BRYMER DEVELOPMENT

INFRASTRUCTURE TECHNICAL MEMORANDUM

PROJECT INFORMATION

CLIENT	Brymer
PROJECT	119007

DOCUMENT CONTROL

DATE OF ISSUE	16/04/2025
REVISION	A
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Table of Contents

1. Introduction

1.1. Background

Maven Waikato (Maven) have been engaged by Brymer Farms Ltd to explore the preliminary high-level Earthworks and Three Waters strategy of land development for a proposed residential subdivision development at the Brymer Farms site (Development Area) located at 584 Whatawhata Road (SH23), Hamilton.

1.2. Proposal Summary

Brymer is a residential development that comprises circa 1,650 residential units of varying typologies, such as detached, duplexes, terraces, apartment units and retirement village units, along with a supporting mixed-use neighbourhood centre, open spaces, and infrastructure. The Brymer Masterplan is shown in Figure 1 [below], and contained within the Urban Design Memorandum.

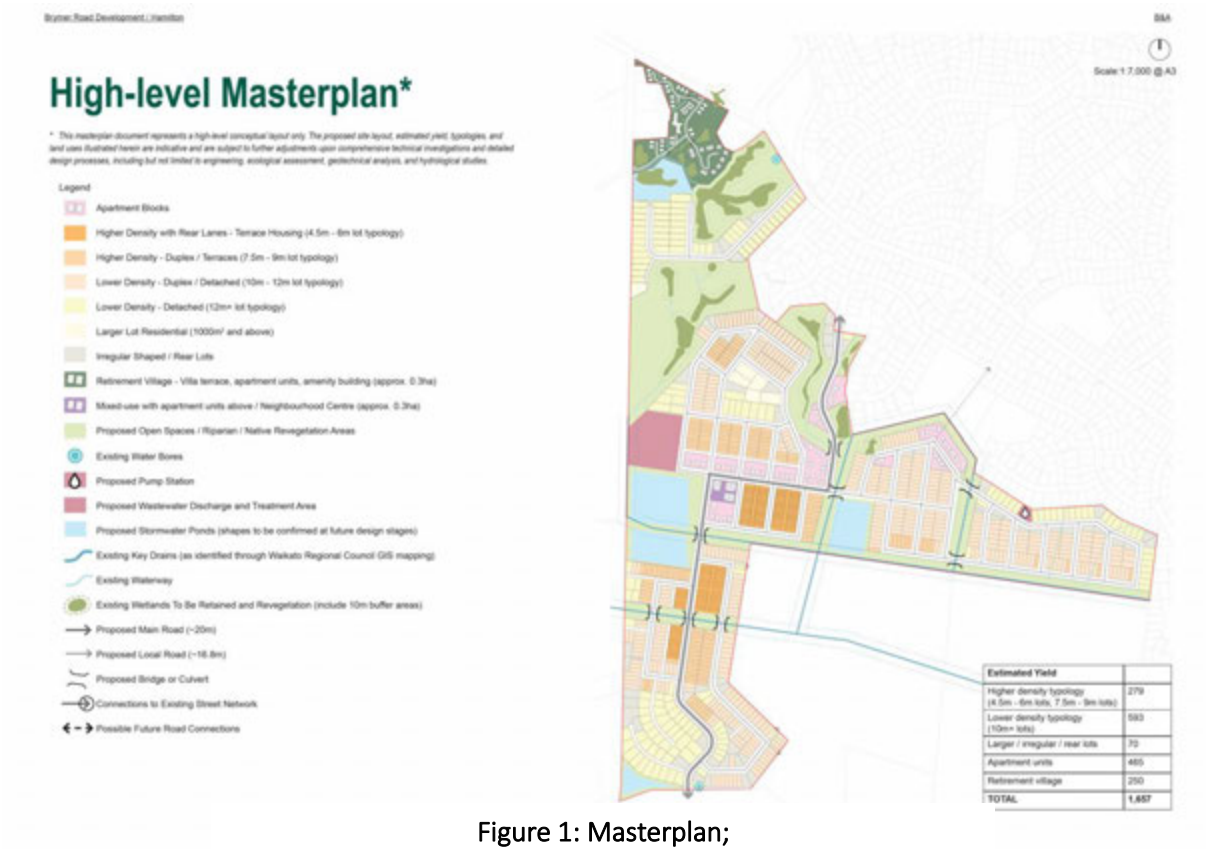


Figure 1: Masterplan;

Source: Barker and Associates; April 2025

The residential community is underpinned by a series of design principles, which focus on creating a well-connected, legible and diverse community on Hamilton City's urban fringe. The proposed transport network, with a 20-metre-wide spine road running north-to-south, is supported by local roads, cycle connections and pedestrian pathways to create an accessible and legible development. As aforementioned, a range of housing typologies and densities are proposed to meet the growing and changing needs of the housing market to ensure there are options for future residents. Each typology has been thoughtfully located, based on opportunities and constraints, with density ranging from terraces, duplexes and standalone dwellings to ensure integration with the adjoining urban footprint.

In the heart of Brymer is a 0.3 hectare mixed-use neighbourhood centre that will provide a range of amenities and services to support the residential development. This mixed-use neighbourhood centre

will likely include commercial properties, cafés and a local superette. Apartment units are provided above the neighbourhood centre. The commercial element of the residential development has been scaled to support the density proposed, located directly adjacent to the majority of apartment building typology.

Sitting at the higher, northern point of the site is a retirement village, that comprises approximately 3.4 hectares, and provides villa terraces, apartment units and an amenity building. This will be serviced by its own private transport network, infrastructure, and high amenity open spaces.

Integrated throughout the residential development are a number of open spaces that are well distributed to create a highly amenable community that will be a pleasant and enjoyable place to live for future residents. The open spaces support ecological restoration through the retention of a number of natural wetlands and riparian revegetation.

The development will be appropriately serviced via a robust infrastructure strategy, which includes a new pump station, wastewater discharge and treatment area, stormwater ponds, and utilisation of the existing water bores.

1.3. Site Description

The Development Area is an 81ha block of land within the jurisdiction of Waikato District Council, west of the Hamilton City Boundary.

The area comprises rural pasture with gentle to steep slopes and gully systems to the North, East, and South extents of the Development Area. Through the central portions of the site the Development Area is low-lying flat farmland, characterised by peat and interspersed with a mixture of streams and straight artificial farm drains.

1.4. Legal Description

The Development Area comprises the following parcels:

- Lot 22 DPS 79526 - 677m2
- Lot 3 DP 385271 - 4.5ha
- Lot 1 DPS 87291 - 57.9ha
- Pt Lot 2 DP 18355 - 18.4ha
- Allot 365 PoP - 1444m2

2. Earthworks & Geotechnical

Earthworks will be required on the site to complete the development. Included within the earthworks are excavation of services and formation of building platforms, paved and landscaped areas. Earthworks will need to be undertaken in accordance with the recommendations made by the geotechnical engineer and other specialists involved.

Measure for erosion and sediment control will need to be designed in accordance with the guidelines of Waikato Regional TR2009/02 document. Resource consent will require that erosion and sediment control measure are implemented and maintained in accordance with the engineering drawings.

A Preliminary Geotechnical Assessment Report for the Brymer area was undertaken by Tonkin and Taylor Ltd in July 2021 refer to Appendix E for the TnT report for further details.

The report identifies the approximate distribution of prevailing landforms and geologies for the local area, typical geotechnical challenges associated with subdivision development on those landforms and presents strategies to mitigate hazards by further geotechnical investigation and design.

Within Brymer the extent of earthworks will vary depending on demand and yield driving design considerations such as developable units, natural watercourses, and protection and mitigation from flooding and overland flow.

3. Three Waters Strategy

3.1. Water Sensitive Urban Design (WSUD)

WSUD is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, to minimise environmental degradation and improve aesthetic and recreational outcomes.

The overarching objectives of WSUD are:

- Protect or enhance the environmental, social, and economic values of downstream environments.
- Reduce the frequency, duration, and volume of stormwater runoff to mitigate the risks of nuisance flooding and moderate post-development flows to waterways.
- Reduce demand on potable water supply.
- Improve amenity in the urban environment.

3.2. Three Waters Strategy

The Three Waters strategy incorporates WSUD engineering design principles to create a low impact, sustainable development which minimises stormwater and wastewater discharge from site.

The Brymer Three Waters Strategy implements several key WSUD techniques, including:

- Restrict/ control the quantity of stormwater and wastewater discharge.
- Reduce the frequency and severity of flooding in urban areas.
- Improve amenity in the urban environment by introducing waterways and green strips.

4. Stormwater Strategy

A high-level Stormwater Management Plan (Appendix A) has been developed to set out the best practice framework for stormwater management.

4.1. Current Stormwater Scenario

Existing stormwater infrastructure within the Development Area is largely limited to farm/roadside drains and streams. A number of these drains are part of Waikato Regional Council's Land Drainage Management Plan for Waikato Central – Ohote Basin (Figure 2 – Drainage Channel - indicative) and receive stormwater from surrounding development (Figure 2 – Stormwater Outlets).

A geotechnical review of the site indicates that peat is present throughout most of the land and therefore stormwater recharge to ground will need to be incorporated into future development wherever impervious area is proposed.

4.2. Suggested Outcomes

Proposed objectives of the stormwater strategy are:

- Consideration of future public networks required in support of the Development Area.
- Existing overland flowpaths identified and investigated.
- Existing flood hazards investigated, mapped, and summarised.
- An option-based assessment for water quality treatment in support of the Development Area.
- Consideration and requirement for extended detention in support of the Development Area to mitigate downstream flooding, erosion and scouring.
- Confirming the need for attenuation of peak flow during storm events up to the 100-yr events.
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained within catchments and streams.

4.3. Reticulation

The Development Area will need to be supported by new public stormwater networks and treatment devices (Figure 2 – Stormwater Ponds) where possible or protection and enhancement of the existing drainage corridor in accordance with statutory requirements where applicable.

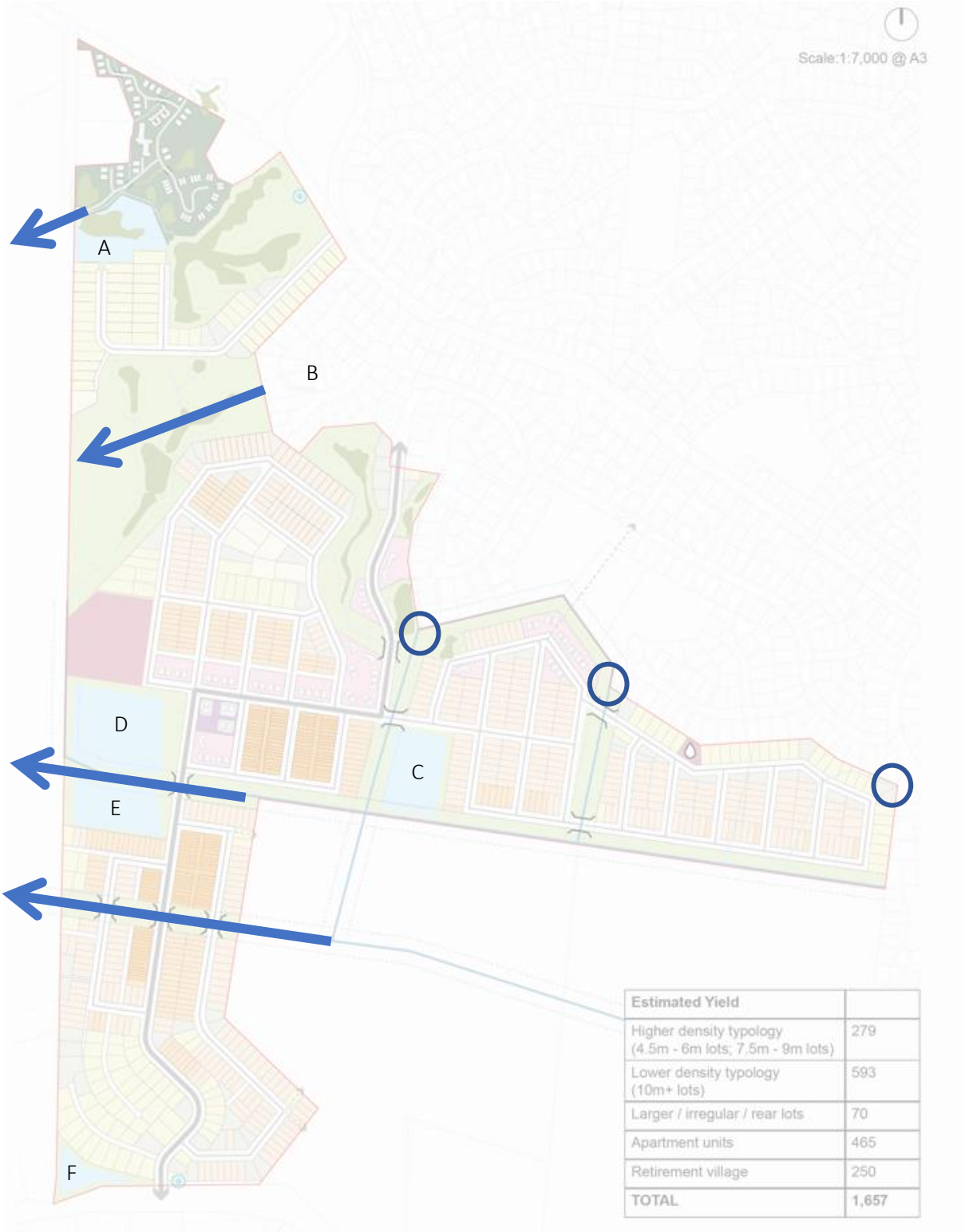
4.4. Groundwater Recharge

As outlined in section 3.1, geotechnical review of the site indicates that peat is present throughout. Where peat is not feasible to be removed, soakage and recharge of stormwater into peat may be implemented to maintain hydrology to prevent dewatering and to mitigate shrinkage. Recharge pits should be designed at regular intervals throughout the development to encourage even distribution of groundwater recharge. Detailed investigations for peat areas will be required by a suitable qualified geotechnical engineer to determine the correct requirements for recharge and to provide development controls for infrastructure and buildings throughout.

4.5. Flooding

A review of the Waikato Regional Council Hazards Portal confirms that flooding occurs during the 100-year flood event to the west of the Development Area in low lying farmland which feeds the Ohote Stream. The western extent of the existing flooding is shown in Pre-Development Catchment Plan (Appendix B).

Figure 2 – Stormwater



Legend

Waikato Central Drainage Scheme – Drainage Channel to Ohote Stream

Stormwater ponds -shape to be determined in design stages (*areas in image 3*)

Stormwater outlet - area received stormwater from surrounding development

Stormwater discharge from the developed site will be restricted to an acceptable level which will avoid adverse downstream stormwater effects.

Catchment	Pre-Development Discharge	Catchment	Post-Development Discharge
A	20.88ha Undeveloped with no attenuation	A1	11.49ha Future developed area with attenuation
B	53.27ha Developed with no attenuation (Existing Residential)	B	No change
C	68.73ha Developed (49.6ha)/ Undeveloped (19.13ha) with no attenuation	C1	19.13ha Future developed area with attenuation
D	34.34ha Developed (2.6ha) /Undeveloped (31.74ha) with no attenuation	D1	31.74ha Future developed area with attenuation
E	20.88ha Undeveloped	E	20.88ha Future developed area with attenuation
F	8.49ha Undeveloped	F	8.49ha Future developed area with attenuation

4.6. Proposed Stormwater Strategy (Catchment A)

Catchment A (20.88ha) stormwater runoff from upstream currently flows through the subject site. This will continue to discharge stormwater to the existing overland flow exit points to the west. Post development flow from catchment A1 (20.88ha) will be attenuated to 80% of predevelopment conditions via a combination of onsite detention, communal dry basins and a stormwater ponds. The stormwater management area required for this proposed catchment is 0.45ha.

4.7. Proposed Stormwater Strategy (Catchment B)

Catchment B (53.27ha) stormwater runoff from upstream currently flows through the subject site. This will continue to discharge stormwater to the existing overland flow exit points to the west. No management of this stormwater is proposed, although waterways will need to be maintained as predevelopment in nature.

Image 1-Stormwater Ponds Wet/Dry Examples

4.8. Proposed Stormwater Strategy (Catchment C)

Catchment C (68.73ha) stormwater runoff from upstream residential area currently flows through the subject site. This will continue to discharge stormwater to the existing overland flow exit points to the south. Post development flow from catchment C1 (19.13ha) will be attenuated to 80% of predevelopment conditions via a combination of onsite detention, communal dry basins and a stormwater ponds. The stormwater management area required for this proposed catchment is 0.76ha.

4.9. Proposed Stormwater Strategy (Catchment D)

Catchment D (34.34ha) stormwater runoff from upstream residential area currently flows through the subject site. This will continue to discharge stormwater to the existing overland flow exit points to the south in between catchments C1 and D1. Post development flow from catchment D1 (31.74ha) will be attenuated to 80% of predevelopment conditions via a combination of onsite detention, communal dry basins and a stormwater ponds. The stormwater management area required for this proposed catchment is 1.27ha.

Image 2-Dry Basin Examples

4.10. Proposed Stormwater Strategy (Catchment E)

Catchment E (10.29ha) stormwater runoff will continue to discharge stormwater to the existing overland flow exit points to the west in the central point of the catchment. Post development flow from catchment E (10.29ha) will be attenuated to 80% of predevelopment conditions via a combination of

onsite detention, communal dry basins and a stormwater ponds. The stormwater management area required for this proposed catchment is 0.41ha.

4.11. Proposed Stormwater Strategy (Catchment F)

Catchment F (8.49ha) stormwater runoff will continue to discharge stormwater to the existing overland flow exit points to the east of the catchment. Post development flow from catchment F (8.49ha) will be attenuated to 80% of predevelopment conditions via a combination of onsite detention, communal dry basins and a stormwater ponds. The stormwater management area required for this proposed catchment is 0.34ha.

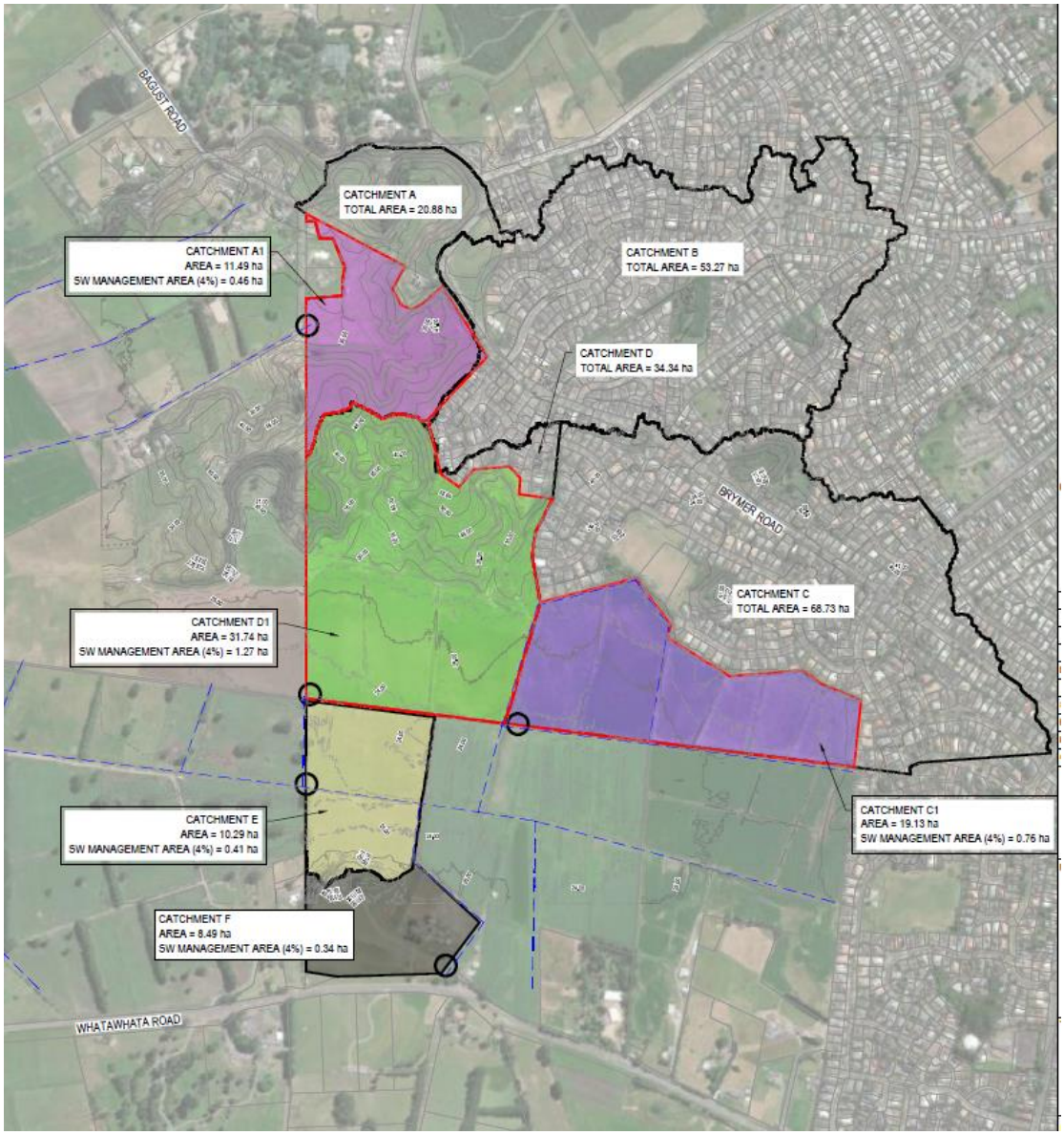


Image 3-Stormwater Catchment Summary

4.12. Onsite Stormwater Mitigation

To ensure the retention of existing groundwater levels, recharge pits will need be installed on all lots to allow recharge of the underlying peat soil. Recharge pits will be designed as per the Waikato Regional Council TR2020/07 Section 8 (Stormwater disposal via Soakage in the Waikato Region) and will be subject to future Building Consent approvals.

Percolation testing will be undertaken to determine the soil infiltration rates are sufficient for the required discharge from the future lot. If infiltration is insufficient, other detention devices like tanks may be required to accommodate the difference.

Preliminary calculations have indicated that onsite mitigation to maintain stormwater discharge for the 10-year rain fall events to pre-development levels for each lot would entail an 4m³ above ground (or below ground) detention tank for every house, based on 150m² impervious area per lot. (100m² roof captured and 50m³ pavement uncaptured) Detention tanks will be subject to building consent from Waikato District Council.

Discharge from each site will be via a proposed stormwater pipe network designed to have capacity for the 10-year storm event which will be subject to Engineering approval from Waikato District Council.

5. Wastewater Strategy

Wastewater discharge from the developed catchment can be provided through implementation of either connection to the Hamilton City Council network or treatment of the Development Area via an independent Treatment Plant (preferred). In this report, connection to the Hamilton City Council wastewater network with the option of a pressure network and gravity network via the option of a "decentralised" wastewater treatment solution have been investigated.

5.1. Reticulation

Any new drainage will be designed to have capacity for the design flow of the Development Area. The topography and soil (Peat) of the site would require the Development Area to be predominantly serviced by a mixture of gravity and pressurised mains with intermediary pump stations in the low points of the Development Area (Figure 3), with eventual discharge to a Wastewater Treatment Plant or Hamilton City Council wastewater network servicing the Development Area (Figure 3).

5.2. Pressure sewer system

Pressure sewer systems are an acceptable alternative to typical gravity Wastewater disposal and provide an effective solution in flat low-lying areas with a high-water table. Pressure sewer systems have advantages in reducing peak flow discharge to downstream infrastructure by creating a sealed network eliminating risks of Inflow & Infiltration, and by smoothing peak flows (as wastewater is stored in a private tank before being pumped to the public network at different times).

The Developments wastewater peak discharge to the downstream transmission line has been calculated at approximately 38l/s. This has been calculated by taking 2200 household units and calculating wastewater disposal as per RITS standards, using PWWF (peak wet weather flow) factor of 1.5, water ingress and infiltration allowances.

The allowable wastewater peak discharge to the downstream transmission line will need to be calculated once the Development Area is determined. If there is no capacity in the public system, MBR maybe adopted as the final discharge solution.

Using an LPS system eliminates ingress and infiltration and therefore allows ADWF (average dry weather flow) to be used for discharge instead of PWWF, an LPS safety factor of 1.2 has been adopted as used in similar systems elsewhere. Using the LPS system, discharge volumes are decreased, and the number of household units able to discharge into the downstream network can be increased if there is sufficient capacity. (Refer to the image 4 below). This option would therefore decrease the total discharge by 57% to 16.5l/s or service a total of 5097 dwellings.

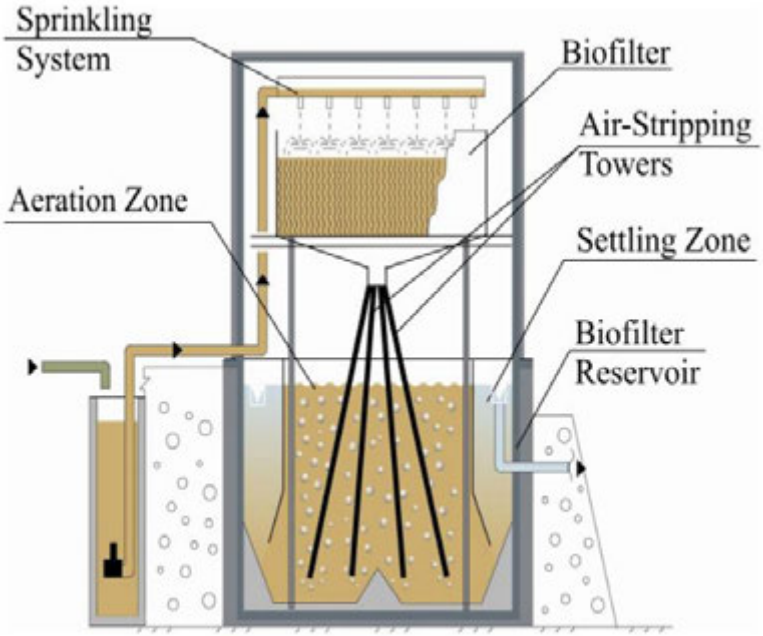
When a OneBox/smart controller is added to an LPS network, the morning and evening peak flows can also be decreased. The smart controller allows the private pump stations to 'talk' to each other and for pumps to activate at different times. Detailed design is to be confirmed with HCC as part of proposed plan change application.

5.3. Decentralised Treatment

Combined Wastewater System/MBR package plant technology could be a viable and affordable alternative to traditional Wastewater Treatment technology. Recent advances in treatment technology have enabled plants to be implemented to land development projects. The benefit of doing so reduces capacity constraints on existing infrastructure and enables the release of developments where standard reticulation to council infrastructure cannot be achieved. Whilst treated liquid waste is "clean" and can be discharged to a stream environment, consideration would need to be given to the effects of such

discharge into the environment for water quality, soakage (especially in low lying peat areas), and subsequent water table mounding and flooding. Due to these constraints, it is likely that plants would only be suitable in good ground away from peat. Where discharge is allowable, position of this would need to be confirmed in future consenting.

Moving forward, early engagement with Waikato Regional Council (WRC), Mana Whenua and Local Councils is recommended to determine the quality of the water discharge from the Combined Systems plant is appropriate for water recharge.



Combined Wastewater Treatment System

Maven Waikato		Job Number	Sheet	Rev
		104170	1	A
Job Title	584 Whatawhata Road (SH23)	Author	Date	Checked
Calc Title	Wastewater Demand Calc	DJM	11/04/2025	DJM

As per Waikato Local Authority RITS standards

Domestic Average Daily Flow (Water Consumption)=	200	*l/person/day*
Infiltration Allowance=	2,250	*l/Ha/day*
Surface Water Ingress=	16,500	*l/Ha/day*

Development Area using Gravity/Pumpstation

No. of dwellings =	**1657.00**	
Catchment area =	**81.14**	*Ha*
Population Equivalent as per Table 5-3=	2.7	*person per dwelling*
Total Population	4474	
Wastewater Peaking factor as per Table 5-2=	1.5	
Average Daily Flow (ADF)=	1077.35	*m³/day*
Peak Daily Flow (PDF)=	17.65	*L/sec*
Peak Wet Weather Flow (PWWF)=	**33.14**	*L/sec*

Equivalent Development Area using LPS -As per RITS

Proposed No. of dwellings =	**4474.00**	
Population Equivalent as per Table 5-3=	2.7	*person per dwelling*
Total Population	12080	
Domestic Average Daily Flow (Water Consumption)=	200	*l/person/day*
Factor of Safety=	1.2	
Domestic Average Daily Flow (Water Consumption)=	240	*l/person/day*
Average Daily Flow (ADF)=	2899.152	*m³/day*
*Average dry weather flow (ADWF)=	**33.56**	*L/sec*

*The table above indicates the total number of dwellings using an LPS system to generate the same wastewater discharge as a typical gravity system.

LPS discharge for 1657 dwellings=	**12.43**	*L/sec*
Discharge % decrease=	57%	

Image 4-Wastewater Discharge

5.4. MBR package plant strategy and example

As outlined above, the required wastewater average flow volume is 1080m³/day. Below is an example of an MBR plant that can cater for a daily flow of 2000m³.

Options are to be discussed around having one centralised MBR/Combined plant that caters for the entire development, or multiple MBR package plants being required with smaller associated catchments. One centralised system would be beneficial for maintenance but would require a more robust reticulation system including more pump stations.

The images below show examples of the typical site layout for the MBR plant and sizing associated with the MBR package plants. Please note that the MBR package plants are approx. 20% of the site area required. For example, the below MBR Package plant (2000m³/day) would require two of the 25m x 7m plants which equates to approx. 1750m² of site required. These assumed areas are subject to detailed design and Engineering Approvals.

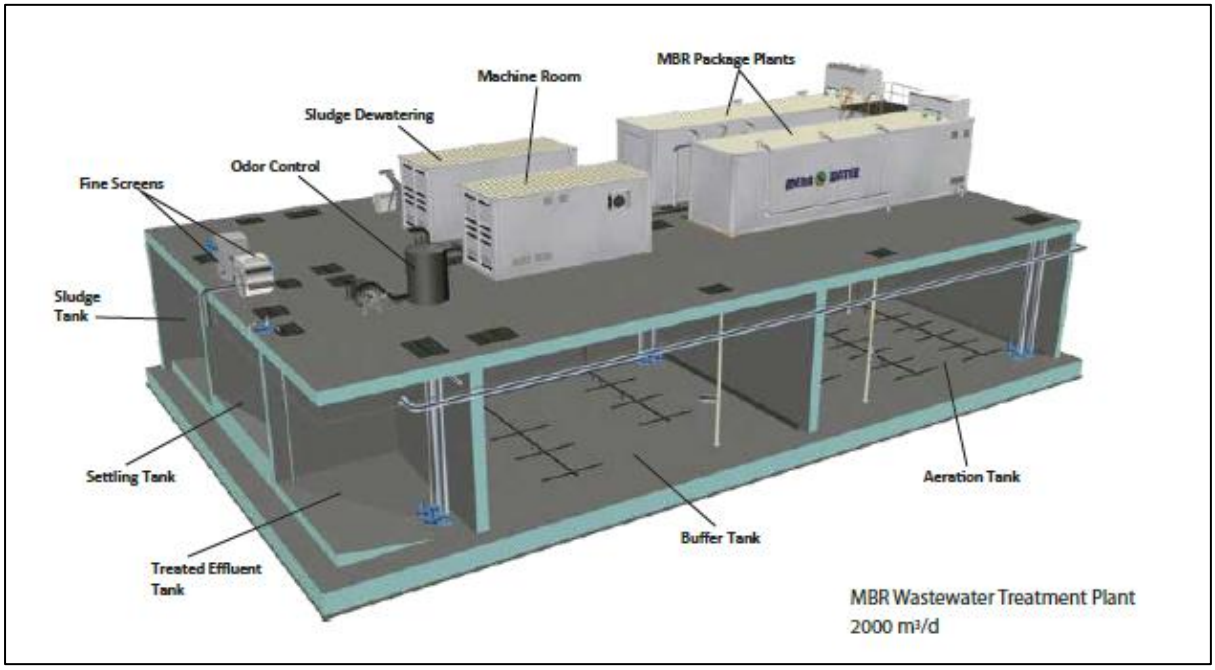


Image 5-MBR Wastewater Treatment Plant for 2000m³/day example

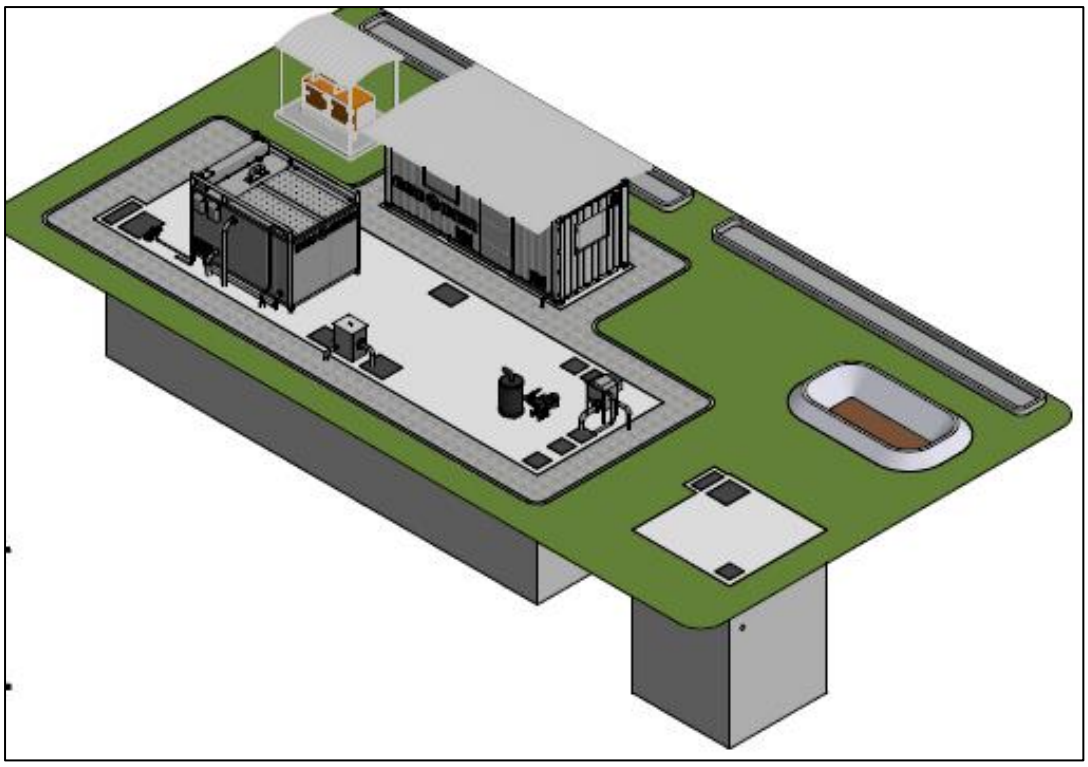
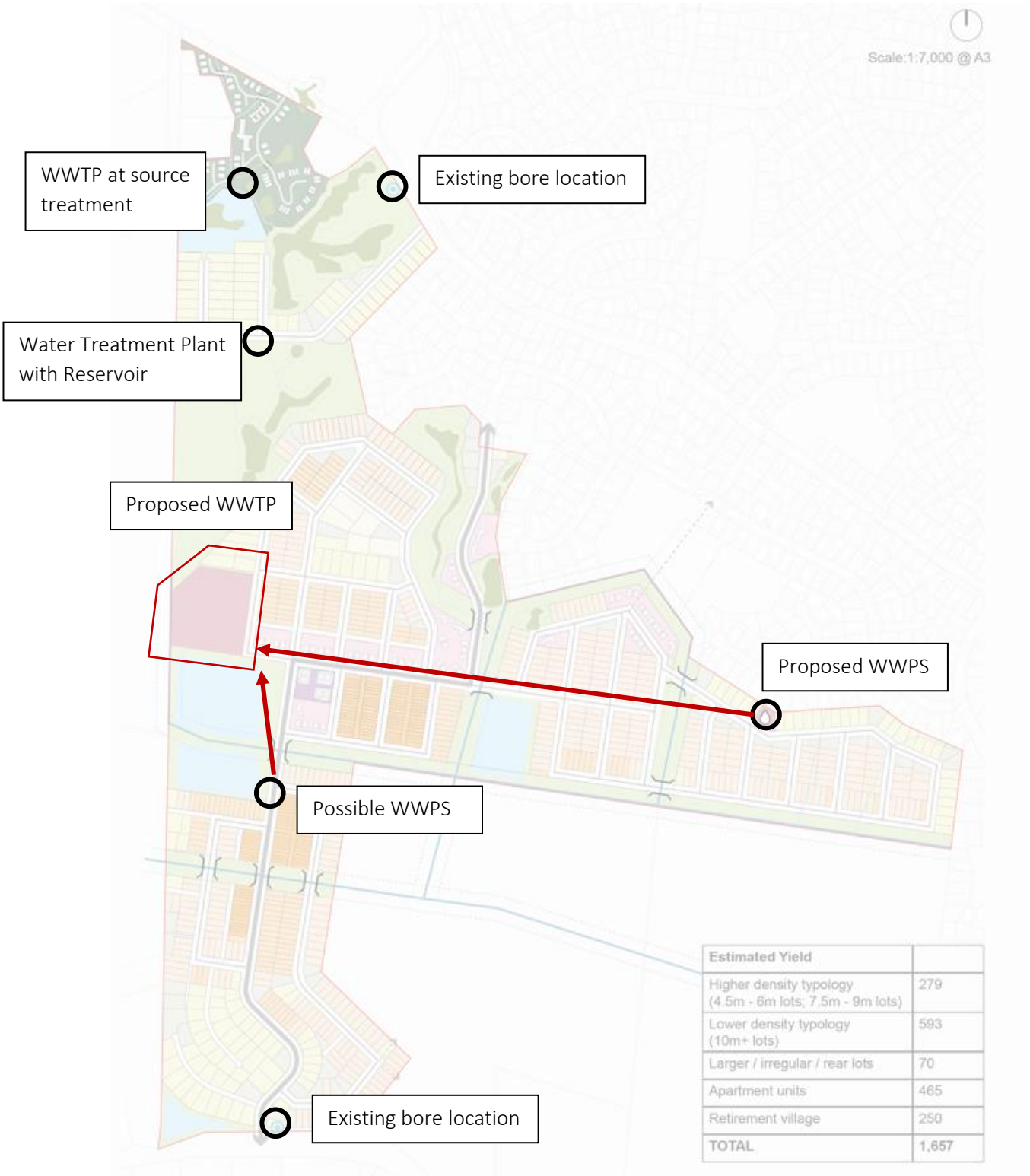


Image 6-Typical MBR Wastewater Treatment Plant layout

Figure 3 – Wastewater and Water



6. Water Strategy

Future development of the site will require a network water supply for potable water and firefighting servicing.

Maven have undertaken a desktop study to identify the most suitable option for potable water for the Development Area. Reticulated and decentralised solutions have been considered.

6.1. Reticulation and Capacity

Reticulation will be designed to provide the Development Area with a suitable means of potable and firefighting supply.

FW2 water supply requirements (NZS 4509) are as follows:

- A primary water flow of 12.5 litres/sec within a radial distance of 135m.
- An additional secondary flow of 12.5 litres/sec within a radial distance of 270m.
- The required flow must be achieved from a maximum of one or two hydrants operating simultaneously.
- A minimum running pressure of 100kPa.

This volume can be offset by using the eventual volume within the reticulation. Furthermore, the water treatment plant will be required to produce the required rate of flow with hydrants placed where required in accordance with NZ 4509. This would then in turn alleviate the need for tanks that store fire supply water. Storage for firefighting water supply may be required to service the above requirements.

6.2. Bore Water Abstraction

A hydrogeological desktop review of the Development Area was undertaken by WGA (April 2025) to consider groundwater as a potable water solution.

Whilst centralised approaches offer long term viability for development, if the Hamilton City Council Boundary is not adjusted then using ground water could provide for development to occur by implementation of Bore Water abstraction, treatment, and storage (Figure 3 – Water Bore).

Further information is contained within the desktop review by WGA April 2025 (Appendix D).

To support the future development, and provide an option for Bore Water abstraction, test bore holes are currently being undertaken onsite to check the aquifers for quantity and the quality of the potable water. Once these tests are completed and the report is produced, we will be able to better ascertain which option is more viable for the project.

The below calculations outline what water supply demand is required for the domestic use component of the development. Further consultation with council stakeholders will be required to determine the required storage volume and Firefighting flow.

If water bore abstraction is the desired outcome, water allocation consents will be required from Waikato Regional Council to meet the demands of the development area.

Maven Associates			Job Number	Sheet	Rev
			119007	1	A
Job Title	584 Whatawhata Road (SH23)		Author	Date	Checked
Calc Title	Water Demand Calc		DJM	11/04/2025	DJM

Water Catchment

As per RITS Standard 6.2.3		3	people per dwelling
	Demand	260	l/person/day

Demand Rates

Average Demand =	260	litres/person/day
Peak Demand (5x) =	1300	litres/person/day

Population	Dwellings	People	Occupancy
Proposed Dwellings	1657	3	4971

Demand	Persons	Rate l/p/day	Flow l/s
AD Water	4971	260	14.96
PD Water	4971	1300	74.80

Peak Demand	Persons	Rate l/p/day	Flow l/s
PD Water	4971	1300	**74.80**

Image 7-Water Supply Demand

6.3. Rainwater Harvesting/Reuse

Reusing rainwater can significantly reduce the amount of water supply demand by household units by up to 50%. Decreasing demand on water supply has multiple benefits including meeting WSUD criteria and decreasing household water bills.

Rainwater can be harvested and used for a range of different applications; for watering the garden or washing the car, for use in the laundry and toilet. Rainwater is harvested directly off the roof and travels through down pipes to a water tank which sits either above ground or below.

Rainwater harvesting requires a building consent and would be enforced by a condition of Resource Consent and consent notice on each title.

The use of rainwater reuse and their effects on water supply demand will need to be investigated and confirmed with council. Rainwater reuse options will be further investigated as part of future Resource Consent applications.

Rainwater harvesting can significantly reduce the amount of water supply demand from household units. Rainwater harvesting will be incorporated where possible into the proposed development during house construction.

7. Conclusions

The Three Waters strategy for the site is to incorporate a WSUD approach to create a low impact, sustainable development which minimises stormwater and wastewater discharge from site.

Stormwater discharge from the developed site will be restricted to an acceptable level which will avoid adverse downstream stormwater effects. Stormwater discharge will be limited by providing attenuation for, and up to the 100-year flows for the overall catchment. Attenuation will be provided via onsite mitigation, dry basins and stormwater ponds.

An overarching stormwater strategy has been developed, and this sets out the high-level, best practice approach for stormwater management within the catchment.

Wastewater drainage can be provided for through implementation of either connection to the Hamilton City Council network or treatment of the Development Area via an independent Treatment Plant (preferred). These options would provide wastewater servicing for a 1650-lot proposed development.

Potable Water can be provided for through implementation of either connection to the Hamilton City Council network or abstraction via in multiple ground bore and an independent Treatment Plant (preferred).

Rainwater harvesting will reduce the amount of water supply demand from household units and will be incorporated where possible into the proposed development during house construction.

Final solutions will require further detailed design after consultation with third party stakeholders including Local Manu Whenua, Waikato Regional Council, Waikato District Council, and Hamilton City Council.

Additional investigation work and detailed reporting for three waters and earthworks will be required to support future development.

8. Limitations

The calculations and assessments included in this report are a 'desktop' analysis and are preliminary in nature based on information available at time of issue. To the best of our knowledge, it represents a reasonable interpretation of available information.

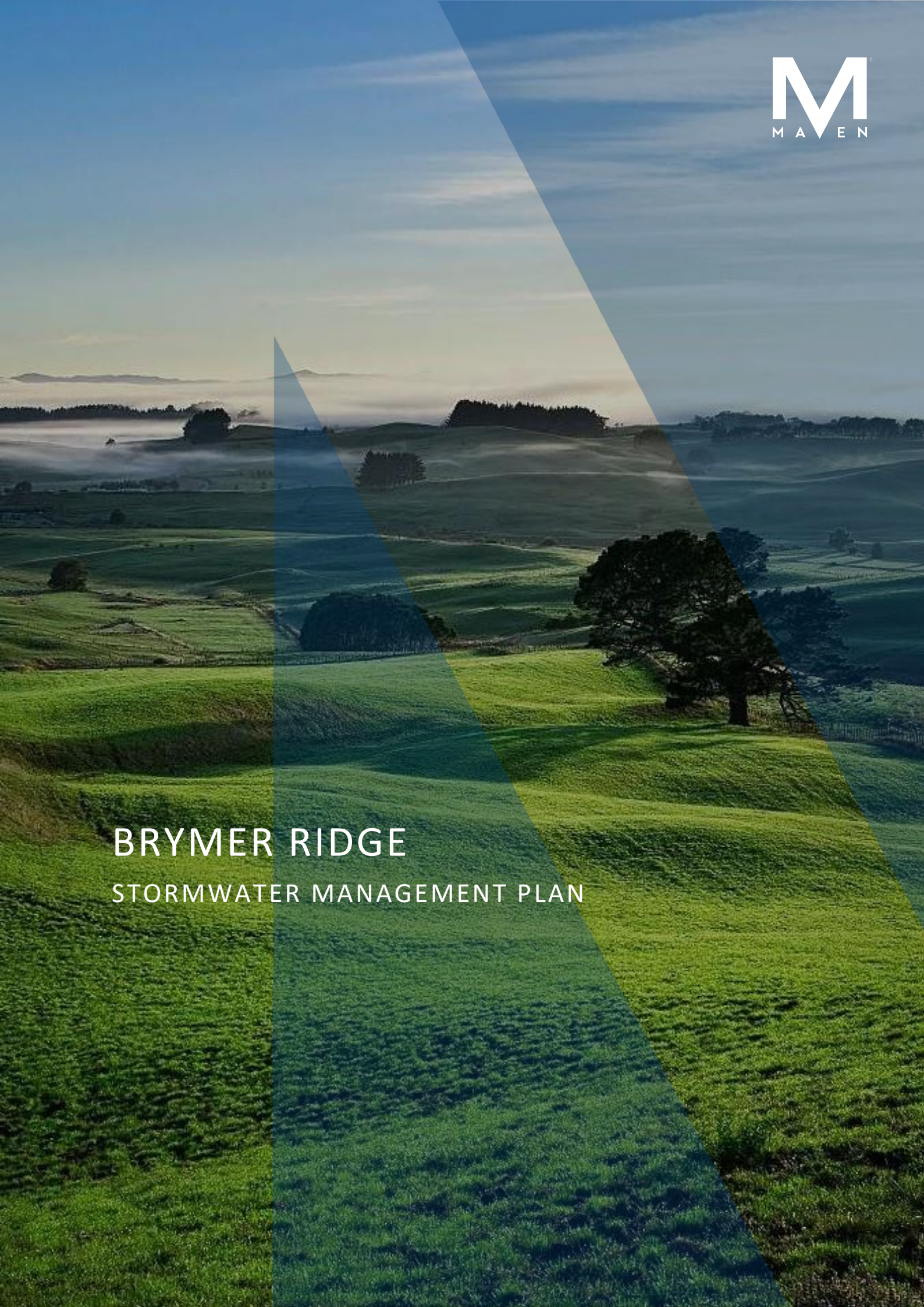
Further community; stakeholder engagement; and feasibility investigations, including engineering design and calculations, will be required to determine the suitability of the Development Area proposed for residential development.

This report is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. It may not be disclosed to any person other than the Client and any use or reliance by any person contrary to the above, to which Maven has not given its prior written consent, is prohibited.

This report must be read in its entirety and no portion of it should be relied on without regard to the limitations and disclaimers set out.

Maven makes no assurances with respect to the accuracy of assumptions and exclusions listed within this report and some may vary significantly due to ongoing stakeholder engagement.

Appendix A – Stormwater Management Report



BRYMER RIDGE

STORMWATER MANAGEMENT PLAN

PROJECT INFORMATION

CLIENT	Brymer Ridge Ltd
PROJECT	119007

DOCUMENT CONTROL

DATE OF ISSUE	16/04/2025
REVISION	C
AUTHOR	Dean Morris Regional Director
REVIEWED BY	Dean Morris Regional Director
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Table of Contents

1. Introduction

1.1. Background

Maven Associates (Maven) have been engaged by Brymer Ridge Ltd to explore the feasibility of land development for a proposed residential subdivision development at the Brymer Ridge Farms site (Development Area) located at 584 Whatawhata Road (SH23), Hamilton.

1.2. Purpose of this report

The purpose of this report is to provide a feasibility assessment of infrastructure servicing for the Development Area (Figure 1 - Proposed Masterplan developed by B&A) in support of an approach to Future Proof to have the area recognised within the Future Proof Settlement Pattern.

1.3. Site Description

The Development Area is an 81ha block of land within Waikato District Council, west of the Hamilton City Boundary.

The area comprises rural pasture with gentle to steep slopes and gully systems to the North, East, and South extents of the Development Area. Through the central portions of the site the Development Area is low-lying flat farmland, characterised by peat and interspersed with a mixture of streams and straight artificial farm drains.

1.4. Proposed Development

The design and layout of the Development Area Masterplan has not been completed at the time of this report. For the purposes of this assessment, and based on information provided by the client and subsequent reporting by other third parties, we have assumed that the development will developed for residential purposes only.

1.5. Legal Description

The Development Area comprises the following parcels:

- Lot 22 DPS 79526 - 677m2
- Lot 3 DP 385271 - 4.5ha
- Lot 1 DPS 87291 - 57.9ha
- Pt Lot 2 DP 18355 - 18.4ha
- Allot 365 PoP - 1444m2

Figure 1 – Proposed Masterplan

1.6. Objectives

An overarching SMP has been developed for the Development Area. The SMP sets out the high-level, best practice approach to stormwater management within the receiving catchment.

The strategy for the future stormwater management is outcome focused. The SMP provides a solution-based approach for the receiving environment. Consideration and emphasis is given to the inclusion of Water Sensitive Urban Design principles, with the overall goal of developing environmentally conscious outcomes which help address and mitigate known and future constraints of the Development Area.

Proposed objectives of the SMP are outlined below:

- Consideration of future public networks required. The report confirms discharge location and provides a design methodology which will guide future development of the area.
- Existing waterways are identified and investigated. Parameters are set which will ensure protection of existing waterway environments in future development.
- Existing overland flowpaths identified and investigated. Design parameters are set which will ensure existing overland flowpaths are allowed for in future development up to and for the 100-yr event.
- Existing flood hazards investigated, mapped, and summarised. Flood mitigation strategies are developed for each of the catchments. This framework will enable the development of the structure plan areas and will guide future development controls.
- The SMP provides an option-based assessment for water quality treatment in support of future development. A review of the relevant statutory framework is undertaken before a high-level strategy is provided for the catchments.

- The consideration and requirement for extended detention in support of future development to avoid any downstream flooding, erosion and scouring. Indicative flood mitigation options are developed for the catchments and receiving environments.
- Confirming the need for the attenuation of peak flow, decreasing stream bed erosion during storm events up to and including the 100-yr events. Attenuation forms part of the overall stormwater management toolbox and solutions are considered (both at-source and catchment wide).
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained to provide catchments with hydraulic neutrality.
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained within catchments and streams. Existing streams are located within the Development Area and it is important to maintain underlying base flows of water into the streams to avoid any effects on stream biodiversity.
- The urbanisation of the Development Area presents an opportunity to provide significant ecological improvements through the protection and planting of riparian margins. Recommendations to guide a future Plan Change application to ensure positive environmental outcomes are achieved.
- Groundwater recharge to areas thereby maintaining water tables and preventing dewatering.
- Information gaps which require further investigation and/or detailed design are identified.

The overall SMP creates a stormwater toolkit, which will guide future development. The toolkit will promote sustainable solutions including the integration of Water Sensitive Urban Design ('WSUD') principles in future land use planning.

2. Stormwater Reticulation

Existing stormwater infrastructure within the Development Area is largely limited to farm/roadside drains and streams. A number of these drains are part of Waikato Regional Council's Land Drainage Management Plan for Waikato Central – Ohote Basin and receive stormwater from surrounding development. The Development Area will need to be supported by new public stormwater networks where possible or protection and enhancement of the existing drainage corridor in accordance with statutory requirements where applicable.

2.1. Stormwater Capacity

The primary reticulated network will be sized to convey the peak discharge for rainfall events up to and including 10-year $_{(cc)}$ ARI to the identified point of discharge. Calculations would need to be provided to relevant Authorities in support of the detailed design of the new public network at Fast track application and Engineering Approval stages. The future networks will need to demonstrate compliance with the Local Authority standards for Subdivision and Land Development

There is no overland flow predicted for the 10-year $_{(cc)}$ ARI event. During the 100-year $_{(cc)}$ event the stormwater runoff will be conveyed by overland flow paths within the proposed development, which will follow the road reserves (where possible) which in turn discharge into the existing watercourses and/or catchment detention solutions contained within the Development Area.

3. Stormwater Quality

3.1. Statutory Context

Future stormwater discharge is required to comply with the Regional Policy Statement and the Regional Resource Management Plan both administered by Waikato Regional Council. The relevant policy criteria is summarised below:

3.1.1. Waikato Regional Policy Statement (RPS)

The Waikato Regional Policy Statement (Te Tauākī Kaupapa here ā-Rohe), or RPS, is a mandatory document that provides an overview of the resource management issues in the Waikato region, and the ways in which integrated management of the region's natural and physical resources will be achieved.

The RPS identifies the significant resource management issues of the region and sets out the objectives, policies, and methods to address these issues. The RPS informs the regional and district plans and consideration of resource consents.

Central to the outcomes sought within the RPS is the protection and enhancement of freshwater ecosystems. The following lists key Waikato RPS high-level objectives relevant to this SMP and the future management of stormwater within the Development Area.

Relevant objectives include:

1. *Integrated management of natural and physical resources;*
2. *Restoration and protection of the health and wellbeing of the Waikato River;*
3. *Avoiding the potential adverse effects of climate change;*
4. *The relationship of tangata whenua with the environment is recognised and provided for;*
5. *Sustainable and efficient use of resources;*
6. *Development of the built environment in an integrated, sustainable and planned manner;*
7. *Maintain or enhance the mauri and identified values of fresh water bodies;*
8. *Maintain or enhance riparian areas and wetlands;*
9. *Historic or cultural heritage sites, areas or landscapes are protected or maintained;*
10. *Healthy, functioning ecosystems and indigenous biodiversity;*
11. *Maintenance and enhancement of amenity;*
12. *Protection of the natural character of wetlands and rivers and their margins;*
13. *Maintenance and enhancement of public access along rivers; and*
14. *The effects of natural hazards are managed.*

The Waikato RPS states territorial authorities should consider promoting best practice stormwater management for urban areas and preparing stormwater catchment plans for greenfield urban developments.

This SMP supports achievement of the above Waikato RPS objectives. It integrates land-use and three-waters planning within the Development Area. The SMP identifies the three-waters infrastructure necessary to accommodate urban growth, whilst giving effect to the relevant development principles, to ensure the freshwater ecosystem is protected and improved through urbanisation.

3.1.2. Waikato Regional Plan

The Waikato Regional Plan is the principal policy tool that enables Waikato Regional Council to carry out its functions to achieve the sustainable management of resources within the Region. With respect to this SMP, the following modules of the Waikato Regional Plan are relevant: matters of significance to Maori, water, river and lake beds, land and soil, and air.

Each module provides an overview of the environmental problems the Regional Council seeks to manage, the objectives to be achieved, policies (actions to be taken) to achieve them, and methods and rules to implement the objectives and policies. Each module also describes the environmental results anticipated and how they will be monitored. Resource consent will be required for any activity that will not comply with permitted activity standards listed under the plan.

Future development will need to be supported by resource consents from Waikato Regional Council under the Waikato Regional Plan. Such activities which would trigger consents are listed below:

1. Works in a stream bed – such as for culvert, bridge, pipeline or stormwater pipeline outfall construction or any stream diversion; and
2. Vegetation clearance and earthworks – including for management of sediment-laden runoff and dust;
3. Diversion and discharge of stormwater into water or onto or into land, including management of contaminants.

3.1.3. Comprehensive City-wide Discharge Consent

Hamilton City Council holds a comprehensive city-wide stormwater consent ('CSDC') which allows for multiple discharges in multiple catchments. The CSDC authorises the diversion and discharge of stormwater from developed areas within Hamilton City existing at the commencement of the consent in 2012. This consent has stringent conditions relating to stormwater quality and quantity effects downstream of this proposal. It is anticipated that the Development Area will be enveloped by the CSDC if brought into Hamilton City via Future Proof. As such, the development of a future ICMP/SMP based off this document will ensure compliance with the Council's CSDC.

The CSDC will authorise any new stormwater diversion and discharge activities established after 2012, if the Waikato Regional Council certifies they comply with the consent's conditions.

To achieve such certification, any new stormwater diversion and discharge activity must meet these two tests:

1) It must be consistent with the conditions of the CSDC; and

2) Either:

a) Where it is in a greenfield area, it must be consistent with an ICMP; or

b) Where it is to be established in an existing urbanised area, it must not increase peak discharge rates or flow volumes in the receiving water body above those that would have occurred when the CSDC was granted in 2012, unless it is demonstrated that any such increases will have no adverse effects.

New stormwater diversion and discharge activities established in developing catchments that are not consistent with Catchment Management Plans will remain as single site resource consents. I.e., the Council's CSDC will not authorise them.

This SMP has been derived on the basis that future discharge consents will be sought in compliance with the CSDC and the consents will be transferred to Council, alongside stormwater infrastructure.

3.1.4. National Environmental Standards for Freshwater

The National Policy Statement for Freshwater 2020 provides local authorities with updated direction on how they should manage freshwater under the Resource Management Act 1991. The Freshwater NES set requirements for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. Anyone carrying out these activities will need to comply with the standards.

The standards are designed to:

- protect existing inland and coastal wetlands.
- protect urban and rural streams from in-filling.
- ensure connectivity of fish habitat (fish passage).
- set minimum requirements for feedlots and other stockholding areas.
- improve poor practice intensive winter grazing of forage crops.
- restrict further agricultural intensification until the end of 2024.
- limit the discharge of synthetic nitrogen fertiliser to land and require reporting of fertiliser use.

Whilst most of the above standards set out to restrict rural uses, specific emphasis has been placed on the protection of all natural wetlands. Earthworks within 10m of natural wetlands is prohibited, and consent is also required for the change in natural drainage patterns within 100m of any natural wetland. The mapping of all existing wetlands is currently underway by Fresh Water Solutions, and any identified areas will need to be avoided and suitably protected by the future development and associated management of stormwater.

3.1.5. Local Authority Code of Practice for Subdivision and Land Development

The Regional Infrastructure Technical Specification (RITS) (Waikato Local Authority Shared Services, 2018) set standards for design and construction of earthworks, transportation, water, wastewater and stormwater infrastructure, landscapes, and accepted materials. Resource consents for subdivisions and developments in the Catchment will require developers to comply with RITS when constructing such infrastructure.

The RITS requires stormwater to be managed according to a hierarchy, which is based on sustainability and efficiency principles. Preference is given to disposing of stormwater by a method that is higher in the following hierarchy – "a" is higher than "b", which is higher than "c", which is higher than "d":

a. Retention of rainwater/stormwater for reuse on site.
b. Soakage techniques.
c. Treatment and detention and gradual release to a watercourse.
d. Treatment and detention and gradual release to a piped stormwater system.

Although the RITS ascribes the term "hierarchy" to this list of measures, the document does not provide criteria for determining when adoption of a lower hierarchy measure is justified.

3.2. Stormwater Quality - Mitigation Options Assessment

An options assessment has been undertaken to establish the best practical design criteria for the stormwater quality design in support of the Development Area. These options include:

- At source stormwater quality control through the following controls:
    - Inert roofing materials for all future buildings.
    - Reduction of impervious areas using permeable paving (where possible).

    - Lot development supported by approved propriety devices such as raingardens, treepits, stormwater filters etc.
- Treatment of public roads and right of ways via approved propriety devices (raingardens, swales, stormwater filters etc) as per GD01 design guidelines.
- Sub-catchment wide stormwater quality provision through detention basins and wetlands.
- Planting of riparian areas and protection of any existing bush features.

3.3. Best Practical Option – Stormwater Quality

The overall preference is for stormwater to be managed as close to source as possible. This requires careful consideration of the wider use of smaller devices (such as inert materials, pervious paving, swales, and rain gardens) in preference to larger devices such as wetlands. These at-source devices are most efficient at improving water quality from frequent short and medium duration events.

The best practical option to mitigate the stormwater quality risk is as follows:

- New public roads are treated to the standards required by Stormwater Management Devices in the Auckland Region (GD01). This will be provided via raingardens or swales. Future road cross-sections would need to consider and allow for such devices alongside services.
- Restrictions around building materials (via consent notices) to ensure roofing materials are non-contaminant yielding.
- Minimisation of impervious areas within the residential lots through the promotion of permeable paving and use of propriety devices prior to discharge into the public network.
- Planting of riparian margins, wetlands, and detention basins. Protection of existing areas of vegetation where practical and possible.

These options would be expanded on further as part of any Plan Change application and would be administered through a comprehensive SMP and/or rules in the District Plan. Subject to the inclusion of the above controls, all stormwater from the Development Area can satisfy the requirements of the relevant statutory documents outlined above.

4. Groundwater Recharge

Low lying plains of the Development Area is formed of a peat bog that has been drained overtime and converted to agriculture and horticultural use. Careful consideration of stormwater management is required on peat soils.

Soakage and recharge of stormwater into peat is likely required to maintain hydrology to prevent dewatering and to mitigate shrinkage. Recharge pits should be designed at regular intervals throughout the development to encourage even distribution of groundwater recharge.

Detailed investigations for each area will be required by a suitable qualified geotechnical engineer to determine the correct requirements for recharge and to provide development controls for infrastructure and buildings throughout the various catchment areas.

5. Flooding

A review of the Waikato Regional Council Hazards Portal confirms that flooding occurs during the 100-year flood event to the west of the Development Area in low lying farmland which feeds the Ohote

Stream. The eastern extent of the existing flooding is shown in Pre-Development Catchment Plan (Appendix B).

5.1. Downstream Flood Mitigation Solutions

To avoid any downstream flooding effects, flood mitigation will be required in support of the future development. Post development run-off from the development areas will require attenuation of peak flows from the site to 80 % of the pre-development level for storm events up to 100-year ARI (average recurrence interval). Subject to this, there will be no increase to downstream flooding effects.

5.2. Flood Mitigation within SL1

Existing flood hazards will need to be mapped and detailed as part of any future Plan Change process. This will require Resource Consents to be obtained for any earthworks or change of land use within the flood plain/flood prone areas. Applicants will need to demonstrate that the development allows for the existing flood plain volume and that there will be no adverse upstream or downstream effects.

5.2.1. Minimum Floor Levels

Floor level requirements in relation to floodplains will be set through rules in the future District Plan. Minimum floor levels freeboard) over the 100-yr flood level will be required for all habitable buildings in accordance with the recommendations provided below:

TABLE 1: MINIMUM FREEBOARD REQUIREMENTS

Freeboard	Minimum Height
Vulnerable Activities	500mm
Les Vulnerable Activities	300mm

** Vulnerable activities defined as residential activities*

** Less vulnerable activities defined as commerce, industry, and rural activities*

All future freeboard clearances shall be in accordance with the criteria stipulated above and would need to demonstrate compliance with Building Code E1 – Surface Water as required.

5.2.2. Retention of Storage Volume

Future development will need to provide for the existing flood storage volume. This is to ensure the provision of flood storage is evenly dispersed throughout the Development Area. The primary means of flood storage will be via wetlands or dry basins, which will be designed to accommodate flood water during storm events. Subject to the retention of existing flood storage volumes, there will be no increase on downstream effects.

5.3. Flooding Summary

Subject to the future development complying with the above, there will be no increase to adverse downstream effects from development. Additional investigation and detailed design is required to refine the preferred solution as part of any future resource consent or plan change approval.

6. Overland Flowpaths

Future development will need to consider overland flowpaths up to and for the 100-yr cc event.

6.1. Overland Flowpaths – Options Assessment

An options assessment has been undertaken to establish the best practical design criteria for the overland flowpath design in support of the Development Area. These options include:

- Retention and protection of existing overland flowpaths through the development area, ideally within green corridors where the overland flow doubles as watercourse.
- Maintaining the flow of OLFPs up to the 100yr cc ARI rainfall event under the maximum probable development scenario.
- Directing all internal OFLPs within the proposed roading network, where possible.
- Piping of upstream OLFPs through the development site.

6.2. Overland Flowpaths – Best Practical Option

The best practical option to mitigate OLFP effects is as follows:

- Retention of natural OLFPs where possible (and practical). Emphasis is provided on the OLFPs which correlate to intermittent or permeant streams within the Development Area.
- Maintaining the flow of OLFPs up to and for the 100yr cc ARI rainfall event under the maximum probable development scenario.
- OLFPs are to be designed where possible within the roading network and discharge into the stormwater devices or existing watercourses (green corridors).
- Minimum freeboards for habitable buildings to be provided as per below:
    - 500mm freeboard for OLFP flow rates above 2m3/s.
    - 500mm freeboard for OLFP less than 2m3/s with average flow depths of 100mm when inundation is against the building.
    - 150mm freeboard for OLFP less 2m3/s
- Resource Consents will require the provision of a depth-velocity assessment to indicate that the hazards associated with OLFPs within the road reserves are minor, with safe passage of vehicles and pedestrians within the road reserve in accordance with best practice guidelines.

7. Green Corridors

Green corridors should be provided within the Development Area. The green corridors would follow the primary tributaries identified and would support the existing and/or proposed wetlands and detention basins. These green corridors would also assist in providing the required flood storage volume and conveyance of overland flows.

The green corridors would be protected from development and would be planted to provide ecological and water quality benefits. The watercourses would be mapped as part of the future consent application and controls would be required to retain these areas and mandate applicants to undertake riparian planting.

8. Conclusions

This high-level SMP sets the framework that will enable the future development. The Plan has considered the relevant statutory documents and will ensure future stormwater discharge from the Development Area complies with the Waikato Regional Council policies.

New public networks will need to be constructed. The network will need to convey the 10-yr ARI event and be designed in accordance with the Local Authority Code of Practice for Subdivision and Land Development.

Overland flowpaths will need to be mapped in any future consent application. Future development of will need to allow for and retain existing overland Flowpaths up to the 100-yr cc ARI event.

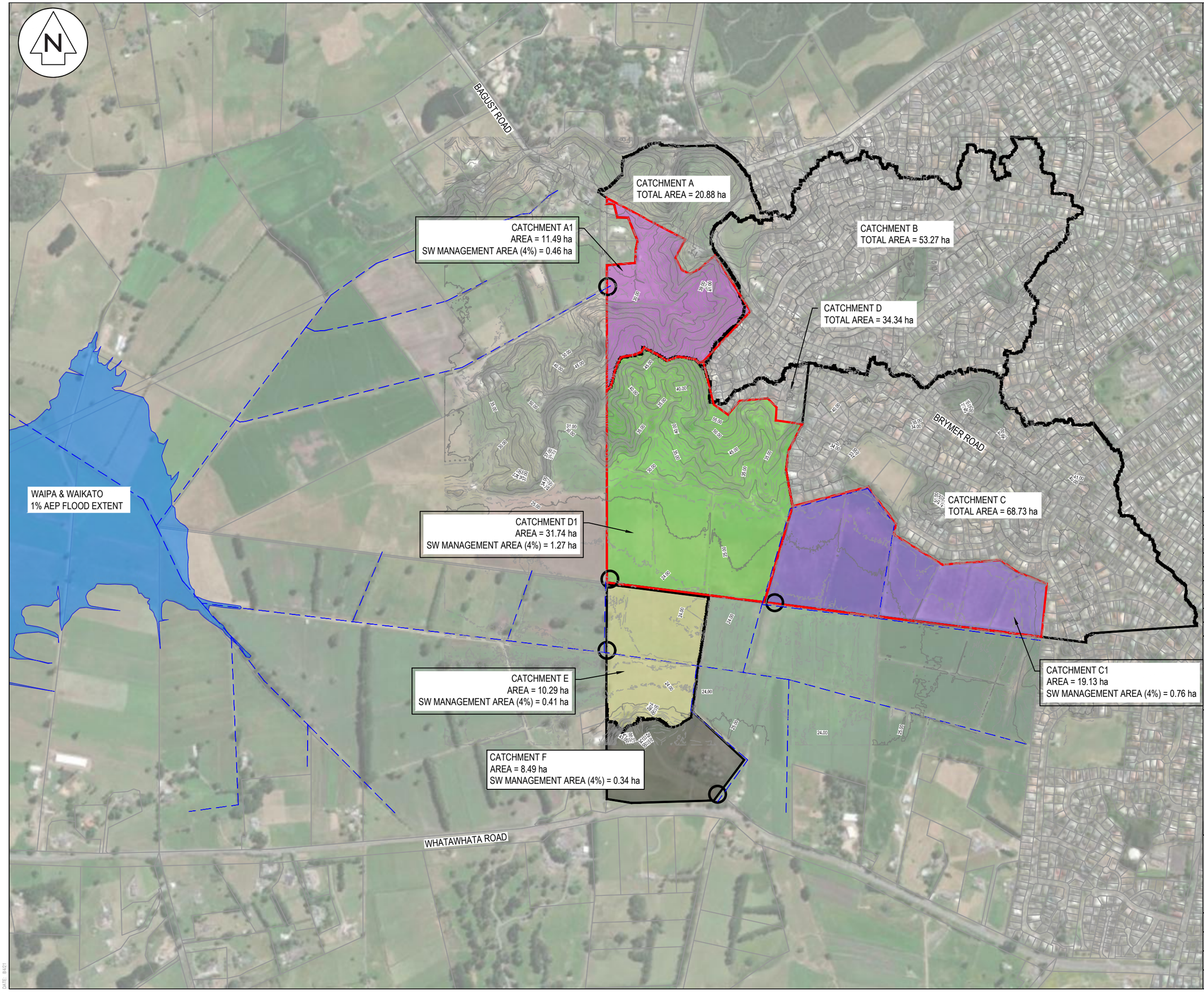
Emphasis has been placed on providing stormwater quality treatment at-source, within both the residential lots and the public roads. Final designs will need to ensure compliance with Auckland Council's GD01 document.

To ensure there is no downstream flooding effects, stormwater neutrality is required from the pre-development conditions for and up to the 100-yr ARI event. Catchment specific solutions have been developed to enable their proposed urbanisation.

Stormwater recharge will need to be designed and constructed at regular intervals throughout the development in low lying plains to maintain groundwater neutrality.

Flood plains will need to be incorporated into any future consent process. Future development applications located within the flood plains will need to maintain the existing storage volume and provide suitable freeboard for all habitable buildings. This will limit the extent of developable land within each catchment unless downstream flood mitigation works are achieved.

Appendix B – Pre-Development Catchment Plan



Legend

- EX BDY
- EX CATCHMENT
- NEW SUBCATCHMENT
- DRAINS
- 1% AEP FLOOD
- DISCHARGE POINT

Rev	Description	By	Date
A	FOR CONSENT	AS	07/2021

	By	Date
Survey	-	-
Design	AS	07/2021
Drawn	AS	07/2021
Checked	JC	07/2021

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5 Owens Road, Epsom
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Project

BRYMER RIDGE DEVELOPMENT HAMILTON FOR BRYMER RIDGE LTD

Title

PRE DEVELOPMENT STORMWATER CATCHMENT PLAN

Project no.	119007		
Scale	1:10000 @ A3		
Cad file	C400-EX CATCHMENT.DWG		
Drawing no.	C400	Rev	A

DATE: 8/421

Appendix C – MBR Wastewater case study and Combined System Examples

WASTEWATER SOLUTIONS AS PURE AS NEW ZEALAND

RAATH AND ASSOCIATES

source to consumption

Raath and Associates specialise in Water and Wastewater treatment solutions. Using proven, all-natural and innovative technologies, Raath and Associates provide tailored solutions to water-based issues.

Nature has spent millions of years developing natural processes that maintain the delicate balance of the environment.

Raath and Associates harness nature's own technology and use it strategically and precisely, to match the demands of humanity's ever-developing society.

Nature's technology evolved

Wastewater treatment is a complex process. Any solution utilised to treat wastewater ultimately involves the removal/reduction of contaminants and nutrients - making the residual water safe to discharge to our environment.

Modern treatment options use a combination of biological, mechanical or chemical processes. To achieve effective treatment, any process requires a combination of energy or time to be added to the system.

- Mechanical processes need electricity to operate
- Chemical processes need chemicals to be added
- Biological processes need time to work

Raath and Associates patented Combined Works system optimises the balance between energy and time.

Combined Works minimises the mechanical process required – removing costly operations such as membranes or air compressors, instead replacing the energy infused in the system with the energy of gravity.

Combined Works requires NO ADDED CHEMICALS to produce safe, clean, and compliant water.

Combined Works creates a stable biological environment that results in an average sludge age of 40 days (more than twice the normal time in alternative processes). This allows nature's process to occur efficiently and safely. This also makes byproducts of the process much less volatile than alternative treatment methods.

- **100% Natural, no additives**
- **Enclosed and odourless**
- **Can operate on renewable energy sources**

How it works

Raath and Associates Combined Works system is capable of treating wastewater, from domestic and industrial sources, to the highest standards imposed in New Zealand and Australia.

For over 100 years Wastewater has been treated using activated sludge systems. These systems harness nature's natural process, and over time that system has been progressively refined.

The Combined Works process is simply the next step in that progress. The current limitations of the traditional activated sludge treatment are diminished, and the efficiency of the process is increased. This results in a lower energy, higher quality treatment – all while using the tried and tested techniques that are both proven and fully natural.

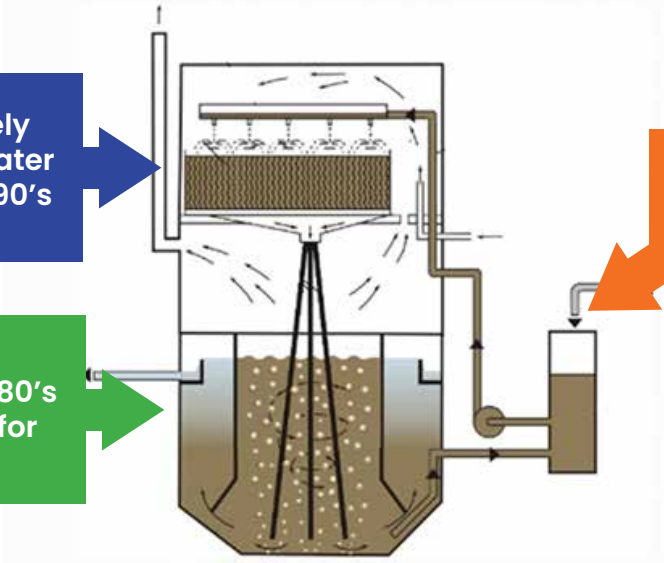
What makes Combined Works different?

Combined works uses two of the most proven systems in the Wastewater treatment industry: Biofilters and Aeration Tanks. These systems are simply arranged in a new and revolutionary way.

Our patented system involves only one moving part – a standard circulation pump. Everything else within the process harnesses the power of gravity, and nature's own biological treatment.

Biofilters – progressively developed for Wastewater treatment since the 1890's

Aeration tanks – first implemented in the 1880's and a proven method for over 100 years



Circulation pump - only moving part

Why Combined Works is the best choice?

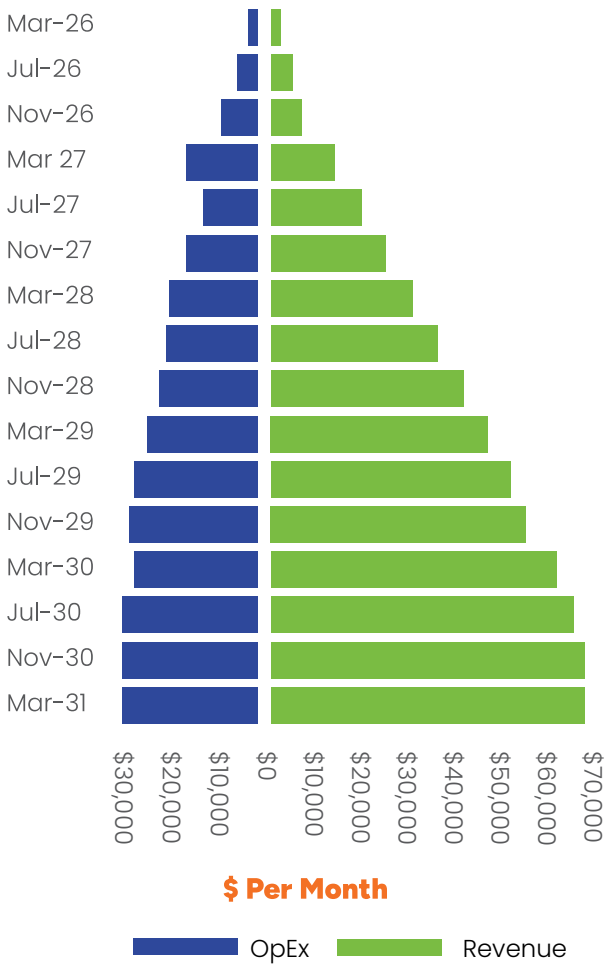
The revolutionary arrangement of the Combined Works system results in its low footprint, requiring very little land area. The system can be completely contained within a traditional building (aesthetic can be fully customised), and blend seamlessly within a development or town. The building also eliminates limitations of traditional activated sludge treatment by easily regulating temperature and ensuring the process is odourless.

Not only does combined works use treatment systems that are proven over generations, it also optimises those processes. By using the energy of gravity to generate fine bubble aeration, and having only one moving part, the energy required for the system in a fraction of any competing system.

With such a substantial reduction in energy demand and minimal moving parts, the operating costs of the Combined Works system are much lower than alternative methods.

The growth charges and rates imposed by authorities are designed to cover the cost of initial build and operating costs - for systems that are simply more expensive. Therefore, by applying the same rates to the Combined Works system, there is a real and tangible ability to construct the system for less than alternative, and generate ongoing profit over the long term, on a low maintenance asset.

OpEx v Revenue



Example of a 600 section subdivision using Watercare Services Ltd 2024 wastewater rates.

Example generates Profit of $420,000 per year when development is complete

Profit generated from the system scales positively (larger developments generate higher proportional profit).

RAATH AND ASSOCIATES
source to consumption

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MENA WATER

OUR AIM - YOUR CONFIDENCE

MBR Package Plants

for Sewage Treatment

From Sewage to Pure Irrigation Water

Convenient Operation

Clean Effluent Water

Modular System

Wastewater Treatment with MBR Technology

Our system ensures reliable reduction or elimination of polluting load such as suspended solids, organic matter, nutrients and microorganisms within an efficient process combination of biological treatment and membrane filtration. The result is clean and high quality effluent water, which can be re-used as service water or discharged to (even sensitive) receiving waters.

