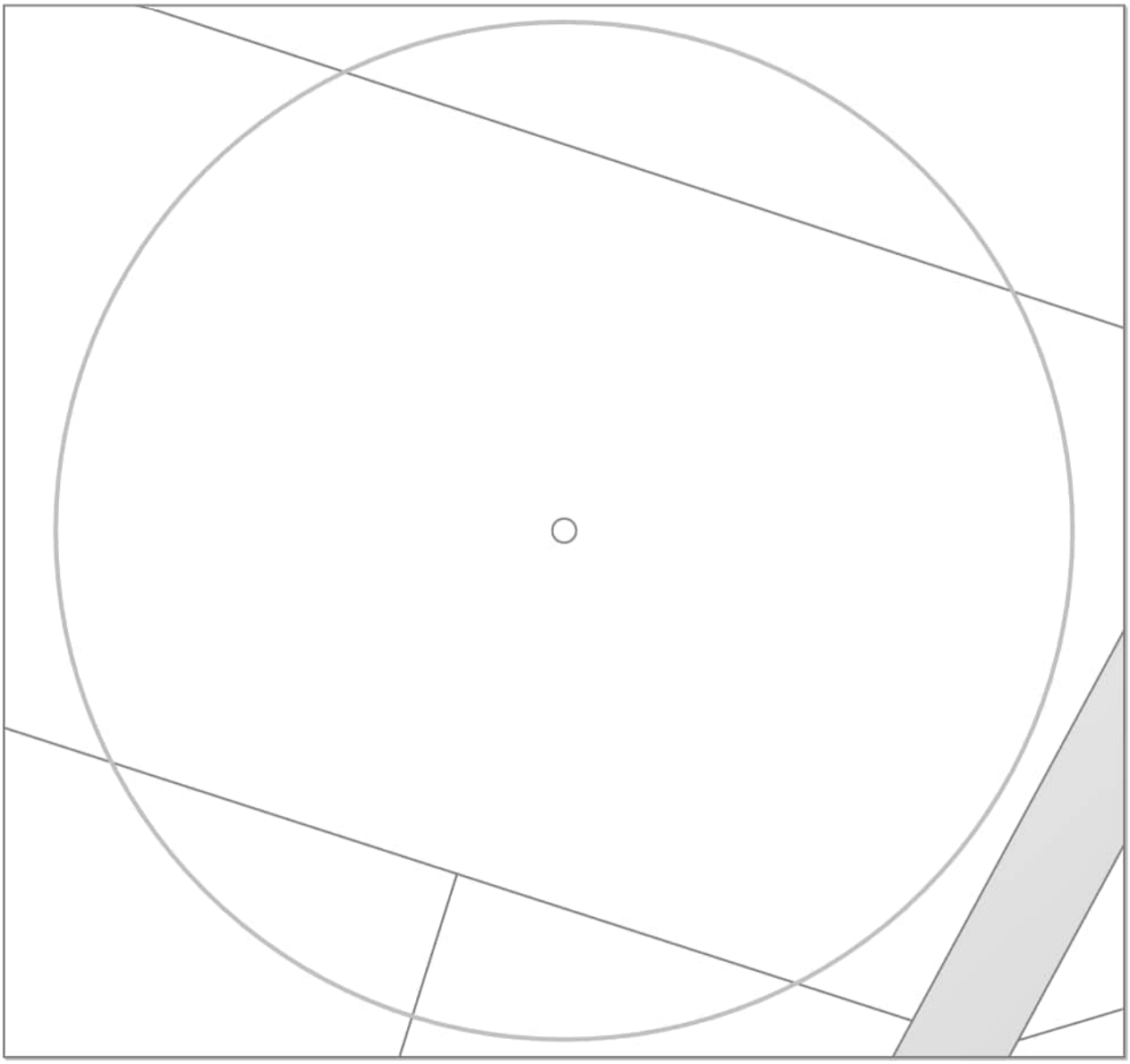
Christchurch City Council

Land Information Memorandum



Property address:

47 Hawkins Road

LIM number: H01333134

Christchurch City Council

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Land Information Memorandum

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Application details

Date issued	29 September 2023
Date received	19 September 2023

Property details

Property address	47 Hawkins Road, Marshland, Christchurch
Valuation roll number	21800 58101
Valuation information	Capital Value: $6,020,000 Land Value: $6,020,000 Improvements Value: $0 *Please note: these values are intended for Rating purposes*
Legal description	Lot 4 DP 23089
Existing owner	Sovereign Palms Limited PO Box 13349 Christchurch 8141

Council references

Rate account ID	73203502
LIM number	H01333134
Property ID	1195783

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Document information

This Land Information Memorandum (LIM) has been prepared for the purpose of section 44A of the Local Government Official Information and Meetings Act 1987 (LGOIMA). It is a summary of the information that we hold on the property. Each heading or "clause" in this LIM corresponds to a part of section 44A.

Sections 1 to 10 contain all of the information known to the Christchurch City Council that must be included under section 44A(2) LGOIMA. Any other information concerning the land as the Council considers, at its discretion, to be relevant is included at section 11 of this LIM (section 44A(3) LGOIMA). If there are no comments or information provided in these sections this means that the Council does not hold information on the property that corresponds to that part of section 44A.

The information included in this LIM is based on a search of Council records only and there may be other information relating to the land which is unknown to the Council. Please note that other agencies may also hold information relevant to the property, or administer legislation relevant to the use of the land, for example, the Regional Council (Ecan), Heritage New Zealand Pouhere Taonga, and Land Information New Zealand.

Council records may not show illegal or unauthorised building or works on the property. The applicant is solely responsible for ensuring that the land is suitable for a particular purpose.

A LIM is only valid at the date of issue as information is based only upon information the Council held at the time of that LIM request being made.

Property file service

This Land Information Memorandum does not contain all information held on a property file. Customers may request property files by phoning the Council's Customer Call Centre on (03) 941 8999, or visiting any of the Council Service Centres. For further information please visit www.ccc.govt.nz.

To enable the Council to measure the accuracy of this LIM document based on our current records, we would appreciate your response should you find any information contained therein which may be considered to be incorrect or omitted. Please telephone the Customer Call Centre on (03) 941 8999.

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A search of records held by the Council has revealed the following information:

1. Special features and characteristics of the land

Section 44A(2)(a) LGOIMA. This is information known to the Council but not apparent from the district scheme under the Town and Country Planning Act 1977 or a district plan under the Resource Management Act 1991. It identifies each (if any) special feature or characteristic of the land concerned, including but not limited to potential erosion, avulsion, falling debris, subsidence, slippage, alluvion, or inundation, or likely presence of hazardous contaminants.

☎ For enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

- **Liquefaction Assessment**

  Christchurch City Council holds indicative information on liquefaction hazard for Christchurch. Information on liquefaction, including an interactive web tool, can be found on the Council website at ccc.govt.nz/liquefaction. Depending on the liquefaction potential of the area that the property is in, the Council may require site-specific investigations before granting future subdivision or building consent for the property.

- **Consultant Report Available**

  Land Information New Zealand (LINZ) engaged Tonkin and Taylor to provide a Geotechnical Report on Ground Movements that occurred as a result of the Canterbury Earthquake Sequence. The report indicates this property may have been effected by a degree of earthquake induced subsidence. The report obtained by LINZ can be accessed on their website at https://www.linz.govt.nz and search Information for Canterbury Surveyors.

Related Information

- There is attached a sub division soil investigation report covering this property.

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2. Private and public stormwater and sewerage drains

Section 44A(2)(b) LGOIMA. This is information about private and public stormwater and sewerage drains as shown in the Council's records.

☎ For stormwater and sewerage enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

- **Property in Local Pressurised Sewer System Zone**

  This property is located within the Council local pressurised sewerage system area. A Council maintained sewerage tank and pump water system is located on this property. A plan showing its location at the property is attached. For further information please contact Christchurch City Council customer services on (03)941 8999.

Related Information

- No up-to-date drainage plan is available for the development of this site. However, the installation of sewer and stormwater drains is checked by the Council prior to the issue of a Code Compliance Certificate.
- Council records indicate that there is a local pressure sewer system at this address for which ownership has, or is required to, vest in Council. Attached is a copy of the systems user guide, for more information you can refer to https://ccc.govt.nz/ownership or contact Christchurch City Councils 3 waters unit on (03) 941 8999.
- At this stage our records do not show a plan of where the pressurised sewerage system is on the property. This may mean that the work has not yet been undertaken. For more details you can contact the Council Assets Systems Team in the 3 Waters Unit on (03) 941 8999.

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3. Drinking Water Supply

Section 44A(2)(ba) and (bb) LGOIMA. This is information notified to the Council about whether the land is supplied with drinking water, whether the supplier is the owner of the land or a networked supplier, any conditions that are applicable, and any information the Council has about the supply.

Please note the council does not guarantee a particular water quality to its customers. If you require information on current water quality at this property please contact the Three Waters & Waste Unit.

☎ For water supply queries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

Related Information

- No up-to-date drainage plan is available for the development of this site. However, the installation of a water connection is checked by the Council prior to the issue of a Code Compliance Certificate.

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4. Rates

Section 44A(2)(c) LGOIMA. This is information on any rates owing in relation to the land.

☎ For rates enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

(a) Annual rates

Annual rates to 30/06/2024: $15,699.21

	Instalment Amount	Date Due
Instalment 1	$3,924.77	15/09/2023
Instalment 2	$3,924.77	15/12/2023
Instalment 3	$3,924.77	15/03/2024
Instalment 4	$3,924.90	15/06/2024

Rates owing as at 29/09/2023: $ 0.00

(b) Excess water charges

For excess water charge enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz/contact-us

(c) Final water meter reading required at settlement?

Property settlements must now ensure all water usage and outstanding debts are accurately accounted for.

To advise of a commercial property settlement, please complete the request for settlement information form at www.ccc.govt.nz/services/rates-and-valuations/solicitors-request

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5. Consents, certificates, notices, orders, or requisitions affecting the land and buildings

Section 44A(2)(d) LGOIMA. This is information concerning any consent, certificate, notice, order, or requisition, affecting the land or any building on the land, previously issued by the Council. The information in this section may also cover building consent and/or code compliance information issued by building certifiers under the Building Act 1991 and building consent authorities that are not the Council under the Building Act 2004.

You can check the property file to identify whether any consent or certificate was issued by a building certifier under the Building Act 1991.

Section 44A(2)(da) LGOIMA. The information required to be provided to a territorial authority under section 362T(2) of the Building Act 2004. There is currently no information required to be provided by a building contractor to a territorial authority under section 362T(2) of the Building Act 2004. The Building (Residential Consumer Rights and Remedies) Regulations 2014 only prescribed the information that must be given to the clients of a building contractor.

☎ For building enquiries, please phone (03) 941 8999, email EPADutyBCO@ccc.govt.nz or visit www.ccc.govt.nz.

(a) Consents

- BCN/1975/141 Applied: 16/01/1975 Status: Completed
  47 Hawkins Road Marshland
  Permit granted 22/01/1975
  Permit issued 22/01/1975
  SHED & SHOP- Historical Reference PER75011617
- BCN/1975/158 Applied: 17/01/1975 Status: Completed
  47 Hawkins Road Marshland
  Permit granted 10/02/1975
  Permit issued 10/02/1975
  SIGN- Historical Reference PER75011619
- BCN/1985/887 Applied: 21/02/1985 Status: Completed
  47 Hawkins Road Marshland
  Permit granted 14/03/1985
  Permit issued 14/03/1985
  EXTN SHOP- Historical Reference PER85012095
- BCN/1985/6693 Applied: 08/10/1985 Status: Completed
  47 Hawkins Road Marshland
  Permit granted 29/11/1985
  Permit issued 29/11/1985
  STORAGE SHED & SHOP- Historical Reference PER85011357
- BCN/2023/2156 Applied: 18/04/2023 Status: Completed
  47 Hawkins Road Marshland
  Exemption from building consent approved 28/04/2023
  Private water supply, wastewater and stormwater - Oakbridge Subdivision Lots 124, 127, 128, 158-161, 174, 175,243, 244, 252, 253

(b) Certificates

Note: Code Compliance Certificates were only issued by the Christchurch City Council since January 1993.

(c) Notices

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(d) Orders

(e) Requisitions

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6. Certificates issued by a building certifier

Section 44A(2)(e) LGOIMA. This is information notified to the Council concerning any certificate issued by a building certifier pursuant to the Building Act 1991 or the Building Act 2004.

☎ For building enquiries, please phone (03) 941 8999, email EPADutyBCO@ccc.govt.nz or visit www.ccc.govt.nz.

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7. Weathertightness

Section 44A(2)(ea) LGOIMA. This is information notified to the Council under section 124 of the Weathertight Homes Resolution Services Act 2006.

☎ For weathertight homes enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

If there is no information below this means Council is unaware of any formal Weathertight Homes Resolution Services claim lodged against this property.

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8. Land use and conditions

Section 44A(2)(f) LGOIMA. This is information relating to the use to which the land may be put and conditions attached to that use. The planning information provided below is not exhaustive and reference to the Christchurch District Plan and any notified proposed changes to that plan is recommended: https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/christchurch-district-plan/.

There maybe some provisions of the Christchurch City Plan or Banks Peninsula District Plan that affect this property that are still operative.

☎ For planning queries, please phone (03) 941 8999, email DutyPlanner@ccc.govt.nz or visit www.ccc.govt.nz.

- **Regional plan or bylaw**

  There may be objectives, policies or rules in a regional plan or a regional bylaw that regulate land use and activities on this site. Please direct enquiries to Canterbury Regional Council (Environment Canterbury).

(a)(i)Christchurch City Plan & Banks Peninsula District Plan

(ii)Christchurch District Plan

- **Liquefaction Management Area (LMA)**

  Property or part of property within the Liquefaction Management Area (LMA) Overlay, which is operative.

- **Outline Development Plan**

  Property or part of property is within an Outline Development Plan area, which is affected by specific provisions that are operative.

- **District Plan Zone**

  Property or part of property within the Future Urban Zone Zone, which has been publicly notifed.

- **District Plan Zone**

  Property or part of property within the Residential New Neighbourhood Zone, which is operative.

(b) Resource consents

If there are any land use resource consents issued for this property the Council recommends that you check those resource consents on the property file. There may be conditions attached to those resource consents for the property that are still required to be complied with.

- RMA/2022/927 - Combined subdivision / land use consent
  Fee simple subdivision - 119 lots with land use
  Status: Consent issued
  Applied 29/03/2022
  Conditions changed/cancelled - s127 17/05/2023
  Conditions changed/cancelled - s127 07/08/2023
  Granted 27/09/2022
  Decision issued 27/09/2022

- RMA/2023/1314 - Combined subdivision / land use consent

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47 Hawkins Road Marshland
Stage 6-14 Subdivision - Fee Simple - 216 Lots with land use
Status: Processing
Applied 29/05/2023

- RMA/2023/1945 - Land Use Consent
  Global Resource Consents, Network Rating Unit
  Global NESCS consent for contaminated soil disturbance
  Status: On hold - processing suspended by applicant
  Applied 28/07/2023

Related Information

- Council records show that there is a current/on hold monitoring job in our system. This monitoring is to ensure that the resource consent conditions have been met. For further information you can contact the Compliance & Investigation team A on 941 8999 or email: rcmon@ccc.govt.nz and reference to resource consent RMA/2022/927.
- Council records shows there is an outstanding development contribution notice issued against this property development. For more information please contact the Development Contribution team on 941 8999 or email: developmentcontributions@ccc.govt.nz. RMA/2022/927.

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9. Other land and building classifications

Section 44A(2)(g) LGOIMA. This is information notified to the Council by any statutory organisation having the power to classify land or buildings for any purpose.

☎ For land and building enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

Please refer to Section 1 for details

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10. Network utility information

Section 44A(2)(h) LGOIMA. This is information notified to the Council by any network utility operator pursuant to the Building Act 1991 or the Building Act 2004.

☎ For network enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

- **None recorded for this property**

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11. Other information

Section 44A(3) LGOIMA. This is information concerning the land that the Council has the discretion to include if it considers it to be relevant.

☎ For any enquiries, please phone (03) 941 8999 or visit www.ccc.govt.nz.

(a) Kerbside waste collection

- Your organics are collected Weekly on Wednesday. Please leave your organics at the Kerbside by 6:00 a.m.
- Your recycling is collected Fortnightly on the Week 2 collection cycle on a Wednesday. Please leave your recycling at the Kerbside by 6:00 a.m. Your nearest recycling depot is the Styx Mill EcoDrop.
- Your refuse is collected Fortnightly on the Week 2 collection cycle on a Wednesday. Please leave your rubbish at the Kerbside by 6:00 a.m. Your nearest rubbish depot is the Styx Mill EcoDrop.

(b) Other

- **Floor Levels Information**

  Christchurch City Council holds a variety of information relevant to building/property development across the city. This includes minimum finished floor levels that need to be set to meet the surface water requirements in clause E1.3.2 of the building code (where this applies), and the requirements of the Christchurch District Plan (where a property is in the Flood Management Area). Where this information has been processed for your site, it can be viewed at https://ccc.govt.nz/floorlevelmap/, otherwise site specific advice can be obtained by emailing floorlevels@ccc.govt.nz

- **Guest Accommodation**

  Guest accommodation (including whole unit listings on Airbnb; BookaBach; etc.) generally requires a resource consent in this zone when the owner is not residing on the site. For more information, please refer to: https://ccc.govt.nz/providing-guest-accommodation/.

- **Community Board**

  Property located in Papanui-Innes-Central Community Board.

- **Tsunami Evacuation Zone**

  This property is not in a tsunami evacuation zone. It is not necessary to evacuate in a long or strong earthquake or during an official Civil Defence tsunami warning. Residents may wish to offer to open their home to family or friends who need to evacuate from a tsunami zone, and should plan with potential guests to do so in advance.More information can be found at https://ccc.govt.nz/services/civil-defence/hazards/tsunami-evacuation-zones-and-routes/

- **Electoral Ward**

  Property located in Innes Electoral Ward

- **Listed Land Use Register**

  Hazardous activities and industries involve the use, storage or disposal of hazardous substances. These substances can sometimes contaminate the soil. Environment Canterbury identifies land that is used or has been used for hazardous activities and industries. This information is held on a publically available database called the Listed Land Use Register (LLUR). The Christchurch City Council may not hold information that is held on the LLUR Therefore, it is recommended that you check Environment Canterbury's online database at www.llur.ecan.govt.nz

- **Spatial Query Report**

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A copy of the spatial query report is attached at the end of this LIM. The spatial query report lists land use resource consents that have been granted within 100 metres of this property.

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DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

GEOTECHNICAL REPORT FOR SUBDIVISION

34300 / 203 PRESTONS ROAD, OAKBRIDGE SUBDIVISION

/ KB CONTRACTING & QUARRIES LTD AND SUBURBAN ESTATES LTD

0800 999 333
hello@do.co.nz

11 Deans Avenue, Addington
PO Box 589, Christchurch 8140
www.do.co.nz

Quality Assurance

Title:	203 Prestons Road, Oakbridge Subdivision
Client:	KB Contracting & Quarries Ltd and Suburban Estates ltd.
File Location:	T:\projects\34s\34300 - 171 Prestons Road\Geotech\003 Report\170821.dw.jlp.Oakbridge Geotech Report.doc
Version:	2
Date:	22 August 2017
Project No	34300

Prepared By: **Joanna Lea Petheram**
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Signature:

Authorised By: **Elliot Duke**
DIRECTOR
Senior Civil and Geotechnical Engineer
BE Natural Resources (Hons)
MIPENZ, CPEng, IntPE(NZ)
NZ Geotechnical Society

Signature:

Disclaimer

This geotechnical report has been prepared at the specific instruction of KB Contracting & Quarries Ltd and Suburban Estates Ltd. It addresses geotechnical conditions underlying the parcels of land comprising Lot 2 and Lot 3 DP 25296, Lot 2 and Lot 3 DP 24826, Lot 1, Lot 3, Lot 4, Lot 5, Lot 6 DP 23089 and Lot 2 DP 301363 (held under titles: CB37C/1043, CB37C/1044, CB19B/557, CB4A/784, CB15B/1494, CB6A/114, CB4B/247, CB2A/1469, CB4A/99 and 5293) known as the proposed Oakbridge Subdivision, Redwood, Christchurch.

Davis Ogilvie did not perform a complete assessment of all possible conditions or circumstances that may exist at the site. Conditions may exist which were undetectable given the limited investigation of the site and have not been taken into account in the report.

Davis Ogilvie's opinions are based upon information that existed at the time of the production of this document. Assessments made in this report are based on the conditions found onsite and published sources detailing the recommended investigation methodologies described. No warranty is included—either expressed or implied—that the actual conditions will conform to the assessments contained in this report.

Davis Ogilvie has provided an opinion based on observations, site investigations, and analysis methodologies current at the time of reporting. The report cannot be used by any third party without the written approval of Davis Ogilvie. The report cannot be used if there are changes in the referenced guidelines, analysis methodologies, laws or regulations.

Only KB Contracting & Quarries Ltd. and Suburban Estates Ltd. and the Local and Regional Territorial Authorities are entitled to rely upon this engineering report. Davis Ogilvie & Partners Ltd. accepts no liability to anyone other KB Contracting & Quarries Ltd. and Suburban Estates Ltd. in any way in relation to this report and the content of it and any direct or indirect effect this engineering report may have. Davis Ogilvie & Partners Ltd. does not contemplate anyone else relying on this report or that it will be used for any other purpose.

Information included in this report was obtained and created from maps and/or data extracted from the New Zealand Geotechnical Database (www.nzgd.org.nz), which were prepared and compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way.

Should anyone wish to discuss the content of this report with Davis Ogilvie & Partners Ltd, they are welcome to contact us on (03) 366 1653 or at 11 Deans Avenue, Addington, Christchurch.

Executive Summary

Davis Ogilvie & Partners Ltd. has been engaged by KB Contracting & Quarries Ltd. and Suburban Estates Ltd., to undertake a geotechnical investigation at 203 Prestons Road, Redwood Christchurch, Lot 2 and Lot 3 DP 25296, Lot 2 and Lot 3 DP 24826, Lot 1, Lot 3, Lot 4, Lot 5, Lot 6 DP 23089 and Lot 2 DP 301363 where a 392 lot residential subdivision is proposed.

The purpose of the geotechnical investigation was to determine the underlying ground conditions, assess geotechnical constraints, provide preliminary design criteria for the development, and assess the suitability of the site in accordance with Section 106 of the Resource Management Act (1991). The scope of work for the Davis Ogilvie geotechnical investigation included the following:

- Desk study of published information;
- Geotechnical site investigation including site walkover, forty five Dynamic Cone Penetrometer tests, forty three test pits, two hand augers and sixty two Cone Penetration Tests;
- Liquefaction assessment to enable land classification according to the Ministry of Business, Innovation and Employment Technical Categories;
- Foundation and civil infrastructure recommendations including preliminary soil properties and design parameters;
- Assessment of suitability of the site for subdivision according to Section 106 of the Resource Management Act (1991).

The soil stratigraphy onsite was found to be consistently alluvial in origin; the south west is dominated by silt and sand, with denser gravel deposits within the central area of the site. The central gravel unit is incised by silt and sand which gradually grades to fine grained sediment comprising clay and peat, towards the north east of the site.

The liquefaction assessment of the CPT data indicates a technical category of TC1 and TC2 has been achieved over much of the proposed subdivision, with some areas requiring ground improvement techniques to ensure TC2 ground conditions have been achieved. The creation of a minimum 600 mm densified gravel raft, compacted to NZS4431:1989 will provide sufficient seismic resilience to allow the design and build of TC2 style foundations.

Standard NZS3604:2011 foundations are suitable for areas designated as TC1, subject to lot specific testing and verification of “Good Ground”. TC2 style foundations Option 2 or Option 4 as outlined in MBIE 2012 (or similar proprietary TC2 foundation system) will be appropriate for construction on the areas defined as TC2; however they will require specific engineering design.

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Appendix B – Shallow Geotechnical Test Results

Appendix C – Cone Penetration Test and Liquefaction Analysis Results

Appendix D – Geotechnical Drawings

Appendix C – Statement of Suitability for Subdivision

1.0 Purpose of Report

Davis Ogilvie and Partners Ltd. (Davis Ogilvie) has been engaged by KB Contracting & Quarries Ltd. and Suburban Estates Ltd. to assess the underlying ground conditions at the proposed Oakbridge Subdivision located at 203 Prestons Road, Redwood, Christchurch. This report provides estimations of liquefaction deformation as a result of future earthquakes, recommendations for land development including civil design parameters and an assessment of potential hazards as outlined in Section 106 of the Resource Management Act (1991). The investigation is based on shallow and deep ground geotechnical information acquired during 2016 and 2017, comprising the following;

- Desk study of published information;
- Geotechnical site investigation including site walkover, forty five Dynamic Cone Penetrometer tests, forty three test pits, two hand augers and sixty two Cone Penetration Tests;
- Liquefaction assessment to enable land classification according to the Ministry of Business, Innovation and Employment Technical Categories;
- Foundation and civil infrastructure recommendations including preliminary soil properties and design parameters;
- Assessment of suitability of the site for subdivision according to Section 106 of the Resource Management Act (1991).

1.1 Proposed Development

It is proposed that the development will comprise 392 lots over 37.74 hectare (Ha), as illustrated in Figure 1; the proposed layout as of May 2017. Stage 1 (southwest corner) layout has since been updated (August 2017). It is anticipated that the design will continue to evolve as the development progresses.

Figure 1: Proposed Development Layout of the Oakbridge Subdivision (May 2017).

2.0 Site Description

The site is located between the neighbourhoods of Redwood, to the west and Marshlands, to the east, approximately 6.5 km north of Christchurch City Centre. The site comprises an area of approximately 37.74 hectares (ha), as illustrated upon Figure 2 below.

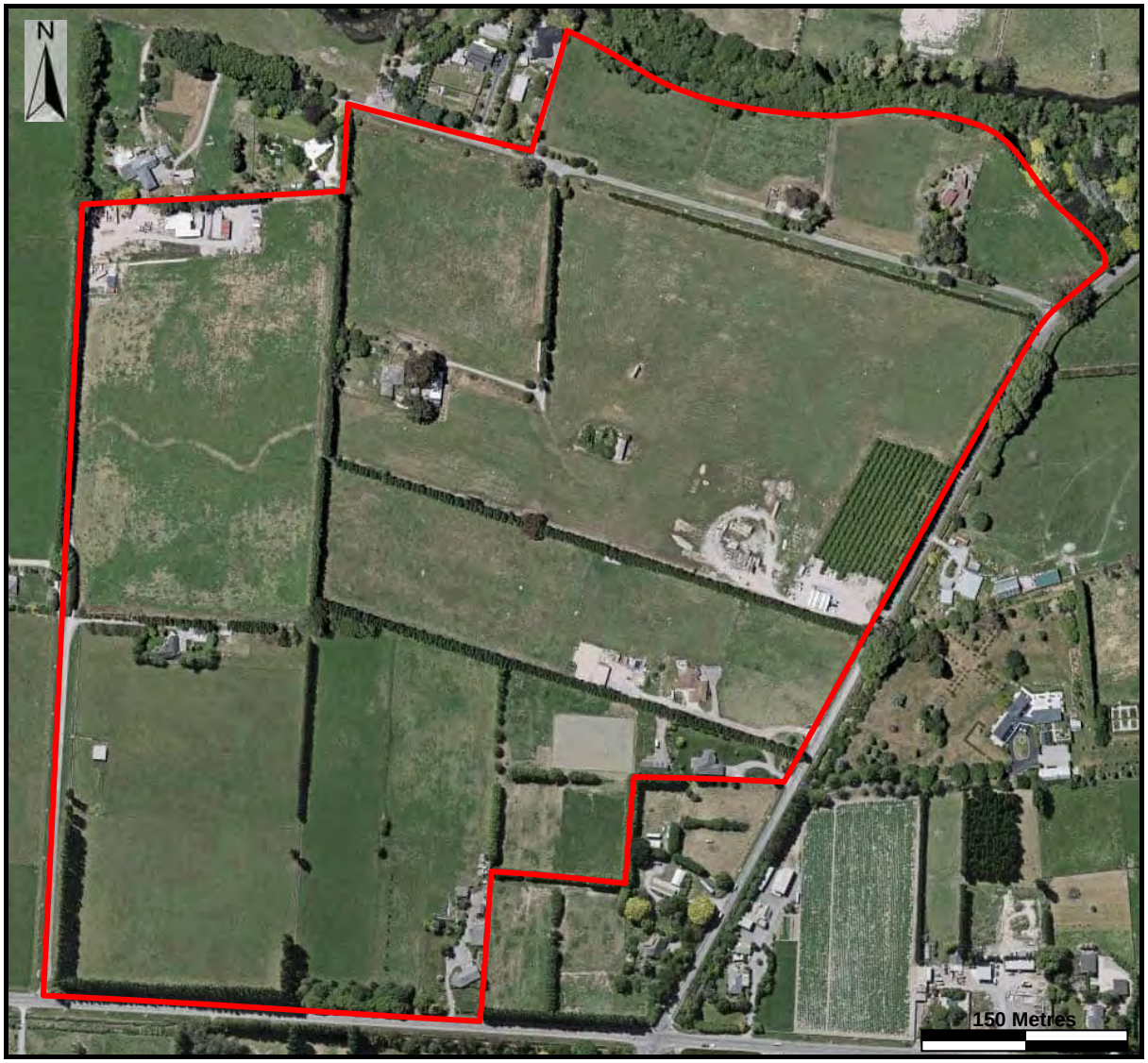

Figure 2: Overview of the site. Approximate site is boundary is defined by solid red line. Aerial photograph sourced from LINZ[1].

Generally the site is bound to the south by Prestons Road, the east by Hawkins Road, the north by the Styx River and, in part, Mills Road to the west. The current land usages are a mix of large lifestyle residential blocks, orchards and arable paddocks/farmland used for grazing and hay making.

[1] https://data.linz.govt.nz/layer/3451-christchurch-0075m-urban-aerial-photos-2015-16/

Existing site levels, based on LiDAR elevations models, range from 3.0 m Lyttelton Vertical Datum (LVD) and 9.0 m LVD[2], an elevation change of 6.0 m. The site has gentle gradients, with an overall slope towards the south west, however there is a distinct ridge that runs through the site from west to east, for approximately 400 metres before it turns to the south east and runs towards the junction of Hawkins and Hills Road; this topographical feature will be further discussed in Section 3.3, as it defines a historic stream channel.

