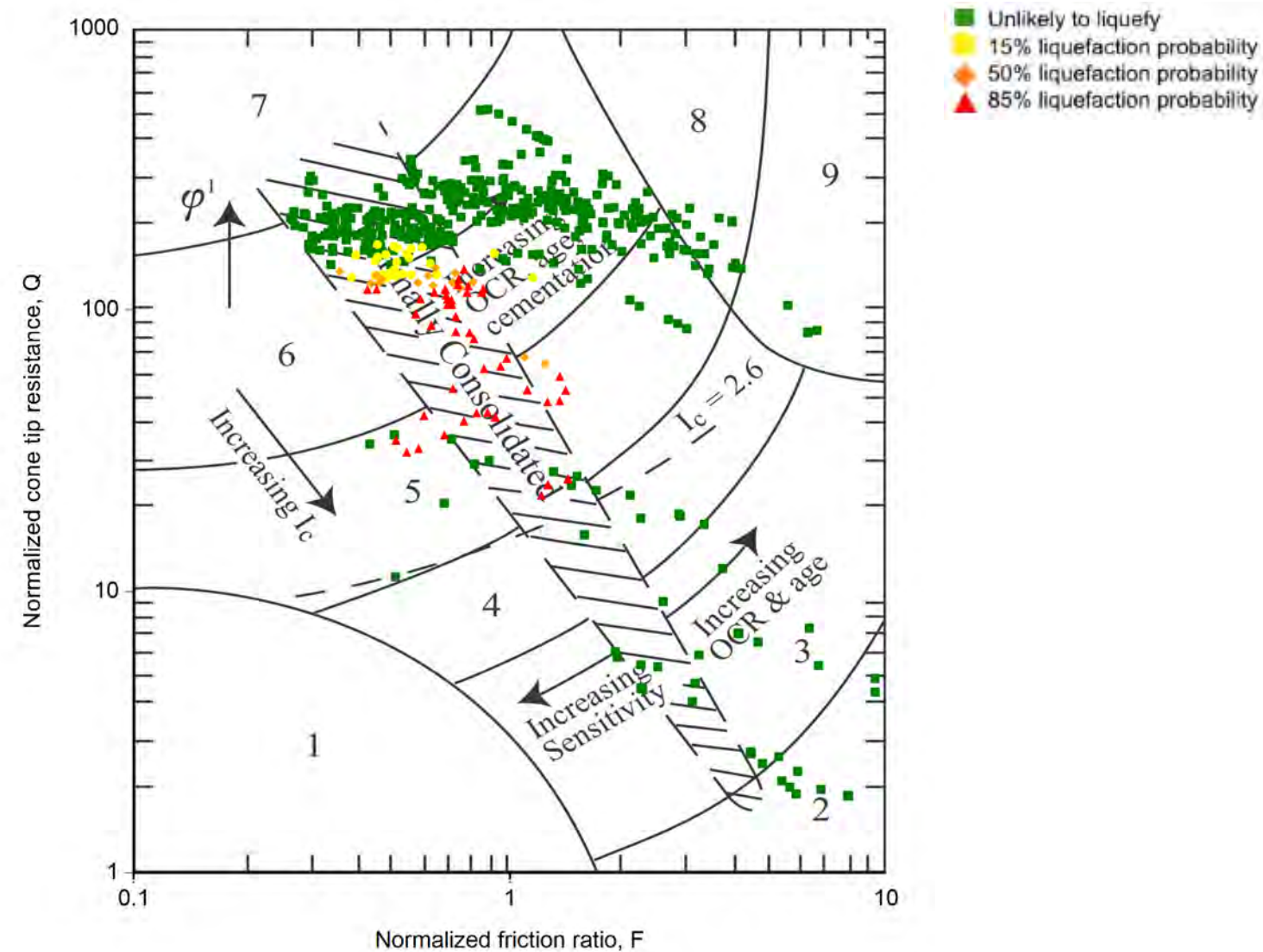
Note: Inverse filtered Q_c/F_s data (10 cm²) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT108		178997	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish						
	15%	54	2.6	7	24	1.1	10						
	50%	45	1.9	5	21	1.1	7						
	85%	34	1.5	3	17	1.1	4						

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

 Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd					LOCATION	Hamilton		DATE	24/06/2021
	PROJECT	Brymer Farms Subdivision								ANALYSED	cand
	TITLE	Liquefaction Analyses					JOB NUMBER	1017355.0000		PAGE	22 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3									

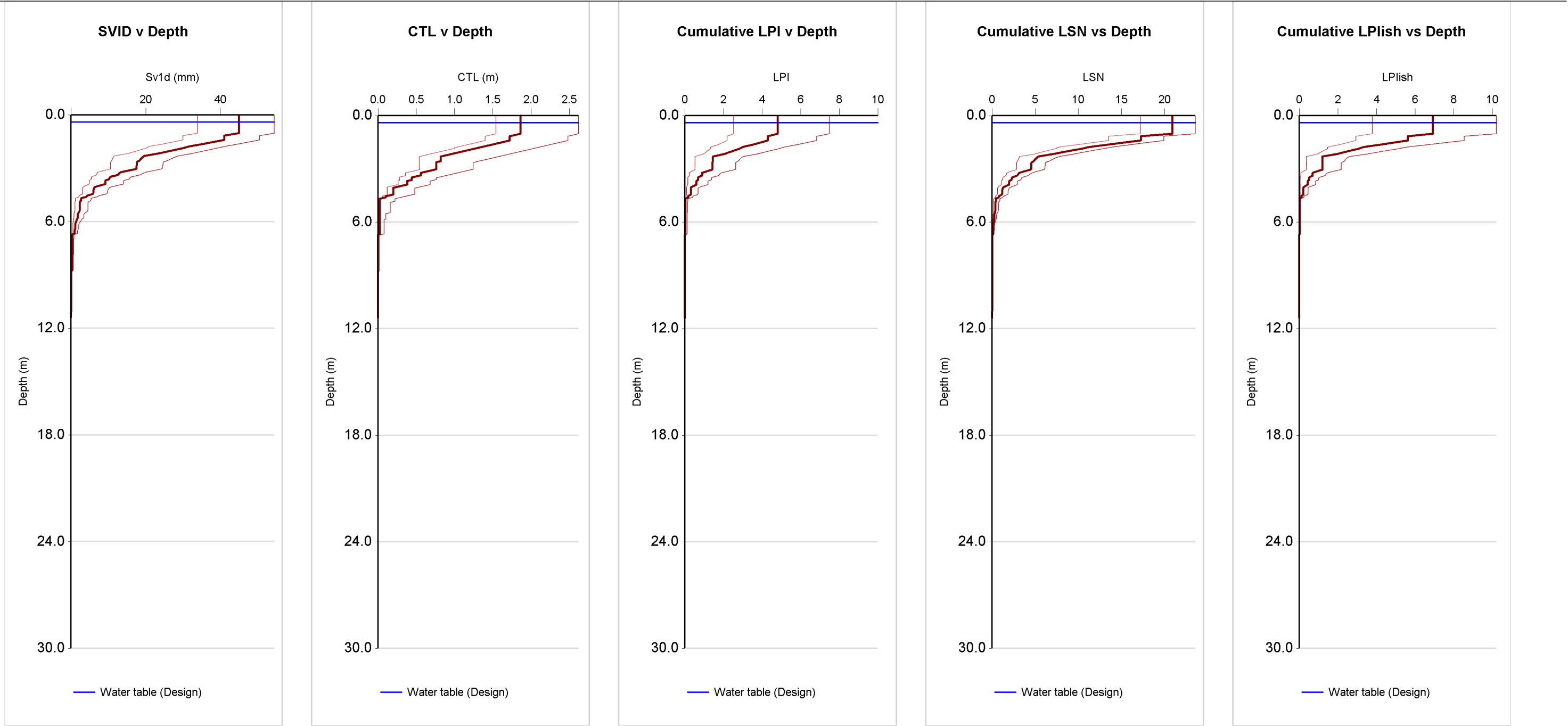


- Sensitive, fine grained
- Organic soils - peats
- Clays - silty clay to clay
- Silt mixtures - clayey silt to silty clay
- Sand mixtures - silty sand to sandy silt
- Sands - clean sand to silty sand
- Gravelly sand to dense sand
- Very stiff sand to clayey sand *
- Very stiff, fine grained *

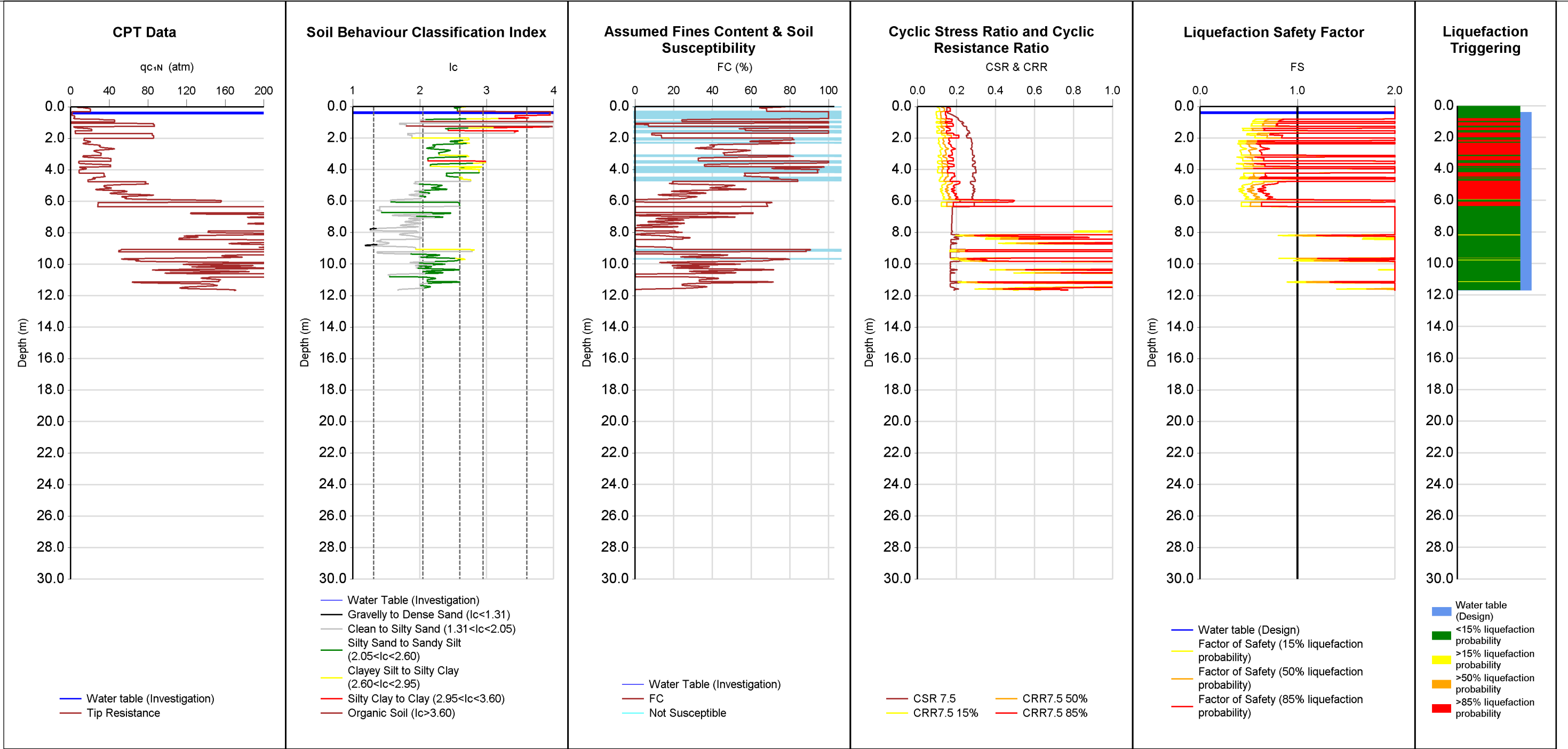
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION		DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision		Hamilton	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses	JOB NUMBER		PAGE	23 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3	1017355.0000				