Scope of Supply for Complete Package Plants

MENA-Water offers complete MBR package plants, pre-assembled as containerized system (ISO sizes). This facilitates easy transportation, fast availability and straight start-up of the MBR plant. Included inside the package housing are all main components such as:

- Stainless steel membrane tank with modules and aeration system
- Blowers for aeration tank and membrane scouring
- Permeate pump, backwash and disinfection system
- Process instrumentation, electrical control cabinet with PLC

For optimized performance of the entire plant, all necessary equipment for installation in the external structures is included in our scope of supply:

- Equipment for lifting station and mechanical pre-treatment
- Diffusers, pumps, mixers for biological treatment
- Equipment for sludge treatment, grit and clean water pumping

If desired, MENA-Water provides comprehensive support for installation, start-up and maintenance activities and can consult anytime via remote monitoring from back office.
Beyond our MBR scope of supply, we can also offer solutions for further plant equipment such as:

- Sludge treatment
- Odor control
- Mobile power generator
- Containerized operator room

MBR Package Plant
MW-MR150

Benefits of our MENA-Water MBR Package Plants

- ✓ Well-proven, complete and clean system solution
- ✓ Compact footprint combined with convenient accessibility
- ✓ Minimum works for site installation and civil structures
- ✓ Full automatic system operation with online monitoring facility
- ✓ Adaptable to future demand due to modular system

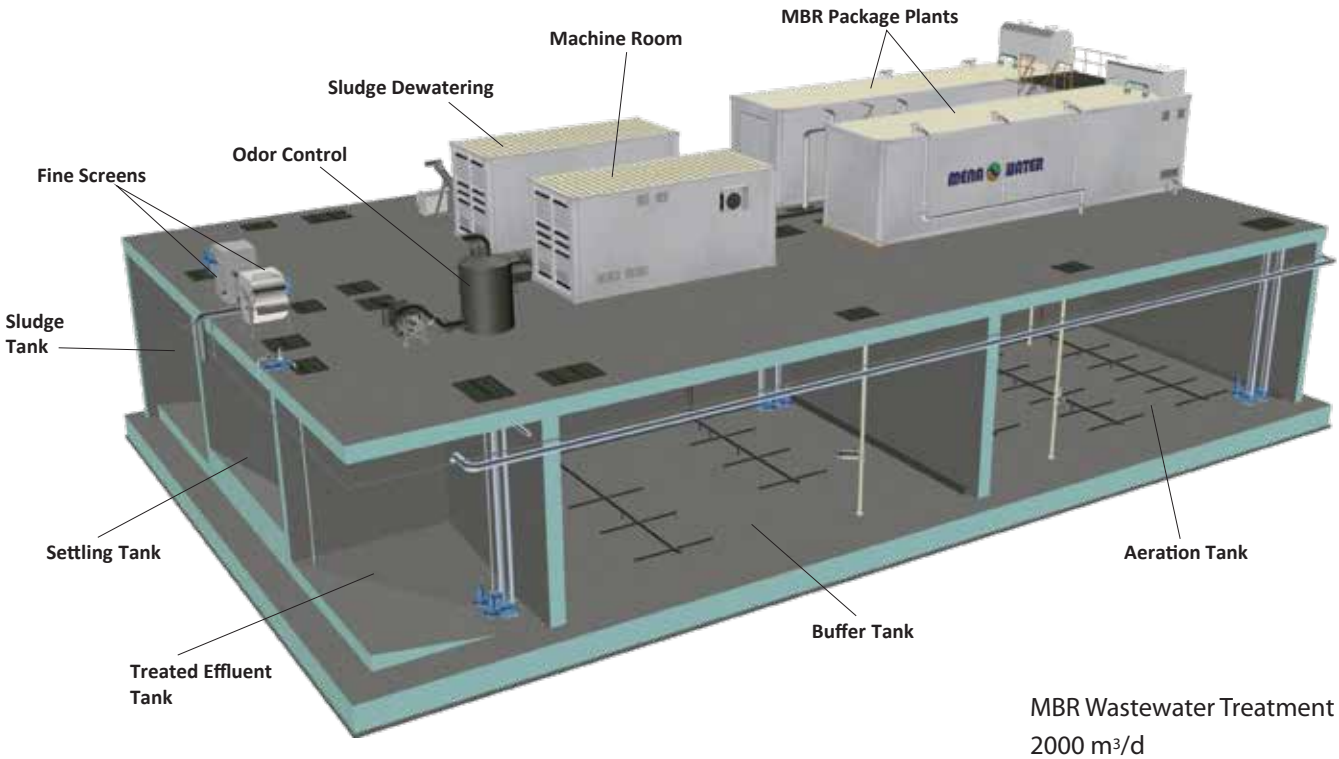
Fields of Application

MENA-Water MBR package plants are capable to handle a wide range of capacities, starting from a daily throughput of a few cubic meters, reaching to some thousands of cubic meters per day. Our plants can be arranged custom-fit to serve your desired wastewater application.

Typical applications are:

- Common municipal sewage treatment
- Independent sewage treatment system for stand-alone operation (hotels / business areas / housing complexes etc.)
- Sanitation solution for outlying locations
- Sanitation solution for close and densely populated residential areas due to minimized smell, dirt and footprint
- Process step for industrial wastewater treatment
- Pre-treatment step for reverse osmosis plants

Standard Sizes	Capacity m³/d	Population Equivalent	Approx. Footprint
MW-MR10	10	up to 85	8 x 3 m
MW-MR25	25	up to 210	8 x 3 m
MW-MR75	75	up to 625	12 x 4 m
MW-MR150	150	up to 1250	14 x 5 m
MW-MR300	300	up to 2500	14 x 6 m
MW-MR450	450	up to 3750	16 x 7 m
MW-MR600	600	up to 5000	20 x 7 m
MW-MR1000	1000	up to 8300	25 x 7 m



MBR Wastewater Treatment Plant
2000 m³/d

MENA WATER

OUR AIM - YOUR CONFIDENCE

MENA WATER FZC

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Member of German Water Partnership

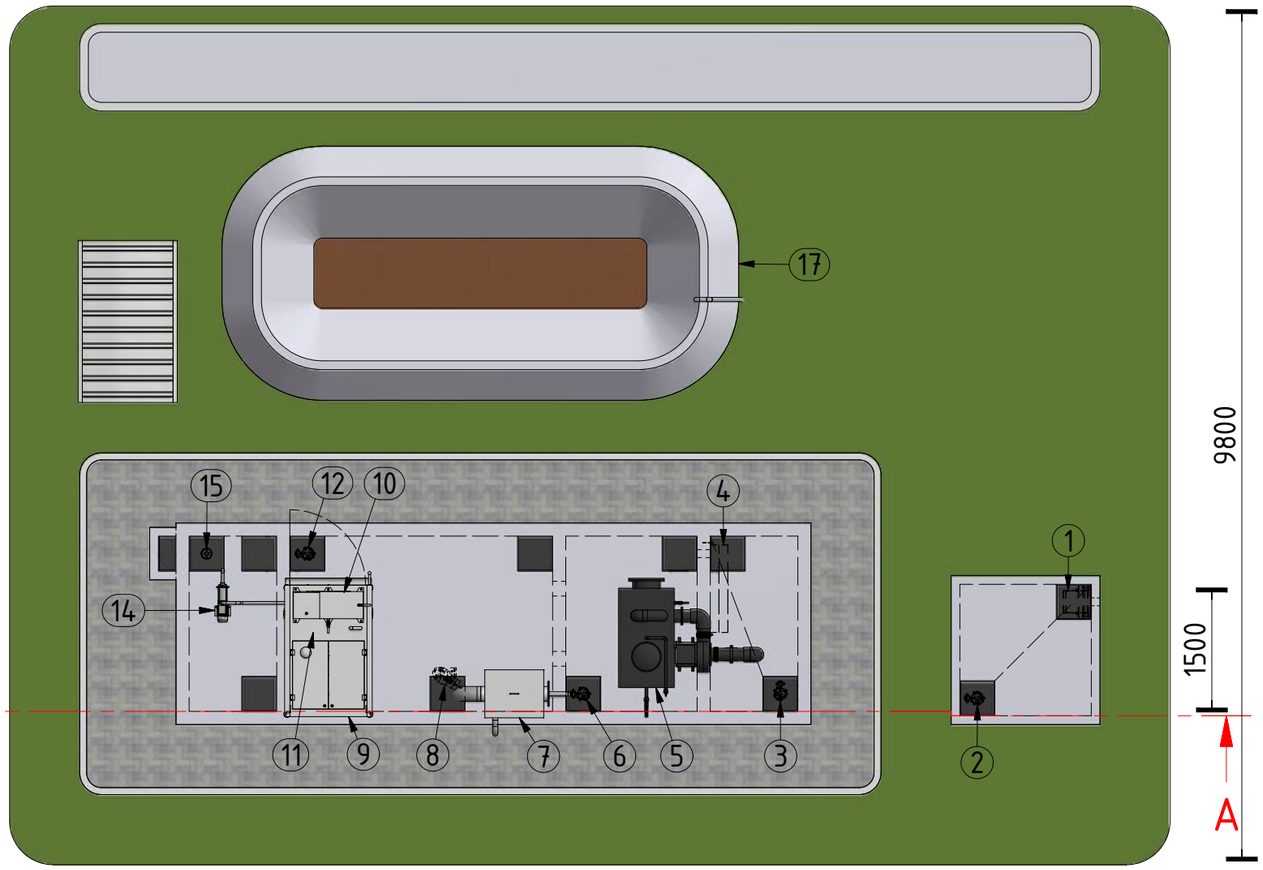
Member of HUBER Group

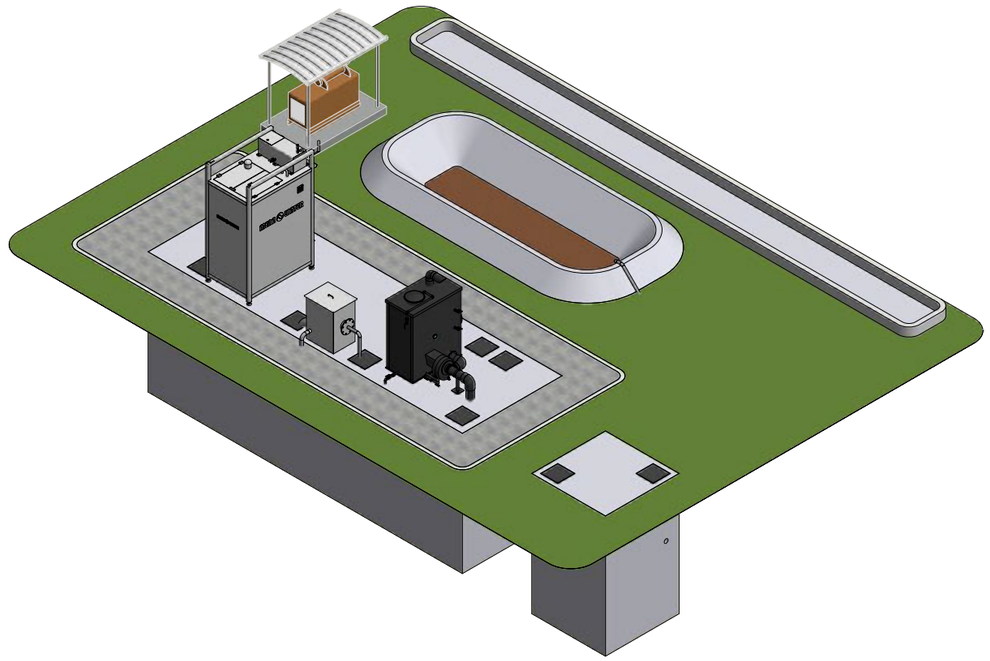
TECHNOLOGY

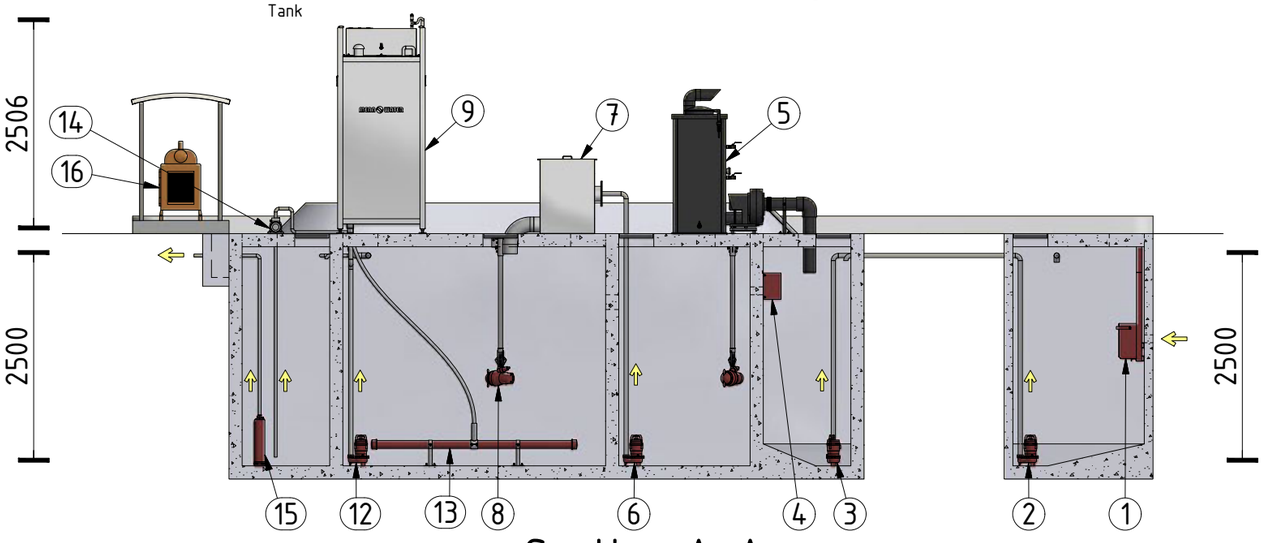
WASTE WATER Solutions

MBR_Esn-0618

Plant Layout







Section A-A

Itemref	Quantity	Title / Name, designation, material, dimension etc.	Article no./ Reference
17	1	Sludge Storage Area	
16	1	Standby Power Generator (DG)	Optional
15	1	Treated Water Discharge Pump (TWP)	Optional
14	1	Service Water Pump (SP)	Optional
13	1	Aeration Diffuser (AD)	
12	1	Recirculation Pump (RCP)	
11	1	Machine Room	
10	1	Control Panel	
9	1	Package Plant MW-MR25-U	
8	1	Aeration Mixer (MX)	
7	1	Secondary Screen (Static)	
6	1	Balancing Pump (BP)	
5	1	Odor Control Unit (OD)	Optional
4	1	Grease Baffle (GOB)	
3	1	Sludge Pump (SP)	Optional
2	1	Lifting Station Pump (LSP)	
1	1	Basket Screen (BKL)	Optional

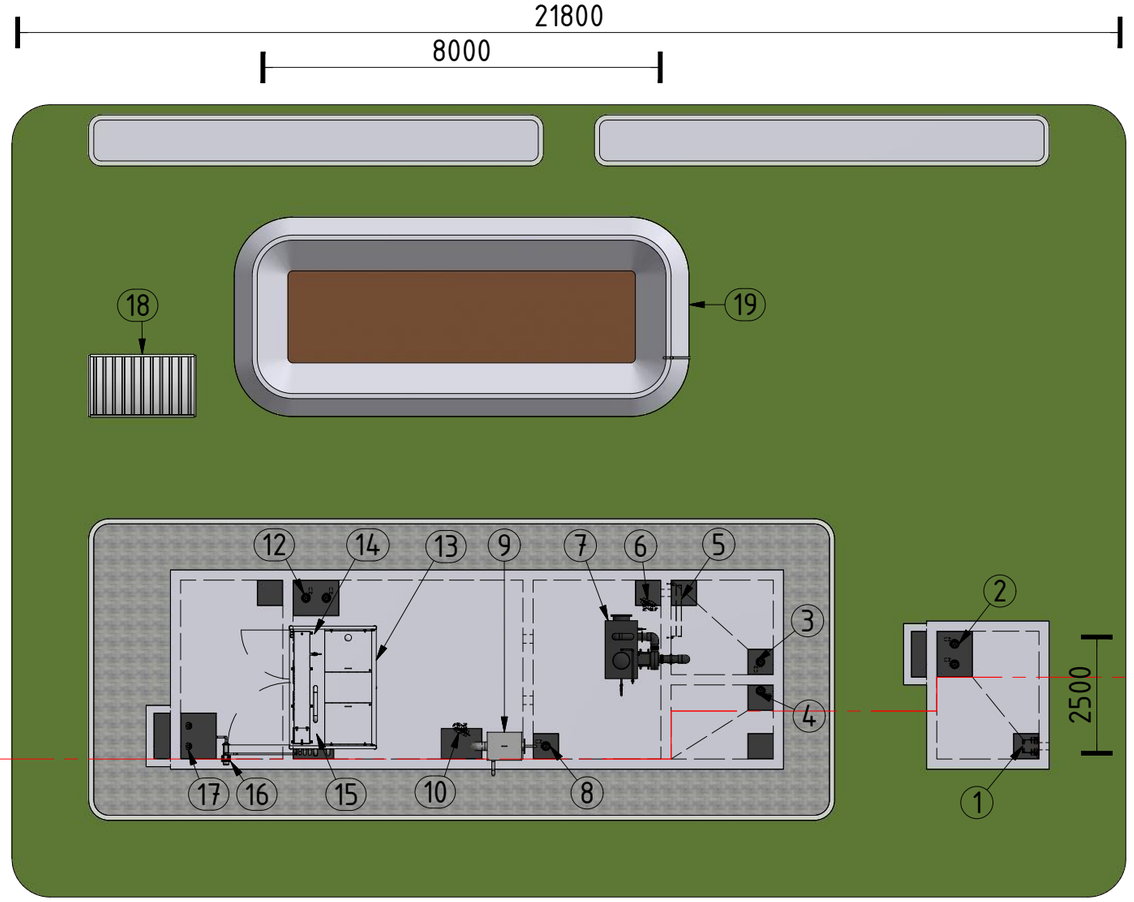
Equipment List

Designed by:	Drawn by:	Approved by:	Paper Size:	Date:	Scale:
A.G	J.T.	A.G.	A3	15-12-2016	N.T.S.

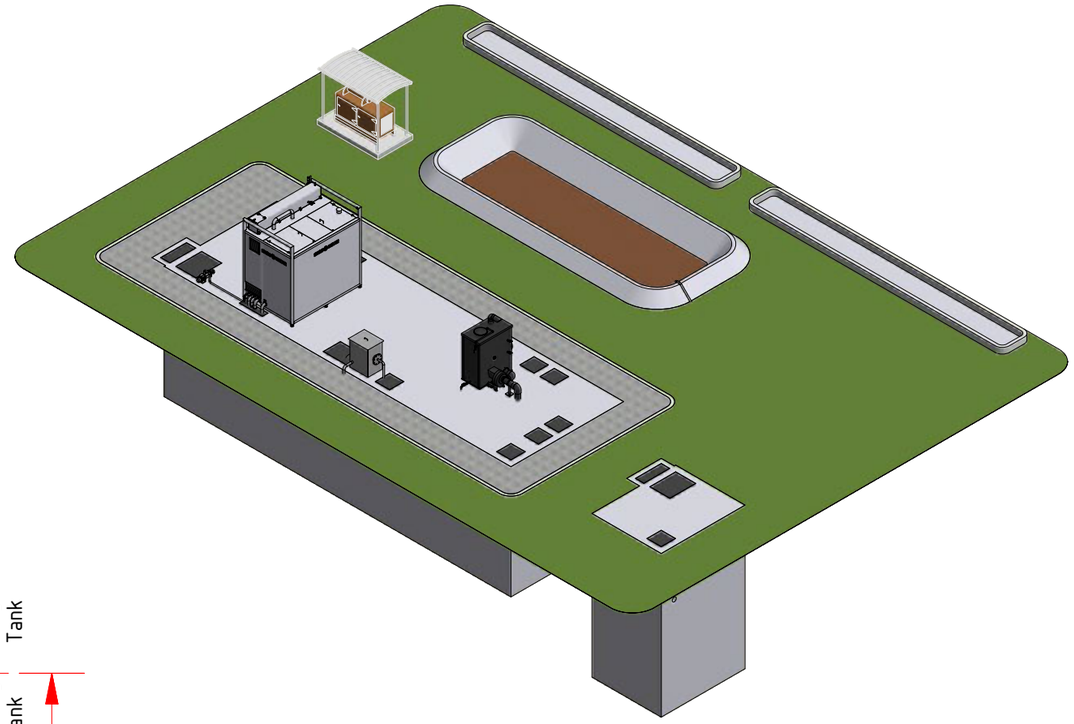
MENA WATER
E-mail: info@mena-water.com - Web: www.mena-water.com

Title: MW-MR25-U
Plant Layout

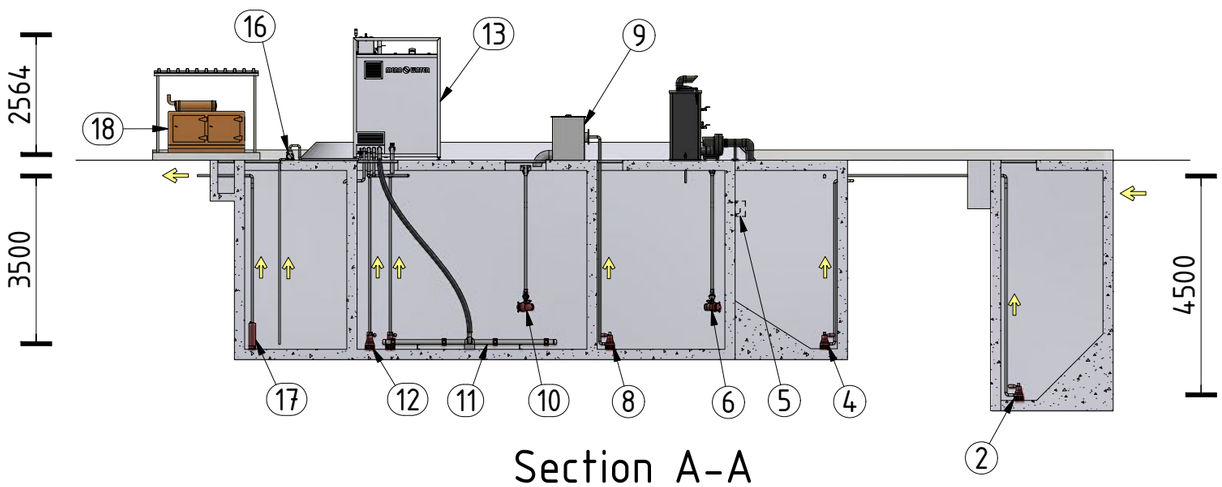
Drawing number: PL-MR25-U-GD-(1)
Edition: V0
Sheet: 1 / 1



Plant Layout



Isometric View



Section A-A

Itemref	Quantity	Title / Name, designation, material, dimension etc.	Article no./ Reference
19	1	Sludge Storage Area	
18	1	Standby Power Generator (DG)	Optional
17	2	Treated Water Discharge Pump (TWP)	Optional
16	1	Service Water Pump (SP)	Optional
15	1	Machine Room	
14	1	Control Panel	
13	1	Package Plant MW-MR75-U	
12	2	Recirculation Pump (RCP)	
11	1	Aeration Diffusers (AD)	
10	1	Aeration Mixer (MX)	
9	1	Secondary Screen (Static)	
8	1	Balancing Pump (BP)	
7	1	Odor Control Unit (OD)	Optional
6	1	Aeration Mixer (MX)	
5	1	Grease Baffle (GOB)	
4	1	Grit Pump (GP)	
3	1	Sludge Pump (SP)	Optional
2	2	Lifting Station Pumps (LSP)	
1	1	Basket Screen (BKL)	Optional

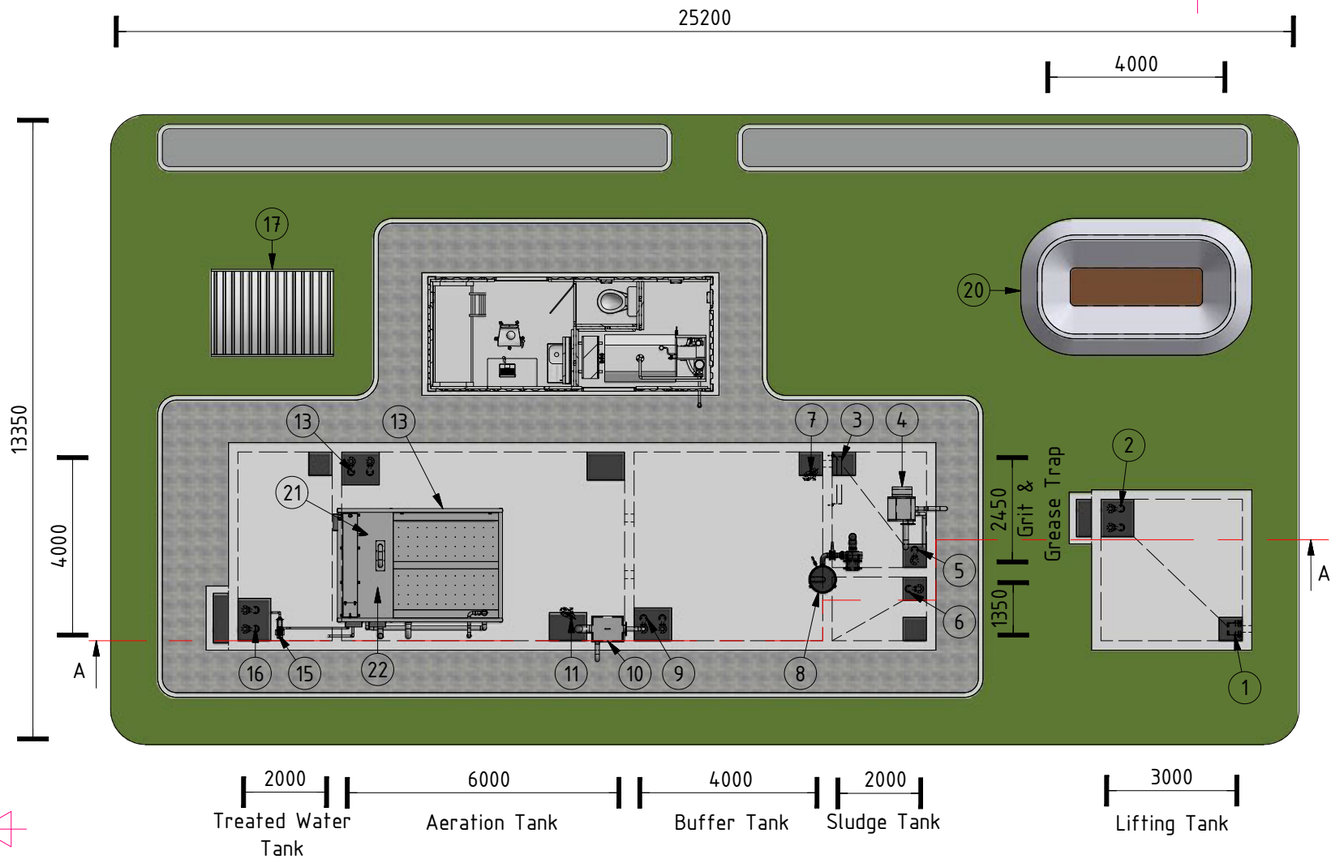
Equipment List

Designed by:	Drawn by:	Approved by:	Paper Size:	Date:	Scale:
A.G	J.T.	A.G.	A3	21-12-2016	N.T.S.

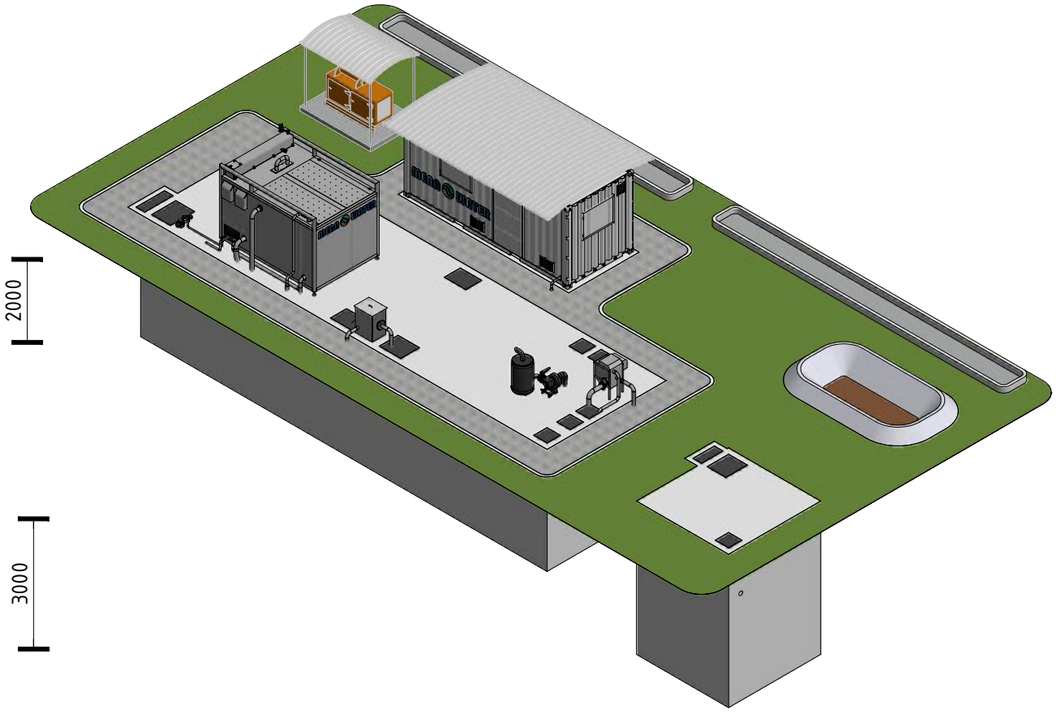
MENA WATER
E-mail: info@mena-water.com - Web: www.mena-water.com

Title: MW-MR75-U
Plant Layout

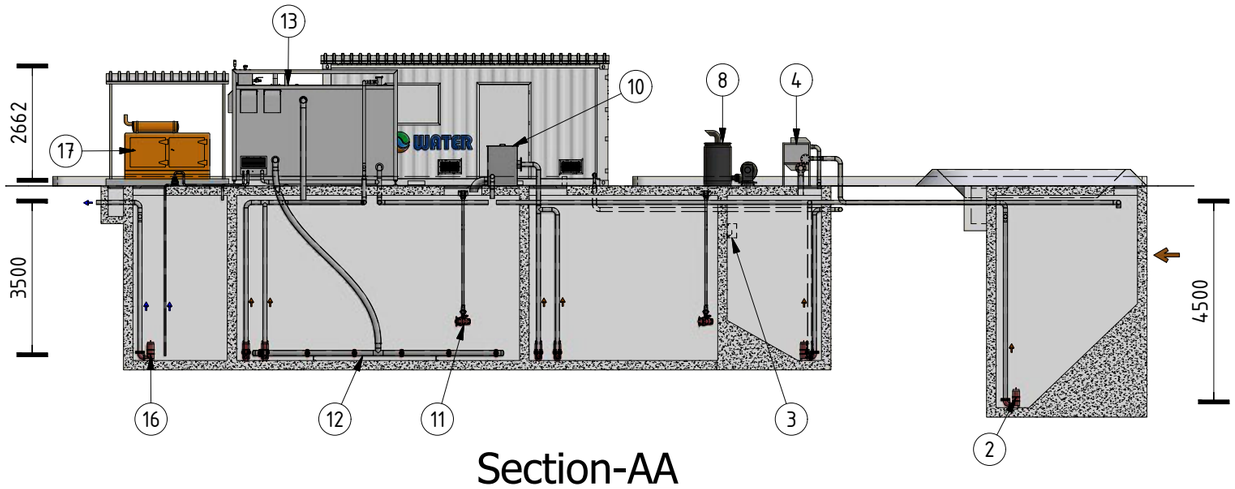
Drawing number:	Edition:	Sheet:
PL-MR75-U-GD-(1)	V0	1 / 1



Plant Layout



Isometric view



Section-AA

Itemref	Quantity	Title / Name, designation, material, dimension etc.	Article no./ Reference
22	1	Machine Room	
21	1	Control Panel	
20	1	Sludge Storage Area	Optional
17	1	Standby Power Generator (DG).	Optional
16	2	Treated Water Discharge Pumps (TWP).	Optional
15	1	Service Water Pump (SP).	Optional
13	1	Package Plant MW-MR150-U	
12	1	Aeration Diffusers (AD).	
11	1	Aeration Mixer (MX).	
10	1	Secondary Screen (Static) (ST-SC 500/1).	
9	2	Balancing Pumps (BP).	
8	1	Odor Control Filter (OD).	Optional
7	1	Buffer Tank Mixer (MX).	
6	1	Sludge Pump (SP).	
5	1	Grit Pump (GP).	
4	1	Automatic Fine Screen (SC).	
3	1	Grease Baffle (GOB).	
2	2	Lifting Station Pumps (LSP).	Optional
1	1	Basket Screen (BKL).	Optional

Equipment List

Designed by:	Drawn by:	Approved by:	Paper Size:	Date:	Scale:
A.G	J.T./C.p.dhyani	A.G.	A3	06-08-2016	N.T.S.

MENA WATER

E-mail: info@mena-water.com - Web: www.mena-water.com

Title: MW-MR150-U
Plant Layout

Drawing number:	Version:	Sheet:
PL-MR150-U-GD-(1)	V0	1 / 1

Appendix D – WGA Potential for Water Reuse Assessment (Bound Separate within Application)

Appendix E – Geotechnical Assessment

REPORT

Tonkin+Taylor

Preliminary Geotechnical Assessment Report

Brymer Farms, 584 Whatawhata Road, Hamilton

Prepared for
Brymer Farms Ltd
Prepared by
Tonkin & Taylor Ltd
Date
July 2021
Job Number
1017075

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Preliminary Geotechnical Assessment Report					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
02/07/21	1	Final issue to client	D. Mills	G. McDougall	C. Davanna

Distribution:

Brymer Farms Ltd	1 electronic copy
Tonkin & Taylor Ltd (FILE)	1 electronic copy

Table of contents

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 m^2) 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 information[3] 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.

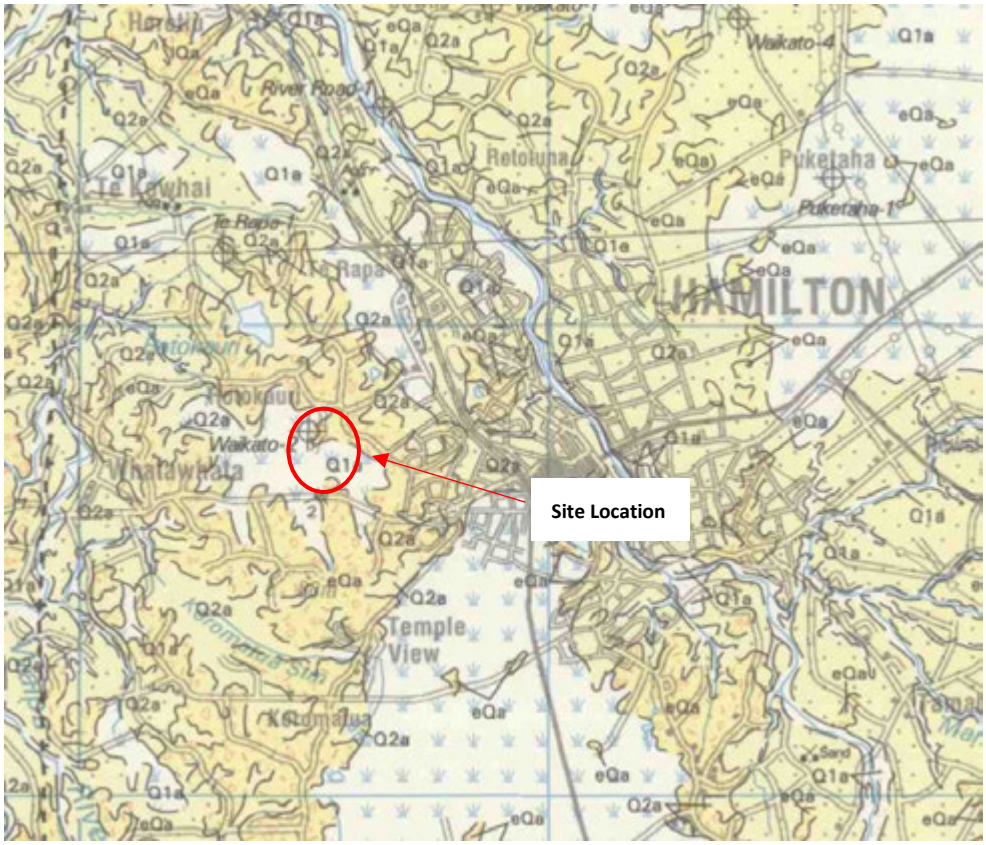


Figure 5.1: Published geology of the site and surrounding area[3]

5.2 Geomorphology

5.2.1 Regional setting

The Hamilton basin is a large tectonic depression (down-thrown block or graben), approximately 2,000 km^2 in area, centred on Hamilton[3]. The basin is bound to the west and east by up-thrown Mesozoic basement rocks[4] 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 form 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 guidelines[4] (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 geology[3] 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, Ru	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	$C_{0,1000}$ x Ru/1.3 x f x 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 develops 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 stie. 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 literature[7] 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

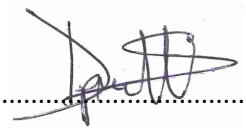
12 Applicability

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:



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Daniel Mills
Senior Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

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Craig Davanna
Project Director

Technical review by:

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Guy McDougall
Senior Geotechnical Engineer

2-Jul-21
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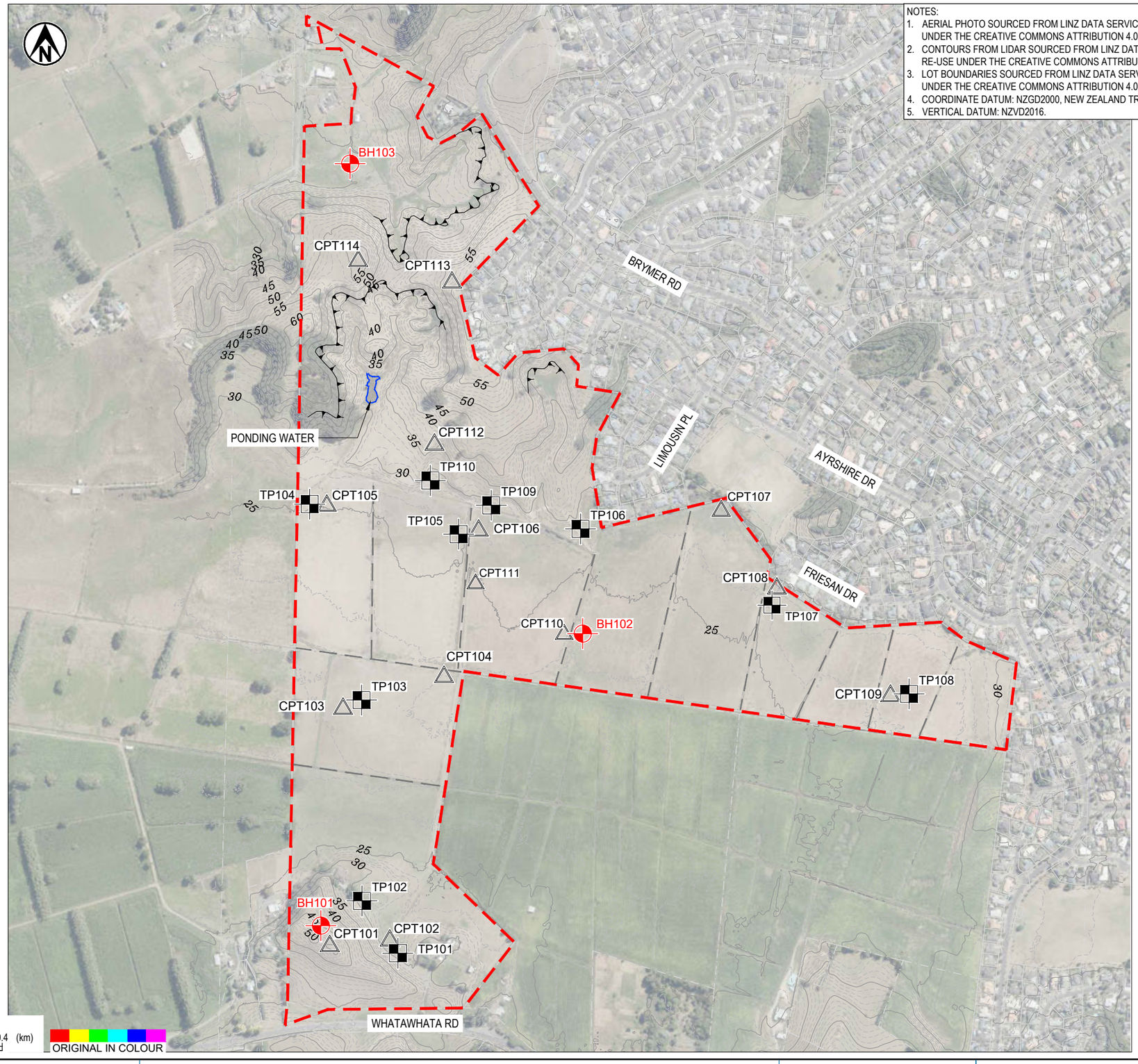
Appendix A: Figures

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

\\ttgroup.local\corporate\Tauranga\Projects\1017355\WorkingMaterial\4.CAD\FIG\FIGURE-01-SiteInvestigationPlan.dwg 2021-Jul-02 3:59:08 PM Plotted By: ROSEMARY SUTTON

NOTES:
1. AERIAL PHOTO SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/x/LSSb8X>, LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 26/05/2021.
2. CONTOURS FROM LIDAR SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/x/FarhCG>, LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 26/05/2021.
3. LOT BOUNDARIES SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/x/cC4fV2>, LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 26/05/2021.
4. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
5. VERTICAL DATUM: NZVD2016.



LEGEND
- LOT BOUNDARIES
- 45 EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SITE BOUNDARY
- FARM DRAINS
- GULLY HEAD CREST
- CPT100 CPT LOCATION (SOFT SOIL THICKNESS)
- TP0100 TRIAL PIT LOCATION (SOFT SOIL THICKNESS)
- BH100 BORE HOLE TEST LOCATION (SOFT SOIL THICKNESS)

A3 SCALE 1:7500
0 0.1 0.2 0.3 0.4 (km)
ORIGINAL IN COLOUR

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PROJECT No.	1017355	
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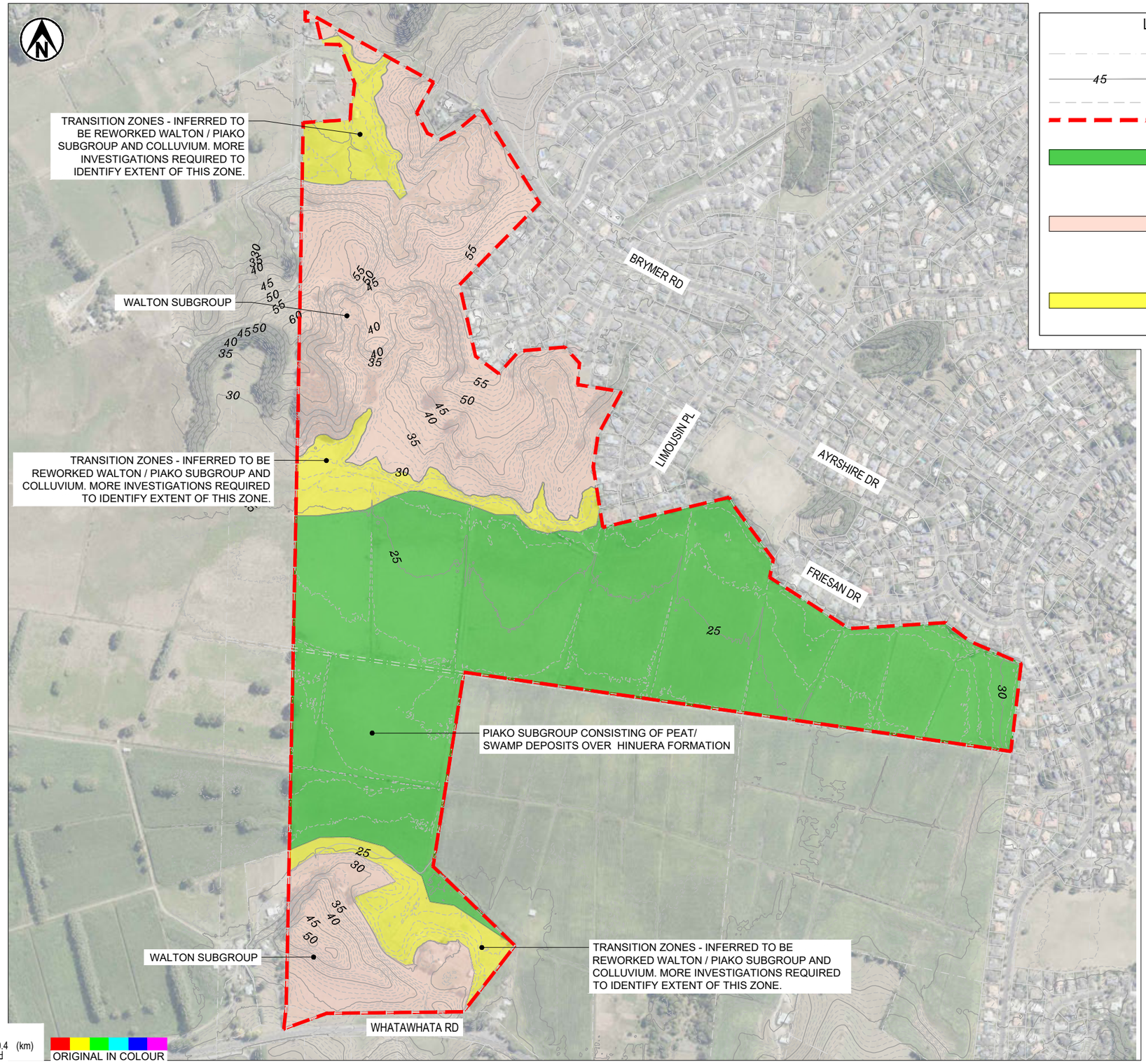
DRAWN	DDAL	Jul.21
CHECKED	RBS	Jul.21
PRELIMINARY DRAFT		
APPROVED	DATE	

CLIENT **BRYMER FARMS LTD.**
PROJECT **BRYMER SUBDIVISION DEVELOPMENT, HAMILTON**
TITLE SITE INVESTIGATION PLAN LAYOUT
SCALE (A3) 1:7500 FIG No. FIGURE 01 REV 1

\\ttgroup.local\corporate\Tauranga\Projects\1017355\WorkingMaterial\4.CAD\FIG\FIGURE-02-LandformZonePlan.dwg 2021-Jul-02 3:59:48 PM Plotted By: ROSEMARY SUTTON



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TITLE LANDFORM ZONE PLAN LAYOUT

SCALE (A3) 1:7500 FIG No. FIGURE 02 REV 1

\\ttgroup.local\corporate\Tauranga\Projects\1017355\WorkingMaterial\4.CAD\FIG\FIGURE-03-SoftsoilThicknessPlan.dwg 2021-Jul-02 4:00:22 PM Plotted By: ROSEMARY SUTTON

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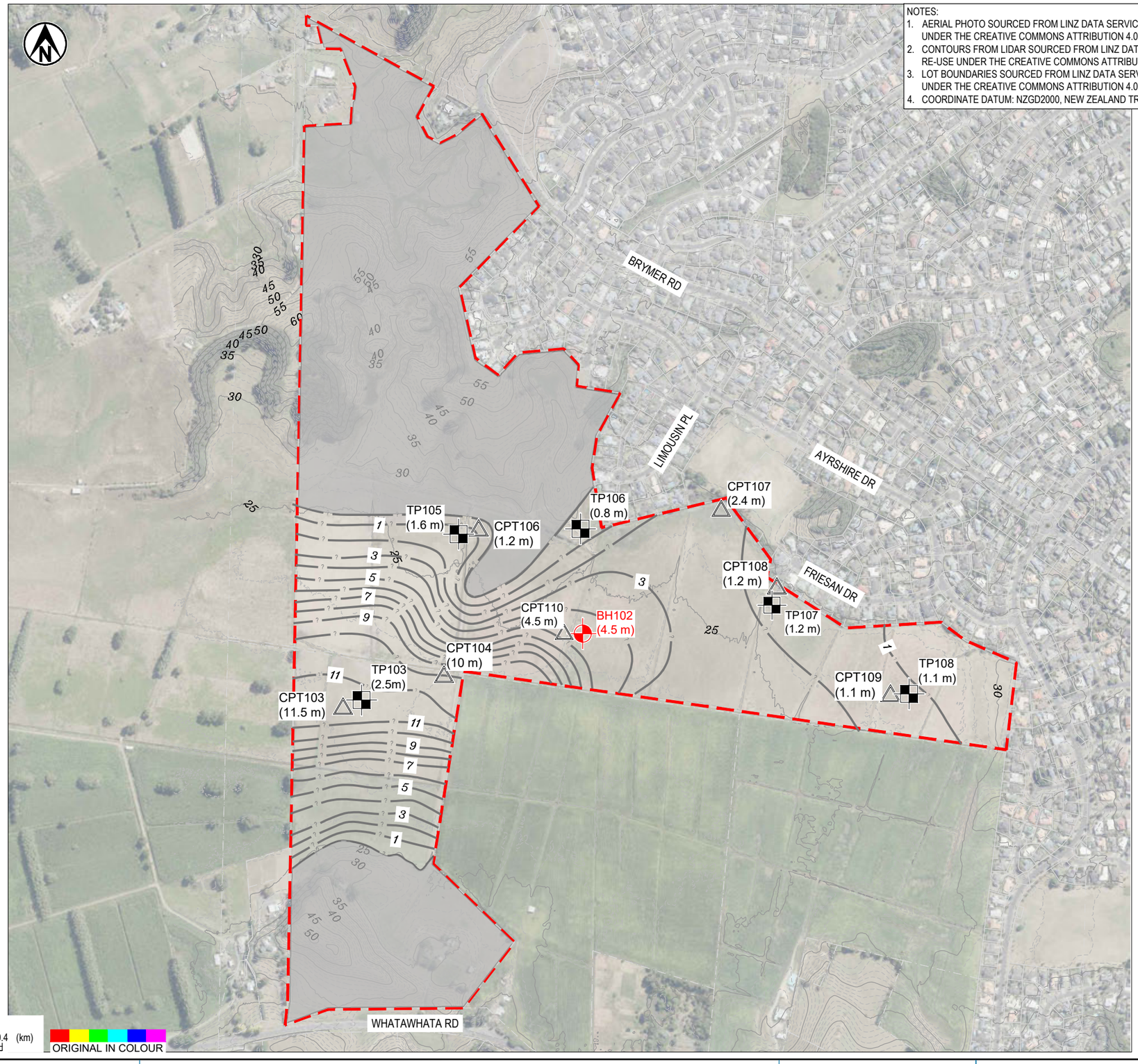
3. LOT BOUNDARIES SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/x/cC4fV2>, LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 26/05/2021.
4. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).



LEGEND

- LOT BOUNDARIES
- 45 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- ? 5 — INDICATIVE SOFT SOIL CONTOURS
- SITE BOUNDARY
- CPT100(1.0m) — CPT LOCATION (SOFT SOIL THICKNESS)
- TP100(1.0m) — TRIAL PIT LOCATION (SOFT SOIL THICKNESS)
- BH100(1.0m) — BORE HOLE TEST LOCATION (SOFT SOIL THICKNESS)

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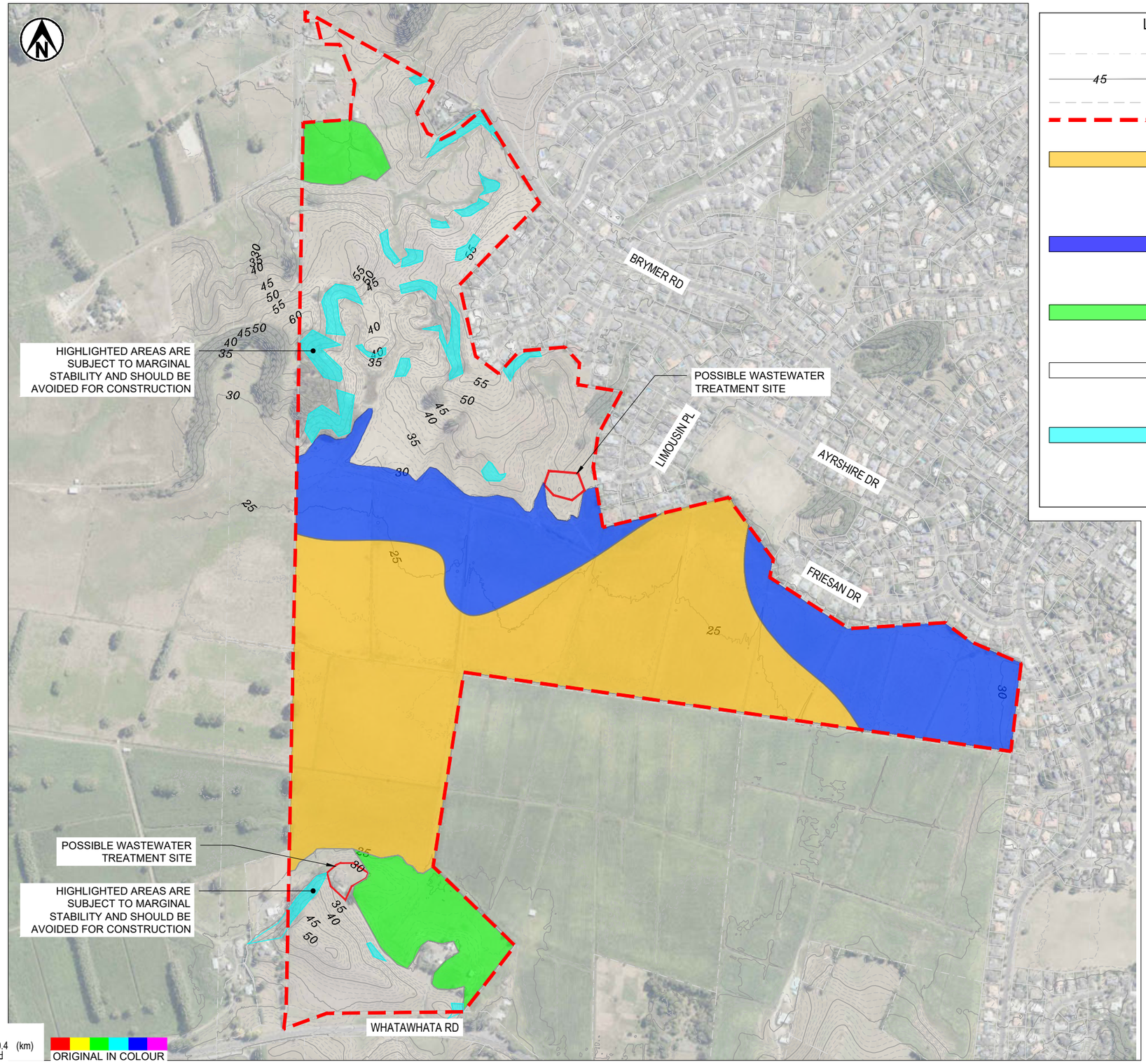
TITLE SOFT SOIL THICKNESS CONTOURS PLAN LAYOUT

SCALE (A3) 1:7500 FIG No. FIGURE 03 REV 1

\\ttgroup.local\corporate\Tauranga\Projects\1017355\WorkingMaterial\4.CAD\FIG\FIGURE-04-GeotechConstraints.dwg 2021-Jul-02 4:01:03 PM Plotted By: ROSEMARY SUTTON



LEGEND

- LOT BOUNDARIES
- EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SITE BOUNDARY
- AREA A: SOFT SOIL AND LIQUEFIABLE SOILS PRESENT. WILL REQUIRE EXTENSIVE REMEDIAL WORKS SUCH AS PRELOADING WITH A TC2 SLAB OR OR DEEP PILES (MIN 20M) TO SUPPORT RESIDENTIAL FOUNDATIONS
- AREA B: SHALLOW SOFT SOILS (PEAT) AND POTENTIALLY LIQUEFIABLE SOILS. AREA REQUIRES UNDERCUTS UP TO 2M TO PROVIDE A NON-LIQUEFIABLE CRUST AND REMOVE PEATS, WITH A TC2 SLAB
- AREA C: LOWER RISK FOR LIQUEFACTION SUSCPETIBILITY AND SOFT SOILS - TC2 FOUNDATION OPTIONS SUCH AS A WAFFLE SLAB, LIKELY APPROPRIATE.
- AREA D: AREAS NOT SHADING WITHIN THE ELEVATED PORTIONS MAY COMPRISE STANDARD NZS3604 FOUNDATION SYSTEMS SUITABLE PROVIDED BUILDINGS ARE SUITABLE SET BACK - TO BE DETERMINED THROUGH QUANTITATIVE STABILITY ANALYSES.
- SLOPES GREATER THAN 25 DEGREES REQUIRING SLOPE STABILITY ANALYSES. DEVELOPMENT SHOULD BE AVOIDED ABOVE AND BELOW THESE STEEPER SLOPES UNTIL FURTHER STABILITY ANALYSIS HAS BEEN UNDERTAKEN.

NOTES:
BOUNDARIES ARE INDICATIVE ONLY BASED ON THE TESTING, MAPPING, AND ANALYSES UNDERTAKEN TO DATE. THESE BOUNDARIES WILL REQUIRE REFINING ONCE SCHEME PLANS ARE AVAILABLE.

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CLIENT **BRYMER FARMS LTD.**
PROJECT **BRYMER SUBDIVISION DEVELOPMENT, HAMILTON**
TITLE GEOTECHNICAL CONSTRAINTS PLAN LAYOUT
SCALE (A3) 1:7500 FIG No. FIGURE 04 REV 1

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: (NZTM2000)	5814995.96 mN 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
R.L.:	45.24m		DRILLED BY: Drillcore
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
								45	0	TS	M	F				*0.00m:* Clayey SILT, trace organics and trace sand; dark brown. Firm, moist, low plasticity. Sand, fine; organics, rootlets. Topsoil.
									0.5			St				*0.30m:* Clayey SILT; brown. Stiff, moist, low plasticity. Suspected small fragments of charcoal.
			100	HQTT				44	1.0							*1.00m:* Silty CLAY; brown. Stiff, moist, medium plasticity.
			100	SPT		● 86/39 kPa 1/2 2/2 2/2 **N=8**			1.5							*1.60m:* Clayey SILT; brown. Stiff, moist, low plasticity. Silt, slow dilatancy.
Weathered Volcanic Ash (HAMILTON ASH)			80	HQTT				43	2.0							*1.95m:* CORE LOSS. 1.95 - 2.25.
									2.5							*2.25m:* Clayey SILT; brown. Stiff, moist, low plasticity.
												VSt				*2.60m:* Clayey SILT; yellowish brown. Very stiff, moist, low to medium plasticity.
			100	SPT		● 117/31 kPa 1/1 1/1 1/0 **N=3**		42	3.0							
Box 1, 0.0-3.6m									3.5							*3.30m:* Clayey SILT; light brown. Very stiff, moist, medium plasticity. Suspected small fragments of charcoal.
			100	HQTT				41	4.0							
			100	SPT		● 33/11 kPa 1/1 0/1 0/2 **N=3**			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

Scale 1:25

Rev.: A

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: (NZTM2000)	5814995.96 mN 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
R.L.:	45.24m		DRILLED BY: Drillcore
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) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (cm)

Box 2, 3.6-7.1m

Walton Subgroup

Depth (m)	RL (m)	Core Recovery (%)	Method	Tests	Moisture / Weathering	Strength/Density	Description and Additional Observations
5.0	40	100	HQTT		M	F	*5.00m:* Silty CLAY; light brown mottled black. Firm, moist, medium plasticity. Suspected small fragments of charcoal. *5.30 - 5.40m:* Minor sand, fine to coarse.
5.5						St	*5.40m:* Silty CLAY; reddish brown mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.
6.0	39	100	SPT	● 75/25 kPa 1/1 1/1 1/2 **N=5**			*5.70 - 5.90m:* Becomes wet, very soft. light greyish brown. Grades to stiff.
6.5		100	HQTT				*6.40m:* Silty CLAY; brownish orange mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.
7.0	38						
7.5		100	SPT	● 42/14 kPa 0/0 0/0 0/0 **N=0**		S-F	*7.50m:* Clayey SILT; yellowish brown mottled black. Soft to firm, moist, low plasticity. Suspected small fragments of charcoal.
8.0	37	100	HQTT				
8.5						F	*8.50m:* Sandy SILT, minor clay; light brown mottled black. Firm, moist, low plasticity.
9.0	36	100	PT			St	*8.90m:* Clayey SILT; light brown mixed with some black. Stiff, moist, low plasticity. Suspected small fragments of charcoal. *9.00m:* Pushtube. Material observed as Clayey SILT as above.
9.5		100	SPT	2/1 2/2 1/3 **N=8**			*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: (NZTM2000) 5814995.96 mN, 1795095.18 mE

R.L.: 45.24m

DATUM: NZVD2016

DRILL TYPE: Tractor Rig

DRILL METHOD: RC

DRILL FLUID: WATER

HOLE STARTED: 18/05/2021

HOLE FINISHED: 19/05/2021

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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Box 3, 7.1-11.4m			100	HQTT				35			M	St				*10.00m:* Silty CLAY; light brown. Stiff, moist, high plasticity.
			100	SPT		● 56/28 kPa 1/1 1/1 0/2 **N=4**			10.5							
			100	HQTT				34	11.0			F				*10.95m:* Silty CLAY; light brown mottled orange. Firm, moist, medium plasticity.
									11.5							*11.70m:* Clayey SILT; light brown mottled orange. Firm, moist, medium plasticity.
			100	SPT		1/2 1/3 4/4 **N=12**		33	12.0			St				*12.00m:* SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.
Walton Subgroup			66	HQTT					12.5							*12.45m:* CORE LOSS. 12.45 - 12.80.
								32	13.0							*12.80m:* SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.
			100	PT					13.5			MD				*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.
			77	SPT		2/2 3/3 3/4 **N=13**		31	14.0							*14.00m:* CORE LOSS. 14.0 - 14.1m.
																14.10m: Sandy SILT; brown. Medium dense, moist, dilatant - rapid. Sand, fine to coarse.
		18/05/2021	100	HQTT					14.5			St				*14.70m:* SILT, some clay, minor sand; light brown mottled black. Stiff, moist, low plasticity.
												VS				*14.90 - 15.00m:* Becomes wet, very soft.

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, 1795095.18 mE (NZTM2000)
R.L.: 45.24m
DATUM: NZVD2016

DRILL TYPE: Tractor Rig
DRILL METHOD: RC
DRILL FLUID: WATER

HOLE STARTED: 18/05/2021
HOLE FINISHED: 19/05/2021
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
			100	PT				30	15.5							*15.00m:* Pushtube, Material observed to be SILT, some clay, minor sand; light brown motted black. Moist, low plasticity.
			100	SPT		1/1 0/1 2/2 **N=5**			15.5		W	F				*15.50m:* SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal.
Box 4, 11.4-16.3m			100	HQTT				29	16.0							
			11	SPT		1/1 3/0 1/1 **N=5**			16.5							*16.50m:* CORE LOSS. 16.5 - 16.9m.
Walton Subgroup			100	HQTT				28	17.0			L				*16.90m:* SILT, minor sand; light brown mottled black. Loose, wet, dilatant - rapid. Sand, fine. Suspected small fragments of charcoal.
									17.5			F				*17.70m:* SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal.
			100	SPT		● 39/6 kPa 0/0 0/0 0/0 **N=0**		27	18.0							*17.80m:* Clayey SILT; greyish white mottled black. Firm, wet, medium plasticity. Silt, slow dilatancy.
												S-F				*18.10m:* SILT, some clay, minor sand; brown. Soft to firm, wet, medium plasticity. Sand, fine to coarse. Pumiceous.
Box 5, 16.3-19.5m			100	HQTT				26	18.5 19.0							
			100	SPT		● 98/25 kPa 1/2 2/2 2/5 **N=11**			19.5			St				*19.40m:* Clayey SILT; greyish white mottled black. Stiff, wet, medium plasticity.
												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

BoreLog 28/06/2021 12:40:44 pm - Produced with Core-GS by GeRoc

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, 1795095.18 mE (NZTM2000)
R.L.: 45.24m
DATUM: NZVD2016

DRILL TYPE: Tractor Rig
DRILL METHOD: RC
DRILL FLUID: WATER

HOLE STARTED: 18/05/2021
HOLE FINISHED: 19/05/2021
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Walton Subgroup			100	HQTT				25	20.00		W	St				*20.00m:* SILT, some clay, trace sand; greyish white mottled black. Stiff, wet, low plasticity. Sand, fine to coarse. Pumiceous.
			100	HQTT					20.5			F				*20.40m:* SILT, some clay; greyish white mottled with some black. Firm, wet, low plasticity.
			100	SPT		● 64/11 kPa 2/3 2/3 5/7 **N=17**		24	21.0			St				*21.00m:* SILT, some clay; grey. Stiff, wet, low plasticity.
			100	HQTT					21.5							
									22.0		M					*22.10m:* SILT, minor sand; light brown mottled orange. Stiff, moist, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous.
			100	SPT		● 84/14 kPa 1/1 0/0 0/0 **N=0**		23	22.5							*22.50m:* CORE LOSS. 22.5 - 22.8m.
									23.0		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.
Box 6, 19.5-23.5m			85	HQTT				22								*22.95m:* CORE LOSS. 22.95 - 23.1m.
																23.10m: SILT, trace sand; light brown mottled orange. Very soft, wet, low plasticity. Silt, rapid dilatancy; sand, fine, pumiceous.
									23.5			F				*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.
			100	SPT		1/0 0/0 0/0 **N=0**		21	24.0							
			100	HQTT					24.5							*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: (NZTM2000)	5814995.96 mN 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
R.L.:	45.24m		DRILLED BY: Drillcore
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Walton Subgroup			100	HQTT				20	25.5		W	F				*25.00m:* 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.
			44	SPT		4/6 6/4 5/5 **N=20**						VSt				*25.40m:* PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments.
																25.50m: CORE LOSS. 25.50 - 25.75m.
									26.0							*25.75m:* PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments.
			100	HQTT				19	26.5			St				*26.40m:* Clayey SILT; light greenish grey. Stiff, wet, medium to high plasticity.
												MD				*26.60m:* SILT, minor sand. Medium dense, wet, dilatant - rapid. Sand, fine to medium.
Box 7, 23.5-27.0m									27.0			VSt				*26.90m:* Clayey SILT, trace sand; brown. Very stiff, wet, medium plasticity. Sand, fine.
																27.00m: CORE LOSS. 27.0 - 27.1m.
Box 8, 27.0-27.5m			77	SPT		4/3 5/5 5/5 **N=20**		18				MD				*27.10m:* Clayey SILT, minor gravel; brown. Very stiff, wet, medium plasticity. Gravel, fine to medium, sub-rounded to angular, brown. Gravel clasts.
																27.30m: SILT, minor sand. Medium dense, wet, dilatant - rapid. Sand, fine to medium.
									27.5							27.45m: Target depth
									28.0							
								17								
									28.5							
									29.0							
								16								
									29.5							

COMMENTS: Hole backfilled with bentonite

Hole Depth 27.45m

Scale 1:25

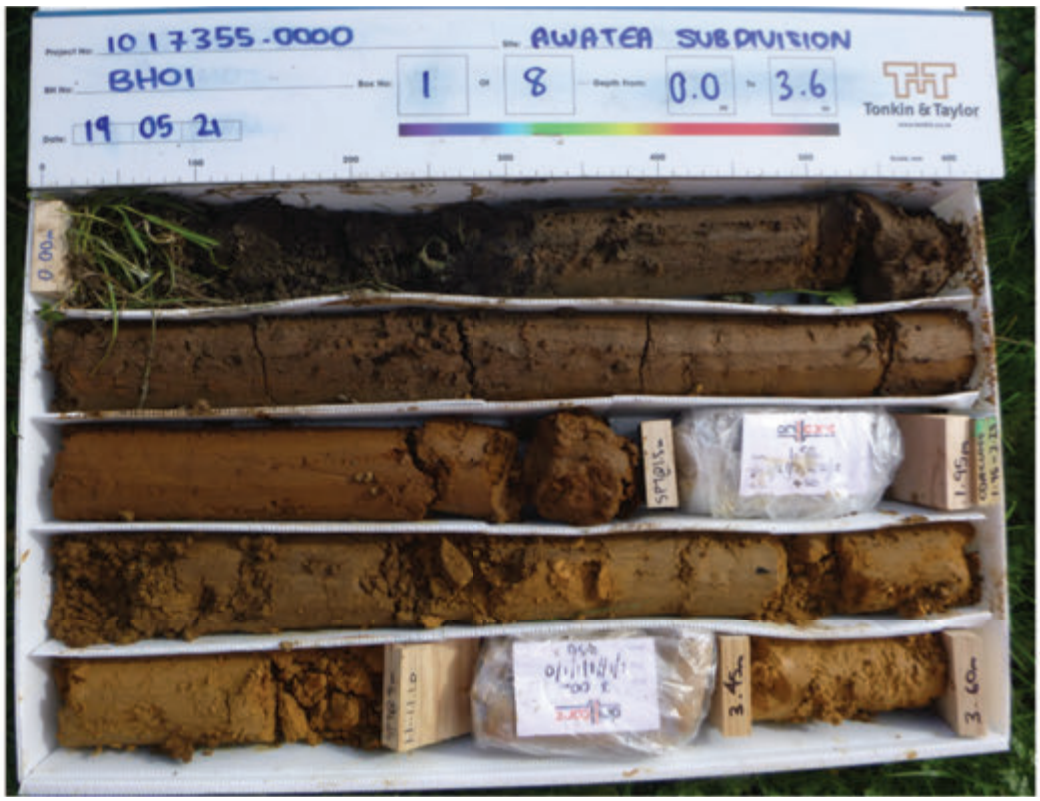
Rev.: A

CORE PHOTOS

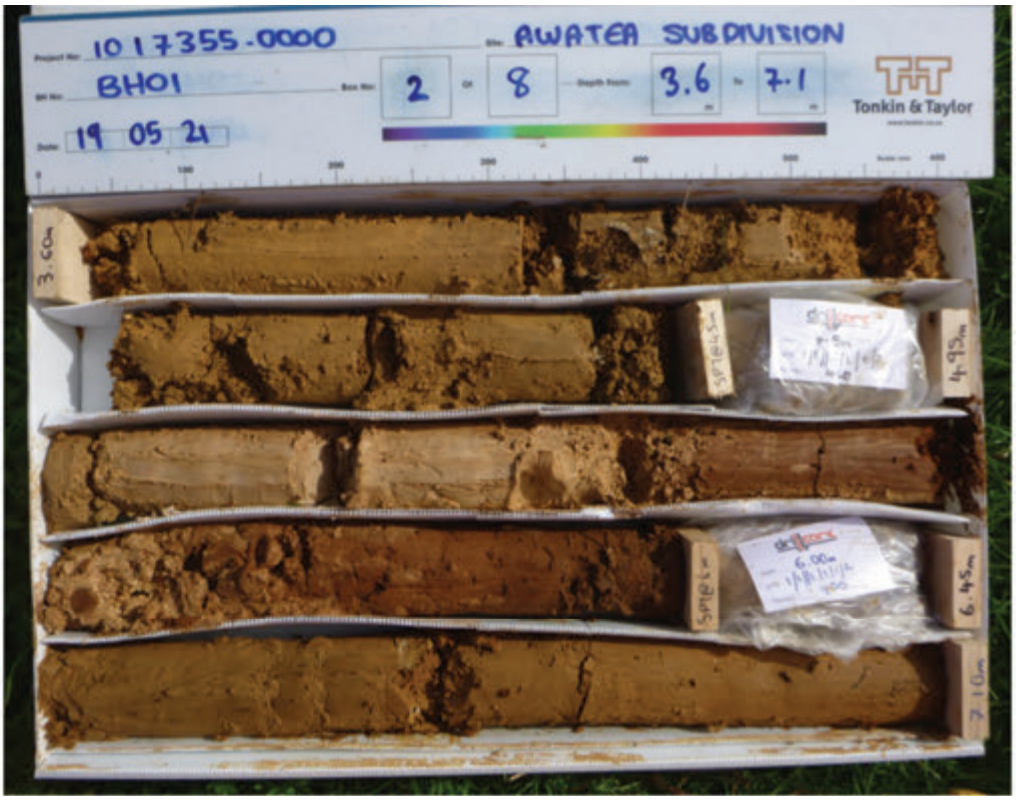
BOREHOLE No.: **BH101**

Hole Location: Southern hill

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



0.00-3.60m



3.60-7.10m

CORE PHOTOS

BOREHOLE No.: **BH101**

Hole Location: Southern hill

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

7.10-11.40m

11.40-16.30m

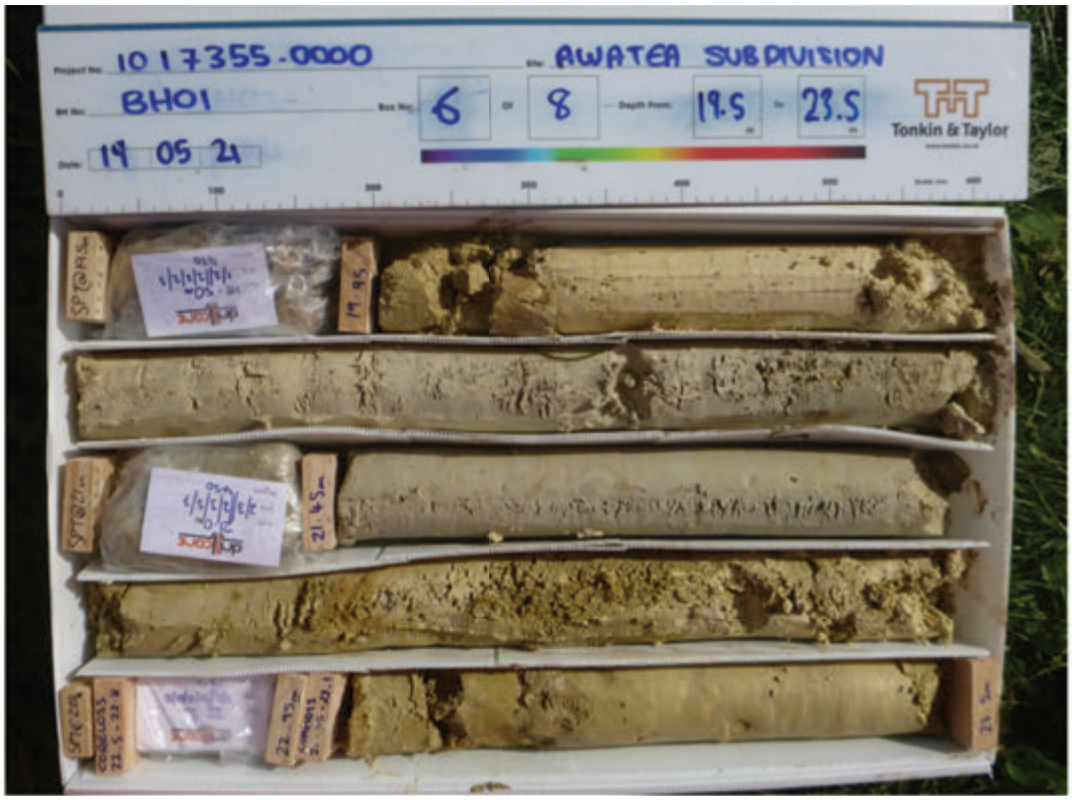
CORE PHOTOS

BOREHOLE No.: **BH101**

Hole Location: Southern hill

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

16.30-19.50m



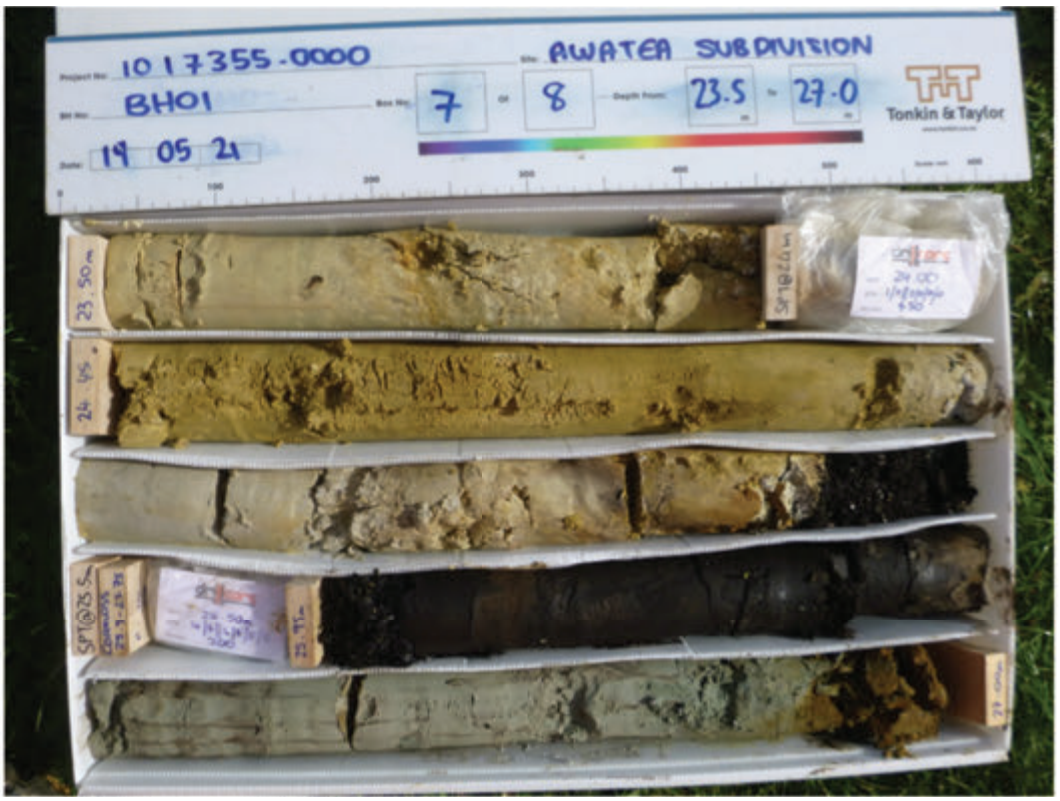
19.50-23.50m

CORE PHOTOS

BOREHOLE No.: **BH101**

Hole Location: Southern hill

PROJECT: Brymer Farms Subdivision		LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: (NZTM2000)	5814995.96 mN 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
R.L.:	45.24m		DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	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: (NZTM2000)	5815510.15 mN 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
R.L.:	26.99m		DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: CAND CHECKED: RWOT

GEOLOGICAL															ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
			16	HQTT					0.5		M-W	L				*0.00m:* SILT, minor organics and minor sand, trace gravel; dark brown. Loosely packed, moist to wet, dilatant - rapid. Sand, fine; gravel, fine, sub-rounded to sub-angular; organics, rootlets. Topsoil.
																0.10m: CORE LOSS. 0.1 - 1.5m.
			0	HQTT				26	1.0							
						● 95/17 kPa			1.5							*1.50m:* NOT LOGGED. Attempted push tube. No Recovery.
			0	PT												
						0/0 0/0 0/0 **N=0**		25	2.0							*2.00m:* CORE LOSS. 2.0 - 2.1m.
			77	SPT							S	VS				*2.10m:* PEAT (FIBROUS); dark brownish black. Very soft, saturated. Organics, wood fragments.
Piako Subgroup			100	HQTT					2.5		W	VL				*2.40m:* Sandy SILT; light greenish grey. Very loose, wet, dilatant - rapid. Sand, fine to coarse, well graded.
																2.60 - 2.90m: Minor clay, low plasticity.
																2.80 - 2.90m: Minor organics; light greenish grey. Medium plasticity. Organics, wood fragments.
								24	3.0			L				*2.90m:* SILT, trace organics; grey. Very loose, wet, dilatant - rapid.
			100	PT												*3.00m:* NOT LOGGED - Push tube.
			100	SPT		0/0 0/0 0/0 **N=0**			3.5			VS				*3.50m:* Silty CLAY, trace organics; grey. Very soft, wet, medium plasticity. Organics, wood fragments.
			100	HQTT				23	4.0							
						● 137/25 kPa			4.5			VSt				*4.50 - 4.90m:* Becomes very stiff.
			100	SPT		2/3 5/6 8/10 **N=29**										

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: 2 OF 4

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

CO-ORDINATES: (NZTM2000) 5815510.15 mN, 1795556.13 mE

R.L.: 26.99m

DATUM: NZVD2016

DRILL TYPE: Tractor Rig

DRILL METHOD: RC

DRILL FLUID: WATER

HOLE STARTED: 17/05/2021

HOLE FINISHED: 18/05/2021

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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Box 1, 0.0-5.5m			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								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**		21	6.0							
			100	HQTT					6.5							*6.60m:* Fine to coarse SAND, minor silt; light greenish grey. Medium dense to dense, wet. Sand, well graded.
Piako Subgroup			100	HQTT				20	7.0							*7.00m:* SILT, minor sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.
												VSt				*7.10m:* PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments.
												MD				*7.30m:* SILT, trace sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.
			66	SPT		7/11 11/11 11/11 **N=44**			7.5							*7.50m:* CORE LOSS. 7.5 - 7.65m.
								19				D				*7.65m:* SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.
			100	HQTT					8.0			VSt				*8.10m:* Clayey SILT, minor organics; dark brownish black. Very stiff, wet, low to medium plasticity. Organics, wood fragments. Amorphous.
Box 2, 5.5-8.8m									8.5							*8.50m:* PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Fine to coarse sand observed at top and bottom of layer. Brown in colour.
											M	D				*8.70m:* SILT, minor sand; light grey. Dense, moist, dilatant - rapid. Sand, fine.
			100	SPT		4/6 10/10 10/10 **N=40**		18	9.0		W					*9.00m:* SILT, some organics, minor sand; dark brownish black. Dense, wet, dilatant - rapid. Sand, fine to medium; organics, wood fragments. Amorphous.
												VSt				*9.30m:* PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments. F-C Sand observed at top and bottom of layer. Brown.
									9.5			D				*9.50m:* SILT, minor sand; light grey. Dense, wet, non-plastic. Silt, rapid dilatancy; sand, fine.
Hinuera Formation			100	HQTT		● 150/28 kPa					M	VSt				*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: (NZTM2000) 5815510.15 mN, 1795556.13 mE

R.L.: 26.99m

DATUM: NZVD2016

DRILL TYPE: Tractor Rig

DRILL METHOD: RC

DRILL FLUID: WATER

HOLE STARTED: 17/05/2021

HOLE FINISHED: 18/05/2021

DRILLED BY: Drillcore

LOGGED BY: CAND | CHECKED: RWOT

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
				100	HQTT					10.5		W	D				*10.00m:* SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.
													VSt				*10.40m:* Clayey SILT; light grey. Very stiff, wet, medium plasticity.
				100	SPT		1/5 4/6 5/7 **N=22**		16	11.0			D				*10.50m:* Sandy SILT; light grey. Dense, wet, dilatant - rapid. Sand, fine. *11.10 - 11.50m:* Minor sand, fine.
				100	HQTT					11.5			VSt				*11.50m:* SILT, some clay; light grey. Very stiff, wet, medium plasticity.
Hinuera Formation	Box 3, 8.8-12.5m			100	SPT		● 195/31 kPa 2/3 3/4 6/6 **N=19**		15	12.0							
										12.5							*12.45m:* CORE LOSS. 12.45 - 12.70m.
				76	HQTT				14	13.0			MD				*12.70m:* Fine to coarse SAND, minor silt. Medium dense, wet. Sand, well graded.
				100	SPT		2/1 1/3 4/6 **N=14**			13.5							
				100	HQTT				13	14.0							*13.95m:* Silty fine to coarse SAND. Medium dense, wet. Sand, well graded. *14.20 - 14.50m:* Sand grades to fine. Poorly graded.
Walton Subgroup										14.5			St				*14.50m:* Clayey SILT; light grey. Stiff, wet, medium plasticity. *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

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 4 OF 4

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 HOLE FINISHED: 18/05/2021
R.L.:	26.99m	DRILL METHOD: RC	DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: CAND CHECKED: RWOT

GEOLOGICAL														ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
			100	SPT		2/4 6/5 5/7 **N=23**			15.5		W	VSt-H				*15.00m:* Clayey SILT, minor organics; greyish black. Very stiff to hard, wet, low to medium plasticity. Organics, wood fragments. Amorphous.
Box 4, 12.5-16.2m			100	HQTT				11	16.0			MD				*15.90m:* Fine to coarse SAND, minor silt; light grey. Medium dense, wet. Sand, well graded.
Walton Subgroup			0	SPT		5/6 8/9 10/10 **N=37**			16.5							*16.50m:* CORE LOSS. 16.5 - 16.95m.
								10	17.0							*16.95m:* CORE LOSS. 16.95 - 17.15m.
			80	HQTT								D				*17.15m:* Fine to coarse SAND, trace gravel; greenish grey. Dense, wet. Sand, well graded; gravel, fine, pumiceous. Weakly cemented.
								9	17.5							
Box 5, 16.2-18.5m			22	SPT		10/18 15/15 15/5 **N>=50**			18.0							*18.00m:* CORE LOSS. 18.0 - 18.35m.
												VD				*18.35m:* Fine to coarse SAND, trace gravel; greenish grey. Very dense, wet. Sand, well graded; gravel, fine, pumiceous. Weakly cemented.
									18.5							18.45m: Target depth
								8	19.0							
									19.5							

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

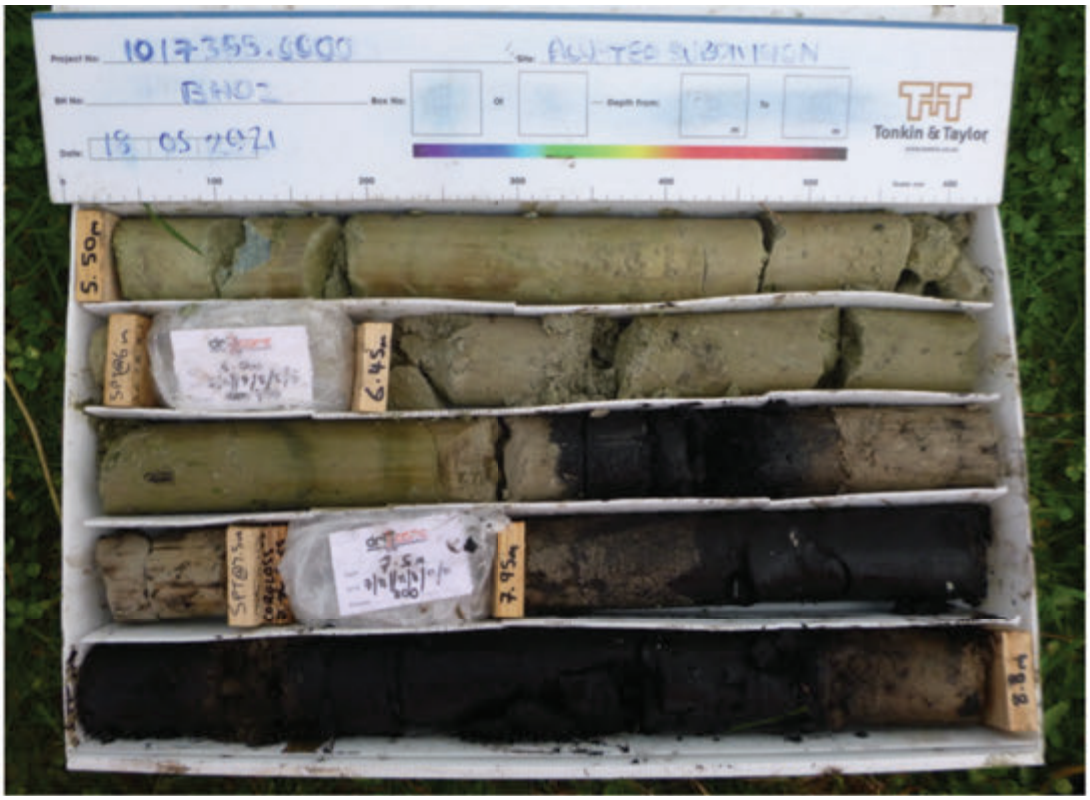
CORE PHOTOS

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

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
		DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
R.L.:	26.99m		DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: CAND CHECKED: RWOT

0.00-5.50m



5.50-8.80m

CORE PHOTOS

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

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
		DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
R.L.:	26.99m		DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: CAND CHECKED: RWOT

8.80-12.45m

12.45-16.20m

CORE PHOTOS

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

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
		DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
R.L.:	26.99m		DRILLED BY: Drillcore
DATUM:	NZVD2016	DRILL FLUID: WATER	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: (NZTM2000)	5816337.35 mN 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021 HOLE FINISHED: 19/05/2021
R.L.:	30.74m	DRILL METHOD: RC	DRILLED BY: Drillcore
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Colluvium Deposits			100 HQTT					30	0.5	TS	M	F				*0.00m:* Clayey SILT, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets.
																0.30m: Clayey SILT, minor sand, trace gravel; brown. Firm, moist, medium plasticity. Sand, fine to coarse; gravel, fine.
			100 HQTT			● 45/17 kPa		29	1.0							*0.70m:* Silty CLAY; brown mottled grey. Firm, moist, high plasticity.
																0.80 - 1.50m: Grades to low plasticity, some sand. Sand is fine to coarse.
									1.5							*1.40 - 1.50m:* Observed as minor clay, wet, rapid dilatancy. Grades to very soft.
			60 PT													*1.50m:* Pushtube. Material observed as Silty CLAY as above.
									2.0							*1.80m:* CORE LOSS. 1.8m - 2.0m.
			100 SPT			0/0 0/0 0/0 **N=0**		28			W	VS				*2.00m:* Clayey SILT, minor sand; grey. Very soft, wet, medium plasticity. Sand, fine to medium.
			100 HQTT						2.5							*2.60 - 2.80m:* Grades to greenish grey.
Box 1, 0.0-3.0m												F				*2.80m:* Clayey SILT, trace sand; greenish grey. Firm, wet, low to medium plasticity. Sand, fine to coarse.
			100 SPT			● 36/3 kPa 1/1 0/1 1/1 **N=3**			3.0							
								27	3.5							
			100 HQTT								M					*3.80m:* Silty CLAY; greenish grey. Firm, moist, medium to high plasticity.
									4.0							
			100 SPT			● 86/25 kPa 1/0 1/0 1/0 **N=2**		26	4.5			St				*4.50 - 5.00m:* Becomes stiff.