It should be noted that the north east corner of the site (near the junction of Selkirk Place and Hawkins Road), slopes towards the north east, from the aforementioned ridge feature. Over a distance of approximately 550 metres the elevation changes by approximately 6.0 m.

A series of land drains define the boundaries of paddocks and are up to 2.5 m wide and 2.0 m deep below Existing Ground Level (EGL). They are either lined (timber or concrete) or are open channels; the general flow of water is to the east and north. The flow of water contradicts the natural flow of the land; Horners Drain which runs along Prestons Road (easterly flow) diverts north at Hawkins Road and deeply incises to approximately 4.5 metres due to topographical effects and drain gradient.

Christchurch City Councils Outline Development Plan (ODP) requires that Horners Drain is to be enhanced and naturalised. This will improve its capacity and functioning for storm water management while ensuring habitat and ecological values are enhanced.

The Styx River is a 22.5 km long spring fed tributary of the Waimakariri River draining an area of approximately 50 km^2 in north Christchurch, reaching from the Christchurch Airport to the Brooklands Lagoon, approximately 10 km north east of the site. The Styx River is defines the northern most extent of the site, with a flow from west to east.

The site has historically been used for agricultural and pastoral purposes, with associated sporadic farm buildings, large fruit orchards and grazing areas; this will be discussed further in Section 3.4 of this report.

River parallel cracks have been observed along the banks of the Styx River (10 and 16 Selkirk Place), which comprises the northern boundary of the site. The mechanism of soil failure is unknown, as these cracks have been observed to be historic and cannot be categorically be determined to be a result of an earthquake, although likely. There is a presence of natural water springs (artesian flow to ground surface) in the area which could have led to slope failure of the gently graded river banks over time, or, this could have been earthquake induced and unmapped; this shall be further discussed in Section 6 of this report.

[2] EQC LiDAR and digital elevation models Canterbury Geotechnical Database Map CGD0500 - 23/07/2012. Accessed May 2017

3.0 Desk Study

A review of published information has been undertaken for the site and surrounding neighbourhood; a summary is presented in the following sections.

3.1 Technical Category and Observed Land Damage

The site has been identified by the MBIE[3] as being in Technical Category (TC) of *"N/A Rural & Unmapped*", therefore normal consenting procedures apply in this area. TC2 is defined by MBIE as an area of land that *"minor to moderate land damage is possible in future large earthquakes".* The neighbourhood of Redwood, 600 m to the west of the site, is primarily categorised as TC2.

The Earthquake Commission (EQC) provides an interpretation of liquefaction based on aerial photography[4] following each significant earthquake of the Canterbury earthquake sequence. Only the aerial photography acquired following the 22 February 2011 and the 23 December 2011 earthquakes encompass the site and have been interpreted as "*No Liquefaction Observed*" on site or within the immediate surrounding areas.

Concurrently with aerial interpretation, EQC performed physical observations[5] of liquefaction throughout Christchurch and surrounding areas, however no observations were carried out on site or within the immediate surrounding area following any of the major earthquake events.

Geological and Nuclear Sciences (GNS) provided an interpretation of aerial photography[6] following the February 2011 earthquake. GNS have identified an area of liquefaction in the form of sand boils directly north of the property at 11 Selkirk Place (Lot 6 Deposited Plan 23089) and at 10 and 16 Selkirk Place (Lot 2 and Lot 3 DP 25296) this does imply that the soils in this area may be susceptible to liquefaction.

3.2 Surrounding Survey Benchmarks

Survey data available on the New Zealand Geotechnical Database for the nearest benchmark (reference BDYP, located on at the junction of Walters and Prestons Road approximately 600 metres east of the site) indicates a cumulative settlement of 151 mm as measured pre September 2010 (7.1 Mw) and post February 2011 (Mw 6.2) seismic events, a summary is provided in Table 1.

[3] Guidance: Repairing and rebuilding houses affected by the Canterbury earthquakes, Ministry of Business, Innovation & Employment (MBIE), December 2012, Wellington, NZ. Part A: Page 3.2 & The New Zelaand Geotechnical Database (Project Orbit): New Zeaand Geotechnical Database Map Layer:"CGD5020" - 30/01/2014
[4] EQC Liquefaction Interpreted from Aerial Photography Canterbury Geotechnical Database Map CGD0200 - 11/02/13. Accessed: 28 Nov 2016
[5] EQC Liquefaction and Lateral Spreading Observations Canterbury Geotechnical Database Map CGD0300 - 23/07/12. Accessed: 28 Nov 2016
[6] Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts. Environment Canterbury Report R12/83. December 2012. Accessed 19 Feb 2013 fromhttp://ecan.govt.nz/advice/emergencies-and-hazard/earthquakes/Pages/liquefaction-information.aspx#review Canterbury Geotechnical Database Map CGD5144 - 19 Feb 13.

Table 1: Summary of survey data from Benchmark BDYP[7]			
Benchmark coordinates	**Northing (m 794060+)**	**Easting (m 381540+)**	**Elevation (m 10+)**
Pre- 4 September 2010	6.866	8.401	3.496
Pre- 22 February 2011	6.938	8.443	3.437
Pre- 13 June 2011	6.882	8.541	3.535
Post 13 June 2011	6.870	8.590	3.345
Movement	**Northing**	**Easting**	**Elevation**
Post 4 Sept 2010 and pre- 22 Feb 2011	0.071	0.042	-0.059
Post 22 Feb 2011 and pre- 13 June 2011	0.016	0.140	-0.143
Post 13 June 2011	0.004	0.189	**-0.151**

Survey benchmark, BDVN, approximately 1 km west has cumulative settlement of 87 mm, for comparison west to east through the neighbourhood. It must be noted that benchmark analysis does not differentiate between tectonic and liquefaction induced settlement and due to the distance from site, limited correlations can be made.

3.3 Peak Ground Accelerations Experienced Onsite

Estimated Peak Ground Acceleration (PGA) values experienced on the site[8] and adjusted to M_w 7.5 are presented in Table 2. Equivalent PGAs for an Mw 7.5 design event have been calculated and are provided for comparison with MBIE (2012) index Serviceability Limit State (SLS) and Ultimate Limit State (ULS) values, (PGA_{SLS} = 0.13 g; PGA_{ULS} = 0.35 g).

Table 2: Peak Ground Accelerations Experienced Onsite				
Earthquake Event	**September 2010**	**February 2011**	**June 2011**	**December 2011**
Magnitude (Mw)	7.1	6.2	6.0	5.9
Estimated PGA onsite	0.19g	0.25g	0.14g	0.21g
Mw 7.5 equivalent PGA	0.17g	0.18g	0.09g	0.14g
Criteria 1: PGA 170% SLS	132%	137%	73%	106%
Criteria 2: 10th percentile PGA	No	No	No	No
Sufficiently Tested	No	No	No	No

[7] **Important notice:** Information included in this section was obtained/created from maps and/or data extracted from the New Zealand Geotechnical Database which were prepared and/or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way. This "Important notice" must be reproduced wherever figures or any derivatives are reproduced. Datum to Christchurch Drainage Datum (CDD) – Mt Pleasant 2000.

[8] Bradley and Hughes (2012a) Conditional Peak Ground Accelerations in the Canterbury Earthquakes for Conventional Liquefaction Assessment, Technical Report for the Ministry of Business, Innovation and Employment, April 2012. 22p

The site has not been 'sufficiently tested' for a Serviceability Limit State (SLS) design event during any of the significant earthquakes of the Canterbury sequence according to criteria defined in the MBIE 2012 Guidance document[9].

An area north of 11 Selkirk Place and at 10 and 16 Selkirk Place, experienced liquefaction as a result of the February 2011 earthquake (PGA ~ 0.18g Mw 6.2), identified by GNS. This suggests that the soils in this area are susceptible to liquefaction at low peak ground accelerations.

3.4 Site History

A review of historic aerial photographs[10] available from between 1941 and 1994 indicates that the site and surrounding neighbourhood was generally undeveloped rural land. Some farm buildings can be seen upon Mills Road in the photograph of 1941, with associated farm sheds seen towards the central north east of the site. Circa 1973 development occurs towards the south, at 203 Prestons Road and the building of a single residential dwelling, with an additional dwelling built between 1973 and 1984, at the aforementioned 11 Selkirk Place.

Between 1973 and 1994 the northern half of the site is used as a market garden, with high density horticulture, with additional residential buildings seen at the corner of Prestons and Hawkins Road. Aerial photography taken during 2004 generally shows the site in its current land use and configuration, as of March 2017.

The most significant feature that can be observed upon the historical aerial photography (Figure 3) is a historical stream channel that is now buried, probably as a result of the agriculture and turning of soil, although onsite it can be seen as a topographical relief feature. It should be noted that the remnant feature does not appear to be associated with the Styx River and was likely an independent channel.

[9] Guidance: Repairing and rebuilding houses affected by the Canterbury earthquakes, Ministry of Business, Innovation & Employment (MBIE), December 2012, Wellington, NZ.
[10] Aerial photography available from the ECan viewer at http://canterburymaps.govt.nz/AdvancedViewer/

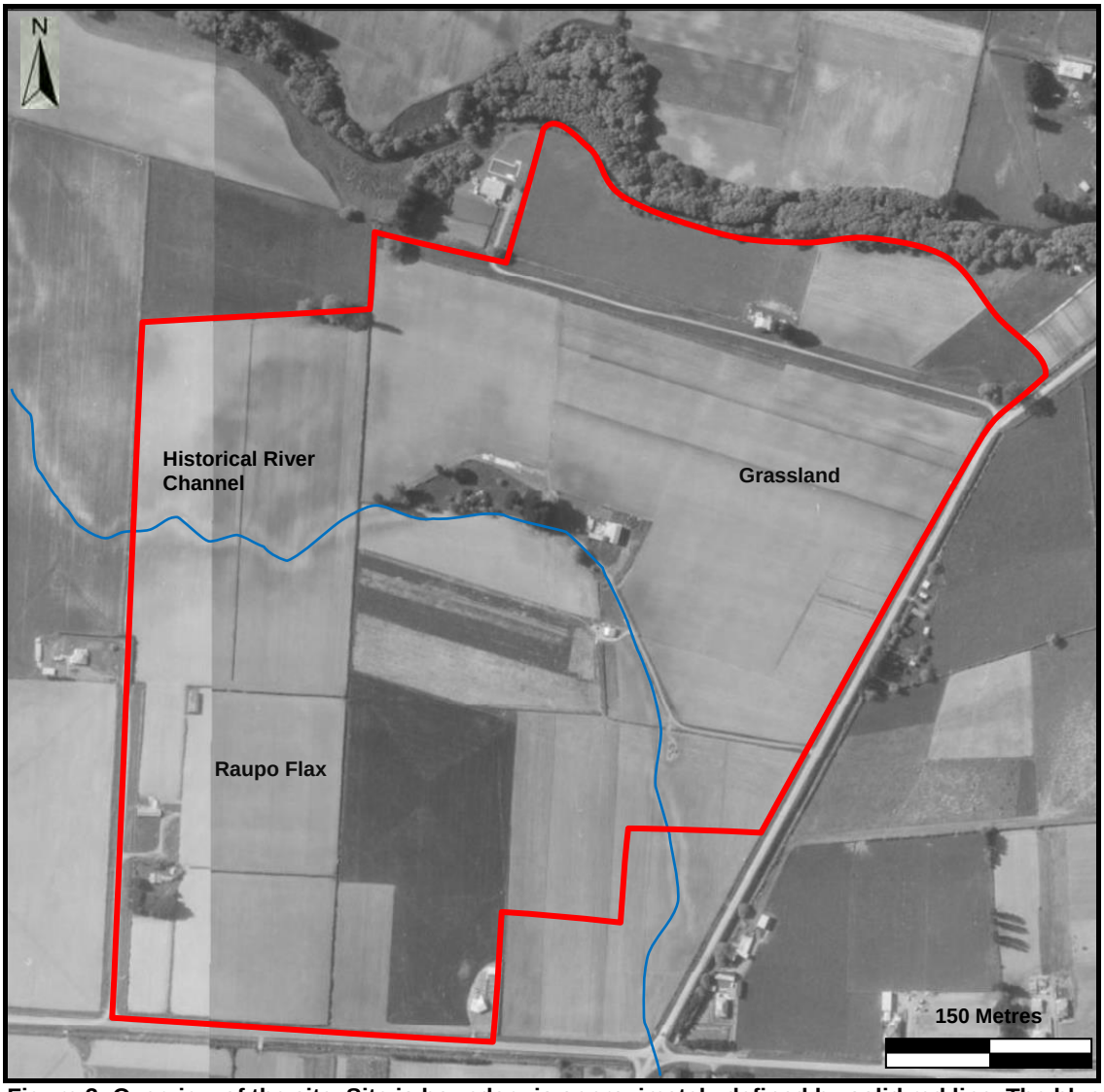

Figure 3: Overview of the site. Site is boundary is approximately defined by solid red line. The blue denotes the now buried river channel. Aerial photograph taken 1965[11].

A review of the Environmental Ecology Black Map published in 1856[12] shows that the site was divided into two ecological features divided by the remnant channel. Figure 4 is an extract from the Black Map and shows the hydrological and ecological features associated with the site.

Interpretation of the 1856 map shows that the "Raupo and Flax Swamp" extended west into what is now the neighbourhood of Redwood and indicates that the site is within the limb of a larger meander of the now buried stream. It should also be noted that this stream was likely spring fed, if in part, as illustrated within the south western corner of Figure 4.

[11] Sourced from canterburymaps.govt.nz
[12] Waterways, Swamps and Vegetation Cover in 1856 Compiled from "Black Maps" approved by J Thomas and Thomas Cass, Chief Surveyors, 856 – Christchurch City Council Information Services digitised Map Ap001725 compiled by Ken Sibley Jul 1989 and revised by G Tibble Apr 1996.

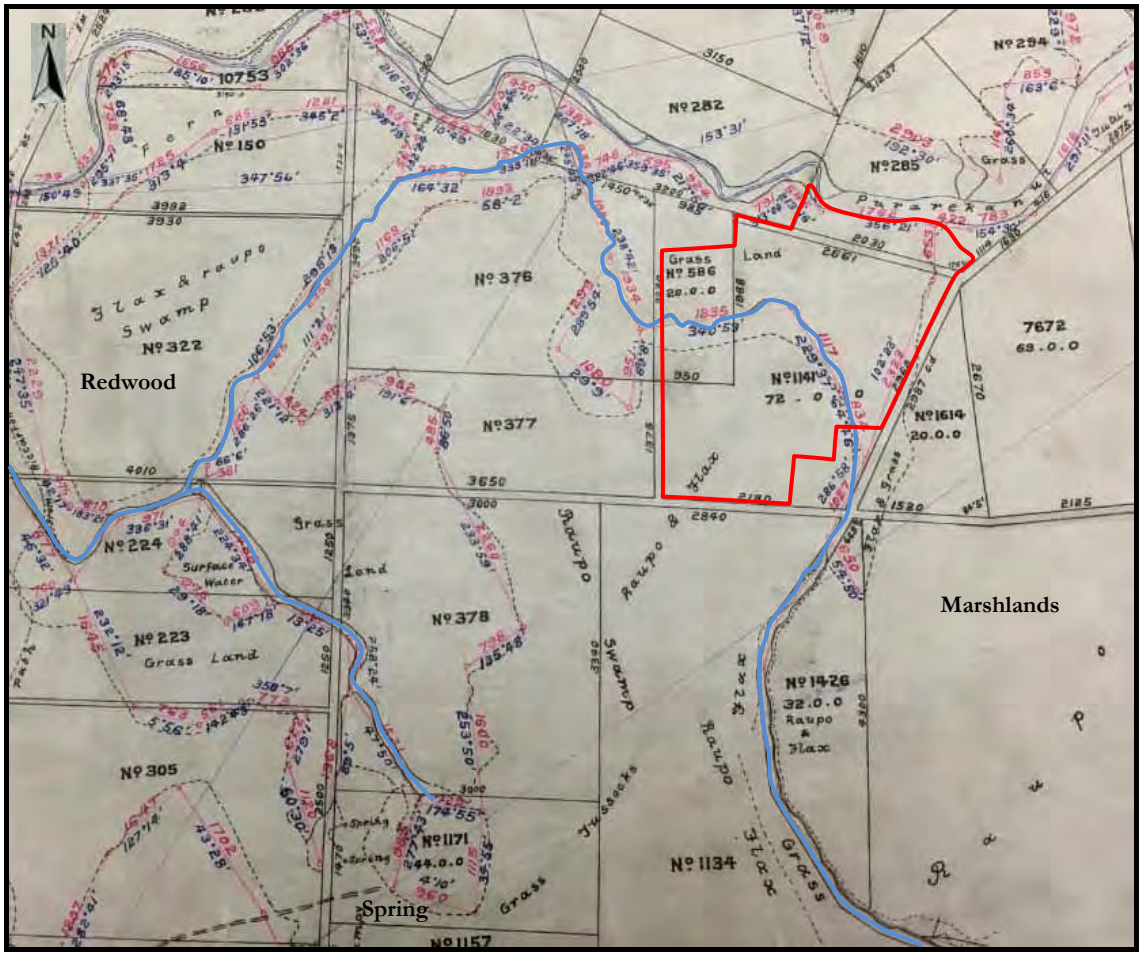

Figure 4: Site is boundary is approximately defined by solid red line and the River Meander defined by solid blue line. Image taken from Black Map 324. Not to scale.

3.5 Geology and Hydrogeology

The published geology[13] of the site has been identified as: *"Dominantly alluvial sand and silt overbank deposits" (Yaldhurst Member) of the Springston Formation.* The published geology also indicates that the site may be underlain by *"Springston Formation Gravel Beds of <10 m thick" (Figure 15 of the publication)* with typically 20 to 25 metres of post glacial sediments overlying the Riccarton Gravel Formation.

A review of the New Zealand Geotechnical Database (NZGD) has revealed that the site has previously had one borehole (BH) and seven Cone Penetration Tests (CPT) undertaken, either on site or within 100 metres of the site. Figure 5 illustrates the test locations and Table 3 is a summary of the borehole and CPT data.

[13] Brown, L.J.; Weeber, J.H., (1992) "Geology of the Christchurch Urban Area". Institute of Geological and Nuclear Sciences.

Figure 5: Geotechnical Test Locations as Illustrated upon the New Zealand Geotechnical Database[14] and Google Earth. Site is boundary is approximately defined by solid red line.

The seven CPTs that have been identified upon the NZGD (Figure 5) are positioned within the limits of the site, therefore provides an indication of the underlying soil composition and density. The interpretation of these CPTs indicates that the north west limits of the site are underlain by very dense coarse granular soils (sand and gravel) from a shallow depth, to at least 8.0 m below EGL (limit of the test).

[14] www.nzgd.org.nz/

Table 3: Summary of Available Geotechnical Testing in the Surrounding Area
All depths are in metres below existing ground level

NZGD Identification (Total Depth)	Location Relative to Site	Summary of Ground Conditions		
		Depth (m)	Cone Resistance (Qt) MPa/SPT N_{50*}	Description
BH_35140 (20.0 m)	100 m (West)	0.0 – 3.5	N_{50*} = 6	Loose SILT
		2.5 – 8.0	N_{50*} = 10 – 30	Loose becoming dense SAND
		8.0 – 12.5	N_{50*} = 9 – 26	Loose to medium dense gravelly SAND
		12.5 – 14.0	N_{50*} = 0	Very loose silty SAND
		14.0 – 18.5	N_{50*} = 2 – 22	Very loose to medium dense SAND
		18.5 – 20.0	N_{50*} = 15	Stiff SILT
CPT_76005 (6.58 m)	North West Corner of Site	0.0 – 1.8	2.2 – 10.3 MPa	Dense SAND and Loose SILT
		1.8 – 6.6 m	16.8 – 59.6 MPa	Very dense SAND and GRAVEL
CPT_76006 (8.14 m)	Central West of the Site	0.0 – 2.0 m	1.0 – 5.9 MPa	Loose to dense SILT
		2.0 – 8.1 m	3.7 – 66.4 MPa	Loose to very dense SAND and GRAVEL
CPT_76007 (6.39 m)	Central West of the Site	0.0 – 3.0 m	1.3 – 7.8 MPa	Loose to dense SILT
		3.0 – 6.4 m	22.0 – 64.9 MPa	Very dense SAND and GRAVEL
CPT_76008 (20.09 m)	South West Corner of Site	0.0 – 3.6 m	0.6 – 2.5 MPa	Loose to medium dense SILT
		3.6 – 19.0 m	3.4 – 19.2 MPa	Medium dense to very dense silty SAND
		19.0 – 20.1 m	18.2 – 50.7 MPa	Very dense SAND and GRAVEL
CPT_76009 (6.93 m)	Central South of the Site	0.0 – 1.8 m	0.9 – 7.6 MPa	Loose to dense SILT
		1.8 – 6.9 m	6.1 – 60.2 MPa	Medium dense becoming very dense SAND and GRAVEL
CPT_76010 (5.93 m)	Centre of Site	0.0 – 1.0 m	1.5 – 3.8 MPa	Loose to dense SILT
		1.0 – 5.9 m	19.9 – 57.1 MPa	Very dense SAND and GRAVEL
CPT_76011 (11.78 m)	South East Corner of Site	0.0 – 1.2 m	2.0 – 3.6 MPa	Loose to dense SILT
		1.2 – 3.0 m	3.5 – 8.5 MPa	Medium dense to dense SAND
		3.0 – 3.5 m	0.7 – 1.0 MPa	Loose SILT
		3.5 – 7.2 m	19.5 – 44.7 MPa	Very dense SAND and GRAVEL
		7.2 – 9.0 m	0.5 – 5.1 MPa	Loose to dense SILT and firm CLAY
		9.0 – 11.8 m	26.5 – 40.7 MPa	Very dense SAND and GRAVEL

*Borehole drilled by a UDR 650 utilising Tubex 150 – 10th October 2011, supervised by and NZGS logged Golder Associates. No hammer was efficiency provided.

The depositional environment typically associated with the predicted geology is one of alluvial origin, consequently the interpreted geology becomes variable towards the south west, with the dominant soils type being silty sand to approximately 19.5 m below EGL. The lateral and vertical variations of soil composition and density, within an alluvial depositional regime, are typical of Christchurch.

A review of the NZGD Depth to Median Water Table[15] indicates groundwater at the site is between 2.0 – 4.5 m below ground level; with a deepening water table towards the far south west, within Redwood. The nearest shallow ground water instrumentations (INST_601 and INST_598) are 720 m west and 870 m south west respectively (within Redwood), are outlined below. The approximate relative level of both water instrumentations, according to available LiDAR data[16] is 18.0 m CCD, which equates to 8.96 m LVD.

INST_601 indicates a static ground water level of 0.2 – 1.5 m (average of 0.9 m) below EGL between October 2011 and September 2015, a total of forty six readings were taken during this period. INST_598 indicates a static ground water level of 0.4 – 1.6 m (average of 1.2 m) below EGL between August 2011 and September 2015, a total of forty six readings were taken during this period.

A review of the Canterbury Map Website[17] indicates the site is entirely underlain by coastal confined gravel aquifer system. There are multiple Environment Canterbury (ECan) Wells onsite (Figure 6 and Table 4), that are either in use, decommission or were backfilled soon after drilling, although of the wells that have available initial ground water data, the levels range from 0.90 m to 3.65 m below ground level. It should be noted that the ECan wells onsite are monitoring the Riccarton Gravel Aquifer and are not monitoring the shallow ground water regime.

Piezometric contours available, relative to LVD, on the Canterbury Map website shows the 5.0 m contour passing through the north east corner of the site, with the 10.0 m and 15.0 m contours 1,800 m and 3,900 m towards the south west respectively, a piezometric gradient of 1:400 has been determined.

The site is not within the Land and Water Regional (LWRP), Christchurch Groundwater Protection Zone.

[15] Van Ballegooy, S.; Cox, S. C.; Thurlow, C.; Rutter, H. K.; Reynolds, T.; Harrington, G.; Fraser, J.; Smith, T. (2014) Median water table elevation in Christchurch and surrounding area after the 4 September 2010 Darfield Earthquake: Version 2, GNS Science Report 2014/18, April 2014. ISBN 978-1-927278-41-3. 79 p and 8 Appendices & Canterbury Geotechnical Database (2013) "Depth to Water Table (25m-grid DEM)", retrieved 01/12/16 from www.nzgd.org
[16] Canterbury Geotechnical Database Map - CGD0500 - 23/07/2012
[17] http://canterburymaps.govt.nz/AdvancedViewer/

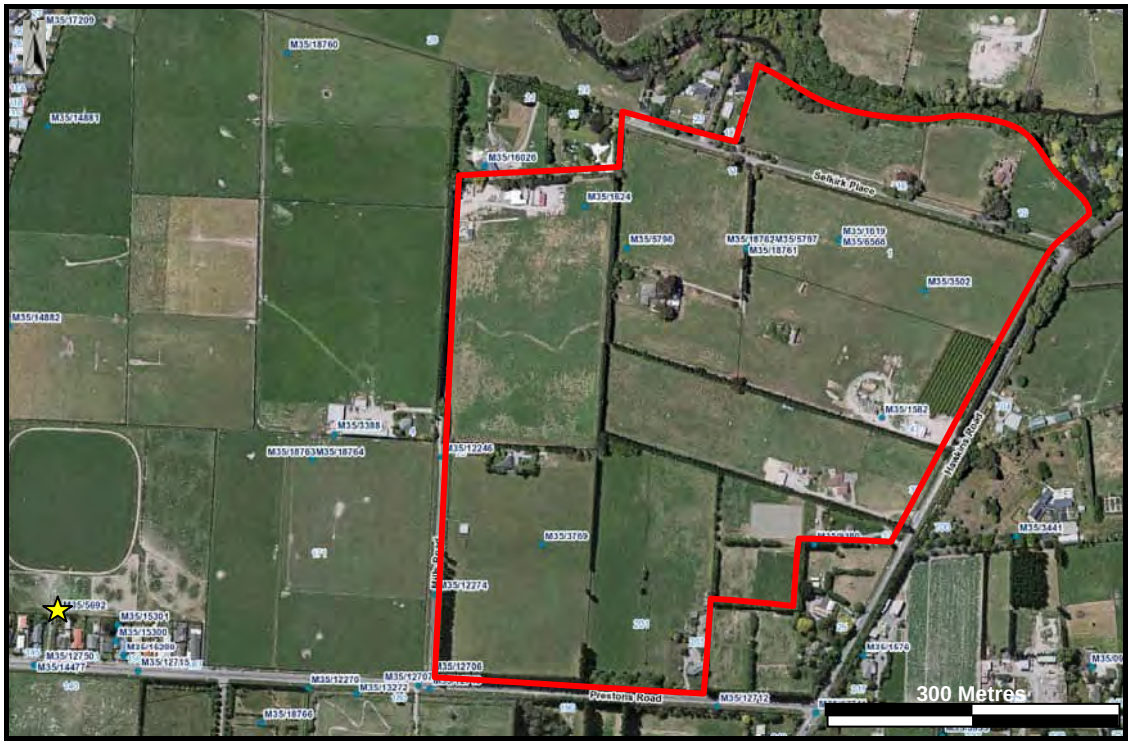

Figure 6: Ecan Wells onsite. Site is boundary is approximately defined by solid red line. Image taken from Canterbury Maps Website[20].

Table 4: Summary of Environment Canterbury Wells Onsite				
ECan Well Identification (Total Depth)	**Depth of Well**	**Initial Depth of Ground Water**	**Calculated Minimum Depth of Ground Water**	**Depth to Gravel**
M35/16026	1.80 m	Unknown	Unknown	Not reached
M35/1624	29.00 m	Unknown	2.20 m (Below MP)	19.20 m
M35/5796	30.50 m	Unknown	2.30 m (Below MP)	No Well Log
M35/18762	15.00 m	Unknown	Unknown	No Well Log
M35/18761	15.00 m	Unknown	Unknown	No Well Log
M35/5797	39.70 m	Unknown	3.00 m (Below MP)	No Well Log
M35/1619	20.70 m	3.50 m (Below MP)	2.78 m (Below MP)	8.50 m
M35/6568	20.70 m	3.65 m (Below MP)	3.20 m (Below MP)	10.40 m
M35/3502	28.30 m	1.70 m	3.00 m (Below MP)	17.79 m
M35/1582	73.20 m	0.90 m	1.50 m (Below MP)	No Well Log
M35/9180	32.00 m	2.90 m	2.30 m (Below MP)	10.00 m
M35/3769	Unknown	Unknown	Unknown	Unknown

The nearest ECan monitoring well (M35/5692) is located at 109 Prestons Road, approximately 900 m west of the site (denoted by a yellow star within Figure 6), and provides water level data from June 1987 to November 2010, a total of 262 monthly readings, from the Riccarton Gravel aquifer approximately 23.3 m below EGL. The minimum recorded level was 1.1 m below EGL, the maximum 2.5 m below EGL with an average of 1.7 m below EGL.

Figure 7 is a graphical representation of ECan well M35/5692, and illustrates an average seasonal variation of 0.7 m between 1987 and 2010.