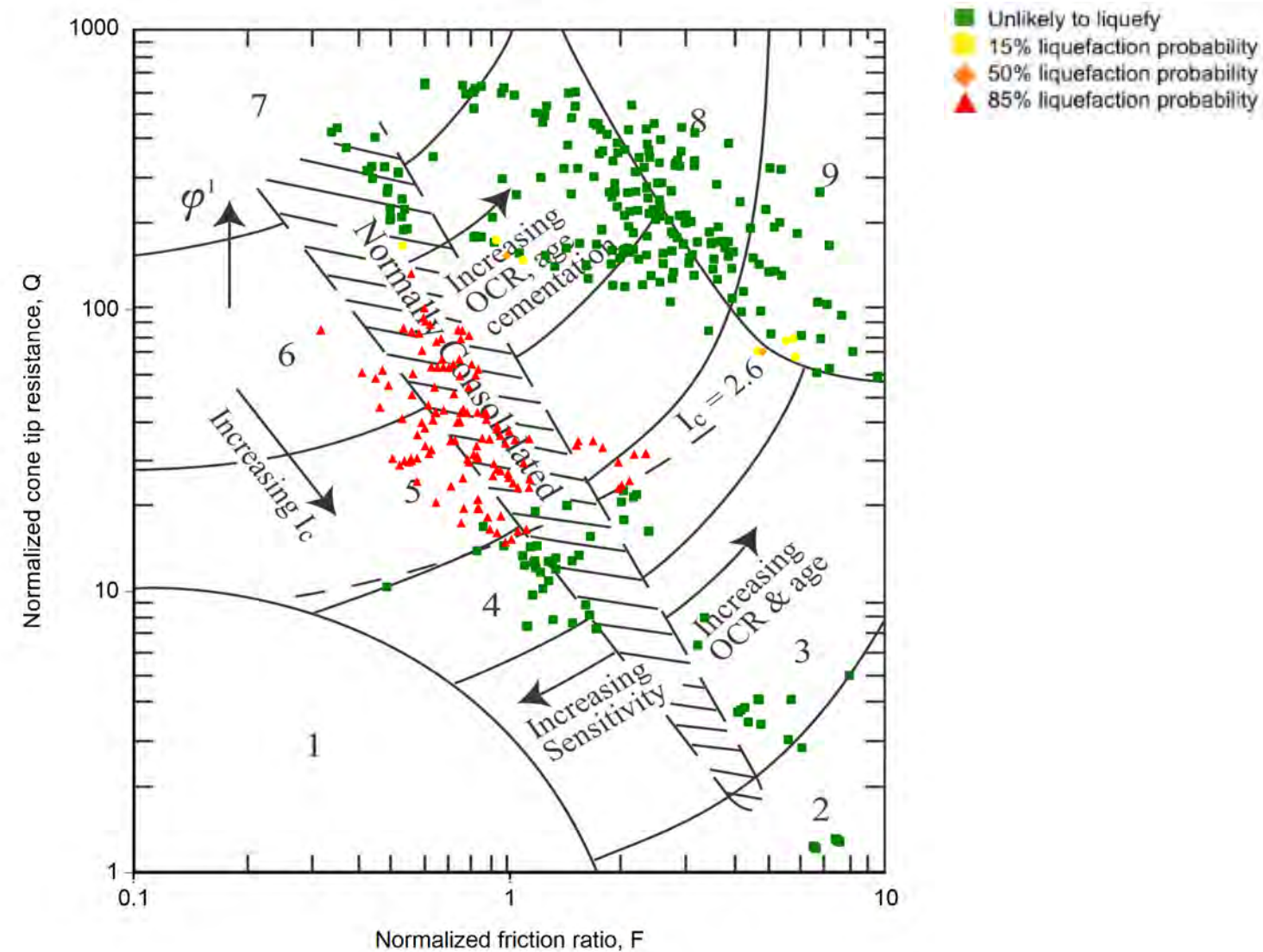
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT108	178997	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT109	178998	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	105	4.1	17	38	0.9	19					
		50%	104	4	14	38	0.9	16					
		85%	101	3.9	10	37	0.9	11					

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

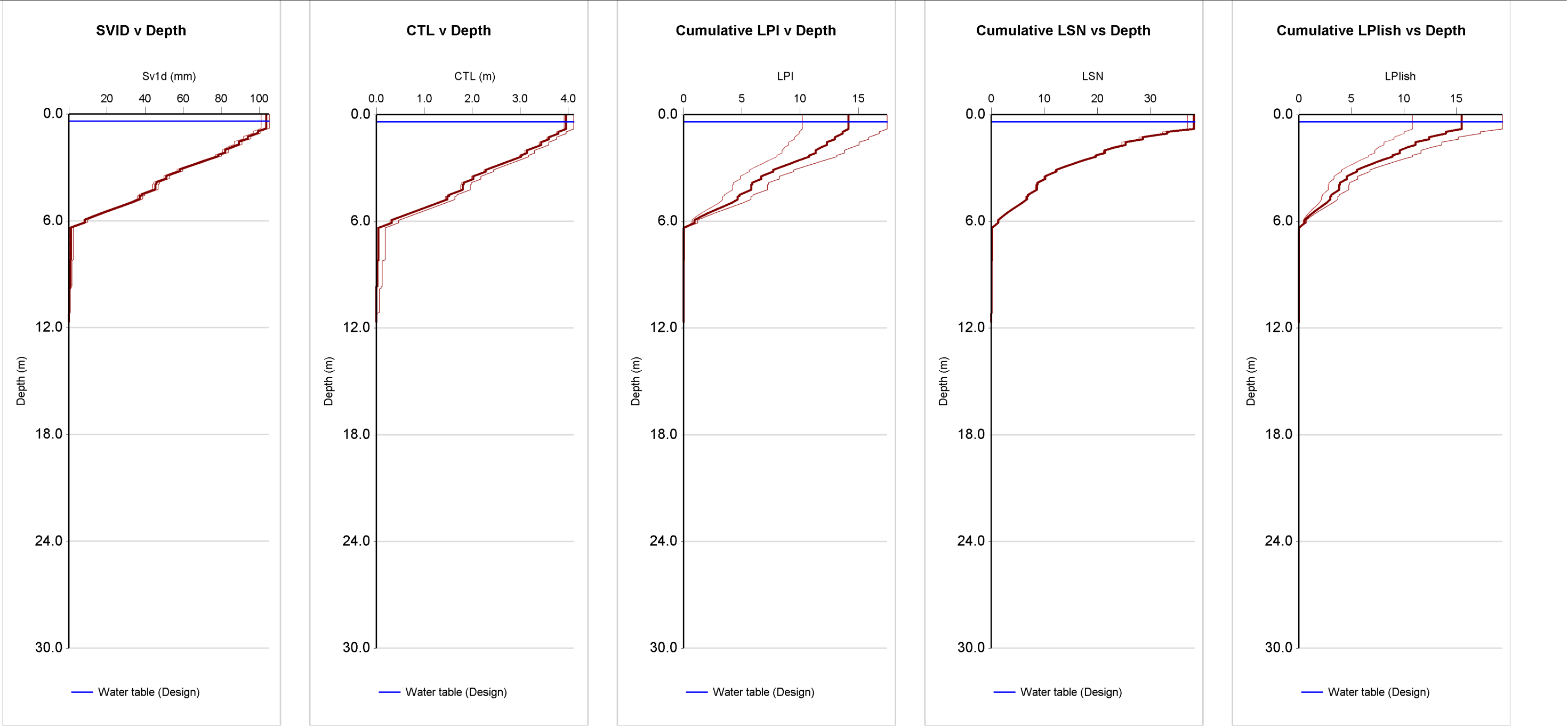


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd		LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision				ANALYSED	cand
		TITLE	Liquefaction Analyses		JOB NUMBER	1017355.0000	PAGE	26 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3					

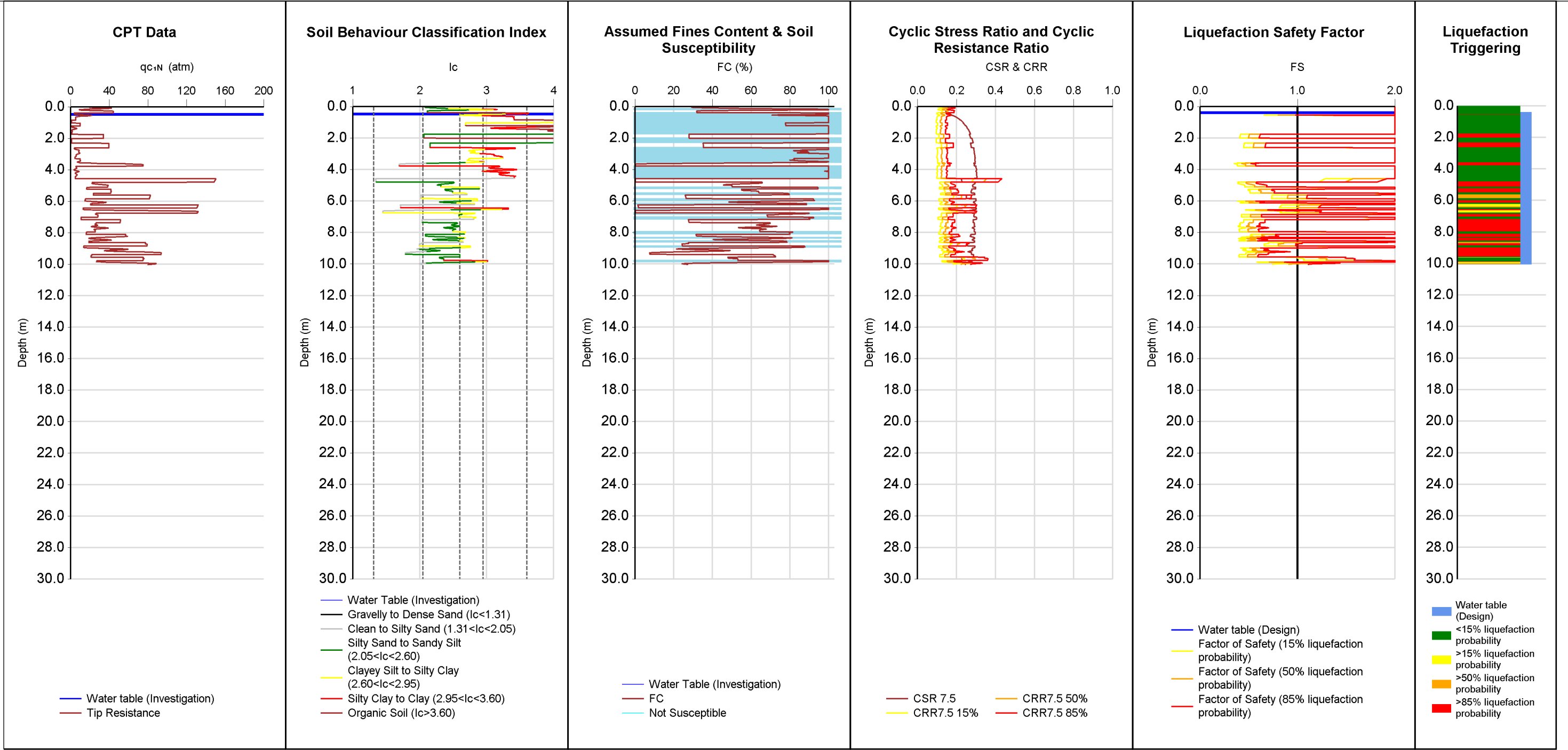


	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT109	178998	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