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: (NZTM2000)	5816337.35 mN 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021 HOLE FINISHED: 19/05/2021
R.L.:	30.74m	DRILL METHOD: RC	DRILLED BY: Drillcore
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Piako Subgroup Box 2, 3.0-6.9m			100	HQTT				25	5.5		W	VL				*5.00m:* Sandy SILT; light greenish grey. Very loose, wet. Silt, rapid dilatancy; sand, fine to medium.
			100	SPT		1/1 3/4 3/5 **N=15**			6.0			MD				*6.00m:* Becomes medium dense.
			100	HQTT				24	6.5							*6.20m:* Fine to coarse SAND, trace silt; light greenish grey. Medium dense, wet. Sand, well graded.
									7.0							
Hinuera Formation			100	SPT		3/6 8/8 14/15 **N=45**		23	7.5			D				*7.20m:* Sandy SILT; greenish grey. Dense, wet. Silt, rapid dilatancy; sand, fine to coarse, well graded.
			100	HQTT					8.0							*8.00m:* Sandy fine GRAVEL; light greenish grey. Dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse.
								22	8.5							*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.
																9.10m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
									9.5							*9.45m:* CORE LOSS. 9.45m - 9.7m.
								21								*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: (NZTM2000)	5816337.35 mN 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
R.L.:	30.74m		DRILLED BY: Drillcore
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)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Box 3, 6.9-11.0m			76	HQTT					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		4/7 8/8 8/8 **N=32**		20				D				*10.50 - 10.90m:* Becomes Dense.
			76	HQTT					11.0			VSt				*10.90m:* SILT, some clay; green. Very stiff, wet, low plasticity. *10.95m:* CORE LOSS. 10.95m - 11.2m. *11.20m:* SILT, some clay; green. Very stiff, wet, low plasticity.
									11.5		M	D				*11.40m:* SILT; light grey. Dense, moist, dilatant - rapid. Weakly cemented.
			100	SPT		1/2 6/6 7/7 **N=26**		19	12.0			MD				*12.00m:* Becomes medium dense.
Hinuera Formation											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. *12.65m:* Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
			80	HQTT				18	12.5							*12.85m:* Fine to coarse SAND, some gravel; brown. Medium dense, wet. Gravel, fine to medium, sub-rounded to sub-angular. Pumiceous.
									13.0							
			100	SPT		4/4 6/7 8/10 **N=31**		17	13.5			D				*13.50 - 13.95m:* Becomes dense.
									14.0							*13.95m:* CORE LOSS. 13.95m - 15.00m.
Box 4, 11.0-15.0m			0	HQTT				16	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

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

0.00-3.00m

3.00-6.90m

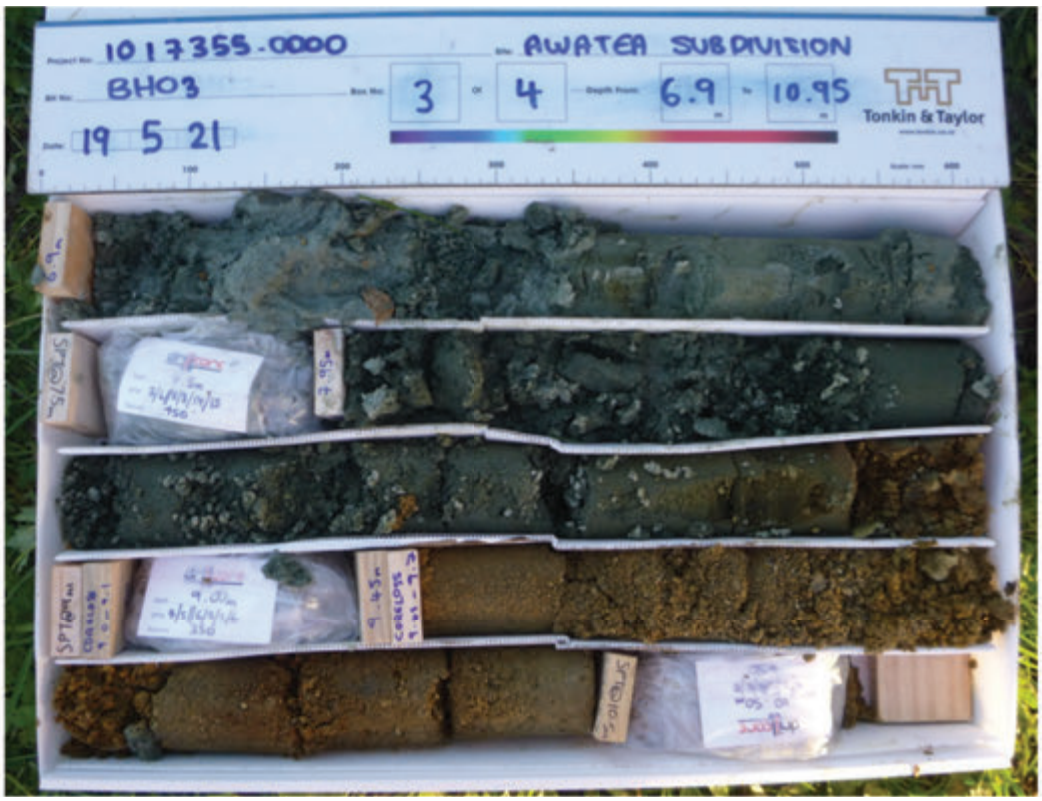
Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH103**

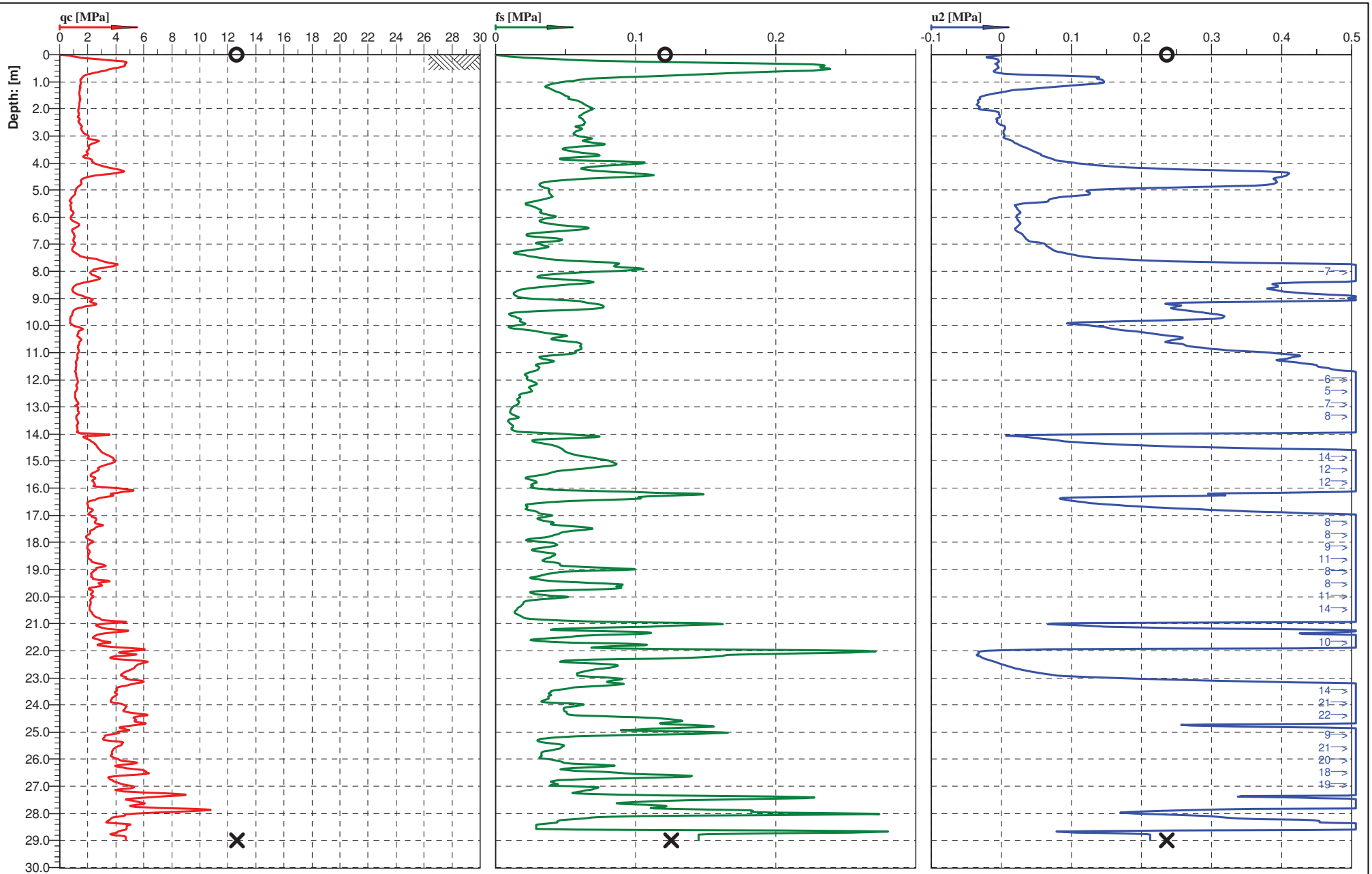
Hole Location: Northern end of site

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



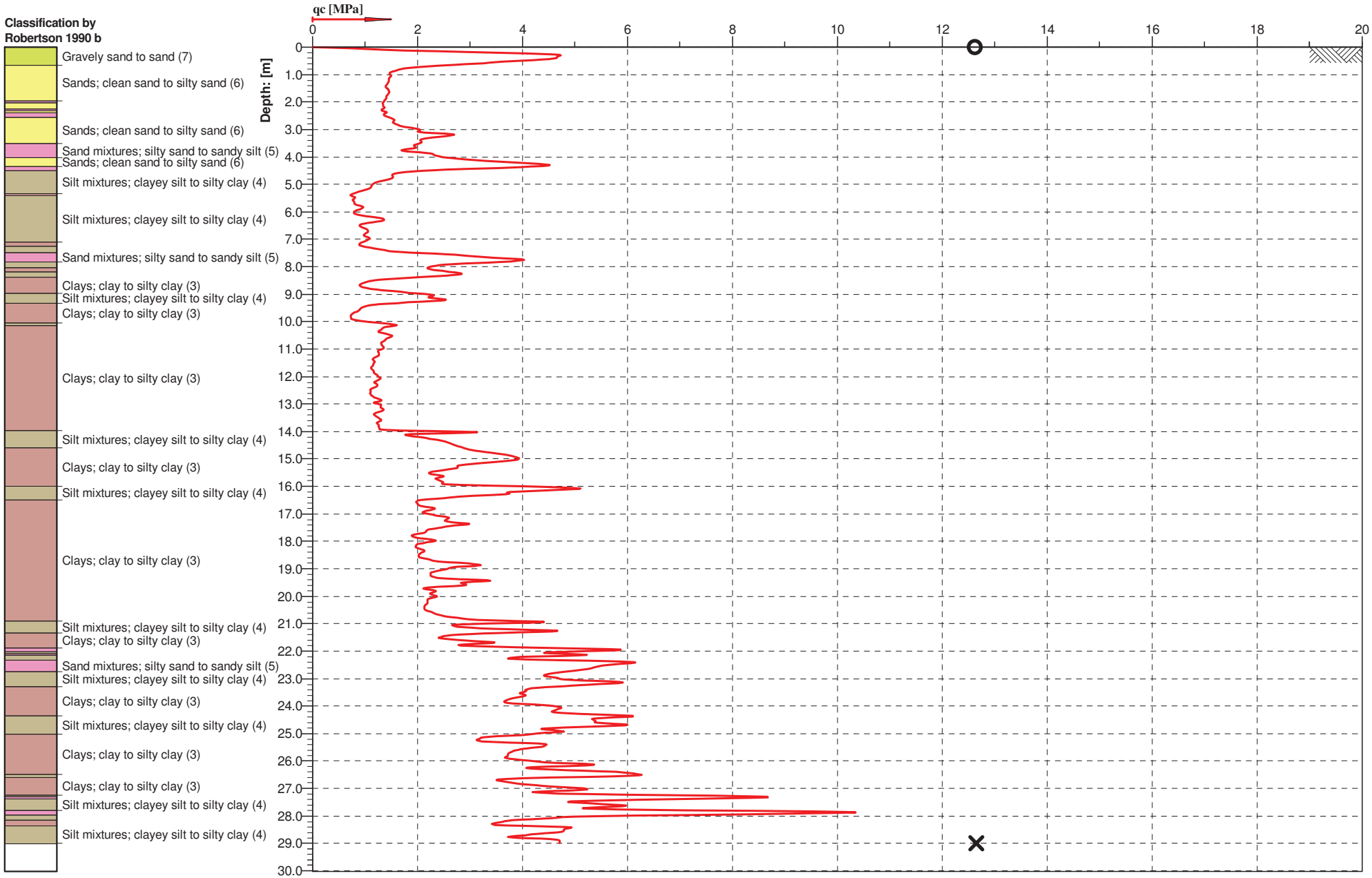
6.90-10.95m

10.95-15.00m



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

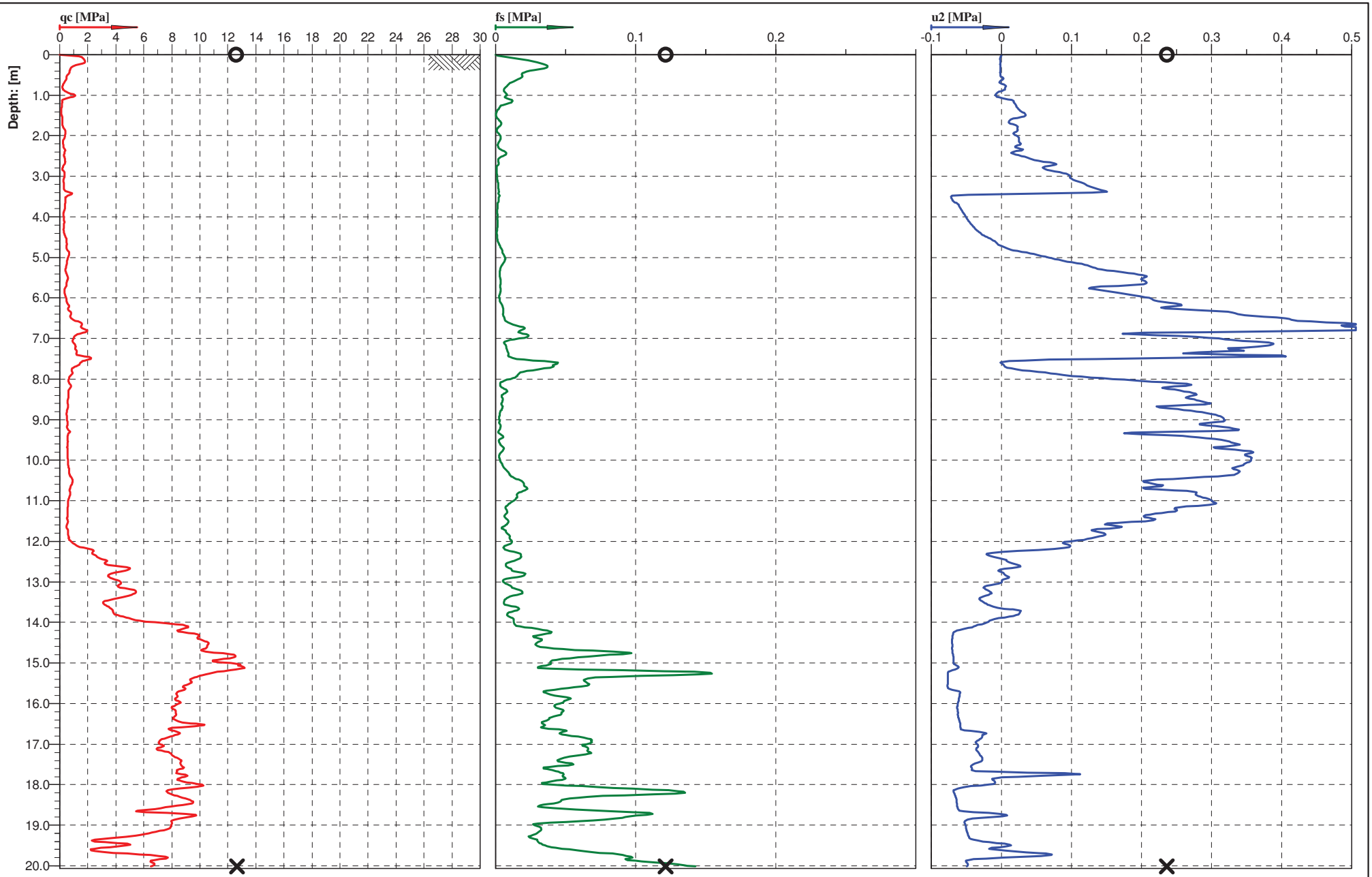
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT101
Project ID: E1795111 N5814959	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 190
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Tilt out at 27m. Lost signal at 29m. hole dipped and collapsed back to 0.25m.		File: CPT101 .cpt	



u2

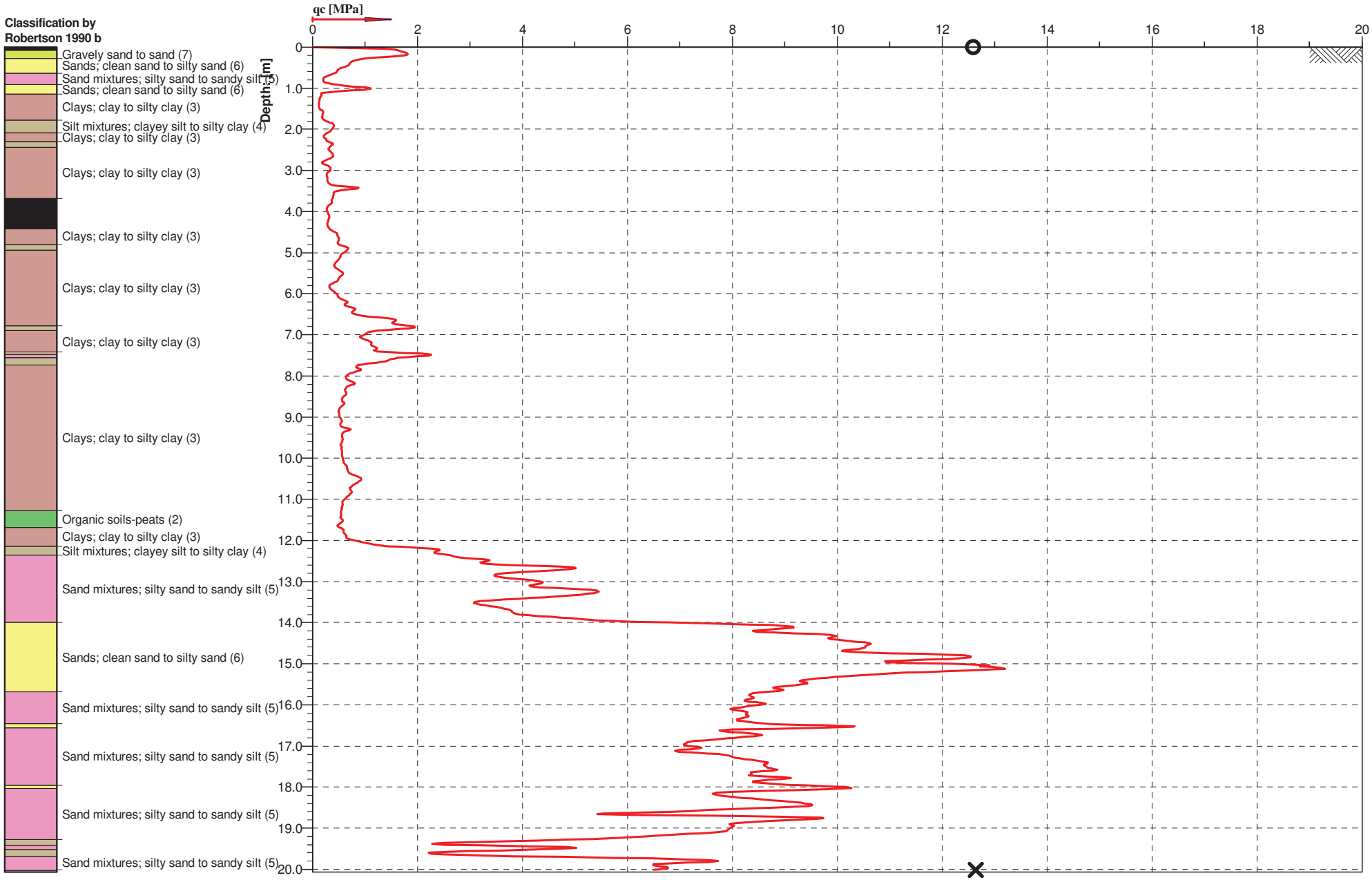
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT101
Project ID: E1795111 N5814959	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 190
Project: 584 WHATAWHATA ROAD		Page: 2/2	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

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: 1/2	Fig.:
Target depth 20m. Hole dipped and collapsed back to 0.35m.		File: CPT102 .cpt	

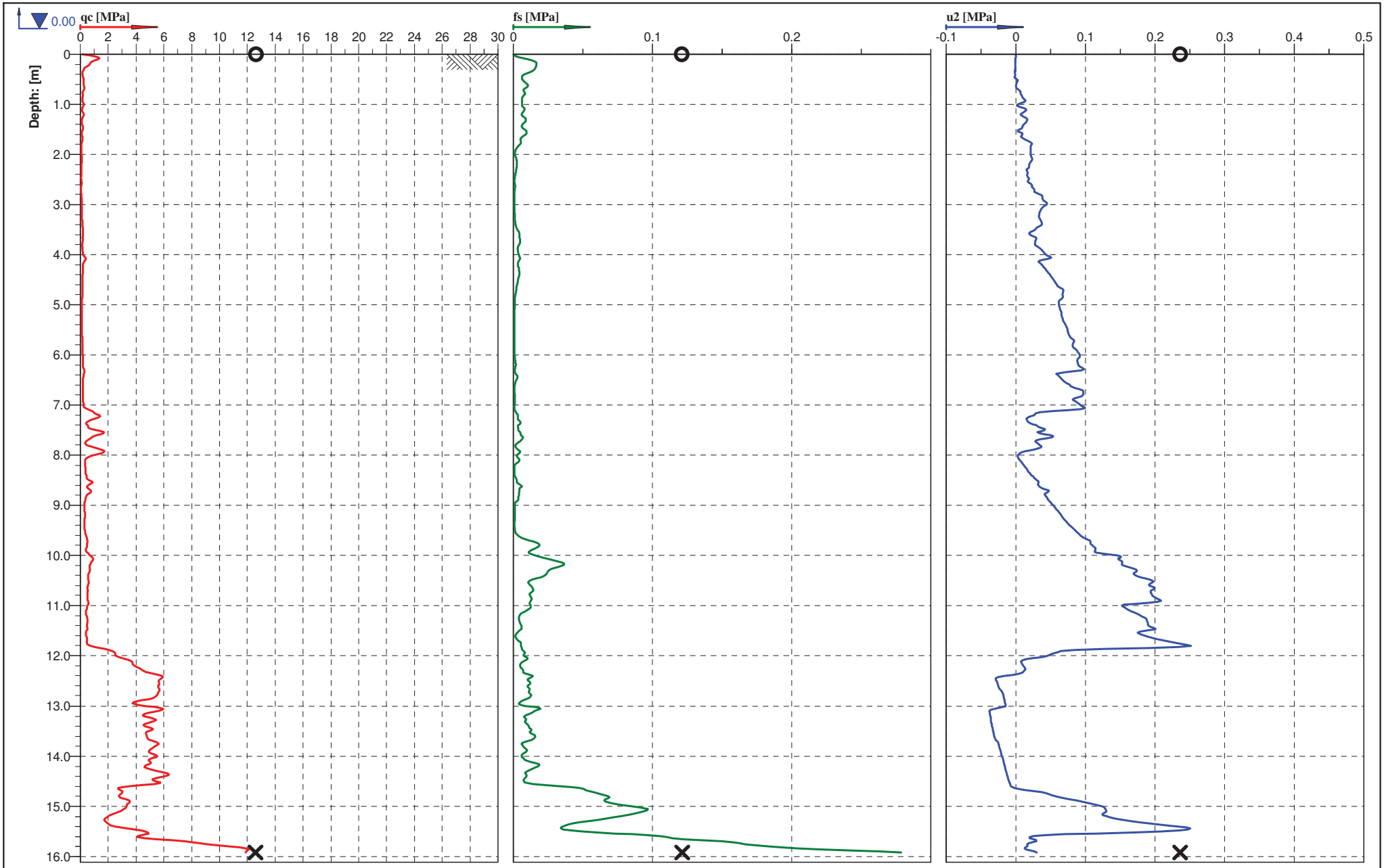


drillcore

u2

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

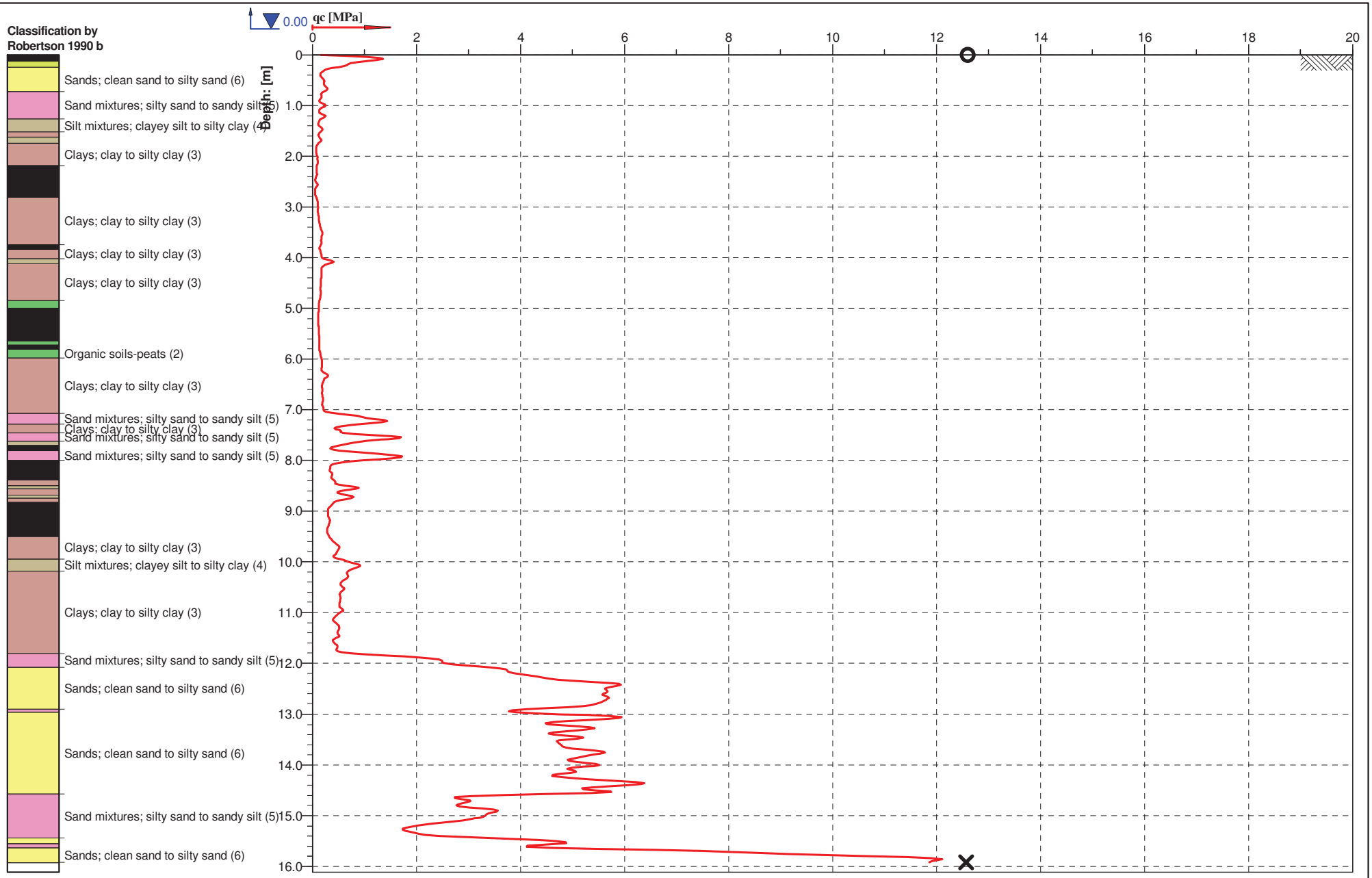
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT102
Project ID: E1795217 N5814969	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 127
Project: 584 WHATAWHATA ROAD		Page: 2/2	Fig.:
Target depth 20m. Hole dipped and collapsed back to 0.35m.		File: CPT102 .cpt	



u2

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: 1/2	Fig.:
Target depth 20m. Refused 15.92m. Water level at grounbd level due to Artesian.		File: CPT103 .cpt	

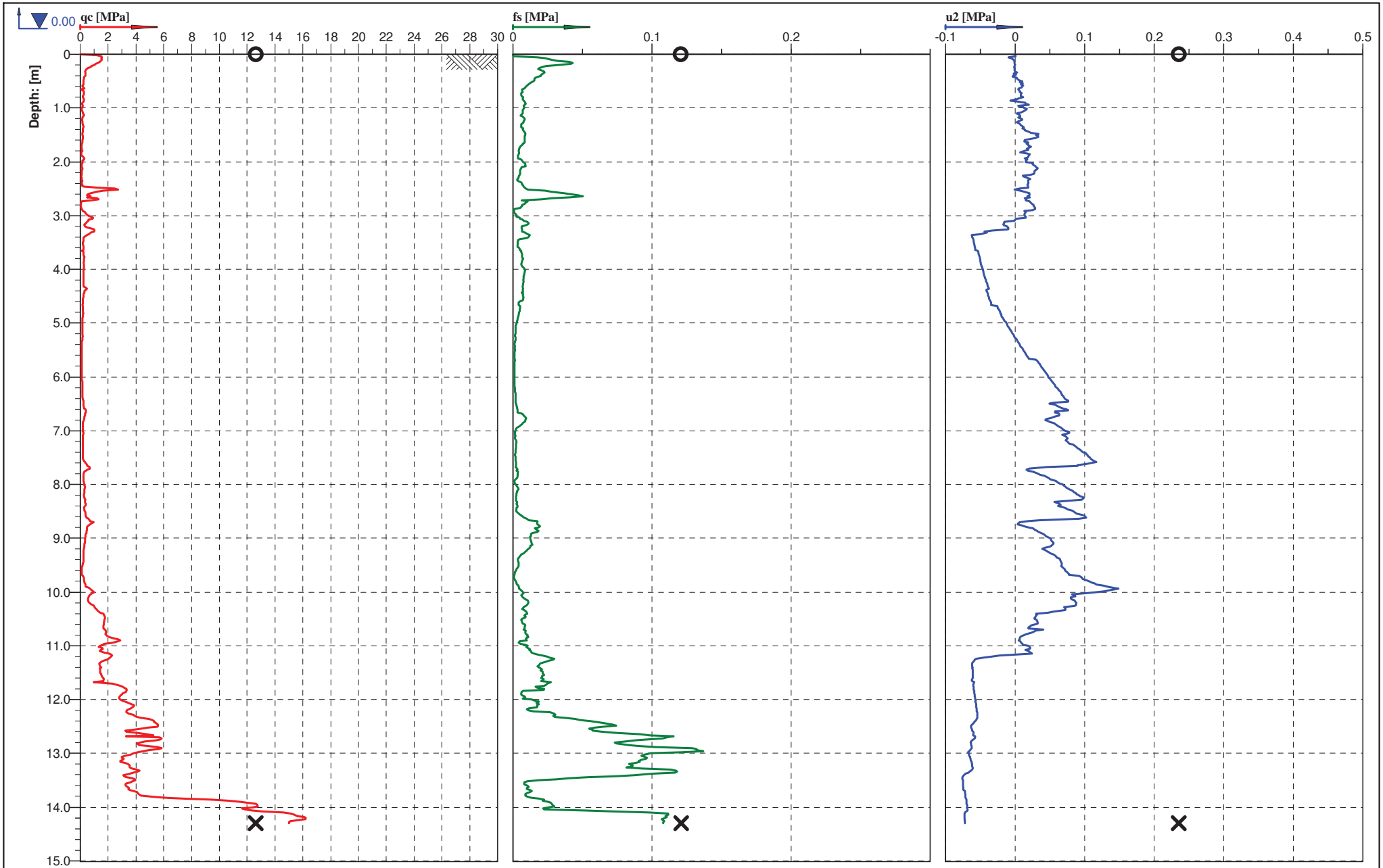


drillcore

u2

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

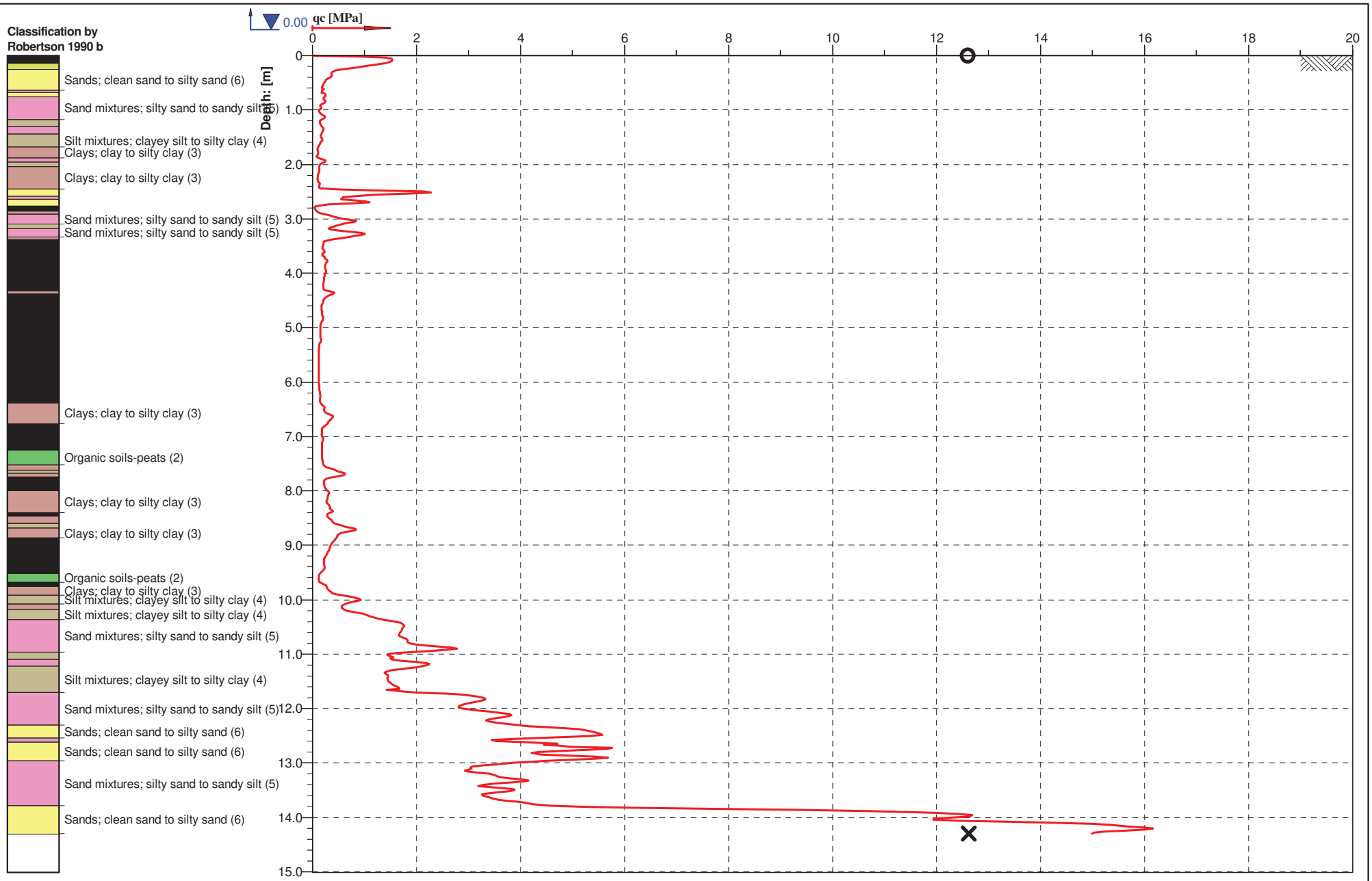
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT103
Project ID: E1795134 N5815377	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 102
Project: 584 WHATAWHATA ROAD		Page: 2/2	Fig.:
Target depth 20m. Refused 15.92m. Water level at grounbd level due to Artesian.		File: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



u2

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

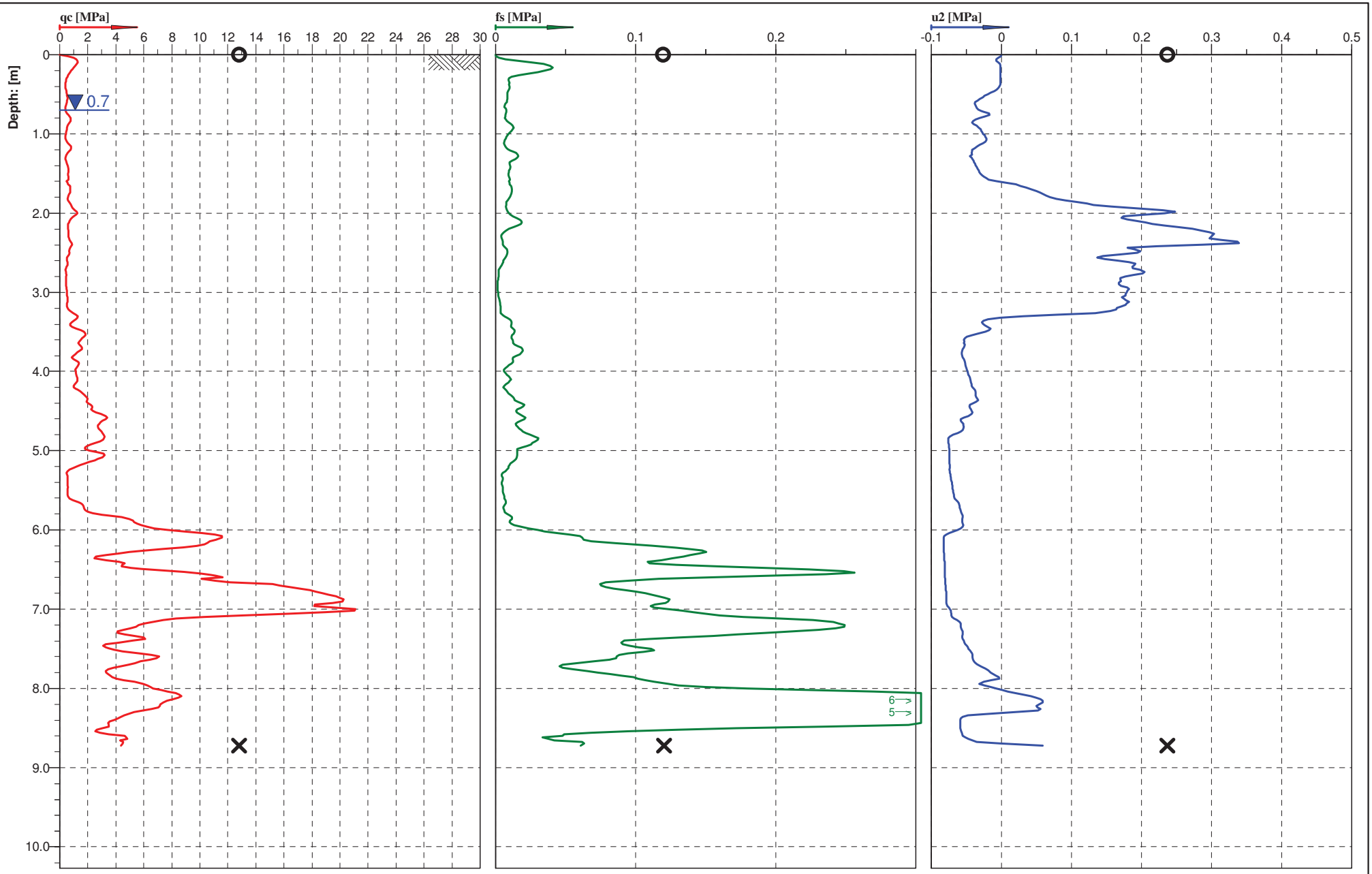
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT104
Project ID: E1795312 N5815433	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 95
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 14.30m. Water at Ground Level due to Artesian.		File: CPT104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



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	

u2

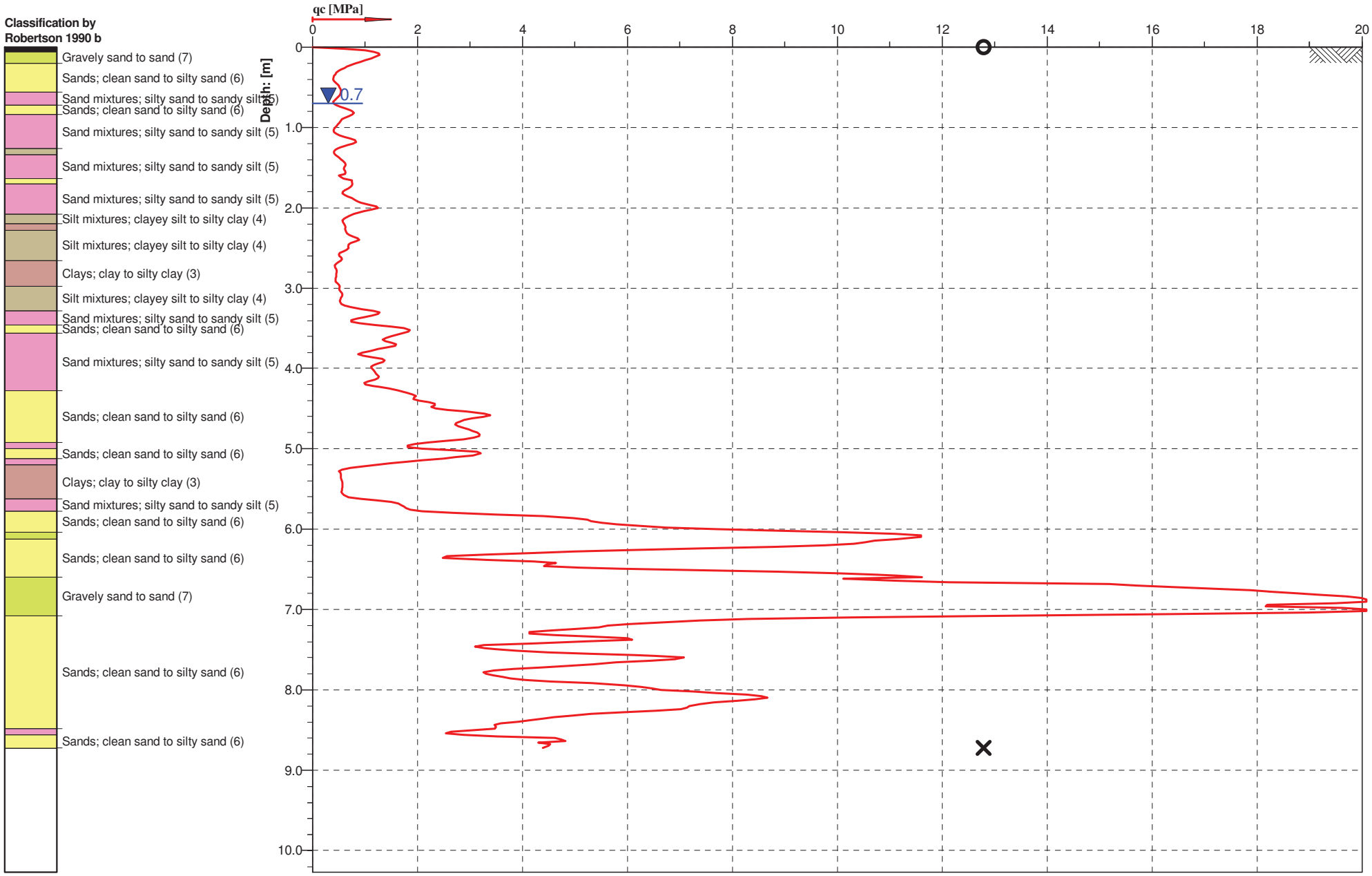
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150



u2

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	

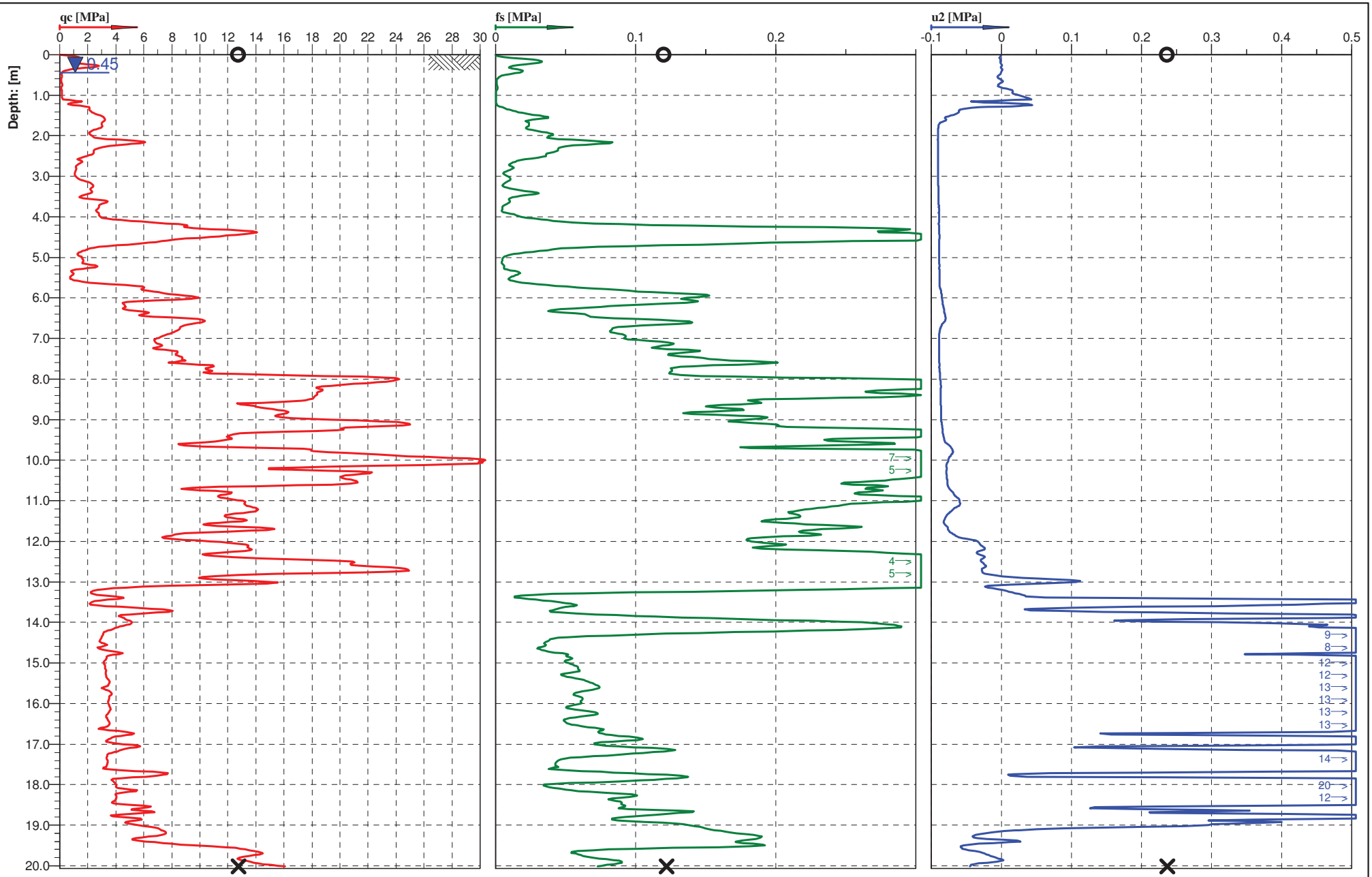


drillcore

u2

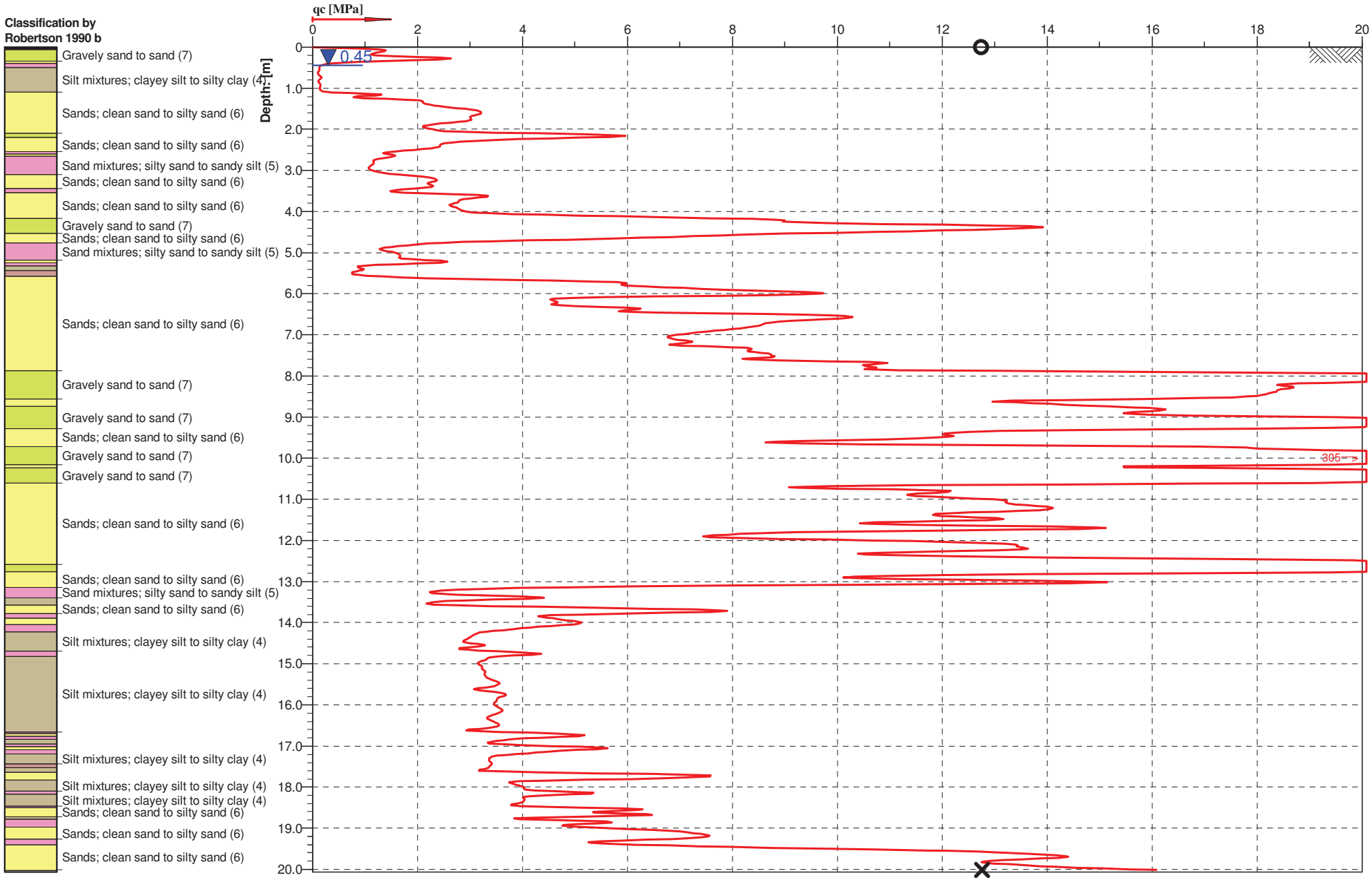
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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

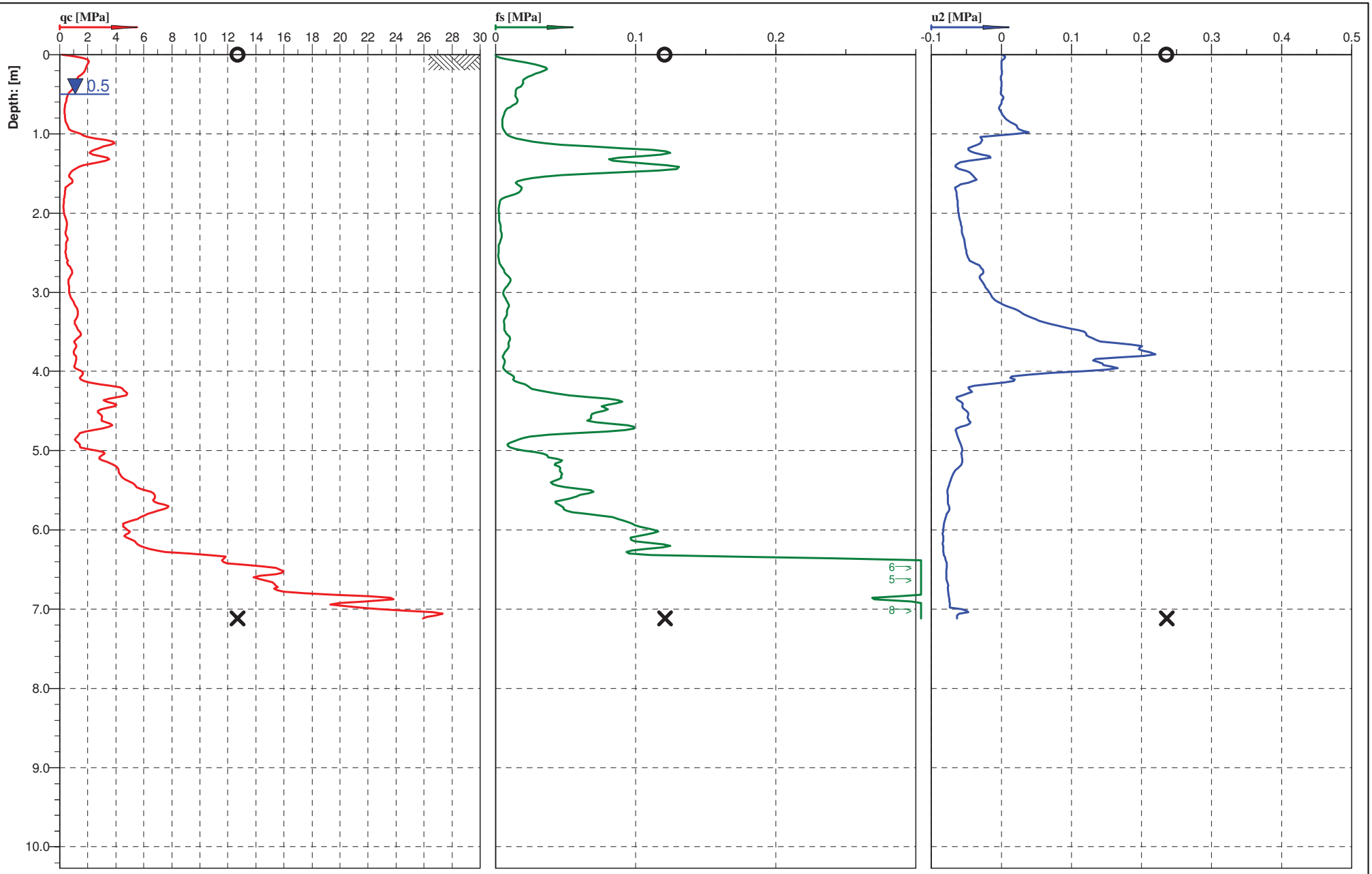
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT106
Project ID: E1795345 N5815691	Client: Tonkin & Taylor	Date: 18/05/2021	Scale: 1 : 127
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m.		File: CPT106 .cpt	



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	

u2

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

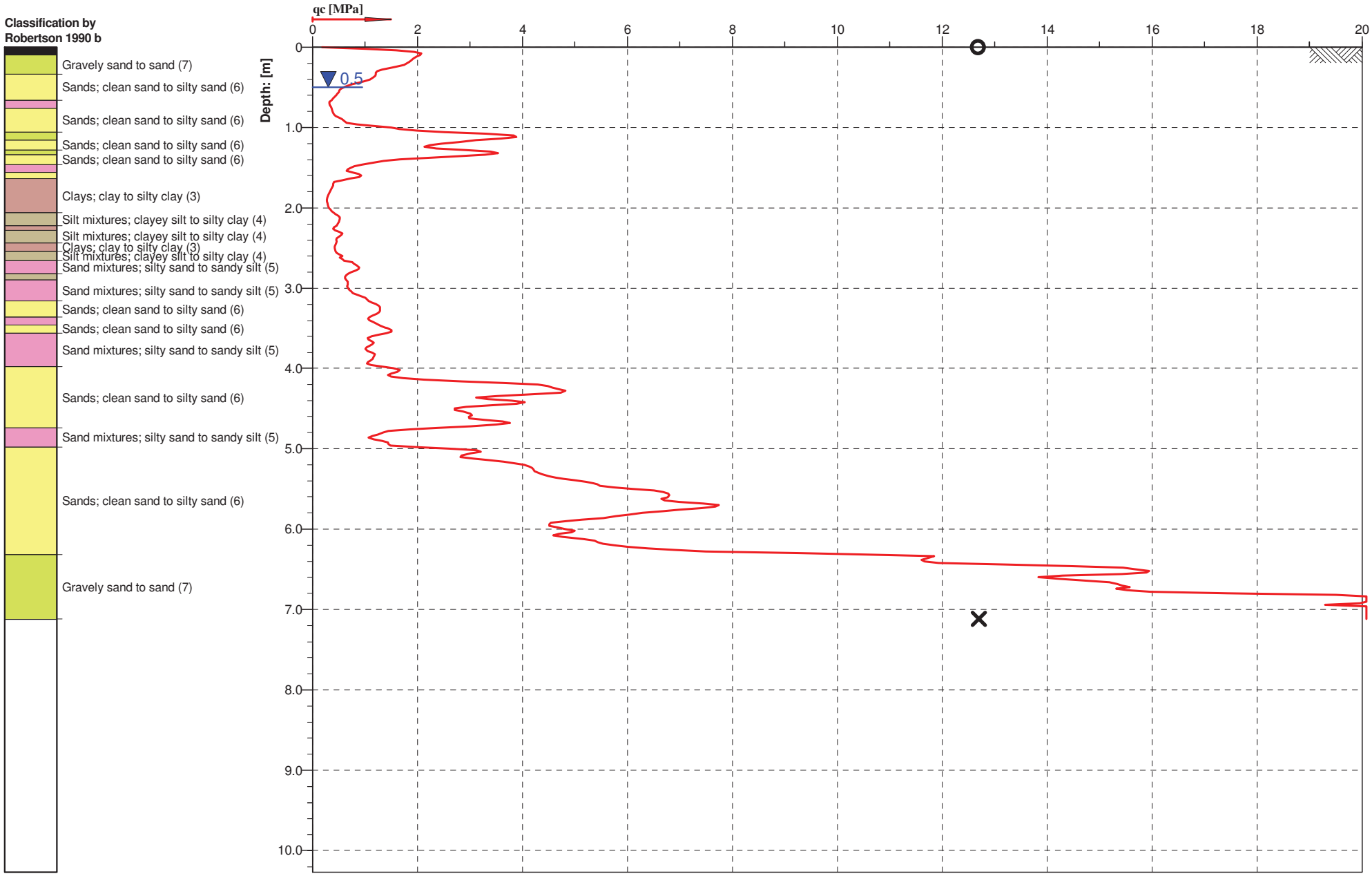


drillcore

u2

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

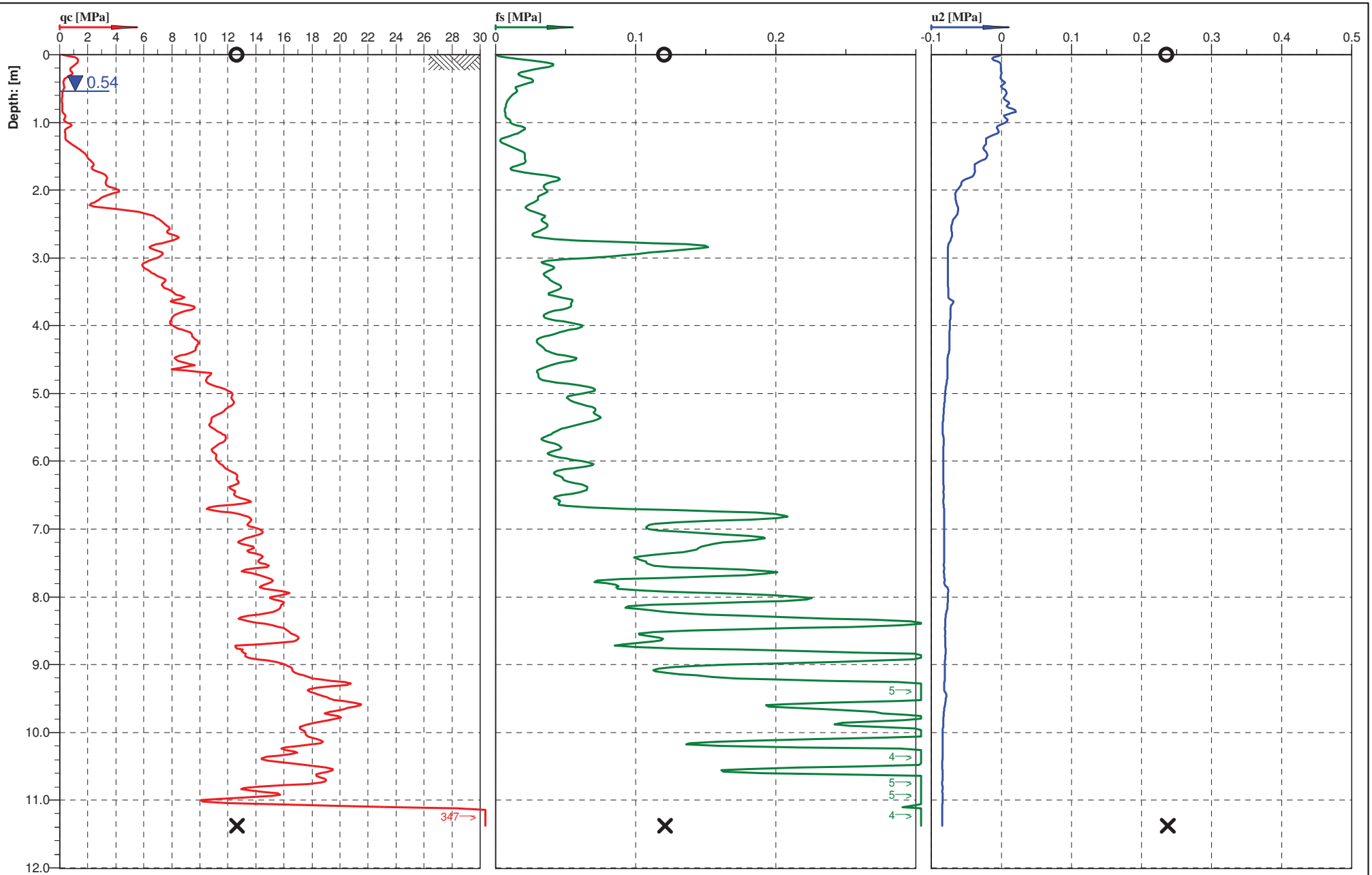
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT107
Project ID: E1795800 N5815725	Client: Tonkin & Taylor	Date: 18/05/2021	Scale: 1 : 65
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 7.12m.		File: CPT107 .cpt	



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	

u2

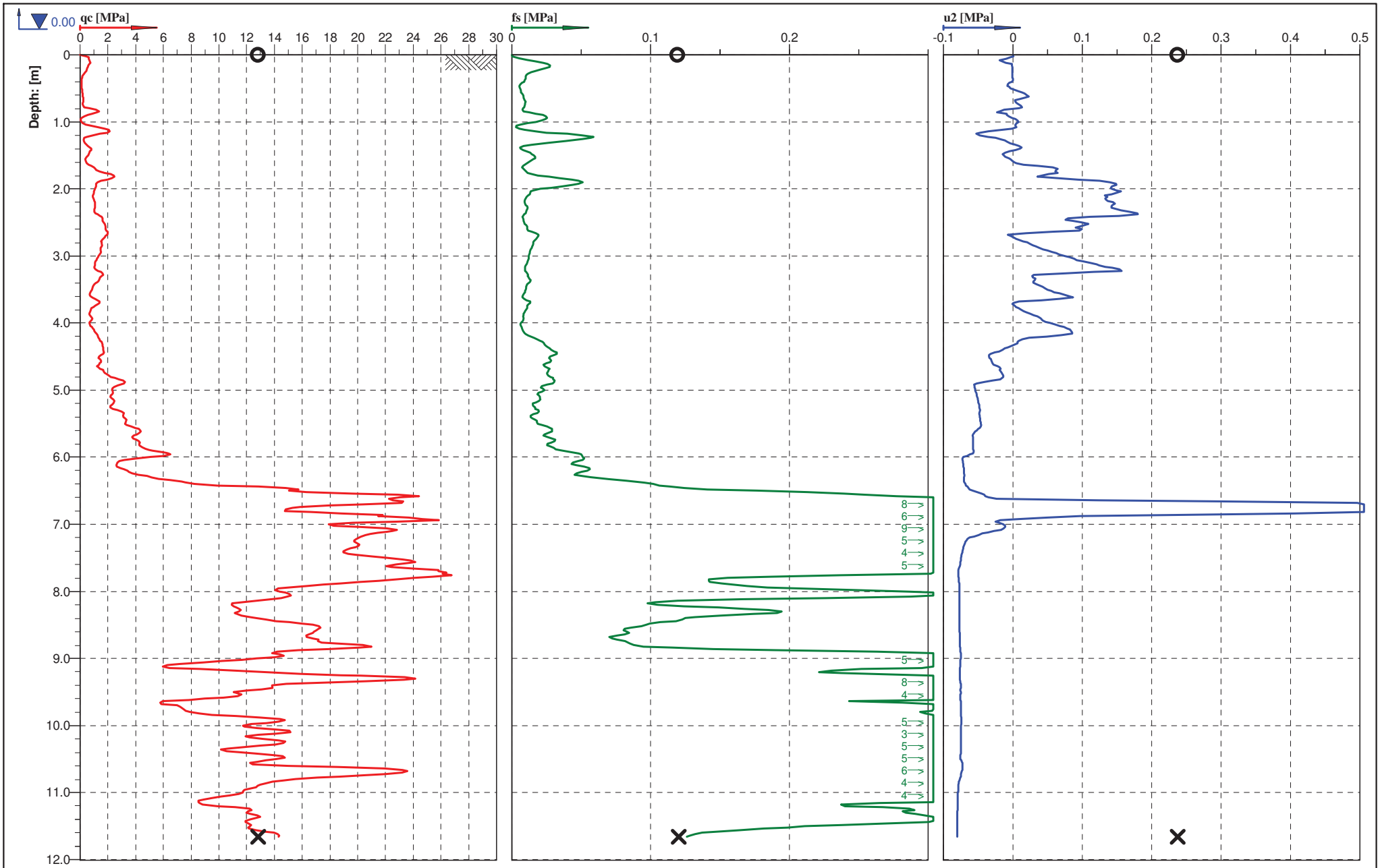
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150



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	

u2

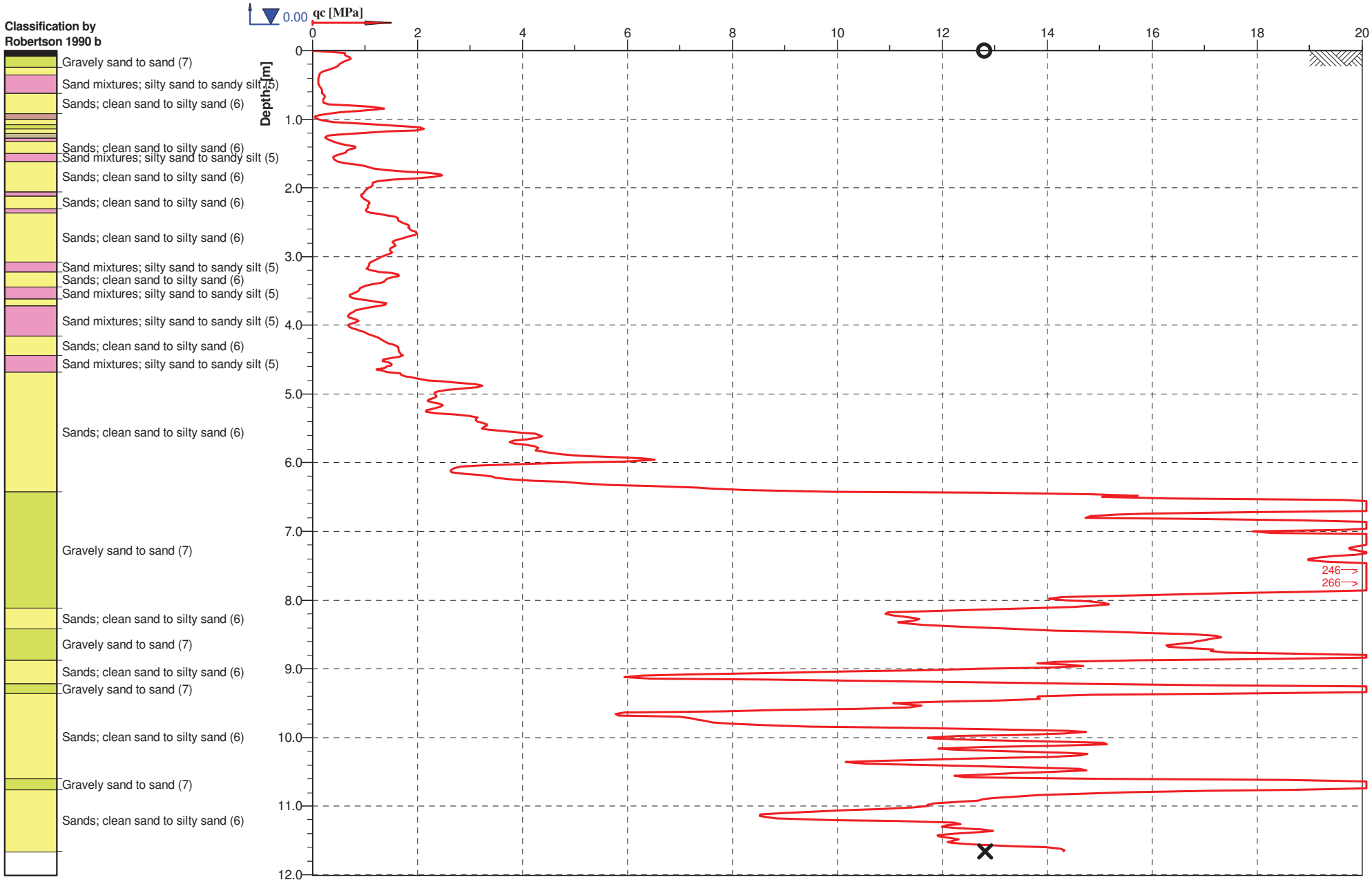
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150



u2

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

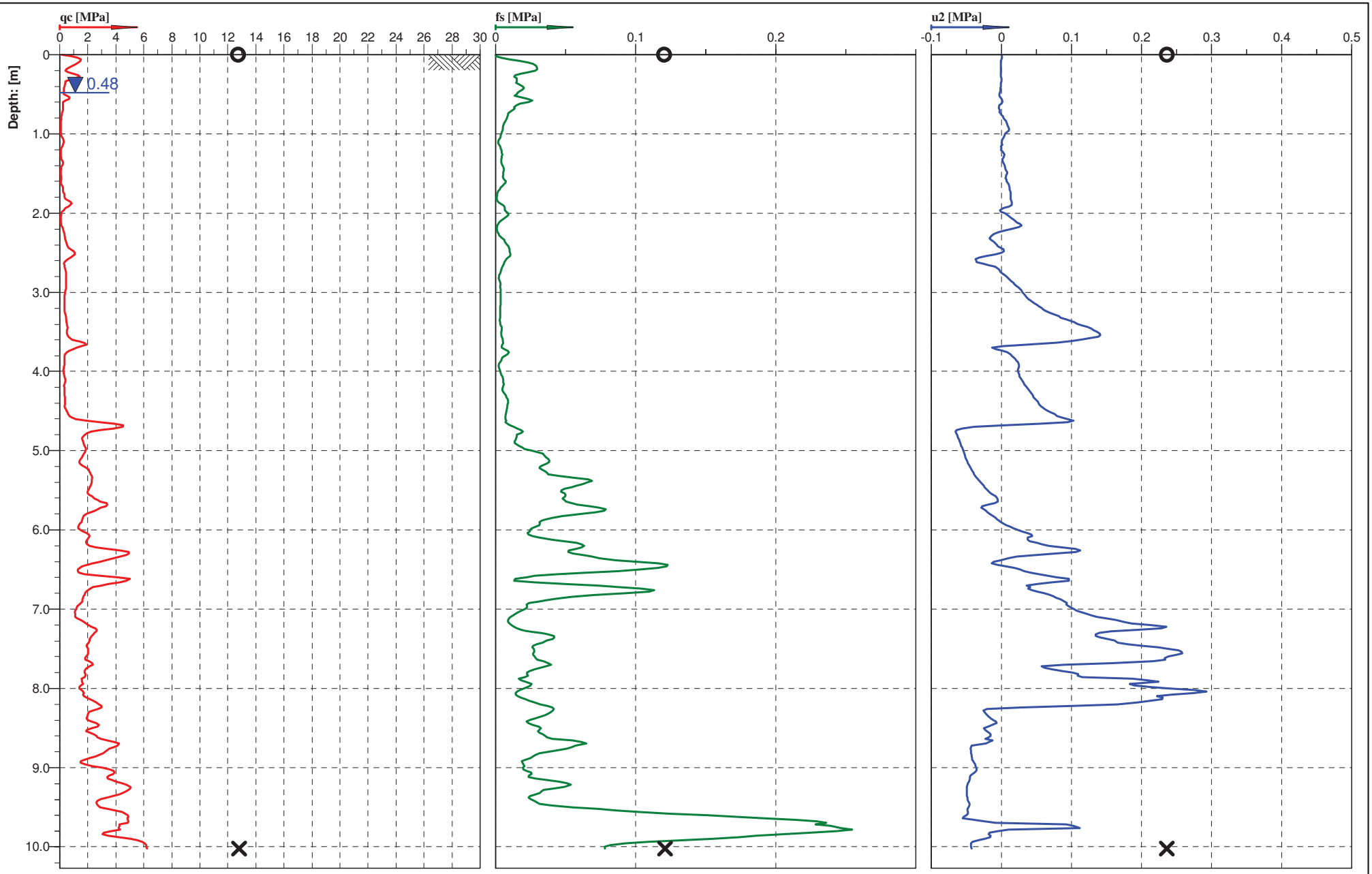
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT109
Project ID: E1796127 N5815399	Client: Tonkin & Taylor	Date: 18/05/2021	Scale: 1 : 76
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 11.66m.		File: CPT109 .cpt	