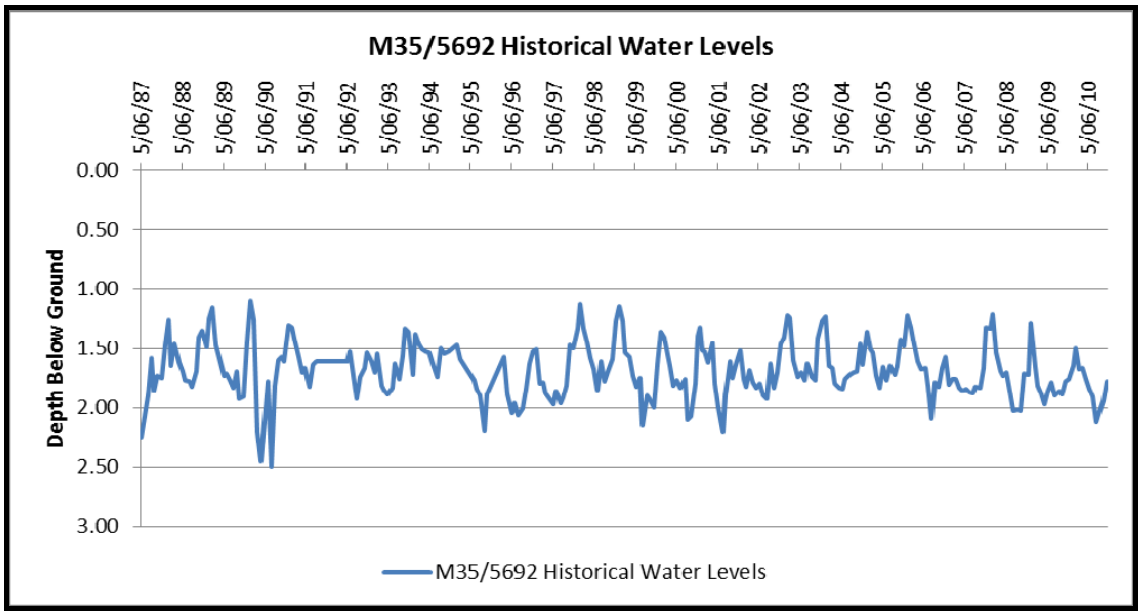

Figure 7: Ecan Well M35/5692 Water Level Seasonal Variation

3.6 ECan Listed Land Use Register

The Listed Land Use Register (LLUR) website[18] indicates that the regional council does have information regarding Hazardous Activities or Industries (as defined on the HAIL list) on the following land parcels: 25, 35 and 47 Hawkins Road, 1 and 11 Selkirk Place. The hazardous activity listed for all addresses is: *"A10 - Persistent pesticide bulk storage or use"* as result of the horticultural past land usage of a fruit orchard.

Please note this does not confirm that the site is contaminated; however it does show there are known historical listed land uses that may have caused elevated levels of potentially harmful contaminants. An environmental Detail Site Investigation (DSI) is currently being conducted and should be read in conjunction with this report. The DSI will test, delineate and provide remedial actions for areas of potential contamination.

[18] http://www.llur.ecan.govt.nz/. Accessed 11/05/17.

It should also be noted that during the geotechnical walkover that empty industrial debris (chemical containers, rubbish, fly tip waste and demolition rubble pits) was observed, at 47 Hawkins Road and towards the west of this address. Due to potential contaminants no geotechnical test pitting was performed in the area; please refer to the DSI for potential fill material thicknesses and subsequent remediation.

3.7 Flood Management

The site is not currently within a Christchurch City Plan Flood Management Area (FMA), nor is it within the proposed Stage 3 District Plan Floor Level and Fill Management Area (FLFMA).

FFL requirements for compliance with Clause E1 of the New Zealand Building Code are based on providing protection from a 2% Annual Exceedance Probability (1 in 50 year Average Recurrence Interval) event. CCC should be contacted at building consent stage to confirm current minimum finished floor levels. The following Figure 8 has been acquired from correspondence with CCC Network Planning City Water and Waste Engineers, who specify a 400 mm freeboard where flooding has been modelled; areas identified in red.

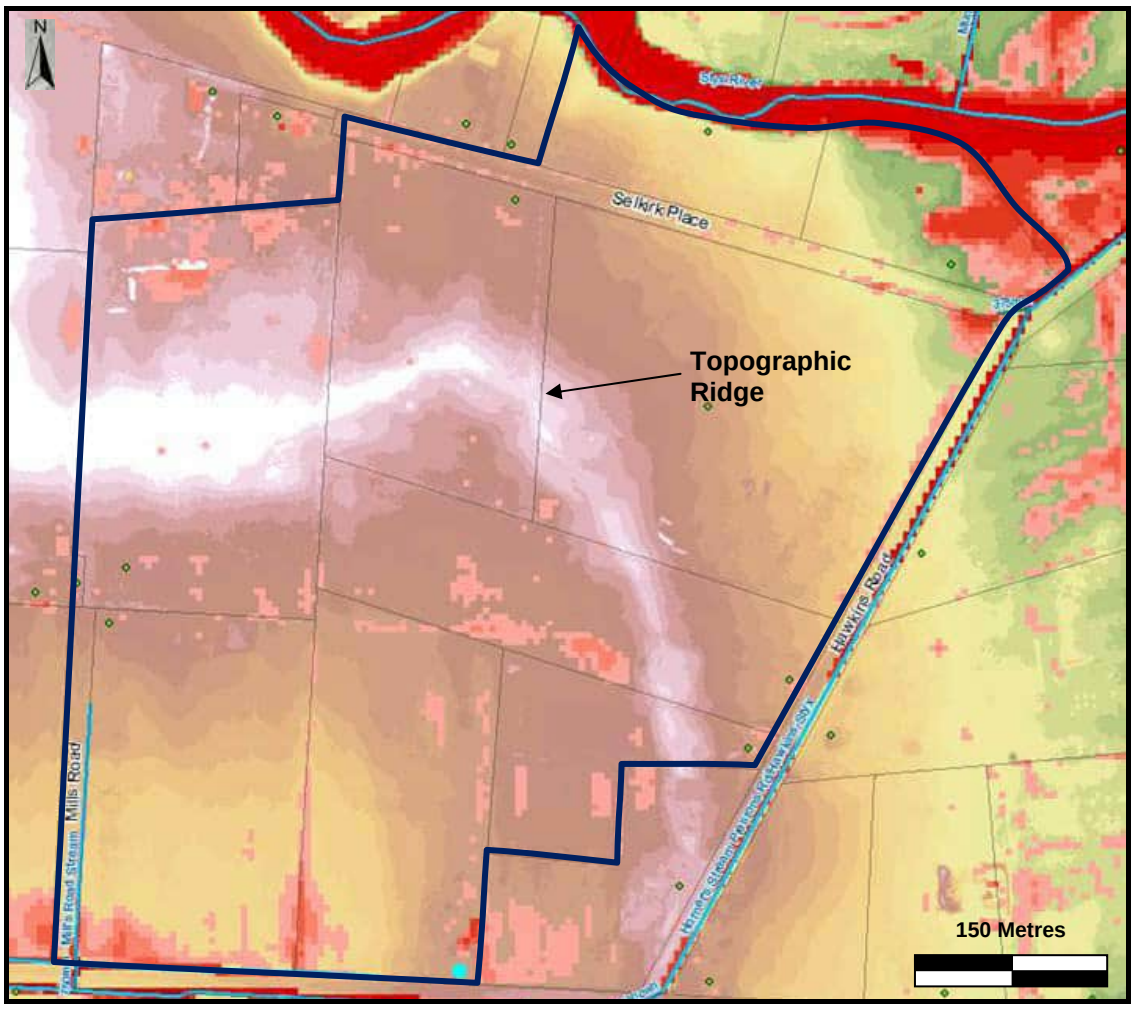

Figure 8: CCC Predicted Flood Levels: 1 in 50 year Average Recurrence Interval

4.0 Aurecon Geotechnical Subdivision Report

Aurecon gave permission for Davis Ogilvie to provide an executive summary of their findings, during their geotechnical investigations into the area of land directly to the west of our site.

The parcels of land immediately to the west of the site, between Mills Road and the Neighbourhood of Redwood, have been investigated by Aurecon as part of their geotechnical investigation report[19] for Alpine View Lifestyle Village Limited.

The proposed Alpine Lifestyle Village is approximately 16.5 hectare and will comprise a retirement village of single and double storey buildings, across Lot 3 DP 5223, Lot 3 DP 1844 and part Lot 4 DP 1844. The site comprises paddocks that are separated by land drains of varying sizes, with a gentle slope from the north east to the south west (3.7 m difference in relative levels). A distinct ridge crosses the north eastern extent of the site; which the same ridge is as discussed in Section 2 of this report.

Thirty Seven Cone Penetrations Tests (CPTs) were performed, supplemented by super heavy dynamic probing, to advance the CPTs that refused at shallow to a target depth of 15.0 m. Six boreholes were drilled and installed with shallow ground water monitoring piezometers. To accompany the investigation, the site was surveyed using Multi-channel Analysis of Surface Waves (MASW) and Ground Penetrating Radar (GPR) surveys.

The results of the Aurecon ground investigation show that the southern end and central areas of the site underlain by silty sands of varying thicknesses, with the northern third dominated by more gravel deposits, with the far north eastern corner underlain by deposits of silty sand.

The Aurecon liquefaction assessment segregates the site into three distinct zones based on future liquefaction potential. The southern third (Zone 1) is categorised as TC2/TC3 and is overlain by a minimum of 2.5 and up to 6.0 m of non-liquefiable stiff to very still crust.

The central third, termed “Zone 2” is categorised at TC3 and it is understood that this area will be reserved for stormwater ponds. Specific foundation recommendations will be provide by Aurecon once the architectural plan is completed.

The northern most third of the site (Zone 3) has been categorised as TC1/TC2 and that typical MBIE enhanced foundation systems are deemed appropriate.

[19] Aurecon Group. March 2017. Rev 1. 171 Prestons Road – Broadwater Development. Geotechnical Subdivision Report for Alpine View Lifestyle Village Limited.

5.0 Davis Ogilvie Geotechnical Investigation

A detailed site walkover was undertaken late November 2016 followed by a geotechnical investigation comprising sixty two Cone Penetration Tests (CPTs) pushed to maximum depth of 18.5 m below Existing Ground Level EGL.

CPTs 5, 17, 27, 28, 37, 40, 42, 47, 48, 53, 56 and 59 were installed with shallow ground water monitoring piezometers (piezos); to permit ongoing ground water monitoring. The piezos comprised entirely of slotted pipe are were pushed to depths ranging from 1.68 m to 6.01 m below EGL, the results of ongoing monitoring are outlined in Section 5.2.

Following the deep ground testing, shallow geotechnical investigations commenced during December 2016. It comprised forty three mechanically excavated Test Pits (TP's) to maximum depth of 4.6 m below EGL, two Hand Augers (HA's) to a maximum depth of 3.0 m below EGL, all of which have been supplemented by forty five Dynamic Cone Penetrometers (DCP's); Figure 9 illustrates test locations. This drawing is also presented in Appendix A.

Tests were terminated either by achieving target depth or by breaching gravel or encountering the groundwater table, where further excavation was deemed impractical due to test pit instability and water ingress. The majority of the mechanically excavated test pits remained stable throughout excavation, until encountering ground water, when instability occurred.

Test pit TP5 and TP53 in the north east and test pits, TP29 and TP34 towards the south, encountered a rapid ingress of ground water, indicating a positive (artesian) ground water regime at the time of excavation.

Test pit 53 was positioned to further investigate a linear depression that had been identified during the Environmental DSI. Upon excavation a rapid ingress of water occurred from 0.7 m below EGL, the creation of this drainage channel (depression) has removed the confining cap of clay like soil, allowing the positive flow of water to near surface.

Figure 9: Geotechnical Site Plan (DWG G01A in Appendix A).

It should be noted that test pits, that would have been, denoted as TP7, TP24 and TP25 were not performed as the soil composition was considered to be laterally comparable between test locations already performed. All test pit identification numbers were correlated to the adjacent CPT numbers.

5.1 Shallow Geotechnical Investigations

The soil profile indicated by the shallow testing is summarised in Table 5 with full logs presented in Appendix B. The ground conditions generally consisted of topsoil from the ground surface to a maximum depth of 0.7 m below EGL. The topsoil is generally underlain by interbedded silt, sand and gravel to the full depth of the test. However a number of shallow investigation test locations also encountered organic peat lenses, organic silt or dense gravel as outlined in Table 5.

The shallow geological testing revealed that the south west is dominated by silt and sand, with denser granular (gravel) deposits within the central area of the site. However the high topographic relief denotes an alluvial silt and sand ridge, with the gravel deposits still apparent, although the gravel is at a greater depth. The aforementioned silt and sand gradually grades to fine grained sediment comprising clay, organic silt and peat, towards the north east.

It could be theorised that the depositional environment of the site, from south west to north east, is one of a large river meander/channel as the cross sectional sediments are typical with those of a braided river channel. Sand of the south west, grades to gravel in the central site, before giving way to deposits of silt, sand and clay (north east), indicating a low energy depositional environment.

Table 5: Summary of the Shallow Soil Profile, Test Pits and Hand Augers.

Test ID	Ground Water Strike	Depth to Gleysol / Assumed Maximum Water Table	SOIL TYPE				
			TOPSOIL / FILL	SILT	SAND	PEAT / ORGANIC SILT	GRAVEL
TP 1	3.2 m	3.0 m	0.0 – 0.4 m	0.4 – 2.3 m 3.0 – 3.2 m	2.3 – 3.0 m 3.2 – 3.6 m	N/A	N/A
TP 2	2.8 m	2.8 m	0.0 – 0.5 m	0.5 – 0.8 m 2.0 – 2.8 m	0.8 – 2.0 m 2.8 – 4.3 m	N/A	N/A
TP 3	3.2 m	2.8 m	0.0 – 0.5 m	0.5 – 1.5 m 1.8 – 2.8 m	1.5 – 1.8 m 2.8 – 4.0 m	4.0 – 4.2 m	N/A
TP 4	N/A	2.3 m	0.0 – 0.3 m	0.4 – 3.6 m	0.3 – 0.4 m	3.6 – 4.2 m	N/A
TP 5	3.8 m	2.6 m	0.0 – 0.3 m	0.3 – 2.8 m	3.8 – 4.5 m	2.8 – 3.8 m	N/A
TP 6	N/A	2.3 m	0.0 – 0.6 m	0.6 – 3.0 m	N/A	3.0 – 4.0 m	N/A
TP 7	**Not Performed**						
TP 8	2.9 m	2.9 m	0.0 – 0.5 m	0.5 – 0.9 m 1.3 – 2.9 m	0.9 – 1.3 m 2.9 – 4.0 m	N/A	N/A
TP 9	2.6 m	2.6 m	0.0 – 0.6 m	0.6 – 0.9 m 1.1 – 1.6 m	0.9 – 1.1 m 1.6 – 3.2 m	N/A	N/A
TP 10	2.8 m	2.8 m	0.0 – 0.4 m	0.4 – 1.4 m	1.4 – 3.3 m	N/A	N/A
TP 11	3.7 m	3.3 m	0.0 – 1.2 m	3.3 – 3.5 m 3.7 – 3.8 m	1.2 – 3.3 m 3.5 – 3.7 m	N/A	N/A
TP 12	2.7 m	2.7 m	0.0 – 0.5 m	0.5 – 1.7 m	1.7 – 4.6 m	N/A	N/A
TP 13	2.8 m	2.8 m	0.0 – 0.6 m	0.6 – 1.8 m	1.8 – 4.3 m	N/A	N/A
TP 14	3.2 m	3.2 m	0.0 – 0.3 m	0.3 – 2.2 m	2.2 – 3.8 m	N/A	N/A
TP 15	3.9 m	3.8 m	0.0 – 0.3 m	0.3 – 3.1 m	3.1 – 3.9 m	N/A	N/A
TP 16	2.4 m	1.8 m	0.0 – 0.3 m	0.3 – 1.8 m	1.8 – 2.2 m	N/A	2.2 – 2.8 m

Table 5: Summary of Shallow Soil Profile, Test Pits and Hand Augers - Continued							
Test ID	Ground Water Strike	Depth to Gleysol / Assumed Maximum Water Table	SOIL TYPE				
			TOPSOIL / FILL	SILT	SAND	PEAT / ORGANIC SILT	GRAVEL
TP 17	3.6 m	2.7 m	0.0 – 0.2 m	0.2 – 0.6 m 1.3 – 1.4 m	0.6 – 1.3 m 1.4 – 2.7 m	N/A	2.7 – 3.7 m
TP 18	2.1 m	2.1 m	0.0 – 0.4 m	0.4 – 1.2 m	1.2 – 3.4 m	N/A	3.4 – 3.7 m
TP 19	2.0 m	2.0 m	0.0 – 0.3 m	0.3 – 1.2 m	1.2 – 3.5 m	N/A	N/A
TP 20	2.5 m	2.1 m	0.0 – 0.2 m	0.2 – 1.0 m	1.0 – 4.0 m	N/A	N/A
TP 21	3.3 m	2.3 m	0.0 – 0.4m	0.4 – 1.3 m	1.3 – 3.7 m	N/A	N/A
TP 22	3.2 m	2.3 m	0.0 – 0.6 m	0.7 – 1.4 m	0.6 – 0.7 m 1.4 – 4.1 m	N/A	N/A
HA 23	N/A	2.3 m	0.0 – 0.3 m	2.0 – 3.0 m	0.3 – 2.0 m	N/A	N/A
TP 24	**Not Performed**						
TP 25	**Not Performed**						
HA 26	N/A	1.6 m	0.0 – 0.5 m	0.5 – 0.9 m	0.9 – 1.9 m	N/A	1.9 – 2.0 m
HA 27	**Not Performed**						
TP 28	3.4 m	1.6 m	0.0 – 0.6 m	0.6 – 1.0 m 1.6 – 2.3 m	1.0 – 1.6 m 2.3 – 3.4 m	N/A	N/A
TP 29	2.5 m	1.5 m	0.0 – 0.4 m	0.4 – 2.5 m	2.5 – 3.0 m	N/A	N/A
TP 30	2.1 m	1.5 m	0.0 – 0.5 m	0.5 – 2.1 m	2.1 – 3.5 m	N/A	N/A
TP 31	2.3 m	1.4 m	0.0 – 0.7 m	0.7 – 2.3 m	2.3 – 3.8 m	N/A	N/A
TP 32	3.6 m	1.7 m	0.0 – 0.3 m	0.3 – 1.7 m	1.7 – 3.7 m	N/A	3.7 – 3.8 m
TP 33	1.6 m	1.4 m	0.0 – 0.4 m	0.4 – 1.6 m	1.6 – 3.7 m	N/A	N/A
TP 34	1.6 m	0.9 m	0.0 – 0.4 m	N/A	0.4 – 3.3 m	N/A	N/A
TP 35	2.9 m	1.3 m	0.0 – 0.3 m	0.3 – 0.6 m	0.6 – 1.3 m	N/A	1.3 – 2.9 m
TP 36	3.0 m	1.4 m	0.0 – 0.3 m	N/A	0.3 – 3.0 m	N/A	3.0 – 3.1 m
TP 37	2.4 m	0.9 m	0.0 – 0.5 m	0.5 – 0.9 m	0.9 – 2.4 m	N/A	2.4 – 2.7 m

Table 5: Summary of Shallow Soil Profile, Test Pits and Hand Augers - Continued							
Test ID	Ground Water Strike	Depth to Gleysol / Assumed Maximum Water Table	SOIL TYPE				
			TOPSOIL / FILL	SILT	SAND	PEAT / ORGANIC SILT	GRAVEL
TP 51	2.1 m	2.1 m	0.0 – 0.3 m 1.3 – 1.6 m	0.3 – 1.3 m 1.6 – 2.1 m	N/A	N/A	N/A
TP 52	2.0 m	2.0 m	0.0 – 1.2 m	1.2 – 2.0 m	N/A	2.0 – 2.3 m	N/A
TP 53	2.9 m	0.7 m	0.0 – 0.3 m	0.3 – 2.2 m 2.8 – 2.9 m	N/A	2.2 – 2.8 m	N/A
TP 54	1.8 m	1.8 m	0.0 – 0.4 m	0.4 – 1.5 m 1.6 – 1.8 m	N/A	1.5 – 1.6 m 1.8 – 2.0 m	N/A
TP 55	N/A	2.2 m	0.0 – 0.4 m	0.4 – 2.2 m	N/A	N/A	N/A
TP 56	N/A	2.6 m	0.0 – 0.5 m	0.5 – 2.6 m	N/A	N/A	N/A
TP 57	N/A	2.0 m	0.0 – 0.3 m	0.3 – 1.0 m 1.7 – 2.0 m	1.0 – 1.7 m	N/A	N/A
TP 58	N/A	2.3 m	0.0 – 0.3 m	0.3 – 1.3 m	1.3 – 2.4 m	N/A	N/A
TP 59	N/A	2.1 m	0.0 – 0.4 m	0.4 – 1.0 m 1.5 – 2.1 m 2.7 – 3.2 m	1.0 – 1.5 m 2.1 – 2.7 m	N/A	N/A
TP 60	N/A	1.5 m	0.0 – 0.3 m	0.3 – 0.6 1.1 – 1.5	0.6 – 1.1 1.5 – 2.3	N/A	N/A
TP 61	2.1 m	1.0 m	0.0 – 0.4 m	0.4 – 1.0 m	N/A	N/A	1.0 – 2.1 m
TP 62	2.4 m	1.1 m	0.0 – 0.3 m	0.3 – 1.1 m	1.1 – 2.7 m	N/A	N/A

5.2 Shallow Ground Water Regime

Mechanical excavation of test pits provides an insight into the shallow geology, however the majority of the shallow soils encountered were low permeable silts and silty sands; and as such it would have taken considerable time for the ground water level to reach hydrostatic equilibrium, within an open test pit, to provide information upon the shallow water level.

As a result the majority of the test pits encountered ground water at a depth deeper than what is expected, with any discernible water strike occurring as a result of breaching a permeable soil, such as gravel.

Therefore the ground water strikes recorded, upon the attached shallow investigation results (see Table 5), which were encountered at the time of excavation, shall only be utilised for the design of short term excavations and civil infrastructure, as the water level may not have reached hydrostatic equilibrium.

Generally the entirety of the test pits and hand augers were observed to have a similar upper stratigraphy of soils, with varying quantities of silt and sand, which became grey/blue with depth.

Gleysol soils exhibit a blue/grey colour due to anoxic conditions (saturated profile below ground water level) in which they are deposited, typically directly above these grey/blue soils are soils that are mottled with patterns of reddish brown, orange and yellow patches, which is a consequence of a fluctuating water table as the iron in the soil is exposed and therefore oxidises.

Gleysol soils were encountered in all test pits and hand augers (see Table 5), therefore can provide information upon the shallow water regime, which has been used in liquefaction potential estimations. Typically the depth to Gleysol type soils ranged from 0.7 – 3.8 m below existing ground level across the site, indicating that the water table rarely drops below this level thus not promoting oxidisation of the iron minerals within the soil.

A total of twelve open standpipe Piezometers (Piezos) have been installed comprising entirely of slotted pipe and were pushed to depths ranging from 1.68 m to 6.01 m below EGL, following the extraction of the CPT. To date a total of eleven monitoring visits have occurred between December 2016 and May 2017, the average recorded ground water levels taken during the monitoring visits are presented in Table 6. The table includes water depth relative to Christchurch City Datum. The water levels recorded during this period have begun to rise as the winter approaches; to date a maximum variation of 0.55 m has occurred, within the Piezo at CPT 17. Monitoring is ongoing.

Table 6: Average Ground Water Levels Recorded from Piezometers Onsite

CPT (Piezo Depth)	CCD Ground Level at CPT	Average Ground Water Level (Depth Below RL)	Average Ground Water Level Below CCD
5 (4.08 m)	13.52 m	2.34 m	11.18 m
17 (2.67 m)	17.47 m	2.42 m	15.05 m
27 (2.10 m)	15.27 m	2.00 m	13.27 m
28 (2.32 m)	16.78 m	0.68 m	16.10 m
37 (1.68 m)	15.75 m	1.13 m	14.63 m
40 (2.77 m)	15.10 m	0.26 m	14.84 m
42 (3.58 m)	17.59 m	2.54 m	15.05 m
47 (5.13 m)	17.17 m	4.19 m	12.99 m
48 (4.02 m)	17.03 m	3.98 m	13.05 m
53 (4.08 m)	12.88 m	0.74 m	12.14 m
56 (5.90 m)	14.03 m	2.60 m	11.43 m
59 (6.01 m)	14.91 m	2.59 m	12.32 m

The CPTs locations were set out by DO surveyors; therefore the ground level was recorded during the marking out of test locations. This data can be combined with the ground water monitoring data to provide an estimate of the piezometric surface beneath the site. This surface is shown on the Cross Section in Figure 10.

Generally the south and west of the site has a piezometric surface of between 14.63 m and 15.05 m below CCD, whilst the central and north east of the site a level of 11.43 m and 13.05 m below CCD.

It should be noted that the far north east piezo at CPT 5 has an average ground water level of approximately 11.18 m below CCD; this is approximately 2.0 m lower than what is predicted within this area. This denotes that the underlying geology of fine grained soils is most likely confining the ground water table; and correlates with the artesian water pressure discovered in this area during excavation of Test Pit 5 at the same location.

Approximately 150 m north of Test Pit 5, upon the banks of the Styx River, a flowing spring has been observed highlighting the artesian nature of the underlying water regime within this area.

The piezometer installed within CPT 28 indicates a ground water level which is approximately 1.4 m above the predicted piezometric surface derived from other nearby piezos, CPT 37 and CPT 40. The piezo has been purged of all water, left for a 24 hour period to recharge, with a similar water level recorded upon re-inspection, therefore eliminating the possibility of water ingress from above / surrounding overland flow.

It is theorised that the piezo is also indicating an artesian response of the underlying water regime. Careful consideration should be given to not impeding and/or removal of these confining layers, as by doing so will allow connectivity of the artesian water to the ground surface.

As formerly stated the nearby ECan well (M35/5692), indicates an average seasonal variation 0.7 m between 1987 and 2010, therefore it can be construed that this variation can be applied to the piezometric surface. It should be noted that the piezometric levels have been derived from monitoring mostly during the summer months, however ongoing monitoring into the winter months has indicated a general rise in water levels.

5.3 Deep Geotechnical Investigations

A total of sixty two Cone Penetration Tests (CPTs) were pushed; the CPT logs are presented in Appendix C along with their subsequent liquefaction analysis.

The tests ranged in termination depth between 3.04 m and 18.50 m below EGL, either refusing due to very dense shallow gravels or achieving required penetration depth, using a Pagani truck mounted CPT rig which utilises 20 Tonnes thrust capacity and 80 MPa CPT tip pressure from a 15 cm^2 cone.

The CPT testing confirmed deep silty sand soils towards the south west and mid-north east, a distinct ridge of gravel through the central areas of the site and clay and peat soils in the far north east, as illustrated in Figure 10.

The soils towards the north east have been deemed to be “clay like”, therefore may be subjected to cyclic softening during future earthquake or long term consolidation when loaded by housing and/or infrastructure, this is discussed further in Section 8.0.

Table 7 provides a summary of the CPT results; all but four of the CPTs encountered gravel during testing, with the overlying soils comprising finer grained soil of clay, silt and sand.

Table 7: Cone Penetration Tests – Summary of Results

CPT	Depth Achieved	Ground Water Level*	Gravel Depth	Termination Criterion
1	15.0 m	3.0 m	9.5 m to 15.0 m	Target Depth Achieved
2	14.9 m	2.8 m	8.2 m to 14.9 m	Max Tip Resistance
3	12.8 m	2.8 m	7.0 m to 12.8 m	Max Tip Resistance
4	15.0 m	2.3 m	6.0 m to 15.0 m	Target Depth Achieved
5	15.0 m	2.6 m	4.5 m to 15.0 m	Target Depth Achieved
6	13.7 m	2.3 m	5.3 m to 13.7 m	Max Tip Resistance
7	15.0 m	2.8 m	7.0 m to 15.0 m	Target Depth Achieved
8	14.0 m	2.9 m	8.0 m to 14.0 m	Max Tip Resistance
9	15.0 m	2.6 m	7.3 m to 15.0 m	Target Depth Achieved
10	15.0 m	2.8 m	8.0 m to 15.0 m	Target Depth Achieved
11	15.0 m	3.3 m	8.0 m to 15.0 m	Target Depth Achieved
12	15.0 m	2.7 m	8.5 m to 15.0 m	Target Depth Achieved
13	15.0 m	2.8 m	10.3 m to 15.0 m	Target Depth Achieved
14	9.6 m	3.2 m	5.5 m to 9.6 m	Max Tip Resistance
15	6.2 m	3.8 m	5.5 m to 6.20 m	Max Tip Resistance
16	7.1 m	1.8 m	2.4 m to 7.06 m	Max Tip Resistance
17	5.1 m	2.7 m	2.6 m to 5.06 m	Max Tip Resistance
18	18.5 m	2.1 m	3.0 m to 18.5 m	Target Depth Achieved
19	15.0 m	2.0 m	5.0 m to 15.0 m	Target Depth Achieved
20	15.0 m	2.1 m	9.3 m to 15.0 m	Target Depth Achieved
21	15.0 m	2.3 m	Not Encountered	Target Depth Achieved
22	15.0 m	2.3 m	Not Encountered	Target Depth Achieved
23	13.0 m	2.3 m	8.5 m to 13.2 m	Max Tip Resistance
24	15.0 m	2.4 m	7.5 m to 15.0 m	Target Depth Achieved
25	5.5 m	2.0 m	3.0 m to 5.48 m	Max Tip Resistance

*Depth to gleysol.