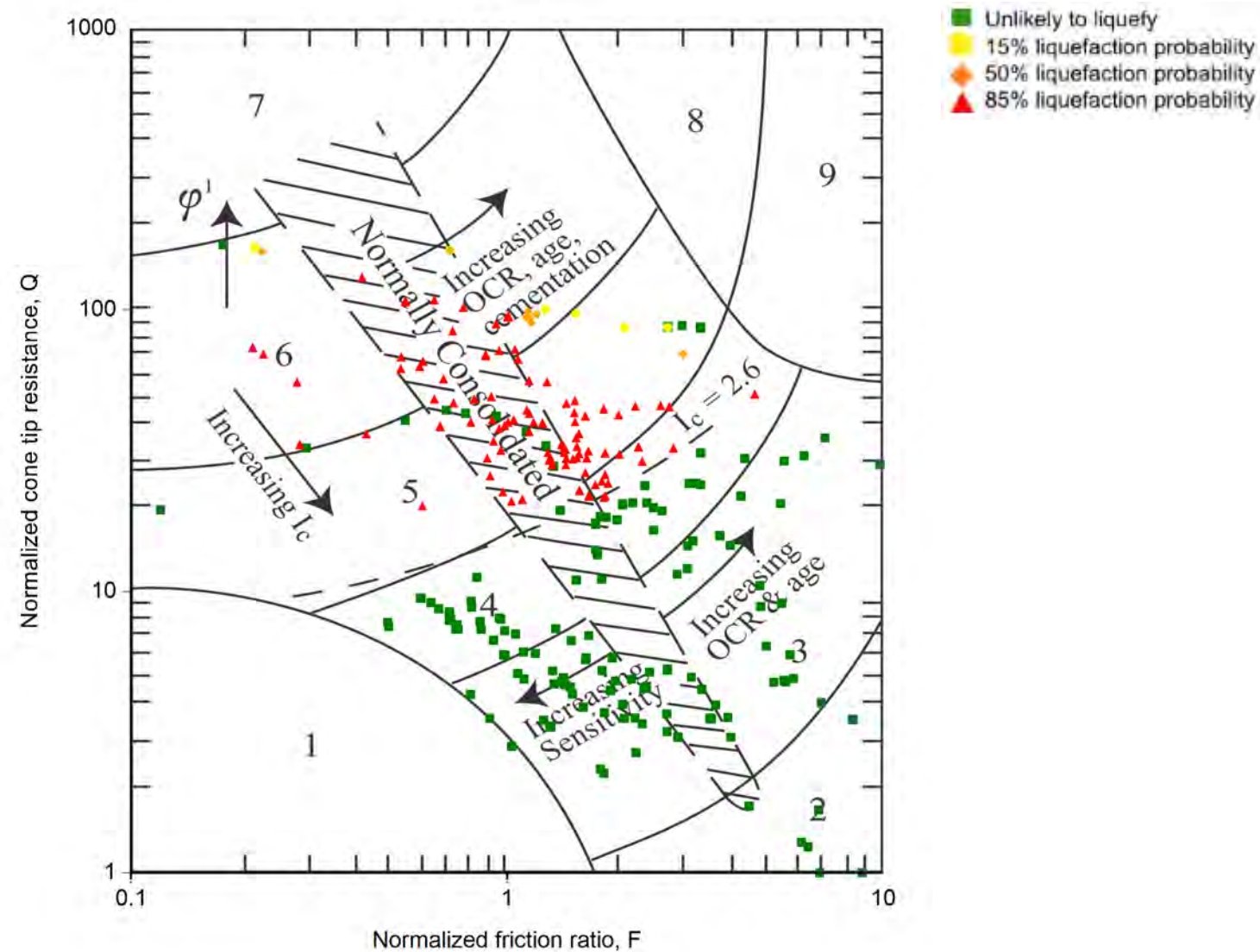
CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
PROJECT	Brymer Farms Subdivision			ANALYSED	cand
TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	27 of 47 pages
COMMENT	1 in 1000 Year Event - ULS IL3				



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT110		178999	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	107	4.4	15	22	1.8	11						
	50%	101	4.1	11	21	1.8	9						
	85%	94	3.6	8	20	1.8	6						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

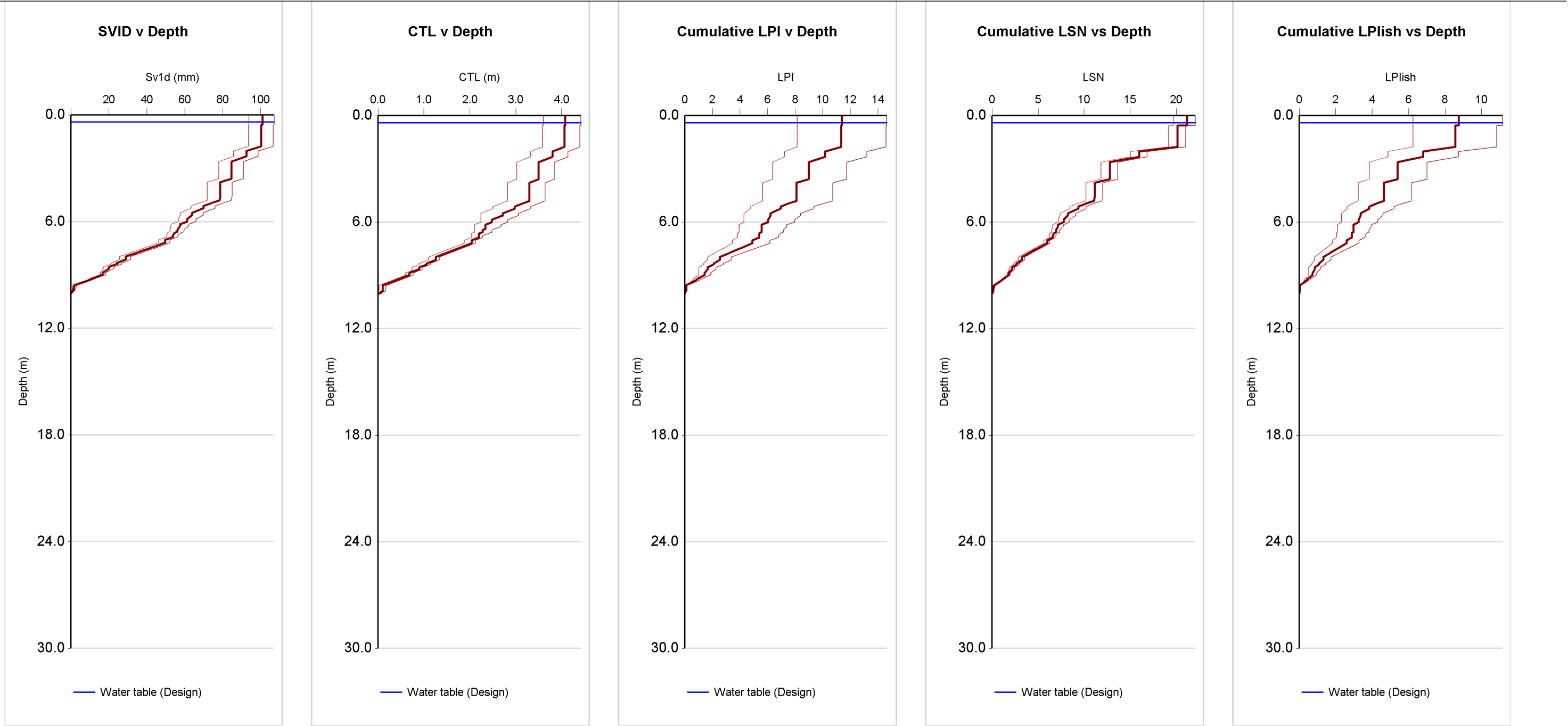


- | | |
|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

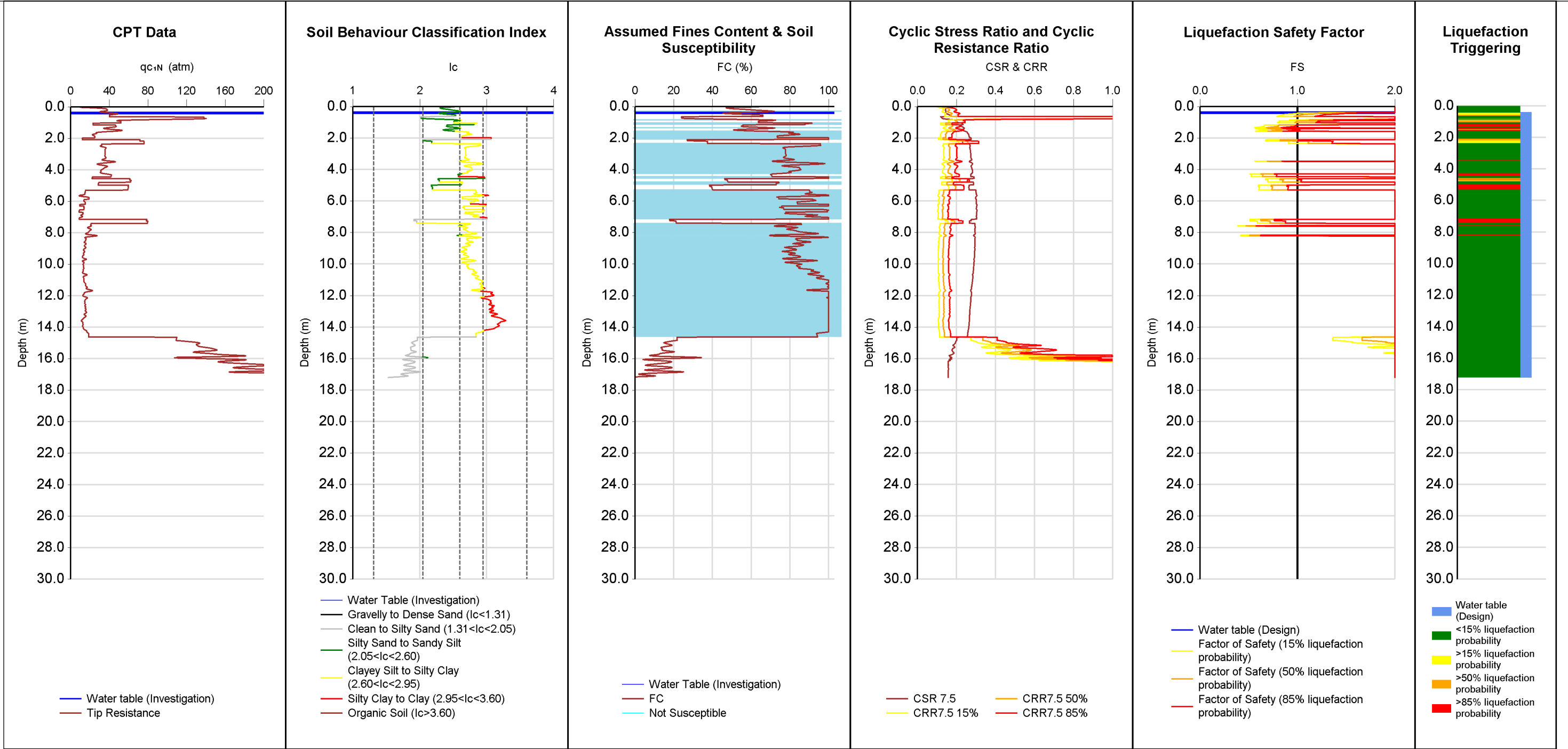
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	29 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3				