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	

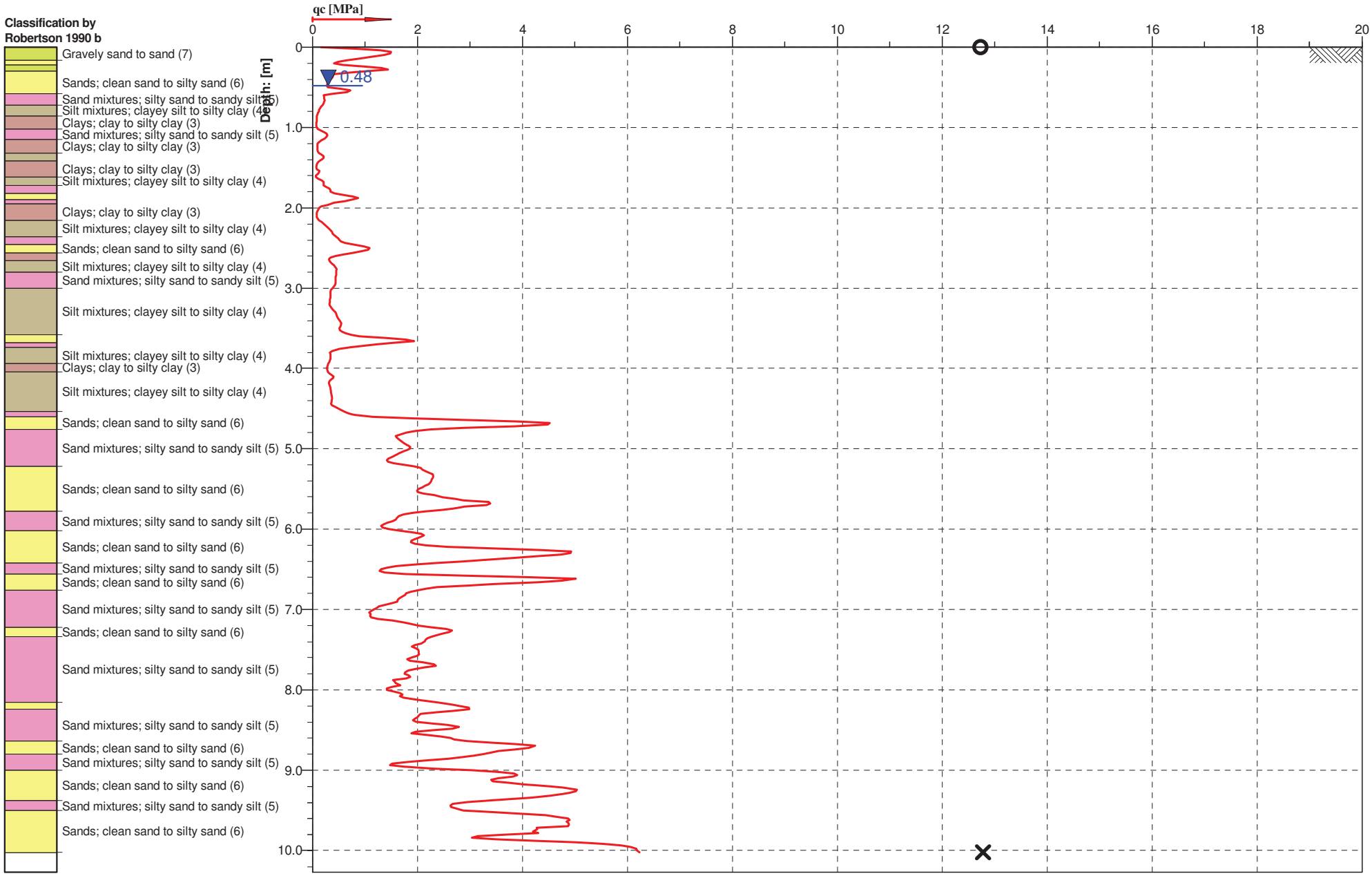
u2

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

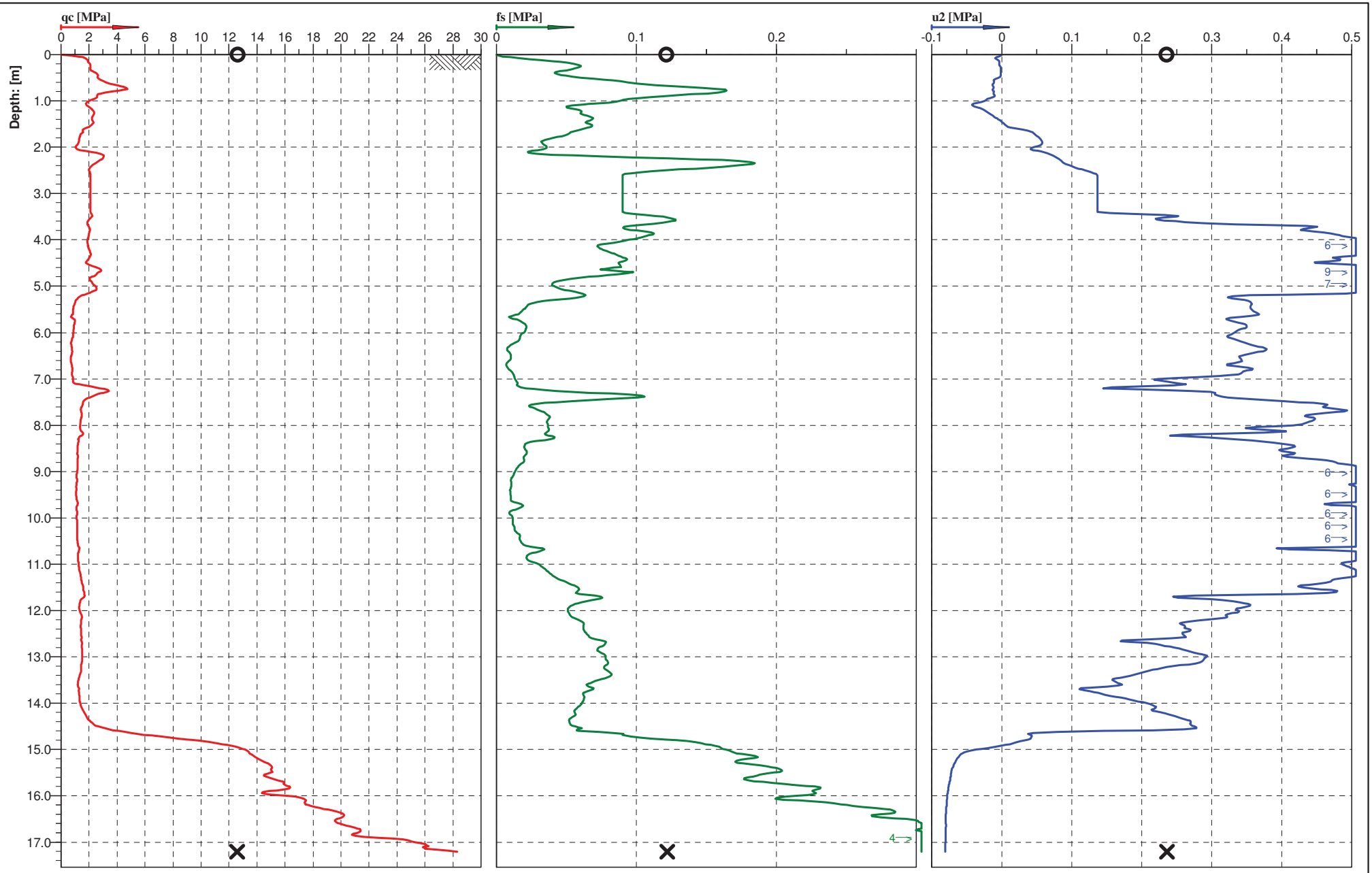


Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT110
Project ID: E1795560 N5815509	Client: Tonkin & Taylor	Date: 18/05/2021	Scale: 1 : 65
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 10.02m. Poor Anchoring.		File: CPT110 .cpt	

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: 2/2	Fig.:
Target depth 20m. Refused 10.02m. Poor Anchoring.		File: CPT110 .cpt	

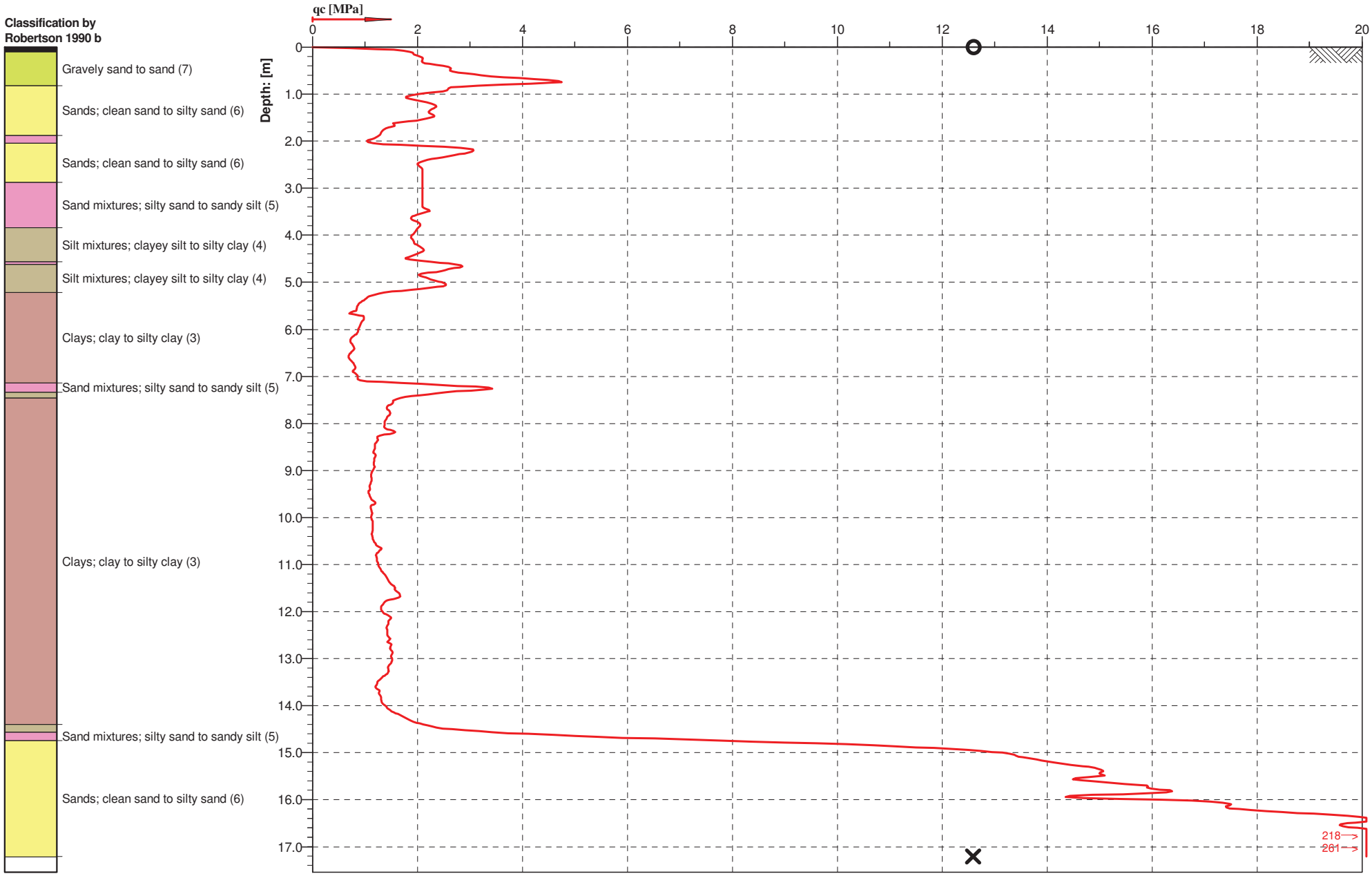


drillcore

u2

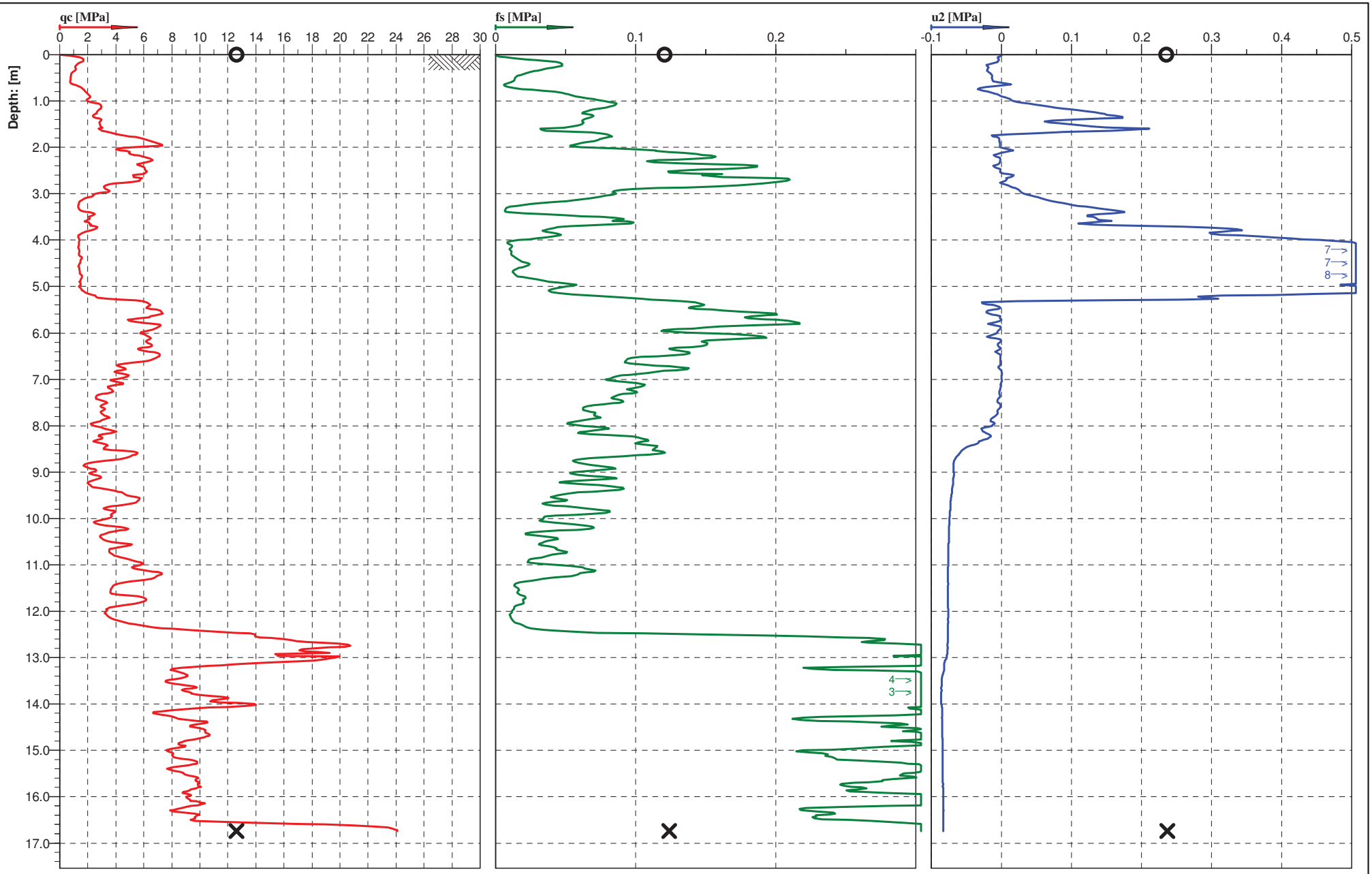
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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: 1/2	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.: 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	

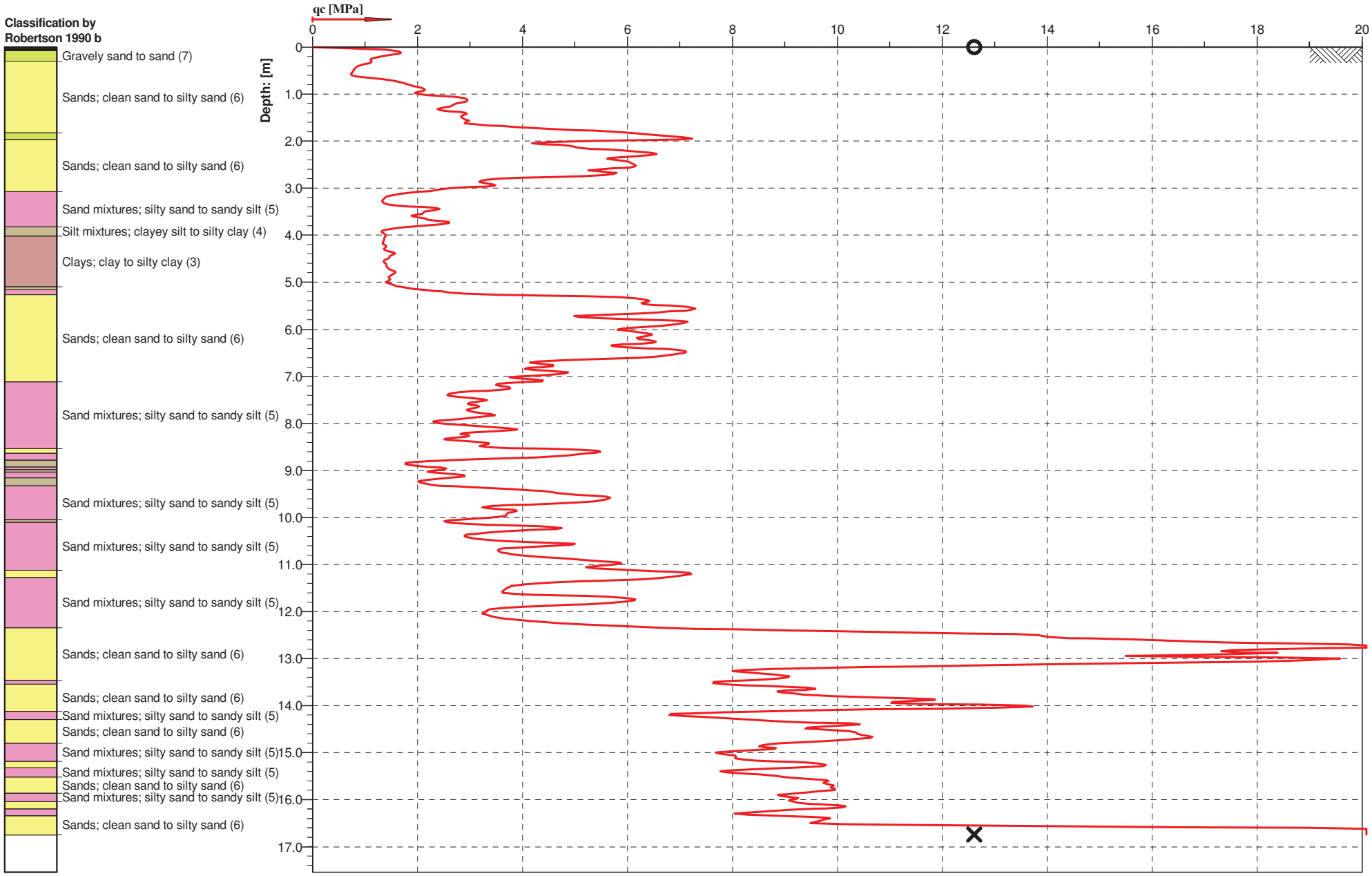


drillcore

u2

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

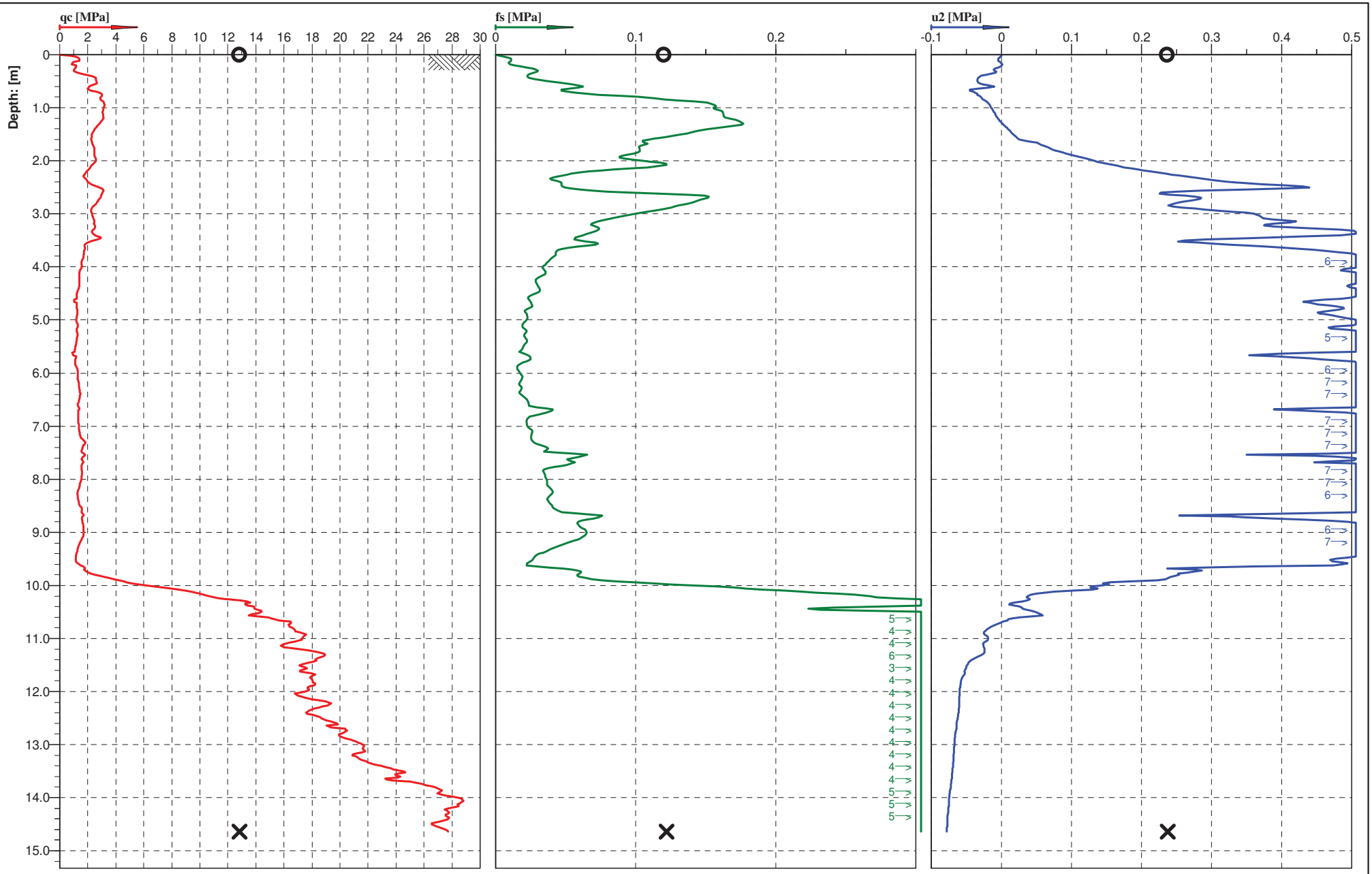
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT112
Project ID: E1795295 N5815842	Client: Tonkin & Taylor	Date: 17/05/2021	Scale: 1 : 111
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 16.74m. Hole dipped and collapsed back to 1.80m.		File: CPT112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



u2

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	

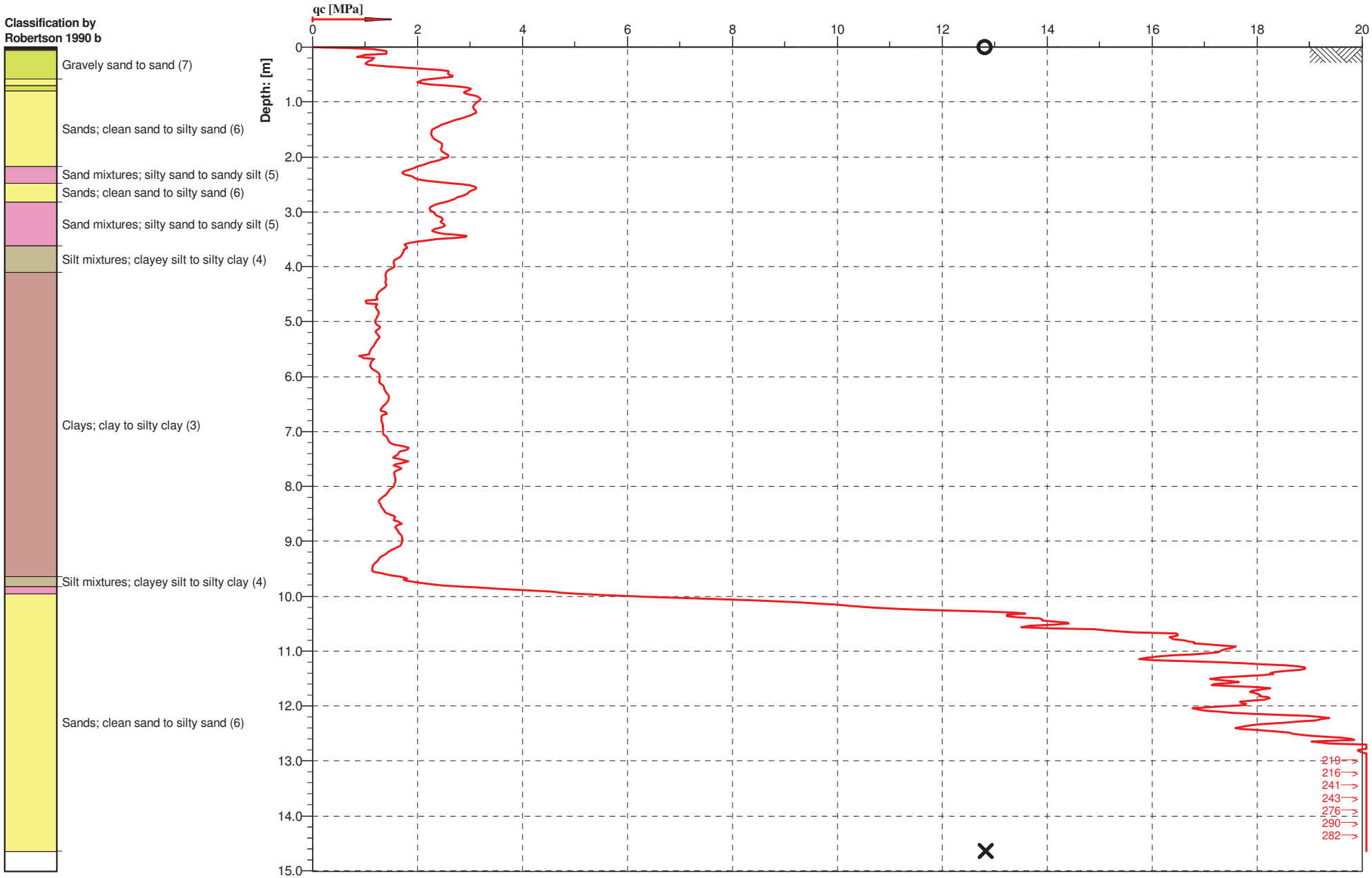


drillcore

u2

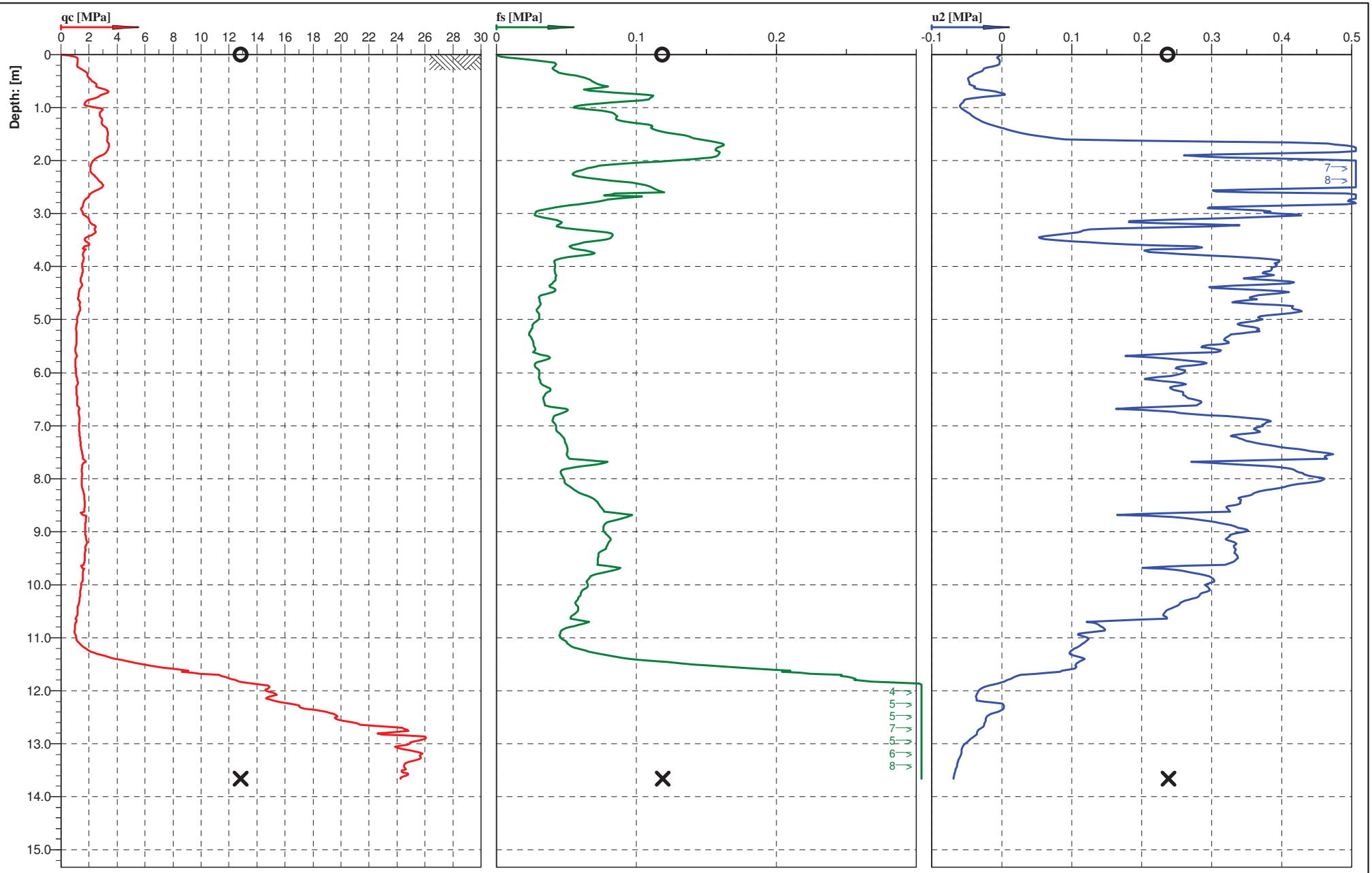
Cone No: 5465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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 anc ollapsed back to 0.67m.		File: CPT113 .cpt	



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

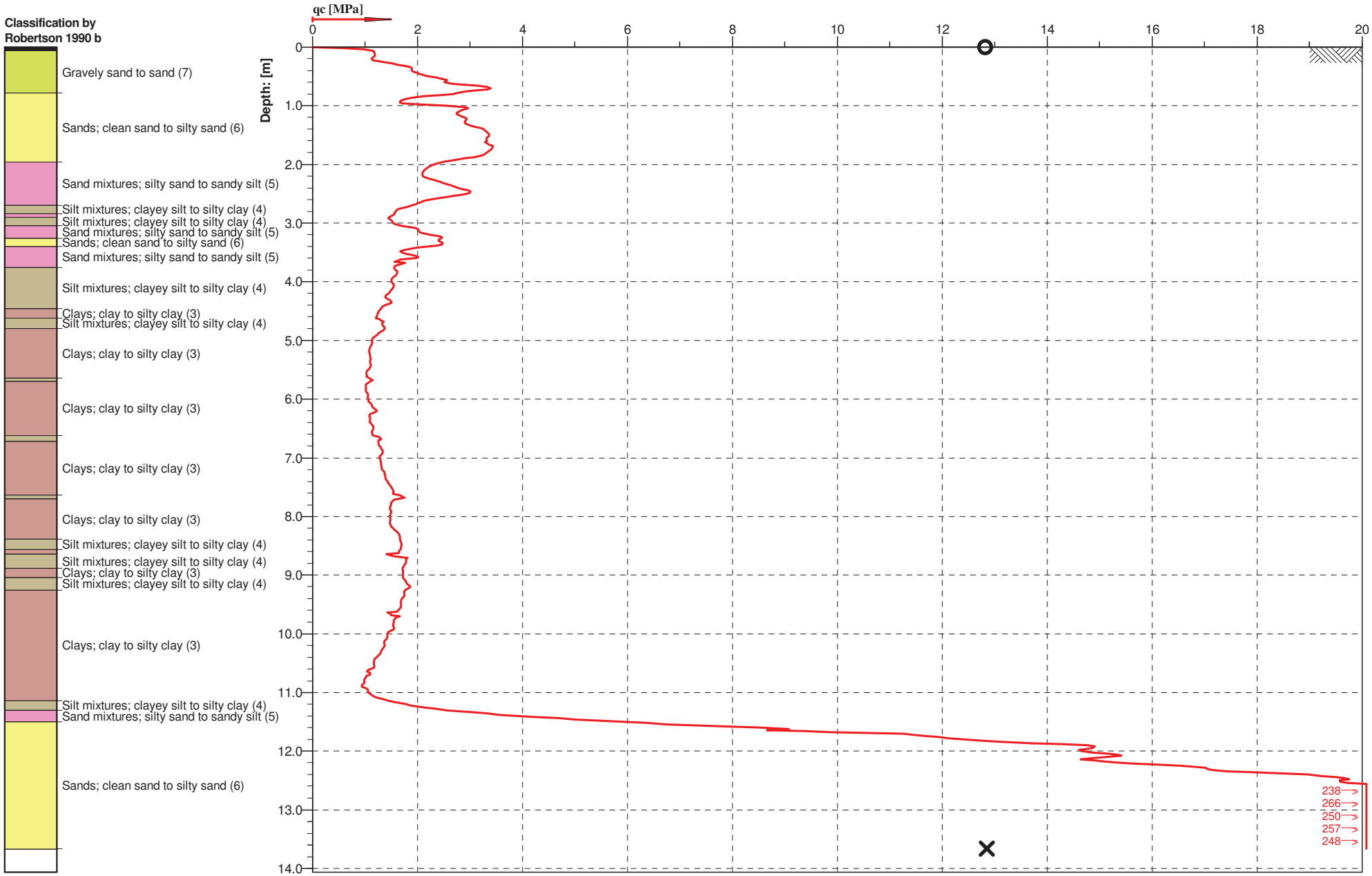
Location: Hamilton	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT113
Project ID: E1795326 N5816127	Client: Tonkin & Taylor	Date: 18/05/2021	Scale: 1 : 95
Project: 584 WHATAWHATA ROAD		Page: 2/2	Fig.:
Target depth 20m. Refused 14.64m. Hole dipped anc ollapsed back to 0.67m.		File: CPT113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



u2

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 : 97
Project: 584 WHATAWHATA ROAD		Page: 1/2	Fig.:
Target depth 20m. Refused 13.66m. Hole dipped and collapsed back to 2.4m.		File: CPT114 .cpt	



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	

u2

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

EXCAVATION LOG

Tonkin+Taylor

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: (NZTM2000)	5814947.62 mN 1795230.76 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	28/05/2021
		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	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		78/39 kPa 56/36 kPa 50/33 kPa 95/45 kPa 178/56 kPa 81/50 kPa 111/42 kPa		28 27 26 25 24	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* SILT, some clay, minor organics and minor sand; dark brown. Firm, moist, low plasticity. Sand, fine; organics, rootlets. Topsoil. *0.30m:* Clayey SILT; brownish grey mottled orange. Stiff, moist, medium plasticity. *0.50 - 1.00m:* Brownish orange *1.00m:* Clayey SILT, minor organics; grey. Firm to stiff, moist, low to medium plasticity. Organics, wood fragments *1.50 - 1.70m:* Grades to stiff. *1.70m:* Silty CLAY; brownish orange. Very stiff, moist, high plasticity. *2.80m:* Silty CLAY; light brown. Stiff, moist, high plasticity. *3.20 - 3.80m:* Grades to light brown, mottled grey. Pumiceous. *3.80m:* SILT, some clay, trace sand; greyish white. Very stiff, moist, low plasticity. Sand, fine to medium, pumiceous 4.3m: Machine limit	M	F St F-St St VSt St VSt		2.10m: , Water seepage observed. 4.30m: , Water seepage observed	Colluvium Deposits Walton Subgroup

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: (NZTM2000)	5815039.72 mN 1795167.56 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	28/05/2021
		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	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		125/53 kPa 109/39 kPa 195/81 kPa 139/59 kPa 72/64 kPa 66/36 kPa 53/31 kPa 75/42 kPa		28 27 26 25 24	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* SILT, some clay, minor organics, trace sand; dark brown. Firm, moist, low plasticity. Sand, fine to medium; organics, roots greater than 2mm diameter. Topsoil. *0.20m:* Clayey SILT, minor organics; brownish grey mottled orange. Very stiff, moist, medium plasticity. Organics, roots greater than 2mm diameter. *0.50 - 1.00m:* Brownish orange. *1.30m:* Silty CLAY; brownish orange. Very stiff, moist, medium to high plasticity. *1.90m:* SILT, some clay, minor organics; grey orange. Very stiff, moist, low plasticity. Organics, wood fragments. *2.50m:* Organic SILT, minor clay; grey mottled black. Stiff, moist, medium plasticity. Organics, wood fragments. *2.80m:* Silty CLAY; light brown mottled grey. Stiff, moist, medium to high plasticity. *3.60 - 4.10m:* Grades to brownish orange. *3.90 - 4.10m:* Reddish orange mottling. *4.10m:* SILT, some clay, trace sand; greyish white mottled orange. Stiff, moist, low plasticity. Sand, fine to medium, pumiceous. 4.4m: Machine limit	M	F VSt St	10 25 50 100 200	2.60m: , Water seepage observed.	Colluvium Deposits Walton Subgroup

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: (NZTM2000)	5815393.95 mN 1795147.06 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 28/05/2021
		EQUIPMENT: 8T Digger	EXCAV. FINISHED: 28/05/2021
R.L.:	23.24m	OPERATOR: Drillcore	LOGGED BY: CAND
DATUM:	NZVD2016	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	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3	No Support Required	28/05/2021	33/28 kPa 86/31 kPa		23 22 21 20 19	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* Sandy SILT, minor organics; dark brown. Firm, moist, dilatant - slow. Sand, fine to medium; organics, rootlets. *0.20m:* PEAT (FIBROUS AND AMORPHOUS), minor silt; brownish black. Soft to firm, saturated. Spongy. Tree branches up to 200mm in diameter. *2.50m:* SILT, some clay, minor organics; light grey. Very soft, wet, low plasticity. Organics, rootlets. *3.10m:* Becomes stiff. 3.4m: Machine limit	M S W	F S-F VS St	10 25 50 100 200	1.00m: , Water seepage observed. 1.70m: , Water seepage observed. 2.80m: , Relatively rapid water seepage observed.	Piako Subgroup

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.: **TP104**

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: (NZTM2000)	5815738.07 mN 1795075.30 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	28/05/2021
		EQUIPMENT:	8T Digger	EXCAV. FINISHED:	28/05/2021
R.L.:	25.24m	OPERATOR:	Drillcore	LOGGED BY:	CAND
DATUM:	NZVD2016	DIMENSIONS:	4.7m 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	28/05/2021	● 67/45 kPa ● 106/28 kPa ● 137/53 kPa		25 24 23 22 21	0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* SILT, some clay, minor sand; dark brown. Firm, moist, low plasticity. Sand, fine. Topsoil. *0.30m:* Silty CLAY; light brown mottled orange. Stiff, moist, medium to high plasticity. *1.20m:* Becomes very stiff. *1.70m:* Sandy SILT; light greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, pumiceous. Interbedded clay lenses up 100mm . *2.10m:* Silty CLAY; light grey. Very stiff, wet, medium plasticity. *2.60m:* Sandy SILT; light greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, pumiceous. Interbedded clay lenses up 100mm . 3.5m: Target depth	M W	F St St-VSt L VSt L	10 25 50 100 200		Colluvium Deposits Piako Subgroup

SKETCH / PHOTO:

COMMENTS:

Hole Depth 3.5m

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: (NZTM2000)	5815685.10 mN 1795337.69 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 28/05/2021
		EQUIPMENT: 8T Digger	EXCAV. FINISHED: 28/05/2021
R.L.:	25.84m	OPERATOR: Drillcore	LOGGED BY: CAND
DATUM:	NZVD2016	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	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3	No Support Required	28/05/21	31/25 kPa 53/28 kPa		25 24 23 22 21	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*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. 1.8m: Other - see notes	M W S	F S-F L	10 25 50 100 200	0.80m: , Rapid water seepage observed 1.10m: , Rapid water seepage observed.	Piako Subgroup

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

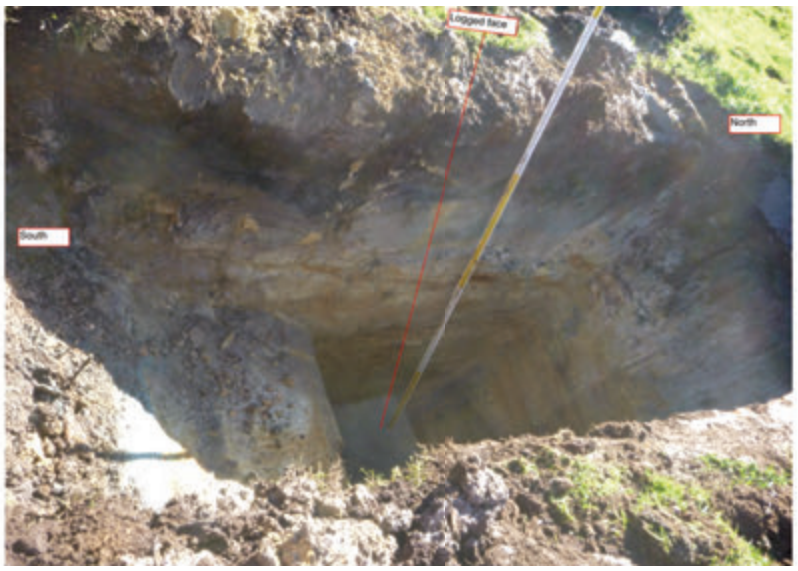
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision		LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: (NZTM2000)	5815694.55 mN 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 \ WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3	No Support Required	01/06/2021 ▼	● 31/25 kPa		27	0.5	TS	*0.00m:* SILT, some clay, minor organics. Firm, moist, low plasticity. Organics, rootlets. Topsoil.	M	F	10 25 50 100 200		
								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.	
					26	1.0		*0.80m:* Sandy SILT, trace organics; light greenish grey. Loosely packed, wet, dilatant - rapid. Organics, rootlets.		L		0.80m: , Water seepage observed.	
						1.5		*1.70m:* Minor gravelly, fine.					
					25	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.					
						2.5		*2.50m:* Sandy SILT; light brown mottled orange. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse. Interbedded silt lenses. Pumiceous.					
		01/06/2021 ▼			24	3.0							
						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: (NZTM2000)	5815568.47 mN 1795891.13 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	01/06/2021
		EQUIPMENT:	8T Digger	EXCAV. FINISHED:	01/06/2021
R.L.:	26.64m	OPERATOR:	Drillcore	LOGGED BY:	CAND
DATUM:	NZVD2016	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	No Support Required	01/06/2021	● 41/28 kPa		26 25 24 23 22	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets. Topsoil.	M	F	10 25 50 100 200		
								0.30m: PEAT (FIBROUS AND AMORPHOUS); dark brown. Soft to firm, wet. Organics, wood fragments. Tree branches up to 200mm observed.	W	S-F		0.60m: , Visual assessment of PEAT indicated soft to firm.	
								1.20m: Sandy SILT, minor organics; light greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to medium; organics, rootlets. Tree branches up to 200mm in diameter..		L		1.20m: , Water seepage observed.	
								1.70m: Silty fine to medium SAND; light greenish grey. Loosely packed, wet. Sand, well graded. Interbedded silt lenses.				1.70m: , Water seepage observed.	
								2.40m: Colour grades to greenish grey. Sand grades to fine to coarse. Minor gravel, fine. Pumiceous.					Piako Subgroup
								3m: Target depth					

SKETCH / PHOTO:

COMMENTS:

Hole Depth 3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Tonkin+Taylor

Excavation Id.: **TP108**

Hole Location: Eastern low lying lands

SHEET: 1 OF 1

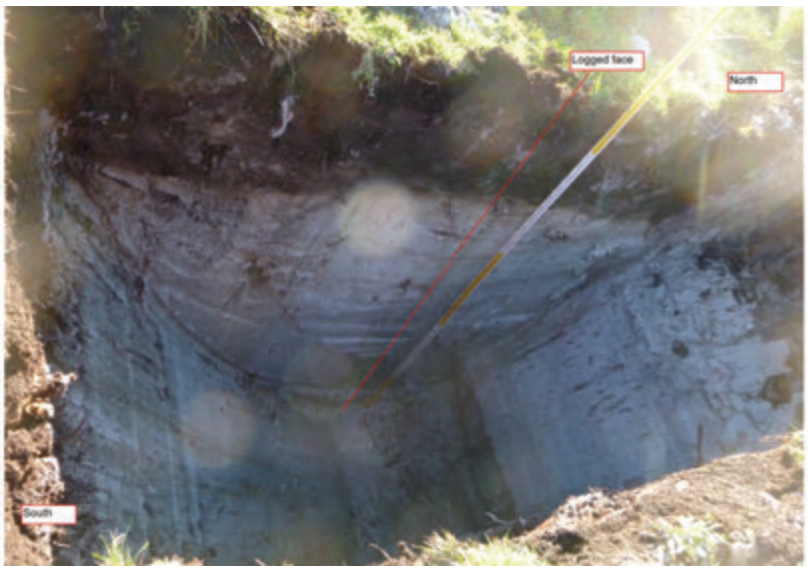
PROJECT: Brymer Farms Subdivision | LOCATION: 584 Whatawhata Rd, Temple View | JOB No.: 1017355.0000

CO-ORDINATES: (NZTM2000)	5815403.99 mN 1796130.68 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	01/06/2021
		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	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE \ WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3											10 25 50 100 200		
	No Support Required	01/06/2021	28/19 kPa 72/16 kPa 125/34 kPa 97/44 kPa		26 25 24 23	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets. Topsoil.	M	F			
								0.30m: PEAT (FIBROUS AND AMORPHOUS); dark greyish black. Soft, wet. Organics, wood fragments. Spongy, tree branches up to 300mm diameter.	W	S		0.70m: , Water seepage observed.	
								1.10m: Silty CLAY, minor organics; light greenish grey. Stiff, wet, medium to high plasticity. Organics, rootlets.		St			
								1.80 - 2.30m: Grades to very stiff.		VSt			
								2.30m: Tree branches up to 50mm diameter observed.					
								2.80m: Sandy SILT, minor gravel; light greenish grey, bedded. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, well graded; gravel, fine, sub-rounded to sub-angular, pumiceous.		L			
								3.30m: Gravel becomes trace gravel.		L			
												4.00m: , Ponding water observed.	
								4.3m: Target depth					

SKETCH / PHOTO:



COMMENTS:

Hole Depth 4.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP109**

Hole Location: Northern foot hillls

SHEET: 1 OF 1

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

CO-ORDINATES: (NZTM2000)	5815735.93 mN 1795395.12 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	01/06/2021
		EQUIPMENT:	8T Digger	EXCAV. FINISHED:	01/06/2021
R.L.:	26.99m	OPERATOR:	Drillcore	LOGGED BY:	CAND
DATUM:	NZVD2016	DIMENSIONS:	4.7m 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		53/41 kPa			0.5	TS	*0.00m:* SILT, some clay; dark brown. Firm, moist, low plasticity.	M	F-St			Colluvium Deposits
								0.20m: Clayey SILT, minor organics; dark brown. Stiff, moist, medium plasticity. Organics, wood fragments. Rootlets. Light brown sand lense up to 100mm.		St			
			34/19 kPa		26	1.0		*0.70m:* SILT, some clay, trace organics; light brown mottled orange. Firm, wet, low plasticity. Organics, rootlets. Rootlets, light brown sand lense up to 100mm.	W	F			
			47/34 kPa			1.5		*1.10m:* SILT, some clay, trace organics; light greenish grey. Firm, wet, low plasticity. Organics, rootlets.					
			82/41 kPa		25	2.0		*1.70m:* Silty CLAY; light greenish grey mottled orange. Stiff, wet, medium to high plasticity. Silt, non dilatant. *2.00m:* Trace sand, fine to coarse.		St		2.00m: , Water seepage observed.	
						2.5		*2.30m:* Sandy SILT; greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse. *2.70m:* Colour changes to brown. Interbedded silt layers.		L		2.80m: , Water seepage observed.	Piako Subgroup
					24	3.0						3.20m: , Water seepage observed.	
						3.5		3.3m: Target depth					
					23	4.0							
						4.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 3.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Tonkin+Taylor

Excavation Id.: **TP110**

Hole Location: Northern foot hillls

SHEET: 1 OF 1

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

CO-ORDINATES: (NZTM2000)	5815779.66 mN 1795287.86 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	01/06/2021
		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 \ WEATHERING CONDITION	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 ● 113/44 kPa ● 213/44 kPa ● 169/32 kPa		27 26 25 24	0.5 1.0 1.5 2.0 2.5 3.0 3.5	TS	*0.00m:* SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets. *0.30m:* Silty CLAY, minor organics; light grey mottled orange. Stiff, moist, medium plasticity. Organics, wood fragments. Tree branches up to 50mm in diameter. *0.70 - 0.90m:* Becomes brownish orange, very stiff. *0.90m:* SILT, some clay, minor organics; grey mottled brown. Very stiff to hard, moist, low plasticity. Organics, wood fragments. *1.40m:* Grades to very stiff. *1.50m:* Sandy SILT; light greenish grey mottled brown. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, well graded. *2.00m:* Colour changes to light brown mottled orange. Interbedded silt lenses. *3.10 - 3.60m:* Colour changes to brown.	M W	F St VSt VSt-H VSt L		2.50m: , Water seepage observed. 3.10m: , Water seepage observed.	Colluvium Deposits Piako Subgroup
		01/06/2021			23	4.0 4.5		3.8m: Target depth					

SKETCH / PHOTO:

COMMENTS:

Hole Depth 3.8m

Scale 1:42

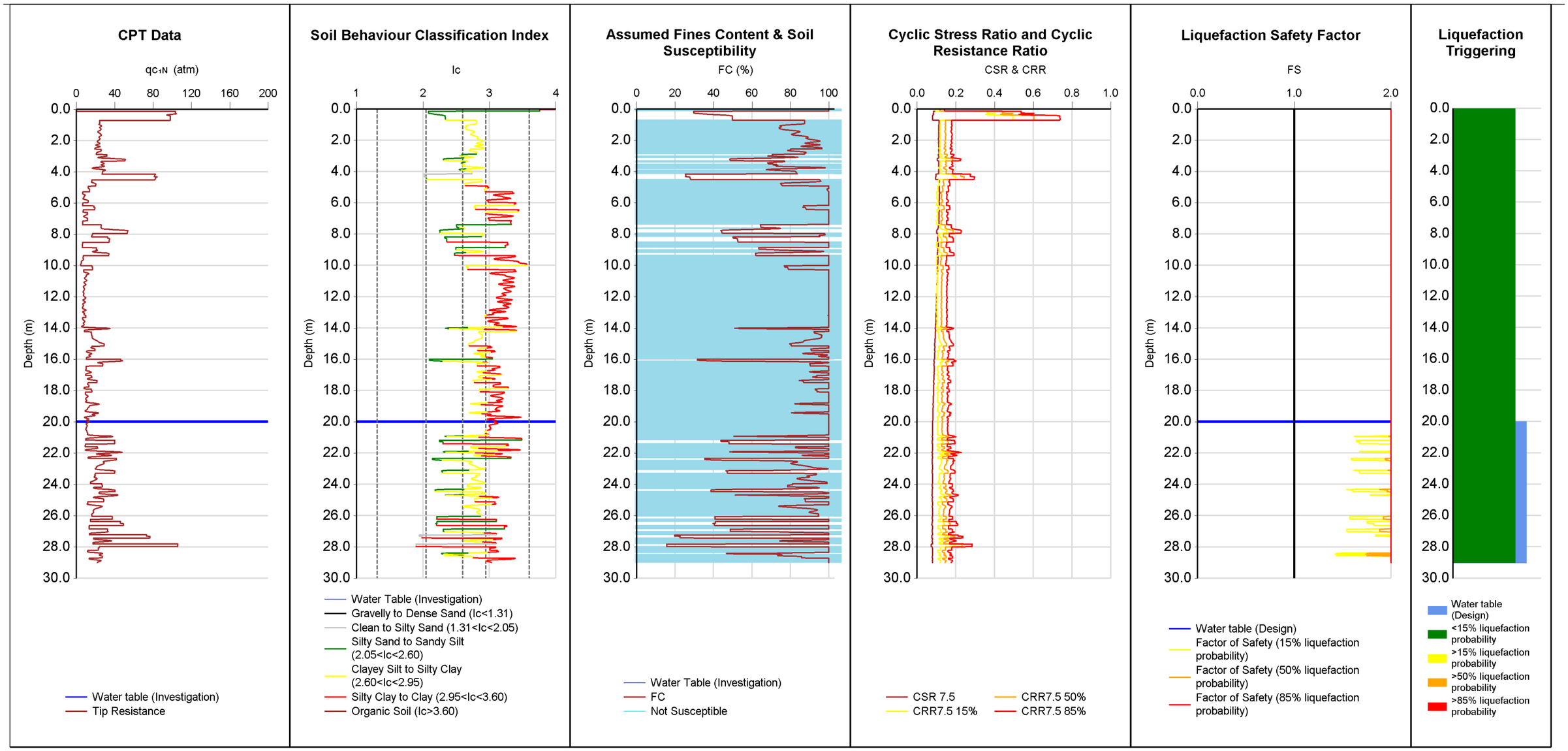
Rev.: A

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.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	15%	3	0	0	0	29	0
	50%	0	0	0	0	29	0
	85%	0	0	0	0	29	0

Reviewed by:

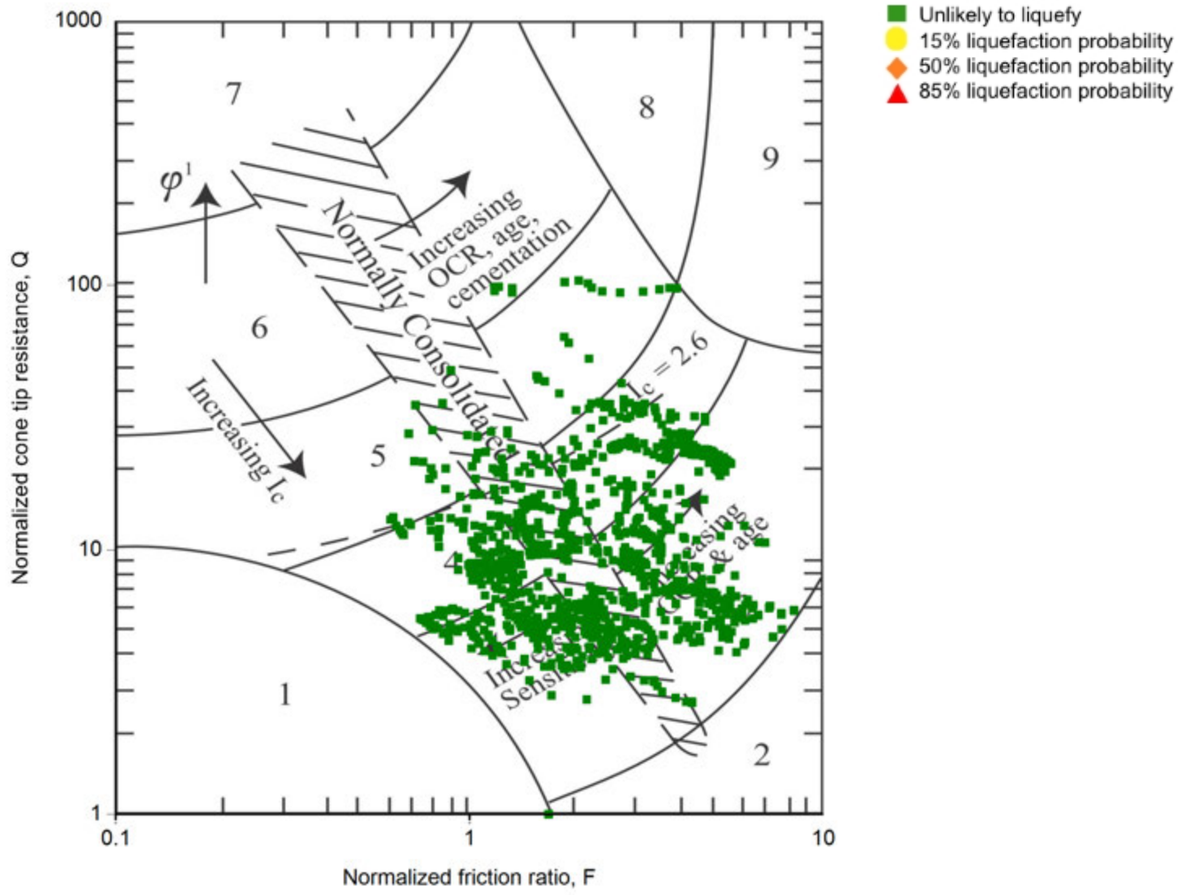
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

Tonkin + Taylor

Exceptional thinking together

V2.4.15

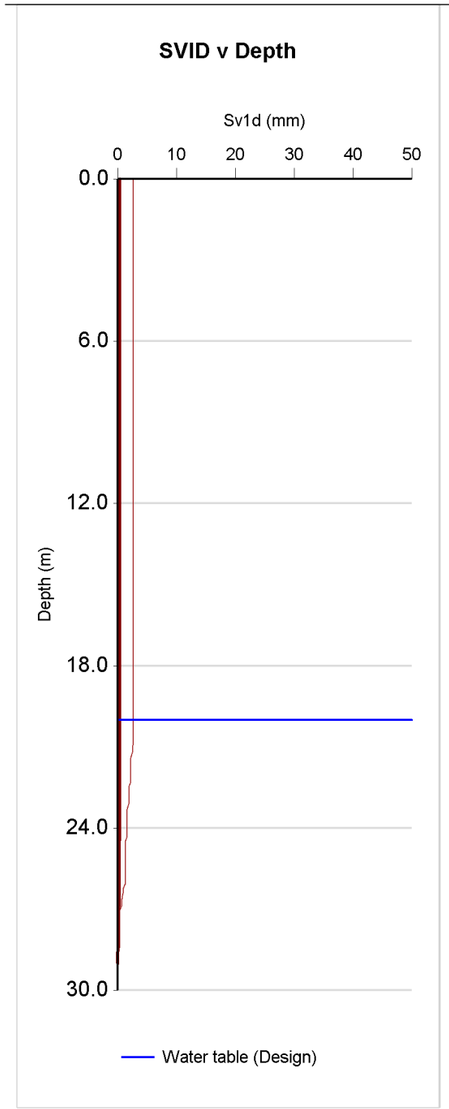
CLIENT	**Brymer Farms Ltd**	LOCATION	Hamilton
PROJECT	**Brymer Farms Subdivision**	DATE	24/06/2021
TITLE	**Liquefaction Analyses**	ANALYSED	cand
COMMENT	1 in 500 Year Event - ULS IL2	JOB NUMBER	**1017355.0000**
		PAGE	1 of 47 pages

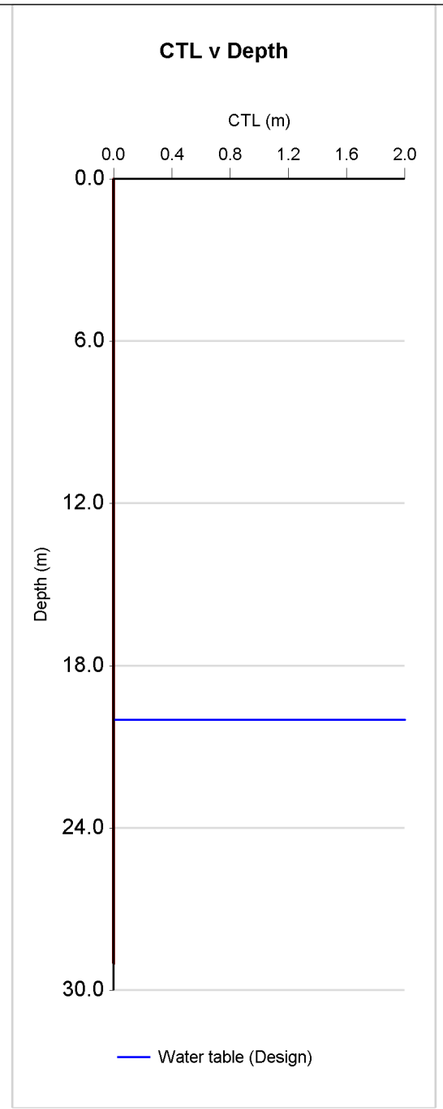


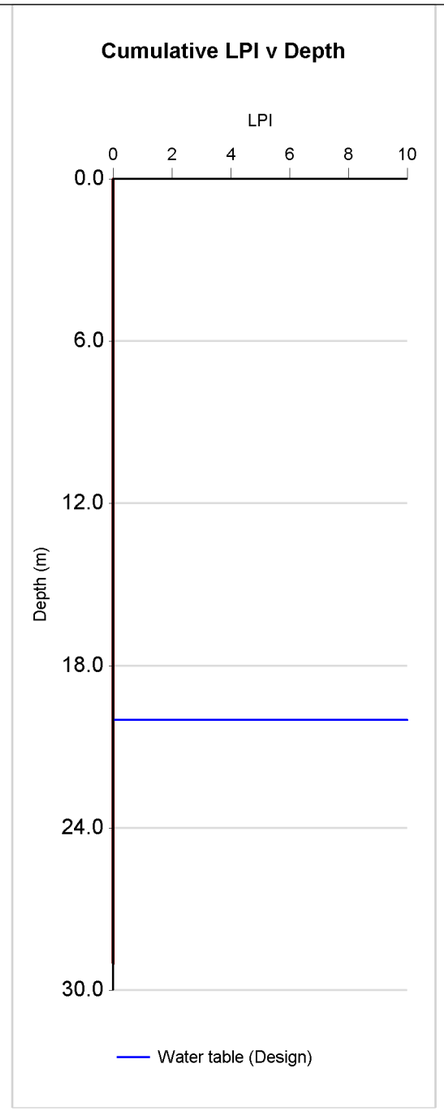
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

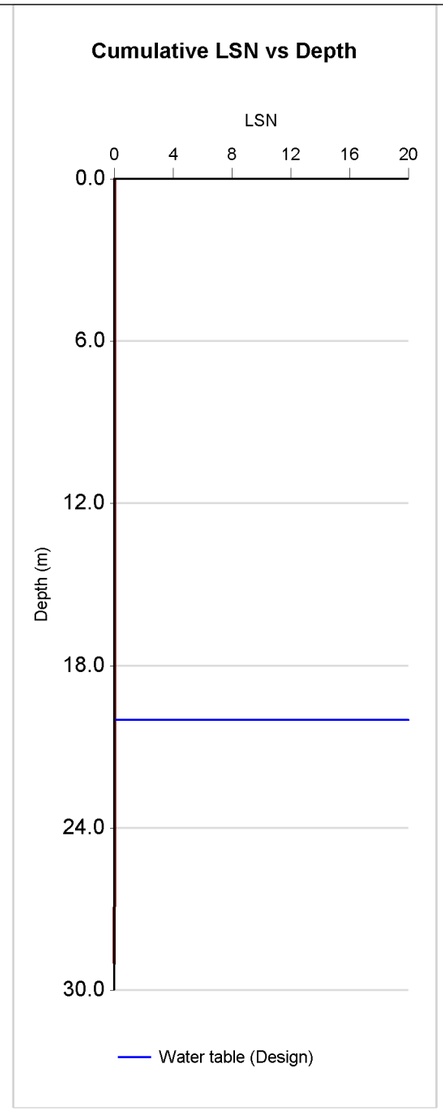
*Heavily overconsolidated or cemented

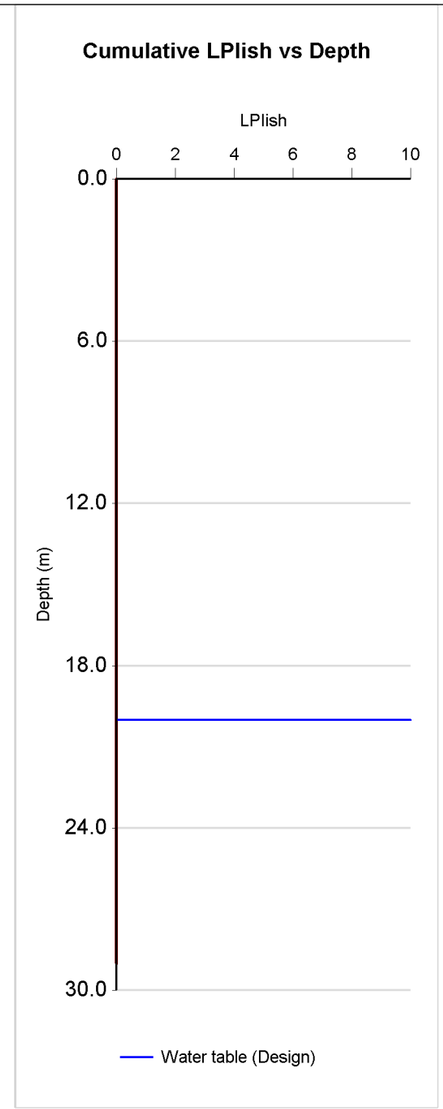
CPT-based soil behavior type classification chart by Robertson (1990)



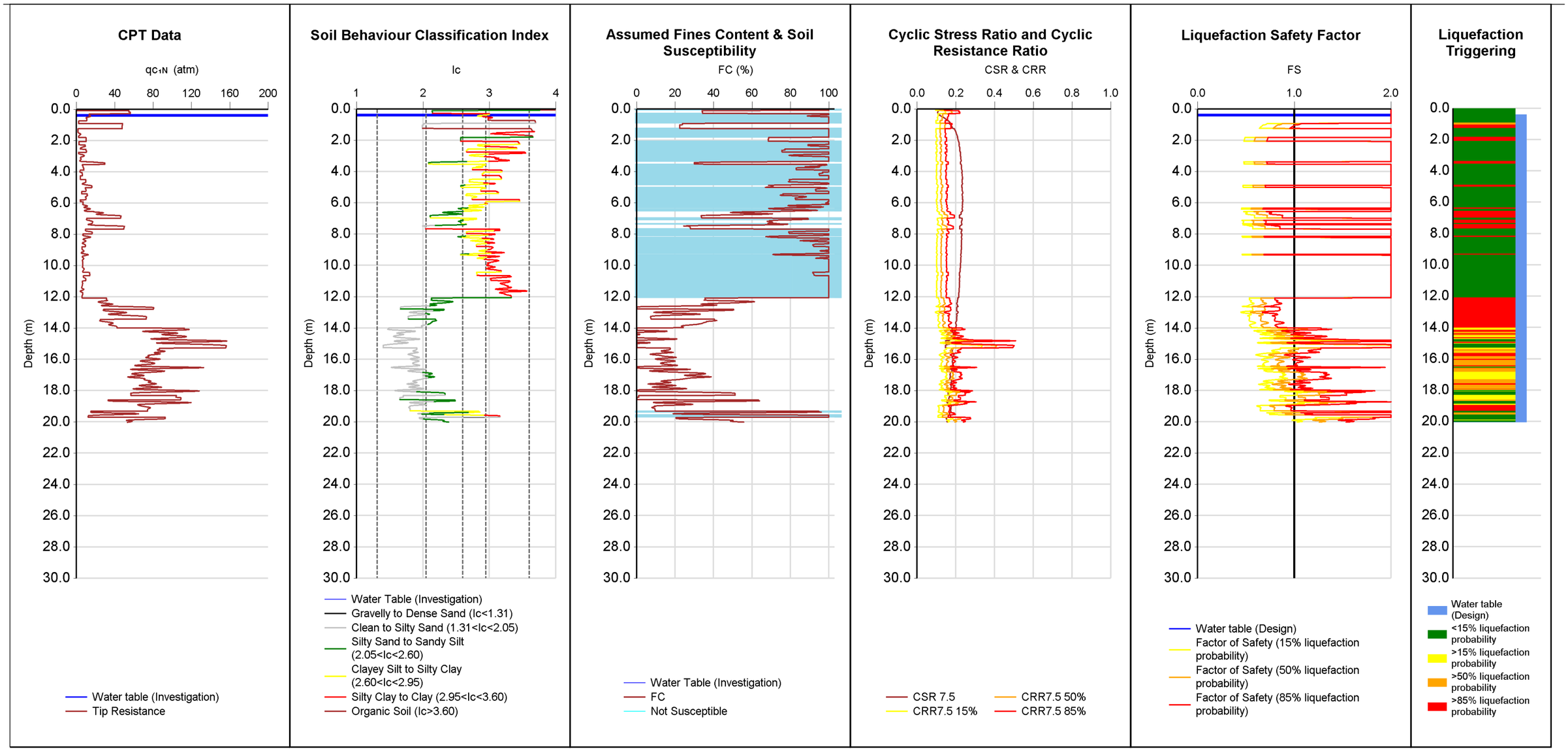








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT101	178990	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



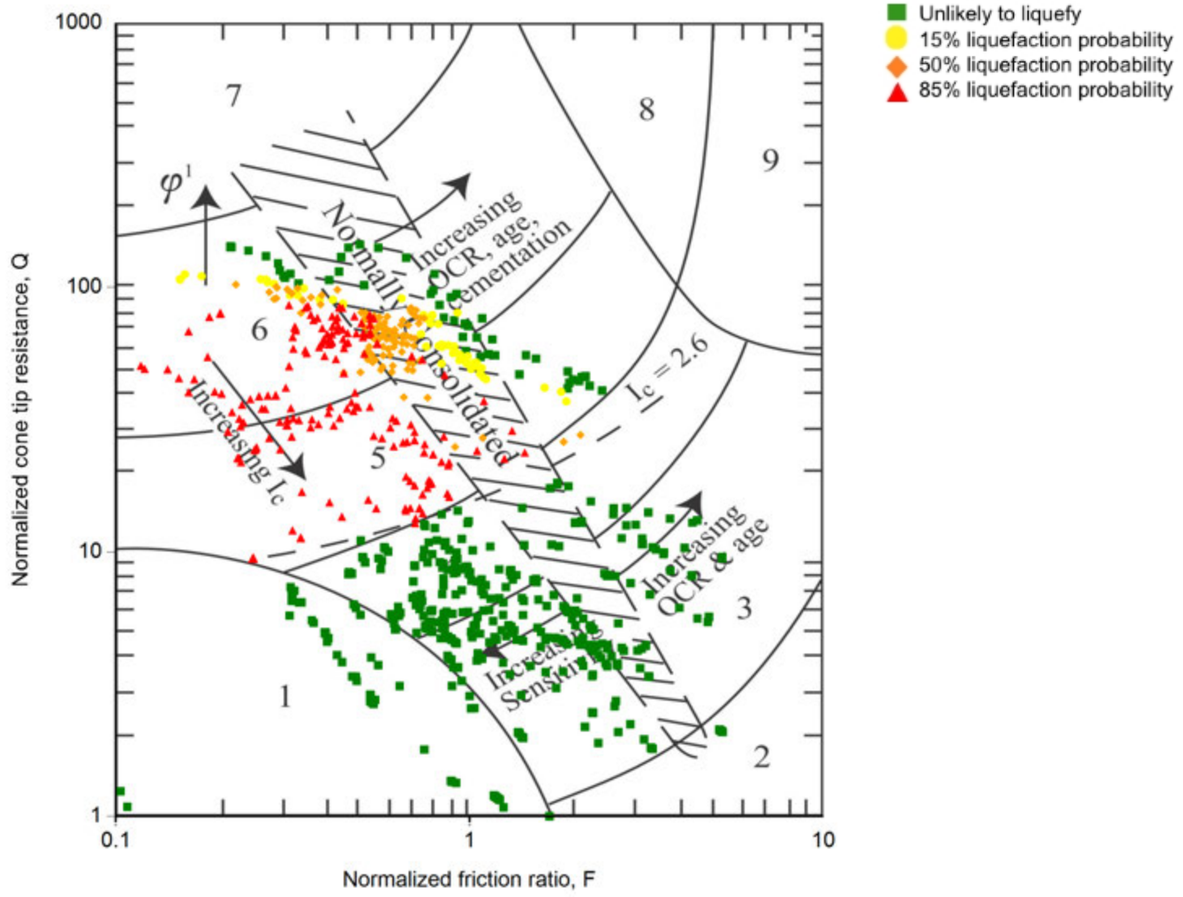
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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:

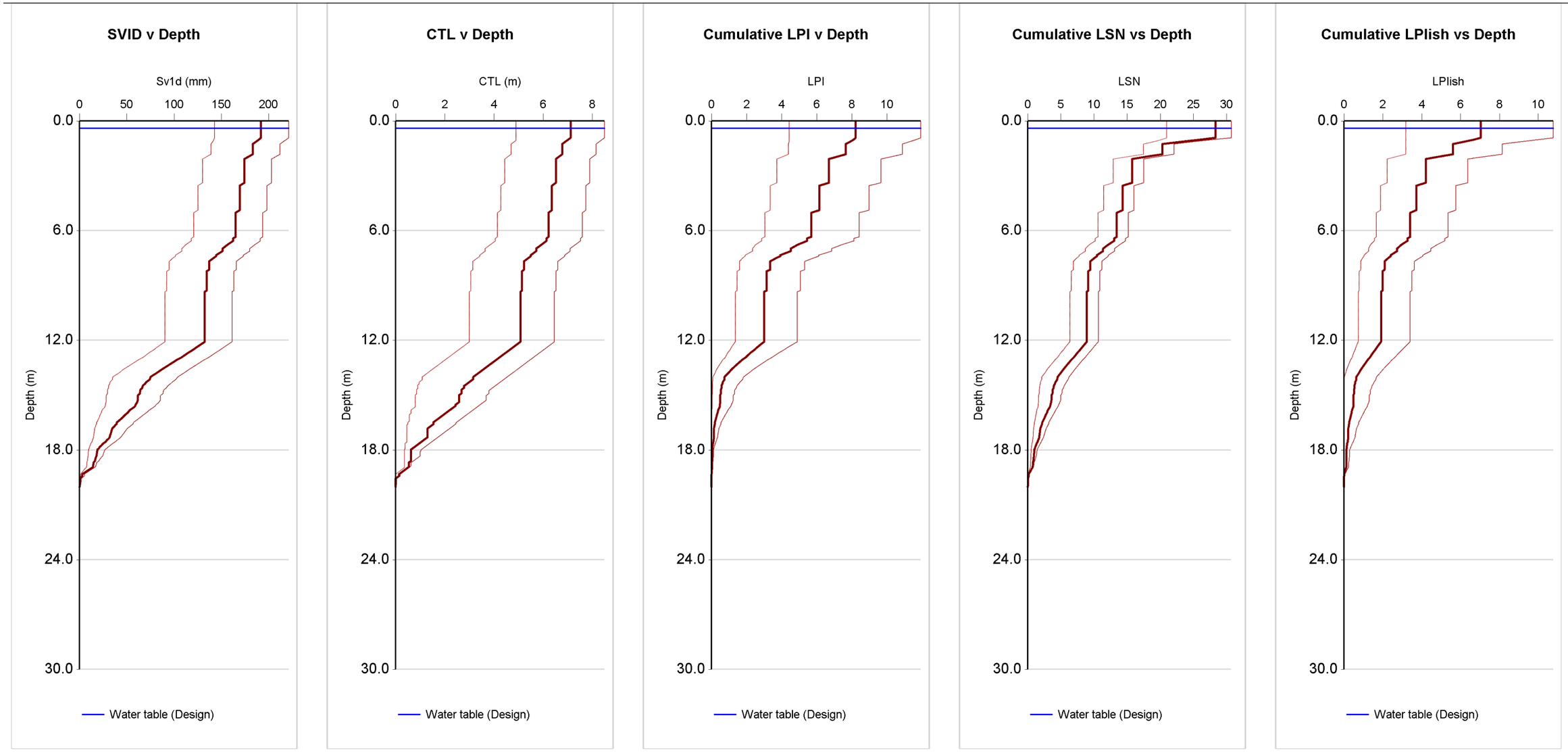
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