Table 7: Cone Penetration Tests – Summary of Results – Continued				
CPT	**Depth Achieved**	**Ground Water Level***	**Gravel Depth**	**Termination Criterion**
26	3.0 m	1.6 m	1.9 m to 3.04 m	Max Tip Resistance
27	4.9 m	2.0 m	2.0 m to 4.92	Max Tip Resistance
28	15.0 m	1.6 m	3.0 m to 15.0 m	Target Depth Achieved
29	6.6 m	1.5 m	3.0 m to 6.56 m	Max Tip Resistance
30	15.0 m	1.5 m	4.0 m to 15.0 m	Target Depth Achieved
31	15.0 m	1.4 m	Not Encountered	Target Depth Achieved
32	6.9 m	1.7 m	3.2 m to 6.94 m	Max Tip Resistance
33	15.0 m	1.4 m	6.0 m to 15.0 m	Target Depth Achieved
34	7.6 m	0.9 m	3.4 m to 7.62 m	Max Tip Resistance
35	9.5 m	1.3 m	1.3 m to 9.5 m	Max Tip Resistance
36	5.5 m	1.4 m	3.8 m to 5.52 m	Max Tip Resistance
37	8.8 m	0.9 m	2.5 m to 8.82 m	Max Tip Resistance
38	15.0 m	1.5 m	7.0 m to 15.0 m	Target Depth Achieved
39	8.0 m	1.5 m	2.4 m to 8.04 m	Max Tip Resistance
40	7.2 m	1.5 m	2.8 m to 7.18 m	Max Tip Resistance
41	15.0 m	2.0 m	4.0 m to 15.0 m	Target Depth Achieved
42	7.5 m	2.0 m	3.4 m to 7.48 m	Max Tip Resistance
43	5.7 m	2.2 m	2.84 m to 5.72 m	Max Tip Resistance
44	15.0 m	2.2 m	Not Encountered	Target Depth Achieved
45	4.2 m	2.4 m	2.4 m to 4.22 m	Max Tip Resistance
46	12.7 m	2.8 m	8.3 m to 12.72 m	Max Tip Resistance
47	13.6 m	2.8 m	8.5 m to 13.60 m	Max Tip Resistance
48	12.1 m	2.8 m	8.5 m to 12.10 m	Max Tip Resistance
49	15.0 m	2.1 m	8.5 m to 15.0 m	Target Depth Achieved
50	12.4 m	2.0 m	7.9 m to 12.42 m	Max Tip Resistance
51	15.0 m	2.1 m	4.3 m to 15.0 m	Target Depth Achieved
52	12.0 m	2.0 m	4.0 m to 12.0 m	Max Tip Resistance
53	15.0 m	0.7 m	4.5 m to 15.0 m	Target Depth Achieved
54	15.0 m	1.8 m	5.0 m to 15.0 m	Target Depth Achieved
55	15.0 m	2.2 m	7.0 m to 15.0 m	Target Depth Achieved
56	15.0 m	2.6 m	7.5 m to 15.0 m	Target Depth Achieved
57	15.0 m	2.0 m	7.5 m to 15.0 m	Target Depth Achieved
58	15.0 m	2.3 m	7.0 m to 15.0 m	Target Depth Achieved
59	15.0 m	2.1 m	8.0 m to 15.0 m	Target Depth Achieved
60	5.7 m	1.5 m	4.4 m to 5.7 m	Max Tip Resistance
61	3.9 m	1.0 m	1.0 m to 3.9 m	Max Tip Resistance
62	15.0 m	1.1 m	1.5 m to 15.0 m	Target Depth Achieved
*Depth to gleysol.				

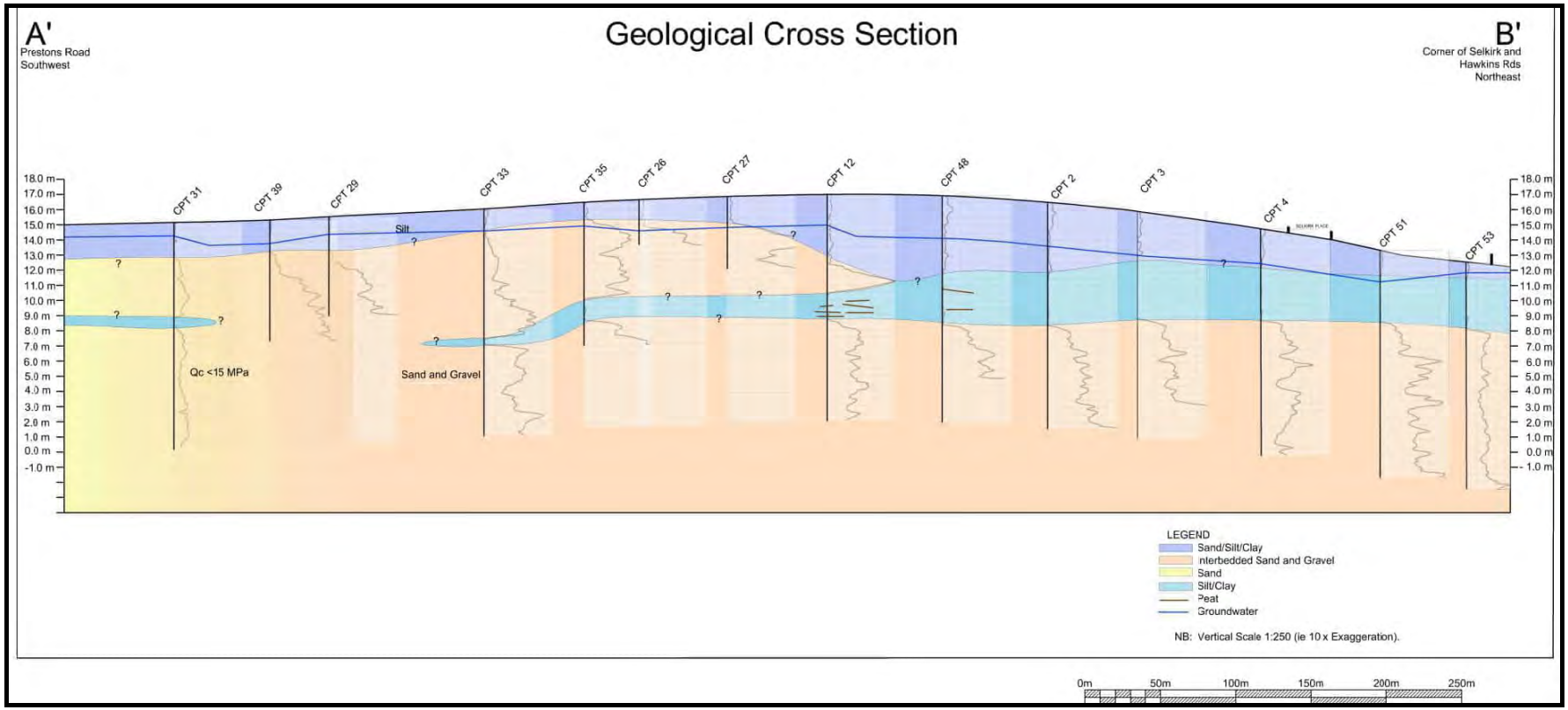

Figure 10: Geological Cross Section; A' South west (Prestons Road) to B' North east (Hawkins Road) – see DWG G05A in Appendix D.

6.0 Liquefaction Assessment

6.1 Design Criteria

Liquefaction and lateral spread analysis including proposed Technical Category (TC) recommendations have been performed to current Ministry of Business, Innovation and Employment 2012 Guidelines (defined as MBIE)[20] specifically the Supplementary Guidance issued October 2014[21].

Appendix C2 of the MBIE (2012) Guidance and Supplementary Guidance (2014) outlines the Peak Ground Acceleration (PGA) values which should be adopted for liquefaction analysis within the Canterbury Region; these values are outlined in Table 8.

Table 8: Interim recommendations for PGA values for geotechnical design in Canterbury

Annual probability of exceedance (design life of 50 years)	Peak Ground Accelerations (PGA) 1170.5 - Class D soils
	Liquefaction-triggering analysis only
1/25	Serviceability Limit State: 0.13g (Mw 7.5)
1/25	Serviceability Limit State: 0.19g (Mw 6.0) (IL4 Structures only)
1/500	Ultimate Limit State: 0.35g (Mw 7.5)

Appendix D of the MBIE (2012) Guidance summarises the assessment requirements for subdivision in the Canterbury Region, specifically Section 16.4 (Part D) has been adopted for liquefaction assessment which utilises the Liquefaction Calculation Methodology outlined in Appendix D1 using Boulanger & Idriss 2014 liquefaction triggering procedures[22]. Part D (MBIE 2012) provides the following (Table 9) liquefaction induced deformation limits for residential sites.

[20] Ministry of Business, Innovation and Employment (MBIE). December 2012. Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes.
[21] MBIE. October 2014. Clarifications and updates to the guidance: Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes
[22] Boulanger, R.W & Idriss, I .M. April 2014. CPT and SPT Based Liquefaction Triggering Procedures. Report Number: UCD/CGM-14/01.

Table 9: Liquefaction Assessment Deformation Limits (MBIE 2012)						
Technical Category	**Predicted Land Damage**	**Liquefaction Deformation Index Limits**				**Likely foundations - Abstract from MBIE 2012 Guidance (subject to individual assessment)**
		Vertical Settlement		**Lateral Stretch**		
		SLS 0.13 g Mw 7.5	**ULS** 0.35 g Mw 7.5	**SLS** 0.13 g Mw 7.5	**ULS** 0.35 g Mw 7.5	
TC1	Liquefaction damage is unlikely in a future large earthquake	15 mm	25 mm	Not Expected		• NZS 3604 timber piles and floor or tied concrete slabs (as modified by B1/AS1 where ULS bearing capacity > 300 kPa • Raft foundations (Options 1-4) • Specific engineering design
TC2	Minor to moderate Liquefaction damage is possible in a future large earthquake	50 mm	100 mm	<50 mm		• Light construction with timber floors and shallow piles as per NZS 3604 where ULS bearing capacity > 300 kPa • Enhanced perimeter foundation wall (see section 4.2) and shallow piles as per NZS 3604 • Raft foundations (Options 1–4) • Specific engineering design
TC3	Moderate to significant Liquefaction damage is possible in a future large earthquake	>50 mm	>100 mm	>50 mm		• Deep piles (section 15.2) • Site ground improvement (section 15.3) • Surface structures with shallow foundations (section 15.4), whichever is the most appropriate for the site, • Specific engineering design

6.2 Liquefaction Assessment Methodology

Analysis of the CPT data obtained has been carried out to the methodologies outlined in section Part C (Section 13.5) and Part D of the MBIE (2012) guidance; interpreted results are presented in Appendix C.

6.3 Estimated Liquefaction Induced Vertical Settlements

During interpretation of the Cone Penetration Test (CPT), mechanically excavated test pits and hand augers, it has been construed that the natural ground water level across the site varies laterally and spatially.

Whilst piezometer monitoring of the shallow water regime is currently ongoing, a water level has been derived for each individual CPT based on the corresponding nearby test pit/hand auger. Ground water levels have been derived as the depth the soil colouration becomes a Gleysol like blue/grey, indicating a saturated soil. This level is generally shallower than the ground water strike as observed during the shallow investigations.

The estimated liquefaction induced vertical settlements (index values), of the CPT's performed, are presented in Table 10. Eighteen CPTs terminated at a shallow depth, thus not achieving the required 10 m penetration used for estimating liquefaction induced settlements, however eleven of these CPTs continued into the gravel formation, with up to 6.32 m of penetration into gravel recorded.

A cross section (Figure 10) through the site indicates that this gravel unit is likely to be sufficiently thick and continuous at depth, that although the CPTs refused at a shallow depth, their derived index values are still a reliable indication of future ground performance, as very dense gravel is unlikely to liquefy under seismic loading.

Estimations have been rounded to the nearest 5 mm and are colour coded as TC1 (grey), TC2 (yellow) or TC3 (blue) in Table 10. Figures 11, 12 and 13 are visual representations of the estimations at SLS_1 (013g Mw 7.5), SLS_2 (0.19 g Mw 6.0) and ULS (0.35 g Mw 7.5) design level events.

Although it is worth noting that majority of SLS_1 (0.13 g Mw 7.5) settlements are between TC1 and TC2 deformation limits, with two one CPT (CPT 38 and CPT 57) at TC3. By applying the design criteria of SLS_2 deformation design limits to the results, some estimations that are up to 50 mmm over the TC2 criterion at SLS. Careful ground engineering can mitigate and reduce these estimations to TC2; this will be discussed further in Section 6.5 of this report.

Table 10: Estimated Liquefaction Induced Vertical Settlements					
CPT (Depth)	CPT Test Depth (Termination Criteria)	Ground Water Level Used in Analysis	(MBIE Index Values – Limited to 10 metres)		
			SLS_1 Mw 7.5 PGA: 0.13 g **2014** (MBIE Index Values)	SLS_2 Mw 6.0 PGA: 0.19 g **2014** (MBIE Index Values)	ULS Mw 7.5 PGA: 0.35 g **2014** (MBIE Index Values)
CPT_1	15.00 m Target Depth	3.0 m	20 mm	40 mm	70 mm
CPT_2	14.86 m Target Depth	2.8 m	10 mm	35 mm	60 mm
CPT_3	12.82 m Target Depth	2.8 m	5 mm	10 mm	20 mm
CPT_4	15.00 m Target Depth	2.3 m	5 mm	10 mm	10 mm
CPT_5	15.00 m Target Depth	2.6 m	0 mm	10 mm	15 mm
CPT_6	13.68 m Target Depth	2.3 m	5 mm	5 mm	10 mm
CPT_7	15.00 m Target Depth	2.8 m	10 mm	30 mm	40 mm
CPT_8	14.02 m Target Depth	2.9 m	5 mm	10 mm	20 mm
CPT_9	15.00 m Target Depth	2.6 m	10 mm	20 mm	35 mm
CPT_10	15.00 m Target Depth	2.8 m	10 mm	40 mm	60 mm
CPT_11	15.00 m Target Depth	3.3 m	10 mm	20 mm	75 mm
CPT_12	15.00 m Target Depth	2.7 m	10 mm	35 mm	70 mm
CPT_13	15.00 m Target Depth	2.8 m	30 mm	75 mm	100 mm
CPT_14	9.62 m Target Depth	3.2 m	0 mm	10 mm	50 mm
CPT_15*	6.20 m Gravel: 5.50 – 6.20 m	3.8 m	0 mm	5 mm	40 mm
CPT_16*	7.06 m Gravel: 2.04 – 7.60 m	1.8 m	0 mm	5 mm	15 mm
CPT_17*	5.06 m Gravel: 2.60 – 5.06 m	2.7 m	0 mm	0 mm	0 mm
CPT_18	18.50 m Target Depth	2.1 m	0 mm	5 mm	50 mm
CPT_19	15.00 m Target Depth	2.0 m	25 mm	65 mm	120 mm
CPT_20	15.00 m Target Depth	2.1 m	40 mm	70 mm	100 mm
CPT_21	15.00 m Target Depth	2.3 m	10 mm	25 mm	60 mm
CPT_22	15.00 m Target Depth	2.3 m	45 mm	85 mm	110 mm
CPT_23	13.02 m Target Depth	2.3 m	40 mm	70 mm	100 mm
CPT_24	15.00 m Target Depth	2.4 m	40 mm	75 mm	80 mm
CPT_25*	5.48 m Gravel: 3.00 – 5.48 m	2.0 m	0 mm	5 mm	20 mm
CPT_26*	3.04 m Gravel: 1.90 – 3.04 m	1.6 m	0 mm	0 mm	<5 mm
CPT_27*	4.92 m Gravel: 2.00 – 4.92 m	2.0 m	0 mm	0 mm	0 mm
CPT_28	15.00 m Target Depth	1.6 m	5 mm	15 mm	50 mm
CPT_29*	6.56 m Gravel: 3.00 – 6.56 m	1.5 m	0 mm	10 mm	20 mm
CPT_30	15.00 m Target Depth	1.5 m	10 mm	20 mm	70 mm
CPT_31	15.00 m Target Depth	1.4 m	30 mm	55 mm	160 mm
CPT_32*	6.94 m Gravel: 3.20 – 6.94 m	1.7 m	5 mm	15 mm	45 mm
CPT_33	15.00 m Target Depth	1.4 m	5 mm	10 mm	60 mm
CPT_34*	7.62 m Gravel: 3.40 – 7.62 m	0.9 m	0 mm	5 mm	20 mm

Note – all estimated settlements are recorded to the nearest 5mm.
Key: Grey - TC1 Deformation, Yellow - TC2 Deformation, Blue - TC3 Deformation
* Denotes either early termination in very dense gravels or penetration into soils that are predicted to not liquefy. Software utilised in analysis: CLiq Version 2.1.6.7 © 2007 GeoLogismiki.

Table 10: Estimated Liquefaction Induced Vertical Settlements - Continued					
CPT (Depth)	**CPT** Test Depth (Termination Criteria)	**Ground Water Level Used in Analysis**	**Idriss & Boulanger 2014 Methodology (MBIE Index Values – Limited to 10 metres)**		
			SLS_1 Mw 7.5 PGA: 0.13 g **2014** (MBIE Index Values)	**SLS_2** Mw 6.0 PGA: 0.19 g **2014** (MBIE Index Values)	**ULS** Mw 7.5 PGA: 0.35 g **2014** (MBIE Index Values)
CPT_35*	**9.46 m** Gravel: 1.50 – 9.46 m	**1.3 m**	**0 mm**	**0 mm**	**0 mm**
CPT_36*	**5.52 m** Gravel: 3.80 – 5.52 m	**1.4 m**	**10 mm**	**20 mm**	**50 mm**
CPT_37*	**8.82 m** Gravel: 2.50 – 8.82 m	**2.4 m**	**5 mm**	**10 mm**	**45 mm**
CPT_38	**15.00 m** Target Depth	**1.5 m**	**60 mm**	**100 mm**	**160 mm**
CPT_39*	**8.04 m** Gravel: 2.40 – 8.04 m	**1.5 m**	**0 mm**	**5 mm**	**25 mm**
CPT_40*	**7.18 m** Gravel: 2.80 – 7.18 m	**0.0 m****	**5 mm**	**5 mm**	**25 mm**
CPT_41	**15.00 m** Target Depth	**2.0 m**	**0 mm**	**10 mm**	**40 mm**
CPT_42*	**7.48 m** Gravel: 3.40 – 7.48 m	**2.0 m**	**0 mm**	**5 mm**	**30 mm**
CPT_43*	**5.72 m** Gravel: 2.84 – 5.72 m	**2.2 m**	**0 mm**	**0 mm**	**30 mm**
CPT_44	**15.00 m** Target Depth	**2.2 m**	**5 mm**	**15 mm**	**45 mm**
CPT_45*	**4.22 m** Gravel: 2.40 – 4.22 m	**2.4 m**	**0 mm**	**0 mm**	**0 mm**
CPT_46	**12.72 m** Target Depth	**2.8 m**	**5 mm**	**20 mm**	**60 mm**
CPT_47	**13.66 m** Target Depth	**2.8 m**	**5 mm**	**15 mm**	**60 mm**
CPT_48	**12.10 m** Target Depth	**2.8 m**	**5 mm**	**20 mm**	**60 mm**
CPT_49	**15.00 m** Target Depth	**2.1 m**	**20 mm**	**45 mm**	**80 mm**
CPT_50	**12.42 m** Target Depth	**2.0 m**	**10 mm**	**30 mm**	**60 mm**
CPT_51	**15.00 m** Target Depth	**2.1 m**	**5 mm**	**5 mm**	**5 mm**
CPT_52*	**11.96 m** Gravel: 4.00 – 11.96 m	**2.0 m**	**5 mm**	**15 mm**	**20 mm**
CPT_53	**15.00 m** Target Depth	**0.7 m**	**15 mm**	**15 mm**	**35 mm**
CPT_54	**15.00 m** Target Depth	**1.8 m**	**10 mm**	**15 mm**	**20 mm**
CPT_55	**15.00 m** Target Depth	**2.2 m**	**25 mm**	**40 mm**	**40 mm**
CPT_56	**15.00 m** Target Depth	**2.6 m**	**25 mm**	**30 mm**	**40 mm**
CPT_57	**15.00 m** Target Depth	**2.0 m**	**80 mm**	**100 mm**	**120 mm**
CPT_58	**15.00 m** Target Depth	**2.3 m**	**45 mm**	**80 mm**	**85 mm**
CPT_59	**15.00 m** Target Depth	**2.1 m**	**40 mm**	**65 mm**	**75 mm**
CPT_60*	**5.72 m** Gravel: 4.40 – 5.72 m	**1.5 m**	**15 mm**	**35 mm**	**70 mm**
CPT_61*	**3.94 m** Gravel: 1.00 – 3.94 m	**1.0 m**	**0 mm**	**0 mm**	**10 mm**
CPT_62	**15.00 m** Target Depth	**1.1 m**	**10 mm**	**10 mm**	**20 mm**
CPT_76005	**6.58 m** Gravel: 2.00 – 6.58 m	**1.8 m**	**0 mm**	**0 mm**	**0 mm**
CPT_76006	**8.14 m** Gravel: 3.00 – 8.14 m	**2.1 m**	**5 mm**	**15 mm**	**70 mm**
CPT_76007	**6.39 m** Gravel: 3.40 –6.39 m	**1.8 m**	**0 mm**	**5 mm**	**25 mm**
CPT_76008	**20.09 m** Target Depth	**1.5 m**	**50 mm**	**80 mm**	**125 mm**
CPT_76009	**6.93 m** Gravel: 2.2 – 6.93 m	**1.5 m**	**0 mm**	**5 mm**	**50 mm**
CPT_76010	**5.93 m** Gravel: 1.2 – 5.93 m	**1.3 m**	**0 mm**	**0 mm**	**0 mm**
CPT_76011	**11.78 m** Target Depth	**0.9 m**	**40 mm**	**65 mm**	**90 mm**

Note – all estimated settlements are recorded to the nearest 5mm.
Key: Grey - TC1 Deformation, Yellow - TC2 Deformation, Blue - TC3 Deformation
* Denotes either early termination in very dense gravels or penetration into soils that are predicted to not liquefy ** Based on piezometer measurements (TC 1 with 1.5 m GWL). .Software utilised in analysis: CLiq Version 2.1.6.7 © 2007 GeoLogismiki.

The settlement estimates outlined in Table 10, are 'free-field' estimates and do not take into account the future impact of residential dwellings, civil infrastructure, ground surface deformation resulting from soil ejecta or seismic-induced shear movements in the form of lateral movement that may occur during future large earthquakes, towards a free edge (Section 6.4).

6.4 Estimated Liquefaction Induced Lateral Movement

The Styx River defines the norther limits of the site and can be deemed a "Free Edge" with regards to liquefaction induced lateral movement. The settlement estimates outlined in Table 11, are 'free-field' estimates of "lateral spreading", to assign a Technical Category, the predicted "lateral stretch" needs to be estimated, as outlined in Table 9.

Table 11: Estimated Liquefaction Induced Lateral Spreading

CPT (Free Edge Distances)	**CPT** Test Depth (Termination Criteria)	**Ground Water Level Used in Analysis**	**Idriss & Boulanger 2014 Methodology (Lateral Spread Estimations – Limited to 2H)**		
			SLS_1 Mw 7.5 PGA: 0.13 g **2014**	**SLS_2** Mw 6.0 PGA: 0.19 g **2014**	**ULS** Mw 7.5 PGA: 0.35 g **2014**
CPT_53 L = 75.0 m. H = 2.0 m	**15.00 m** Target Depth	**0.7 m**	**35 mm**	**40 mm**	**60 mm**
CPT_54 L = 50.0 m. H = 2.5 m	**15.00 m** Target Depth	**1.8 m**	**70 mm**	**120 mm**	**120 mm**
CPT_56 L = 50.0 m. H = 3.0 m	**15.00 m** Target Depth	**2.6 m**	**50 mm**	**110 mm**	**120 mm**
CPT_58 L = 50.0 m. H = 4.0 m	**15.00 m** Target Depth	**2.3 m**	**350 mm**	**900 mm**	**1000 mm**
CPT_59 L = 50.0 m. H = 4.0 m	**15.00 m** Target Depth	**2.1 m**	**300 mm**	**700 mm**	**1100 mm**

Note – all estimated lateral movements are recorded to the nearest 5mm.
Software utilised in analysis: CLiq Version 2.1.6.7 © 2007 GeoLogismiki.

Lateral stretch calculations have been applied to CPT 58, the stretch analysis indicates that using distance increments (L) from the free edge and maintaining a constant free edge height (H), that the lateral stretch estimations are severe.

Table 12 provides the estimations of earthquake induced stretch, which are predicted during various levels (SLS to ULS) of earthquake shaking. As a result detailed design will be required to fully assess the risk and determine appropriate remedial strategies to improve the performance of the land.

This statement applies only to 10 and 16 Selkirk Place (Lot 2 and lot 3 DP 25296, held under titles: CB37C/1043 and CB37C/1044 respectively), please refer to the attached statement of professional opinion for consent notice that is currently recommended to be applied to these lots.

Table 12: Estimated Liquefaction Induced Lateral Spreading					
CPT (Free Edge Height)	**Setback from Free Edge**	**Ground Water Level Used in Analysis**	**Idriss & Boulanger 2014 Methodology (Lateral Stretch Estimations – Limited to 2H)**		
			SLS_1 Mw 7.5 PGA: 0.13 g **2014**	**SLS_2** Mw 6.0 PGA: 0.19 g **2014**	**ULS** Mw 7.5 PGA: 0.35 g **2014**
CPT_58 **H = 4.0 m**	**20 m**	**2.3 m**	**630 mm**	**1460 mm**	**1440 mm**
	50 m		**80 mm**	**180 mm**	**130 mm**
	100 m		**20 mm**	**50 mm**	**40 mm**
Software utilised in analysis: CLiq Version 2.1.6.7 © 2007 GeoLogismiki.					

The Christchurch City Councils Outline Development Plan (ODP) requires that Horners Drain is to be enhanced and naturalised. This will improve its capacity and functioning for storm water management while ensuring habitat and ecological values are enhanced, however as a consequence will create a "Free Edge".

Horners drain current configuration and direction will be altered and realigned north at the Junction of Prestons Road and Mills Road, to defined the western boundary of the site. The current ODP defines the land to be "set aside" for the realignment as being approximately 40 metres wide, encompassing the land directly to the west of (current) Mills Road.

At this time it is unknown the predicted depth of the proposed redirected drain, therefore it is difficult to quantify the lateral area of influence that may be subjected to lateral movement during future earthquakes.

Once Horners Drain has been designed, definitive quantifiable estimations of predicted lateral movement can be derived, however in the interim 100 m from the proposed realignment (crest of slope) should be assessed for potential lateral movement. This shall be further discussed in Section 6.6 of this report; "Recommended Technical Category".

6.5 Cyclic Softening

It has been identified that the soils towards the north east corner of the site (Figure 10) in the upper 4.0 m to 6.0 m of the soil column (from below EGL), exhibit *"clay like"* properties therefore may be susceptible to cyclic softening during future large earthquakes. Such soil behaviour is less common than failures of *"sand like"* soils[23] due to an increase in the residual undrained shear strength (S_v). Boulanger and Idriss (2006[24] and 2007[25]) have produced a procedure on the evaluating the cyclic softening of *"clay like"* soils, this is based the Cyclic Resistance Ratio (CRR) and undrained shear strength.

[23] Idris I. M & Boulanger R. W. (2008). Soil Liquefaction During Earthquakes
[24] Boulanger R.W. and Idriss, I.M. (2006). "Liquefaction Susceptibility Criteria for Silts and Clays," Journal of geotechnical and Geoenvironmental Engineering, 132 (11), 1413–1426pp
[25] Boulanger R.W. and Idriss, I.M. (2007). "Evaluation of Cyclic Softening in Silts and Clays," Journal of Geotechnical and Geoenvironmental Engineering, 133 (6), 641– 652pp

During an earthquake it can be predicted that, if the Cyclic Stress Ratio (CSR = τ_{cyc}/σ'_{vc}) is close to the cyclic stress ratio divided by the vertical effective stress (S_u/σ'_{vc}) then large deformations are likely. Boulanger & Idriss (2007)[35] suggest a $CRR_{Mw=7.5}$ = 0.8 S_u/σ'_{vc} to define the limit to when deformations are to become large.

The undrained shear strength of clay like soils can be estimated from the CPTs using the equation: $S_u = (q_t - \sigma'_{vc}) / N_{kt}$. Where S_u is the peak undrained shear strength, q_t is the corrected total cone resistance, σ'_{vc} is the vertical effective stress and N_{kt} is the empirical cone factor (N_{kt} = 14).

Performing analysis on CPT_5 utilising the CPeT-IT GeoLogismiki software, provided undrained shear strength (Su) values of between 25 – 50 kPa and remolded shear values of between 3 – 25 between 2.3 and 4.0 metres depth.

The assessment of the residual (remolded) undrained shear strength provides estimations of cyclic softening which is unlikely to be an issue onsite under SLS load conditions. Settlements during ULS conditions are likely to be within TC1/TC2 tolerances however the risk posed by cyclic softening should be assessed for deep structures and significant infrastructure.

6.6 Recommended Land Technical Category

The majority of the site can be defined as TC1 and TC2 based on the testing done to date, with the balance areas potentially requiring ground improvement to improve future performance.

Figures 11, 12 and 13 are a visual representation of the technical categories on site at differing design level earthquakes (SLS_1 SLS_2 and ULS), utilising the estimates of liquefaction induced vertical settlements as outlined in Table 10. These figures also presented in Appendix D.

At this time, the subdivision layout and design has not been finalised, however it is recommended to utilise the areas defined as not achieving TC2 for non-essential civil infrastructure and/or recreational areas such as parks and reserves, to fully utilise the areas deemed as TC1/TC2 for residential occupation.

As the site has not been sufficiently tested to a SLS level event, with evidence of liquefaction ejecta occurring in isolated areas, the soil characteristics of the CPTs close to the recorded evidence of liquefaction have been cross correlated with other CPT's, which exhibit similar soil characteristics. This can therefore be used to delineate the areas which are potentially susceptible to liquefaction during low levels of seismic oscillation.

It should be noted that CPT 20 (close to area of recorded liquefaction) and the CPTs with a similar profile (CPTs 13, 23, 24) meet TC2 criteria during an ULS level event, however fail TC2 during a SLS_2 level event. These areas could be designated as performing to TC2/TC3 hybrid standards. This area could be incorporated into a ground improvement regime and will require an increased thickness of non-liquefiable engineered cap, as outlined below.

Ground improvements may be performed during subdivision construction to create a reinforced gravel raft or stabilised crust to reduce the future settlement risk to be within TC2 deformation limits. This is further discussed in Section 6.7 of this report.

The area towards the south west of the site (lowest lying) is susceptible to liquefaction due to loose silty sands and a high water table. CPT 19, towards the northern end of Mills Road, also performs to TC3, however has been delineated by CPTs 18, 41 and 42 (TC1/TC2), and similar to the performance to that predicted by Aurecon within identified their “Zone 2” of TC3.

CPT’s 57, 58 and 59 all have high estimated vertical settlements at both SLS and ULS levels of shaking; this area is also susceptible to earthquake induced lateral spreading. However as outlined in Section 6.4 is recommended that detailed design and additional geotechnical investigations are performed to fully assess the stretch potential, and therefore provide remedial strategies required to improve the performance of the land.

To manage the lateral spreading risk recommendations could include excavation and replace the existing soil or the installation of a geogrid reinforced gravel butress, rammed aggregate piers or stone columns to improve the grounds’ resilience to lateral movement; these options will be subject to specific engineer design.

As previously discussed, the realignment of Horners Drain will create a free edge; an estimated 100 m from the proposed realignment (crest of slope) should be assessed for potential lateral movement and be incorporated into subdivision design. Once the Horners Drain design has been confirmed the actual area of influence can be derived, however Figure 14 illustrates the estimated 100 m buffer zone of lateral spread influence.