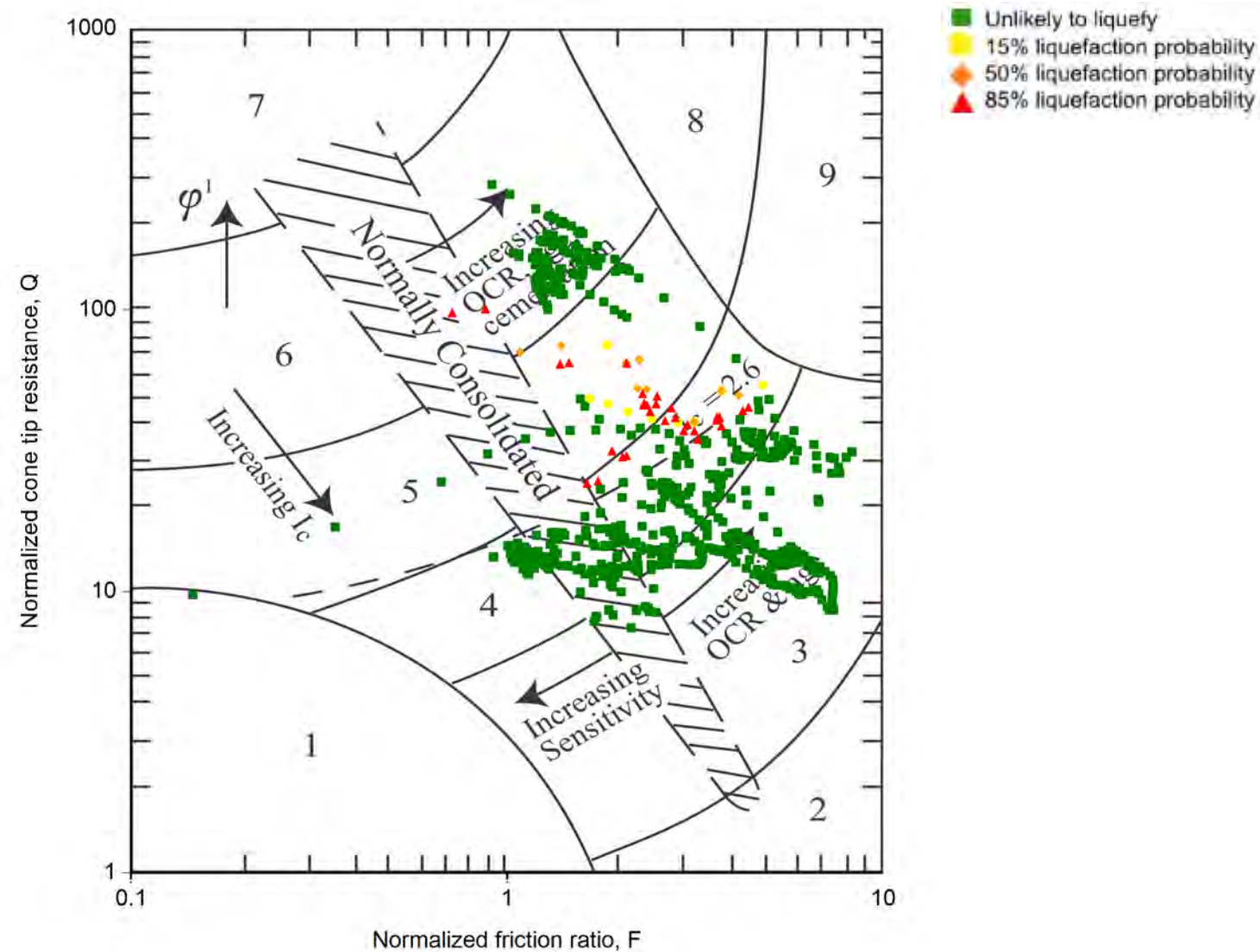
	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT110	178999	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm^2) used.

INPUT	Run Description		TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
	CPT111		179000	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:					
	15%	43	2.1	6	22	0.5	7						
	50%	35	1.8	3	15	0.9	3						
	85%	24	1.3	1	9	1.2	1						

Reviewed by:	
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

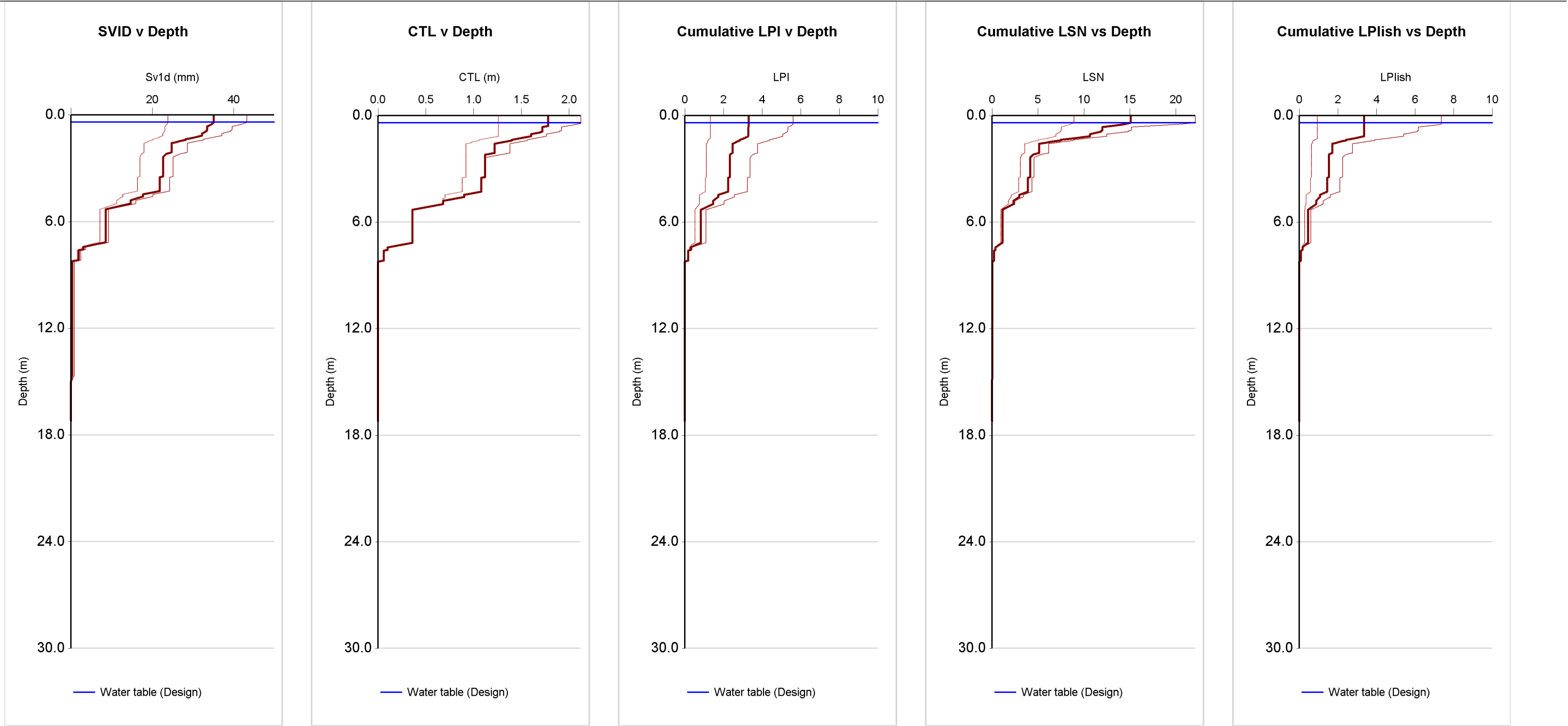


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

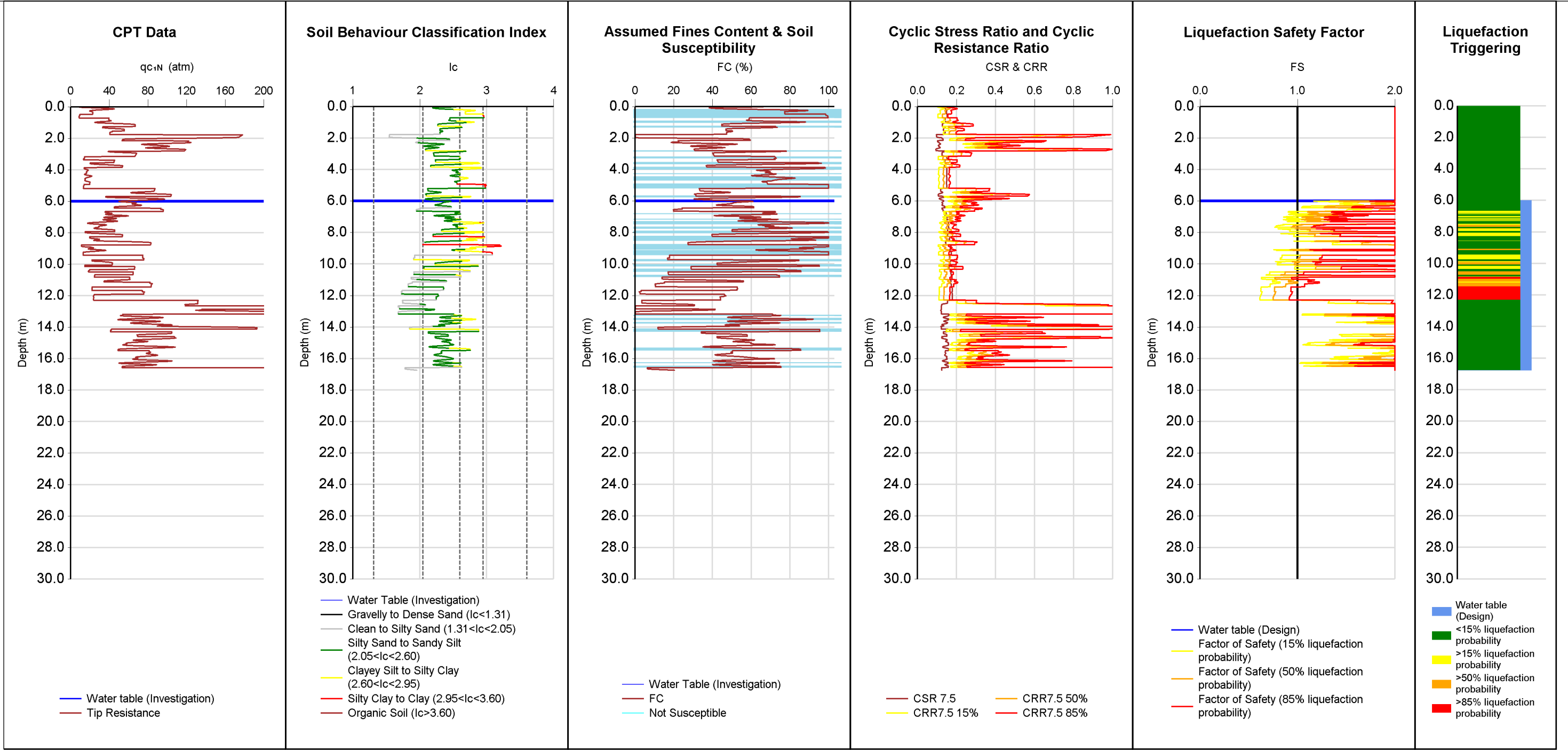
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

 Tonkin+Taylor	Tonkin + Taylor	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
	Exceptional thinking together	PROJECT	Brymer Farms Subdivision	JOB NUMBER	1017355.0000	ANALYSED	cand
	V2.4.15	TITLE	Liquefaction Analyses			PAGE	32 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3					



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT111	179000	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



Note: Inverse filtered Q_c/F_s data (10 cm²) used.