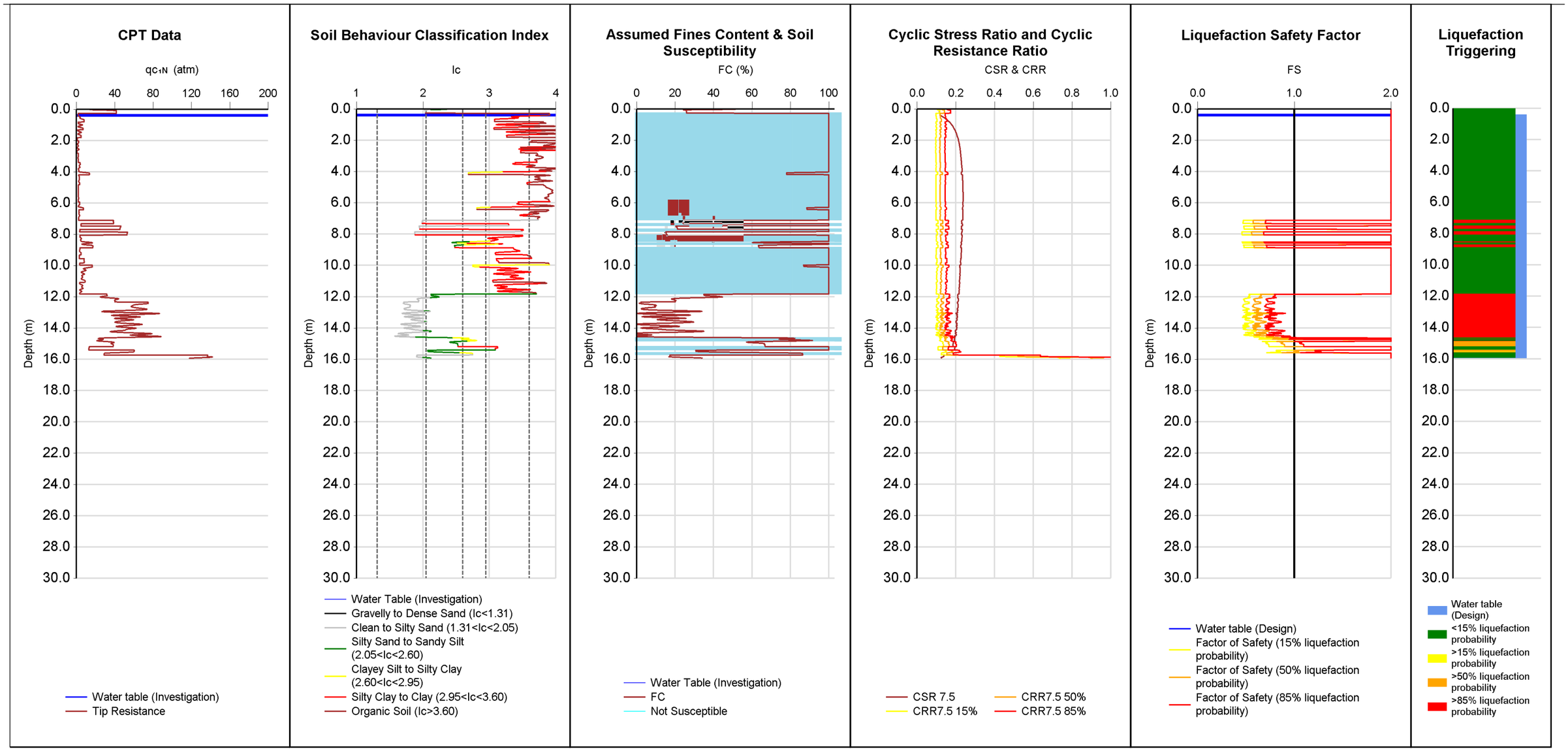
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



	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)
INPUT	CPT102	178991	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



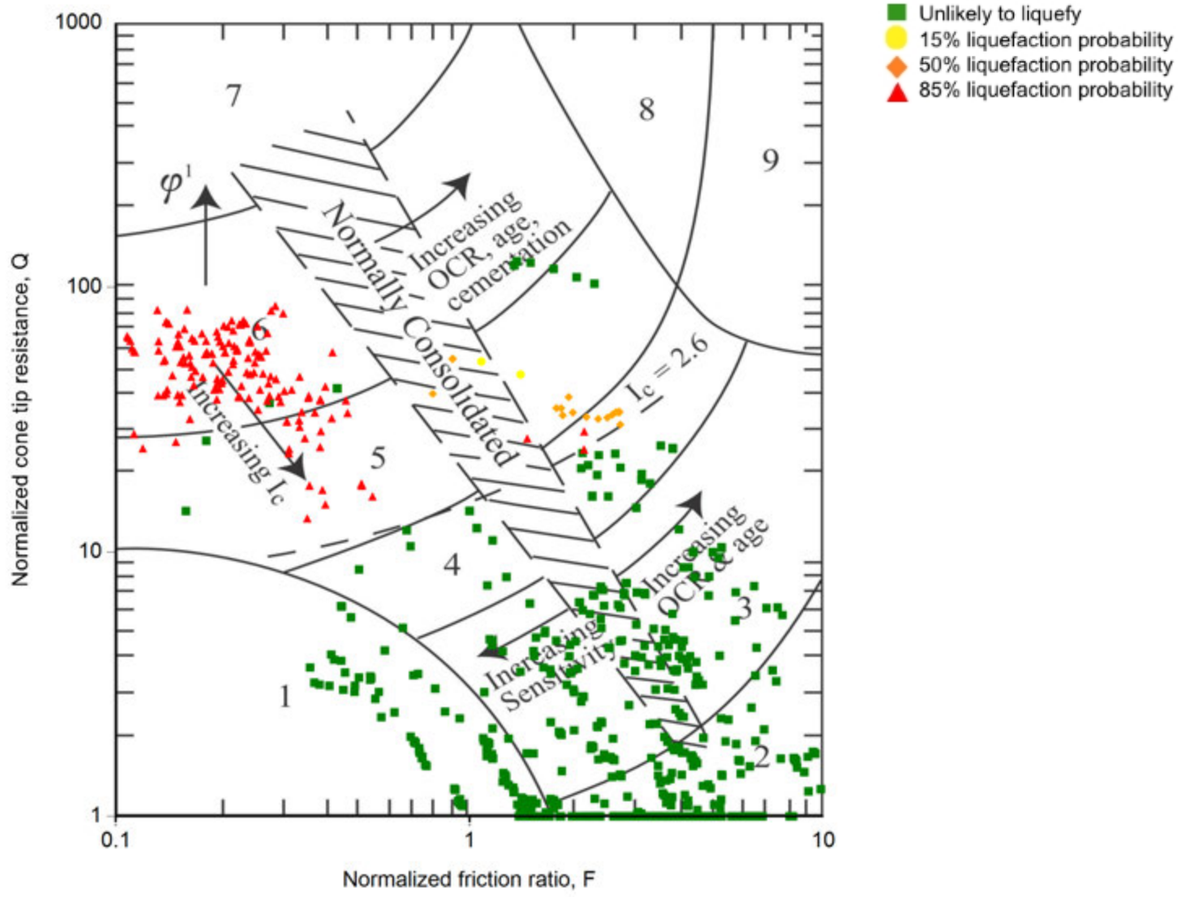
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT103	178992	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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

Reviewed by:

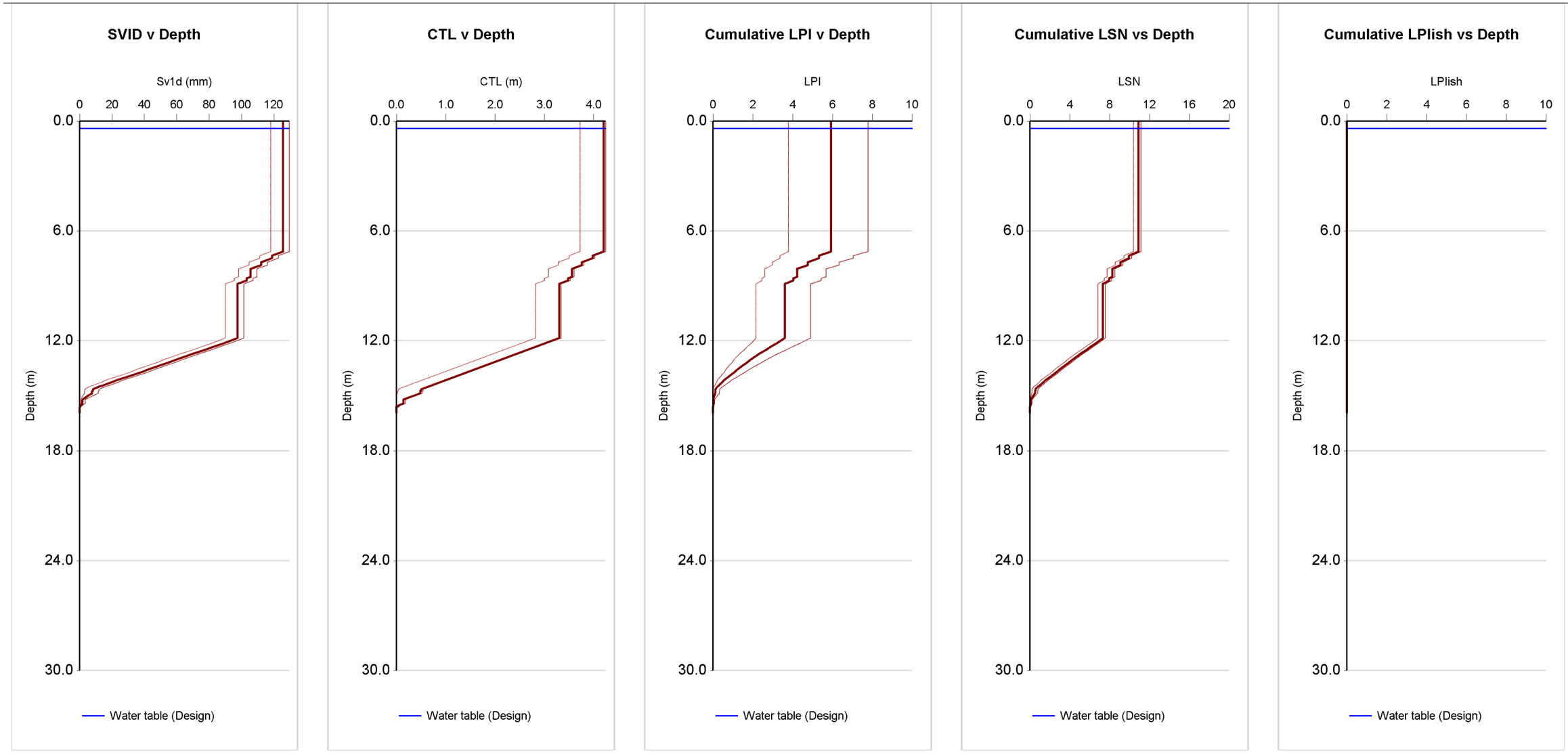
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



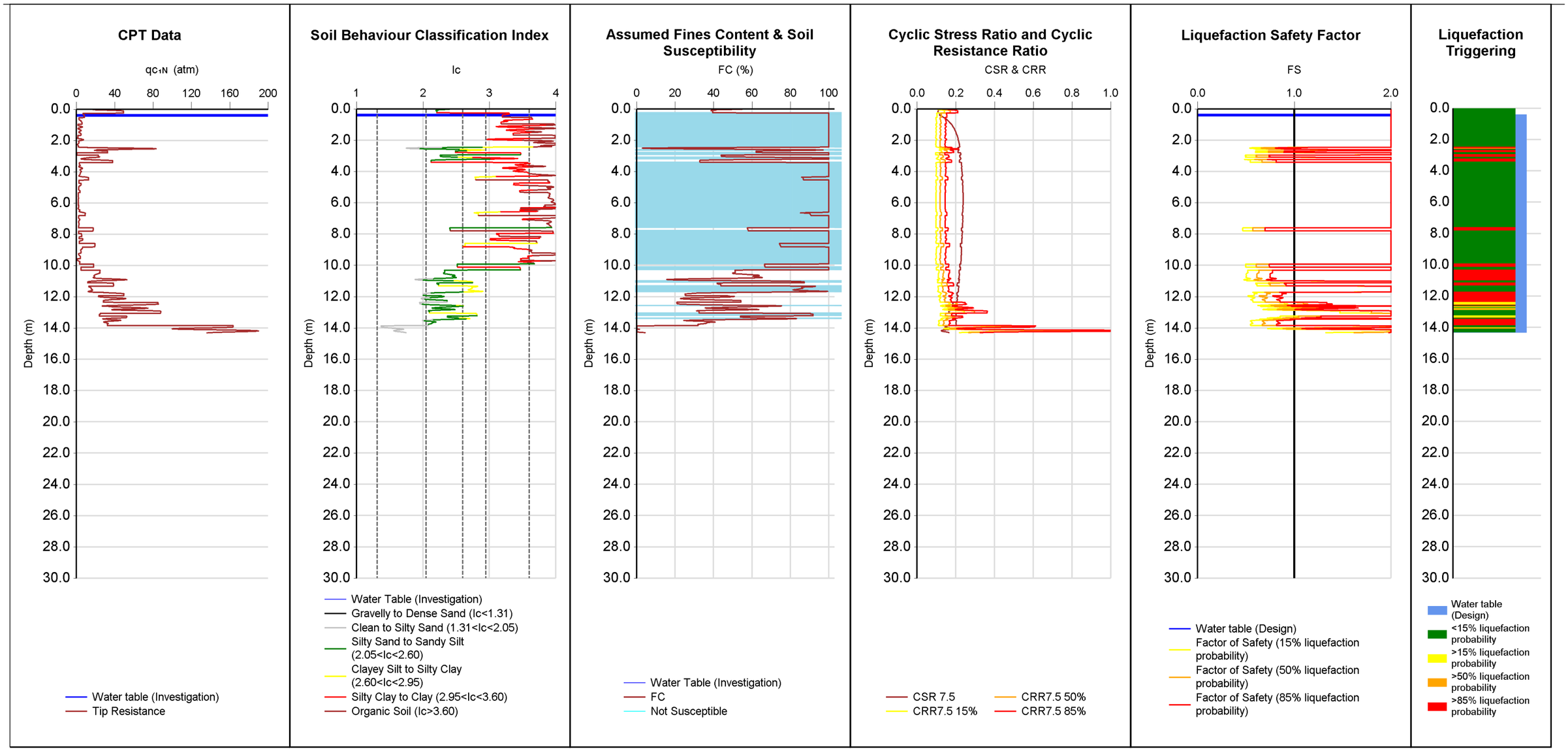
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



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



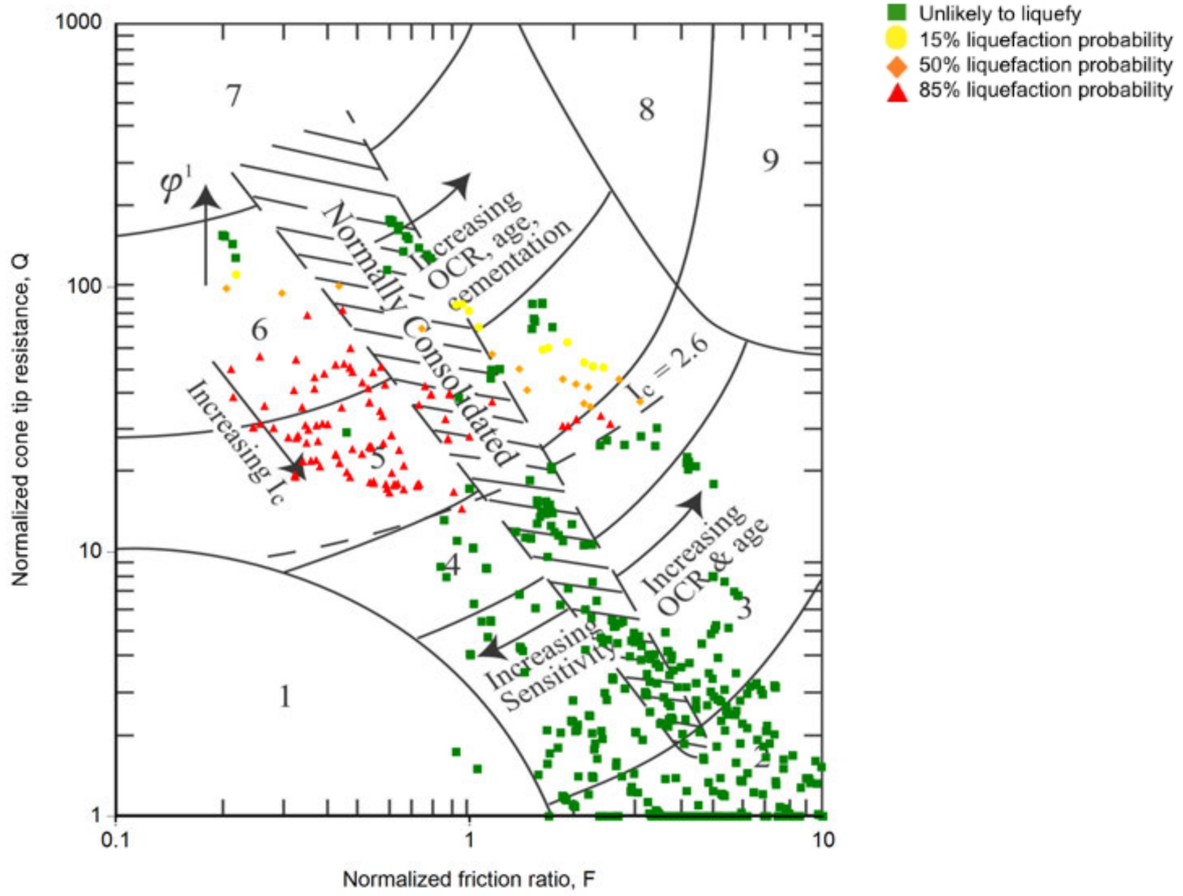
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT104	178993	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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:

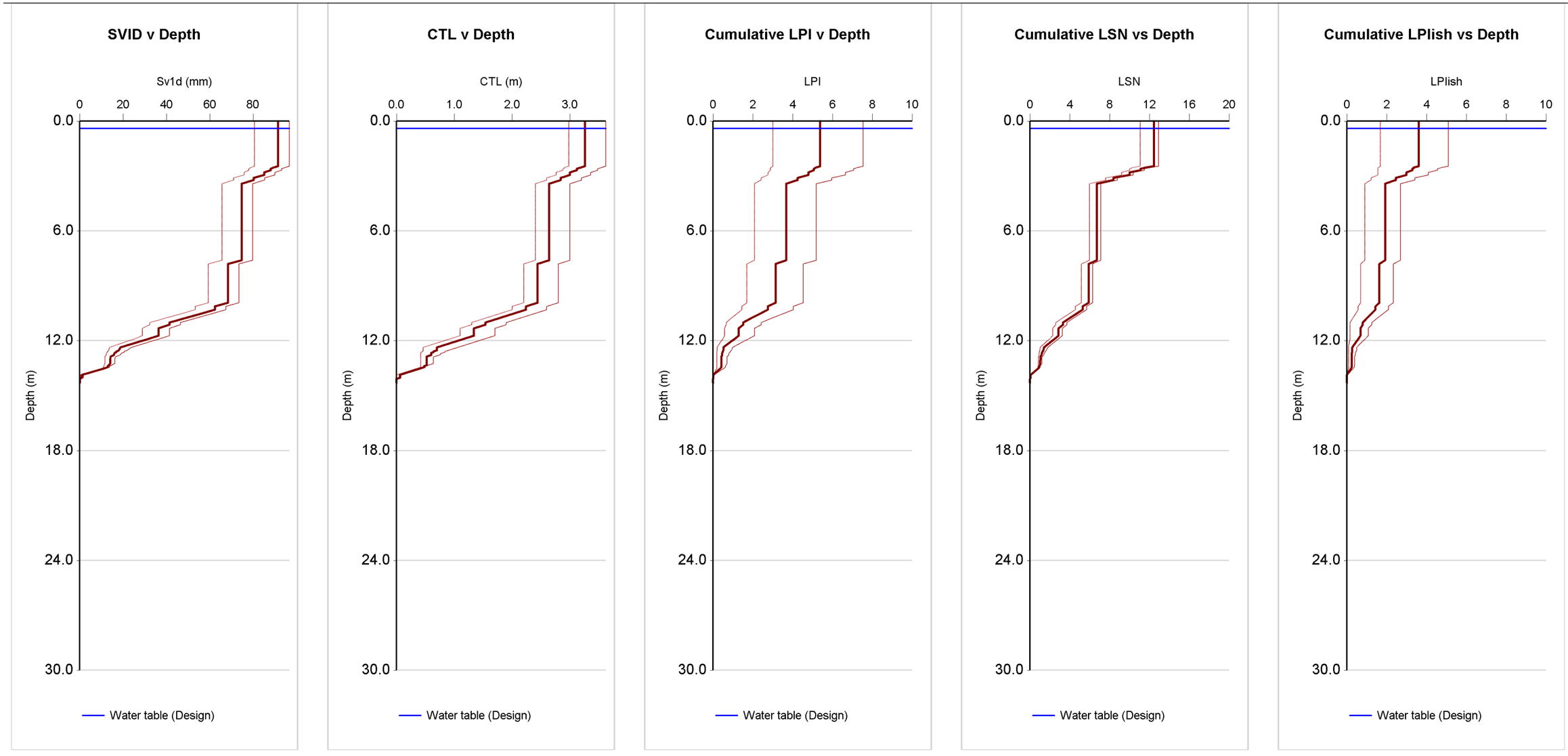
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



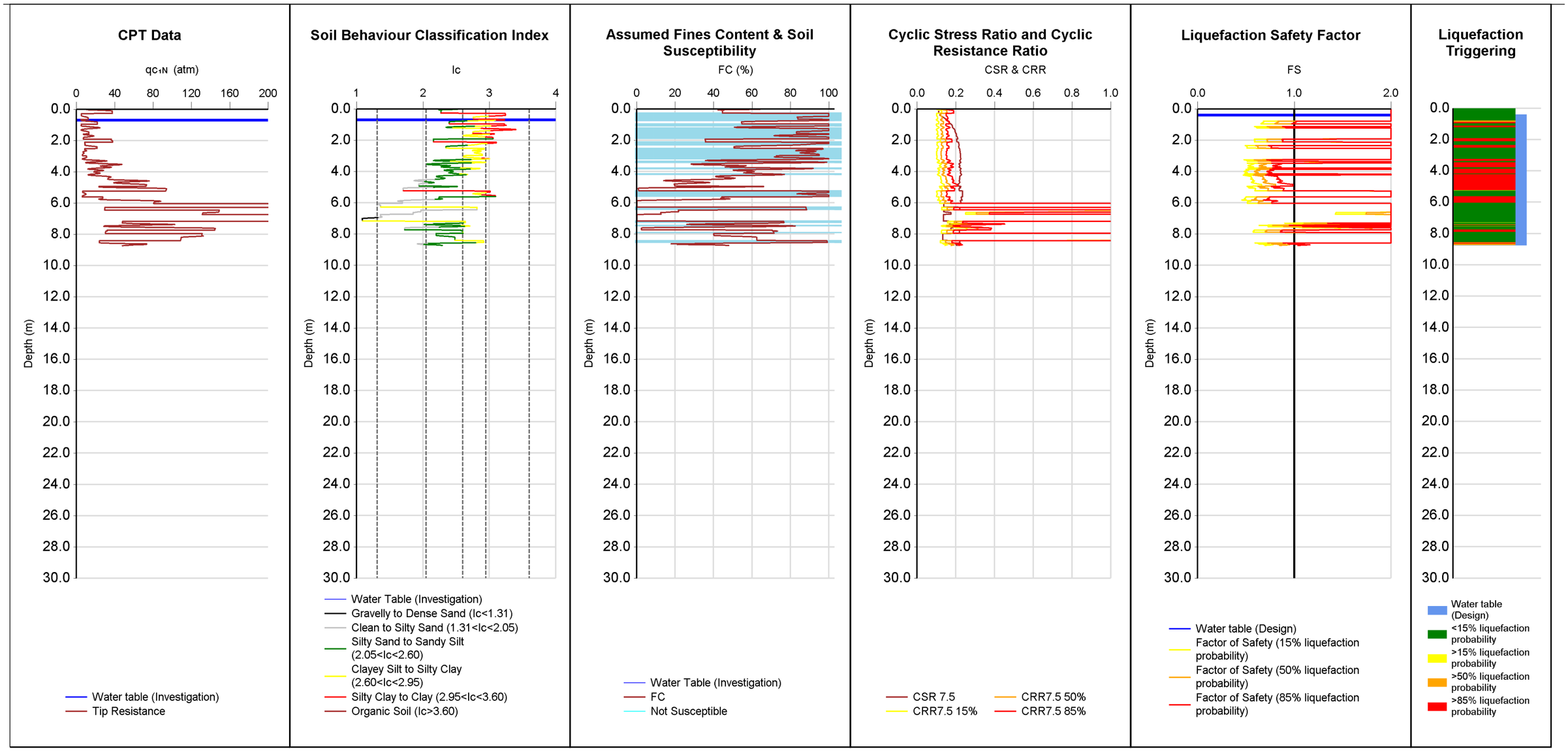
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



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



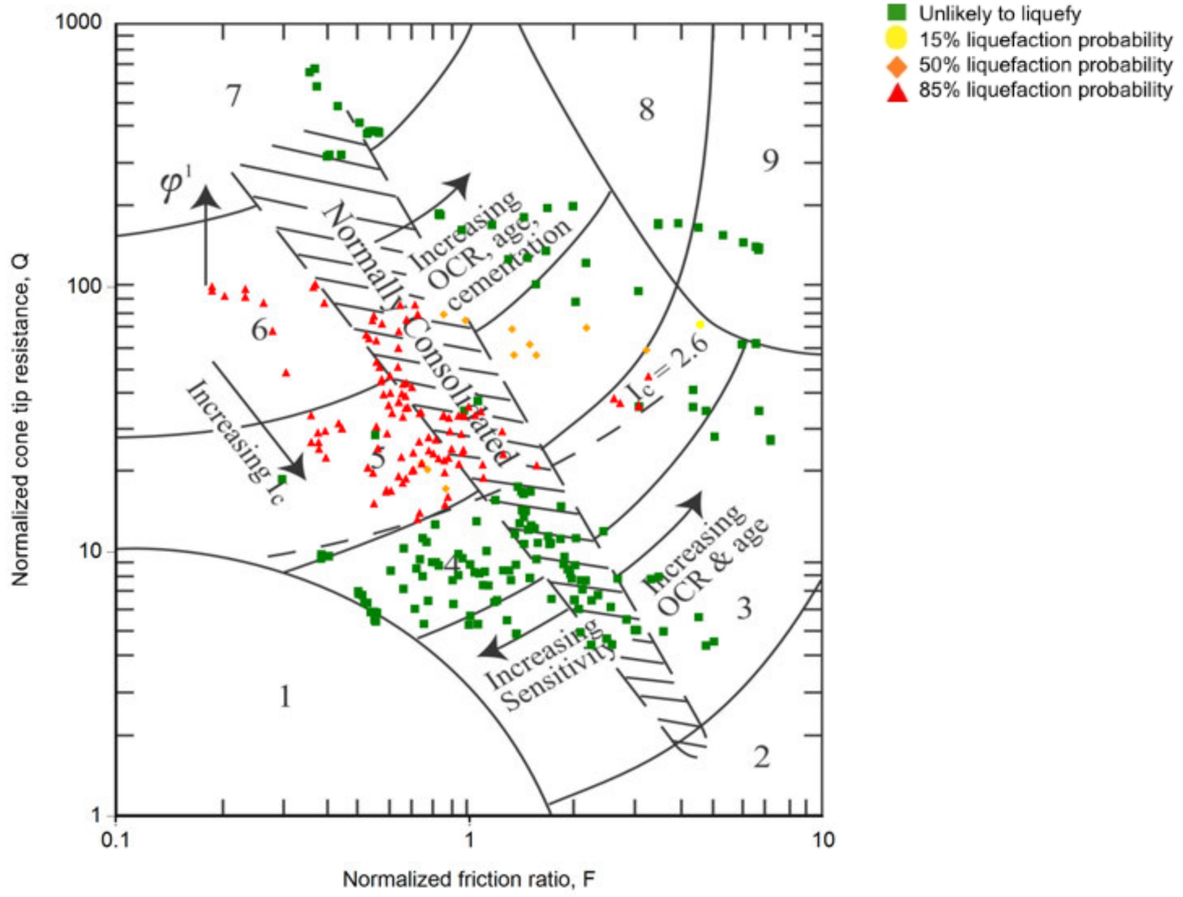
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



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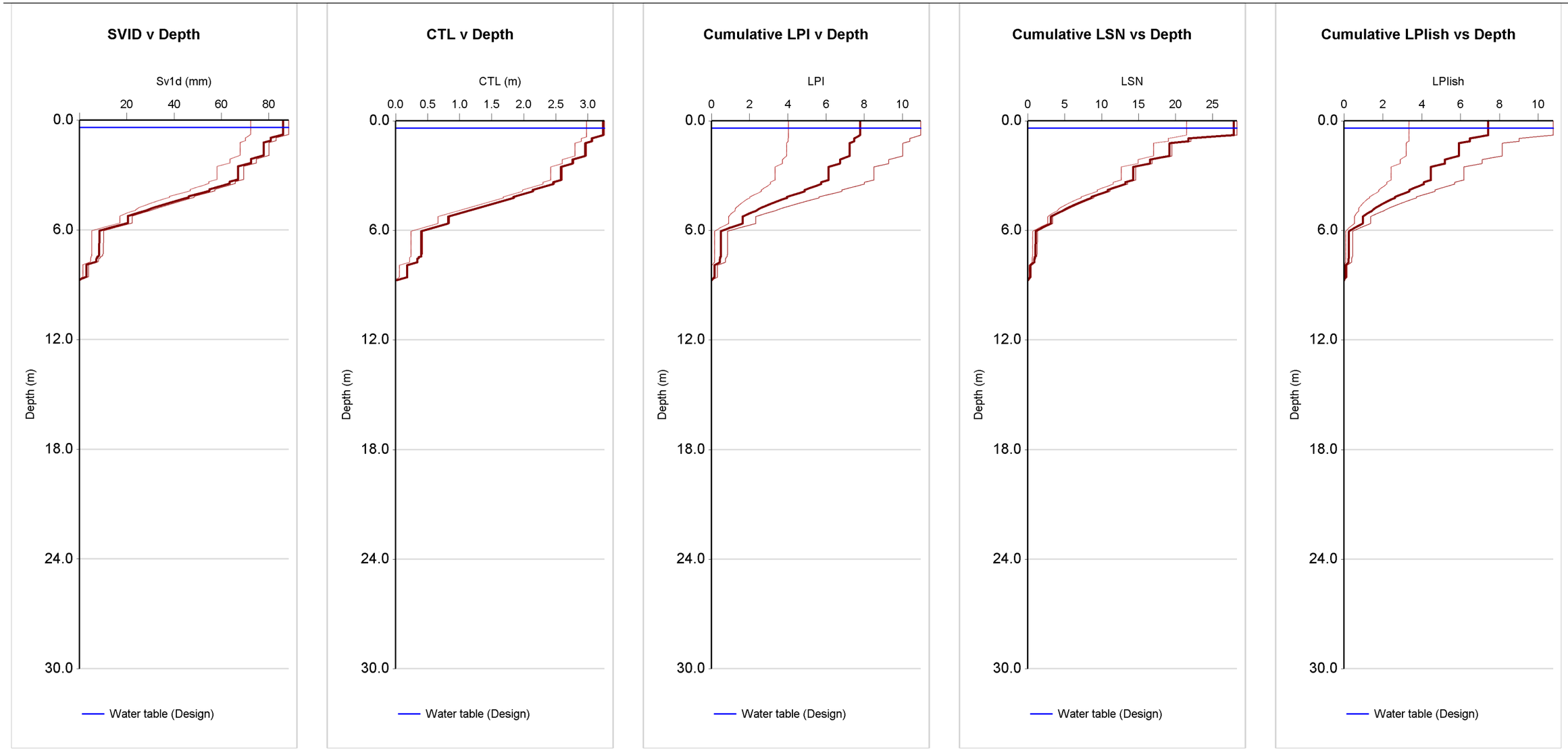
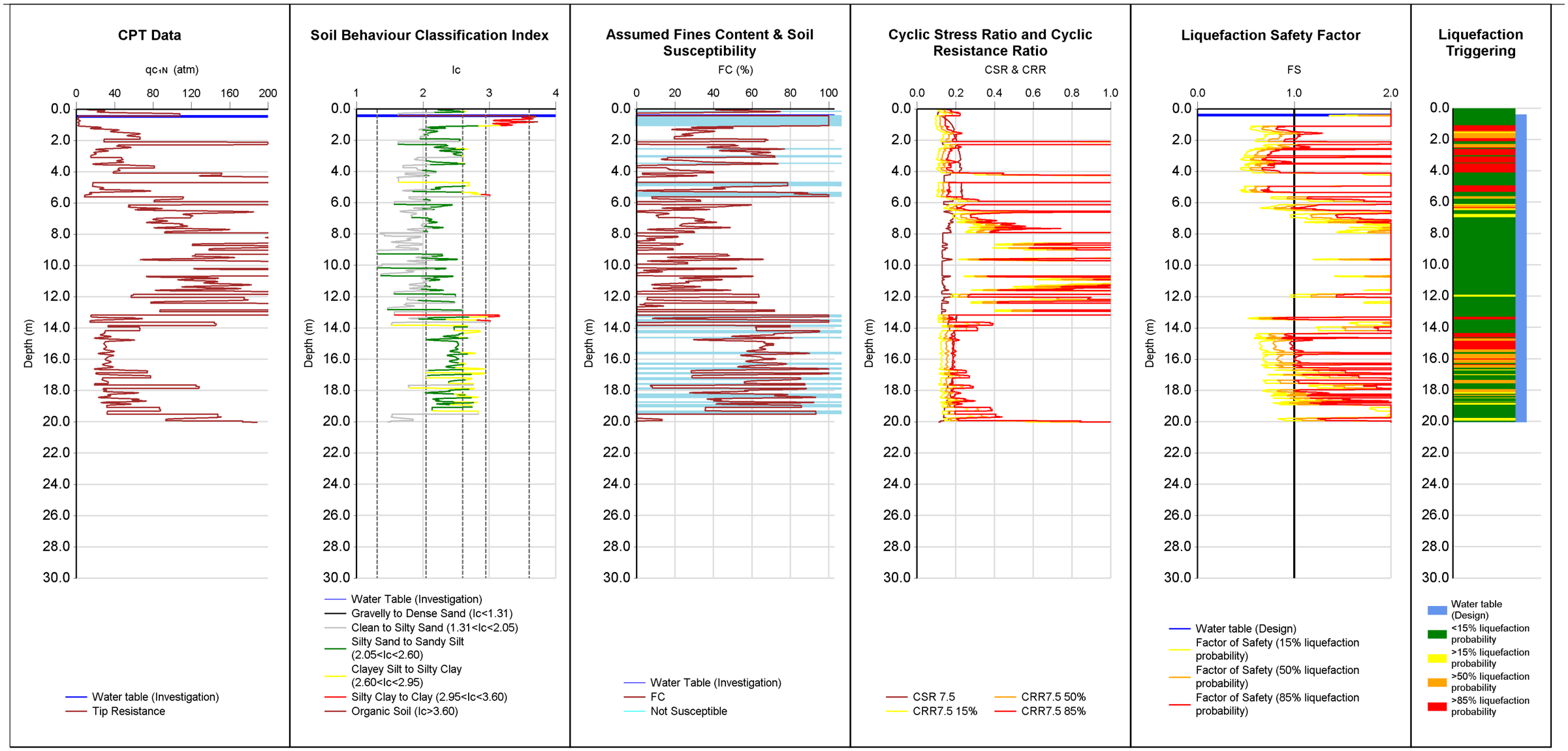
CPT-based soil behavior type classification chart by Robertson (1990)



	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)
INPUT	CPT105	178994	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



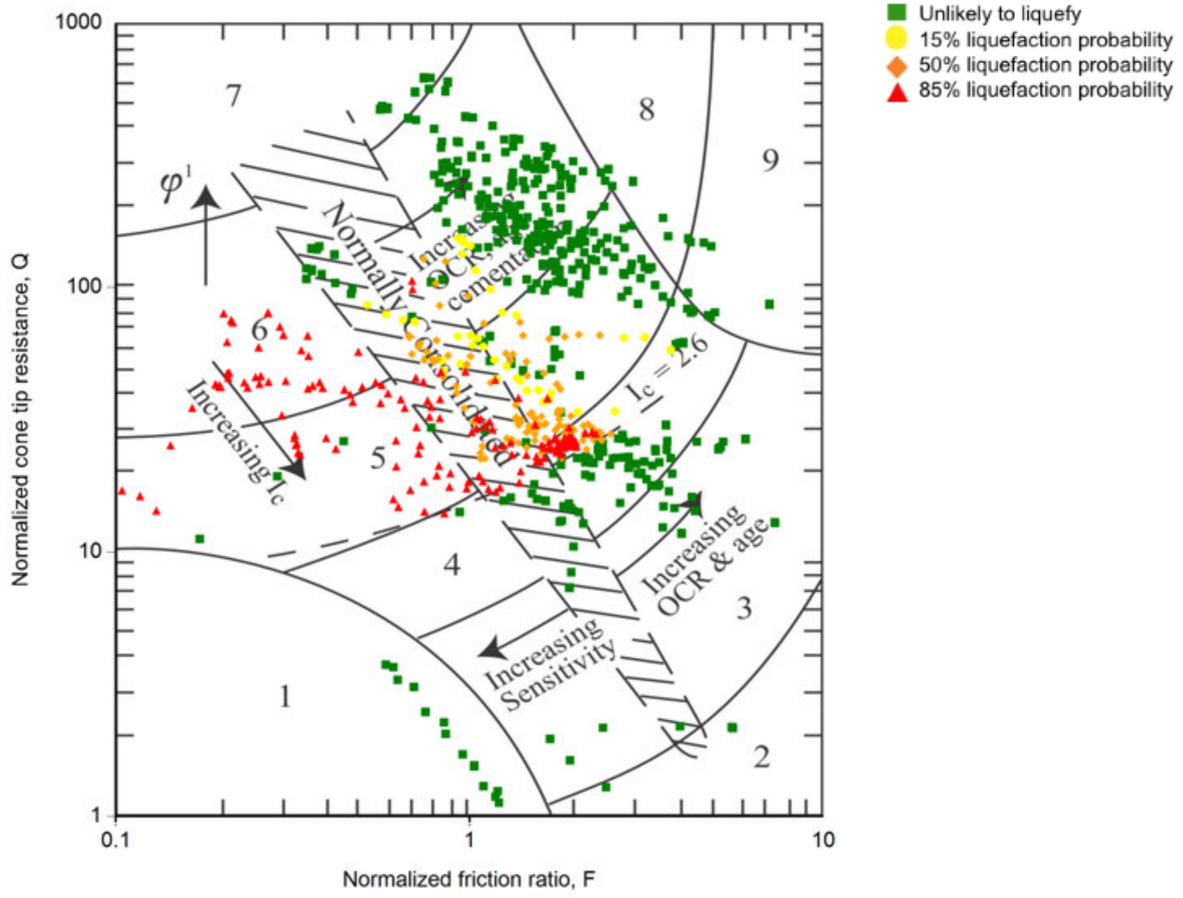
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	15%	179	7.1	14	42	1.2	15
	50%	151	6	9	37	1.2	9
	85%	102	3.5	4	28	1.2	4

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



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8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

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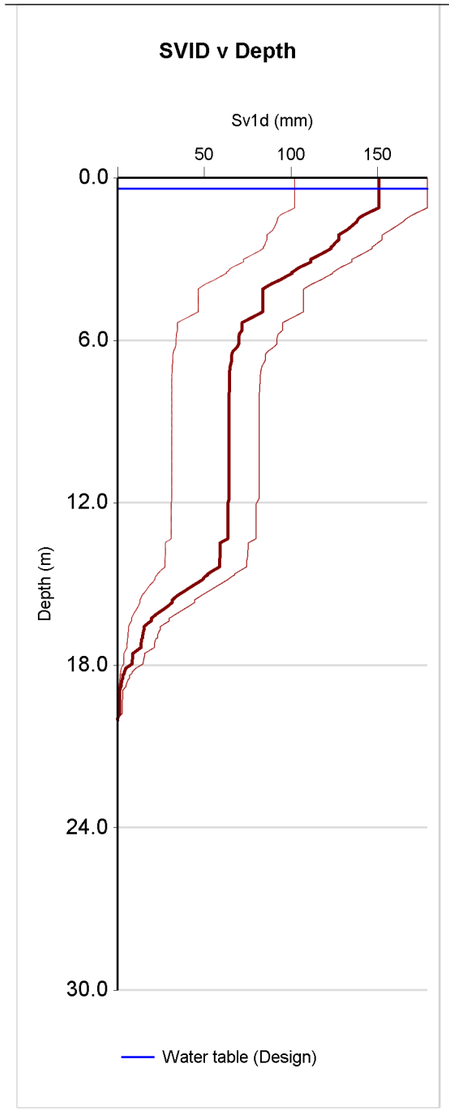
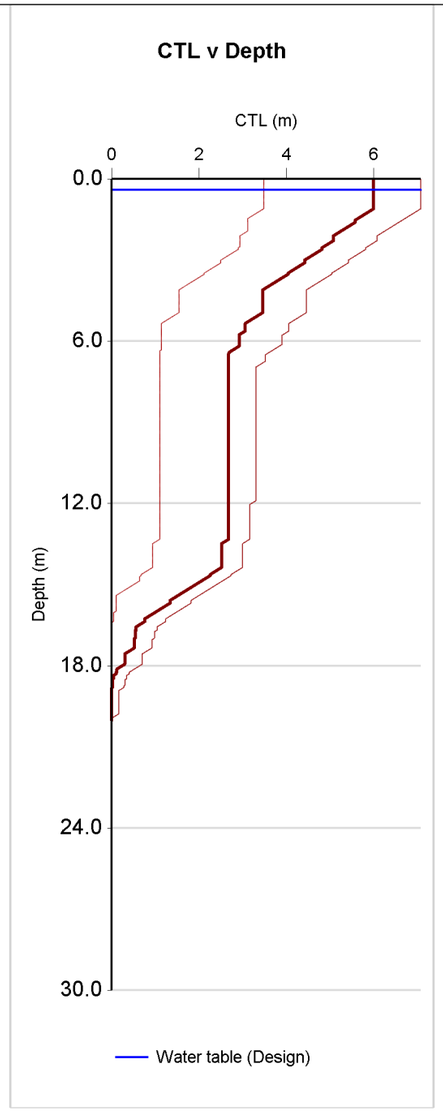
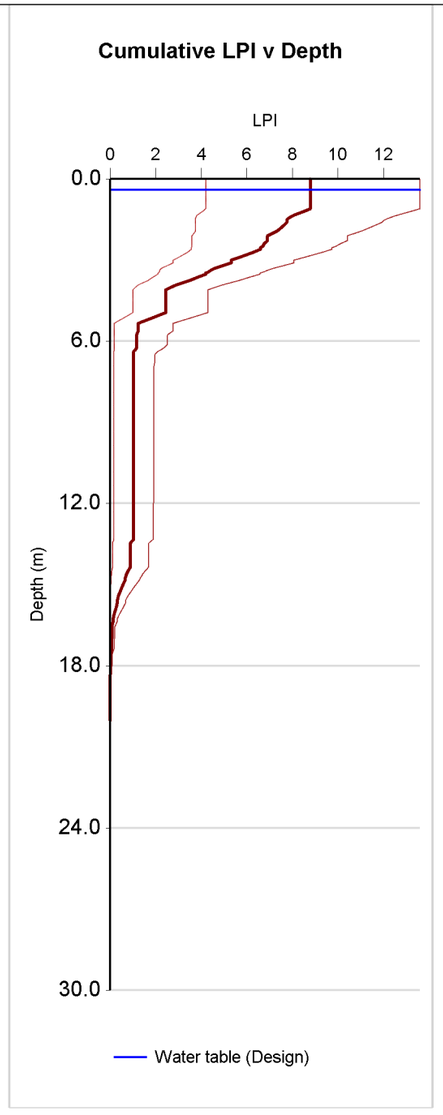
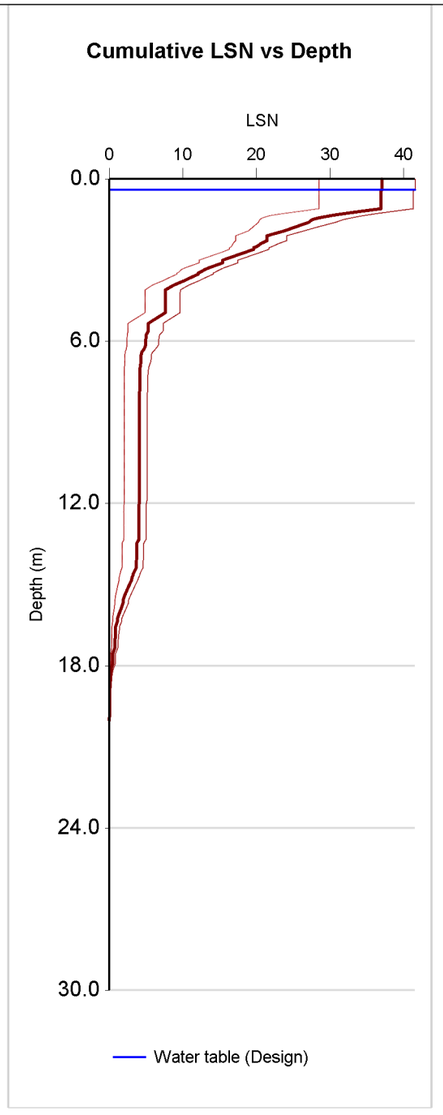
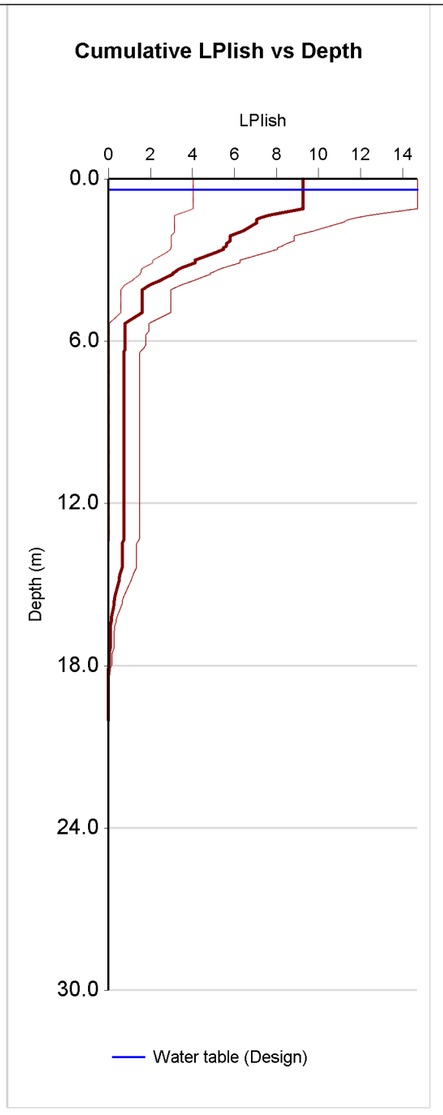
CPT-based soil behavior type classification chart by Robertson (1990)



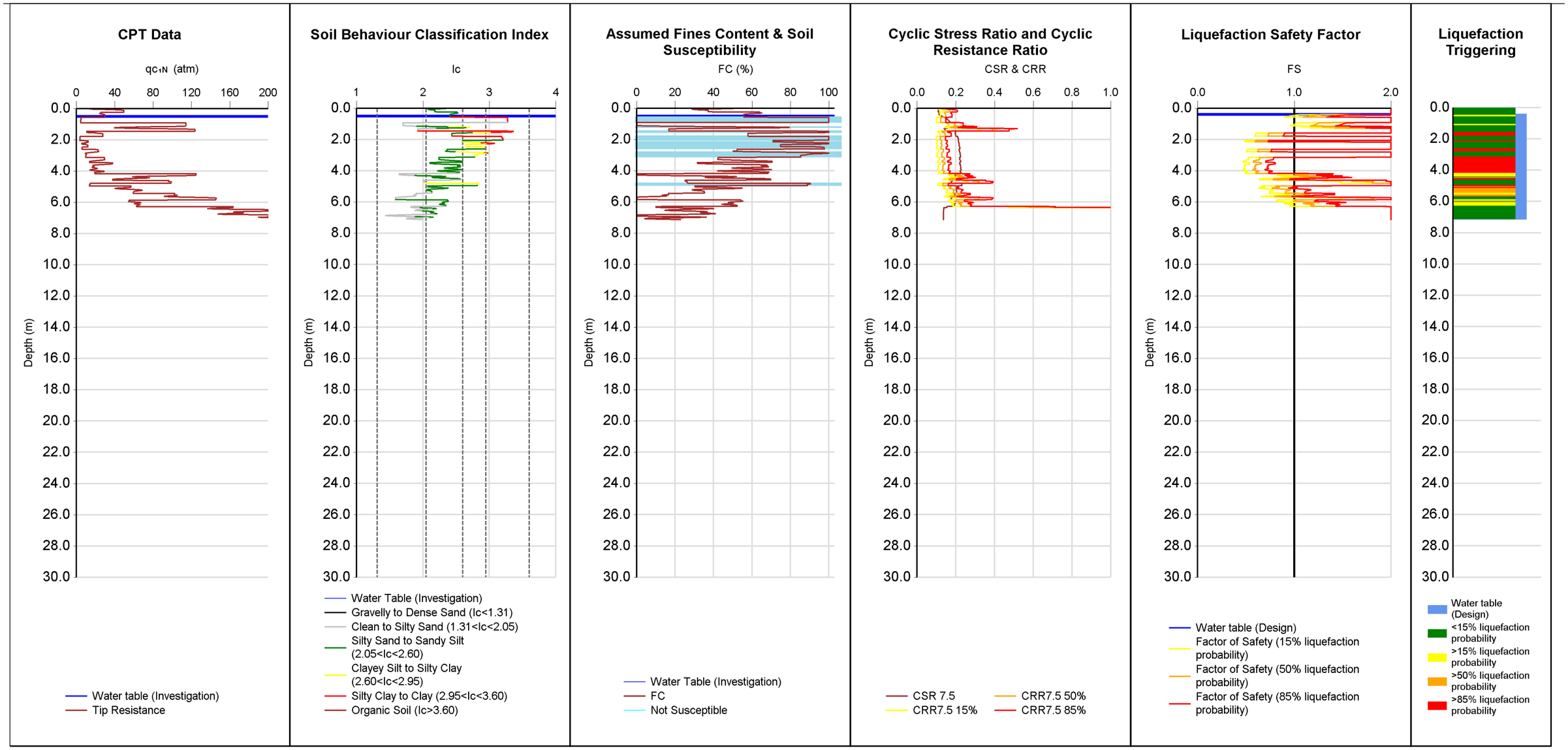








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT106	178995	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



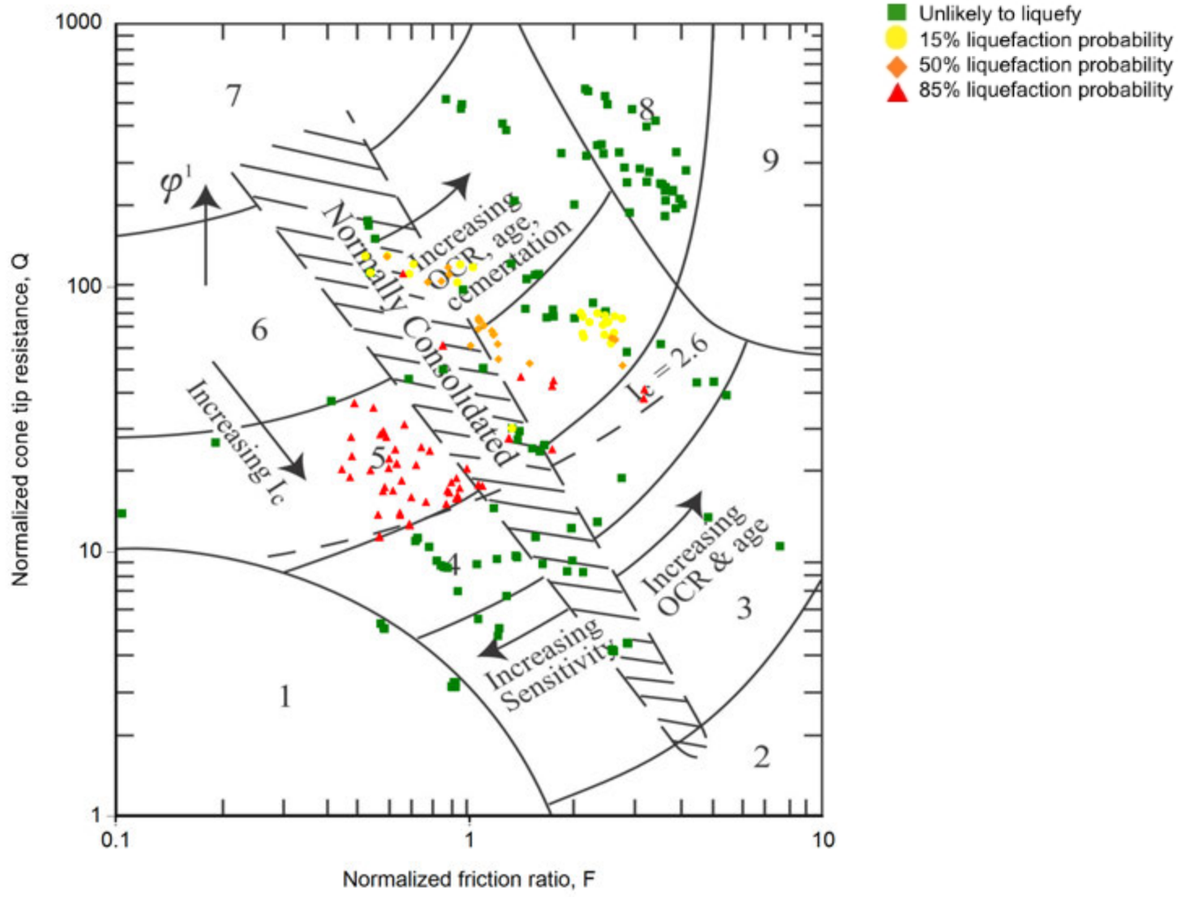
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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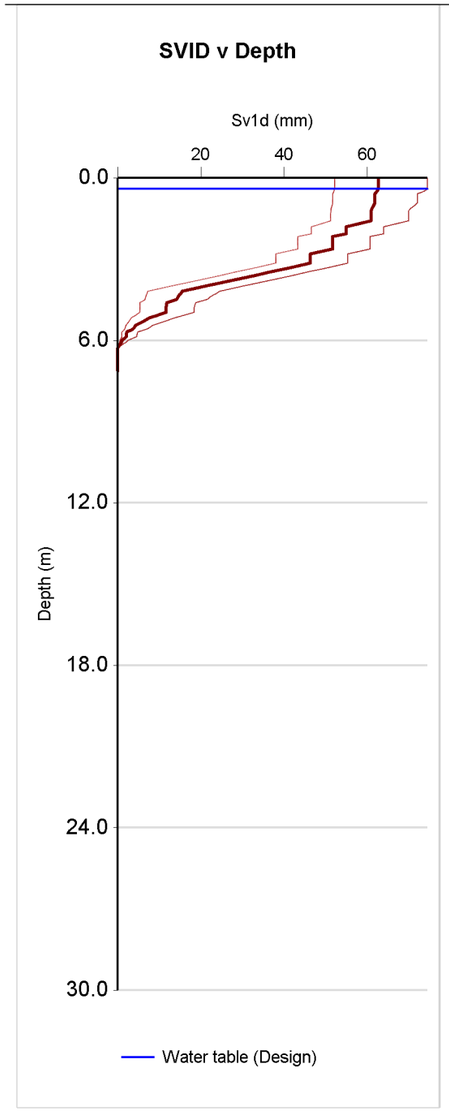
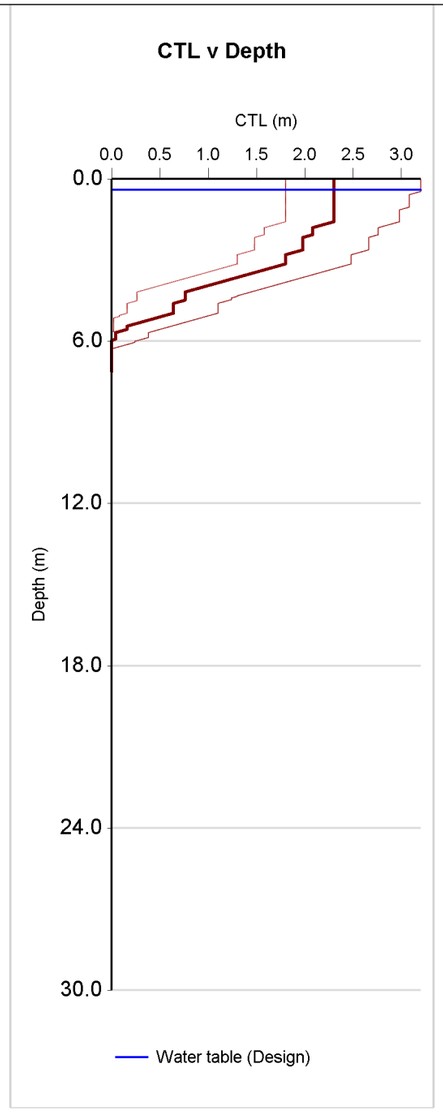
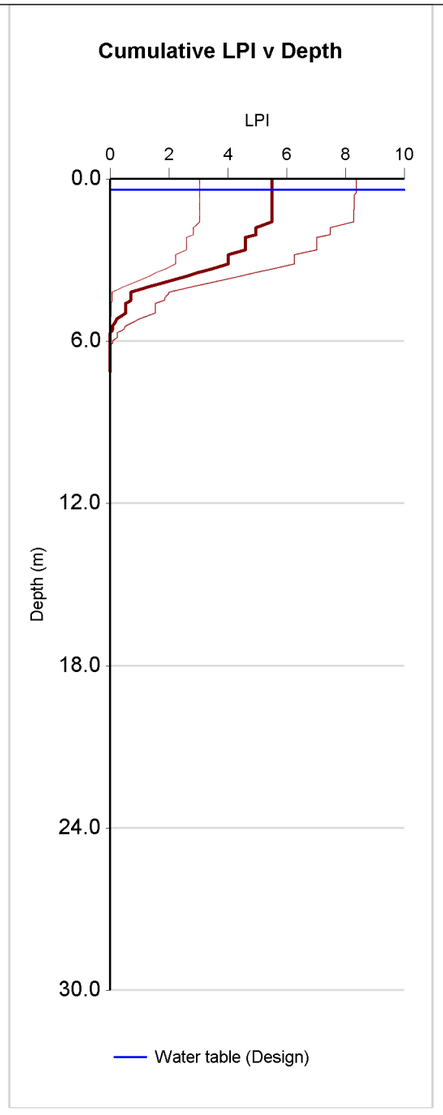
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

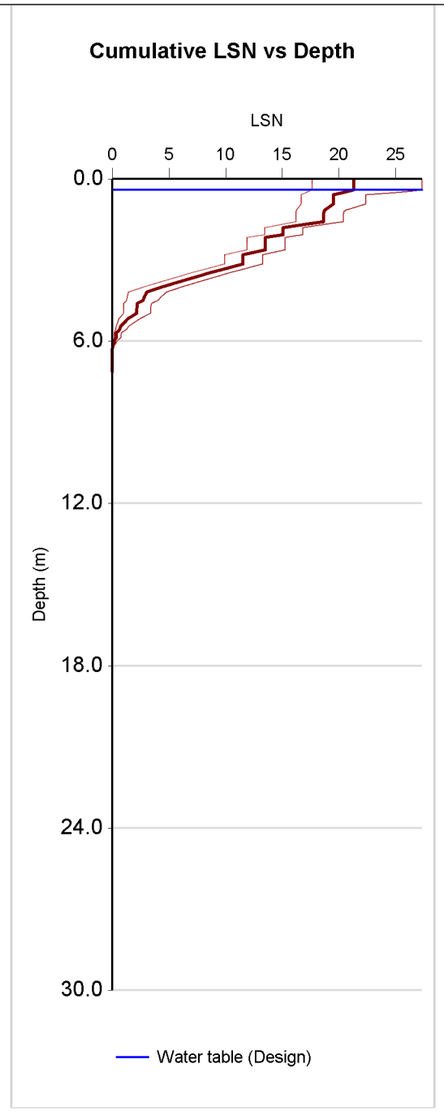
*Heavily overconsolidated or cemented

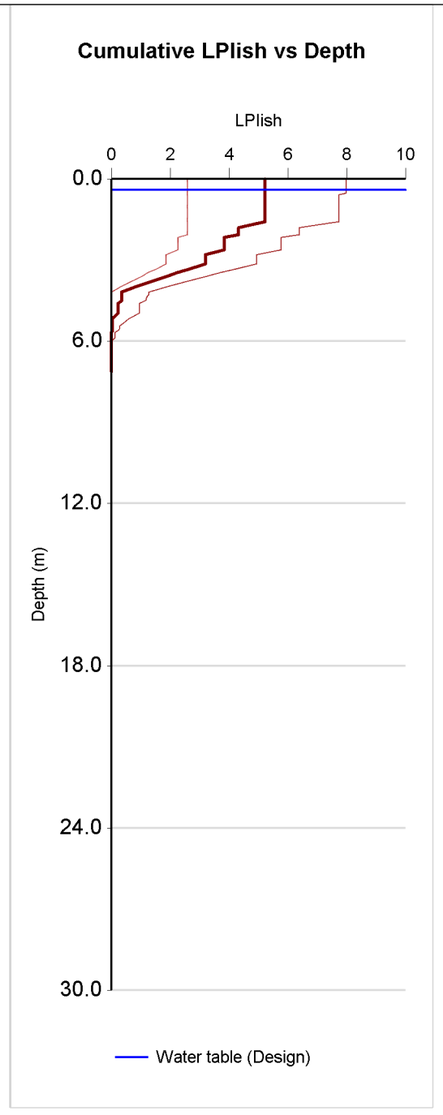
CPT-based soil behavior type classification chart by Robertson (1990)



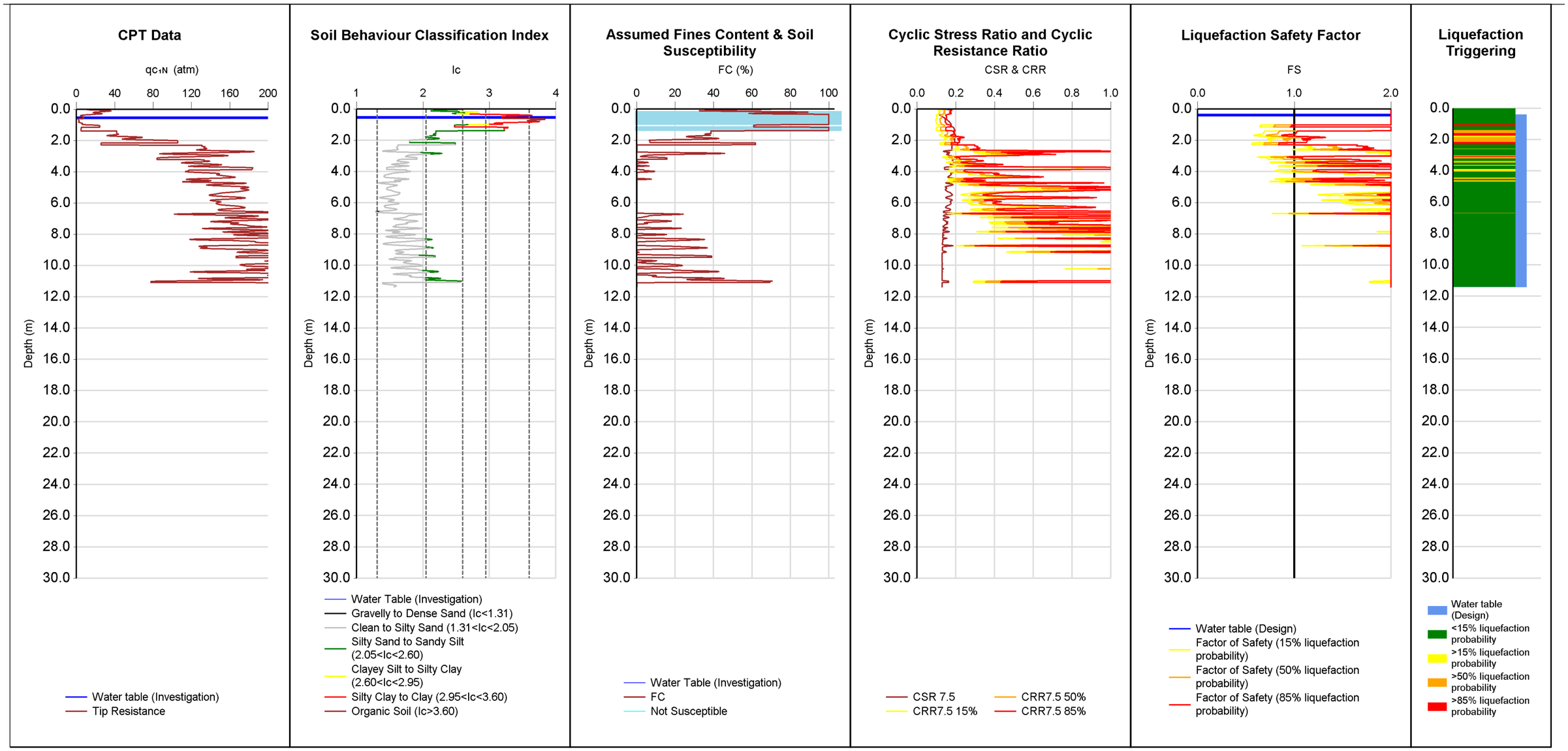








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT107	178996	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



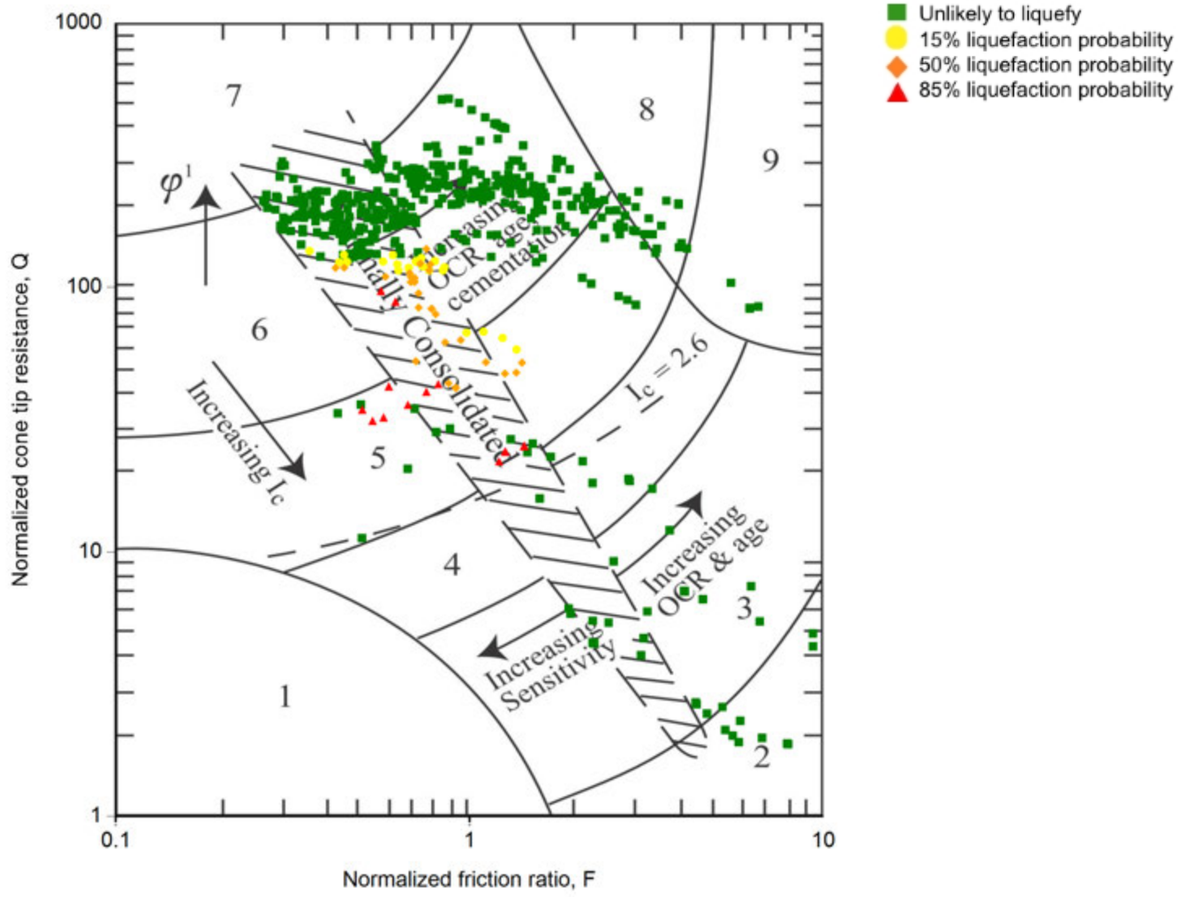
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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6. Sands - clean sand to silty sand
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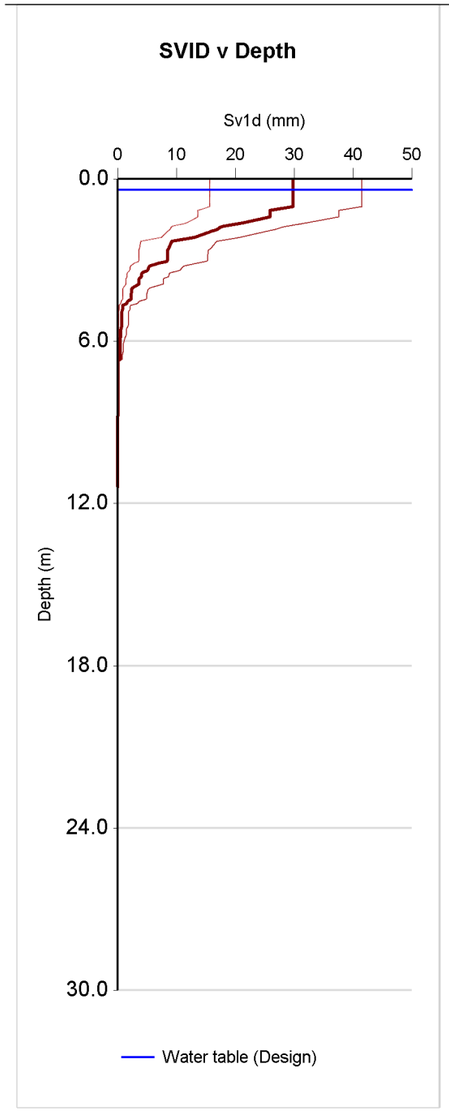
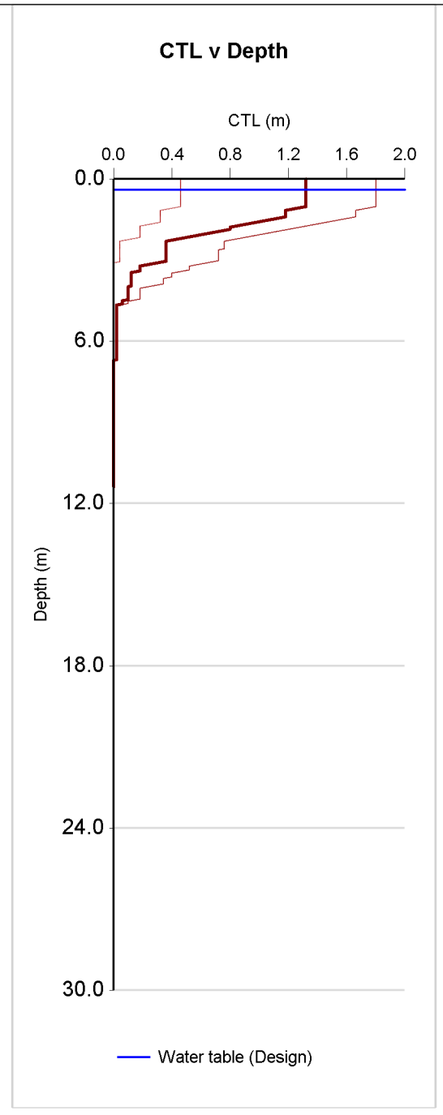
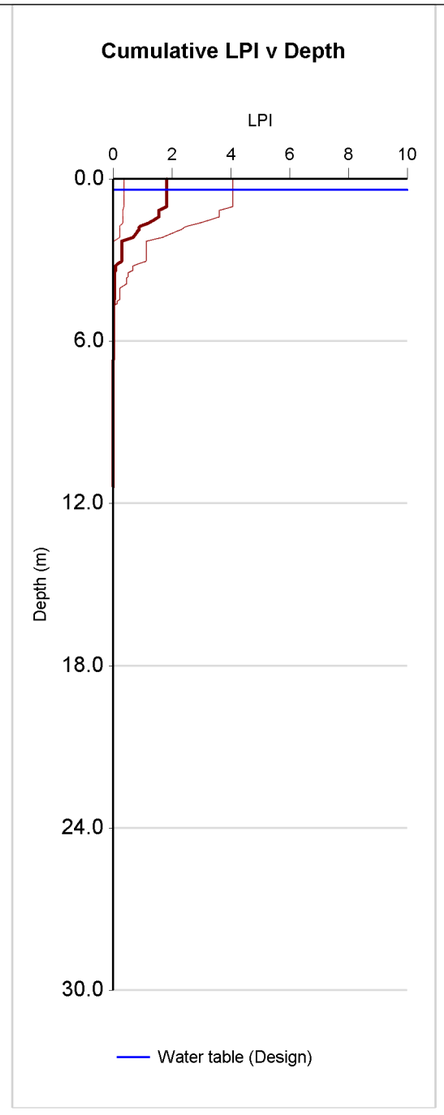
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

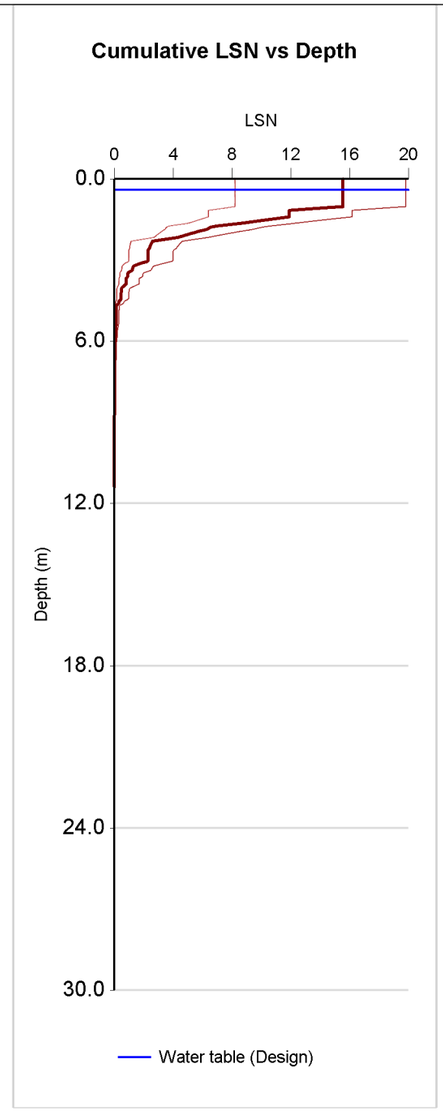
*Heavily overconsolidated or cemented

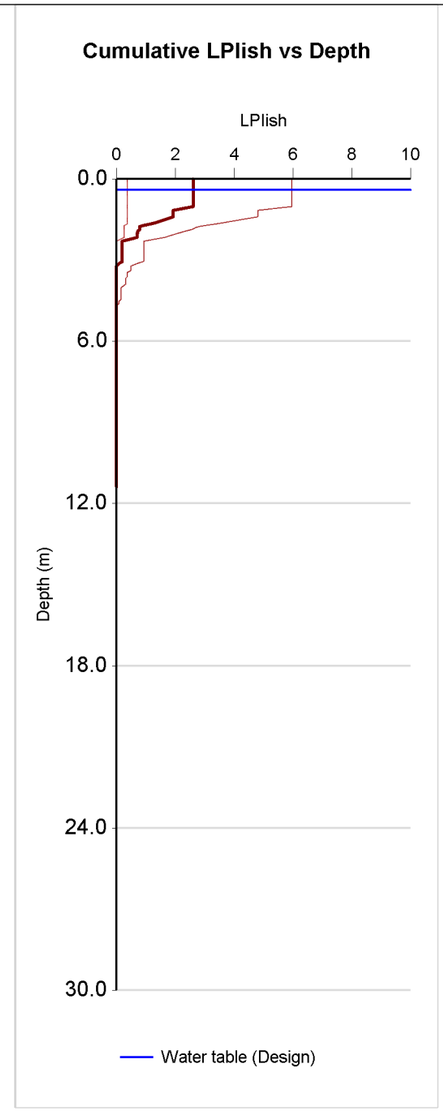
CPT-based soil behavior type classification chart by Robertson (1990)



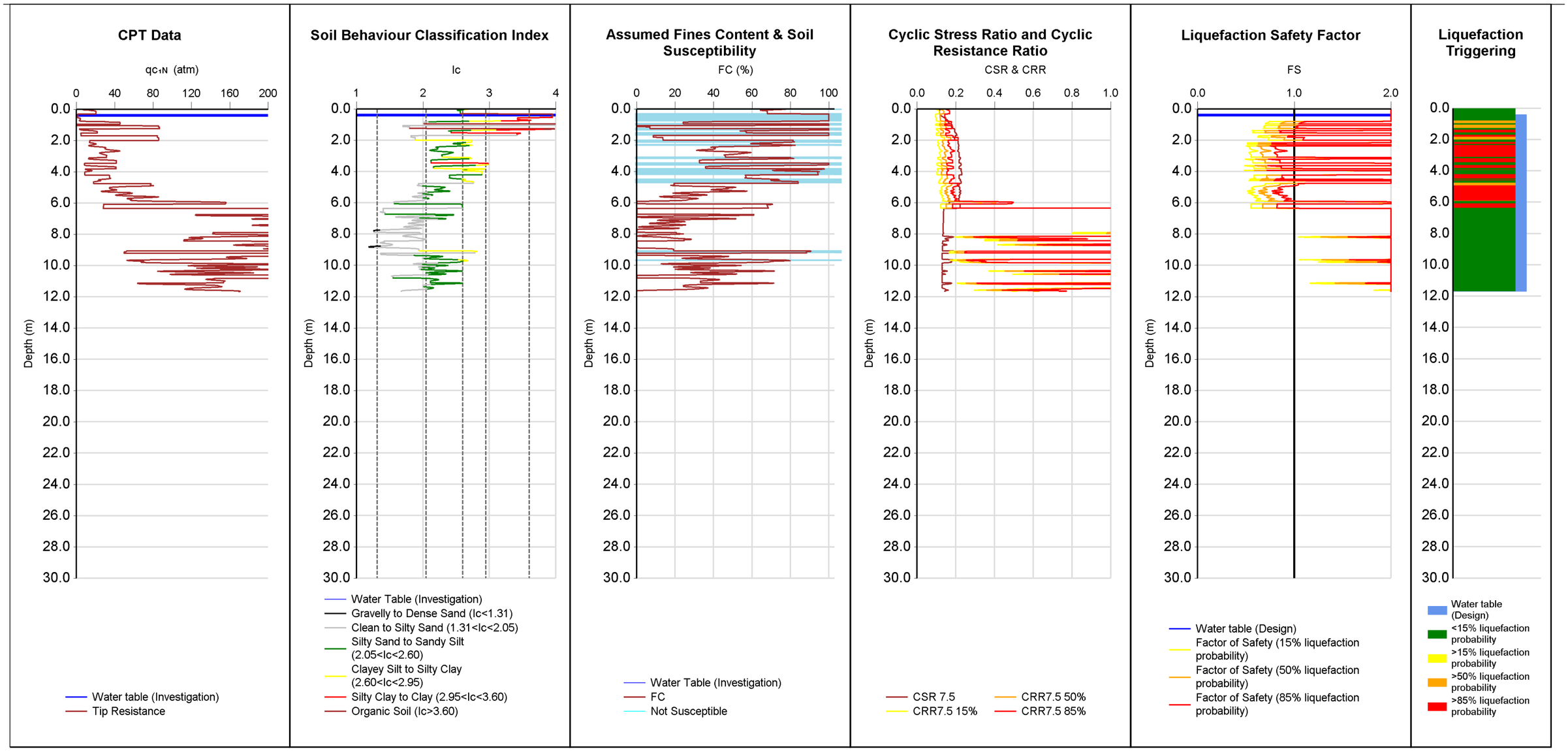








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT108	178997	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