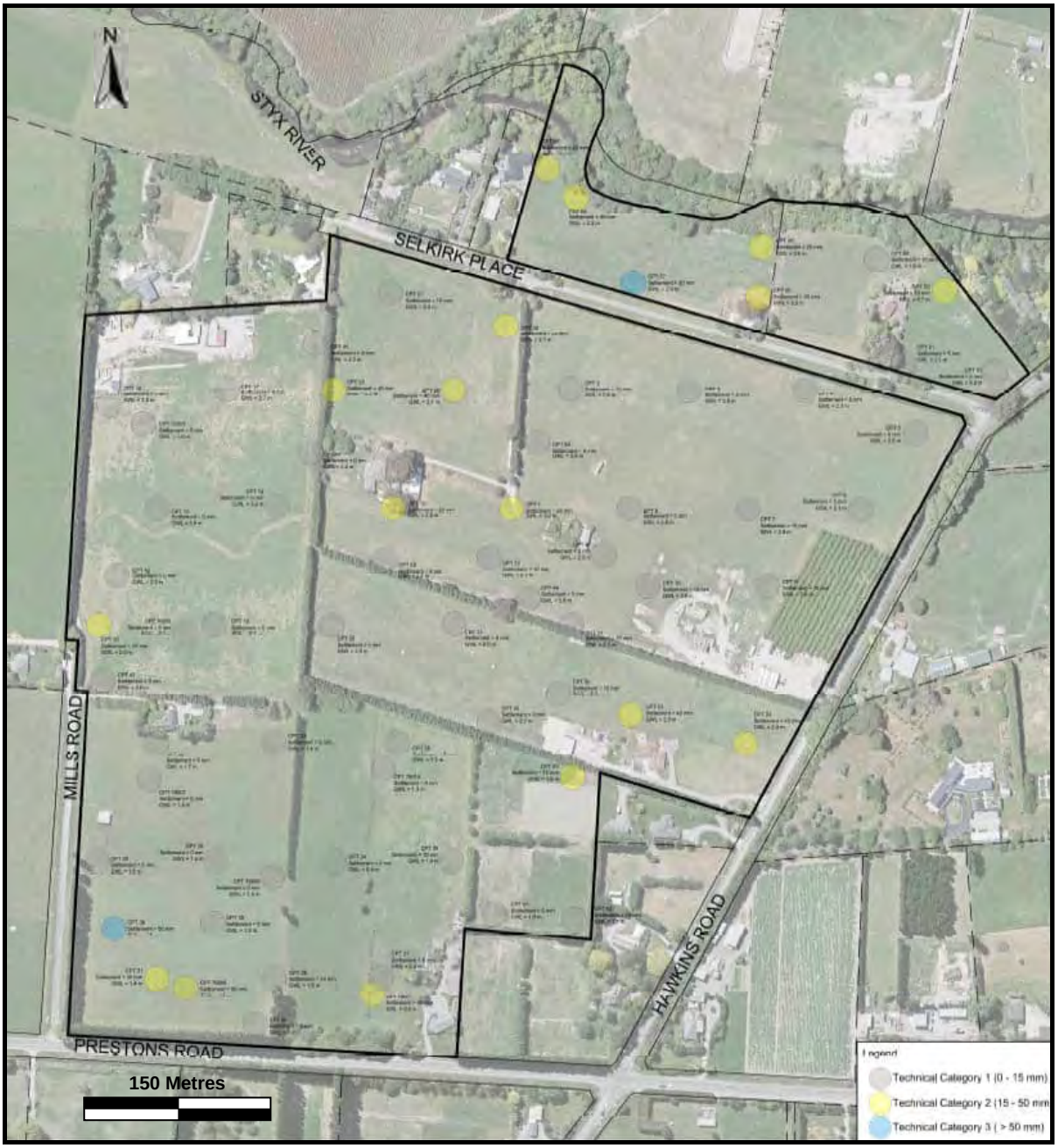

Figure 11: Technical Categories at SLS_1 (0.13 g Mw 7.5) – see DWG G02A in Appendix D.

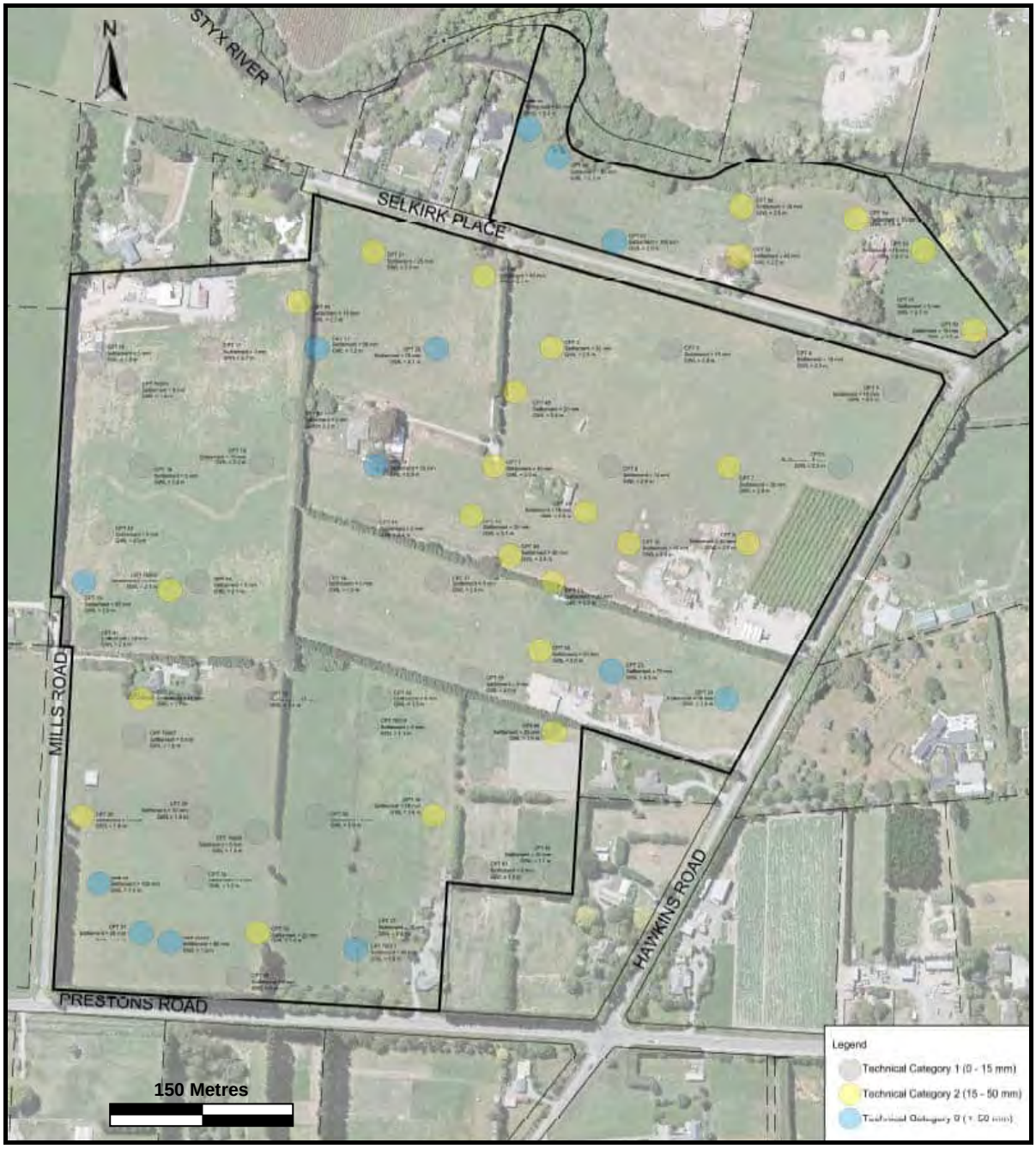

Figure 12: Technical Categories at SLS_2 (0.19 g Mw 6.0) - see DWG G03A in Appendix D.

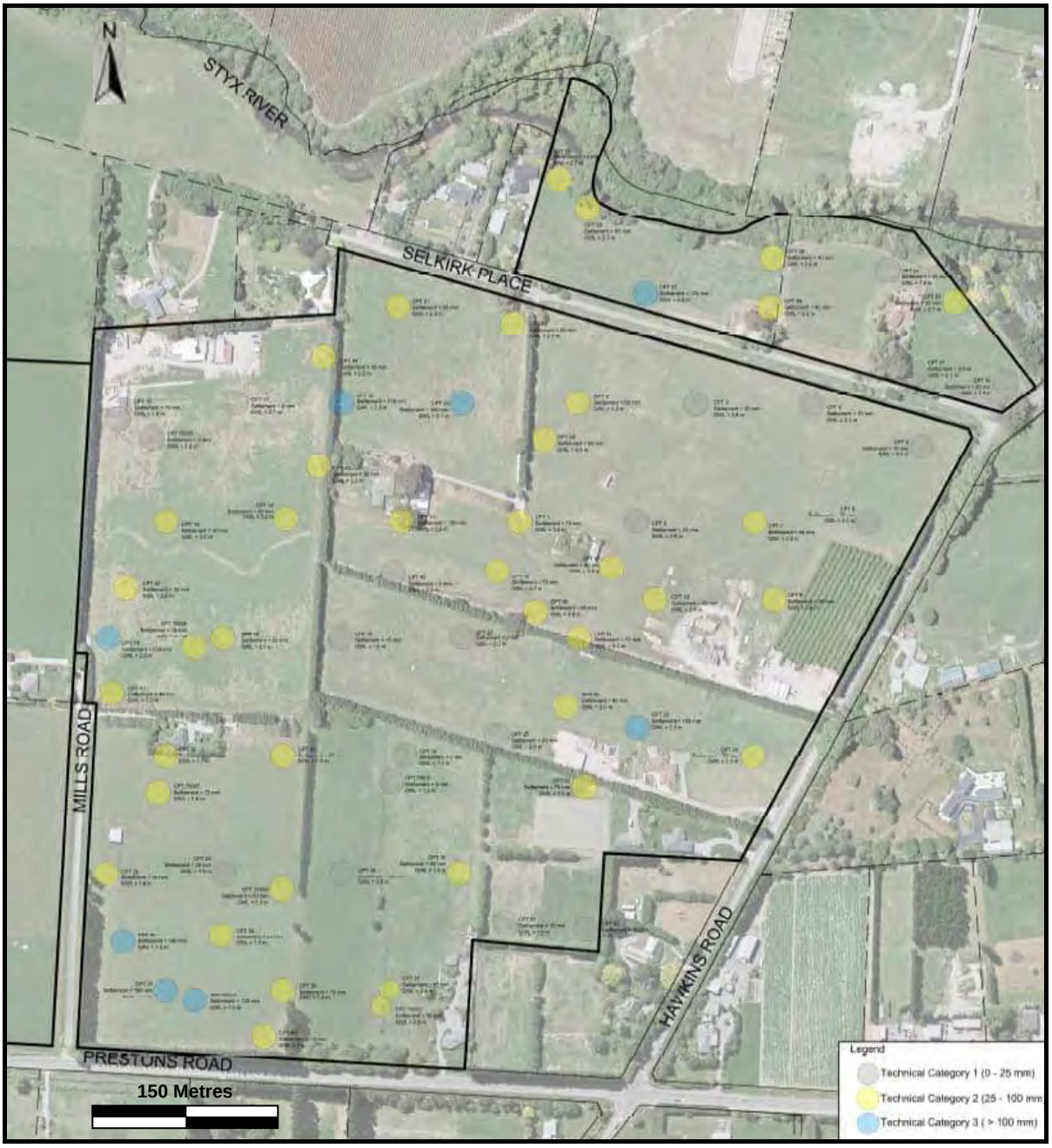

Figure 13: Technical Categories at ULS (0.35 g Mw 7.5) - see DWG G04A in Appendix D.

6.7 Ground Improvement Requirements

As illustrated upon Figures 11, 12 and 13 areas have been identified which require ground improvement, to increase the future seismic resilience to liquefaction. Apart from the south west and far north west corners of the site, these areas can be defined as TC2/3 hybrid in the current configuration.

The creation, during subdivision construction, of a geogrid reinforced 600 mm (minimum) well graded gravel or non-liquefiable stabilised crust, certified to NZS4431:1989 will create suitably seismic resilient platform in which to construct TC2 style foundations.

The south west corner (CPT 31, 38 and 76008) of the site is a relatively small area of ground (approximately 12,000 m^2) that is categorised as TC3; as it is underlain by silty sands (<15MPa) which are predicted to liquefy as the area is also low lying with a high water table. It is understood that this area is to be utilised for storm water retention, therefore not to be used for residential occupation.

The lots which surround the detention pond will also require ground improvement, as the pond will create as a free edge and as such the surrounding lots will need lateral resilience to movement should it occur. Therefore the construction of a well graded gravel raft, with a minimum thickness of 600 mm GAP65 raft (underlain by bidim with two layers TX160 geogrid, or similar) raft would provide suitable ground improvement and mitigation against future lateral deformation.

Figure 14 illustrates the areas of the proposed subdivision which can be categorised as TC1 (grey) and TC2 (yellow) and is a combination of Figures 11, 12 and 13. Please note the areas that will need ground improvement have been identified with hatching upon Figure 14. The area north of Selkirk Place requires additional design, to confirm mitigation measures and has been identified with blue hatching.

The surficial soils grade from silty sand to clay / organic rich towards the north east of the proposed subdivision. The gradation occurs between CPTs; therefore it is problematic to clearly identify an area that is solely dominated by clay / organic rich soils but this should also be considered.

It is understood that the final layout of the subdivision has yet to be confirmed. The final should utilise areas for residential occupation and/or civil infrastructure depending upon the underlying ground conditions and technical category.

Figure 15 provides an example of how the technical categories could be applied to Stage 1 of the subdivision scheme plan (using the preliminary August 2017 version). It is indicative only at this time, as the layout is yet to be finalised and will be subject to change once the final subdivision design has been confirmed.

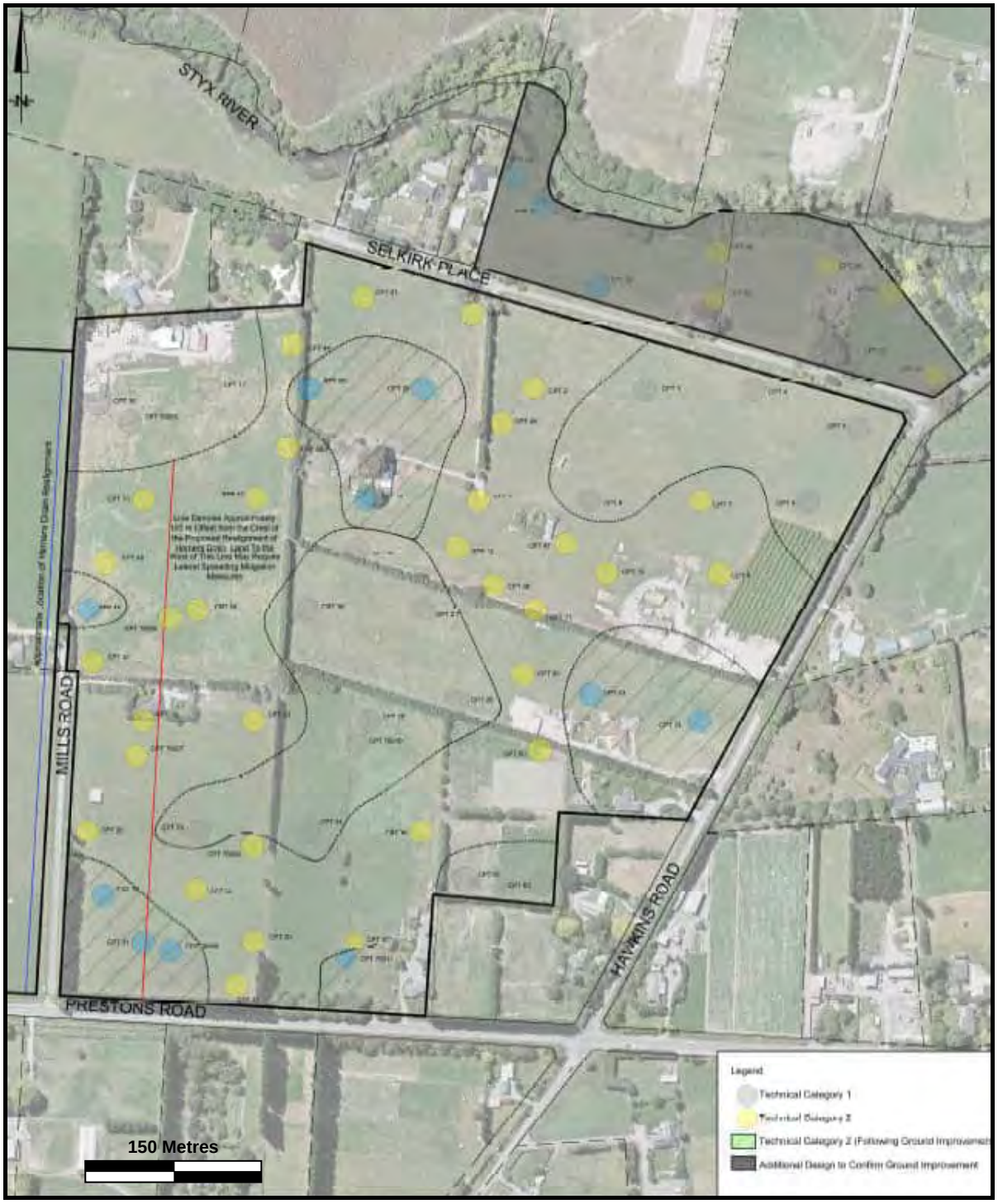

Figure 14: Technical Categorisation and Ground Improvement Required Areas - see DWG G06A in Appendix D.

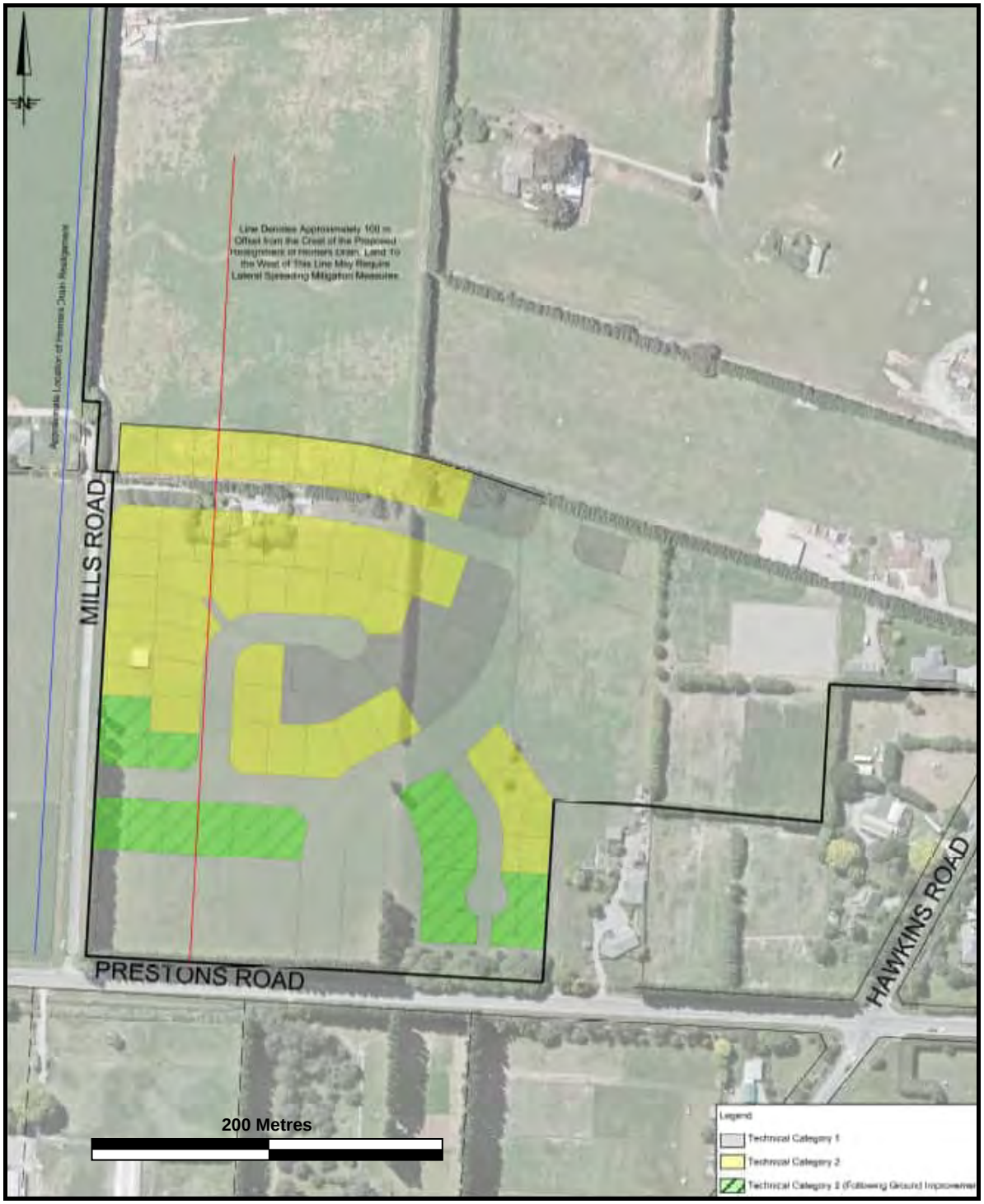

Figure 15: Technical Categorisation Assigned to Stage 1 of the Provisional Subdivision Layout (August 2017) see DWG G07B in Appendix D

7.0 Recommendations for Civil Infrastructure

After the Canterbury Earthquake Sequence the waste water, storm water and potable water systems of Christchurch (and surrounding areas) were largely disrupted and in many cases became ineffective due to the liquefaction impact on the pipe networks[26]. This highlighted the deficiencies within specification of design and construction of the piped reticulation networks.

7.1 Liquefaction Resistance Zoning for Infrastructure Design

The site is not encompassed by the Liquefaction Resistance Index (LRI) Map[27] of Christchurch, as no liquefaction observations were made within the surrounding area of the site, following the Canterbury Earthquake Sequence. The following Table 13 represents the LRI Zones and associated ground deformations, which can be used in design and zonation calculation.

Table 13: LRI Zones and associated ground deformations[25]

Liquefaction Resistance Zones	Equivalent CRR (at water table)	Representative LRI (at water table)	Ground Settlement	Lateral Displacement (relative transient)	Assumed Ground Strains and Thickness of Liquefied Layer
0	<0.065	-	>500 mm	>400 mm	εv >5% γ >4% H_L = 5 – 10 m
1	0.065 – 0.11	0.065	250 – 500 mm	200 – 400 mm	εv = 5% γ = 4% H_L = 5 – 10 m
2	0.11 – 0.16	0.13	50 – 250 mm	40 – 200 mm	εv =3% γ = 2% H_L = 4 – 8 m
3	0.16 – 0.23	0.195	20 – 50 mm	20 – 40 mm	εv =1% γ = 1% H_L = 2 – 4 m
4	0.23	0.26	<20 mm	<20 mm	εv = <0.5% H_L = 0 m

- The ground displacement values exclude effects of lateral spreading
- Design should accommodate the higher value of displacement/deformation
- εv= volumetric strain
- γ = shear strain
- The table and LRI map are for preliminary use and restricted to the water / wastewater systems of Christchurch

The Liquefaction Resistance Index (LRI) provides a numerical indication (zonation) of the soils resistance to liquefaction (Table 13). Based on analysis of the CPT's, utilising an ULS design the event, Liquefaction Resistance Zones (LRZs) have been derived based on the estimated thicknesses of liquefied layers, estimations of vertical settlement and the volumetric strains estimated during liquefaction.

The site south of Selkirk Place, can be zoned a combination Liquefaction Resistance Zone LRZ2 (yellow) and LRZ3 (green) based on analysis of the acquired (to date) geotechnical data, therefore the use of PVC–u is deemed appropriate to be used within the design of the water

[26] Cubrinovski . M. *et al.* December 2011. Liquefaction Imapct on Pipe Networks - Short Term Recovery Project No. 6. Natural Hazards Research Platform. University of Canterbury *et al.*

[27] Cubrinovski, M *et al.* Mar 2014. Impacts of liquefaction on the potable water system of Christchurch in the 2010-2011 Canterbury (NZ) Earthquakes

supply network[28]. A gravity wastewater system is deemed appropriate based on the aforementioned zones and remains the preferred method of reticulation. However consideration can be given to alternative technology such a pressurised sewer systems. Civil design and construction must comply with the current CCC Construction Standard Specifications (CSS).

Liquefaction Resistance Zone recommendations for the parcels of land north of Selkirk Place (Lot 2 and Lot 3 DP 25296) will be provided following additional modelling and analysis of the lateral spread risk. Recommendations will be given to improve the grounds' resilience to lateral movement, following specific engineer design and modelling, it is envisaged that this area will be improved to accept a LRZ2 categorisation.

The CCCs already defined requirements for the wastewater supply network are therefore to use PVC-u for all piped infrastructure; SN16 (minimum stiffness 16 KN) is at present (time of this report) the CCC required minimum pipe stiffness to be incorporated into wastewater design.

All civil construction must comply with the current CCC Construction Standard Specifications (CSS). It is recommended that all civil infrastructures be backfill with well graded gravel to not only form a zone of non-liquefiable material above and the around the pipe but also to create and permeable layer to allow pore pressure to dissipate immediately under and around the pipe thus not to exacerbate the buoyancy effect[29] on the pipe network.

The design of sewer and stormwater manholes shall be specifically engineered, to reduce the effect of liquefaction upon them. They can fail due to the buoyancy effect; and can be affected by land settlement around them. Geotextile wrapped gravel, may provide a suitable working platform at the base of a manhole excavation and provide a workable surface should the soils at depth be unsuitable for founding upon.

Hydraulic modelling will be required to ensure that the site is suitably protected from inundation, from significant water sources including the Styx River. Horners Drain will be redirected from its present course, and be incorporated into the design of the subdivision; to be enhanced and naturalised to provide a point of difference within the proposed neighbourhood. This will improve its capacity and functioning for storm water management while ensuring habitat and ecological values are enhanced.

[28] Christchurch City Council. 20 August 2012. Clarification and revised Guidance on the use of PE pipe in the CCC water supply network
[29] Liquefaction, Fact Sheet. Institution of Professional Engineers of New Zealand

8.0 Building Foundation Recommendations

8.1 Design Criteria

NZS 1170.5 Site soil class: According to NZS 1170.5[30] (2004) a site soil class of D (deep or soft soils) applies due to the significant depth to bedrock.

8.2 Indicative Soil Properties

Estimated soil properties are provided in Table 14 for structural design purposes, subject to site specific identification of underlying soil, as the density and composition varies laterally across the site.

Table 14: Estimated Shallow Soil Properties

Soil Description	Unit Weight[31] (ɤ)	Internal Angle of Friction[32] (Φ)	Cohesion (c)	Modulus of Subgrade Reaction[33]
Natural Soft to stiff SILT/ Sandy SILT	16 – 18 kN/m^3	22 – 25°	5 – 10 kPa	35 – 50 kPa/mm
Natural GRAVEL	18 – 20 kN/m^3	30 – 40°	0 kPa	50 – 200 kPa/mm
Engineered GRANULAR FILL	18 – 20 kN/m^3	30 – 40°	0 kPa	50 – 200 kPa/mm

8.3 Foundation Recommendations

"Good Ground"[34] is defined as:

"*Any soil or rock capable of permanently withstanding an Ultimate Bearing Capacity (UBC) of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a factor of safety of 3.0), but excludes:*

- *Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel with obvious voids;*
- *Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 test 2.2, and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS 4402 test 2.6; and*

[30] New Zealand Standard (NZS) 1170.5. 2004. Structural Design Actions. Part 5: Earthquake Action – New Zealand
[31] Look, B.G. (2007) Handbook of Geotechnical Investigation and Design Tables, Taylor & Francis Group, London, UK.
[32] Bowles, J.E. (2001) Foundation Analysis and Design, McGraw-Hill International Editions – 5th Edition, Table 2-6 pp108.
[33] New Zealand Standard (NZS). 2010.NZS4404:2010. Land Development and Subdivision Infrastructure.
[34] Ministry of Business, Innovation & Employment. 2014. Acceptable Solutions and Verification Methods for New Zealand Building Code Cause B1 Structure.

- *Any ground which could foreseeably experience movement of 25 mm or greater for any reason including one or a combination of land instability, ground creep, subsidence, (liquefaction, lateral spread – for the Canterbury Region Only) seasons swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots".*

Any residential dwellings planned for the proposed lots will require a lot specific shallow geotechnical investigation to confirm underlying ground conditions.

Technical Categories have been defined in Figure 14 as per their attached key; it is likely that NZS 3604:2011 foundations are suitable for areas designated as TC1, subject to lot specific testing and verification of "Good Ground". Following the confirmation of 300 kPa UBC and being devoid of organic, potentially compressible soils the NZS 3604:2011 foundations will not require specific engineering design in these areas.

The use of NZS 3604:2011 for the design of the superstructure is acceptable for the construction for any house within the scope of NZS3604:2011, with the dimensional limitations adhered to and the use limited to Importance Level (IL) 2 (AS/NZS1170.0[35]).

Foundations onsite will require specific engineering design if built within areas defined as TC2 (yellow) or, within areas defined as requiring ground improvement to meet TC2 (yellow with red hatching) design limits.

In accordance with Figure 5.2 in Part A of the MBIE 2012 Guidance and assuming a static soil ultimate bearing capacity of 200 kPa, suitable foundations for new residential buildings would include the following foundation types:

- **Types A & B (timber floors):** Specifically designed shallow pile and/or foundation wall systems suitable for geotechnical ultimate bearing capacities < 300 kPa;

- **Type C (concrete floors):** Stiffened raft slab foundations. Design details are given or in Section 5.3.1 of the MBIE 2012 Guidance (Options 1 – 4) which assume a geotechnical ultimate bearing capacity of 200 kPa.

Cladding and roofing recommendations based on Table 7.2 of the MBIE Guidance shall be adhered to with regards to one and two storey residential builds built in both TC1 and TC2 Zones.

[35] Australia/New Zealand Standard (AS/NZS) 1170.0. 2002. Structural Design Action Part 0: General Principles.