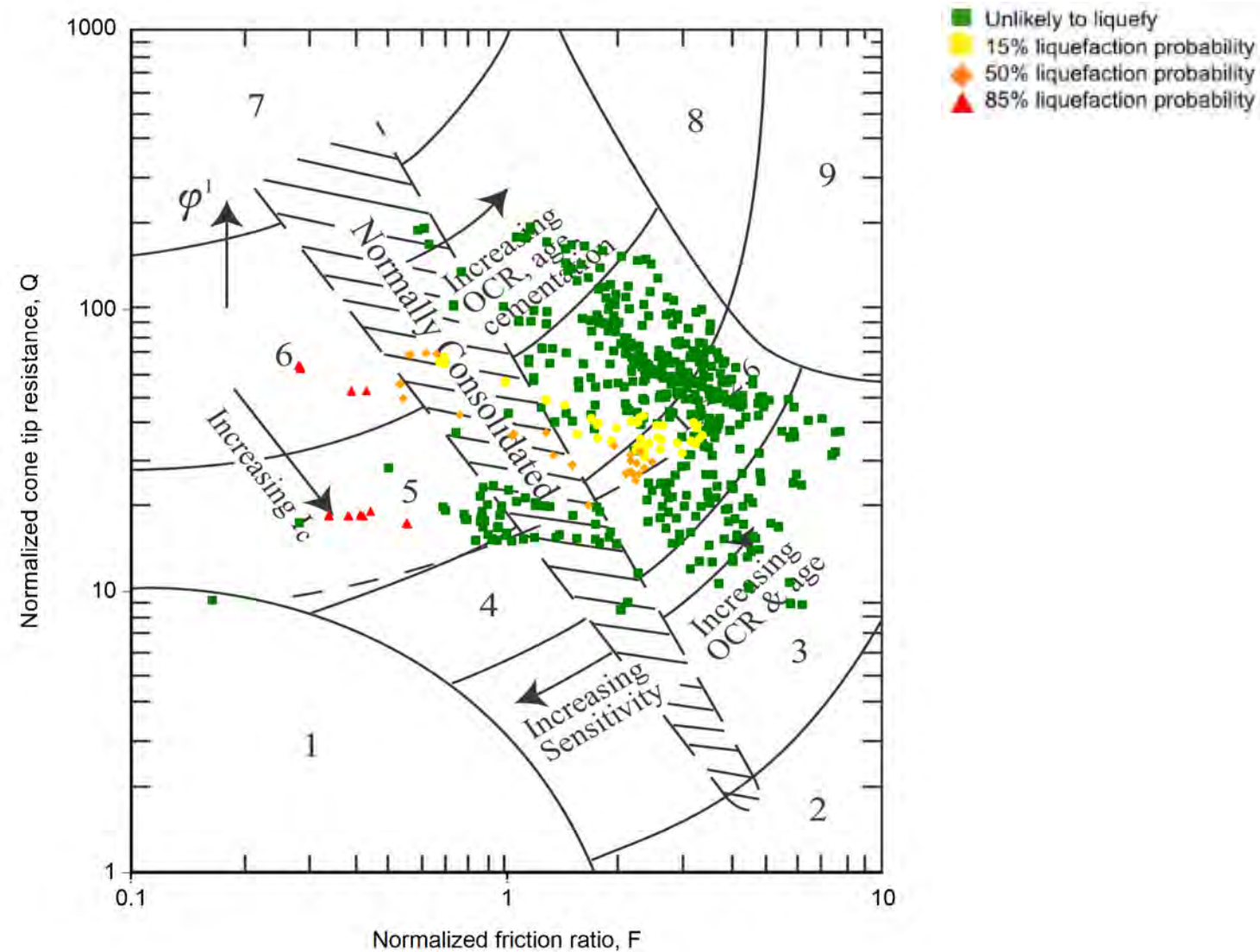
INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT112	179001	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish	Reviewed by:				
		15%	84	3.5	4	8	6.7	0	CPT Inversion	gumc			
		50%	59	2	1	6	7.6	0	Groundwater	gumc			
		85%	32	1	0	3	10.9	0	Susceptibility	gumc			
									Triggering	gumc			
									Consequence	gumc			



Tonkin + Taylor
Exceptional thinking
together
V2.4.15

CLIENT **Brymer Farms Ltd**
PROJECT **Brymer Farms Subdivision**
TITLE **Liquefaction Analyses**
COMMENT 1 in 1000 Year Event - ULS IL3

LOCATION **Hamilton**
JOB NUMBER **1017355.0000**
DATE **24/06/2021**
ANALYSED **cand**
PAGE **34 of 47 pages**

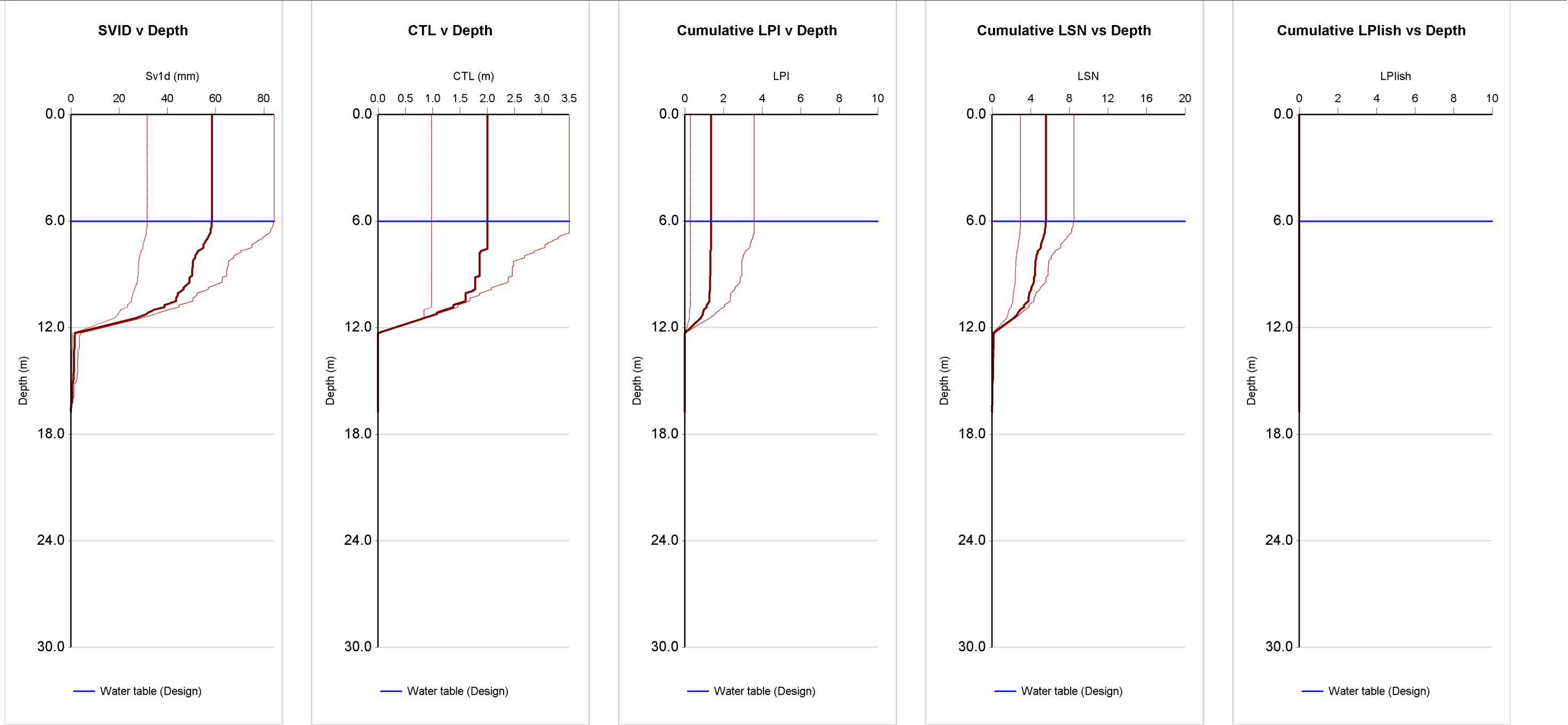


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

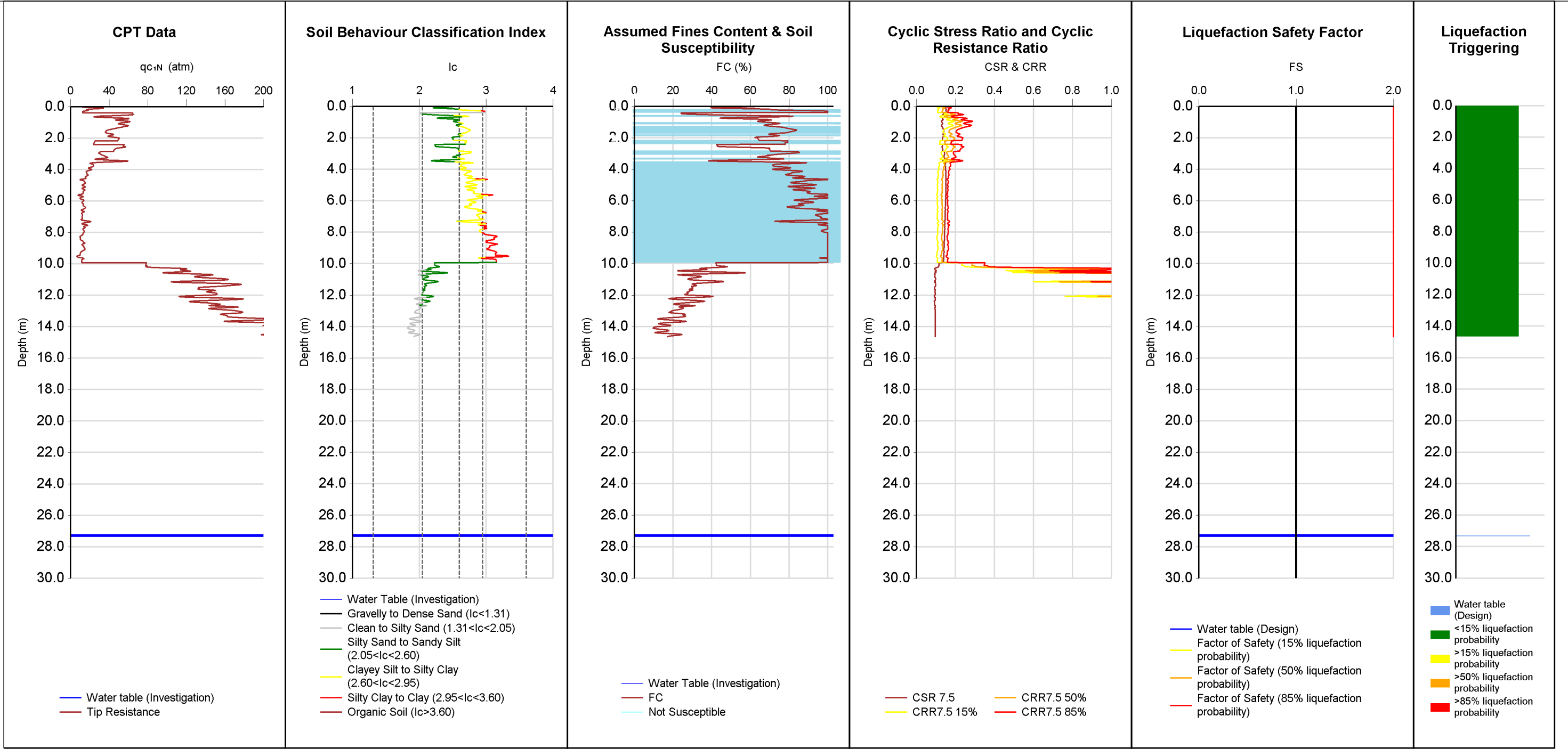
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	35 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT112	179001	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