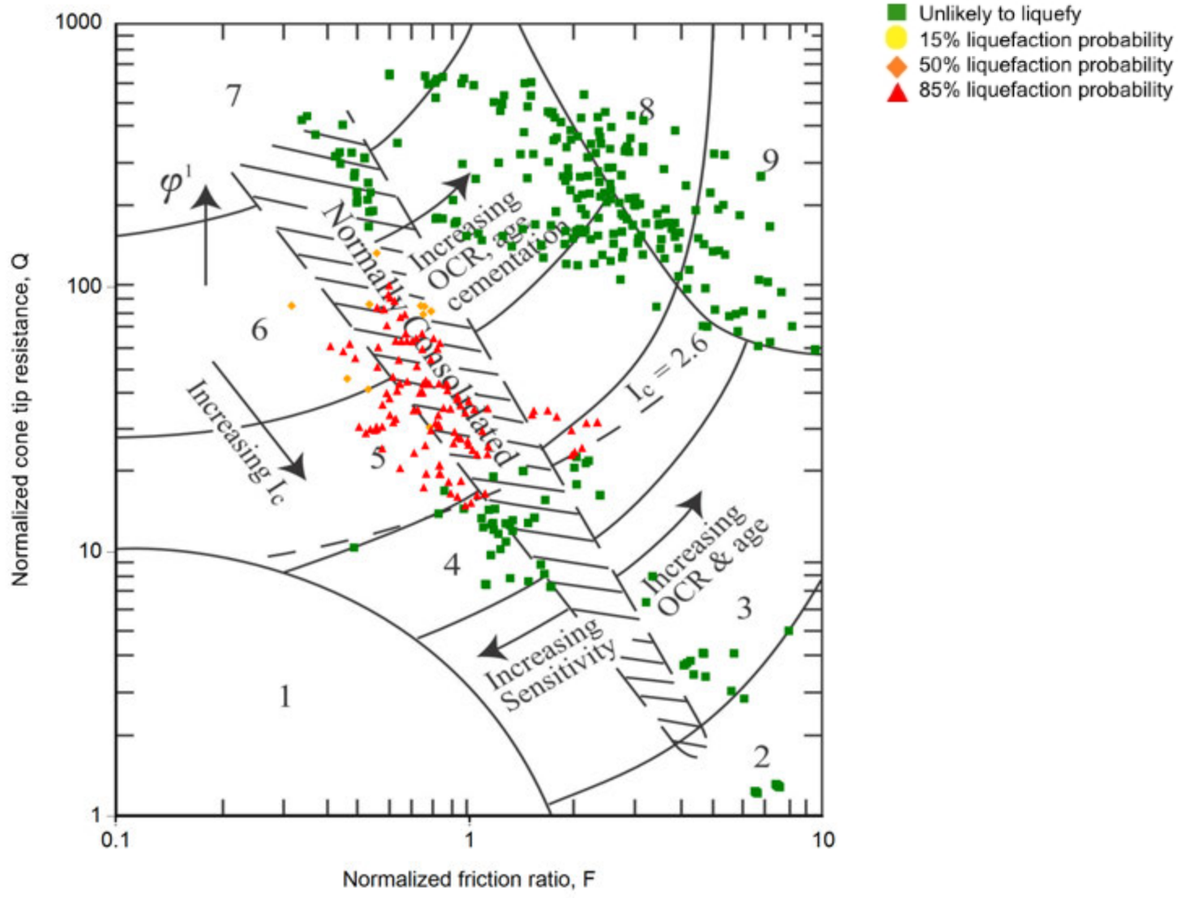
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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)	LPIish
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



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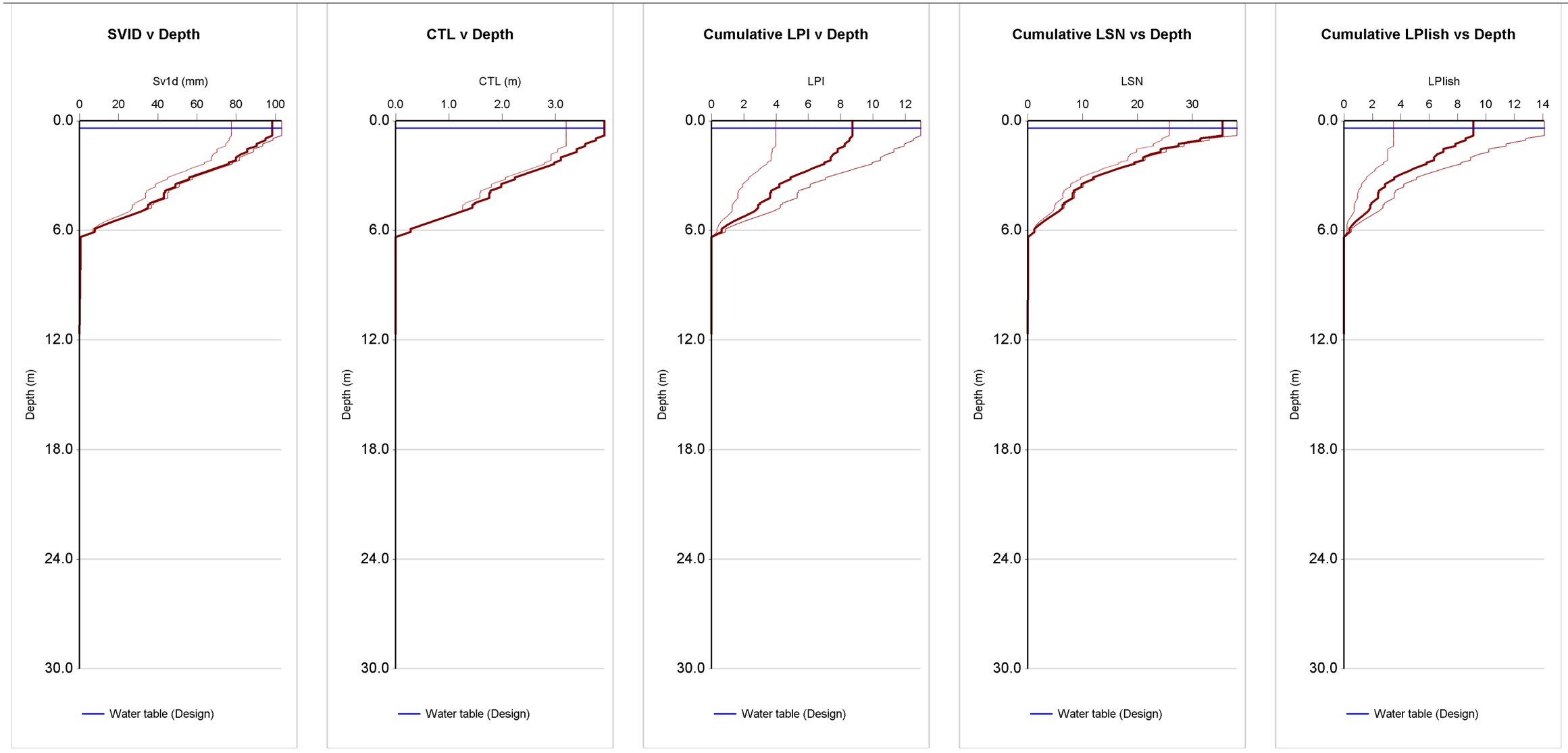
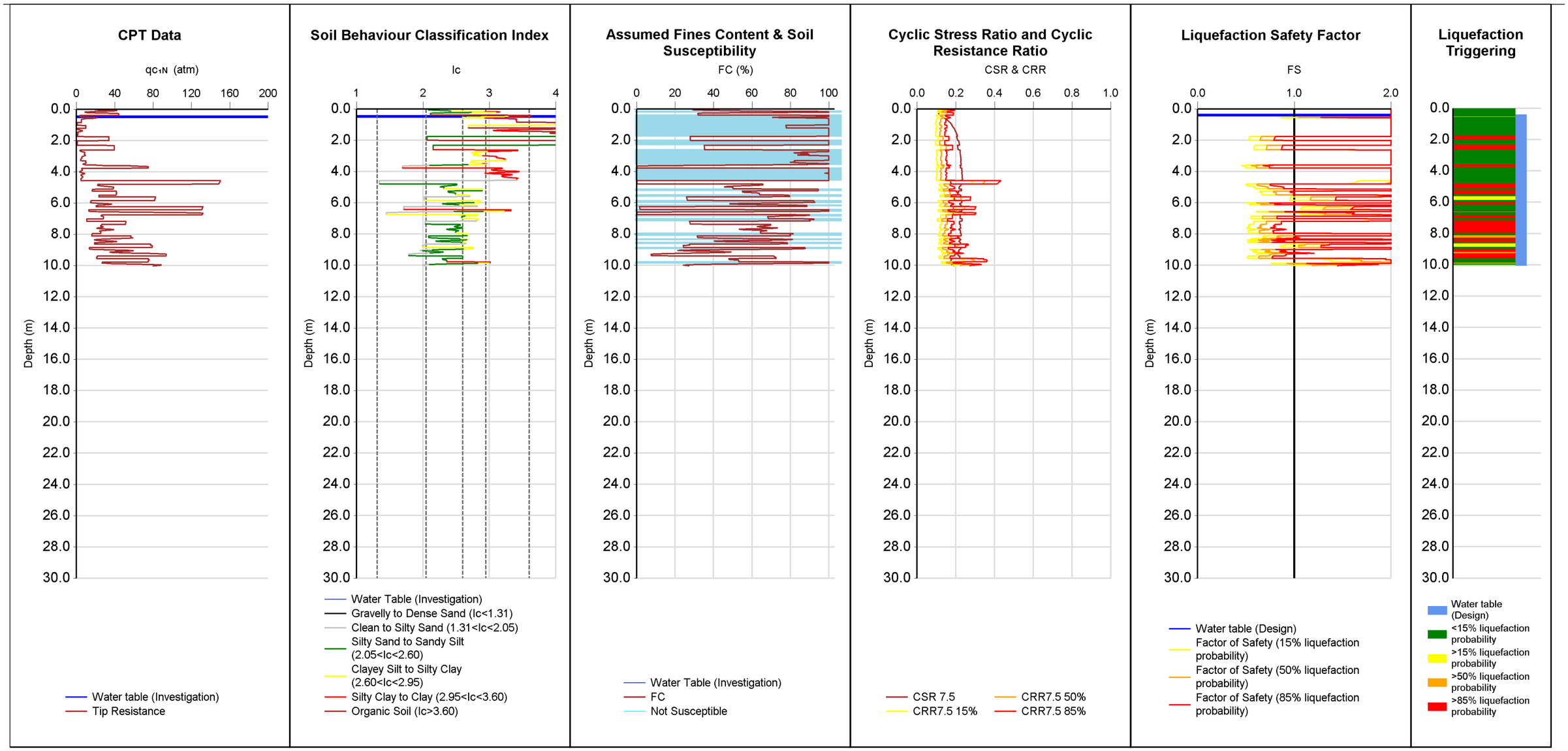


	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT109	178998	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



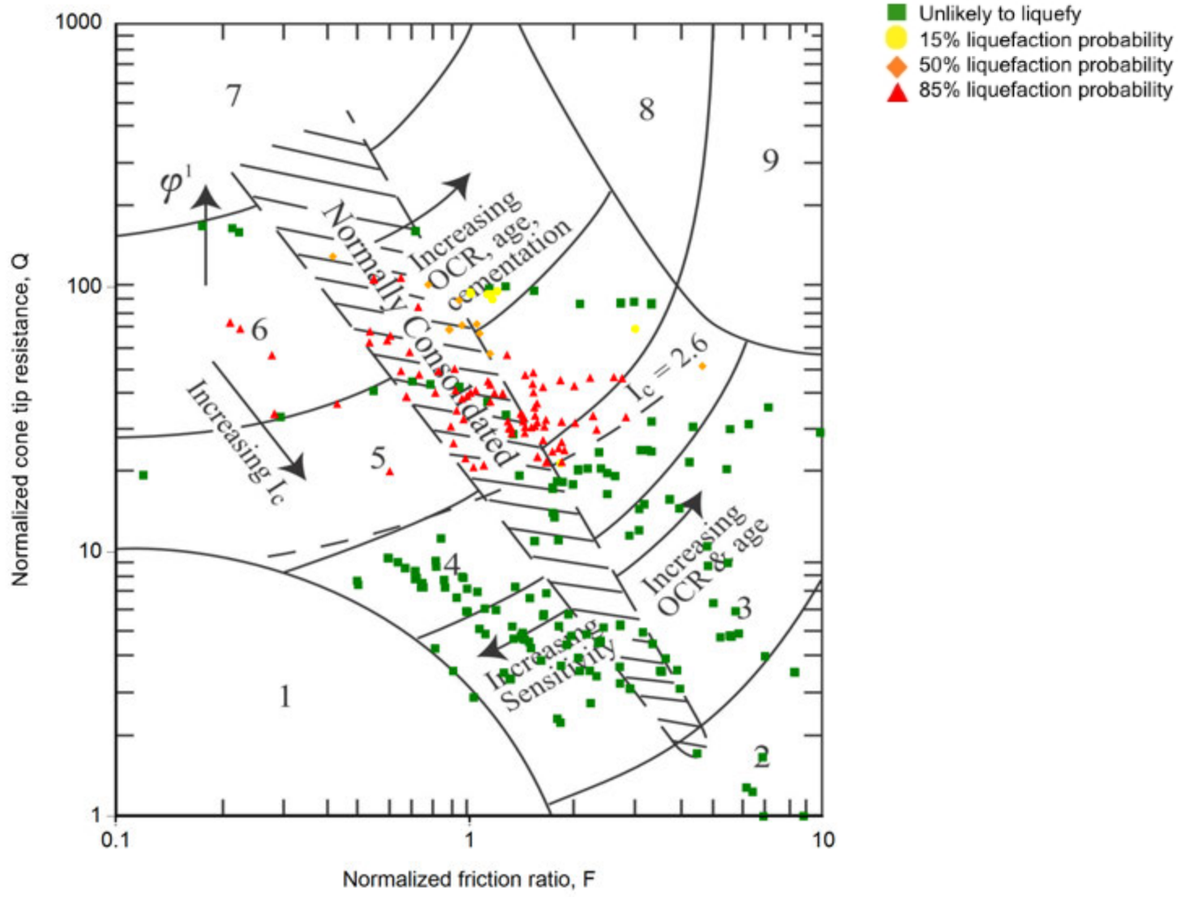
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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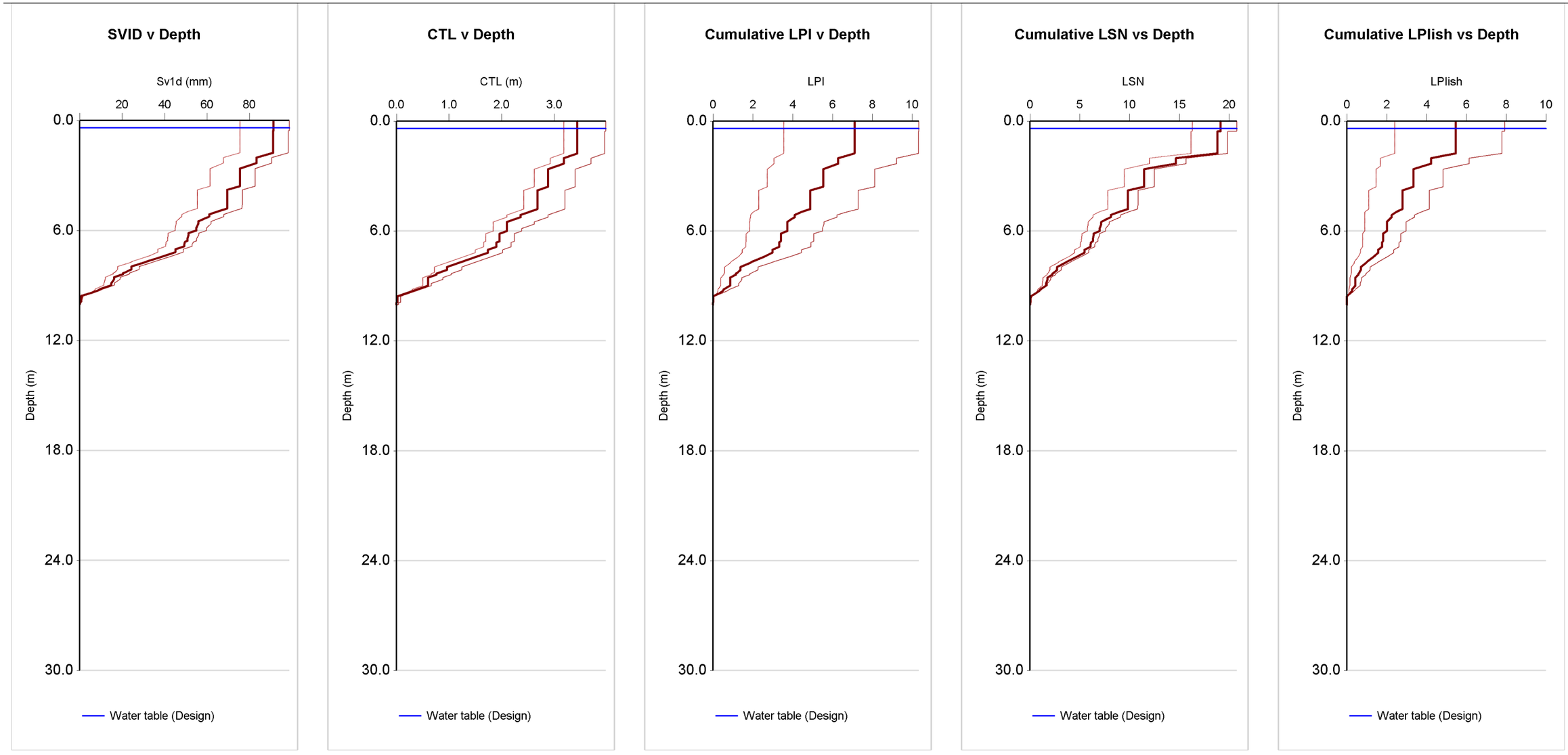
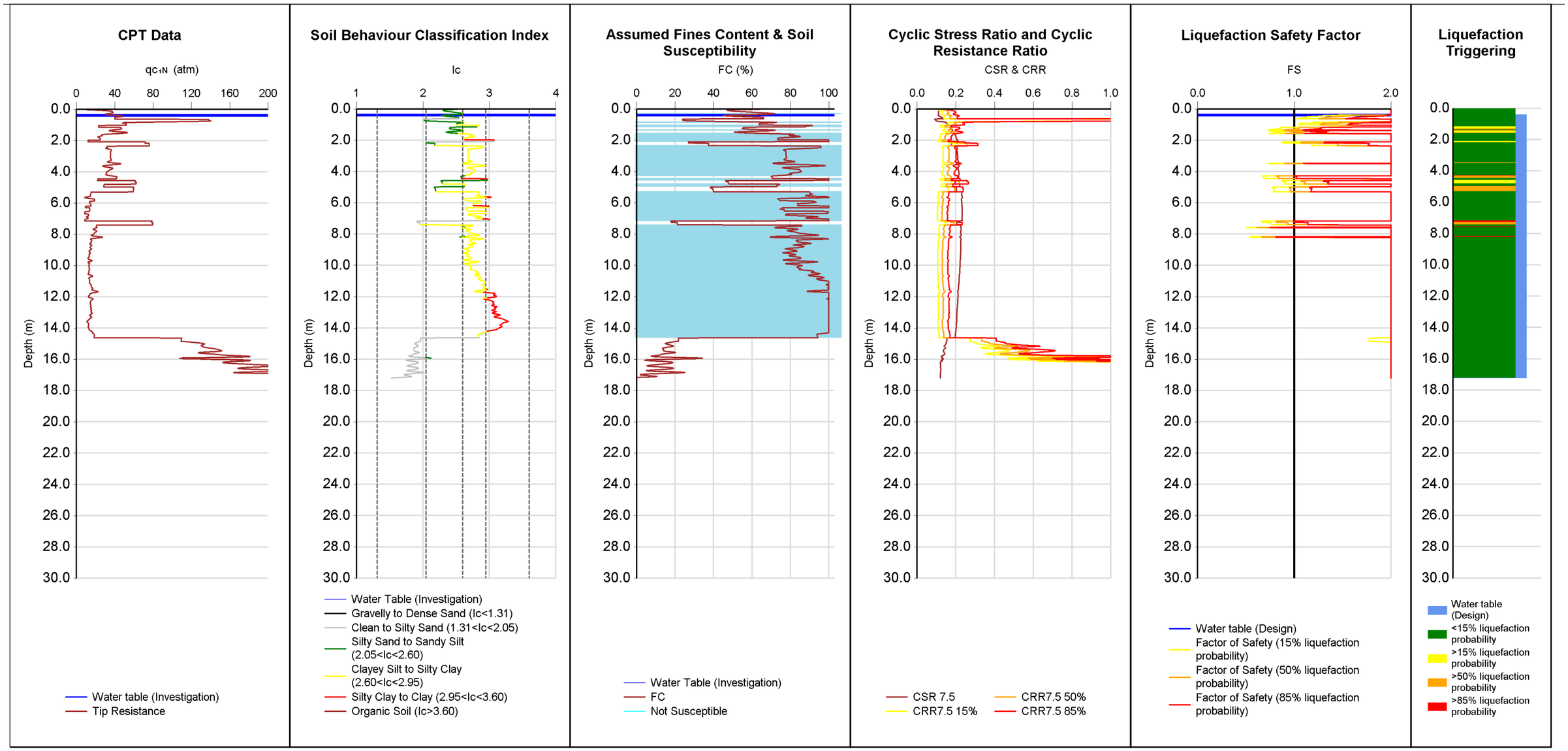


	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT110	178999	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



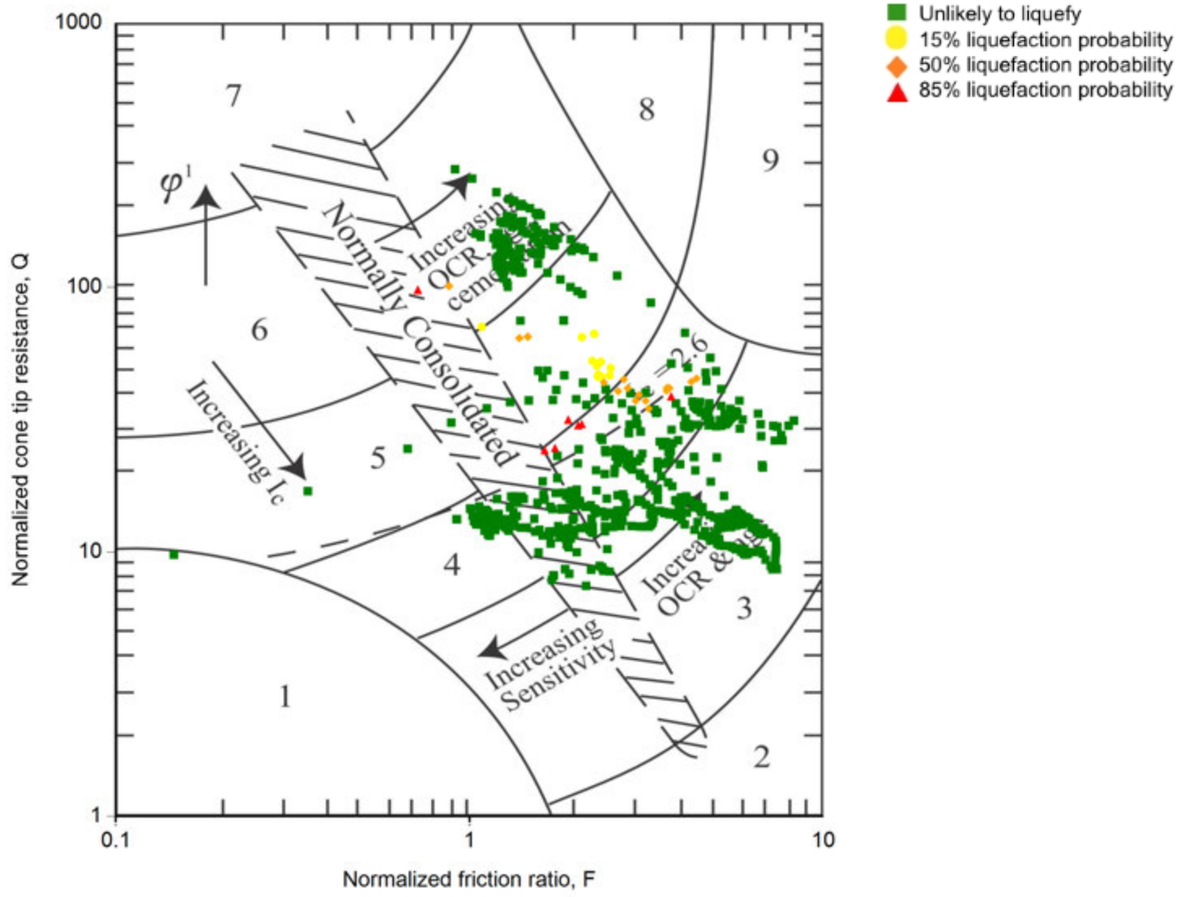
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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)	LPIish
OUTPUT	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:

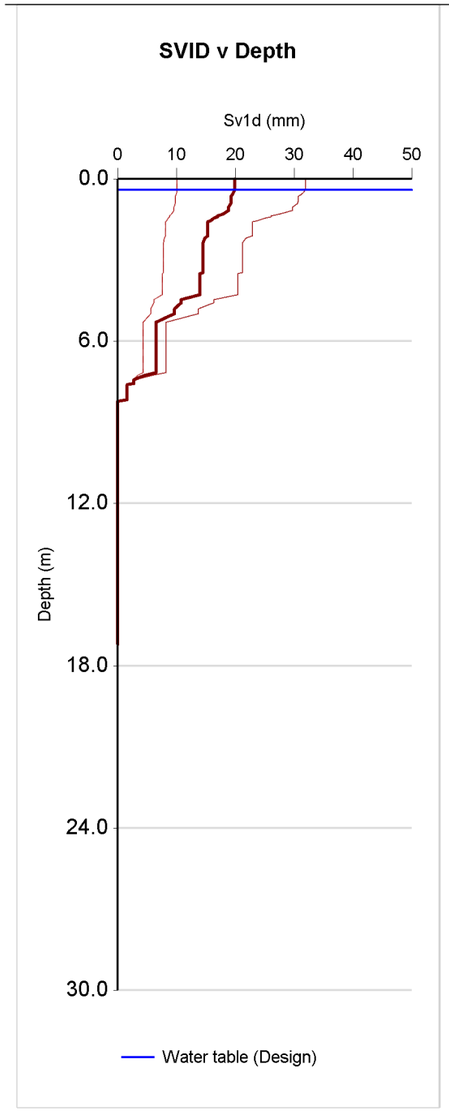
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc

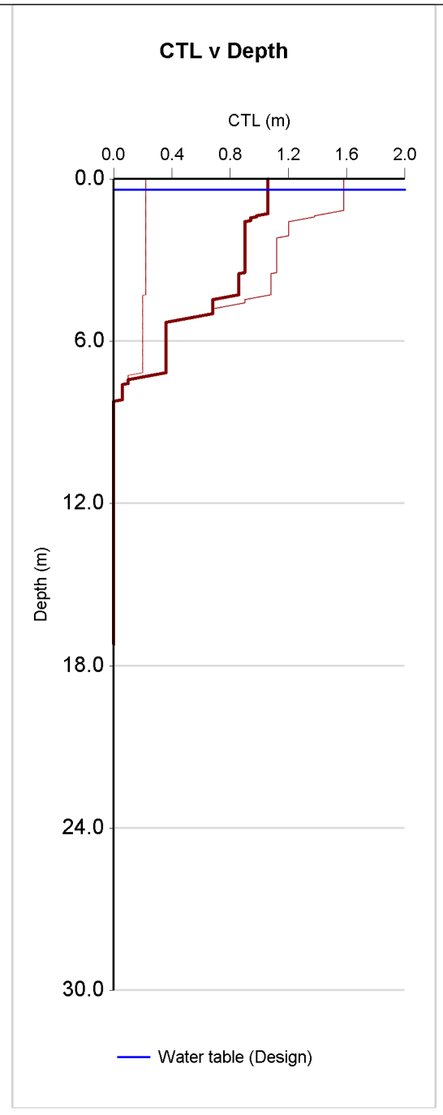


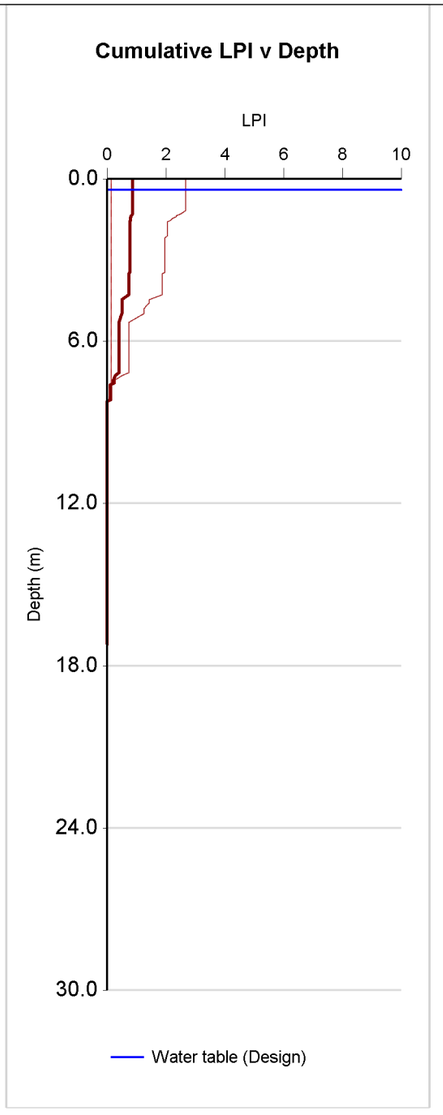
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

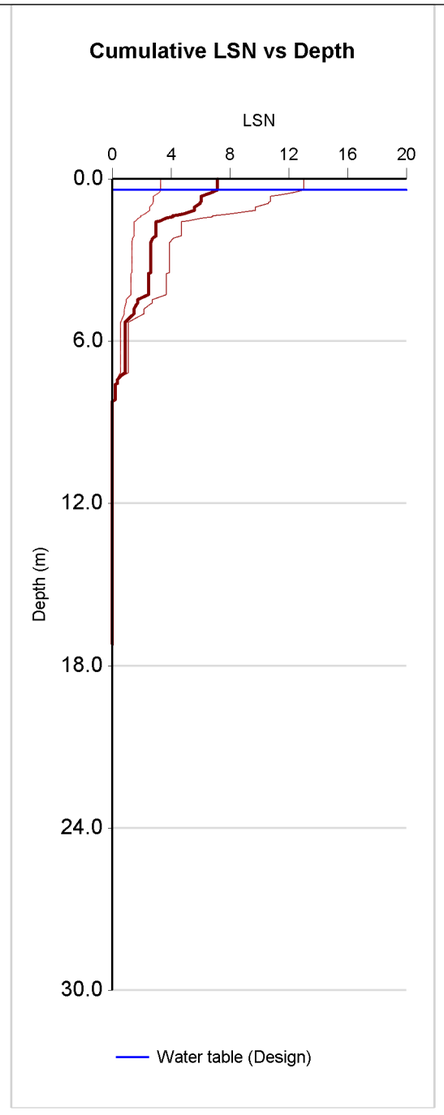
*Heavily overconsolidated or cemented

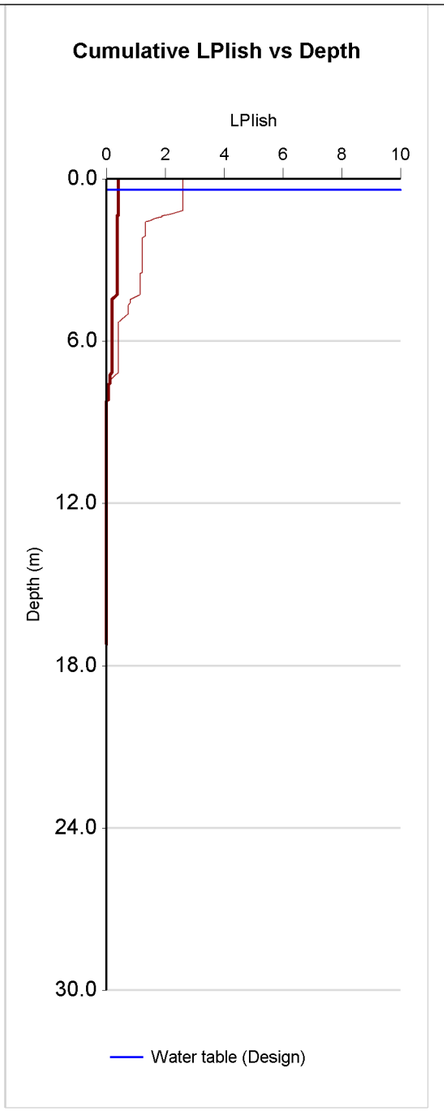
CPT-based soil behavior type classification chart by Robertson (1990)



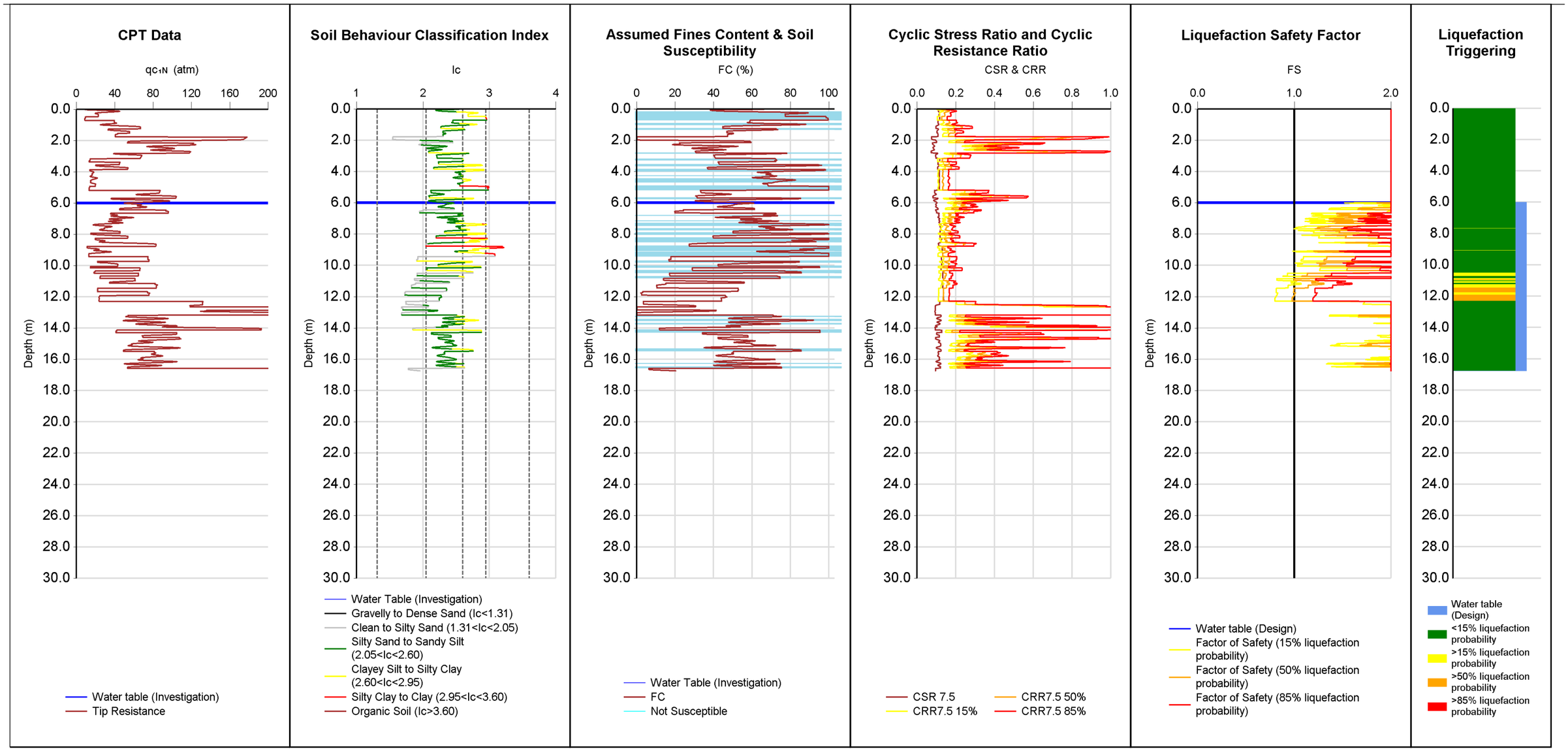








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT111	179000	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



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

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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

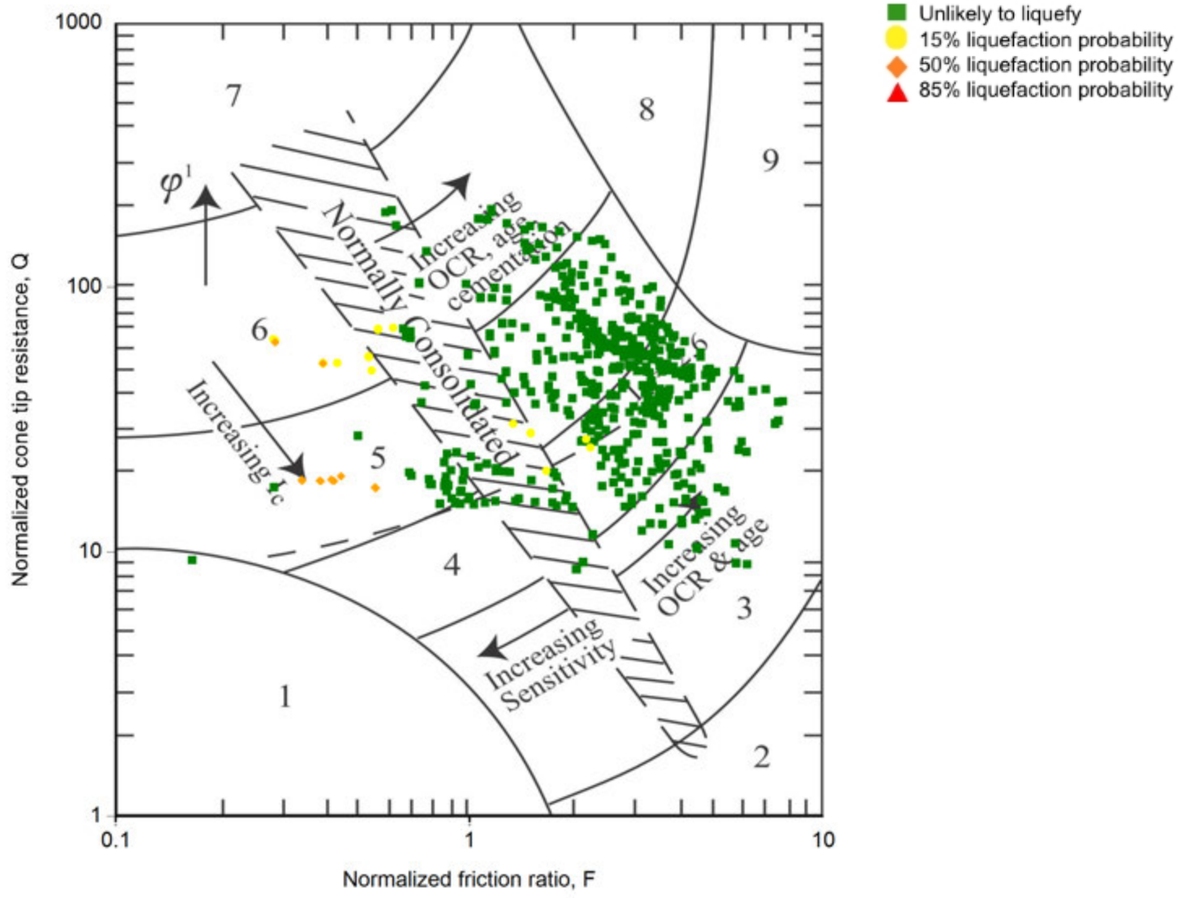
Tonkin + Taylor

Exceptional thinking together

V2.4.15

CLIENT	**Brymer Farms Ltd**	LOCATION	Hamilton
PROJECT	**Brymer Farms Subdivision**		
TITLE	**Liquefaction Analyses**	JOB NUMBER	**1017355.0000**
COMMENT	1 in 500 Year Event - ULS IL2		

DATE	24/06/2021
ANALYSED	cand
PAGE	34 of 47 pages



1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
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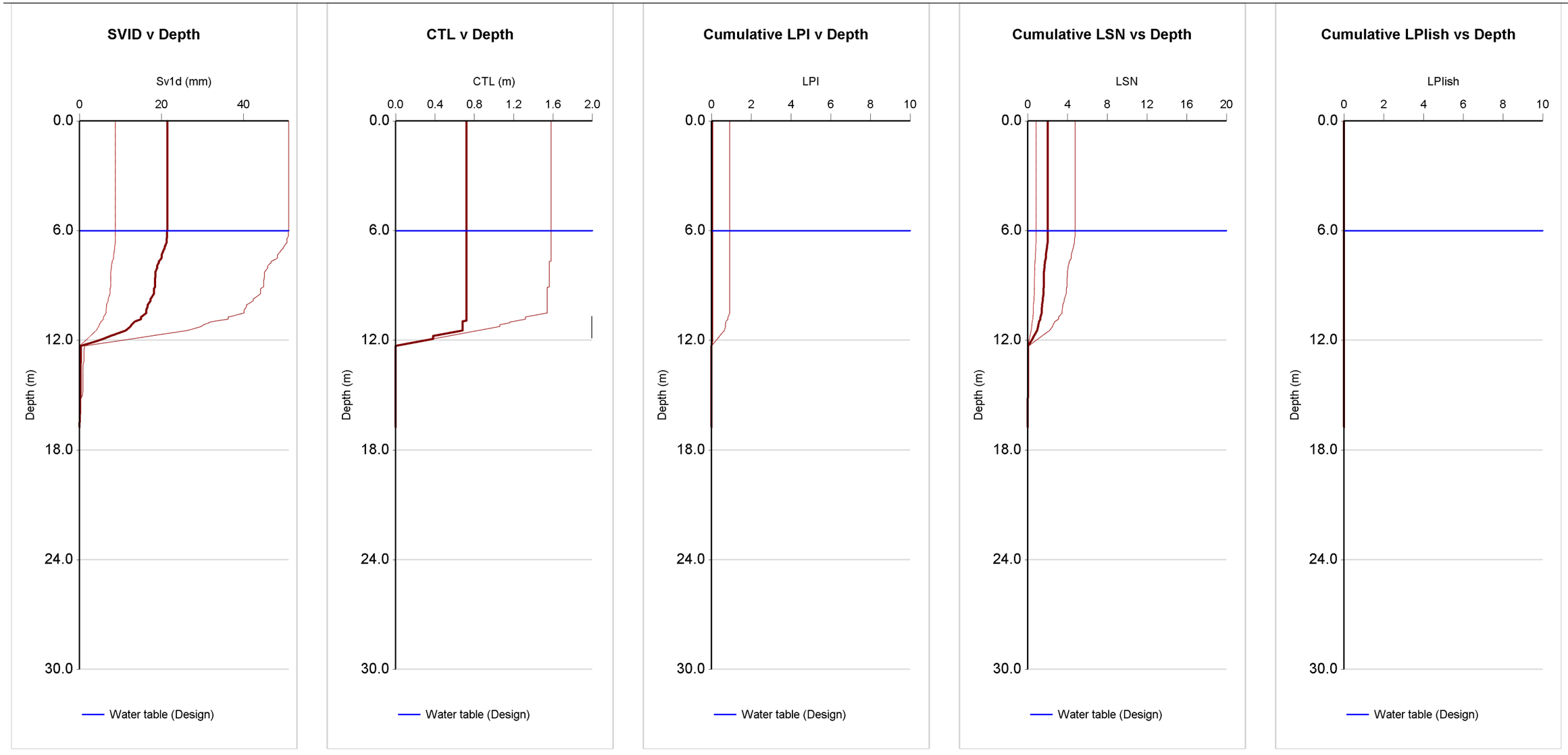
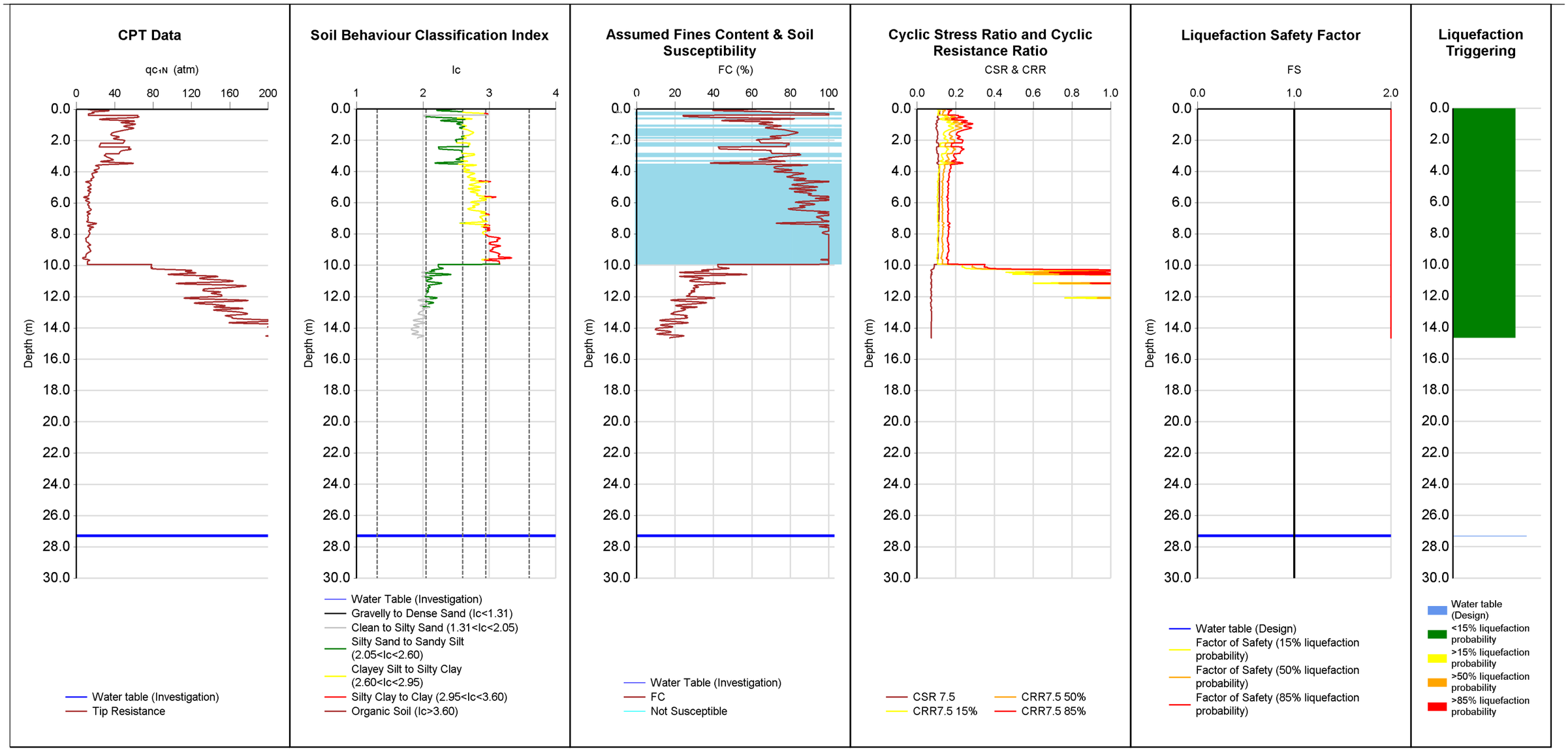
*Heavily overconsolidated or cemented

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



	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)
INPUT	CPT112	179001	17/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



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

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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)	LPIish
OUTPUT	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

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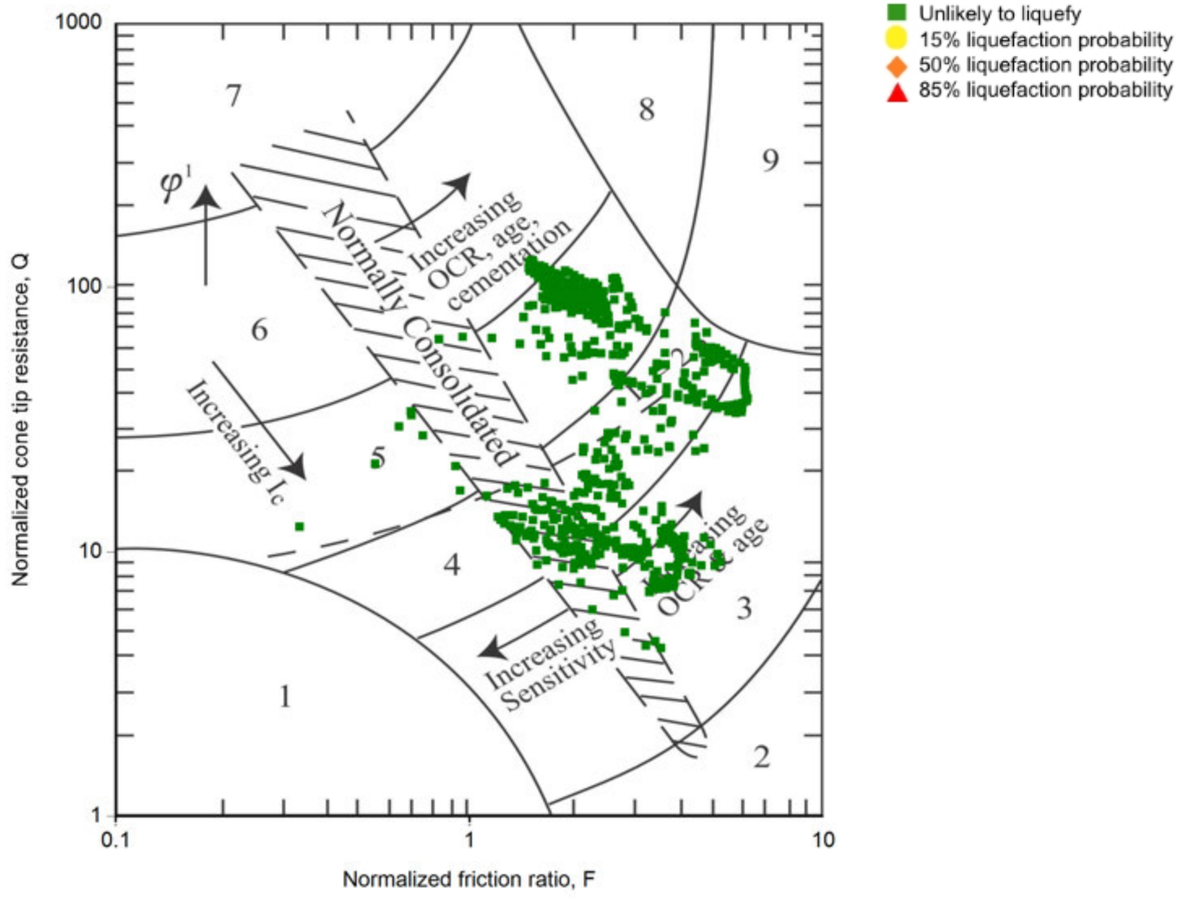
Exceptional thinking together

V2.4.15

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



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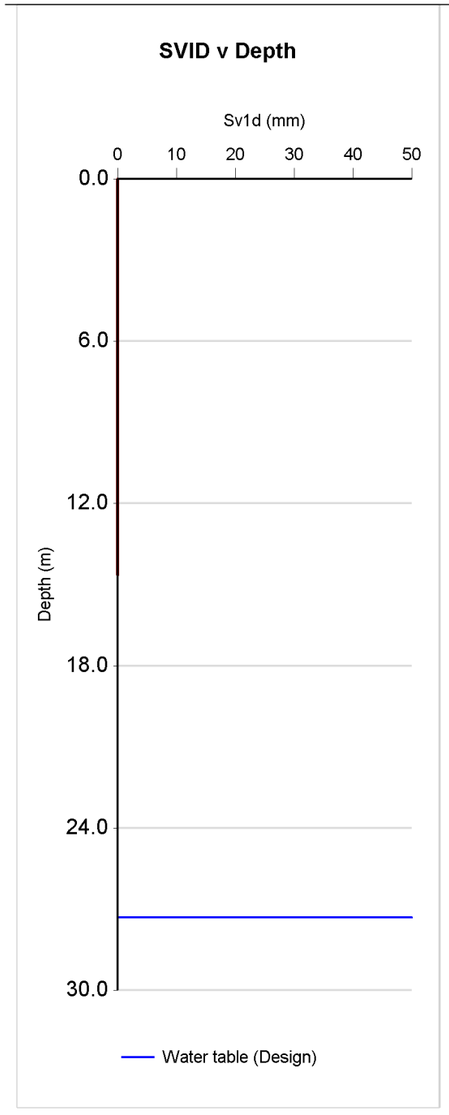
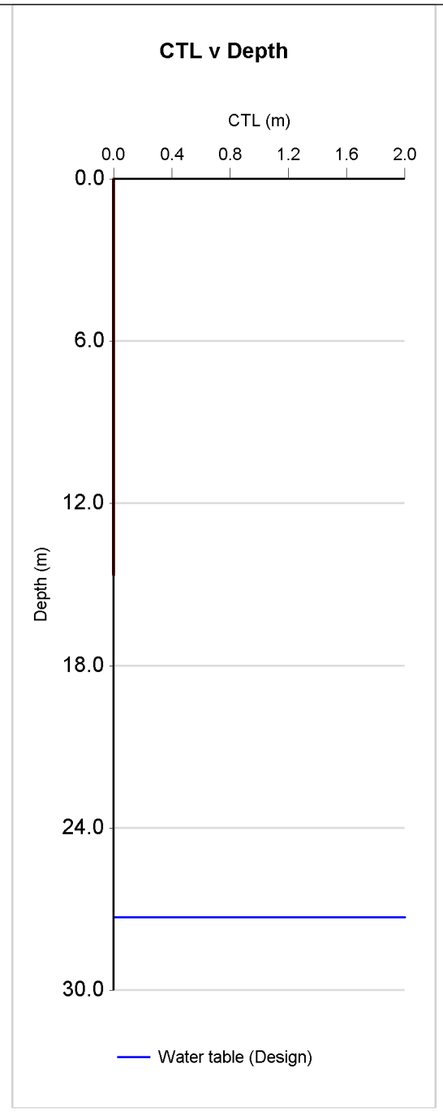
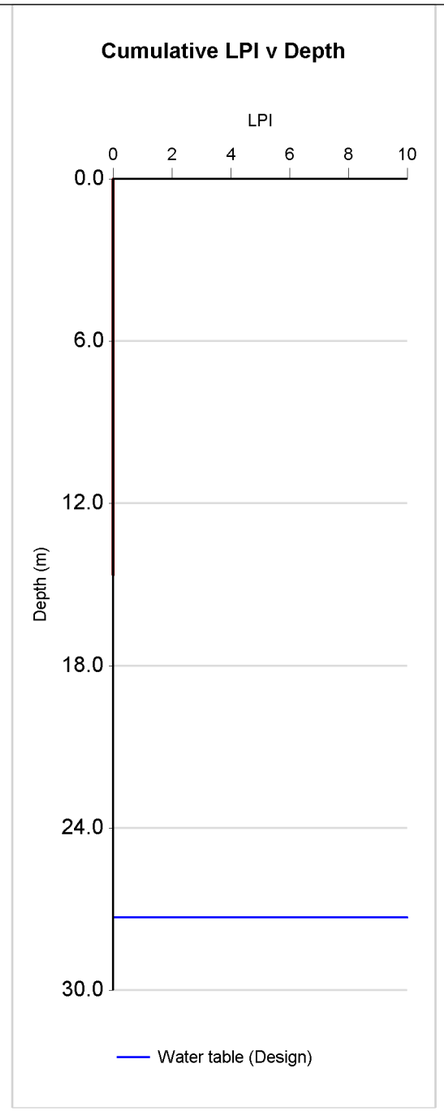
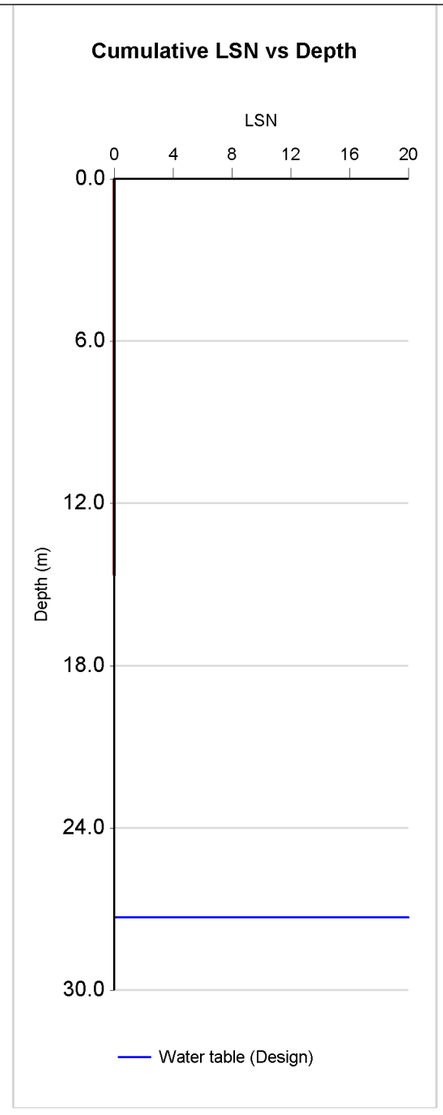
*Heavily overconsolidated or cemented

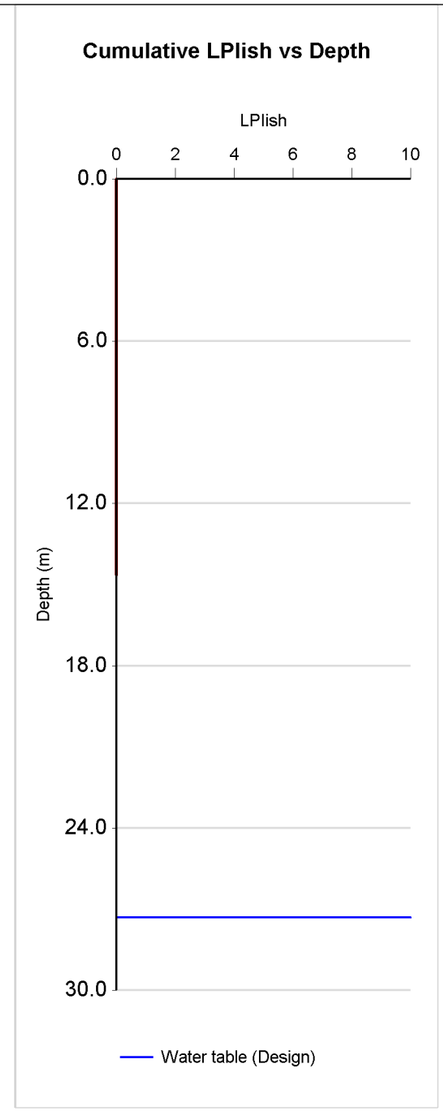
CPT-based soil behavior type classification chart by Robertson (1990)



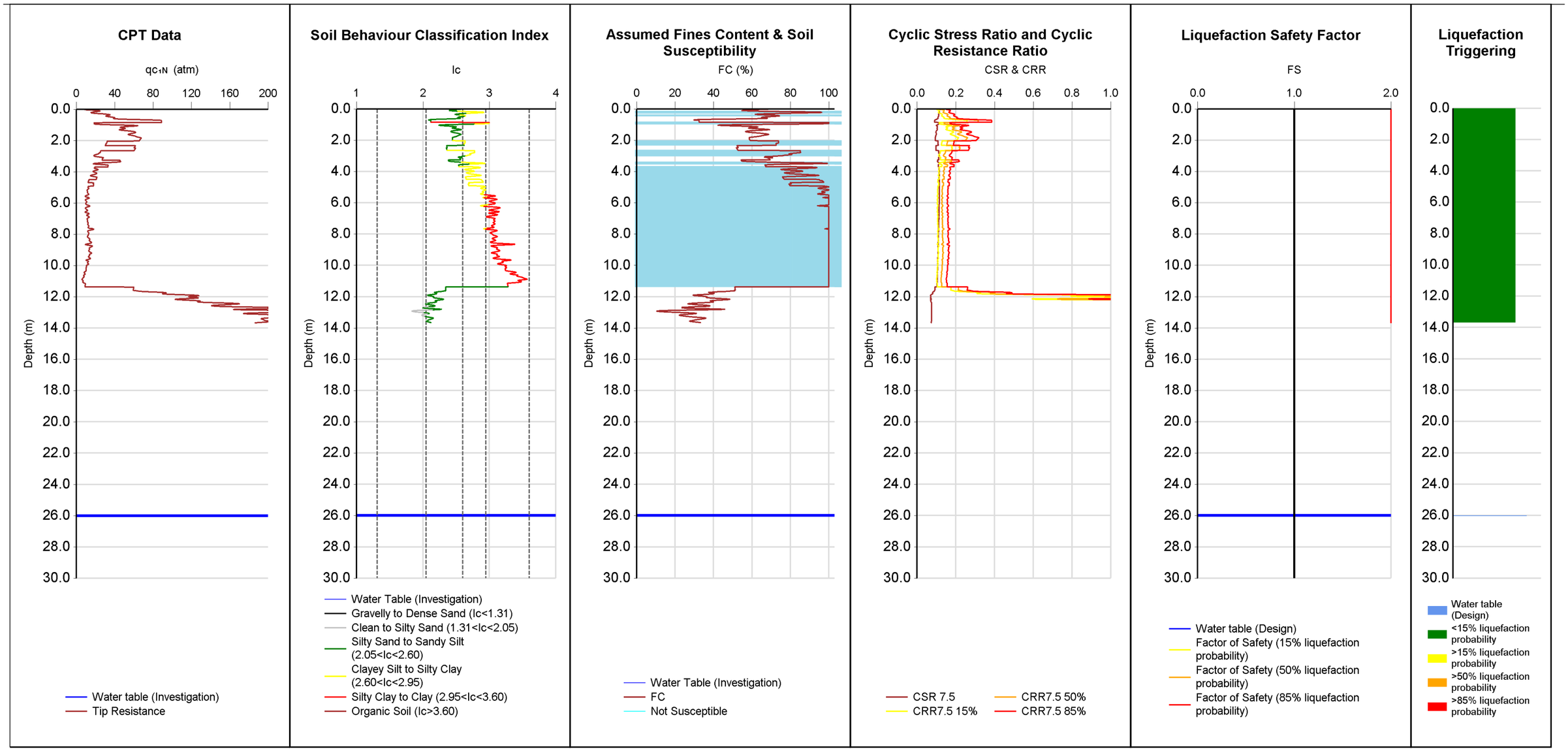








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT113	179002	18/05/2021	0	5.9	0.215	BI-2014	ZRB-2002	17		0	



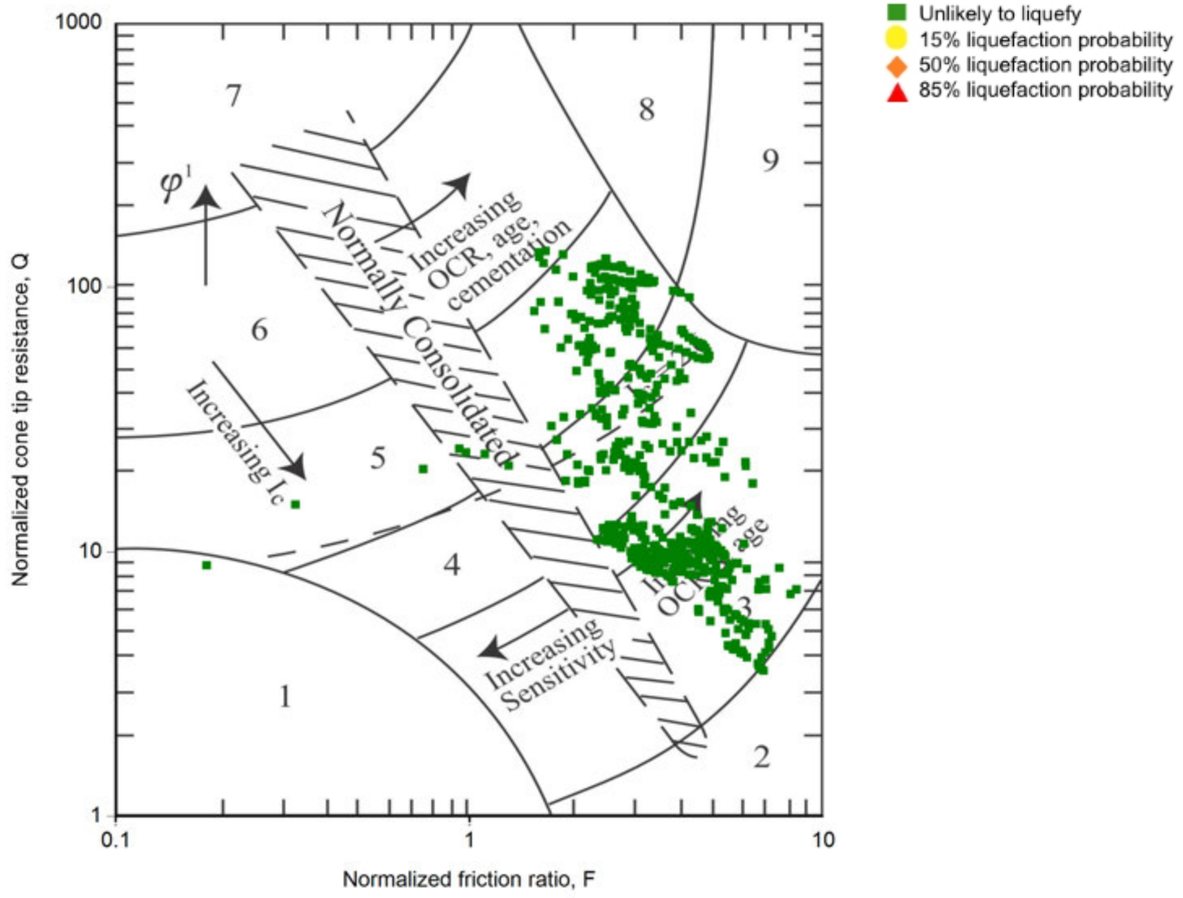
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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)	LPIish
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



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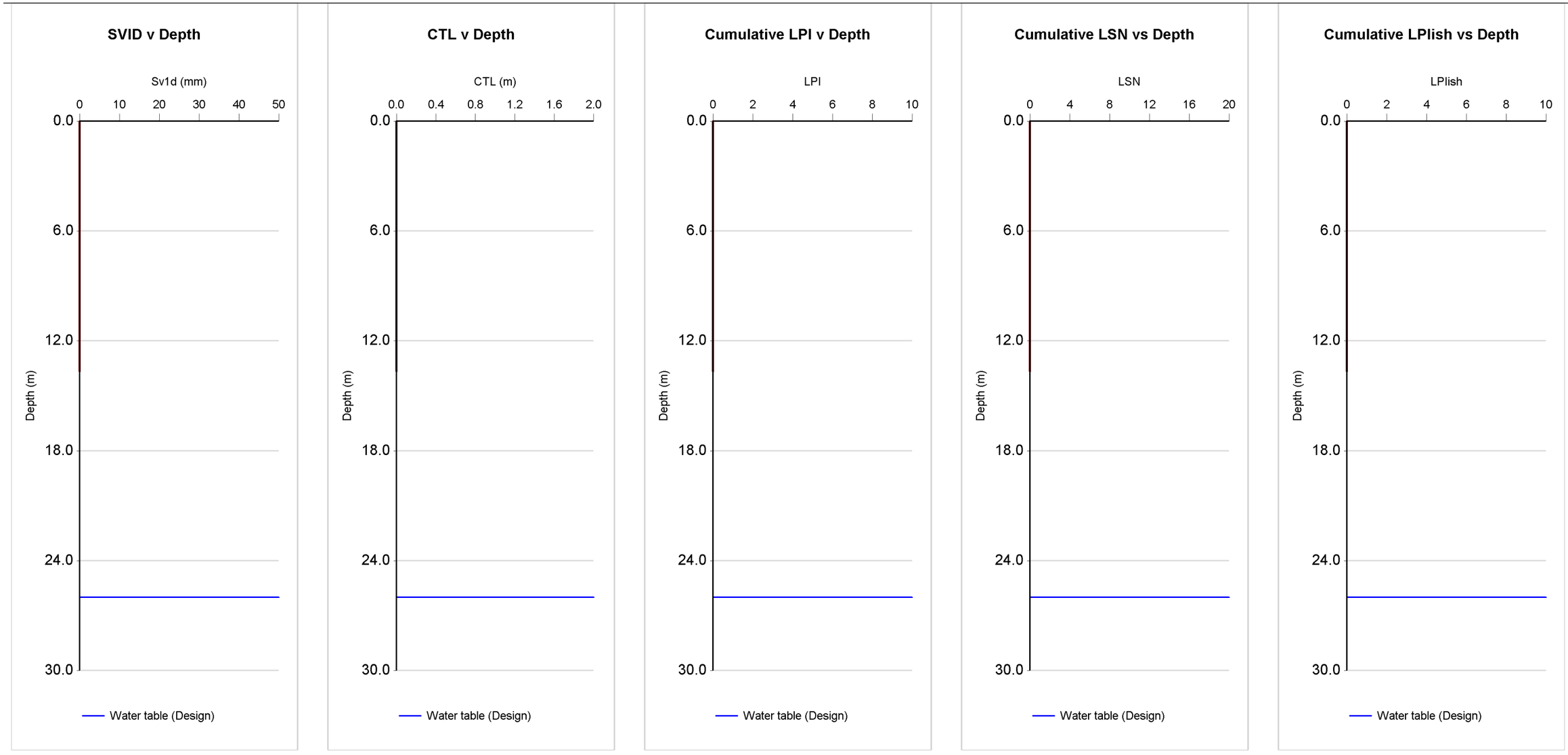
*Heavily overconsolidated or cemented

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



	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)
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

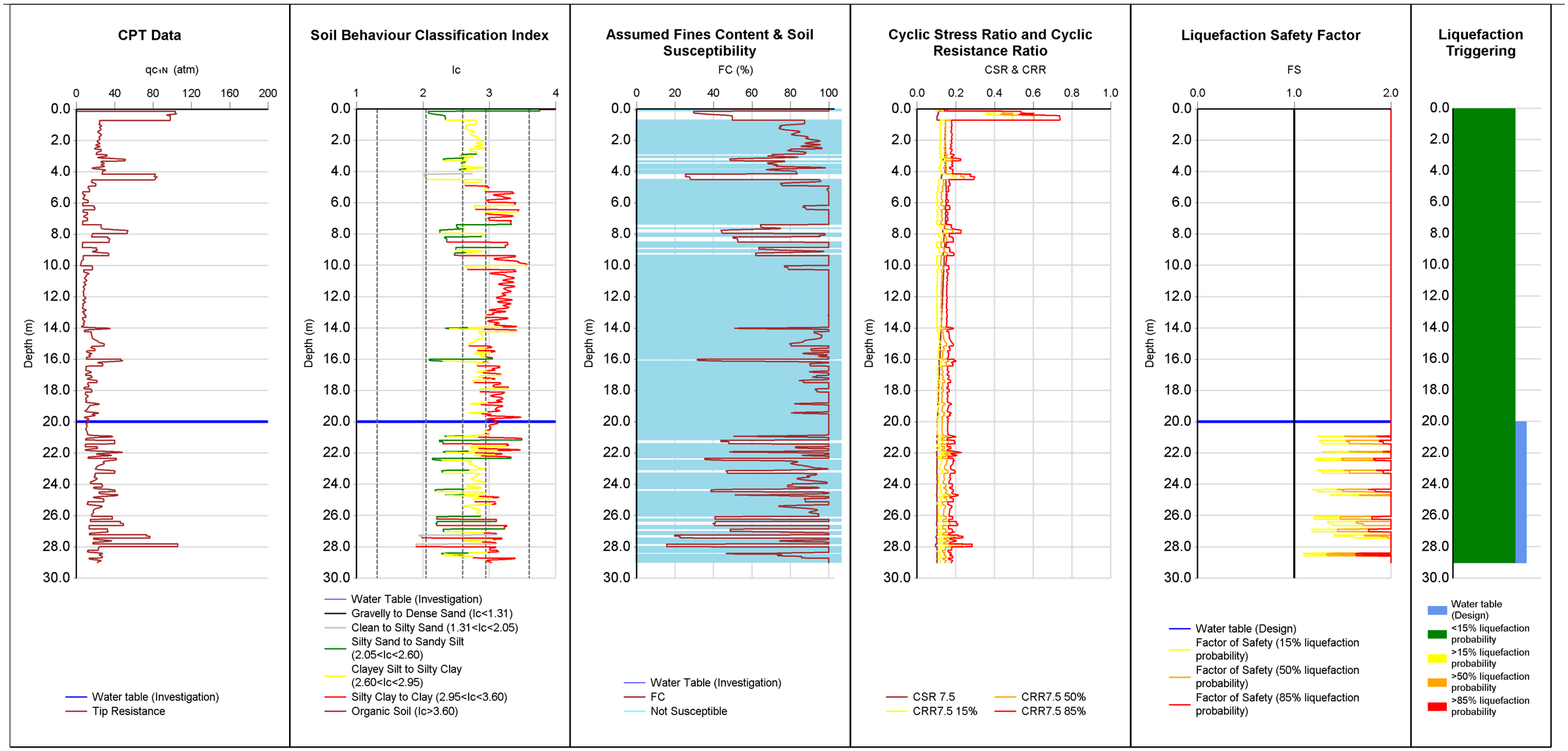
Table 1.1-3 Summary of Fc inputs for liquefaction analysis

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.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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

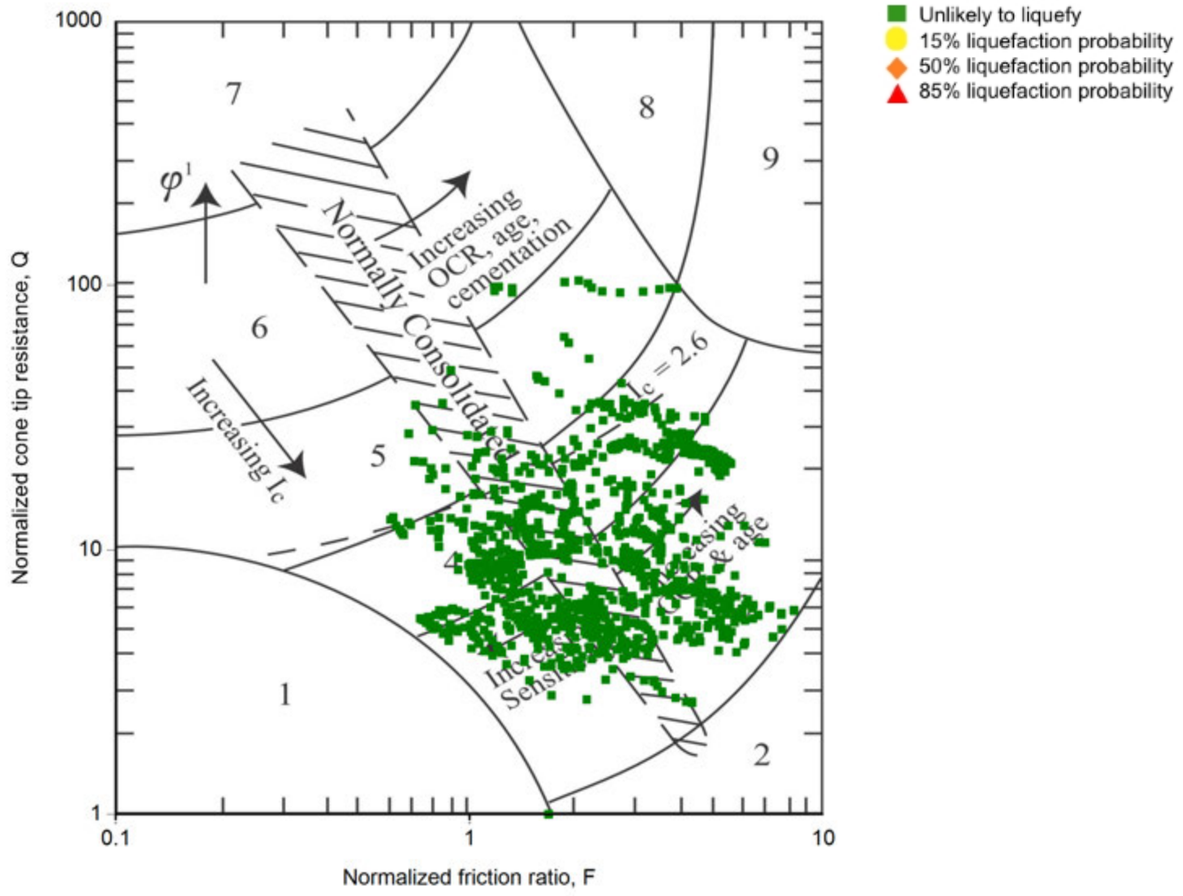
Tonkin + Taylor

Exceptional thinking together

V2.4.15

CLIENT	**Brymer Farms Ltd**	LOCATION	Hamilton
PROJECT	**Brymer Farms Subdivision**		
TITLE	**Liquefaction Analyses**	JOB NUMBER	**1017355.0000**
COMMENT	1 in 1000 Year Event - ULS IL3		