Organic material in the form of peat is present within the north eastern corner of the site, it is likely that although categorised as TC1, TC2 style foundations may be deemed appropriate due to the underlying organic rich soils, and their propensity to consolidate due to static loading over the lifespan of the building (50 years). Once final subdivision layout and design has been derived it is likely that settlement analysis will be required to ensure settlements are within acceptable New Zealand Building Code (NZBC) Standards.

9.0 Section 106 Resource Management Act (1991) Assessment

Section 106 of the Resource Management Act (RMA) requires that the site be assessed for potential material damage from erosion, falling debris, subsidence, slippage, or inundation of the proposed lots. These aspects are addressed in the following section with respect to Lot 2 and Lot 3 DP 25296, Lot 2 DP 301363, Lot 2 and Lot 3 DP 24826 Lot 1, Lot 3, Lot 4, Lot 5 and Lot 6 DP 23089 known as the proposed Oakbridge Subdivision, Redwood, Christchurch.

9.1 Erosion

The site is not subject to significant erosion as it has a generally flat grade with a gentle gradient to a topographical highpoint. The irrigation drains that are adjacent to the site may cause erosion however due to their slight gradient and low energy they are not considered a significant risk. It is also considered that these drains will be remediated during the site development, therefore removing the mechanism of erosion.

The Styx River could cause erosion within the areas north of Selkirk Place, however as this area requires additional modelling and analysis to mitigate the risk of lateral movement. Erosional protection measures will be incorporated into design during the additional works.

9.2 Falling Debris and Slippage

The proposed subdivision is located on flat ground, with no areas bordering the site being elevated; the site has no potential to create, or to be affected by, falling debris. The Styx River can be defined as a free edge, therefore any structure built upon its banks has the propensity to be subjected to slope instability.

It recommended that additional investigation be performed in this area, to determine suitable ground improvement measures to limit the lateral stretch to TC2 deformation limits.

The realignment of Horners Drain, north, will define the sites western limits and is will create a free edge. At the time of the reporting the drains' design dimensions have yet to finalised, however a 100 m zone of influence has been illustrated upon Figure 14 as means of identifying an area potentially subjected to lateral spreading. Once the design is known, lateral spreading calculations should be performed within this area and mitigation measures recommended accordingly.

9.3 Subsidence

There are areas defined within this report (Figure 14) that may be assumed to have a MBIE Technical Category of TC1 and/or TC2 which identifies that either no damage is expected or minor to moderate land damage from liquefaction and/or lateral spreading is possible in future large earthquakes, respectively.

Areas defined as not achieving TC2, will require ground improvement so that the liquefaction potential is reduce to suitable TC2 deformation limits. Typically this will be done by the importation and creation of, a minimum 600 mm, reinforced densified raft.

Organic material in the form of peat is present within the north eastern corner of the site therefore potentially compressible during static settlement. It is likely that settlement analysis will be required to ensure settlements are within acceptable NZBC Standards, should this area be utilised for residential building.

Cyclic softening is unlikely to be an issue onsite under SLS load conditions and settlements during ULS conditions are likely to be within TC1 tolerances however cyclic softening should be assessed for significant infrastructure such as water and sewer pump stations.

The site is deemed suitable for residential development provided that prudent engineering design is used during site development and at building consent stage to provide sufficient protection against potential settlement due to liquefaction settlement or lateral spread.

9.4 Inundation

The Christchurch City Council identifies that the site is with the Styx River catchment area with the Waimakariri River also to the north of the site. The Waimakariri River has a high flooding potential especially in lower areas of Christchurch and surrounding area; however the primary and secondary stopbanks of the Waimakariri River have been predicted to stop a 1 in 10,000 year river breakout scenario[36] entering the Christchurch City, this includes the site.

The site is not currently within a Christchurch City Plan Flood Management Area (FMA), nor is it within the proposed Stage 3 District Plan Floor Level and Fill Management Area (FLFMA).

Hydraulic modelling may be required to ensure that the site is suitably protected from inundation, from significant water sources including the Styx River. Horners Drain will be redirected from its present course, and be incorporated into the design of the subdivision. The hydraulic modelling will need to incorporate the re-direction into design/catchment areas and confirm minimum floor levels in relevant areas.

Finished Floor Level (FFL) requirements for compliance with Clause E1 of the New Zealand Building Code are based on providing protection from a 2% Annual Exceedance Probability (1 in 50 year Average Recurrence Interval) event. CCC should be contacted at building consent stage to confirm current minimum finished floor levels.

[36] www.chchplan.ihp.govt.nz/wp-content/uploads/2015/07/3723-CCC-Natural-Hazards-Evidence-of-Tony-Oliver-Waimak-stopbanks-21-1-2016.pdf

9.5 Listed Land Use Register (LLUR)

A Detailed Site Investigations (DSI) is currently ongoing and will address this potential contamination and provide remediation action as required.

9.6 Section 106 General Discussion

Based on the aforementioned considerations it is determined that the site is suitable for subdivision and residential buildings under Section 106 of the RMA, as long as the recommendations given within this report are followed. Further shallow investigation is recommended at building consent stage to confirm the site specific geology and appropriate design criteria for the house sites.

Technical Categories as illustrated upon Figure 14 of the Geotechnical report are is considered appropriate, subject to the following;

I. *Shallow geotechnical site investigations are required on all individual lots, at building consent stage, to confirm ground bearing capacity and the appropriate foundation design. The recommended density and type of shallow geotechnical testing is defined in NZS 3604:2011.*

II. *Where areas have been categorised as TC2 or an area requiring ground improvement, foundation systems will require specific engineer design, construction observation and certification by a suitably qualified and experienced Chartered Professional Engineer (CPEng),.*

III. *Ground improvement will need to be implemented during the civil construction to ensure TC2 style land performance is achieved, as illustrated upon Figure 14 of the Geotechnical report. This shall consist of a minimum of 600 mm of engineered fill placed in accordance with NZS 4431:1989.*

IV. *Once the realigned Horners Drain has been confirmed, lateral spread analysis should be undertaken and mitigation measures implemented as necessary along the western limits of the site. At present a 100 metre "buffer zone" has been illustrated upon Figure 14 as means of visual representation of Horners Drain.*

V. *Lot 2 and Lot 3 DP 25296 (titles: CB37C/1043 and CB37C/1044), may be subjected to lateral spreading in future large earthquakes. Additional assessment is required to provide suitable lateral spreading mitigation measures. Appropriate ground improvement will be subject to detailed engineering design, observation and certification.*

10.0 Conclusion

It is proposed that the underlying the parcels of land comprising Lot 2 and Lot 3 DP 25296, Lot 2 and Lot 3 DP 24826, Lot 1, Lot 3, Lot 4, Lot 5, Lot 6 DP 23089 and Lot 2 DP 301363 (held under titles: CB37C/1043, CB37C/1044, CB19B/557, CB4A/784, CB15B/1494, CB6A/114, CB4B/247, CB2A/1469, CB4A/99 and 5293) be subdivided into 392 lots over 37.74 hectares (Ha), and will be known as the proposed Oakbridge Subdivision, Redwood, Christchurch.

The site contains a mix of lifestyle residential blocks, orchards and arable farmland. The Listed Land Use Register (LLUR) website indicates that the regional council does have information regarding Hazardous Activities or Industries (as defined on the HAIL list): An environmental Detail Site Investigation (DSI) is currently being conducted and should be read in conjunction with this report.

The site is not currently within a Christchurch City Plan Flood Management Area (FMA), nor is it within the proposed Stage 3 District Plan Floor Level and Fill Management Area (FLFMA). Compliance with either CCC interim floor levels or Clause E1 of the NZ Building Code are required, whichever is appropriate. The suitable levels should be confirmed with CCC at building consent stage.

The geotechnical site investigations consisting the following:

- Forty five Dynamic Cone Penetrometers
- Forty three mechanically excavated test pits
- Two hand augers
- Sixty Two Cone Penetration Tests.

The geological testing revealed that the south west is dominated by silt and sand, with denser granular (gravel) deposits within the central area of the site. The gravel deposits are incised by silt and sand which gradually grades to fine grained sediment comprising clay and peat, towards the north east.

The liquefaction assessment of the CPT data indicates a technical category of TC1 and TC2 has been achieved over much of the proposed subdivision, with some areas requiring ground improvement technics to ensure TC2 has been achieved. The creation of a minimum 600 mm geogrid reinforced densified raft, compacted to NZS4431:1989 will provide the sufficient seismic resilience to allow the design and build of TC2 style foundations.

The south west corner of the subdivision has been defined, and delineated as not achieving TC2 design criteria with regards to the liquefaction potential of the underlying soils; it is understood that this area is to be utilised as a stormwater retention pond, and not be used residential occupation. However the creation of the pond will create a “free edge” and as a result it is recommended that the

surrounding lots be underlain by a minimum 600 mm, geogrid reinforced well graded gravel raft. This will reduce the effects of lateral movement during future large earthquakes to an acceptable TC2 standard.

The site as a whole can be zoned a combination LRZ2 (yellow) and LRZ3 (green) based on analysis of the geotechnical data, therefore the use of PVC–u is deemed appropriate to be used within the design of the water supply network. A gravity wastewater system is deemed appropriate based on the aforementioned zones, although a pressurised sewer system is still a viable option. Civil design and construction must comply with the current CCC Construction Standard Specifications (CSS).

Based on the shallow Dynamic Cone Penetrometer (DCP) results, the calculated Californian Bearing Ratios (CBR's) range from 4 to 10; it is recommended that the CBRs be confirmed onsite at the time of construction and pavement designed appropriately.

NZS3604:2011 foundations are suitable for areas designated as TC1, subject to lot specific testing and verification of "Good Ground".

TC2 style foundations Option 2 or Option 4 as outlined in MBIE 2012, or similar proprietary TC2 foundation system, will be appropriate for construction on the areas defined as TC2 however will required specific engineering design. These style foundations are deemed appropriate also within areas that have been remediated by ground improvement techniques during construction of the subdivision.

Earthworks and modifications to the land surface are planned a part of the site development and ground improvement techniques may be implemented during the civil construction to ensure TC2 style land performance is achieved within areas requiring it.

The area north of Selkirk Place requires additional assessment, to determine mitigation measures; typically the proposed measures could include excavation and replace the existing soil, a gravel reinforced buttress, rammed aggregate piers or stone columns to improve the grounds' resilience to lateral movement. These options will be subject to specific engineer design.

With regards to Section 106 of the RMA, it is determined that the site is suitable for residential subdivision and construction (not to be construed as a guarantee) provided recommendations within this report are followed.

Appendix A

Geotechnical Site Plan

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contractor to locate all existing services & verify all dimensions before commencing work

The Cone Penetration Tests (CPTs) were carried out by McNeill Drilling during 11/2016,01/2017 and 04/2017. CPT 76005 - 76011 were carried out by Geotechnics (03/2016) and obtained from the New Zealand Geotechnical Database. The Test Pits and Hand Augers (HA) were undertaken during 12/2016, 01/2017, and 05/2017.

Test locations are surveyed.
Aerial image obtained from LINZ.
Boundaries are taken from Quickmap.
Cross Section A' - B' Shown on site plan G05A.

0m 50m 100m 150m 200m 250m 300m
Scale 1:3000

issue	date	reason	approved
A	05/17	Geotechnical Report Diagram	JLP

CAD ref: 161123.KT.Site Plan A.dwg

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Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Site Testing

design	drawn	QA check	dwg	issue
DW	KT	JLP	G01	A
scale @ A3	date	file		
1:3000	05/17	34300		

Appendix B

Shallow Geotechnical Test Results

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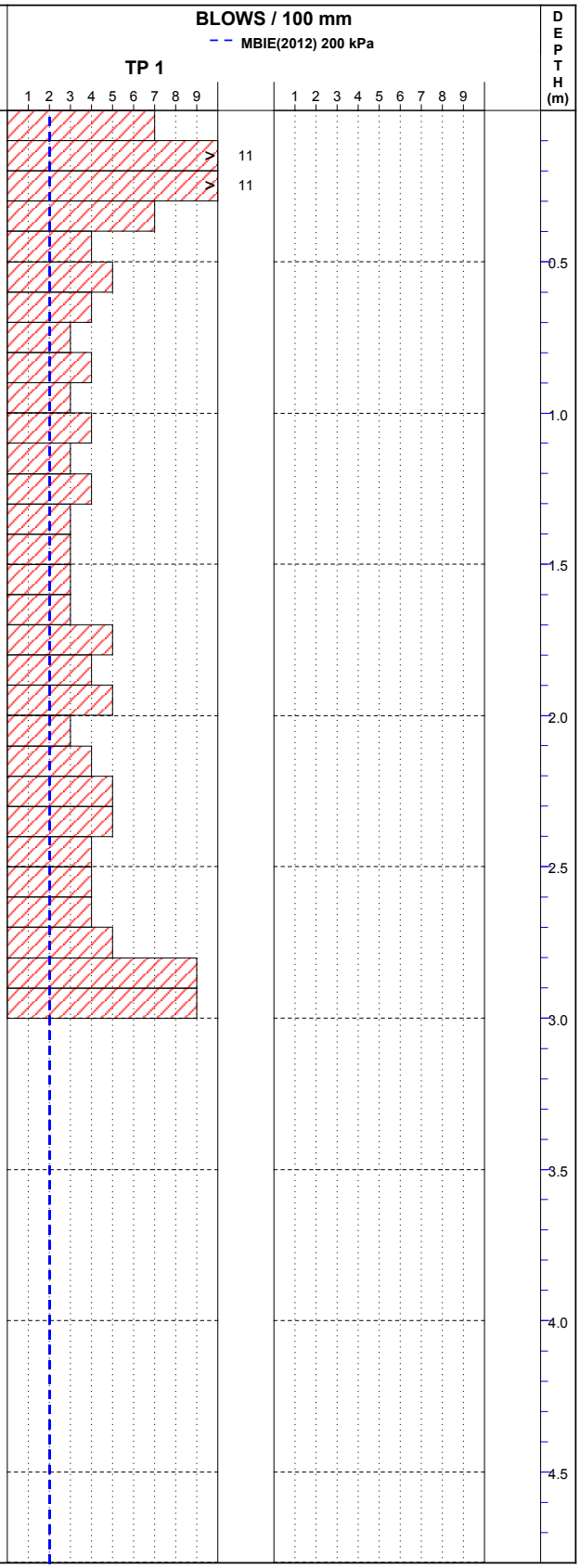
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 1**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	11:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 1	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS		
0.5	Fine sandy SILT; grey mottled orangey brown. Firm to sitff, dry, low plasticity, iron oxide staining. [1.40m]	ML		Groundwater Not Encountered
1.0				
1.5				
2.0	SILT with some fine sand; grey mottled orangey brown. Firm to stiff, wet, low plasticity, iron oxide staining. [0.50m]	ML		
2.5	Fine SAND; greyish brown. Medium dense, wet, iron oxide staining. [0.40m]	SP		
3.0	Silty fine SAND; grey mottled orangey brown. Medium dense to dense, wet, iron oxide staining in bands. [0.30m]	SM		
3.5	Fine sandy SILT; grey mottled orangey brown. Wet, low plasticity, iron oxide staining. [0.20m]	ML		
4.0	Silty fine SAND; bluish grey. Wet to saturated, organic odour, decomposed rootlets and twigs. [0.40m] Test Pit terminated at 3.60m - Target depth achieved.	SM		
4.5				



Logged By:	KT+BP	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Produced with Core-GS by Geroc

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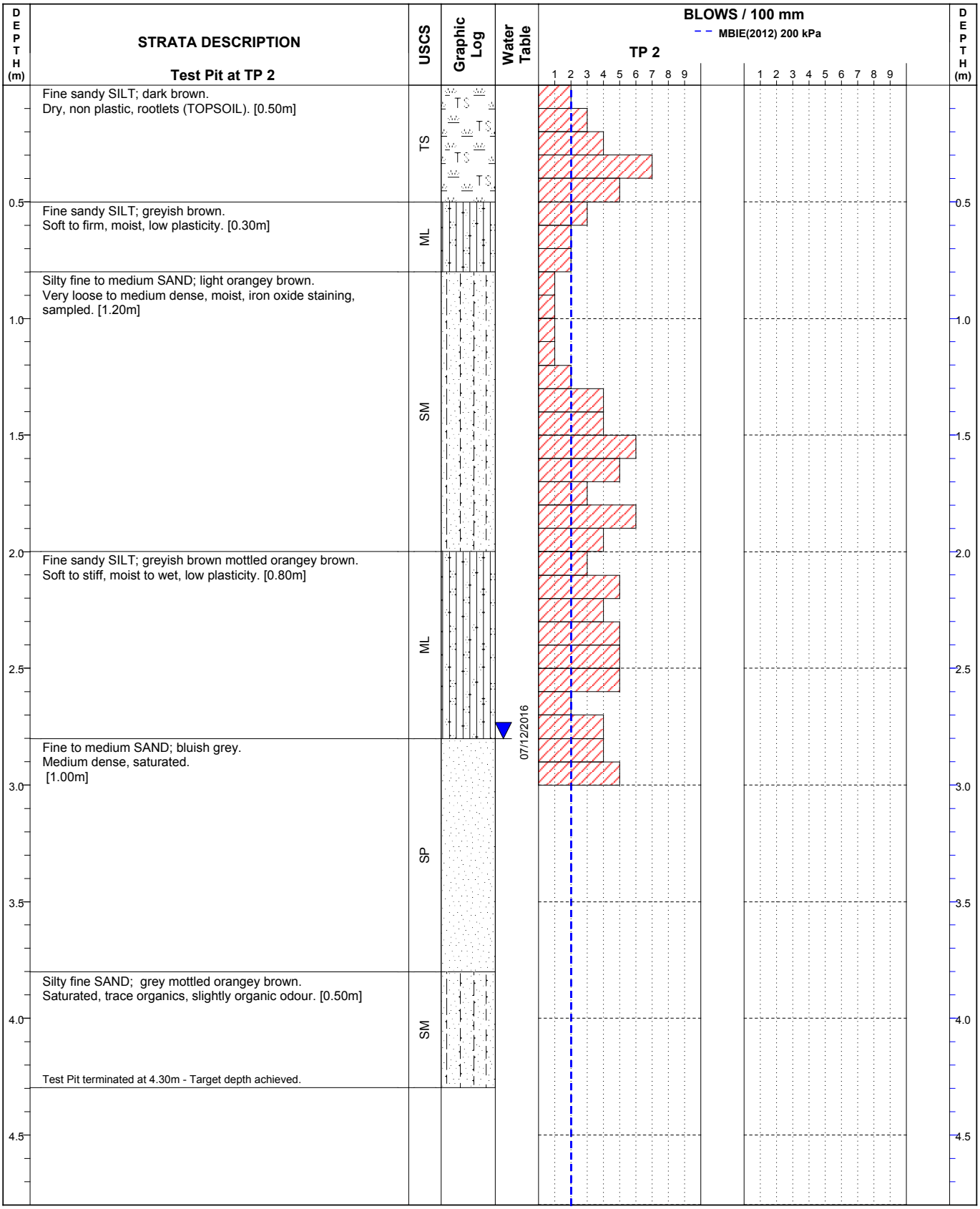
Job Nº / **34300**
Test Nº / **TP 2**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	No water ingress, standing 20 min. Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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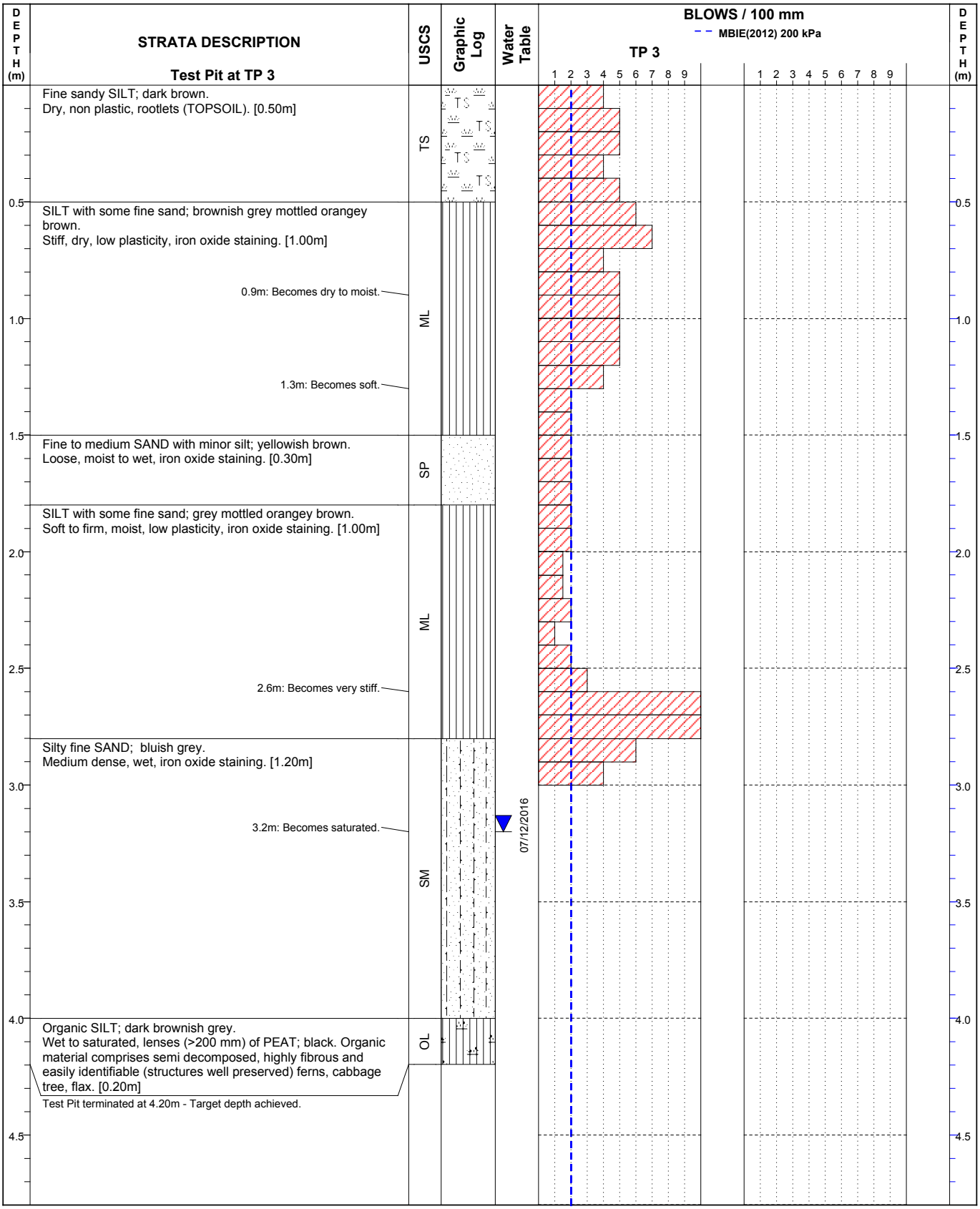
Job Nº / **34300**
Test Nº / **TP 3**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Hole standing for 30 min, no water ingress. Excavation stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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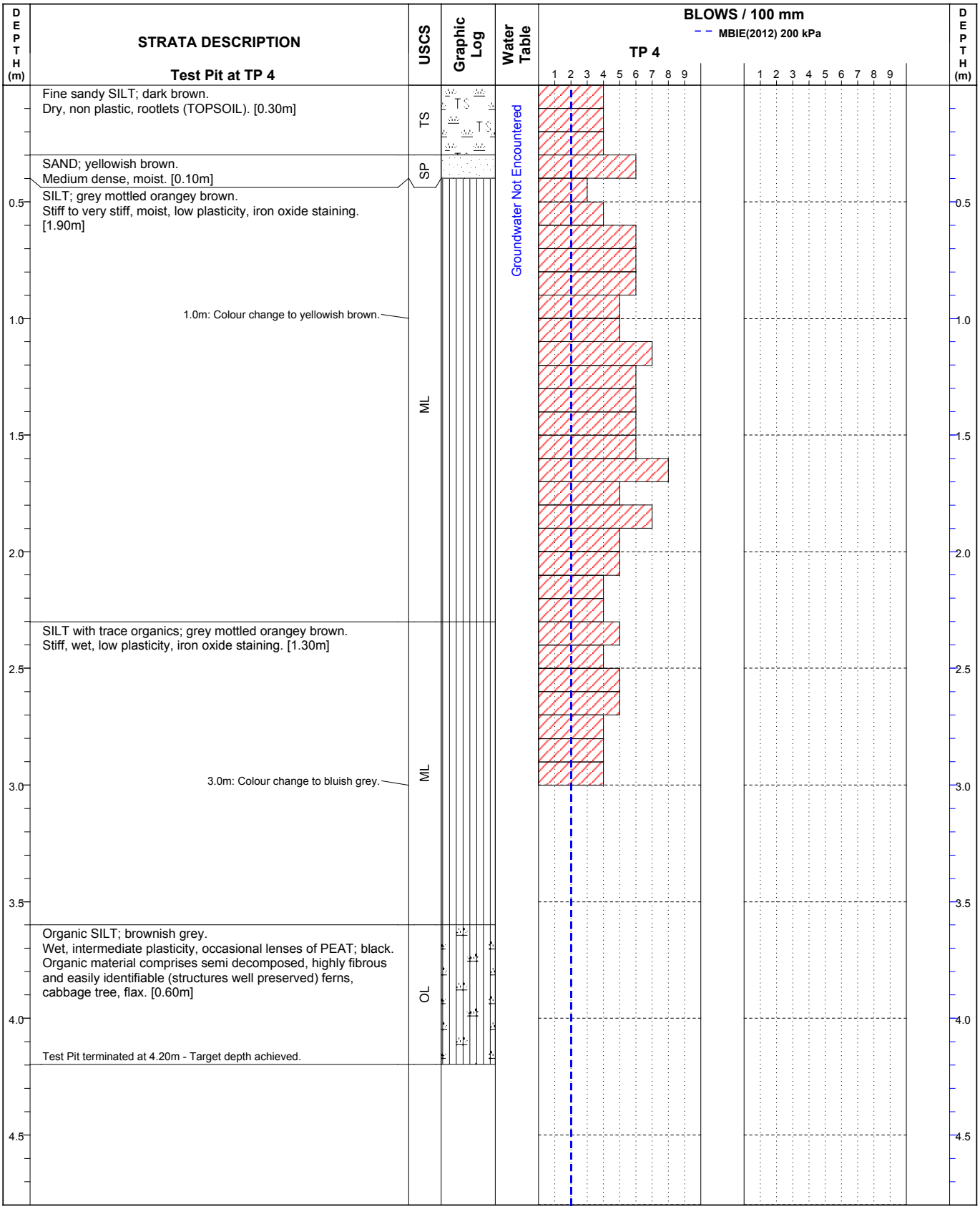
Job Nº / **34300**
Test Nº / **TP 4**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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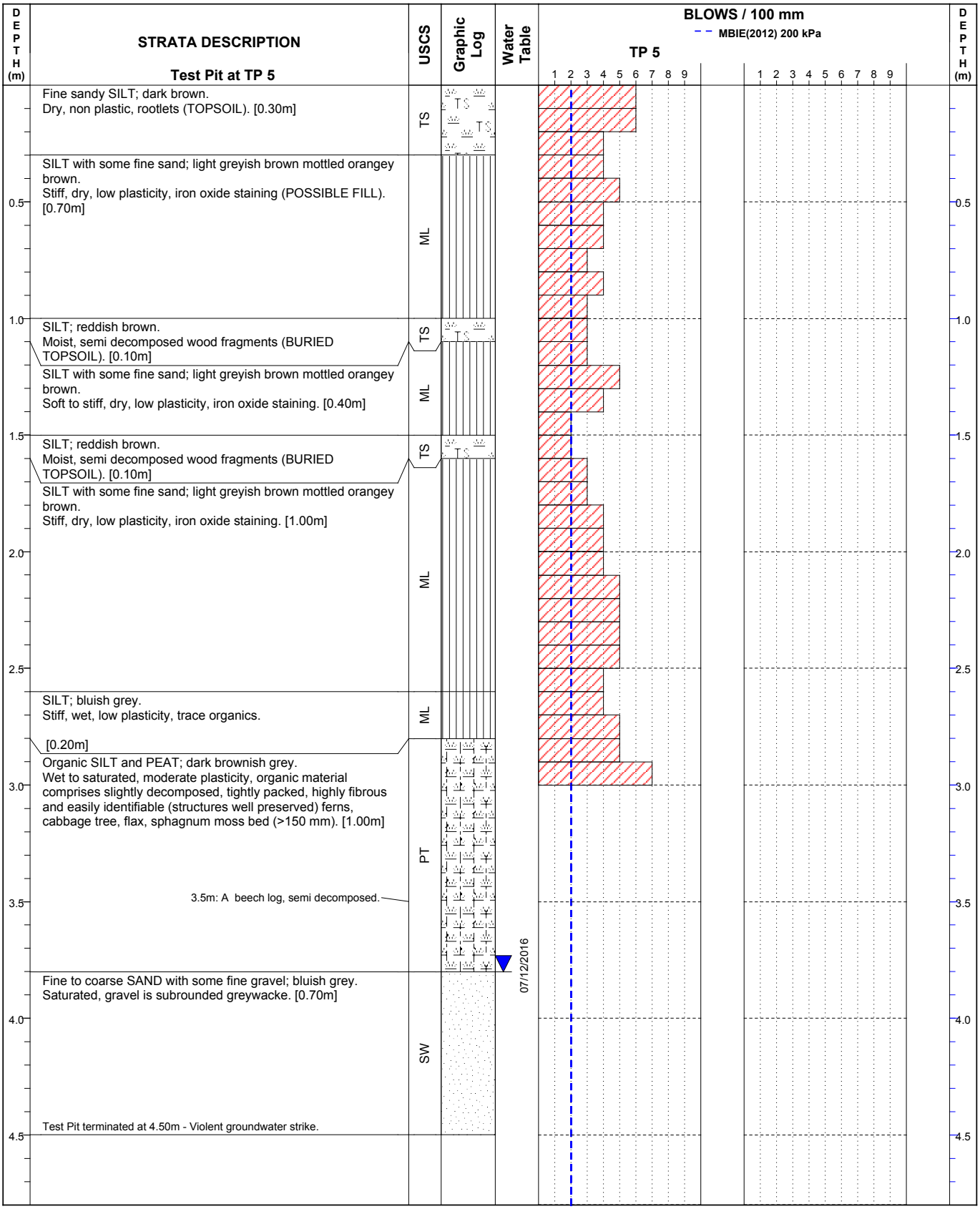
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 5**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Sidewalls stable, positive groundwater pressure, rapid backfill.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