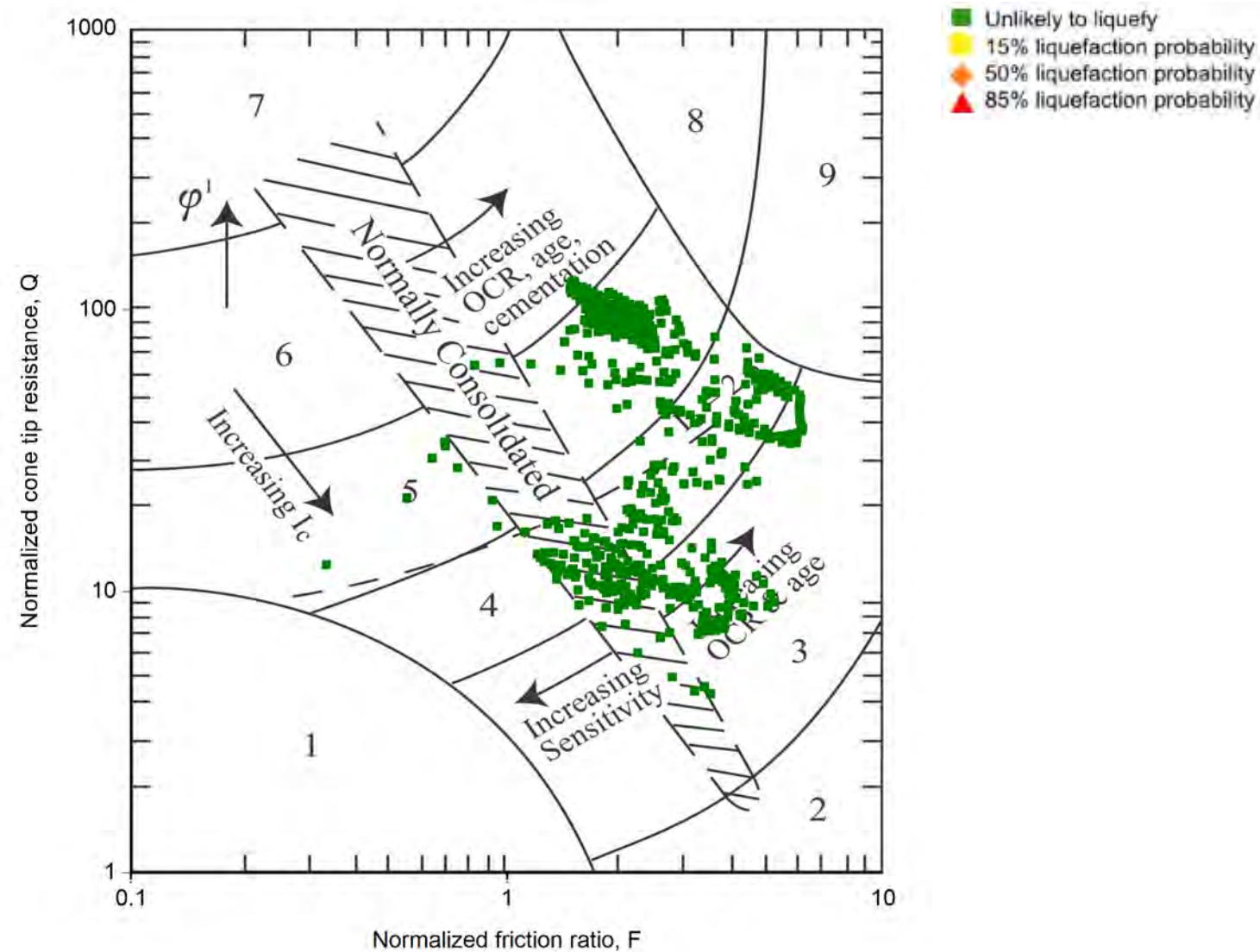
Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT113	179002	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	0	0	0	0	14.6	0					
		50%	0	0	0	0	14.6	0					
		85%	0	0	0	0	14.6	0					

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

 Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
	PROJECT	Brymer Farms Subdivision			ANALYSED	cand
	TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	37 of 47 pages
	COMMENT	1 in 1000 Year Event - ULS IL3				

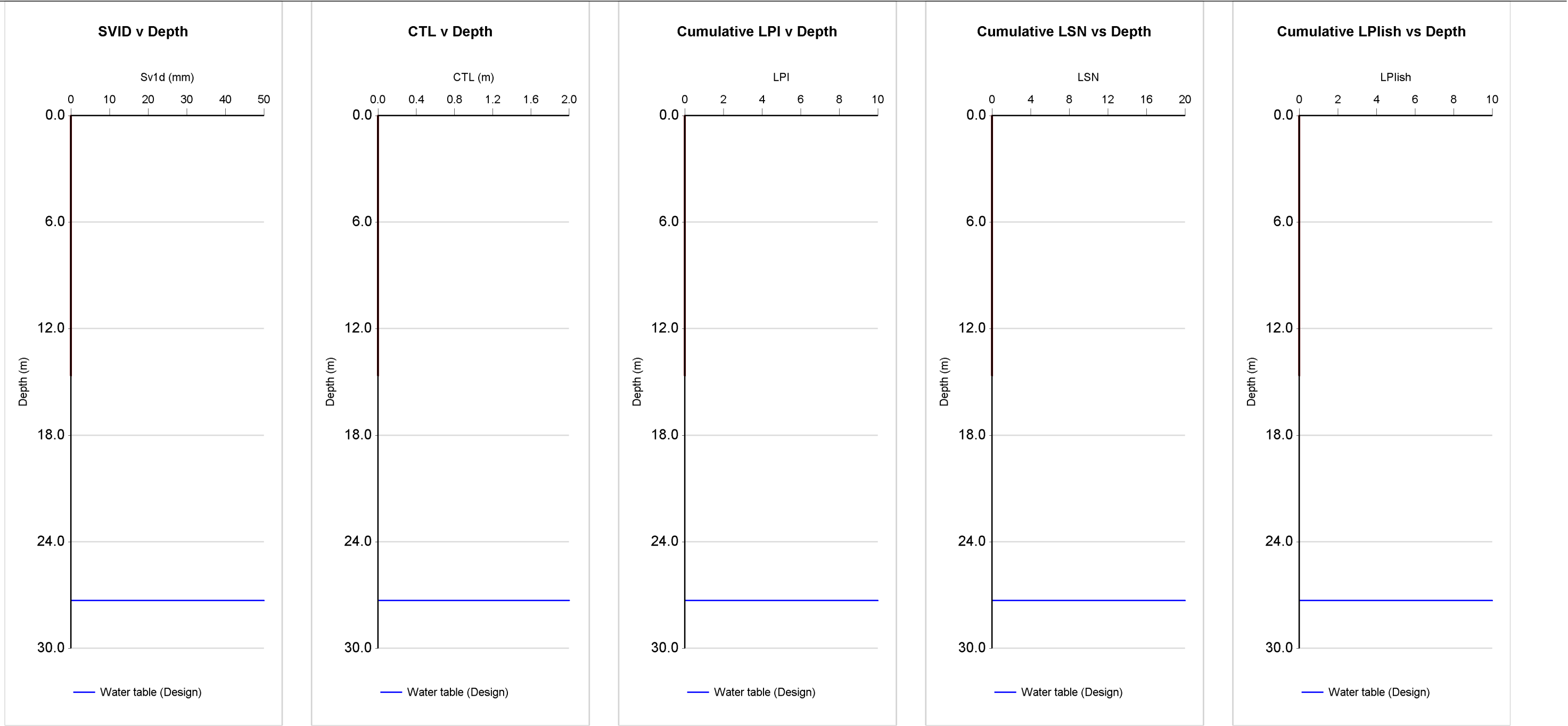


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

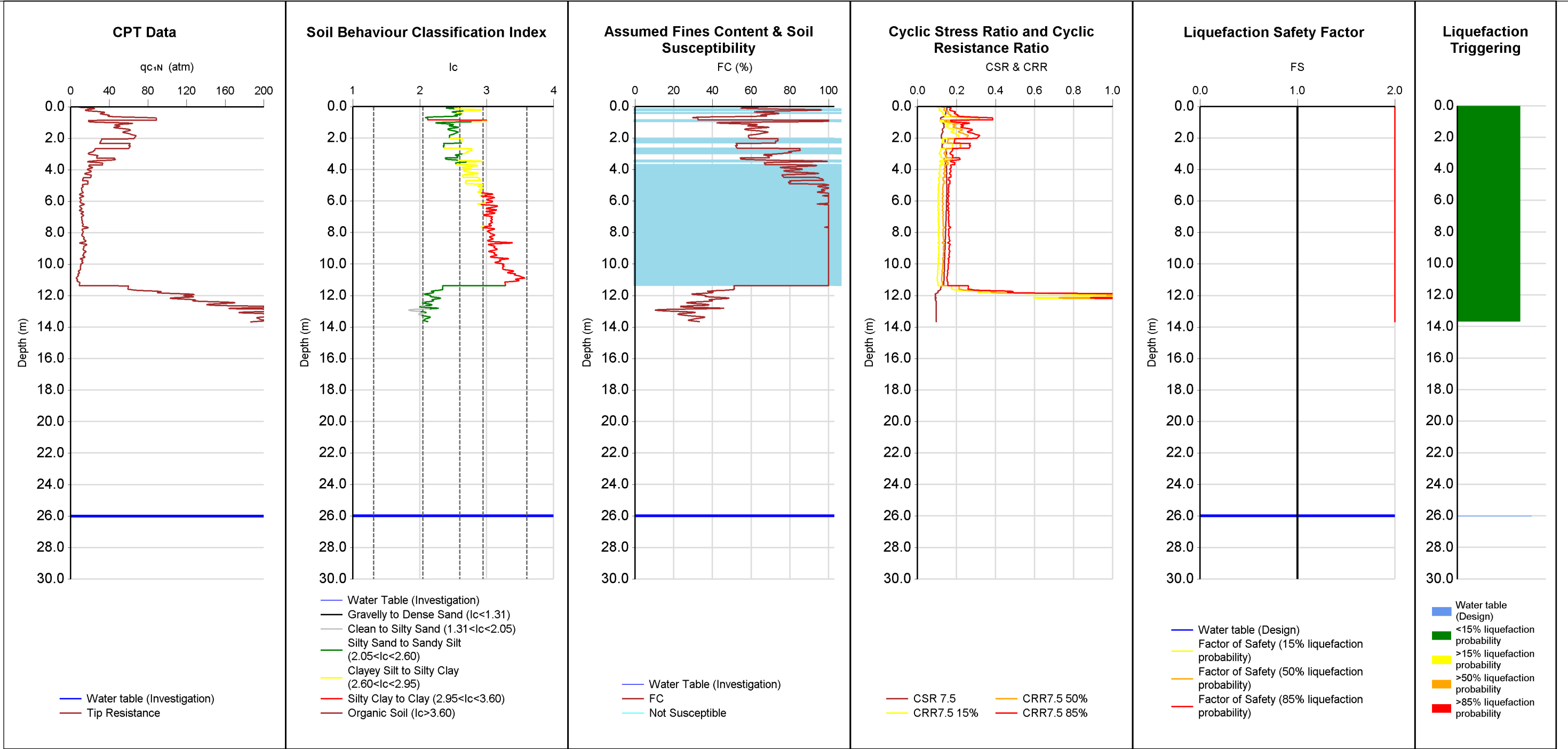
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	38 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT113	179002	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	