DATE	24/06/2021
ANALYSED	cand
PAGE	1 of 47 pages



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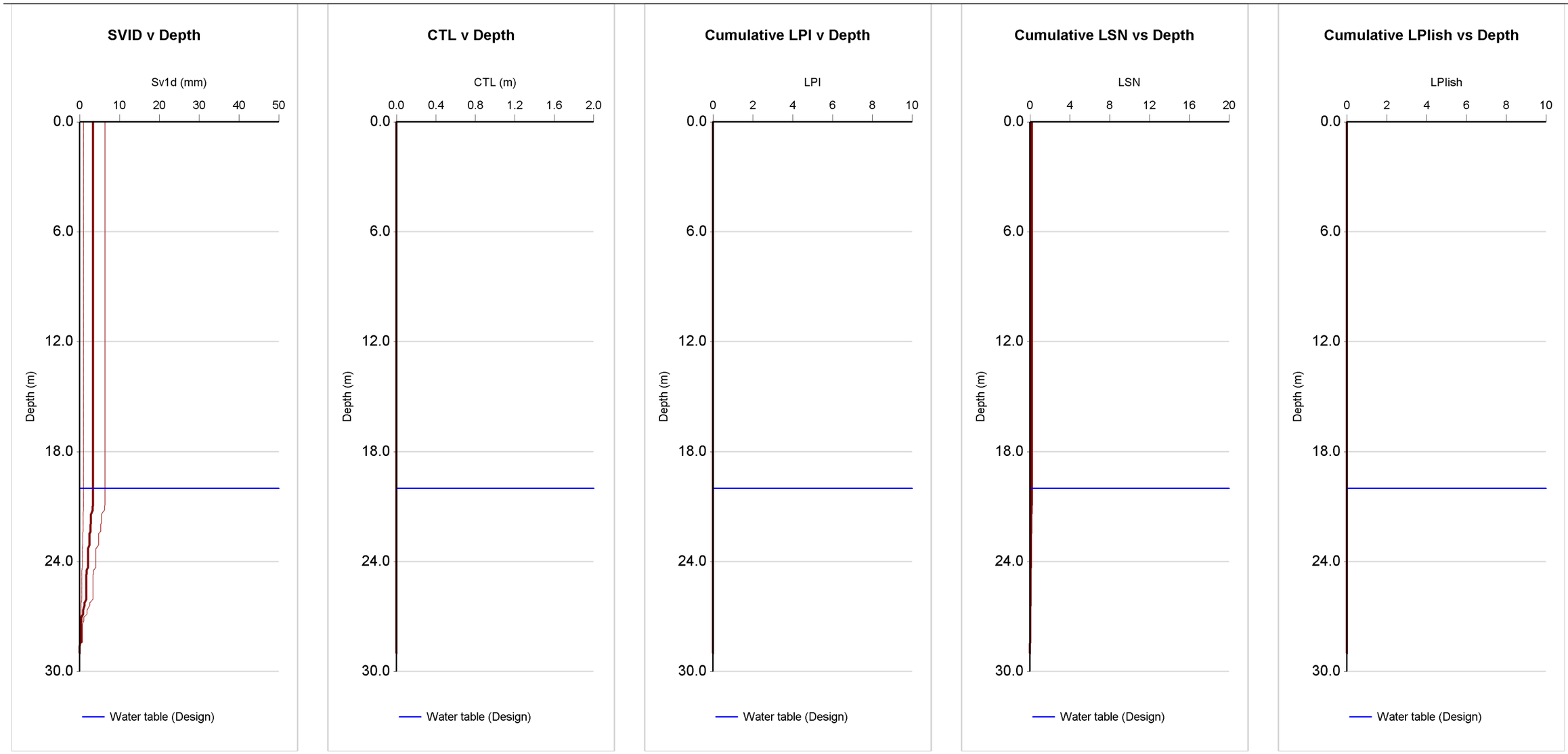
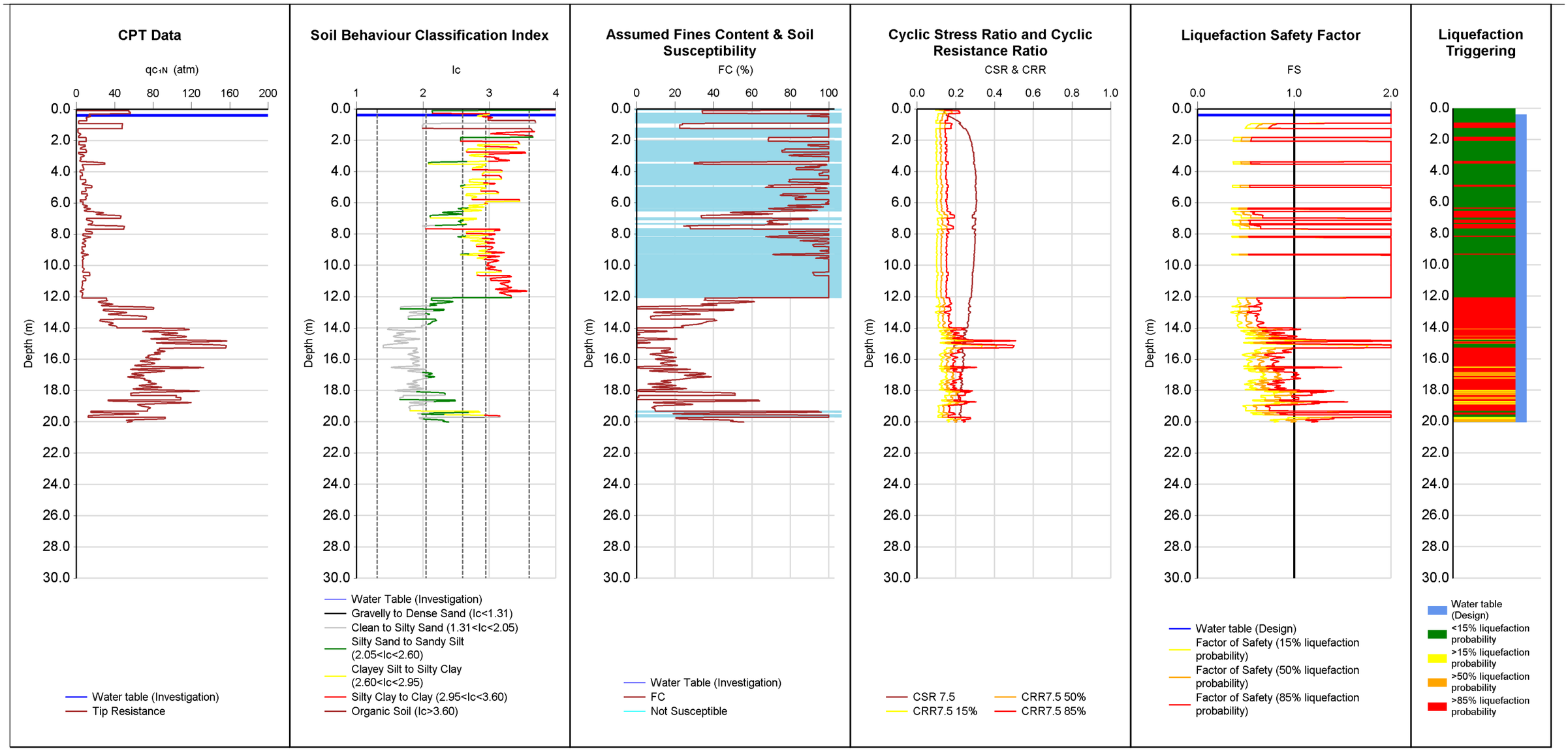
*Heavily overconsolidated or cemented

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



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



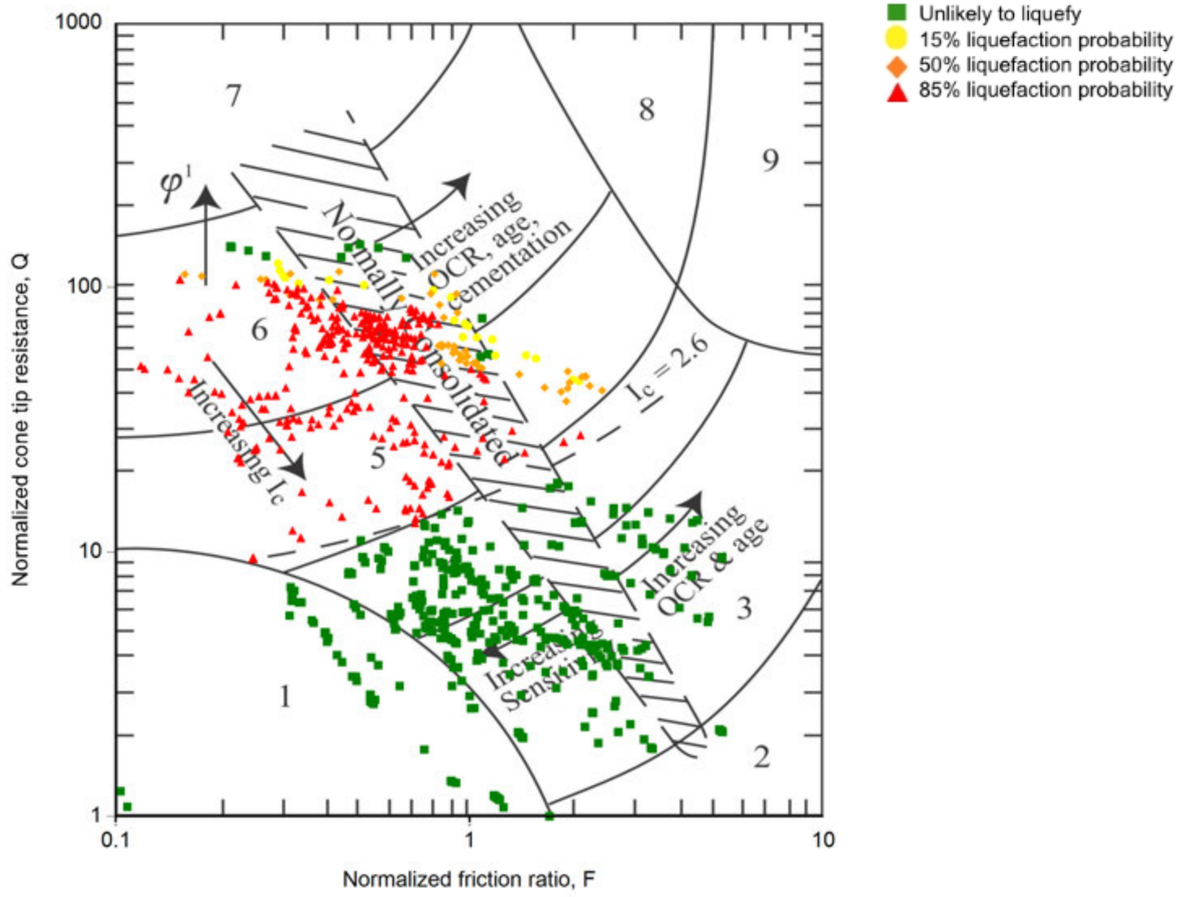
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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:

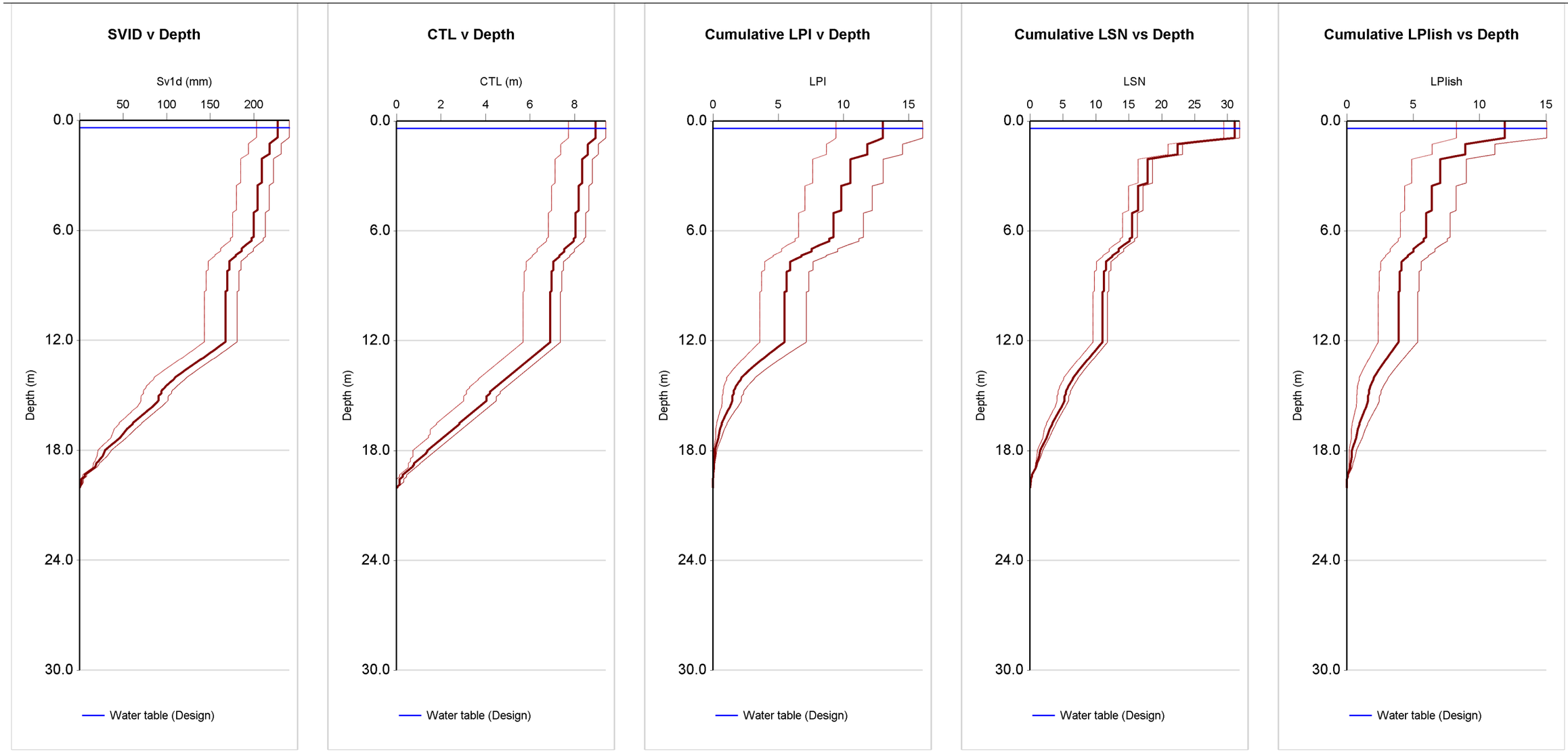
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



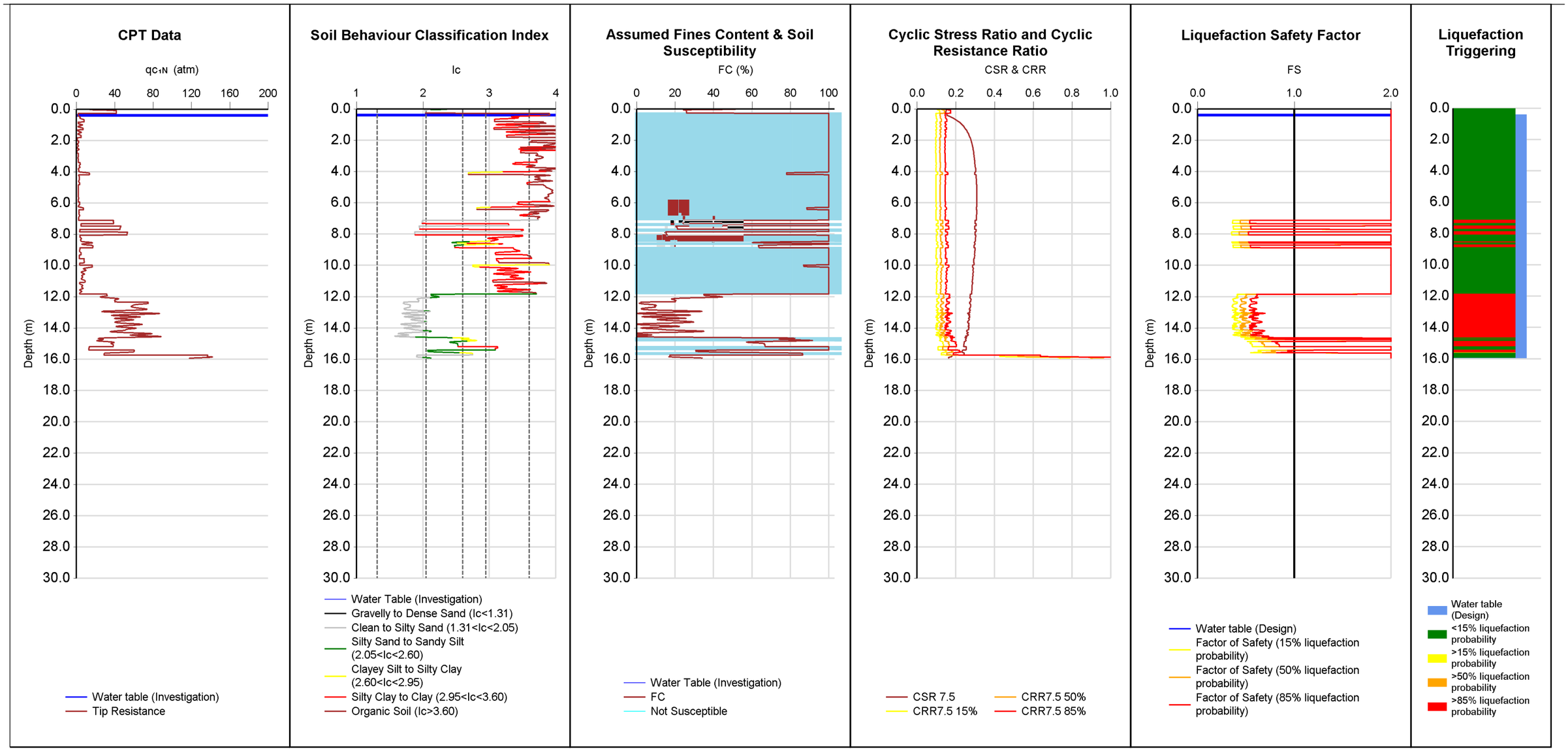
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



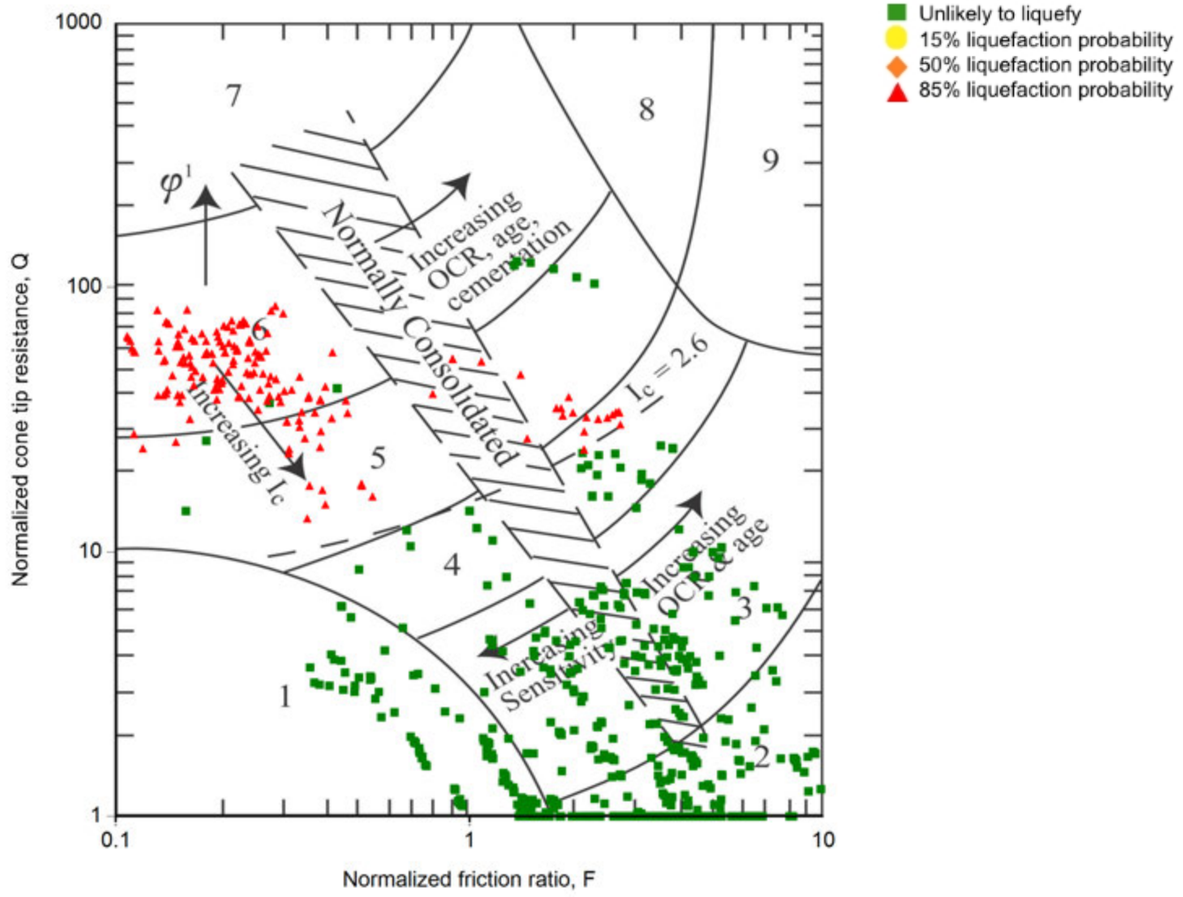
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



1. Sensitive, fine grained
2. Organic soils - peats
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6. Sands - clean sand to silty sand
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8. Very stiff sand to clayey sand *
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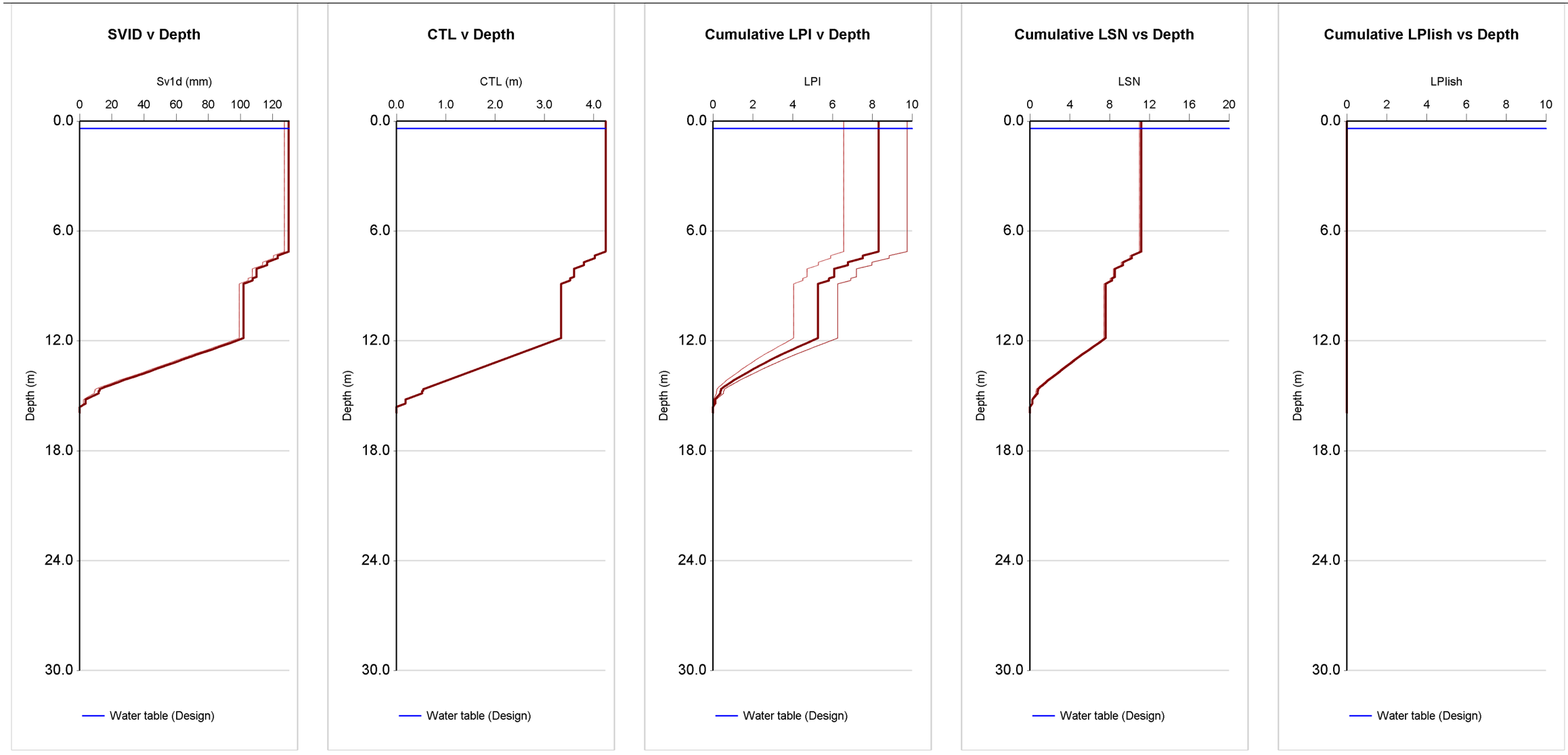
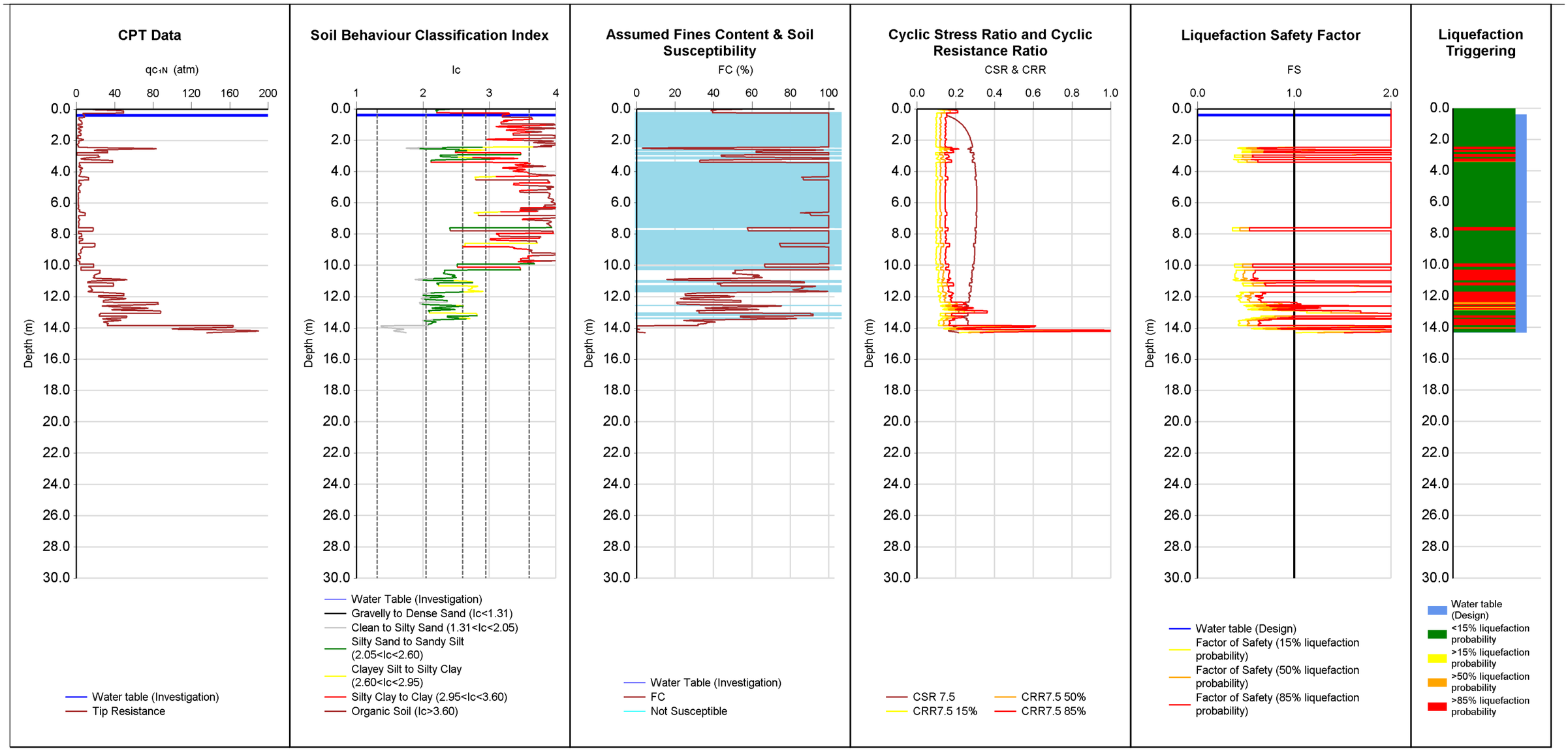
CPT-based soil behavior type classification chart by Robertson (1990)



	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)
INPUT	CPT103	178992	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



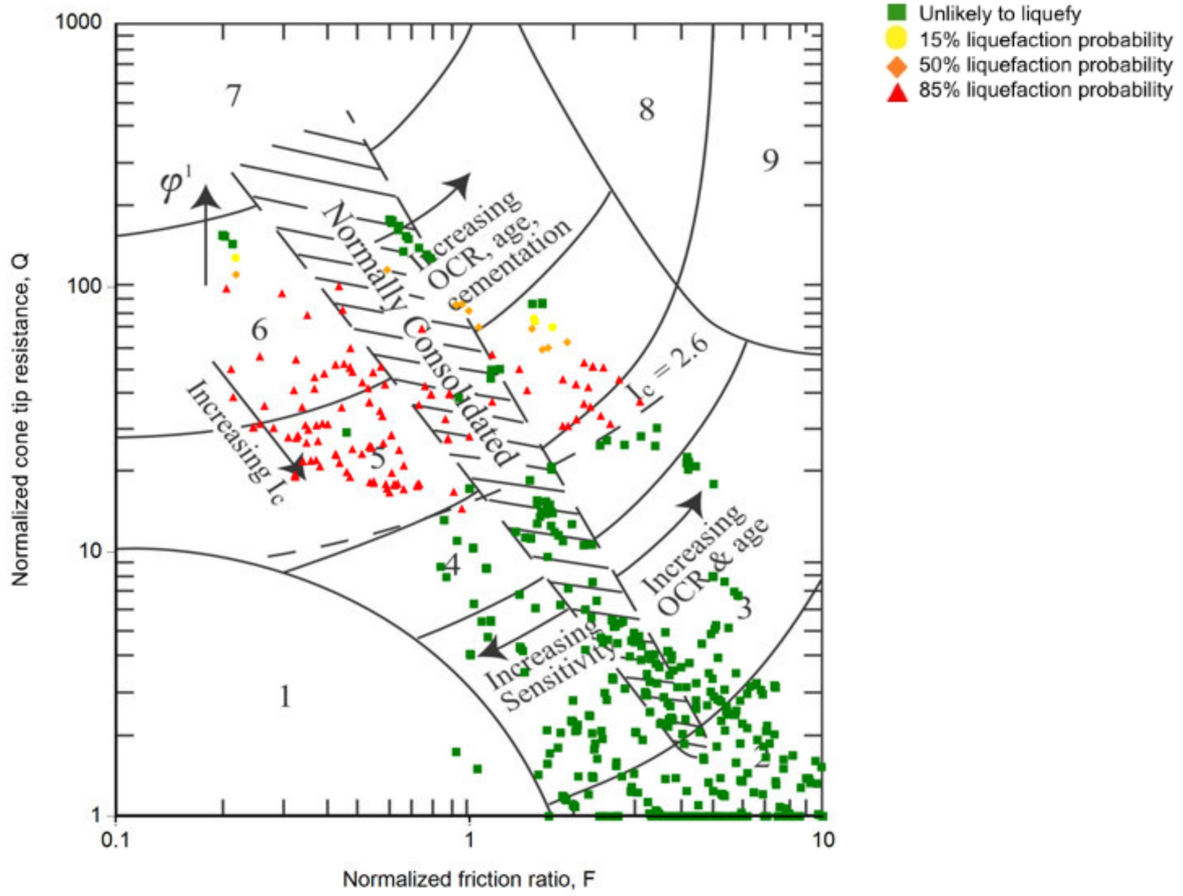
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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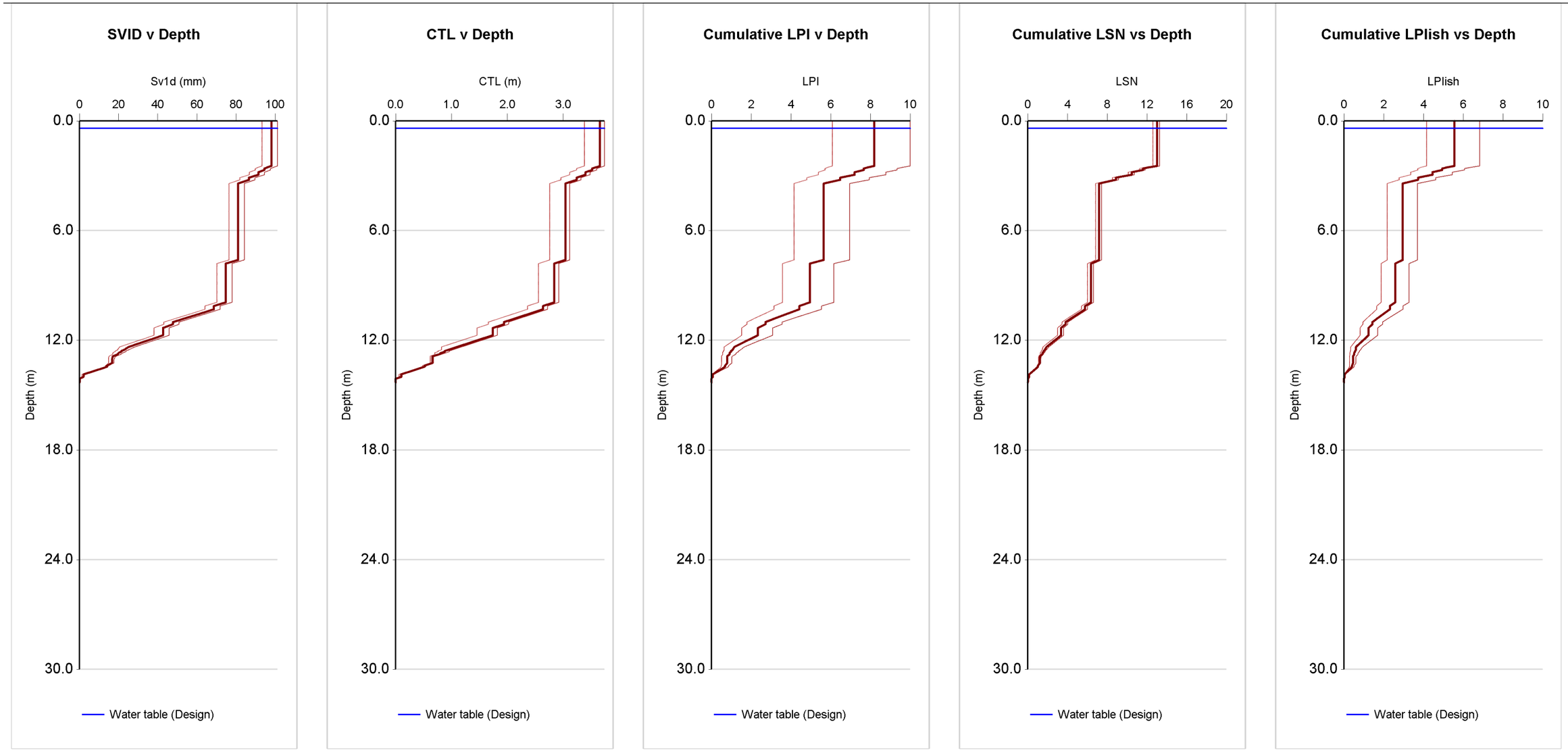
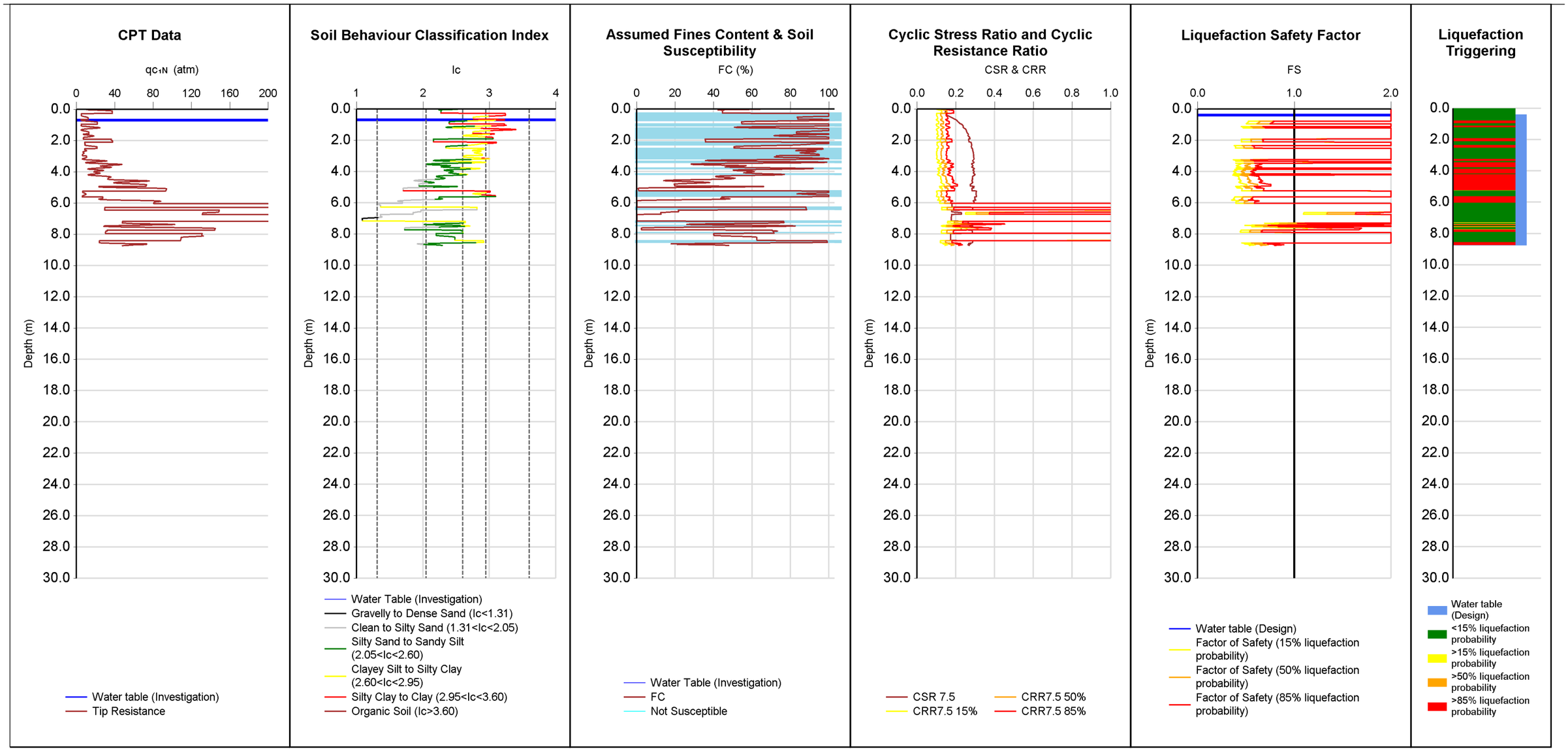
CPT-based soil behavior type classification chart by Robertson (1990)



	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)
INPUT	CPT104	178993	17/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



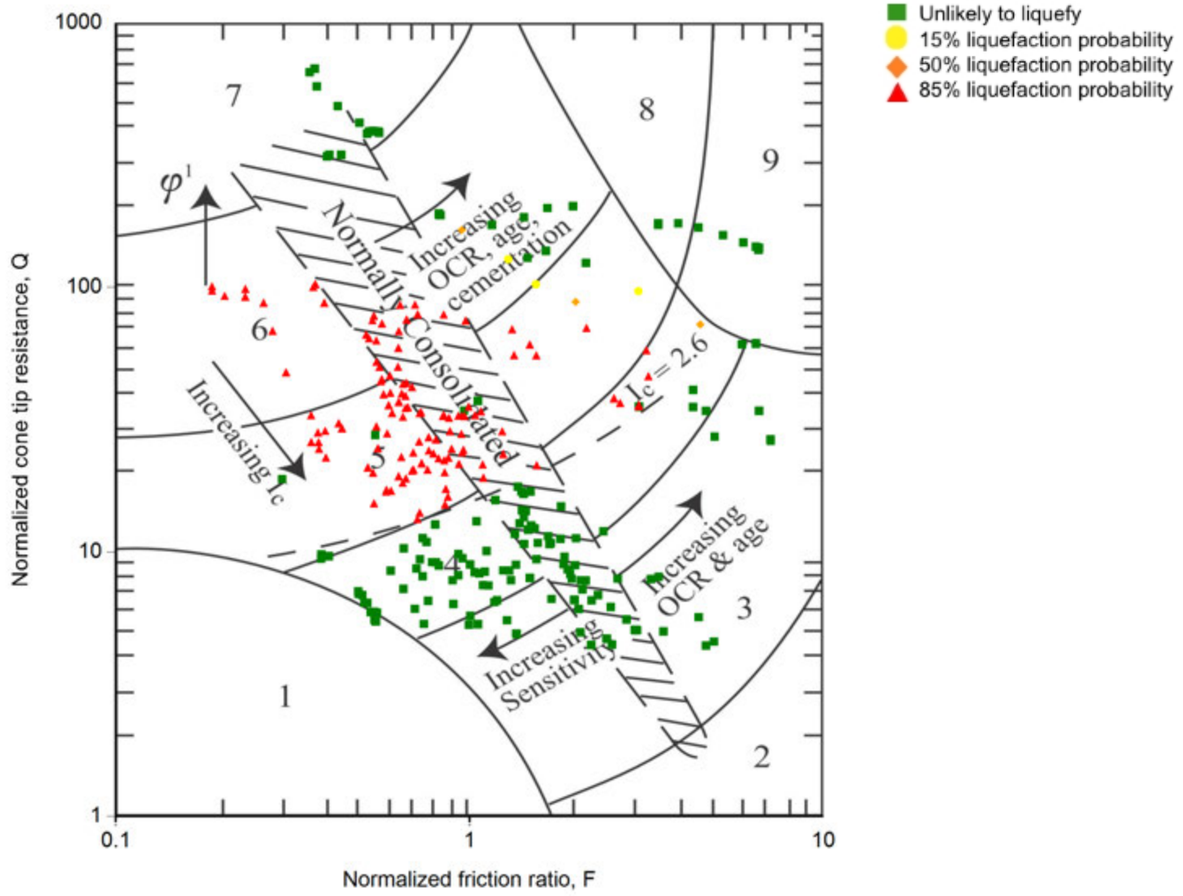
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

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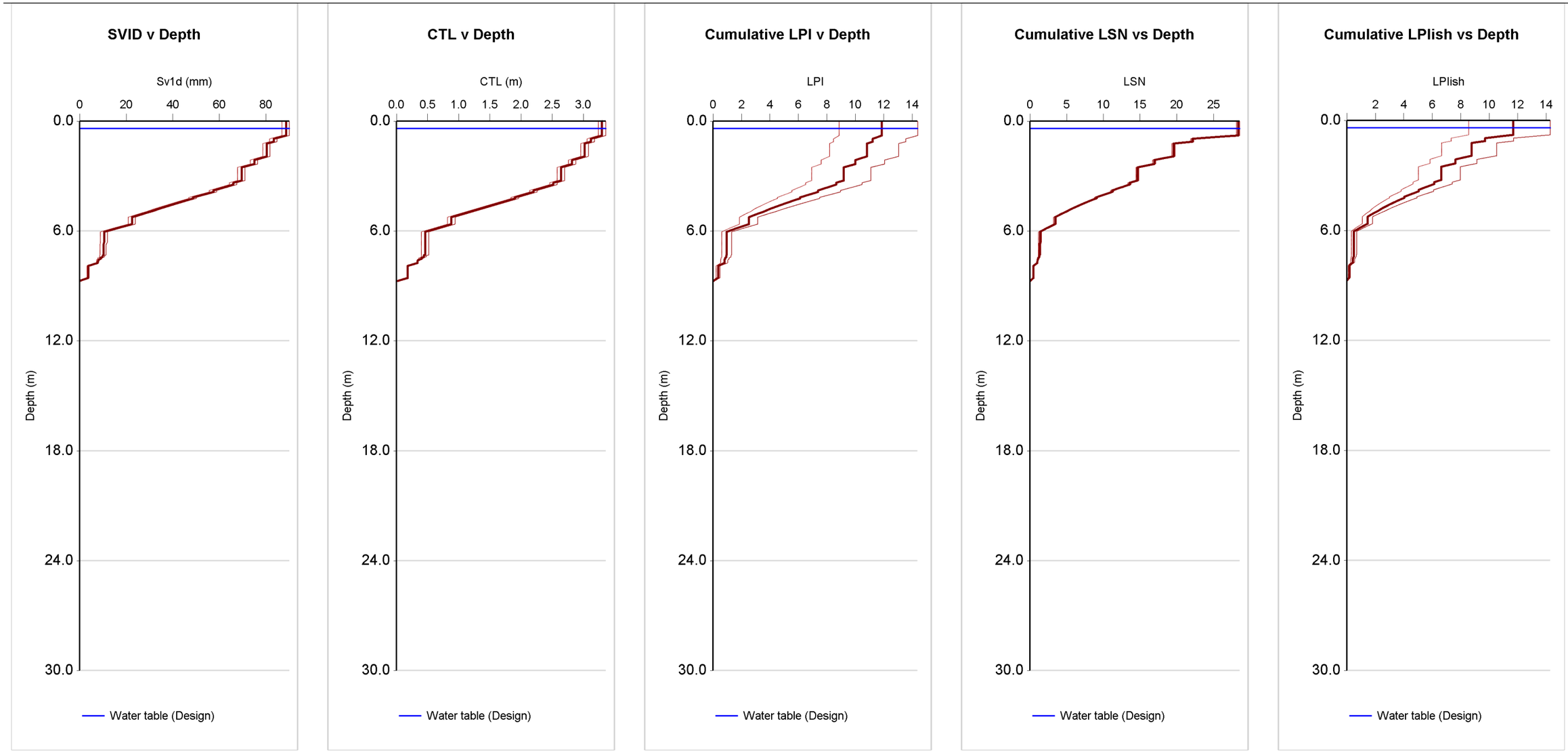
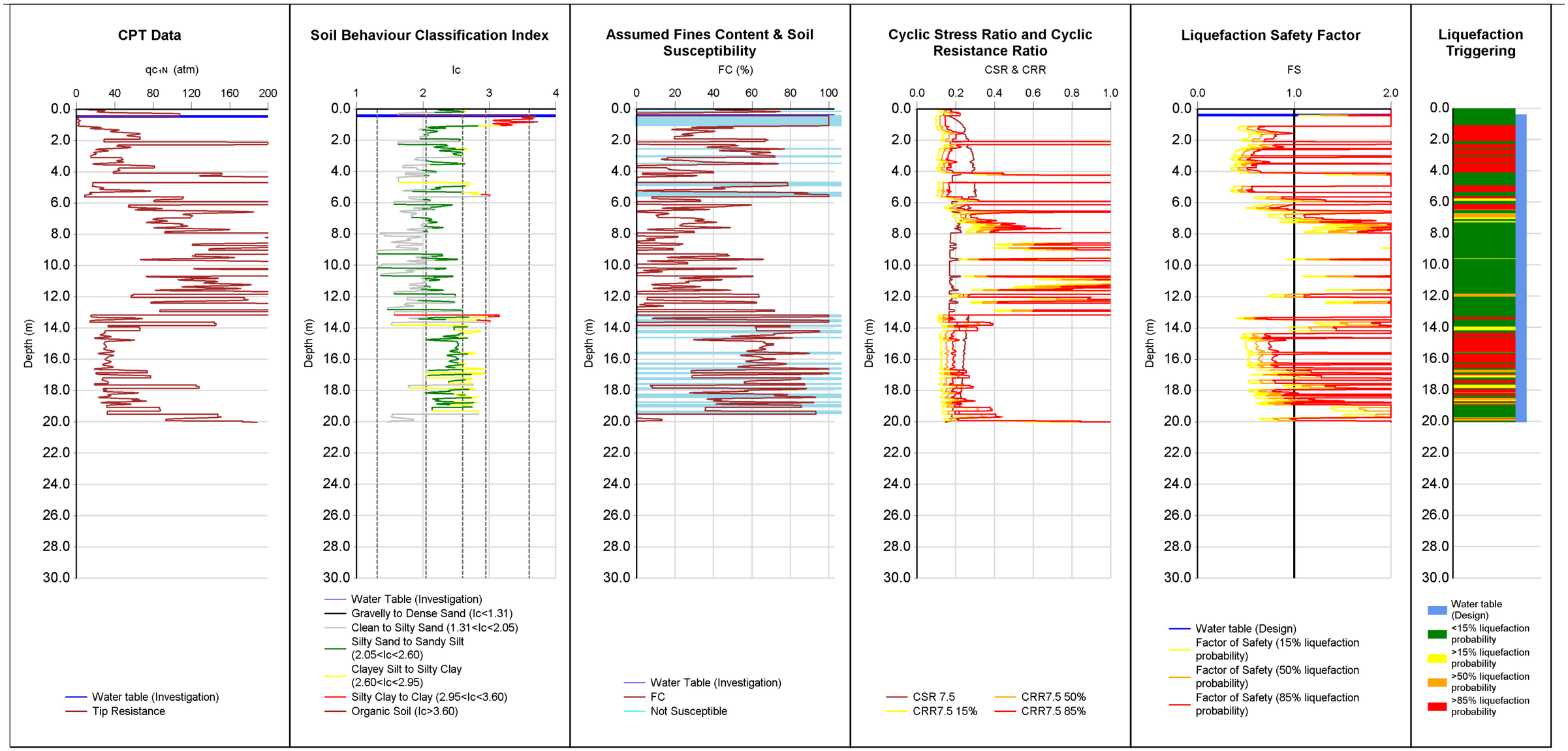
CPT-based soil behavior type classification chart by Robertson (1990)



	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)
INPUT	CPT105	178994	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



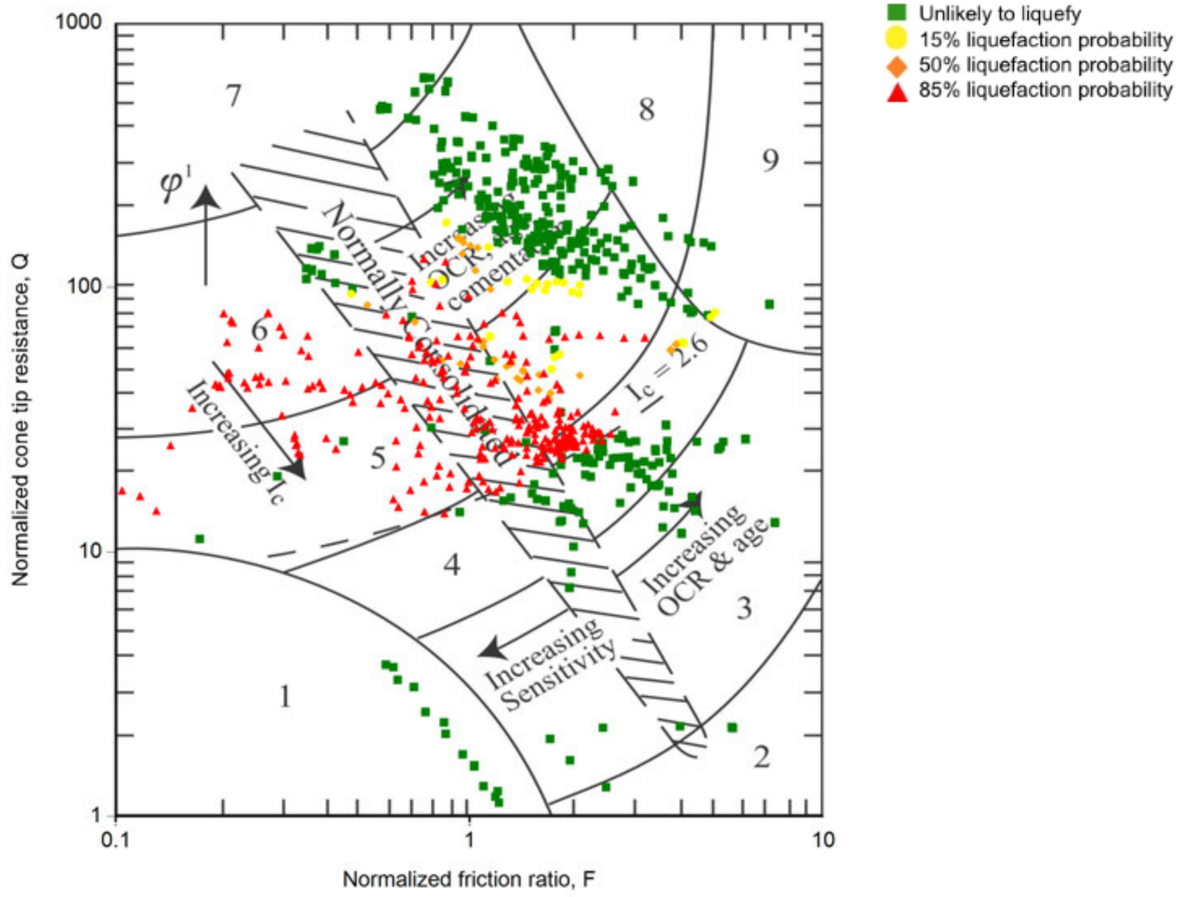
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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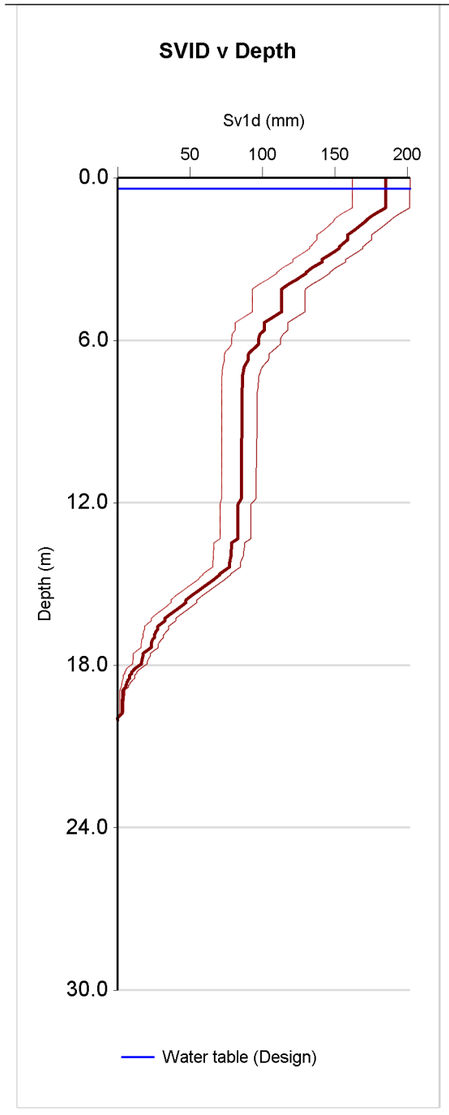
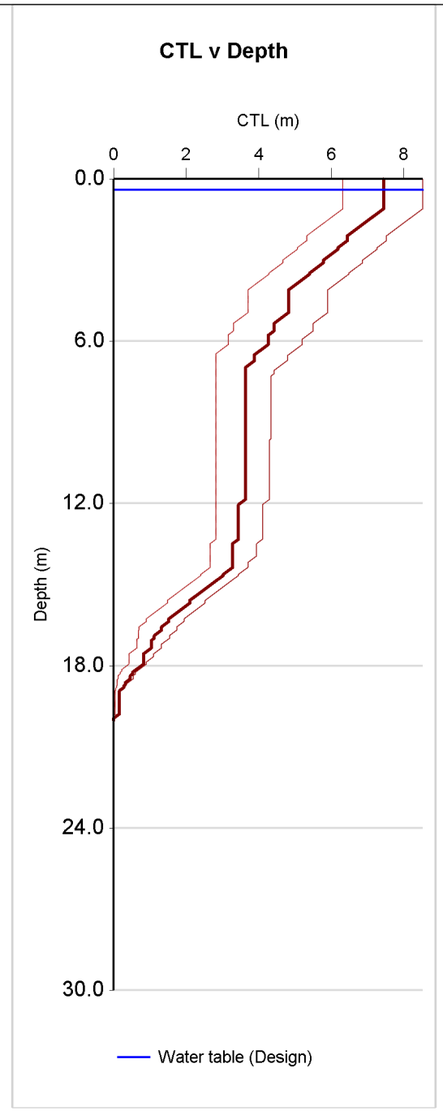
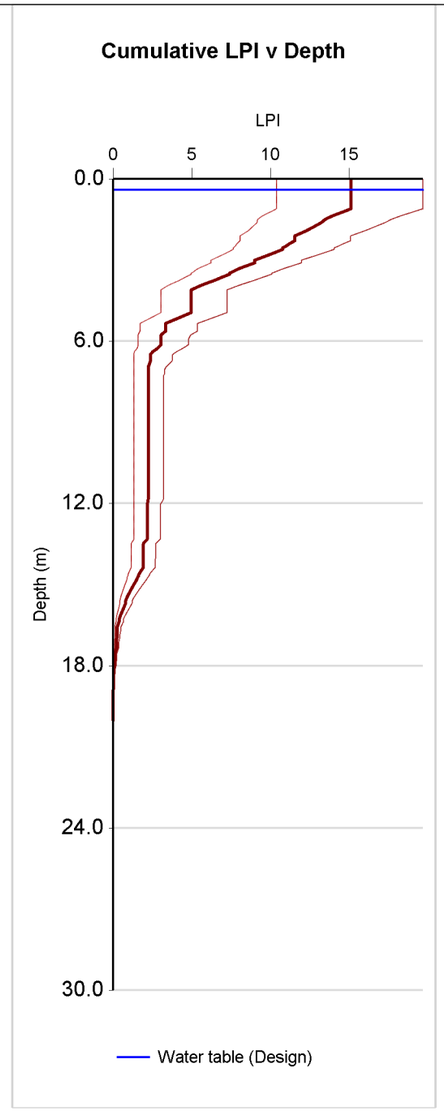
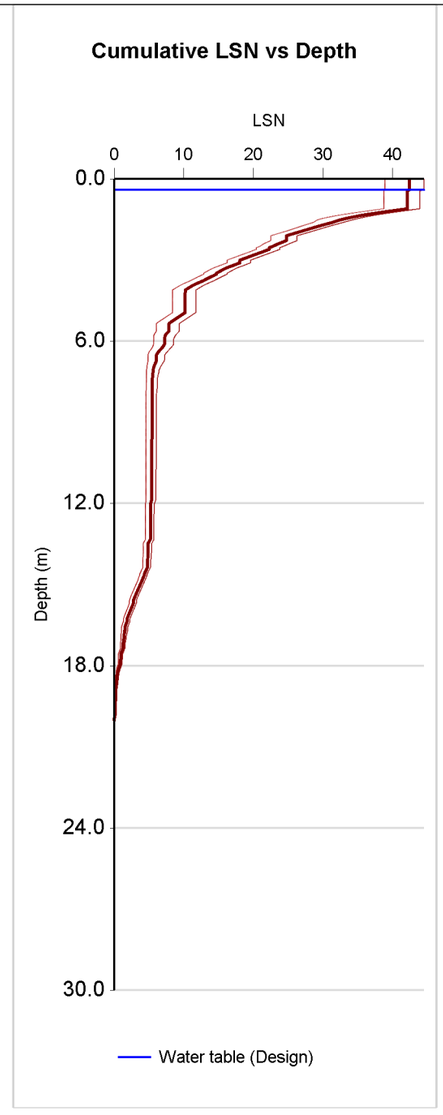
*Heavily overconsolidated or cemented

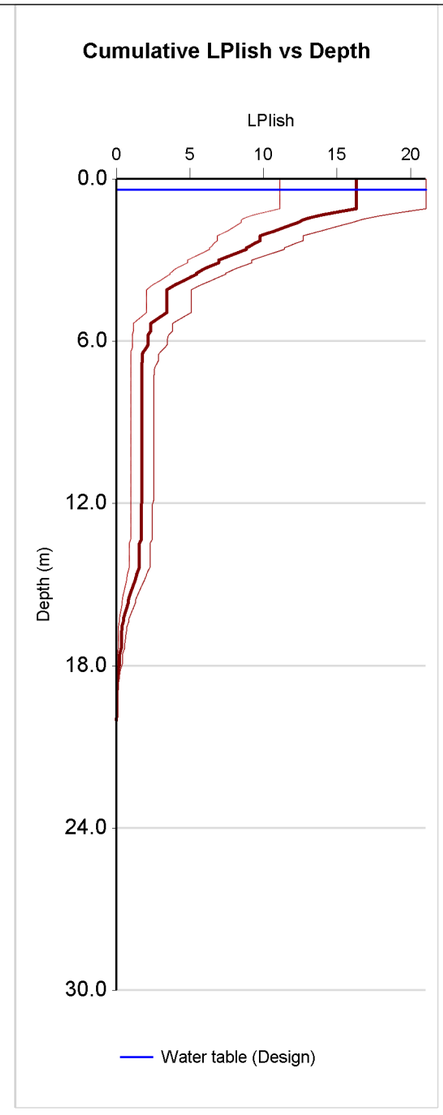
CPT-based soil behavior type classification chart by Robertson (1990)



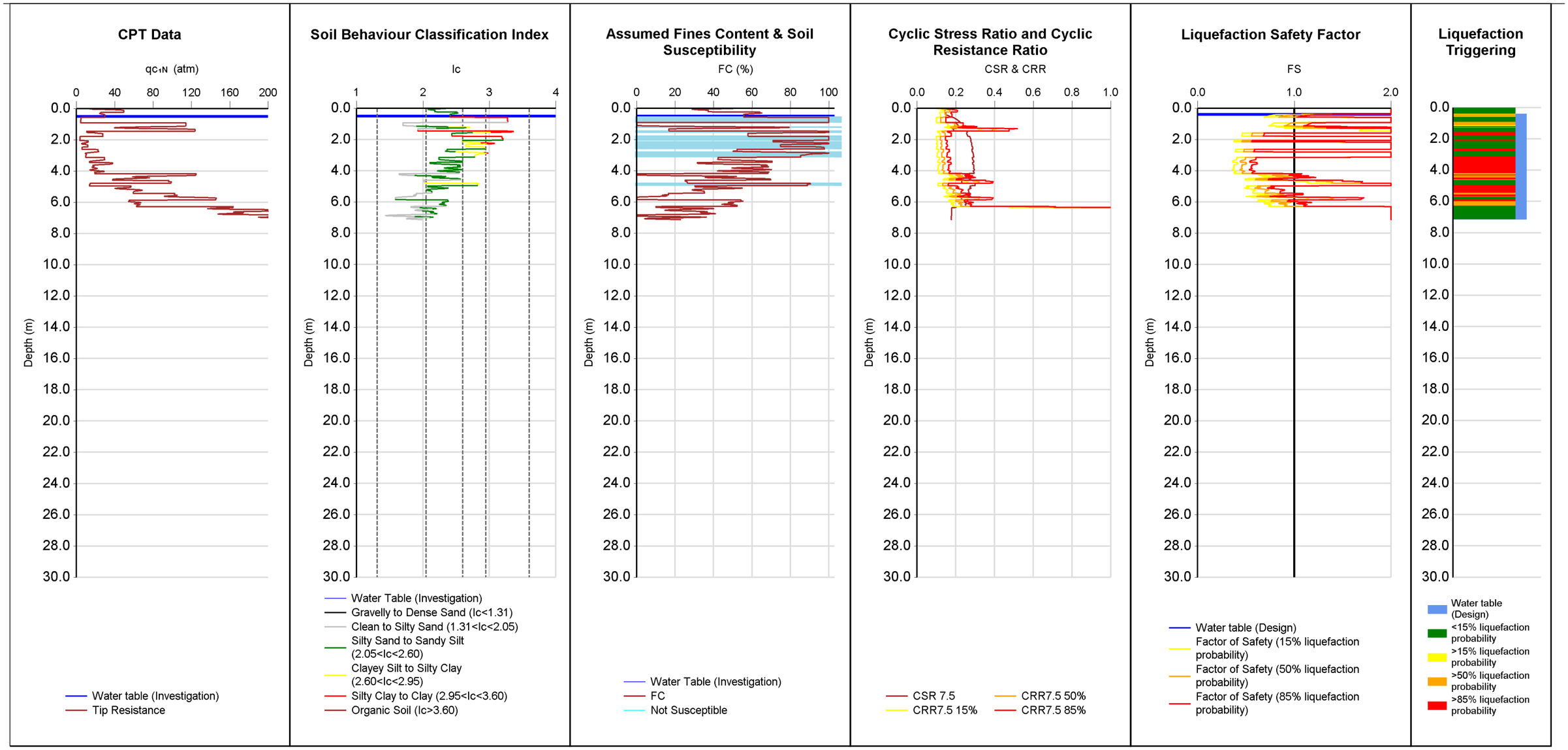








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT106	178995	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



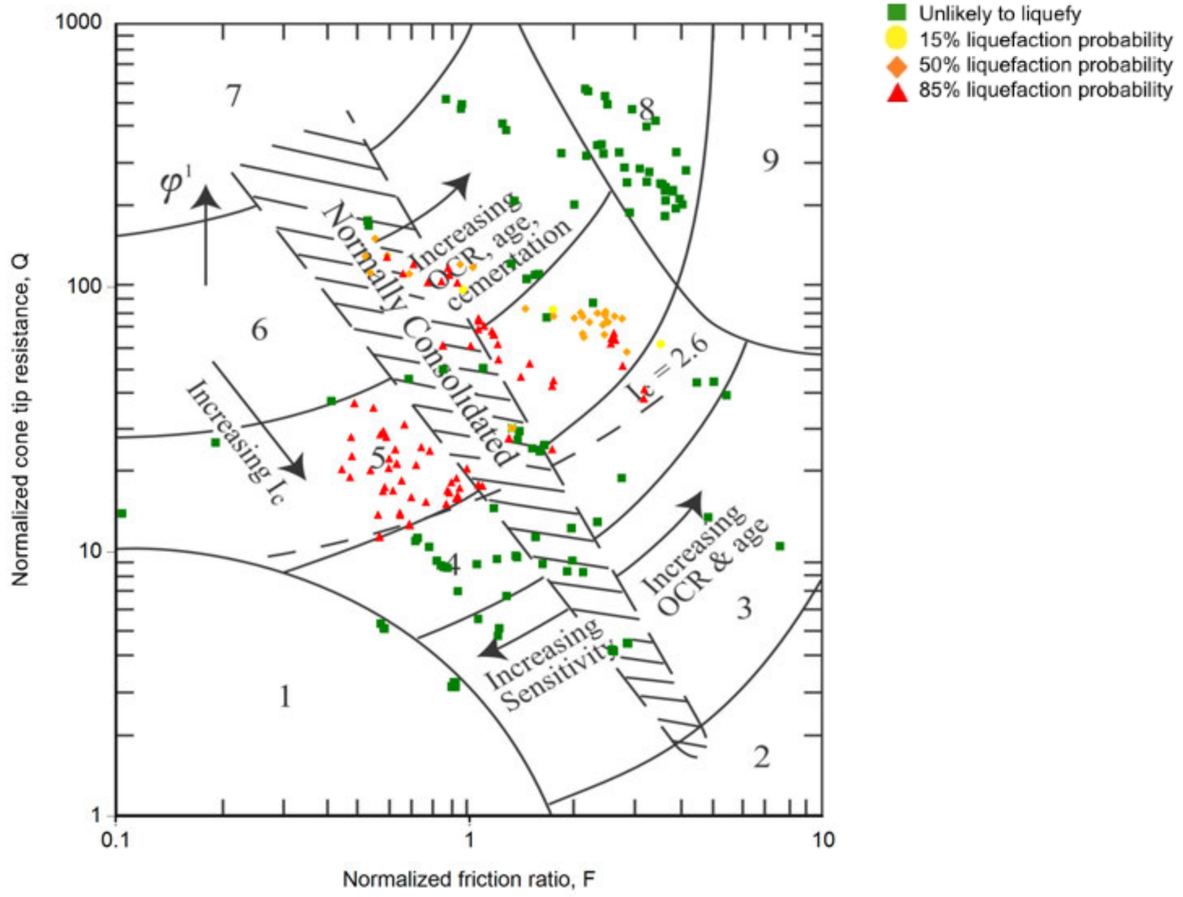
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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:

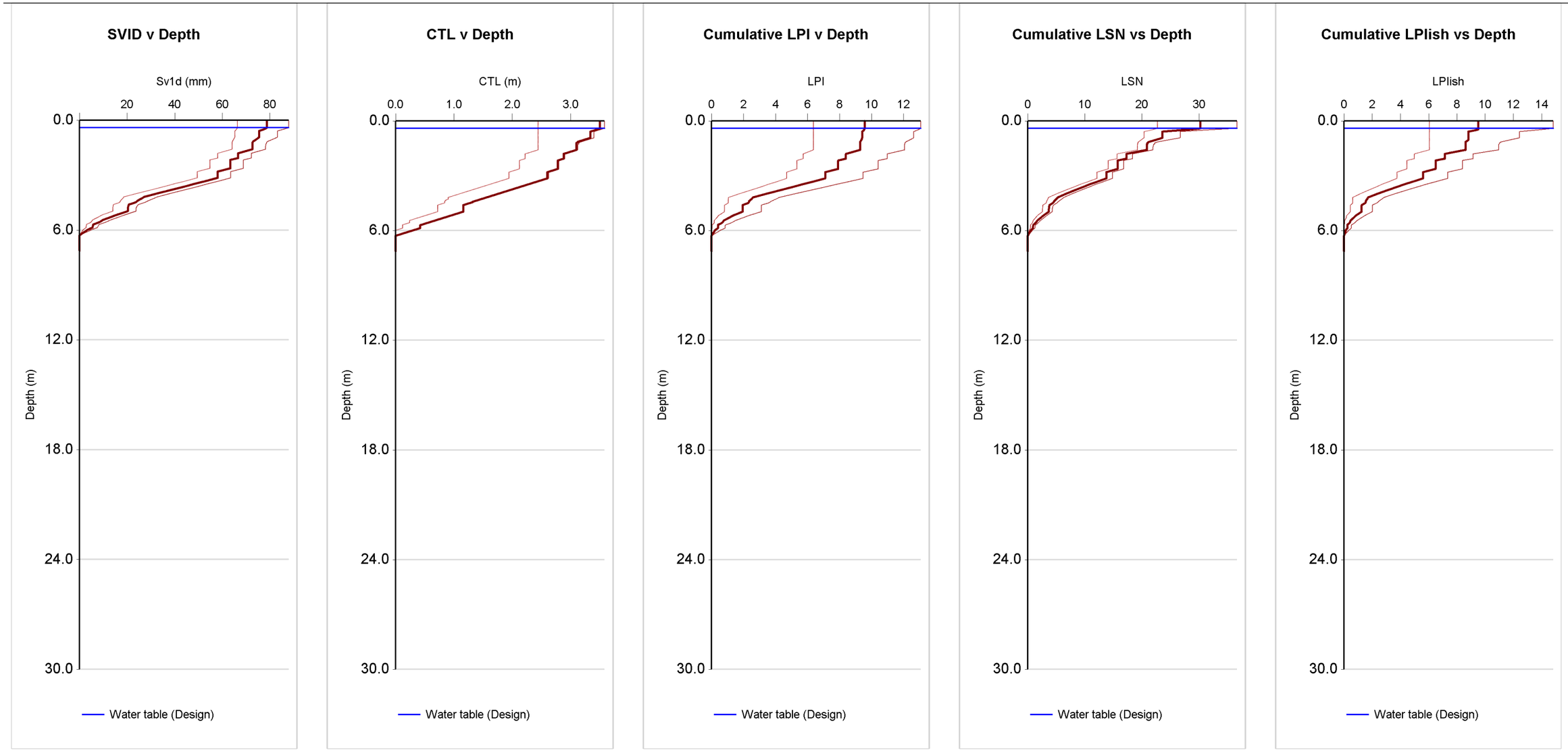
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



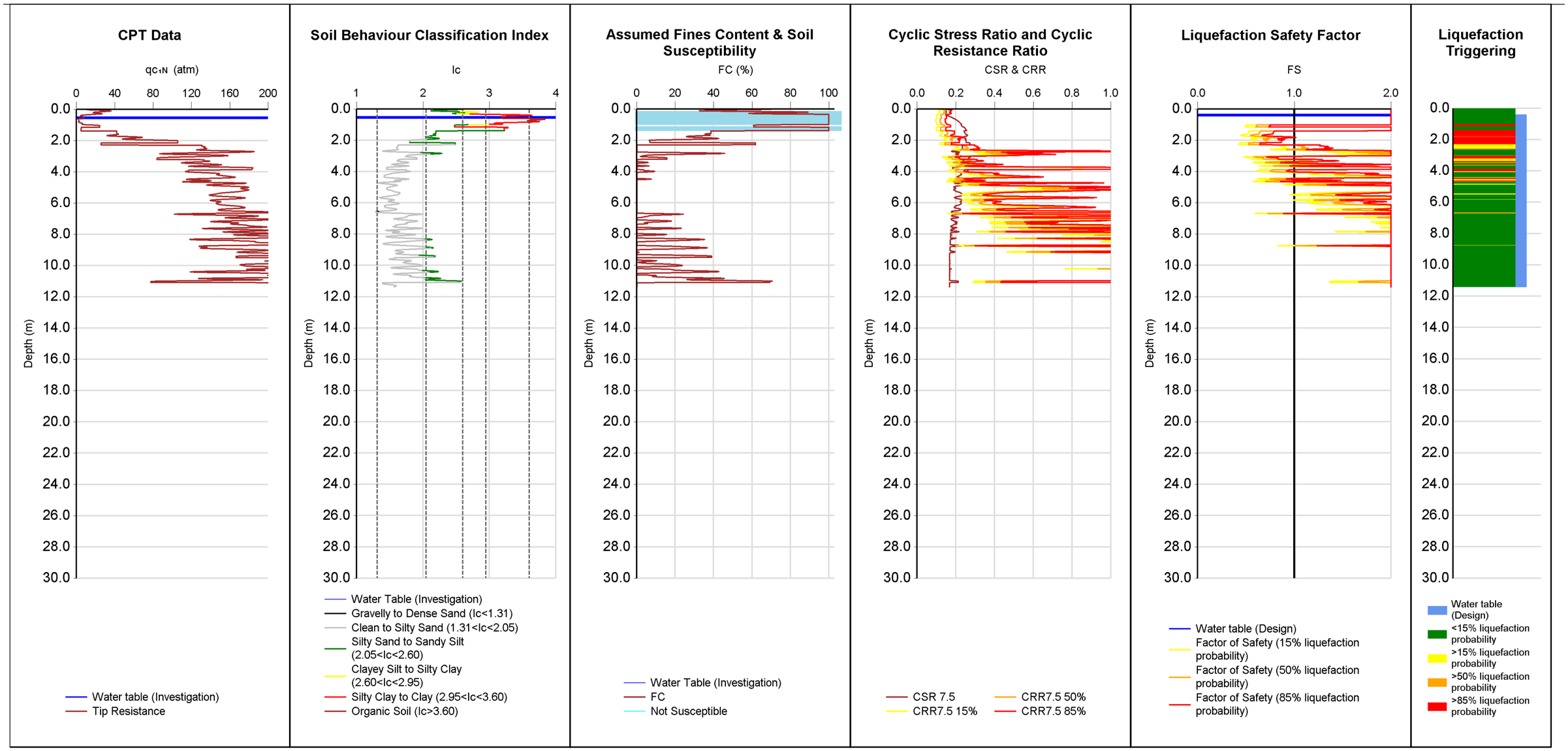
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



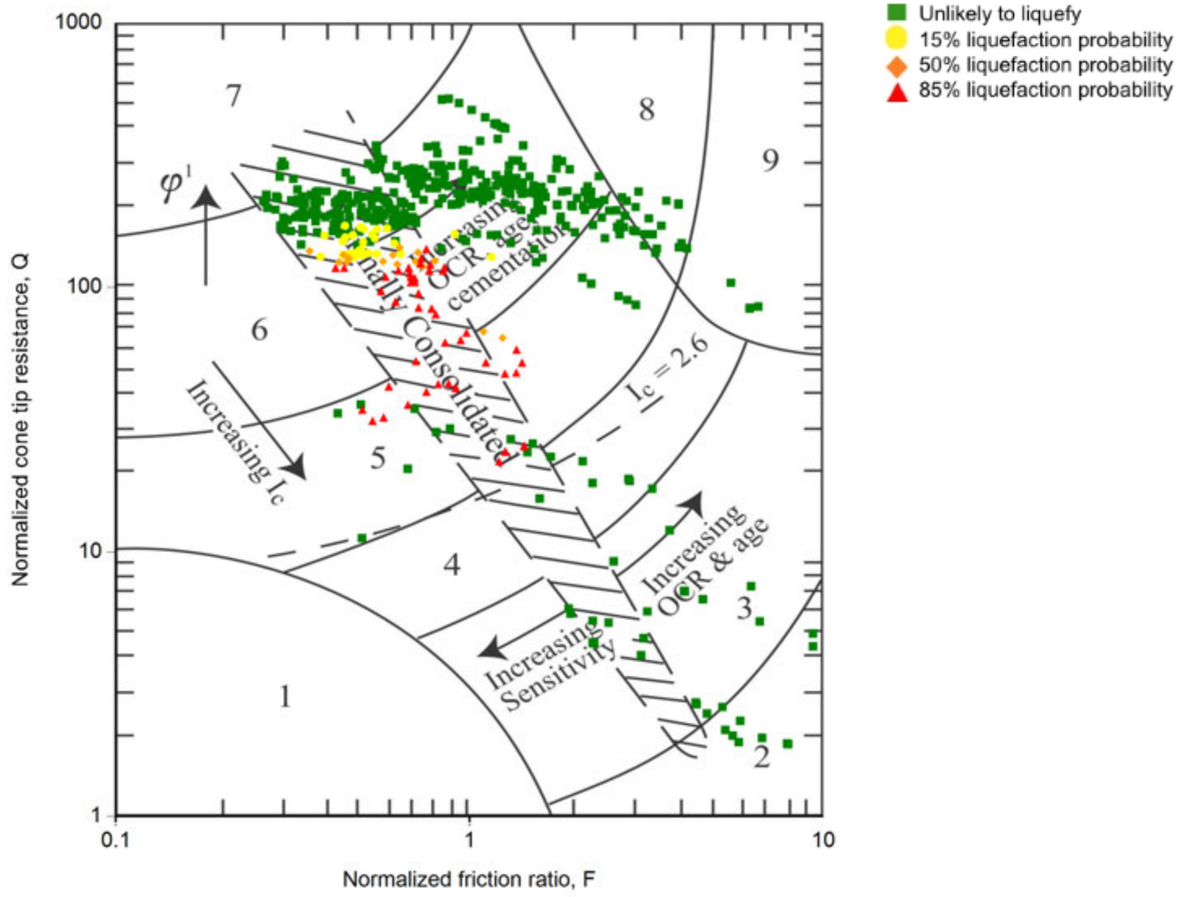
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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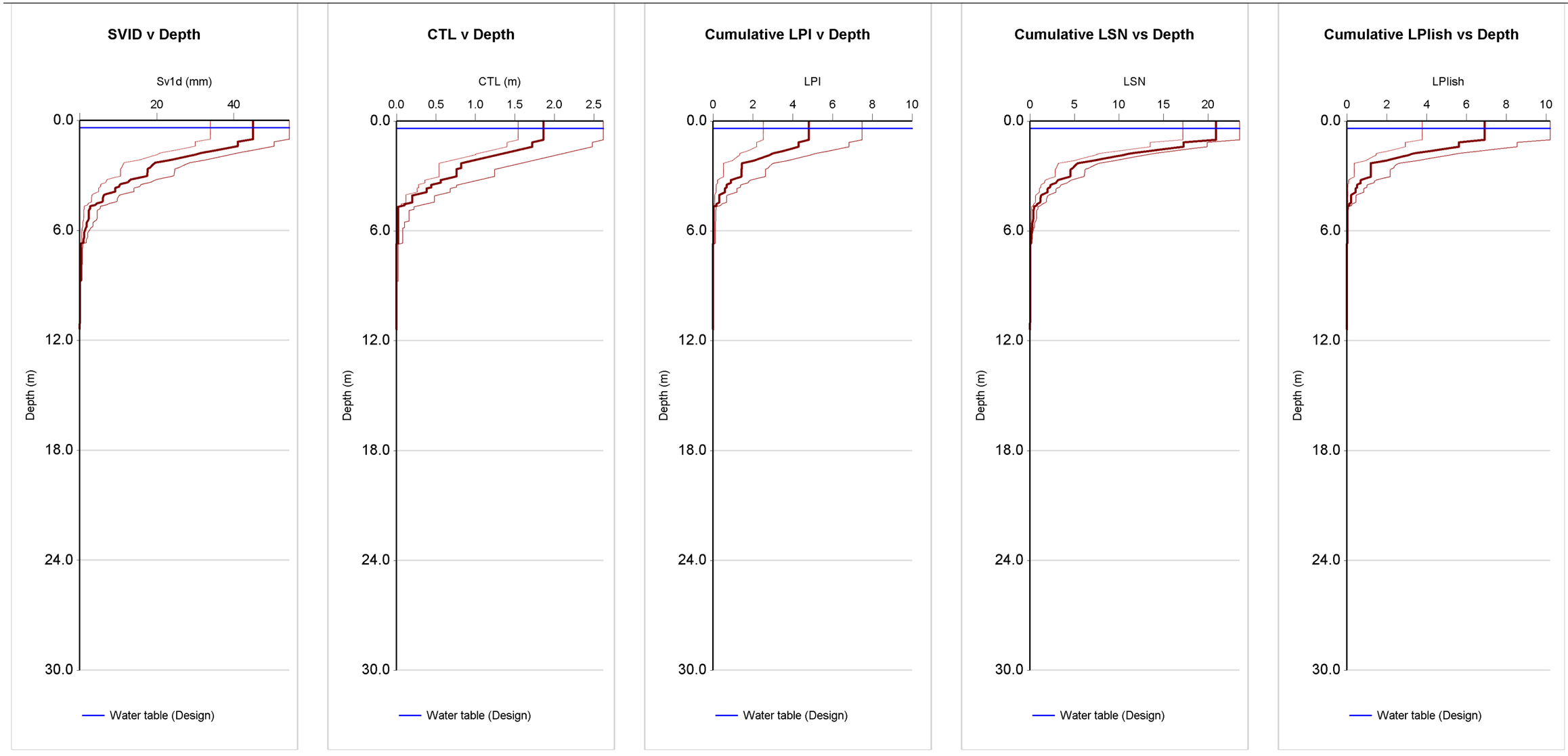
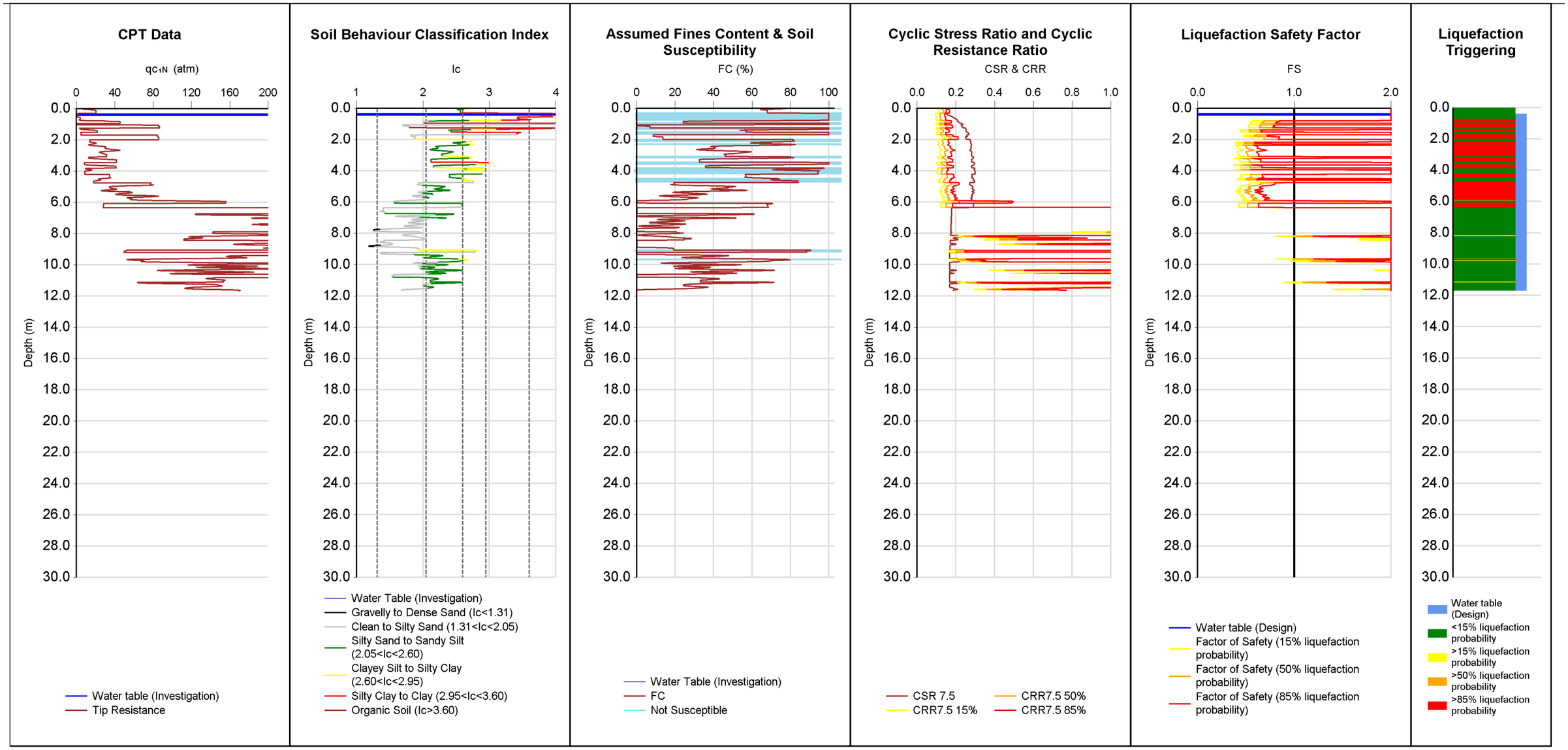
CPT-based soil behavior type classification chart by Robertson (1990)