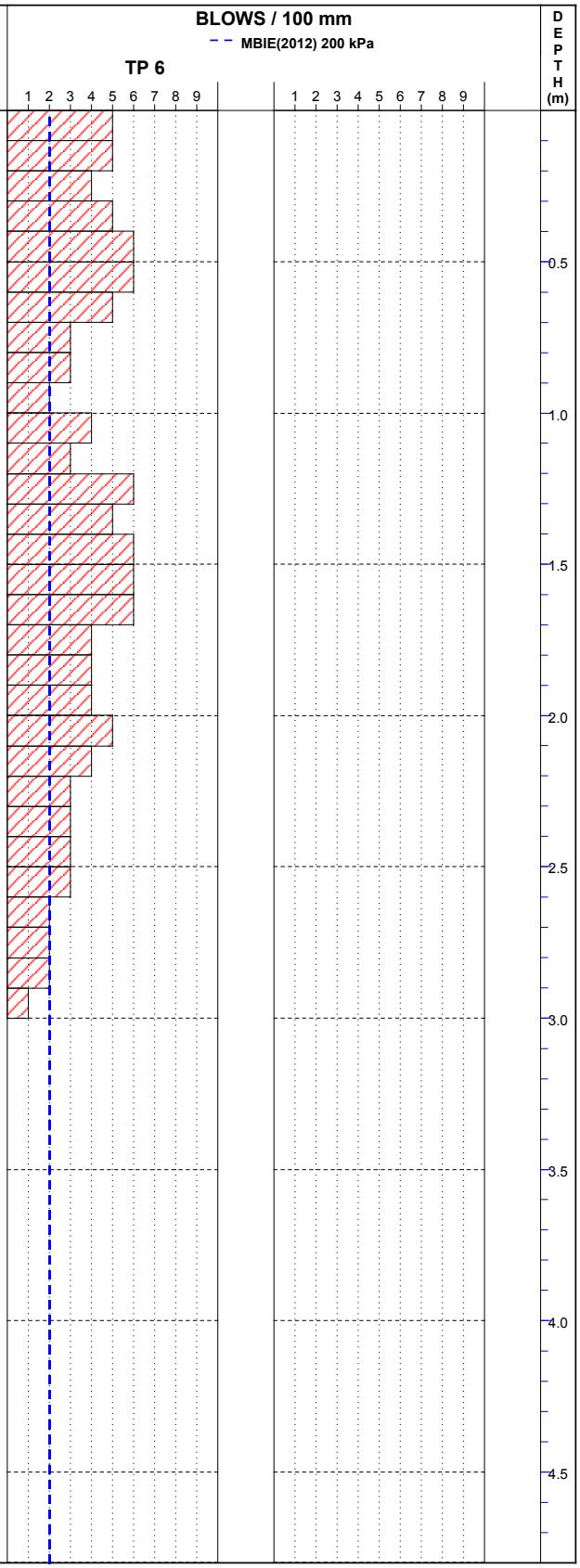
Job Nº / **34300**
Test Nº / **TP 6**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 6	USCS
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.60m]	TS
0.5		
0.6	SILT with some fine sand; light greyish brown mottled orangey brown. Soft to stiff, dry, low plasticity, iron oxide staining (POSSIBLE FILL). [0.50m]	ML
1.0		
1.1	SILT; reddish brown. Moist, semi decomposed wood fragments (BURIED TOPSOIL). [0.10m]	TS
1.2	SILT with some fine sand; light greyish brown mottled orangey brown. Stiff, dry, low plasticity, iron oxide staining. [1.10m]	ML
1.5		
2.0		
2.3	SILT some fine sand; bluish grey. Soft to firm, wet, low to intermediate plasticity, trace organics consisting of rootlets. [0.70m]	ML
2.5		
3.0		
3.0	Organic SILT; dark brownish grey. Wet to saturated, lenses (>200 mm) of PEAT; black. Organic material comprises semi decomposed, highly fibrous and easily identifiable (structures well preserved) ferns, cabbage tree, flax. [1.00m]	OL
3.5		
4.0	Test Pit terminated at 4.00m - Target depth achieved.	
4.5		

Graphic Log

Water Table: Groundwater Not Encountered



Logged By:	KT+BP	**Notes:**	Side walls stable throughout excavation.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Produced with Core-GS by Geroc

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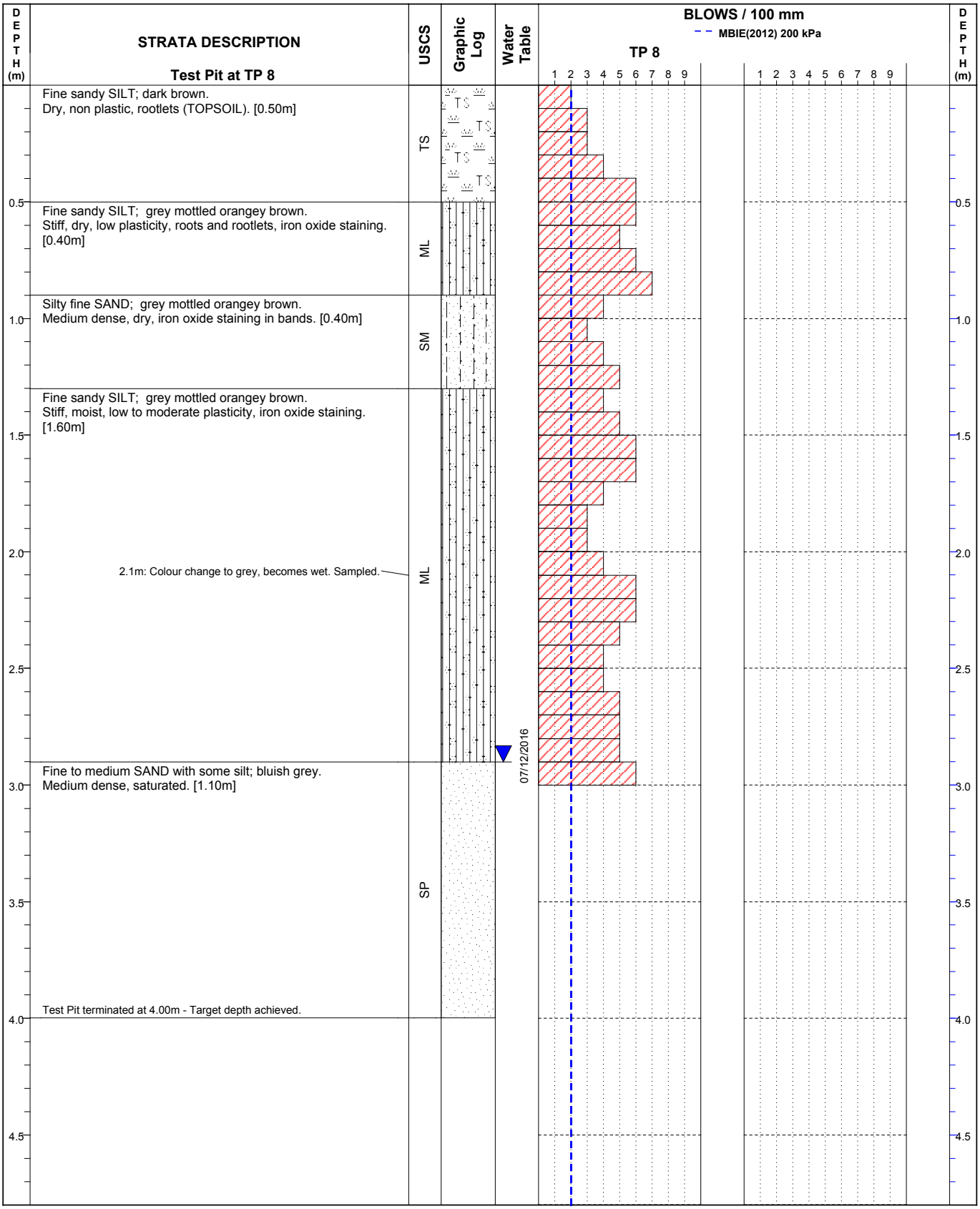
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 8**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Side walls stable throughout excavation.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 9**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 9	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT with trace fine gravel; dark brown. Dry, non plastic, rootlets, gravel is subrounded to rounded greywacke, containing wood and rusty nails (TOPSOIL/FILL). [0.60m]	TS		
0.5				
	SILT with some fine sand; grey mottled orangey brown. Stiff, moist, low plasticity, iron oxide staining. [0.30m]	ML		
1.0	Silty fine SAND; grey mottled orangey brown. Medium dense, moist, iron oxide staining in bands. [0.20m]	SM		
	SILT with some fine sand; grey mottled orangey brown. Stiff, moist, low plasticity, iron oxide staining. [0.50m]	ML		
1.5				
	Fine SAND with minor silt; grey mottled orangey brown. Medium dense to dense, moist to wet, iron oxide staining. [1.60m]	SP		
2.0				
2.5	2.6m: Colour change to bluish grey. Becomes saturated.			07/12/2016
3.0	Test Pit terminated at 3.20m - Target depth achieved.			
3.5				
4.0				
4.5				

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 9
1 2 3 4 5 6 7 8 9 | 1 2 3 4 5 6 7 8 9
13

Logged By:	KT+BP	**Notes:**	Side walls stable throughout excavation.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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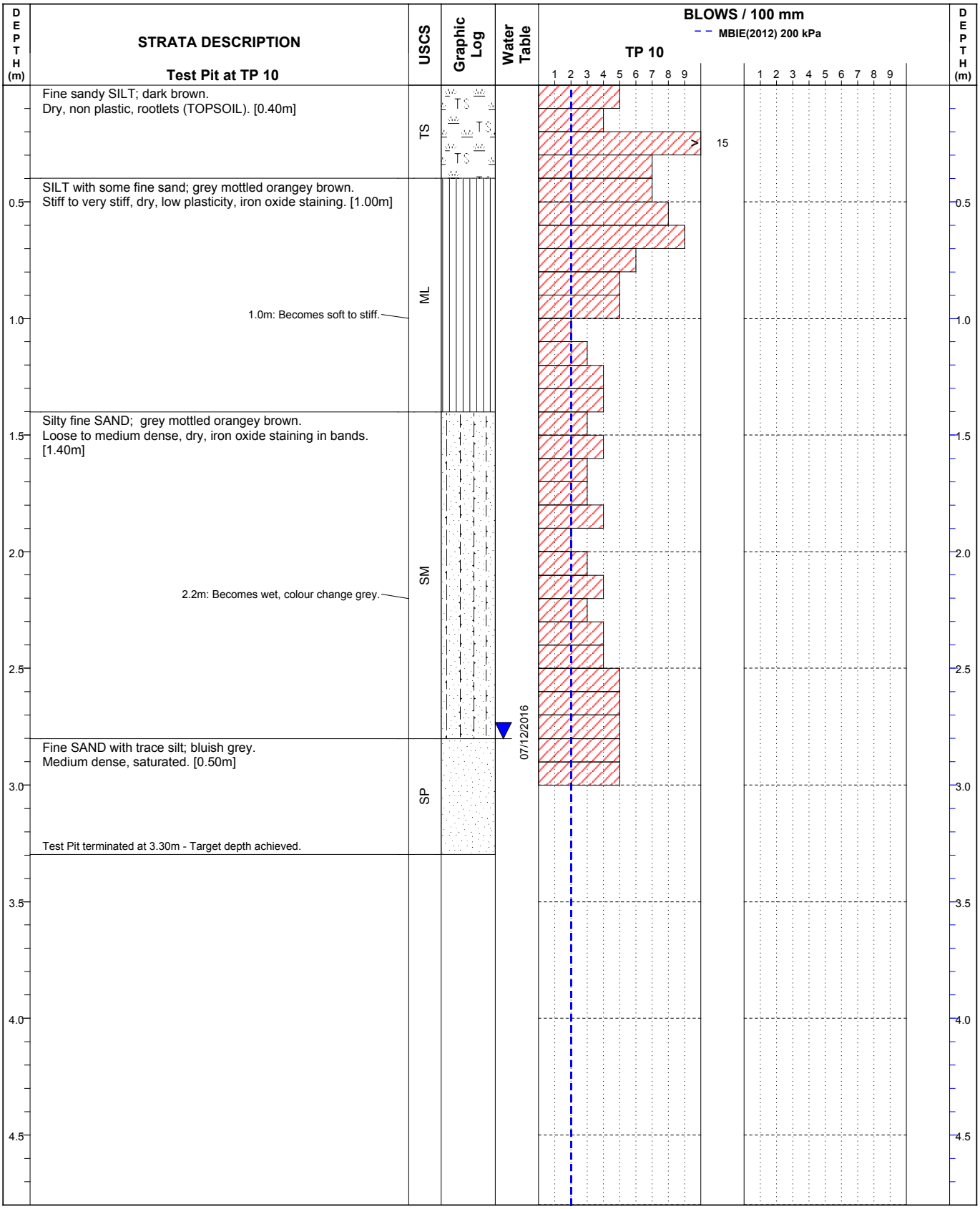
Job Nº / **34300**
Test Nº / **TP 10**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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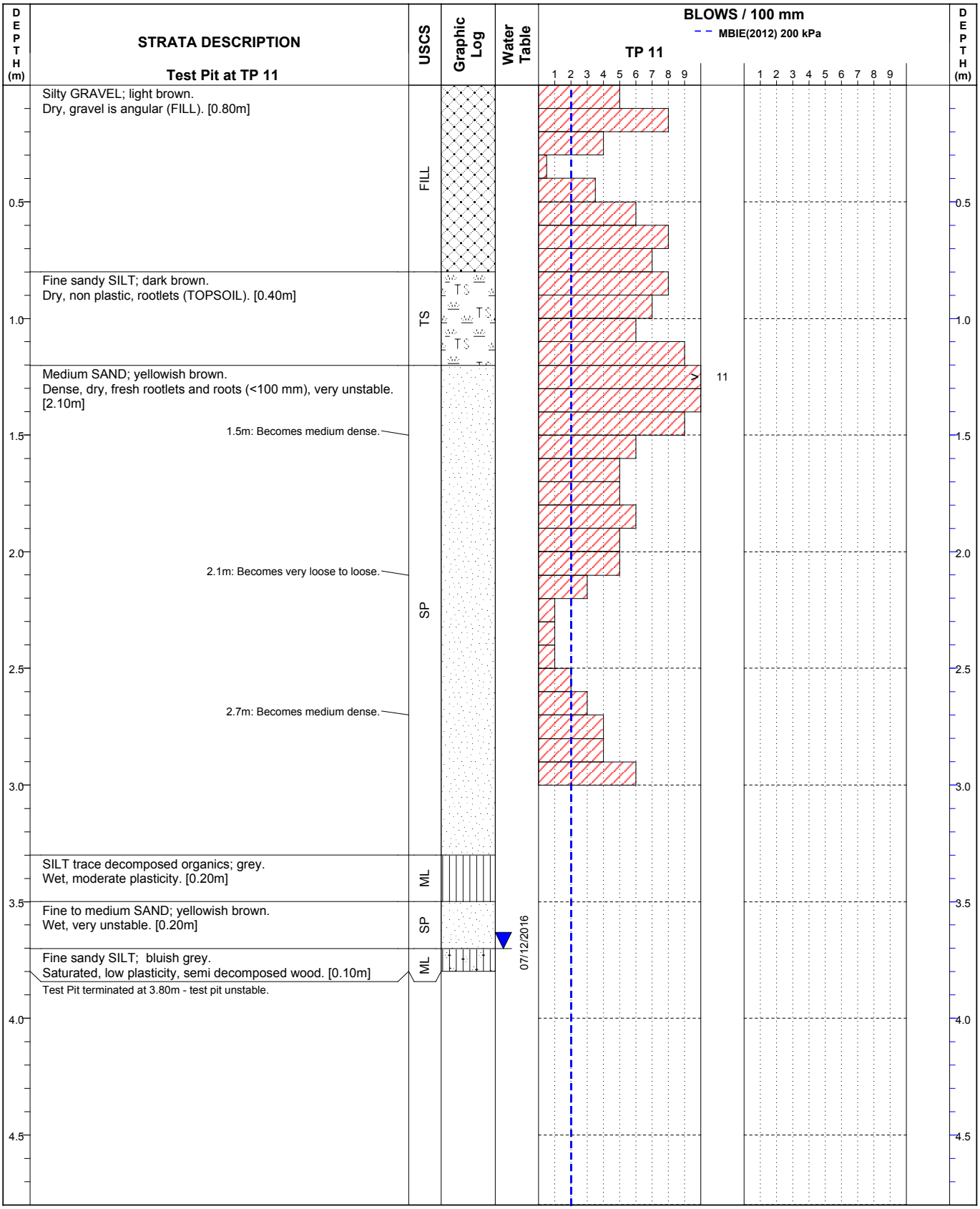
Job Nº / **34300**
Test Nº / **TP 11**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Unstable sidewalls 1.0 - 2.5 m.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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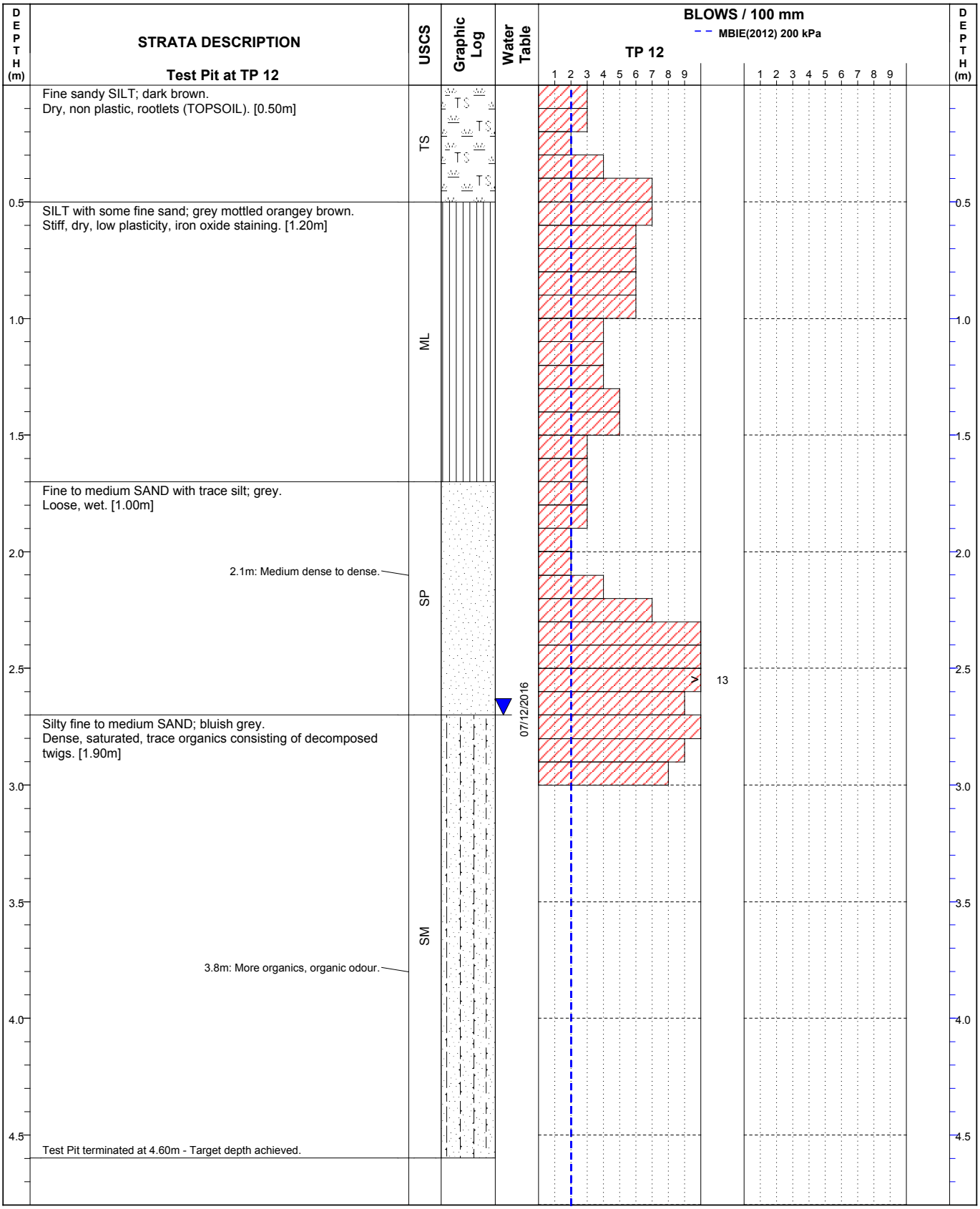
Job Nº / **34300**
Test Nº / **TP 12**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	GW strike at 4.5 m. Steady infilling to 4.1 m after 5 min.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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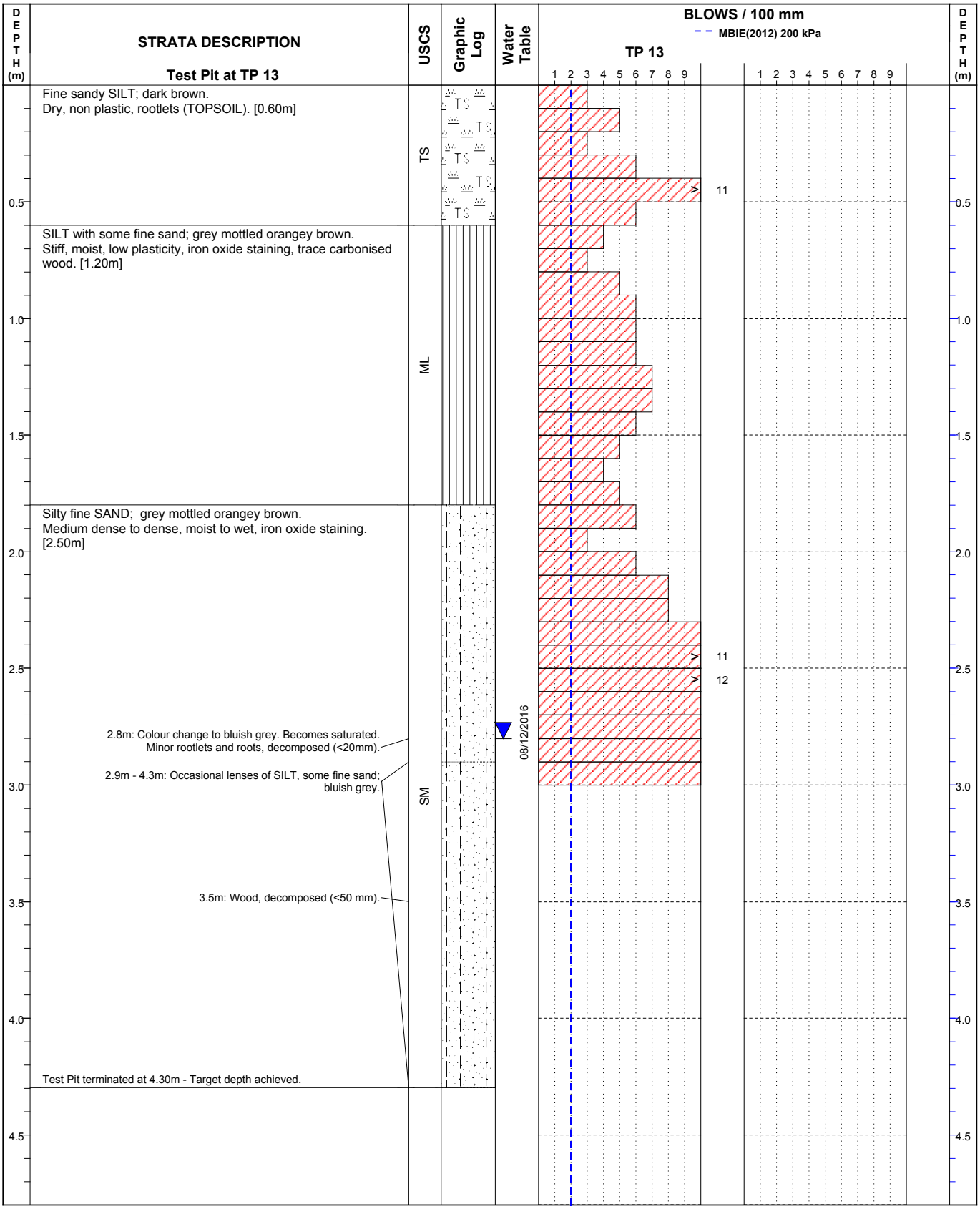
Job Nº / **34300**
Test Nº / **TP 13**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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Job Nº / **34300**
Test Nº / **TP 14**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 14	USCS	Graphic Log
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS	
0.5	SILT; light brown. Soft to stiff, dry, low plasticity, rootlets. [1.10m]	ML	
1.0			
1.5	SILT with some fine sand; grey mottled orangey brown. Firm to very stiff, moist, low plasticity, iron oxide staining. [0.80m]	ML	
2.0			
2.5	Silty fine SAND; grey mottled orangey brown. Very loose to dense, wet, remnant organic material, iron oxide staining. [1.20m]	SM	
3.0	3.2m: Becomes saturated.		
3.5	Fine SAND with minor silt; bluish grey. Saturated. [0.40m]	SP	
	Test Pit terminated at 3.80m - Target depth achieved.		
4.0			
4.5			