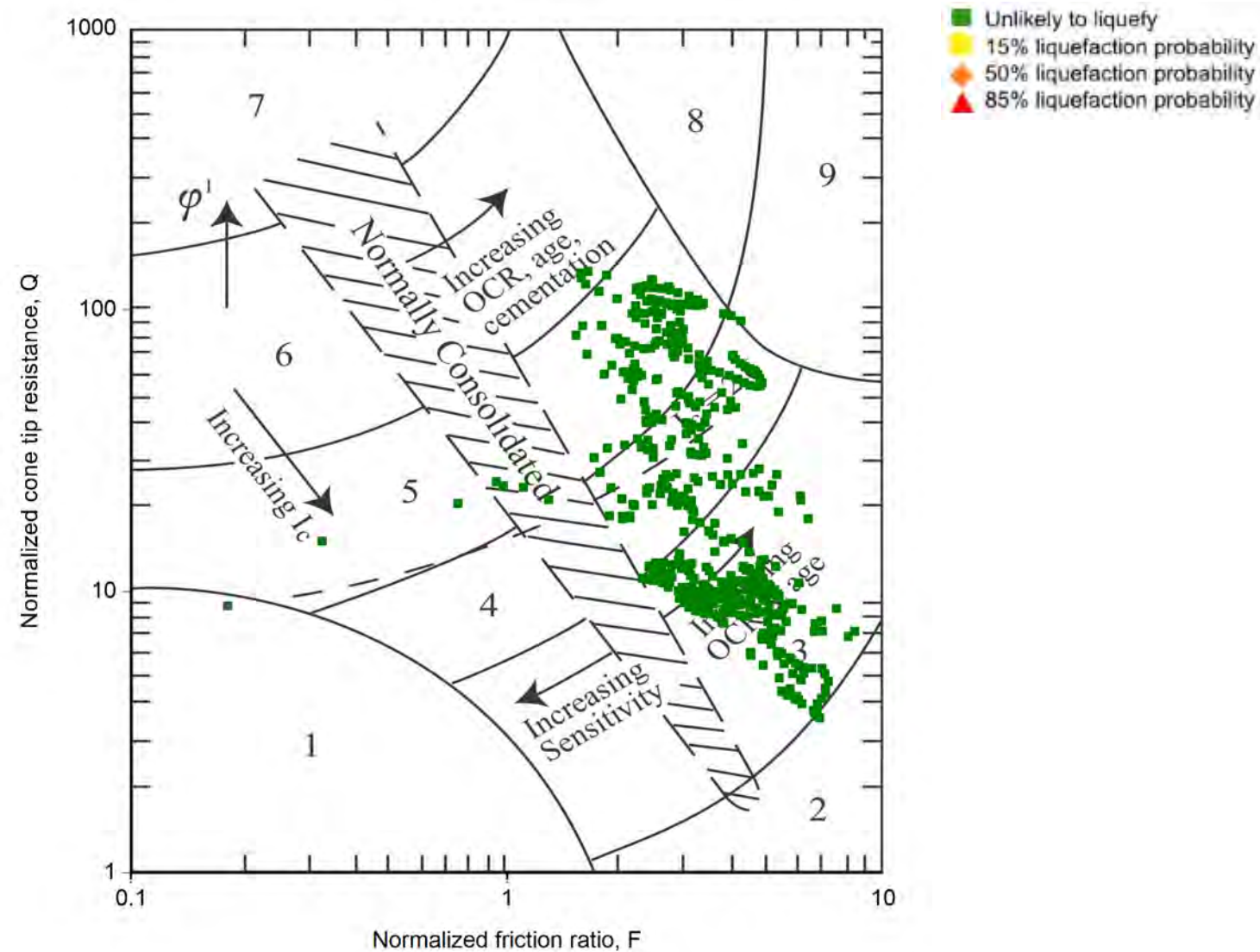


Note: Inverse filtered Qc/Fs data (10 cm²) used.

INPUT		Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
		CPT114	179003	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	
OUTPUT		PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish					
		15%	0	0	0	0	13.7	0					
		50%	0	0	0	0	13.7	0					
		85%	0	0	0	0	13.7	0					

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

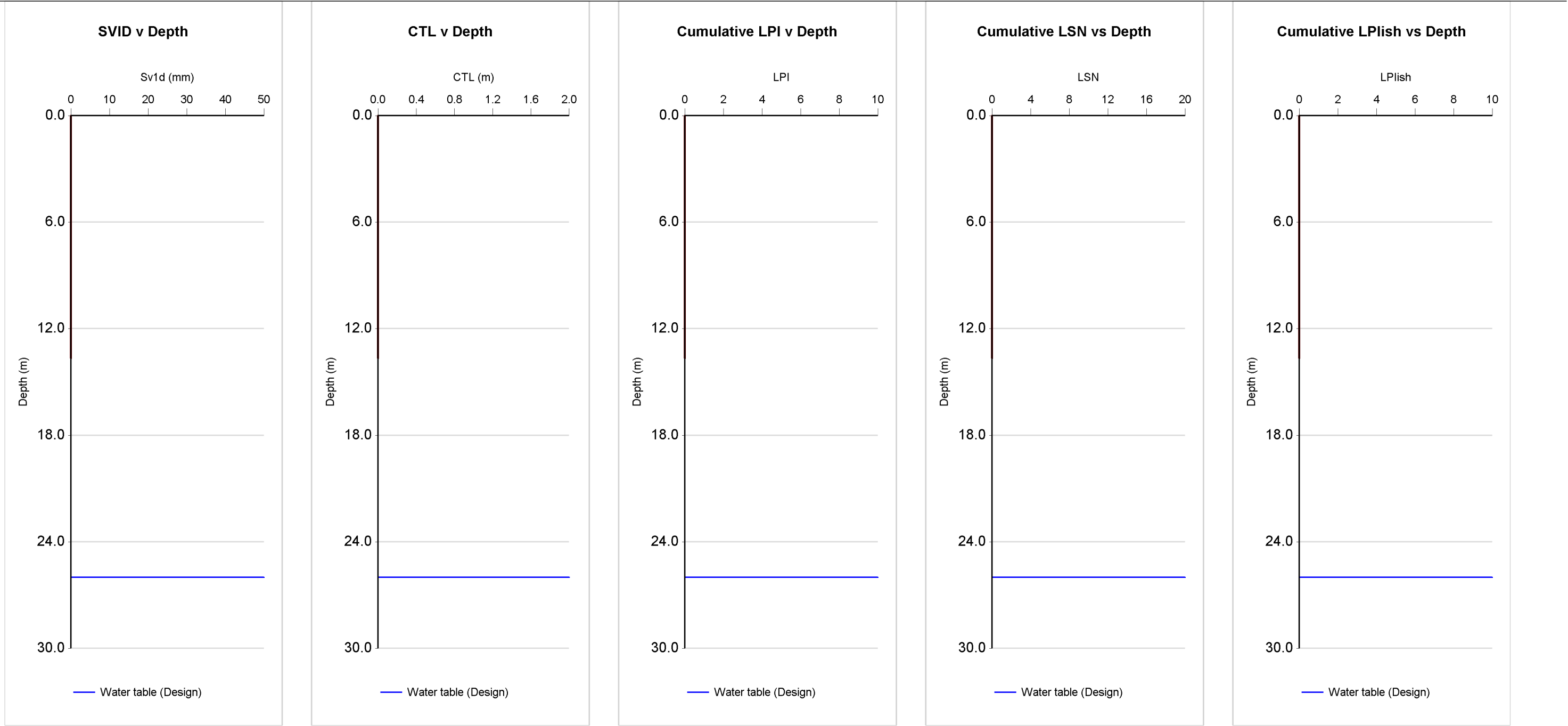


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|--|-------------------------------------|
| 1. Sensitive, fine grained | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats | 7. Gravelly sand to dense sand |
| 3. Clays - silty clay to clay | 8. Very stiff sand to clayey sand * |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained * |
| 5. Sand mixtures - silty sand to sandy silt | |

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	Tonkin + Taylor Exceptional thinking together V2.4.15	CLIENT	Brymer Farms Ltd	LOCATION	Hamilton	DATE	24/06/2021
		PROJECT	Brymer Farms Subdivision			ANALYSED	cand
		TITLE	Liquefaction Analyses	JOB NUMBER	1017355.0000	PAGE	41 of 47 pages
		COMMENT	1 in 1000 Year Event - ULS IL3				



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT114	179003	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	

Error: Subreport could not be shown.

The inputs listed in Table 1.1-1 below have been adopted for the liquefaction analysis.

Table 1.1-1 Summary of inputs for liquefaction analysis

ID	TTGD 178990	TTGD 178991	TTGD 178992	TTGD 178993	TTGD 178994	TTGD 178995
CPT Name	CPT01, 584 Whatawhata Road, Hamilton	CPT02, 584 Whatawhata Road, Hamilton	CPT03, 584 Whatawhata Road, Hamilton	CPT04, 584 Whatawhata Road, Hamilton	CPT05, 584 Whatawhata Road, Hamilton	CPT06, 584 Whatawhata Road, Hamilton
Run description	CPT101	CPT102	CPT103	CPT104	CPT105	CPT106
PGA	0.28g	0.28g	0.28g	0.28g	0.28g	0.28g
Magnitude	5.9	5.9	5.9	5.9	5.9	5.9
Depth to groundwater at time of Investigation (m)	20	0.4	0.4	0.4	0.7	0.45
Depth to groundwater for design (m)	20	0.4	0.4	0.4	0.4	0.4
Predrill depth (m)	0	0	0	0	0	0
Assumed predrill tip resistance and skin friction	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	29	20.02	15.92	14.3	8.72	20.02
Minimum depth of analysis (m)	0	0	0	0	0	0
Maximum depth of analysis (m)	30	30	30	30	30	30
Inverse Filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)

Table 1.1-2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 178990	CPT101	0	0	0
TTGD 178990	CPT101	0	0.01	0
TTGD 178990	CPT101	0.01	30	2.6
TTGD 178991	CPT102	0	0	0
TTGD 178991	CPT102	0	0.01	0
TTGD 178991	CPT102	0.01	30	2.6
TTGD 178992	CPT103	0	0	0
TTGD 178992	CPT103	0	0.01	0
TTGD 178992	CPT103	0.01	30	2.6
TTGD 178993	CPT104	0	0	0
TTGD 178993	CPT104	0	0.01	0
TTGD 178993	CPT104	0.01	30	2.6
TTGD 178994	CPT105	0	0	0
TTGD 178994	CPT105	0	0.01	0
TTGD 178994	CPT105	0.01	30	2.6
TTGD 178995	CPT106	0	0	0
TTGD 178995	CPT106	0	0.01	0
TTGD 178995	CPT106	0.01	30	2.6
TTGD 178996	CPT107	0	0	0
TTGD 178996	CPT107	0	0.01	0
TTGD 178996	CPT107	0.01	30	2.6
TTGD 178997	CPT108	0	0	0
TTGD 178997	CPT108	0	0.01	0
TTGD 178997	CPT108	0.01	30	2.6
TTGD 178998	CPT109	0	0	0