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



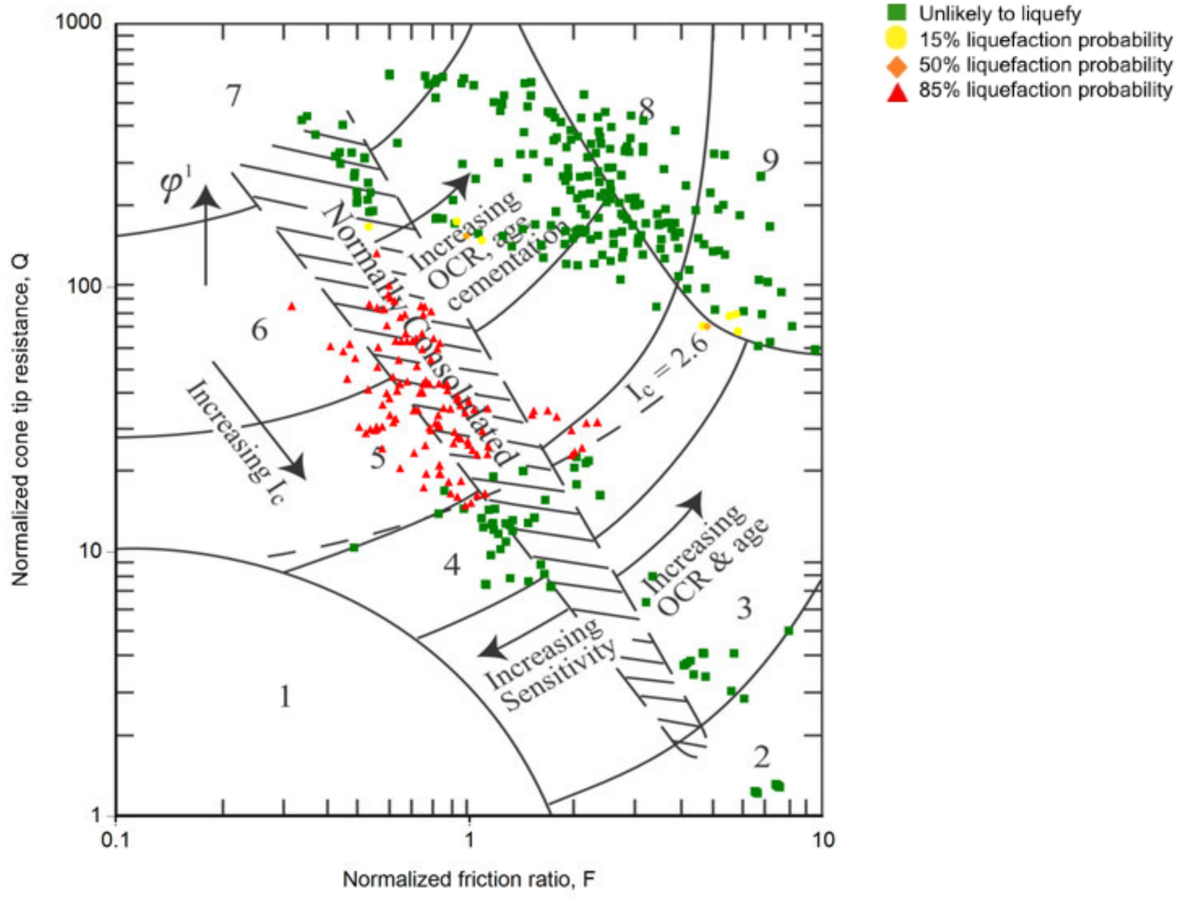
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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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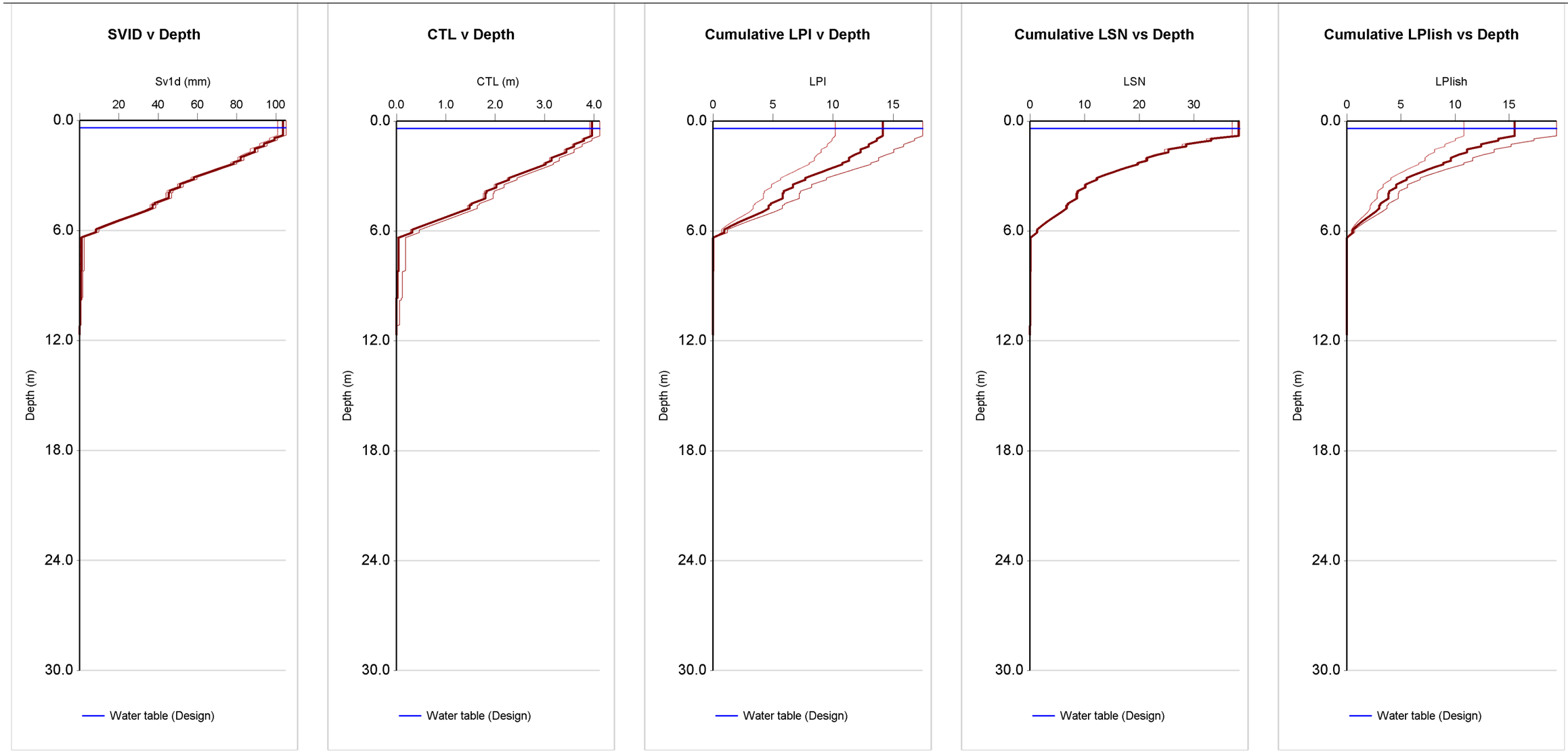
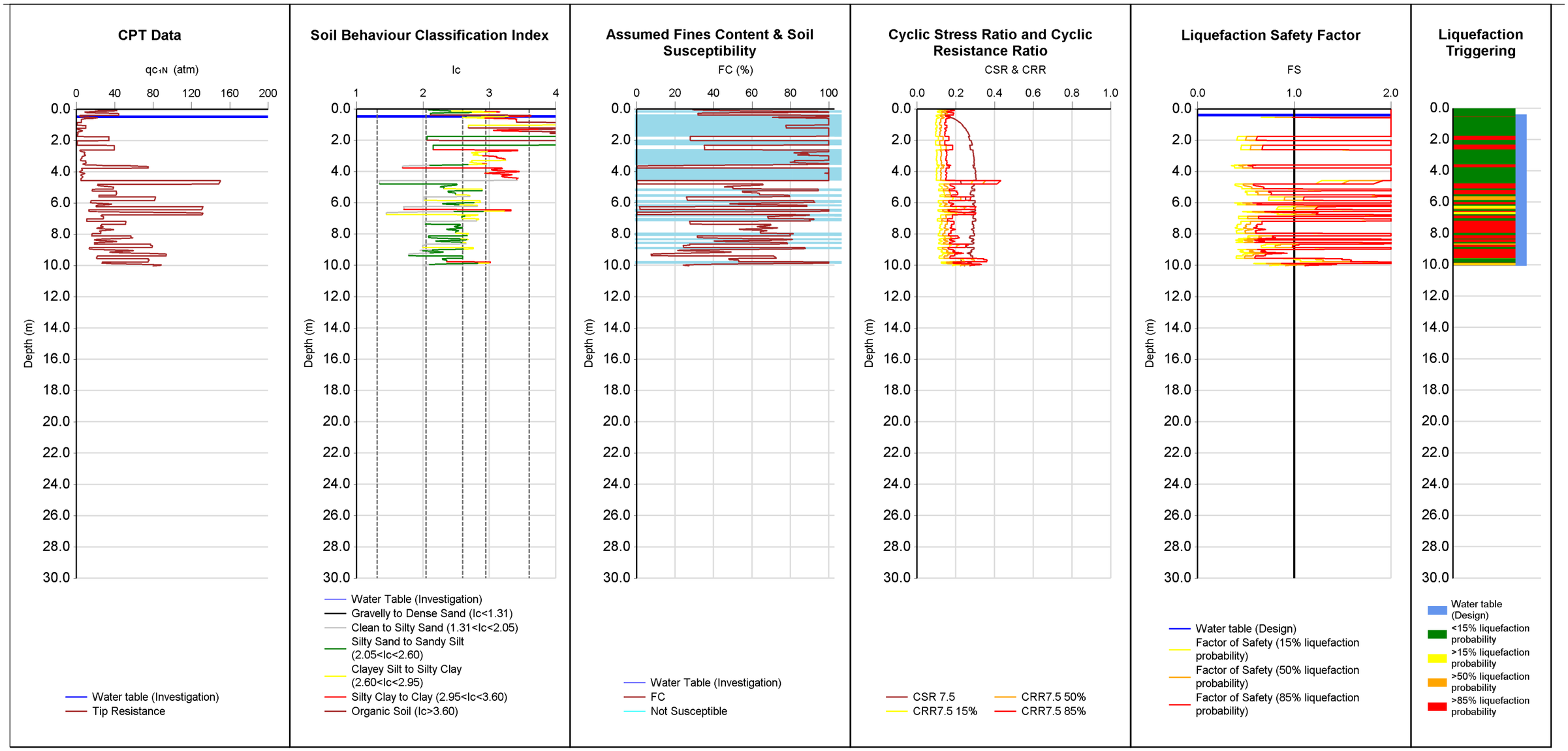


	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT109	178998	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



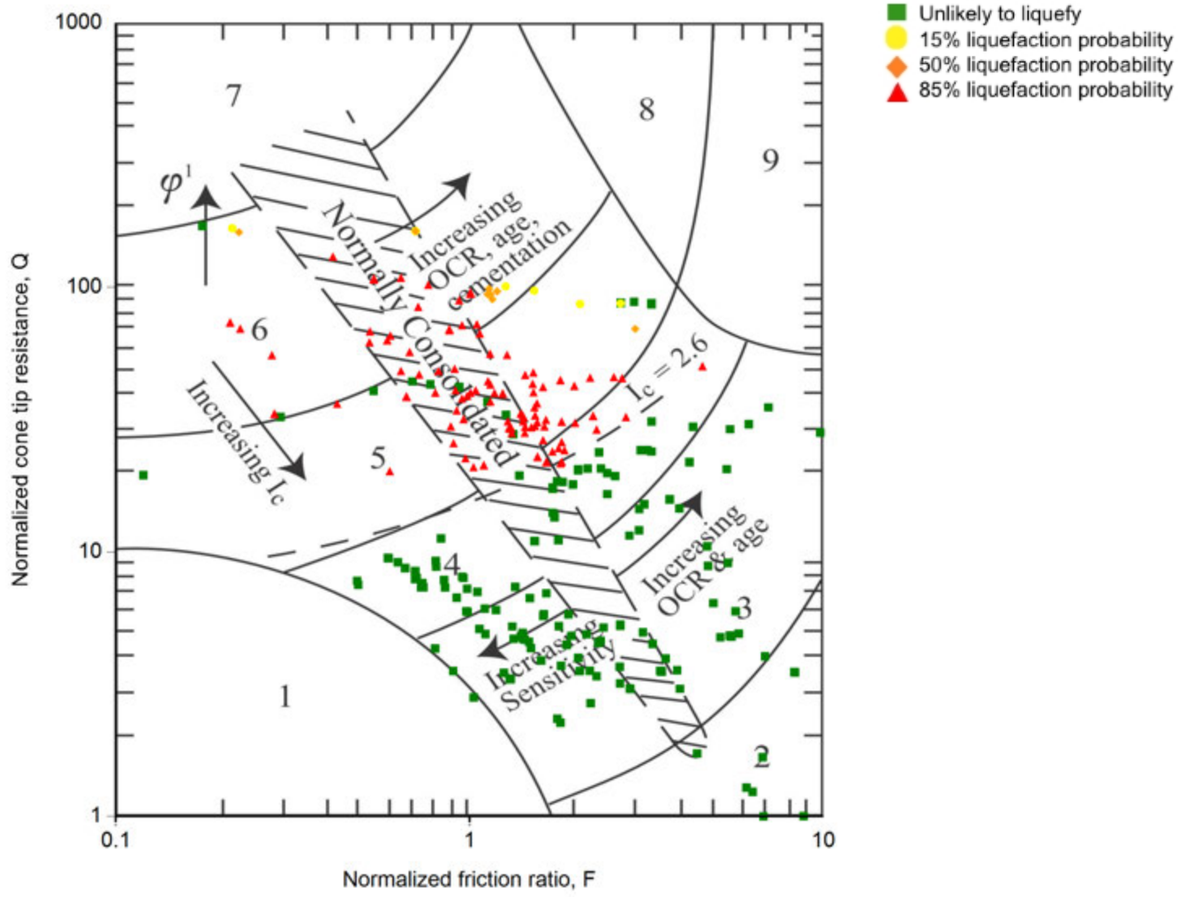
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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:

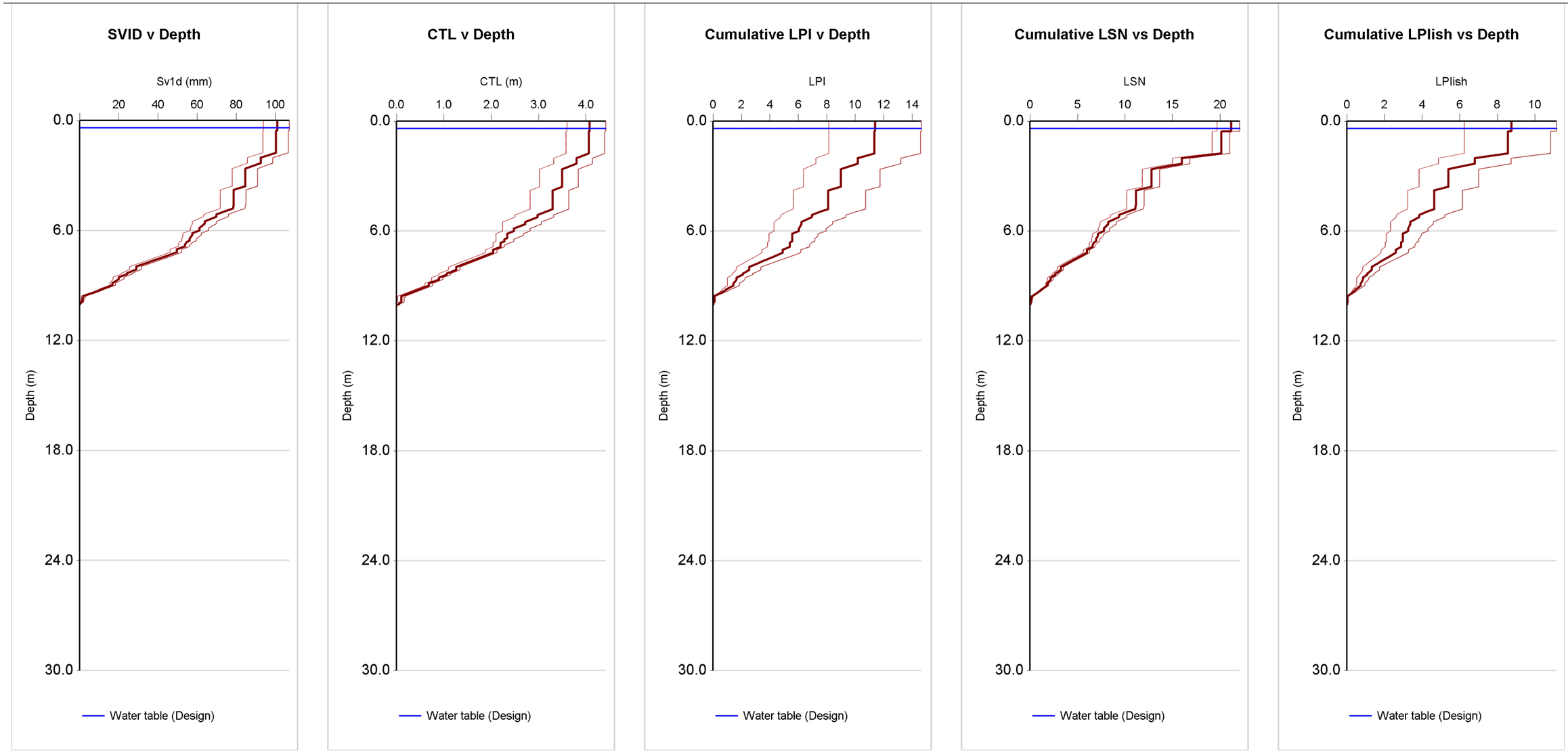
CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



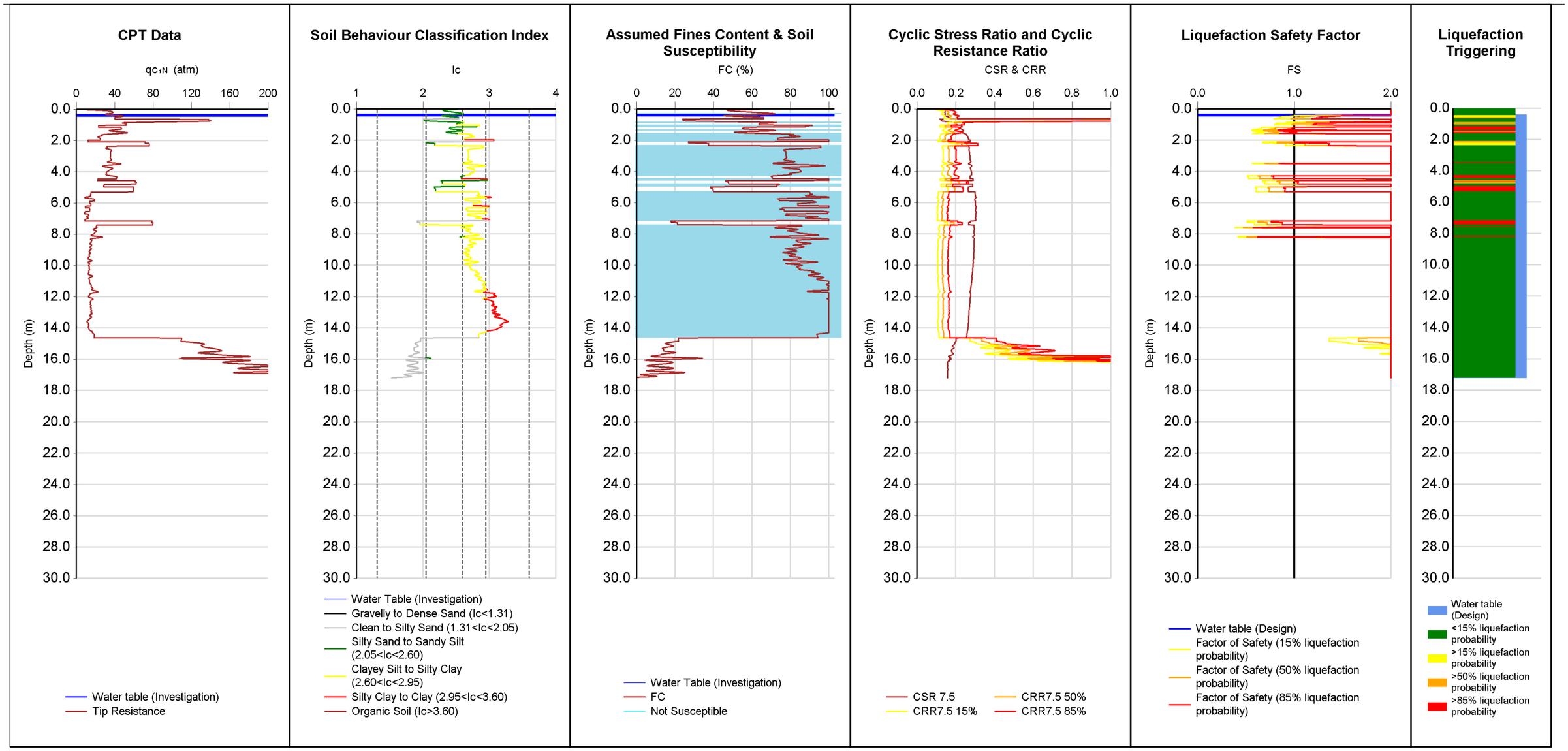
1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained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

*Heavily overconsolidated or cemented

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



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



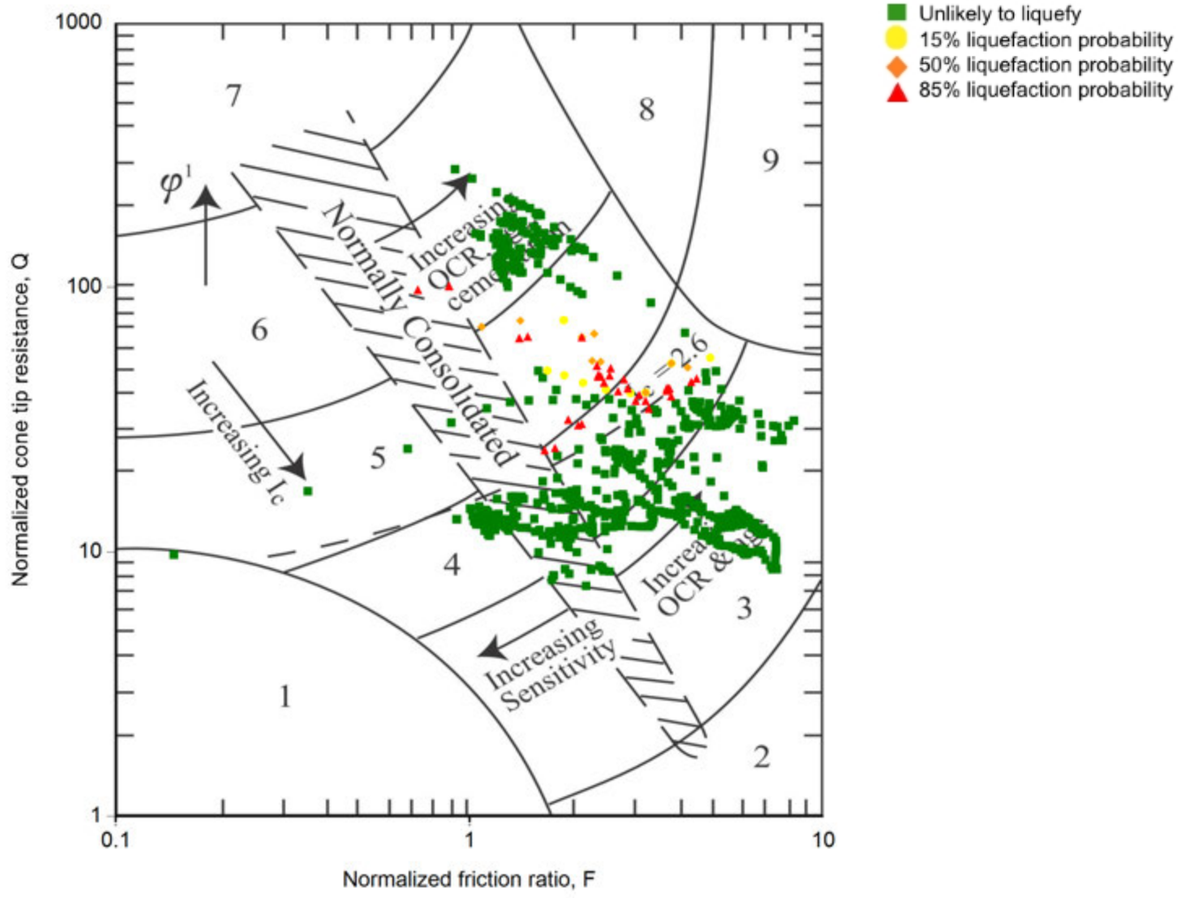
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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



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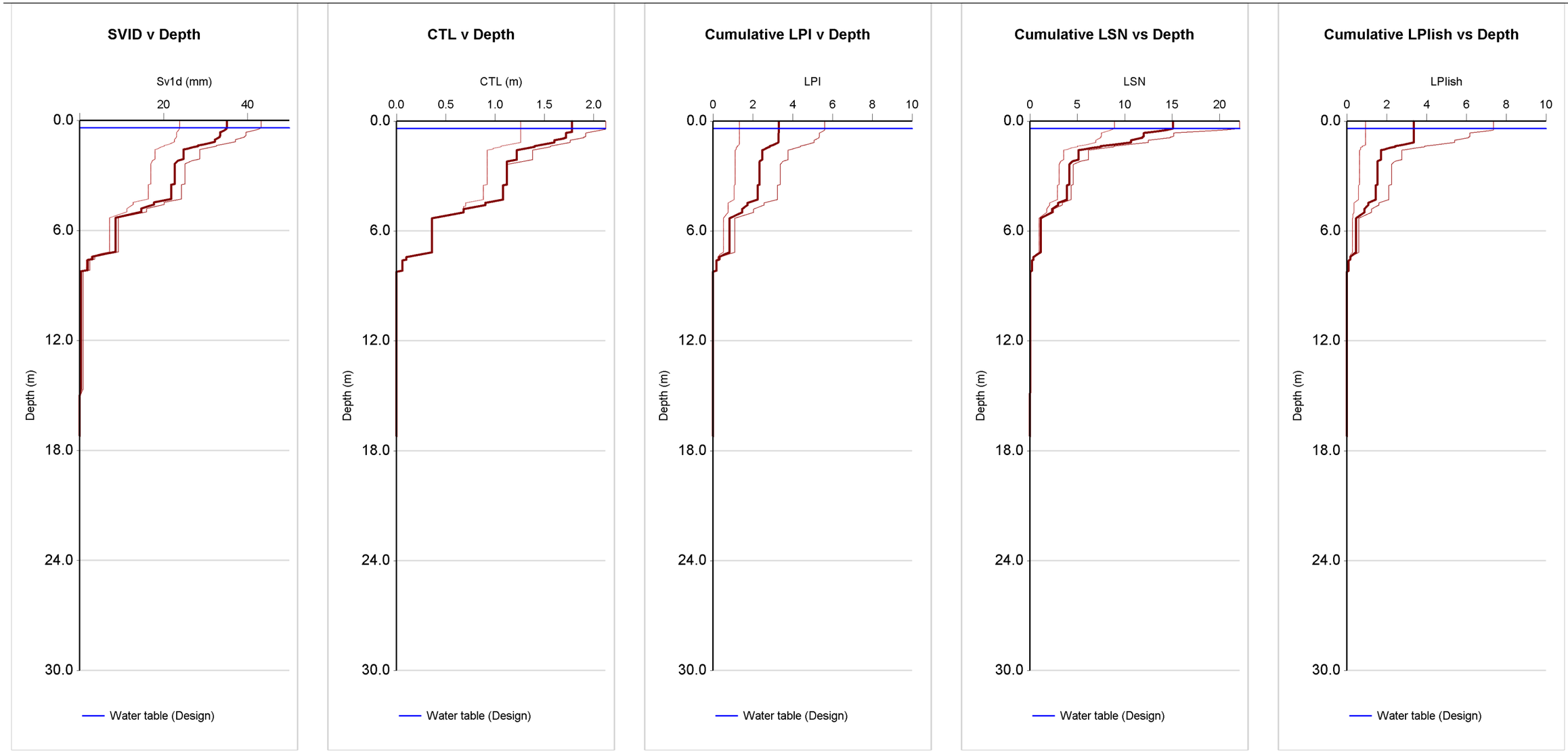
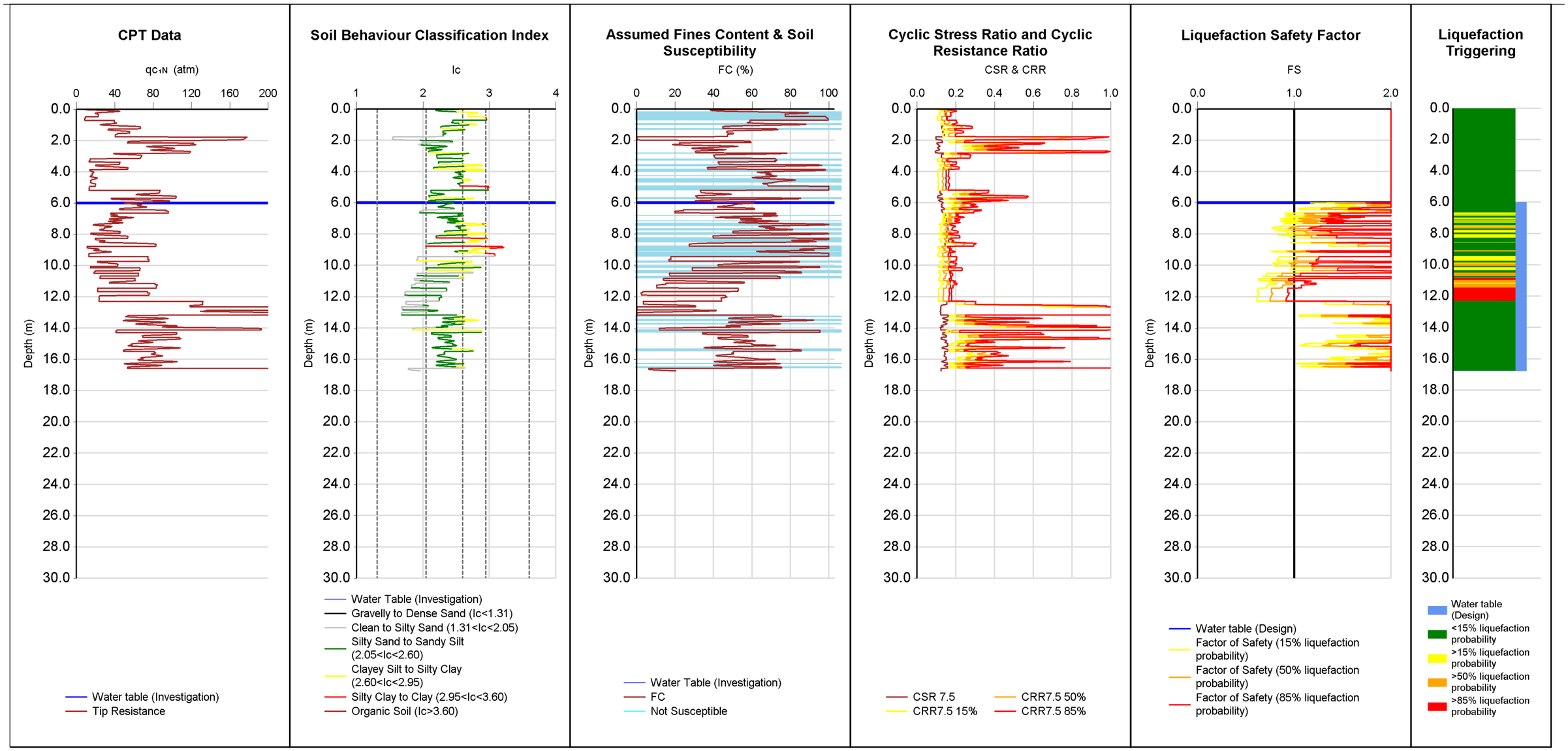
CPT-based soil behavior type classification chart by Robertson (1990)



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	



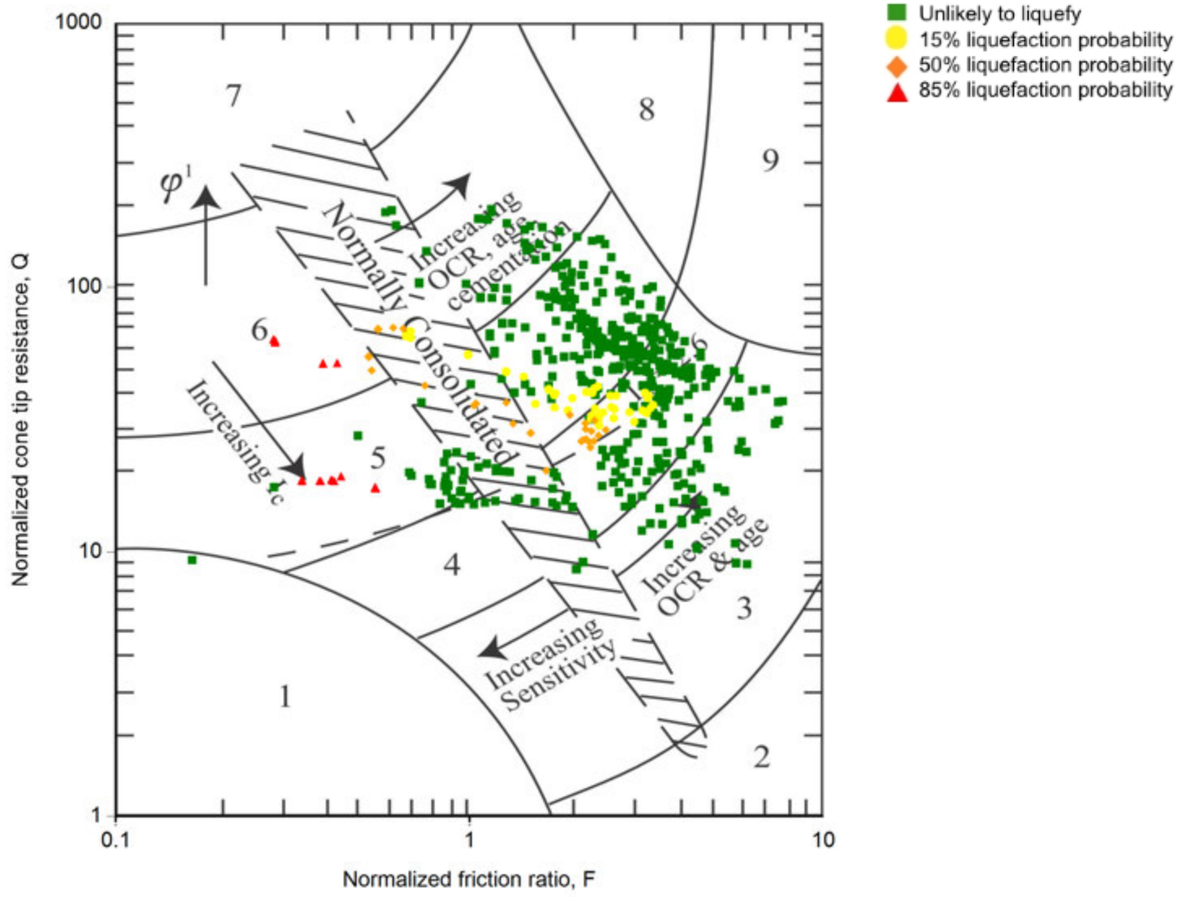
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	15%	84	3.5	4	8	6.7	0
	50%	59	2	1	6	7.6	0
	85%	32	1	0	3	10.9	0

Reviewed by:

CPT Inversion	gumc
Groundwater	gumc
Susceptibility	gumc
Triggering	gumc
Consequence	gumc



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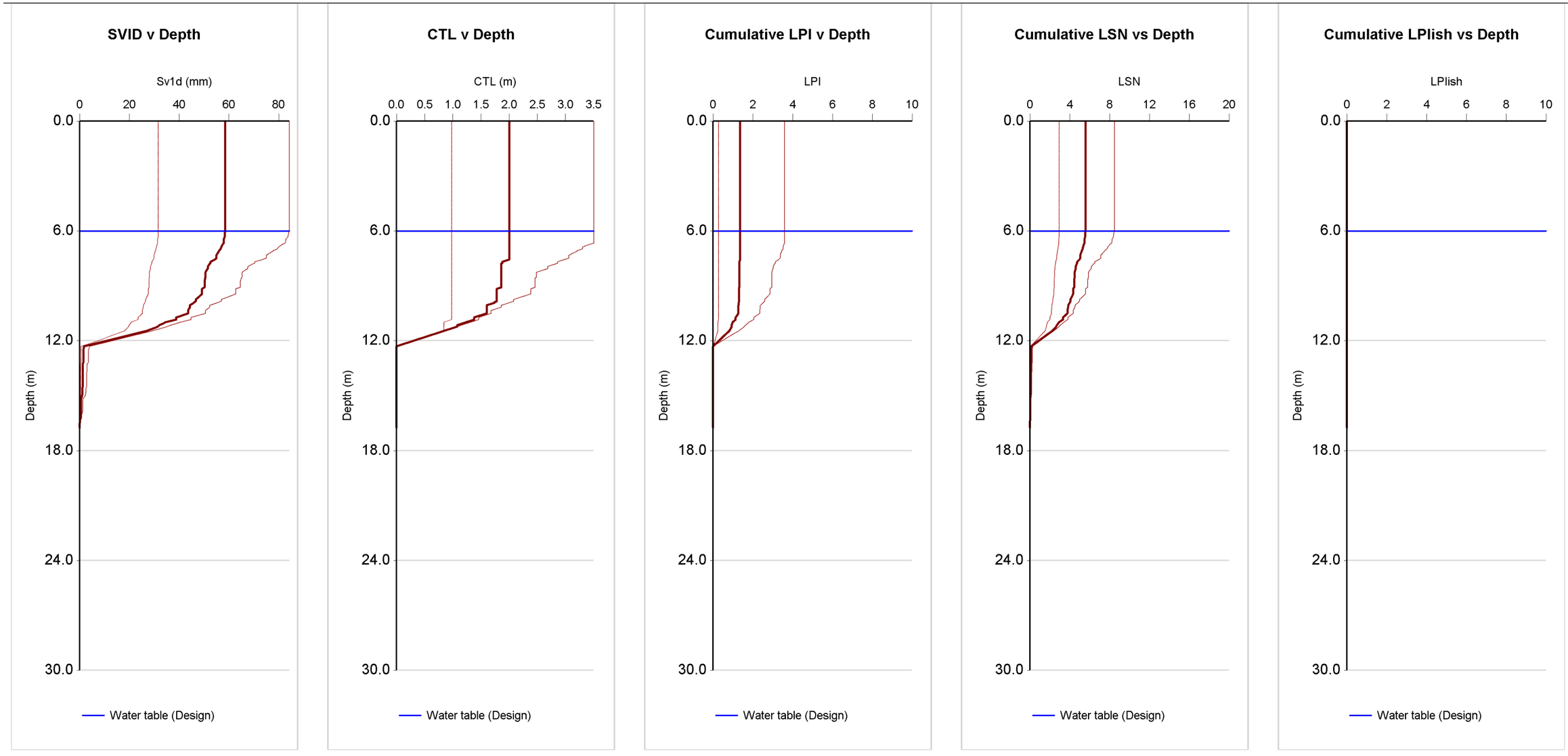
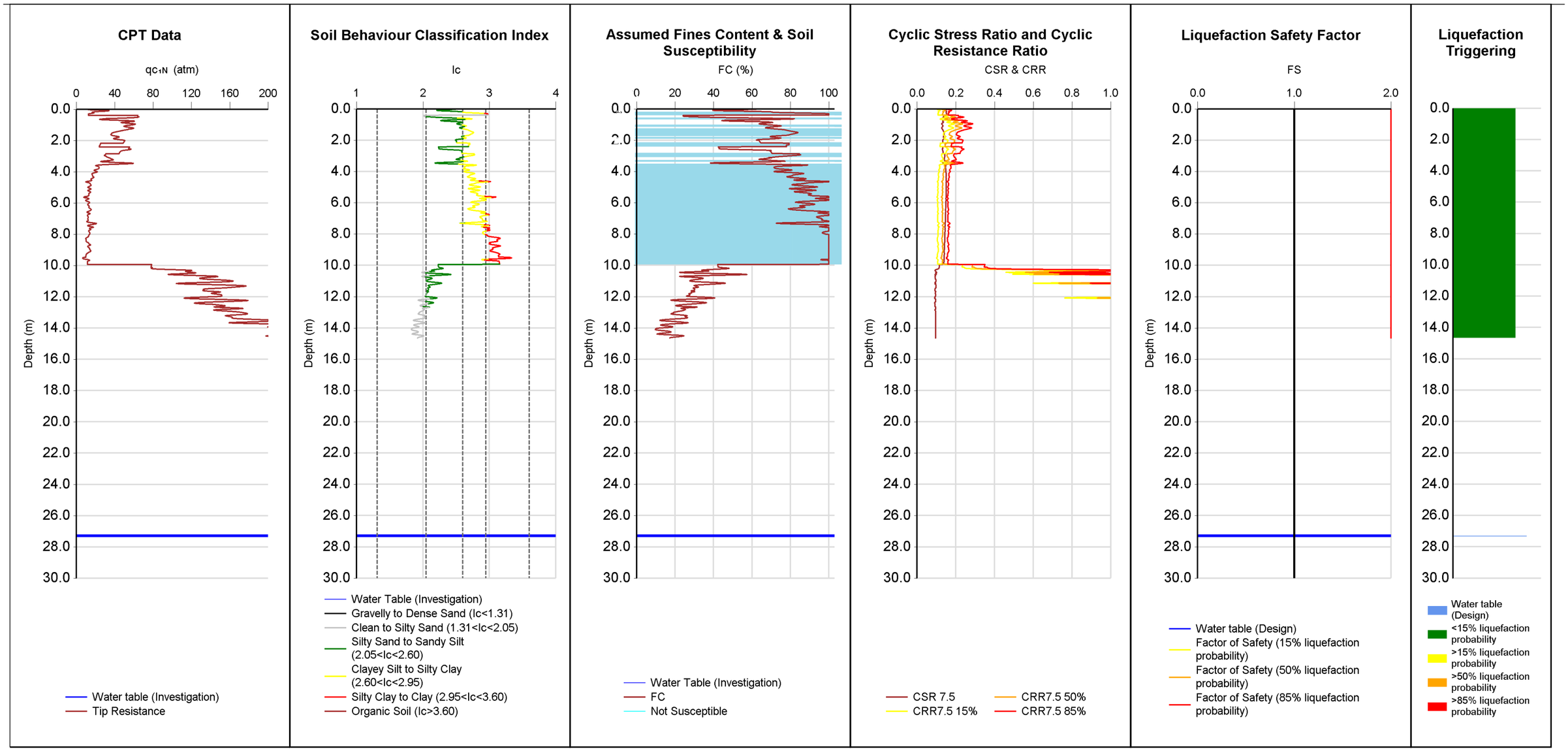
CPT-based soil behavior type classification chart by Robertson (1990)



	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
OUTPUT	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

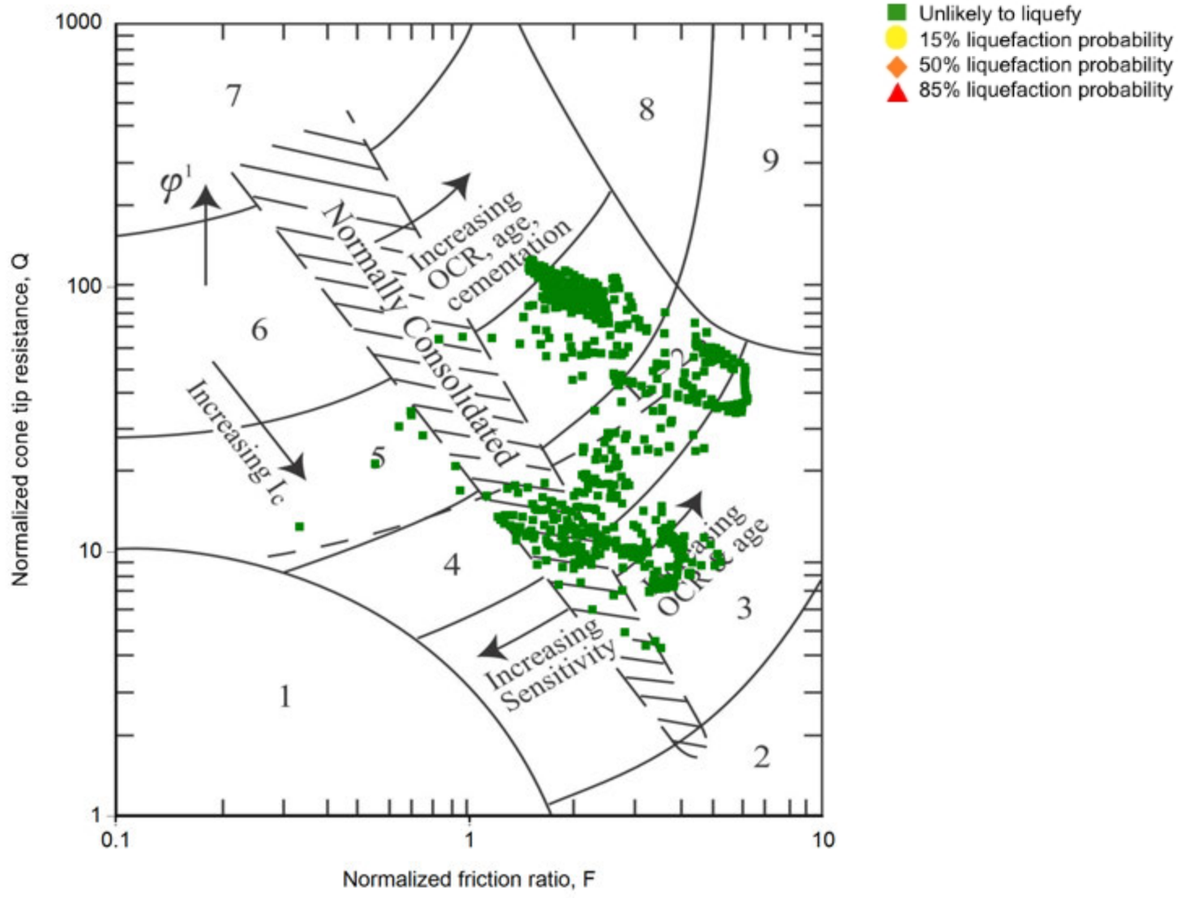
Tonkin + Taylor

Exceptional thinking together

V2.4.15

CLIENT	**Brymer Farms Ltd**	LOCATION	Hamilton
PROJECT	**Brymer Farms Subdivision**		
TITLE	**Liquefaction Analyses**	JOB NUMBER	**1017355.0000**
COMMENT	1 in 1000 Year Event - ULS IL3		

DATE	24/06/2021
ANALYSED	cand
PAGE	37 of 47 pages



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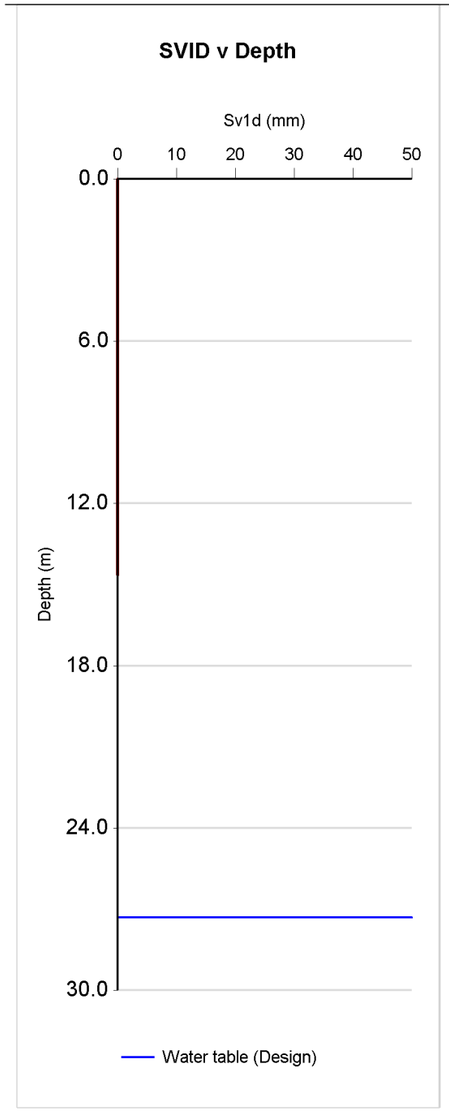
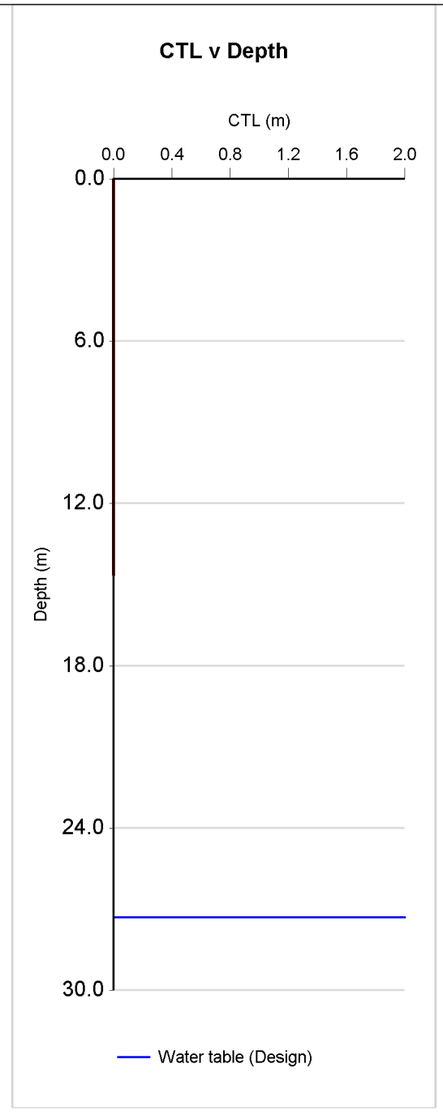
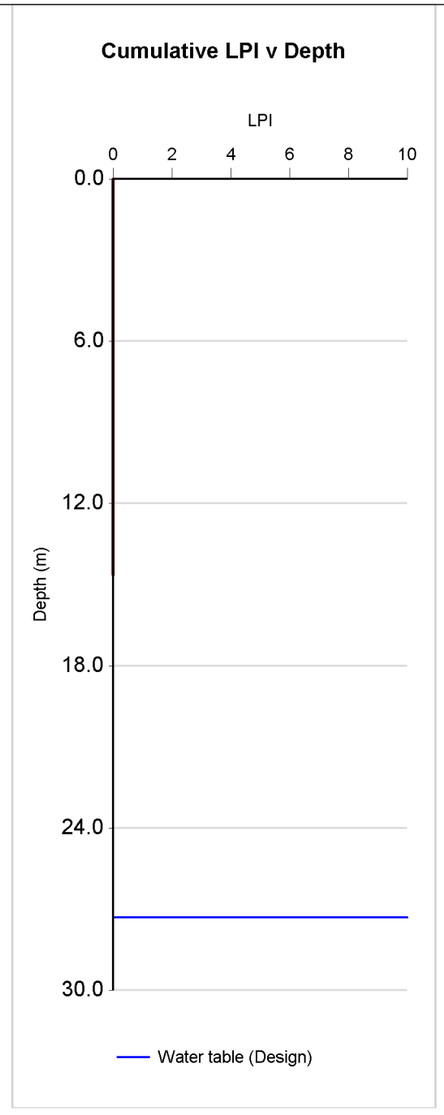
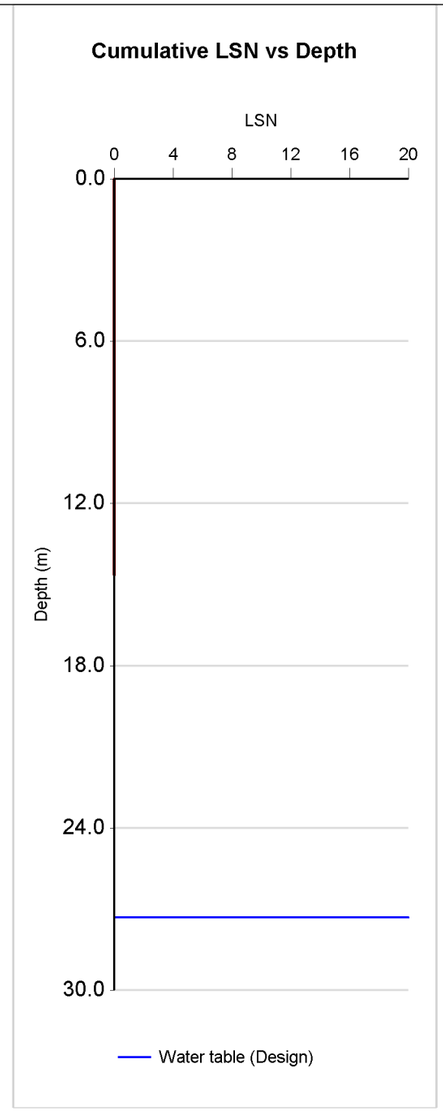
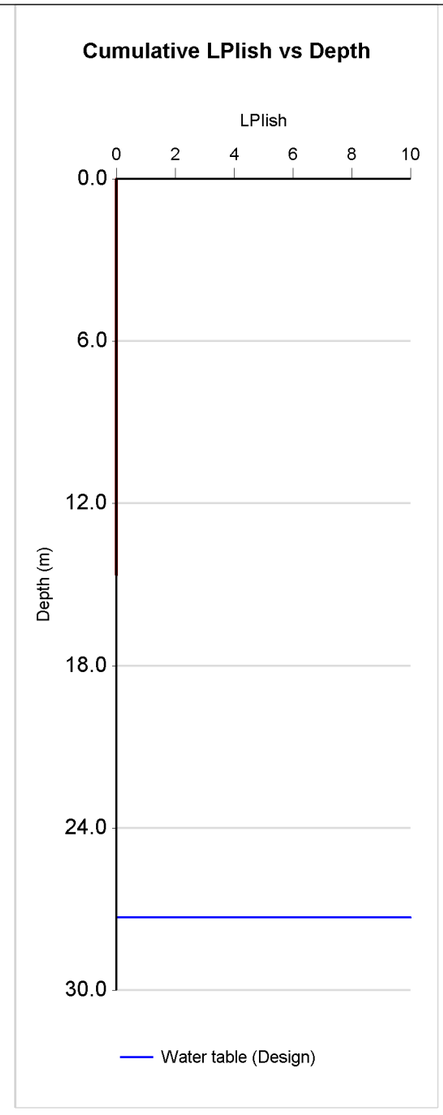
CPT-based soil behavior type classification chart by Robertson (1990)



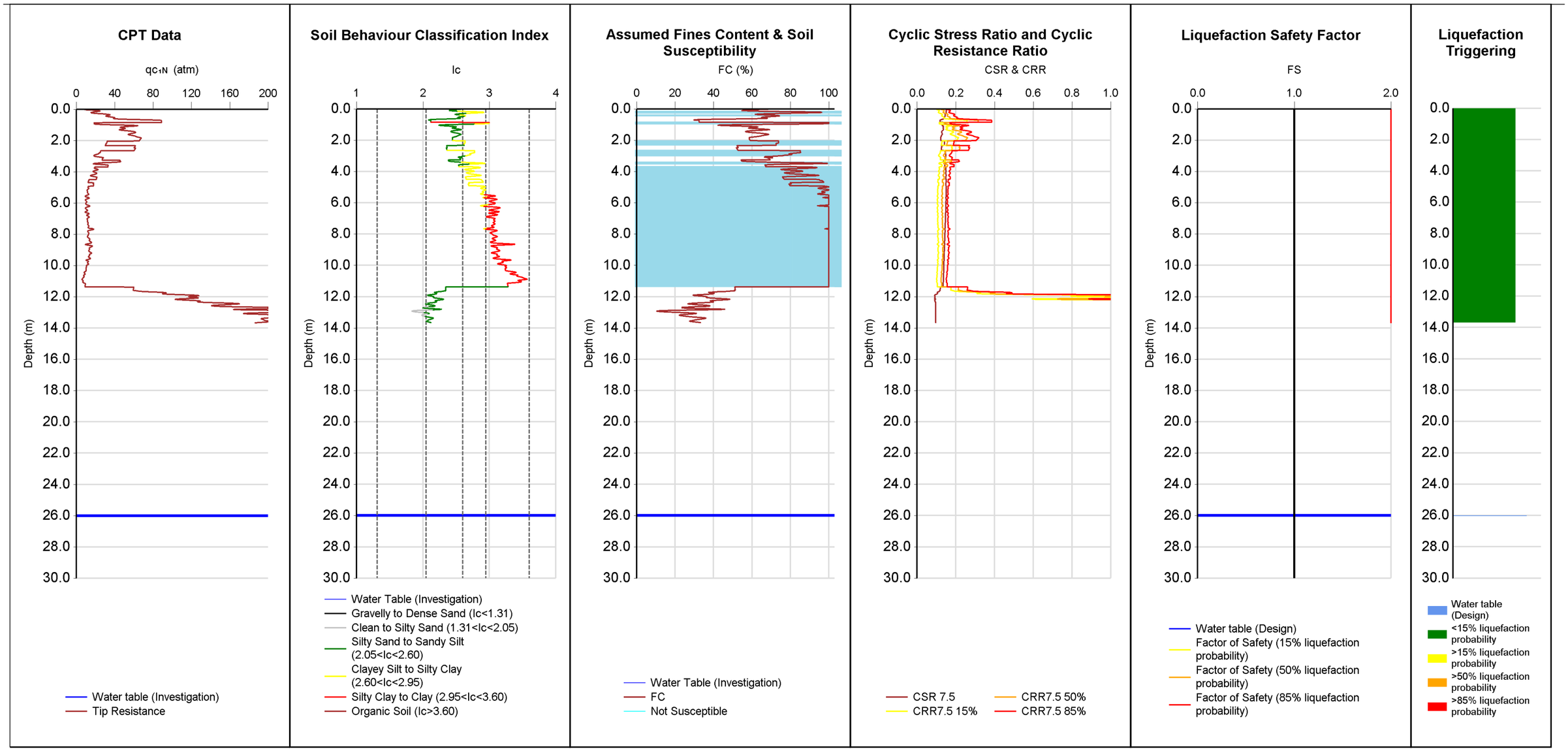








	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	γ (kN/m³)	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
INPUT	CPT113	179002	18/05/2021	0	5.9	0.28	BI-2014	ZRB-2002	17		0	



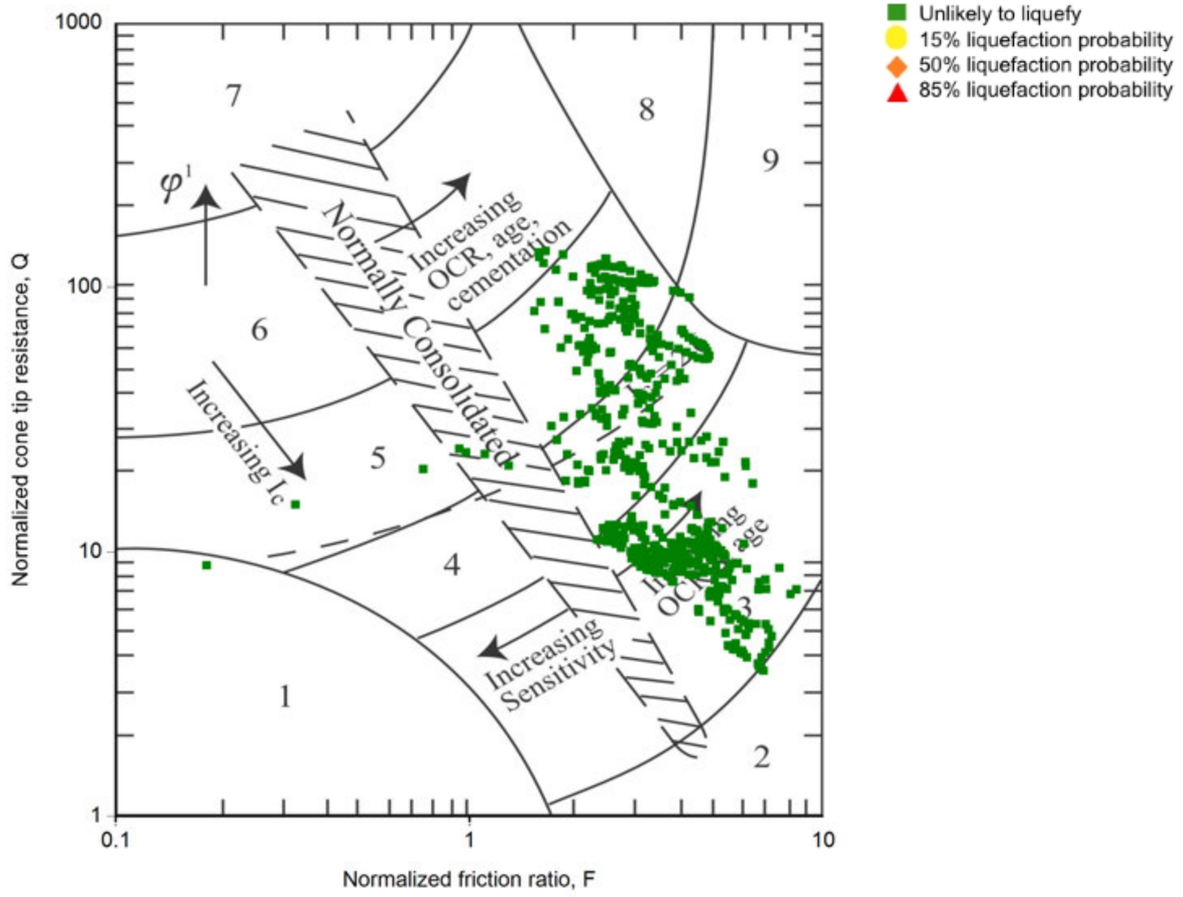
Note: Inverse filtered Qc/Fs data (10 cm²) used.

	Run Description	TTGD ID	Investigation Date	Pre-drill (m)	Magnitude	PGA (g)	Trigger Method	Settlement Method	ɣ (kN/m³)	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	

	PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
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



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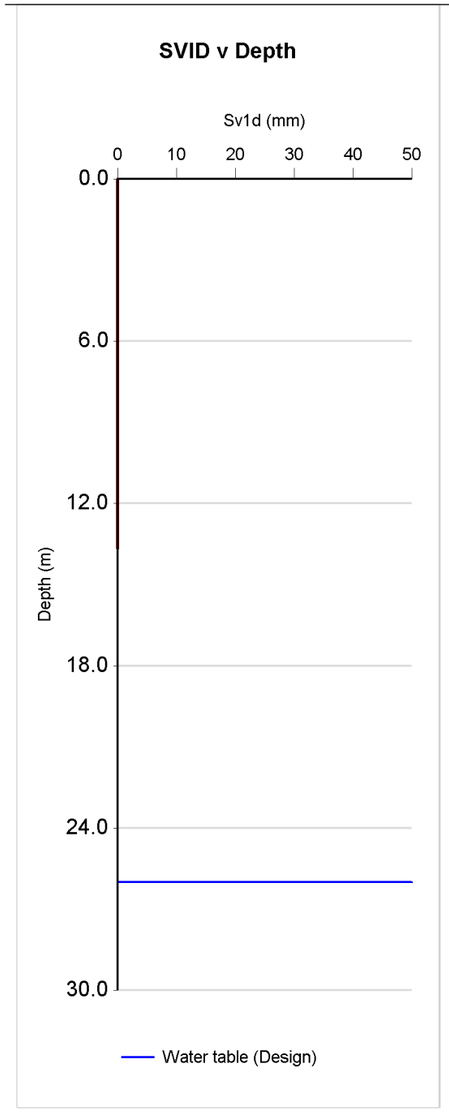
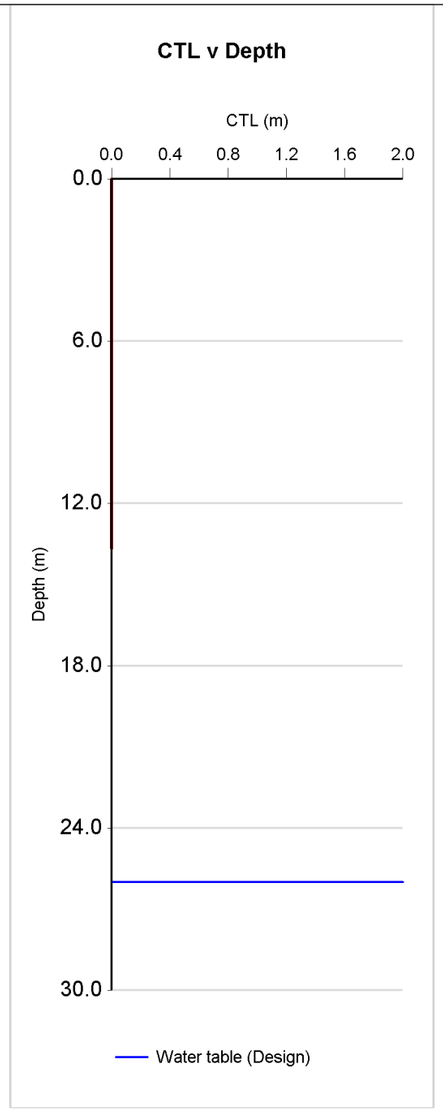
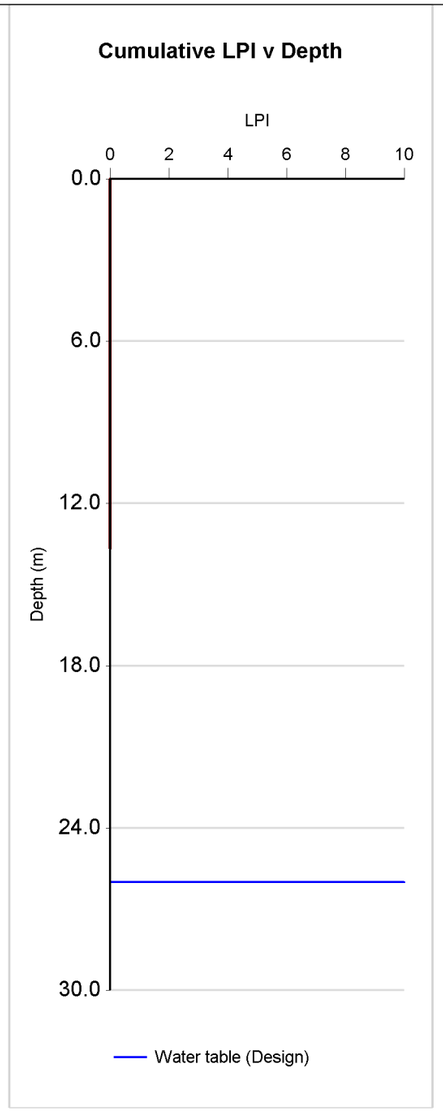
8. Very stiff sand to clayey sand *
9. Very stiff, fine grained *

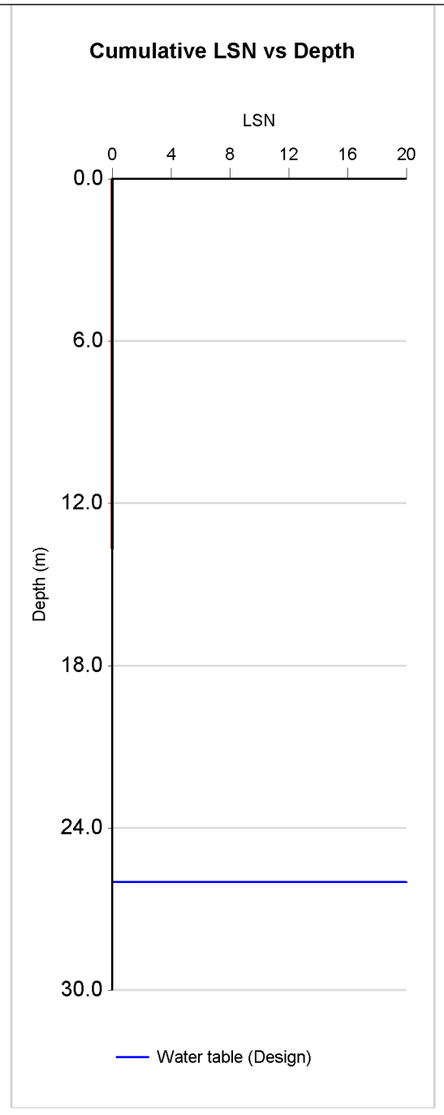
*Heavily overconsolidated or cemented

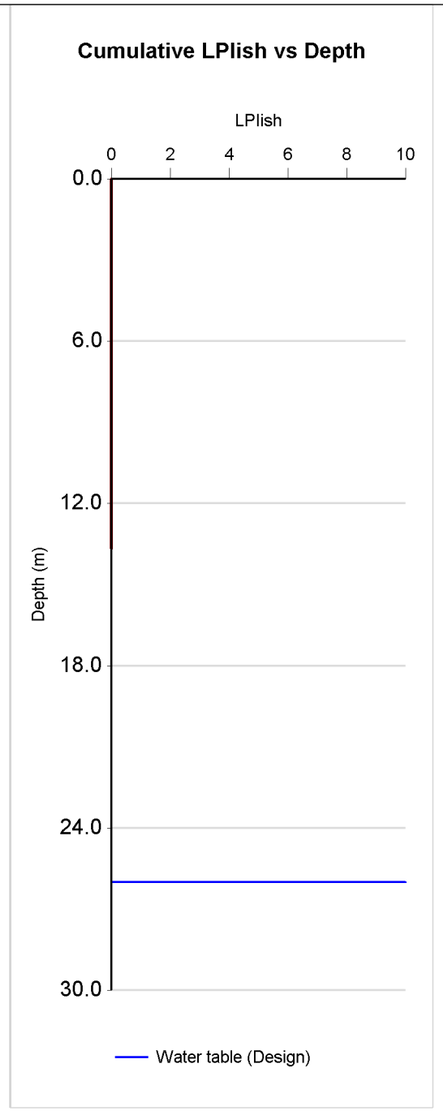
CPT-based soil behavior type classification chart by Robertson (1990)











	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)
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

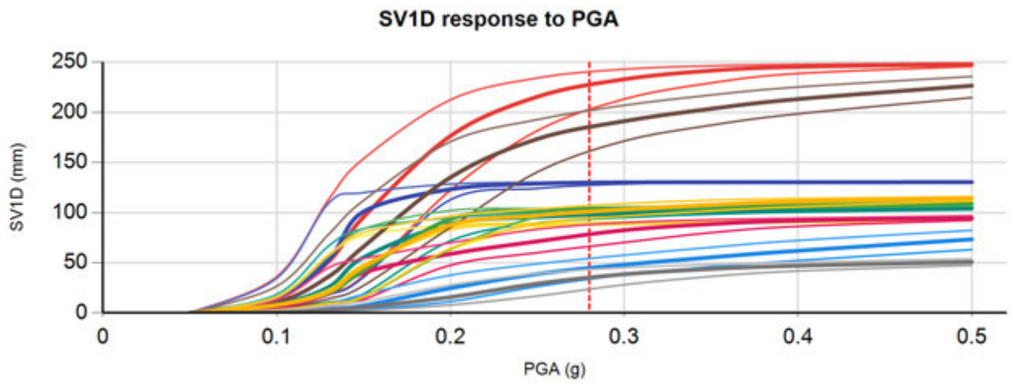
Table 1.1-3 Summary of Fc inputs for liquefaction analysis

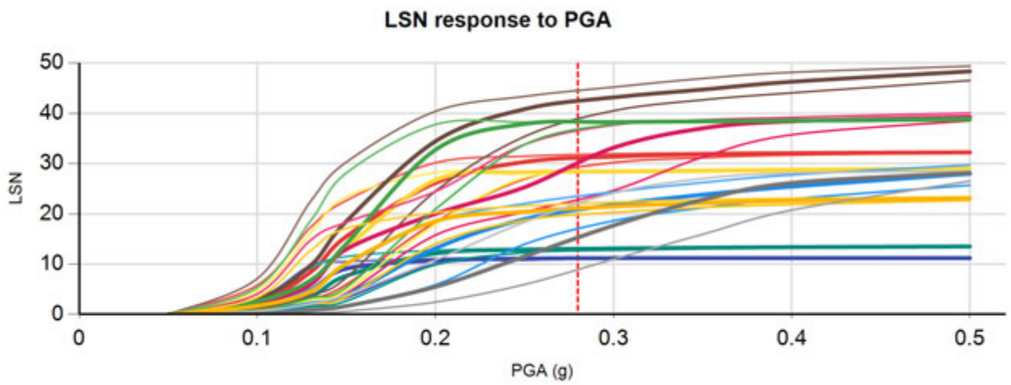
ID	Run description	From (m)	To (m)	Fc
TTGD 178990	CPT101	0.01	30	0 CFC
TTGD 178991	CPT102	0	30	0 CFC
TTGD 178992	CPT103	0	30	0 CFC
TTGD 178993	CPT104	0	30	0 CFC
TTGD 178994	CPT105	0	30	0 CFC
TTGD 178995	CPT106	0	30	0 CFC
TTGD 178996	CPT107	0	30	0 CFC
TTGD 178997	CPT108	0	30	0 CFC
TTGD 178998	CPT109	0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

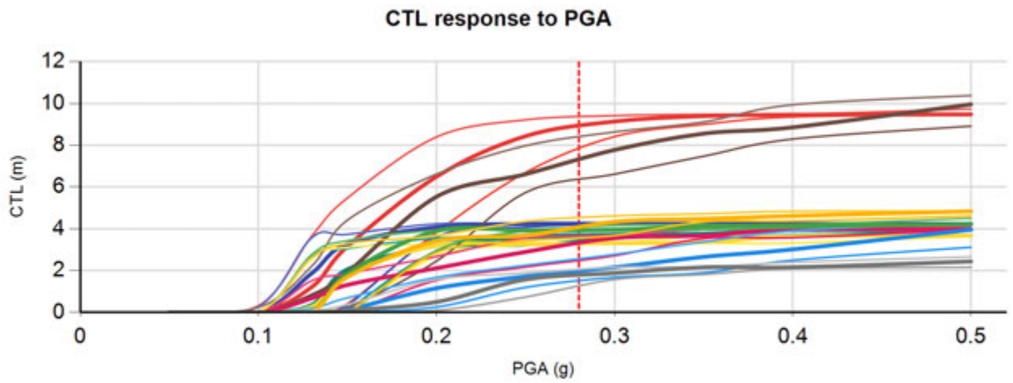
TTGD 178996	TTGD 178997	TTGD 178998	TTGD 178999	TTGD 179000	TTGD 179001	TTGD 179002
CPT07, 584 Whatawhata Road, Hamilton	CPT08, 584 Whatawhata Road, Hamilton	CPT09, 584 Whatawhata Road, Hamilton	CPT10, 584 Whatawhata Road, Hamilton	CPT11, 584 Whatawhata Road, Hamilton	CPT12, 584 Whatawhata Road, Hamilton	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)

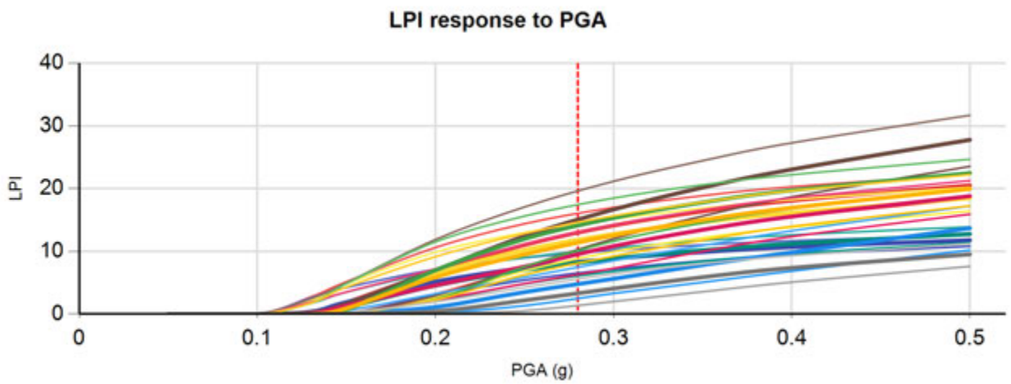
TTGD 179003
CPT14, 584 Whatawhata Road, Hamilton
CPT114
0.28g
5.9
26
26
0
qc= 2 MPa & Fs= 0.01 MPa
Boulanger & Idriss (2014)
ZRB-2002
13.66
0
30
Yes (10 cm^2)

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/m³)	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 exceedance cases respectively.											

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