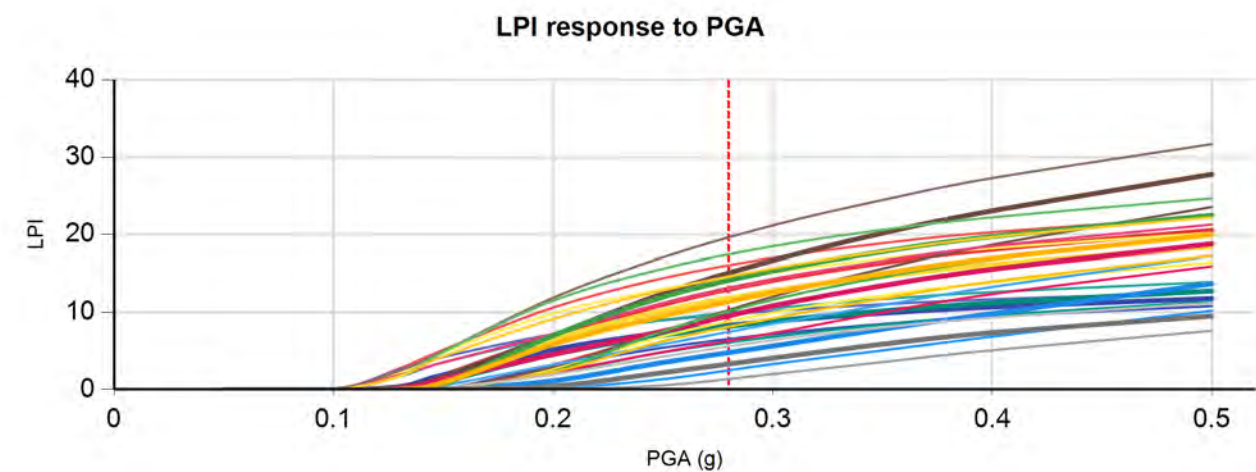
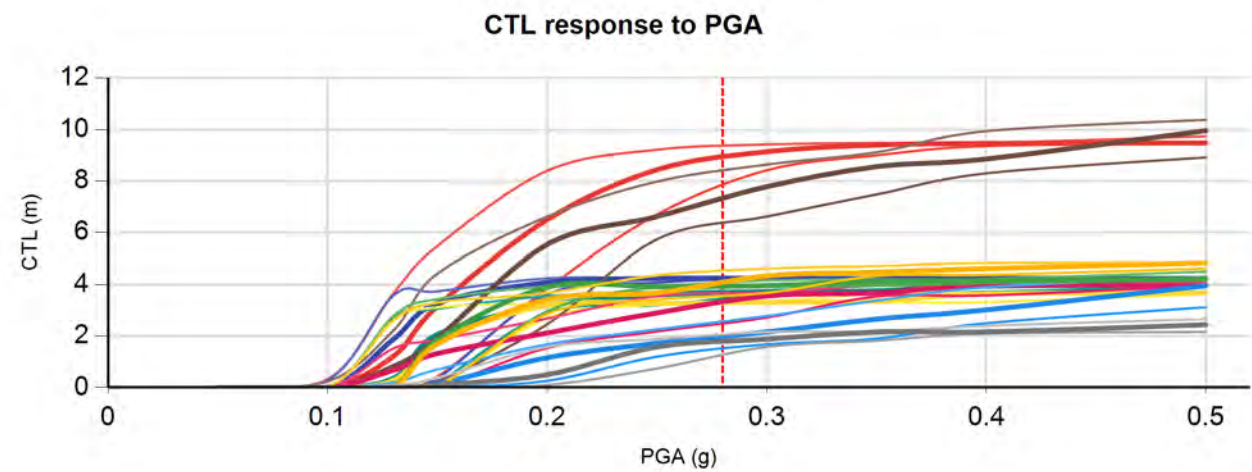
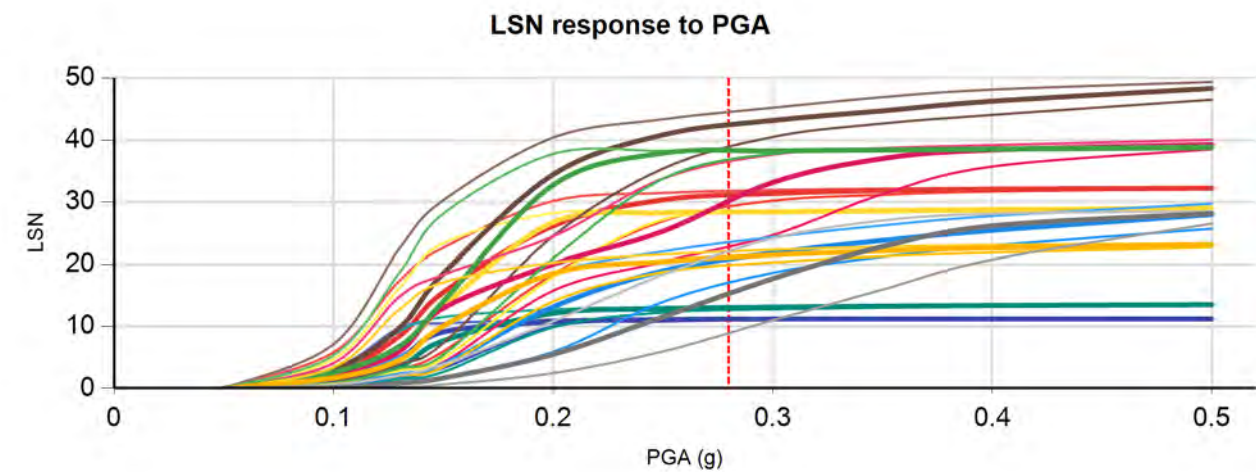
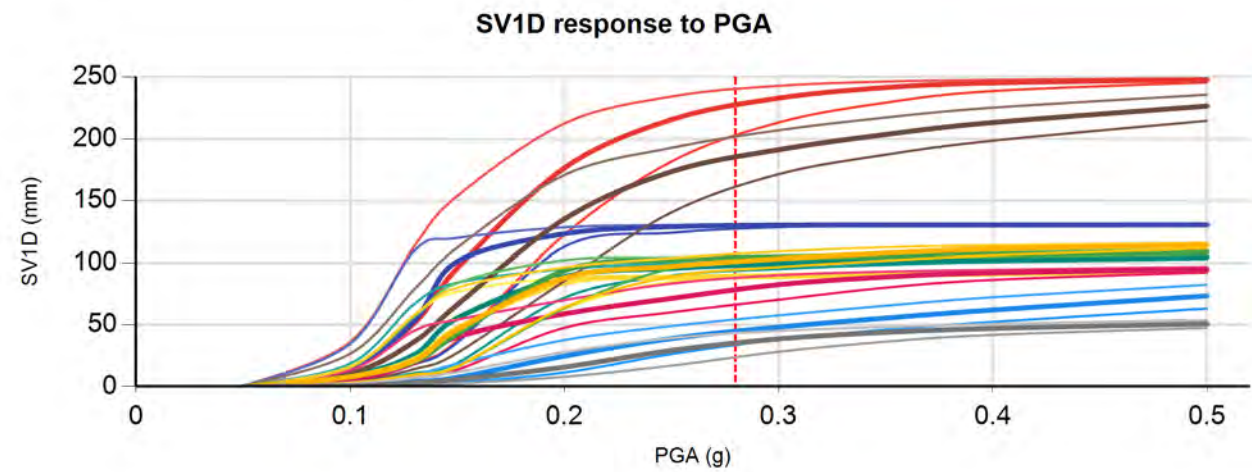
Table 1.1-3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 178990	CPT101	0.01	30	0 CFC
TTGD 178991	CPT102	0	30	0 CFC
TTGD 178992	CPT103	0	30	0 CFC
TTGD 178993	CPT104	0	30	0 CFC
TTGD 178994	CPT105	0	30	0 CFC
TTGD 178995	CPT106	0	30	0 CFC
TTGD 178996	CPT107	0	30	0 CFC
TTGD 178997	CPT108	0	30	0 CFC
TTGD 178998	CPT109	0	30	0 CFC
TTGD 178999	CPT110	0	30	0 CFC
TTGD 179000	CPT111	0	30	0 CFC
TTGD 179001	CPT112	0	30	0 CFC
TTGD 179002	CPT113	0	30	0 CFC
TTGD 179003	CPT114	0	30	0 CFC

TTGD 178996	TTGD 178997	TTGD 178998	TTGD 178999	TTGD 179000	TTGD 179001	TTGD 179002
CPT07, 584 Whatawhata Road, Hamilton	CPT08, 584 Whatawhata Road, Hamilton	CPT09, 584 Whatawhata Road, Hamilton	CPT10, 584 Whatawhata Road, Hamilton	CPT11, 584 Whatawhata Road, Hamilton	CPT12, 584 Whatawhata Road, Hamilton	CPT13, 584 Whatawhata Road, Hamilton
CPT107	CPT108	CPT109	CPT110	CPT111	CPT112	CPT113
0.28g	0.28g	0.28g	0.28g	0.28g	0.28g	0.28g
5.9	5.9	5.9	5.9	5.9	5.9	5.9
0.5	0.54	0.4	0.48	0.4	6	27.3
0.4	0.4	0.4	0.4	0.4	6	27.3
0	0	0	0	0	0	0
qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa	qc= 2 MPa & Fs= 0.01 MPa
Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002	ZRB-2002
7.12	11.38	11.66	10.02	17.2	16.74	14.64
0	0	0	0	0	0	0
30	30	30	30	30	30	30
Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)

TTGD 179003
CPT14, 584 Whatawhata Road, Hamilton
CPT114
0.28g
5.9
26
26
0
qc= 2 MPa & Fs= 0.01 MPa
Boulanger & Idriss (2014)
ZRB-2002
13.66
0
30
Yes (10 cm^2)

TTGD 178998	CPT109	0	0.01	0
TTGD 178998	CPT109	0.01	30	2.6
TTGD 178999	CPT110	0	0	0
TTGD 178999	CPT110	0	0.01	0
TTGD 178999	CPT110	0.01	30	2.6
TTGD 179000	CPT111	0	0	0
TTGD 179000	CPT111	0	0.01	0
TTGD 179000	CPT111	0.01	30	2.6
TTGD 179001	CPT112	0	0	0
TTGD 179001	CPT112	0	0.01	0
TTGD 179001	CPT112	0.01	30	2.6
TTGD 179002	CPT113	0	0	0
TTGD 179002	CPT113	0	0.01	0
TTGD 179002	CPT113	0.01	30	2.6
TTGD 179003	CPT114	0	0	0
TTGD 179003	CPT114	0	0.01	0
TTGD 179003	CPT114	0.01	30	2.6



Vertical dotted line/s indicate user specified PGA at the CPT locations. (actual PGA)

Note: Inverse filtered Qc/Fs data (10 cm²) used.

Run Description	TTGD ID	Investigation Date	Magnitude	PGA (g)	Trigger Method	Settlement Method	CFC	γ (kN/m ³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT102	178991	17/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT103	178992	17/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT104	178993	17/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT105	178994	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT106	178995	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT107	178996	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT108	178997	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT109	178998	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT110	178999	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	
CPT111	179000	18/05/2021	5.9	0.28	BI-2014	ZRB-2002		17		0	

Thicker lines represent the 50% probability of exceedence case and the thinner lines to the bottom and top of the thicker lines represent the 85% and 15% probability of exceedence cases respectively.