Water Table: 08/12/2016

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 14
1 2 3 4 5 6 7 8 9

Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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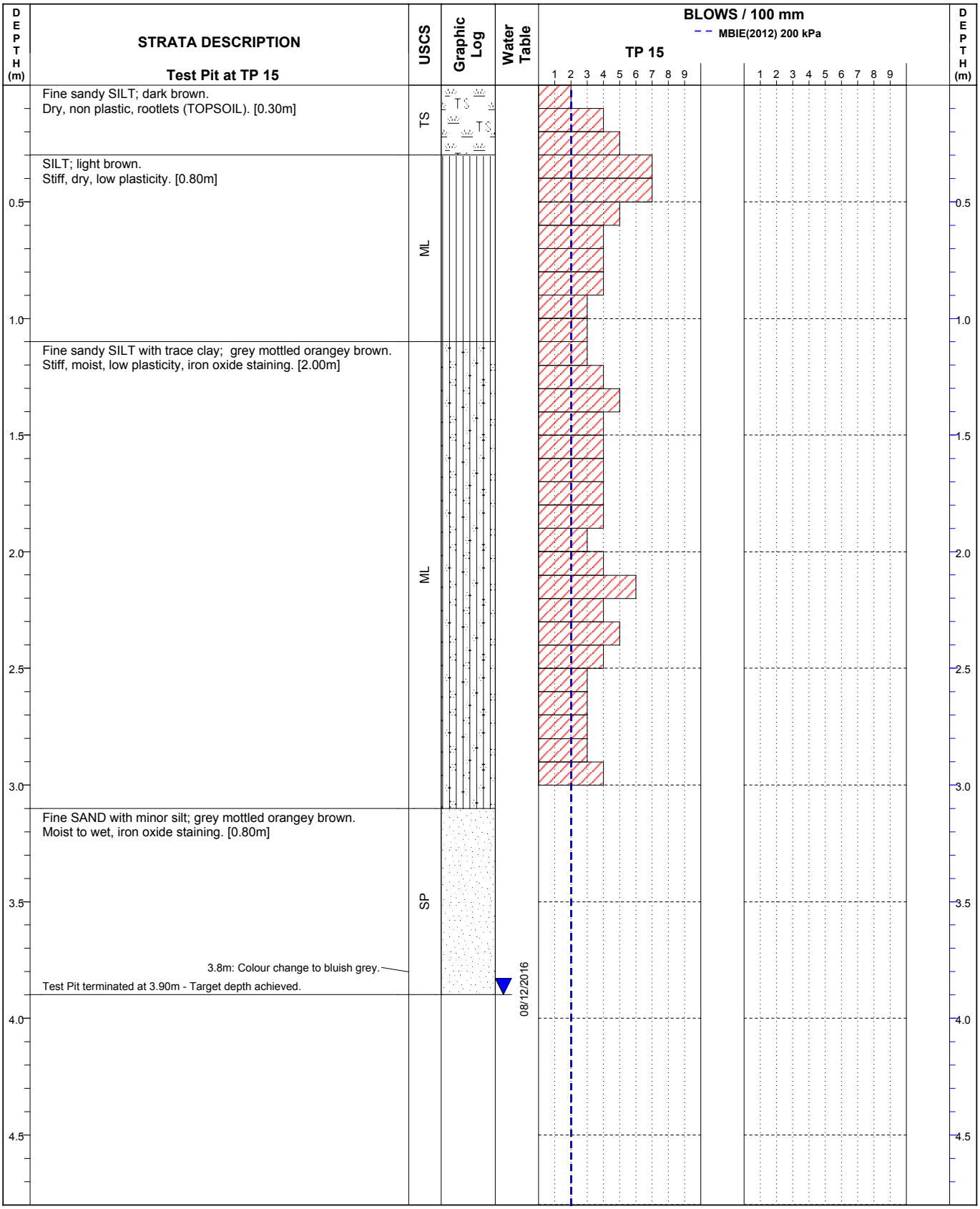
Job Nº / **34300**
Test Nº / **TP 15**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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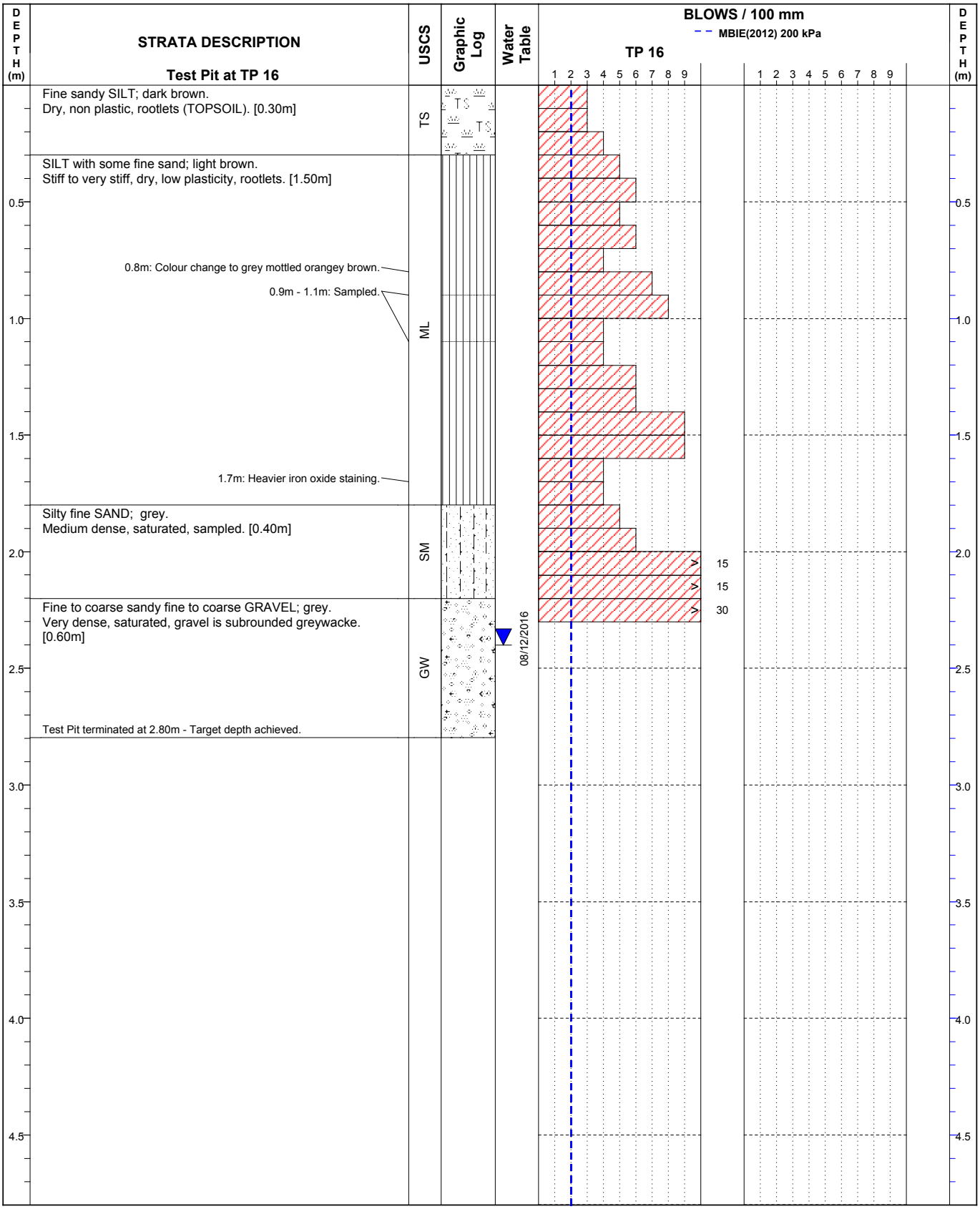
Job Nº / **34300**
Test Nº / **TP 16**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout, groundwater pooling at 2.7 m.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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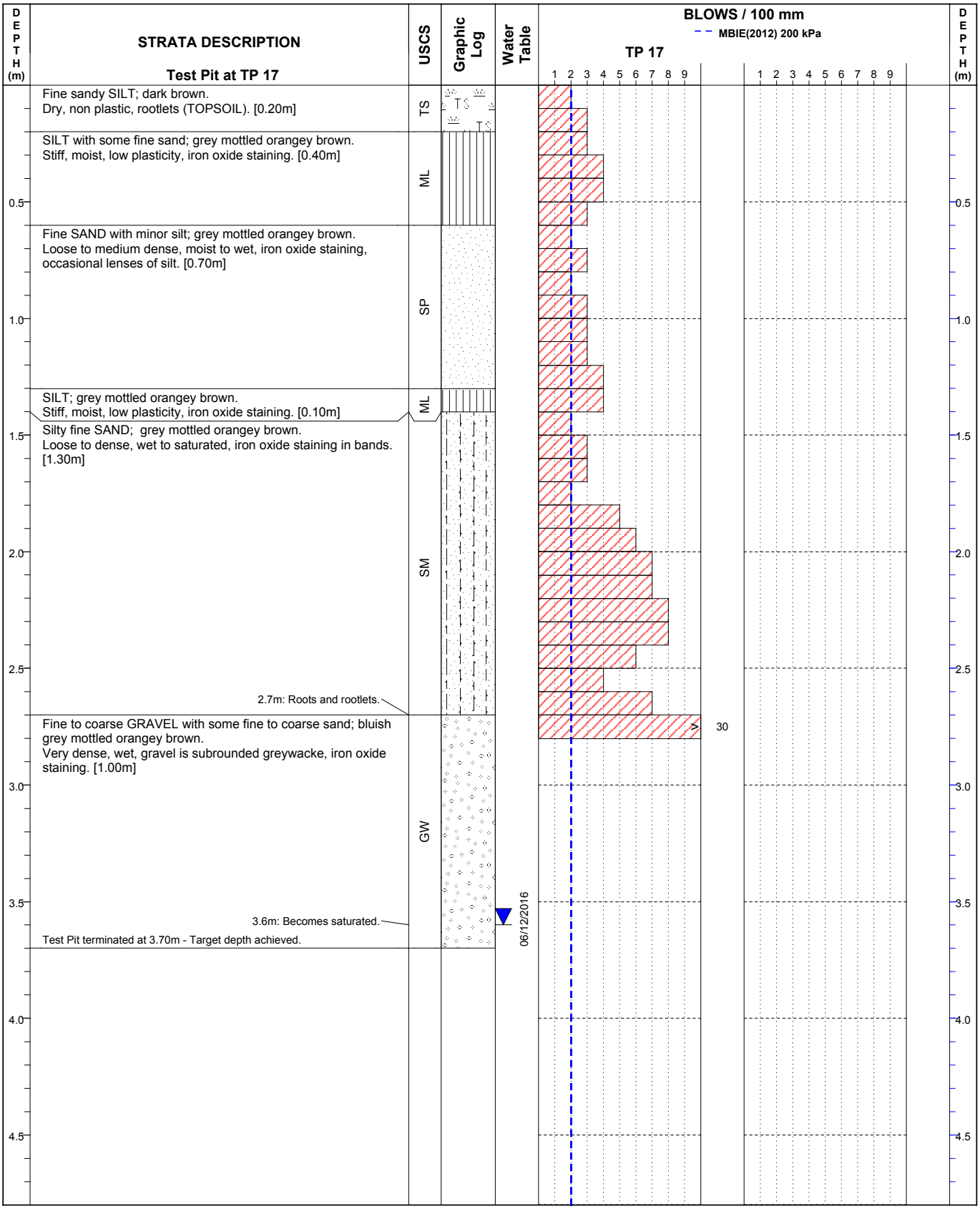
Job Nº / **34300**
Test Nº / **TP 17**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

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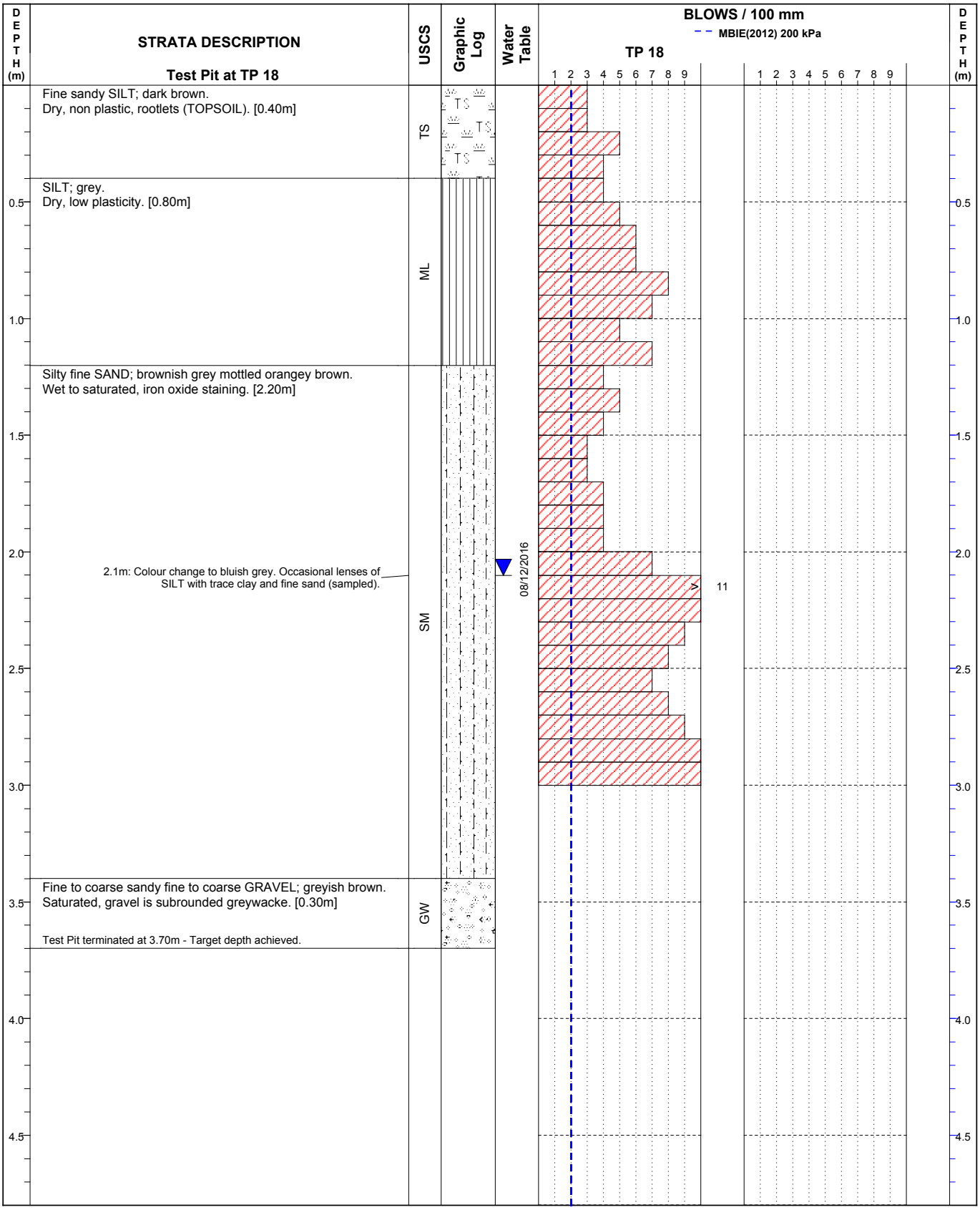
Job Nº / **34300**
Test Nº / **TP 18**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 18	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS		
0.5	SILT; grey. Dry, low plasticity. [0.80m]	ML		
1.0				
1.5	Silty fine SAND; brownish grey mottled orangey brown. Wet to saturated, iron oxide staining. [2.20m]			
2.0	2.1m: Colour change to bluish grey. Occasional lenses of SILT with trace clay and fine sand (sampled).	SM		08/12/2016
2.5				
3.0				
3.5	Fine to coarse sandy fine to coarse GRAVEL; greyish brown. Saturated, gravel is subrounded greywacke. [0.30m] Test Pit terminated at 3.70m - Target depth achieved.	GW		
4.0				
4.5				



Logged By:	KT+MS	**Notes:**	Excavation stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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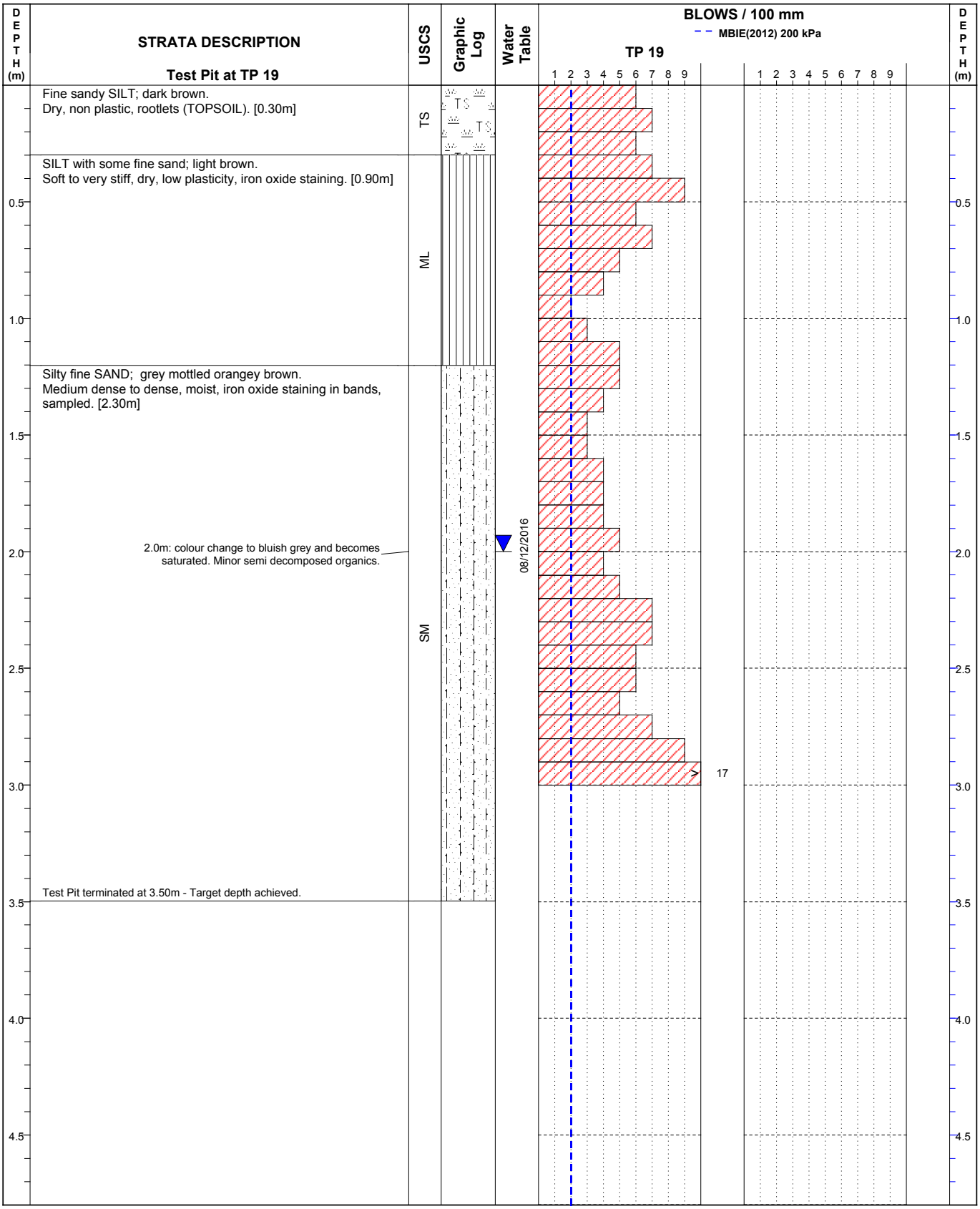
Job Nº / **34300**
Test Nº / **TP 19**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	7:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Excavation stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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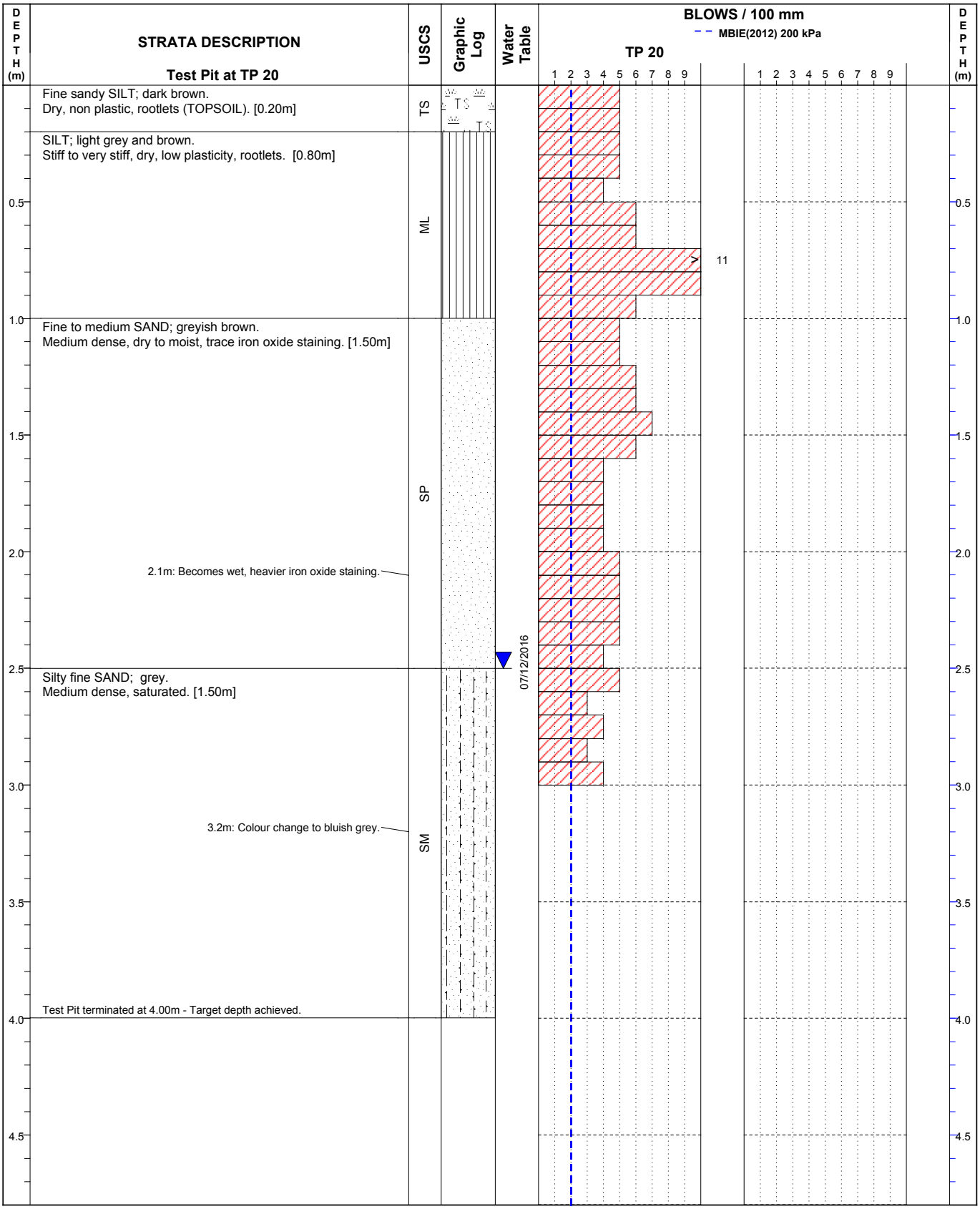
Job Nº / **34300**
Test Nº / **TP 20**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:	MS		

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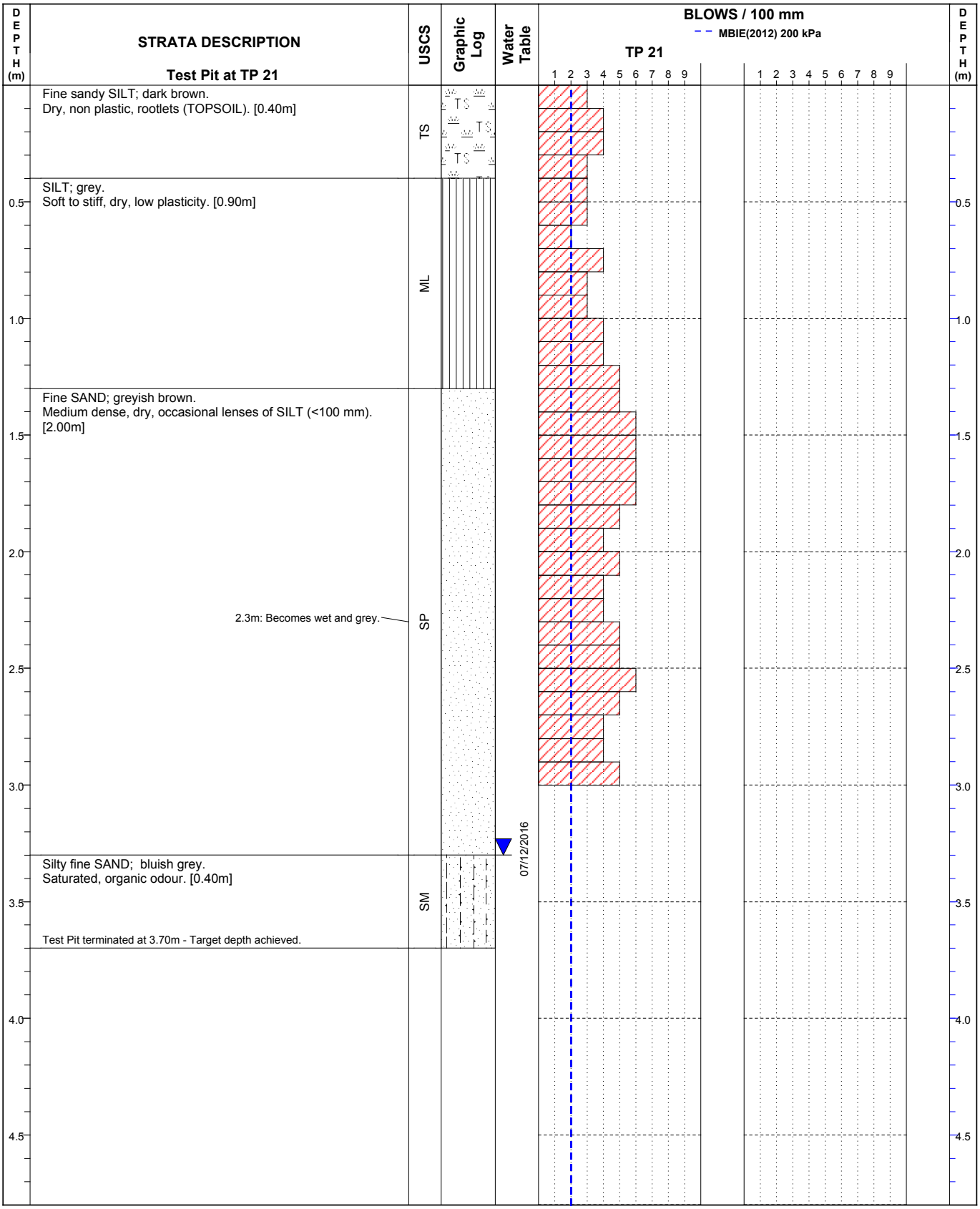
Job Nº / **34300**
Test Nº / **TP 21**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Excavation stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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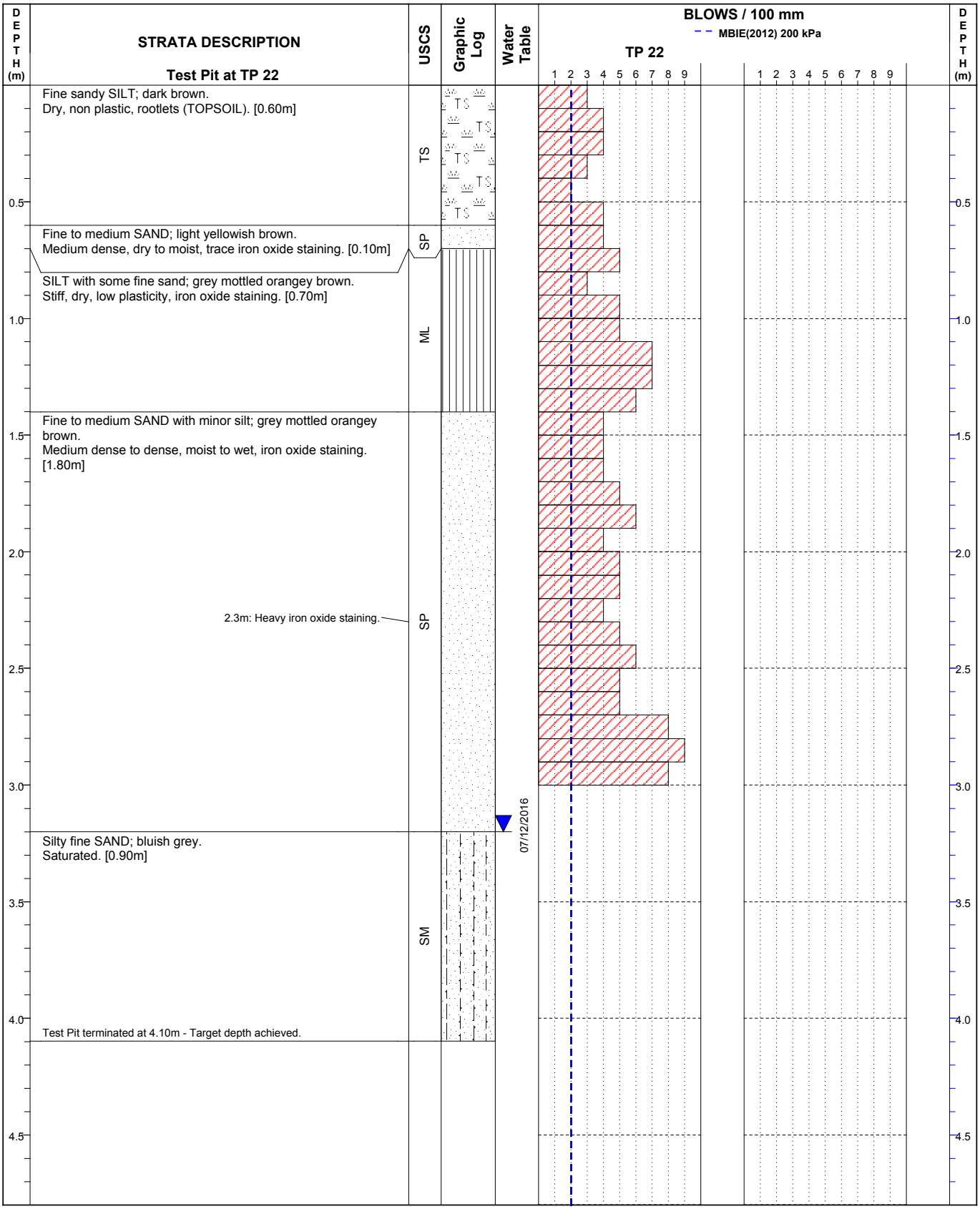
Job Nº / **34300**
Test Nº / **TP 22**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Excavation stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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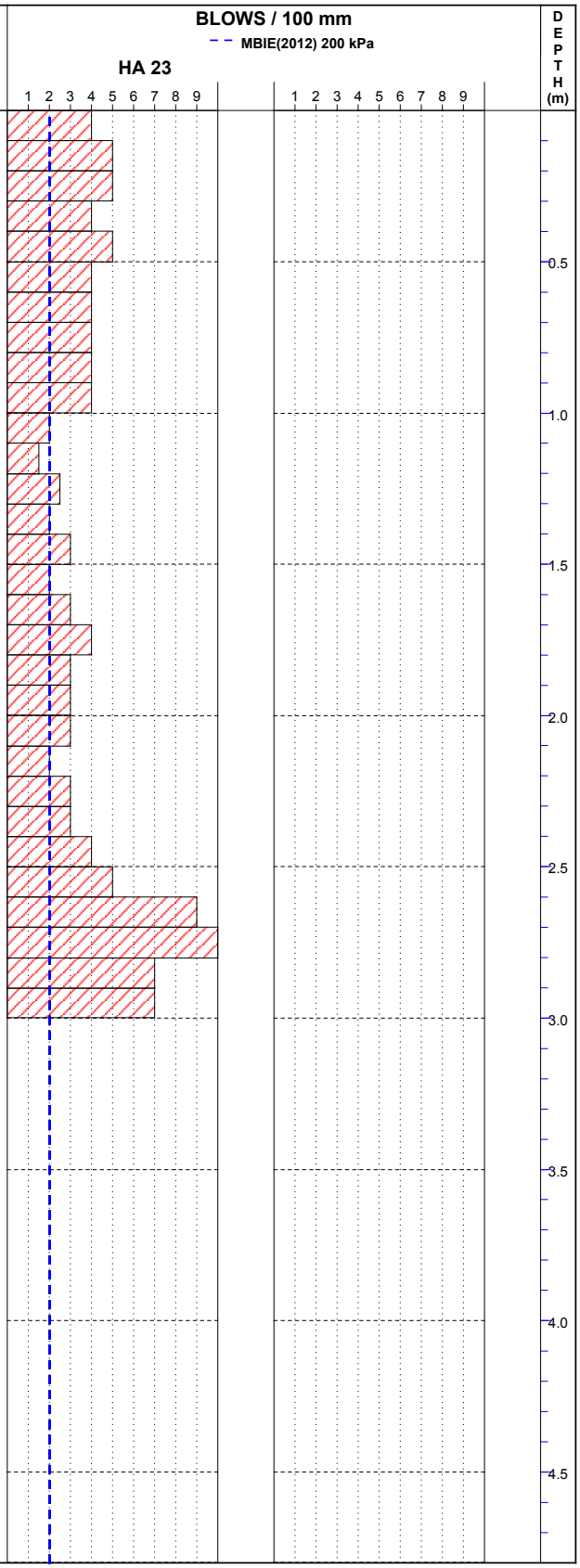
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **HA 23 + HA**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	09/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	8:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	HA

DEPTH (m)	STRATA DESCRIPTION Auger at HA 23	USCS	Graphic Log	Water Table
0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		Groundwater Not Encountered
0.5	Silty fine SAND; grey mottled orangey brown. Medium dense, moist, iron oxide staining in bands. [1.30m]	SM		
1.0	1.0m: Becomes loose.			
1.5	Fine to medium SAND with trace silt; greyish brown. Medium dense, moist, trace iron oxide staining. [0.40m]	SP		
2.0	Fine sandy SILT; grey mottled orangey brown. Firm, moist to wet, low plasticity, iron oxide staining. [0.30m]	ML		
2.5	Slightly organic SILT; greyish brown. Stiff to very stiff, wet, moderate plasticity, organics are amorphous. Poor recovery. [0.70m]	ML		
3.0	Auger terminated at 3.00m - Target depth achieved.			
3.5				
4.0				
4.5				



Logged By:	KT+BP	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:	MS		

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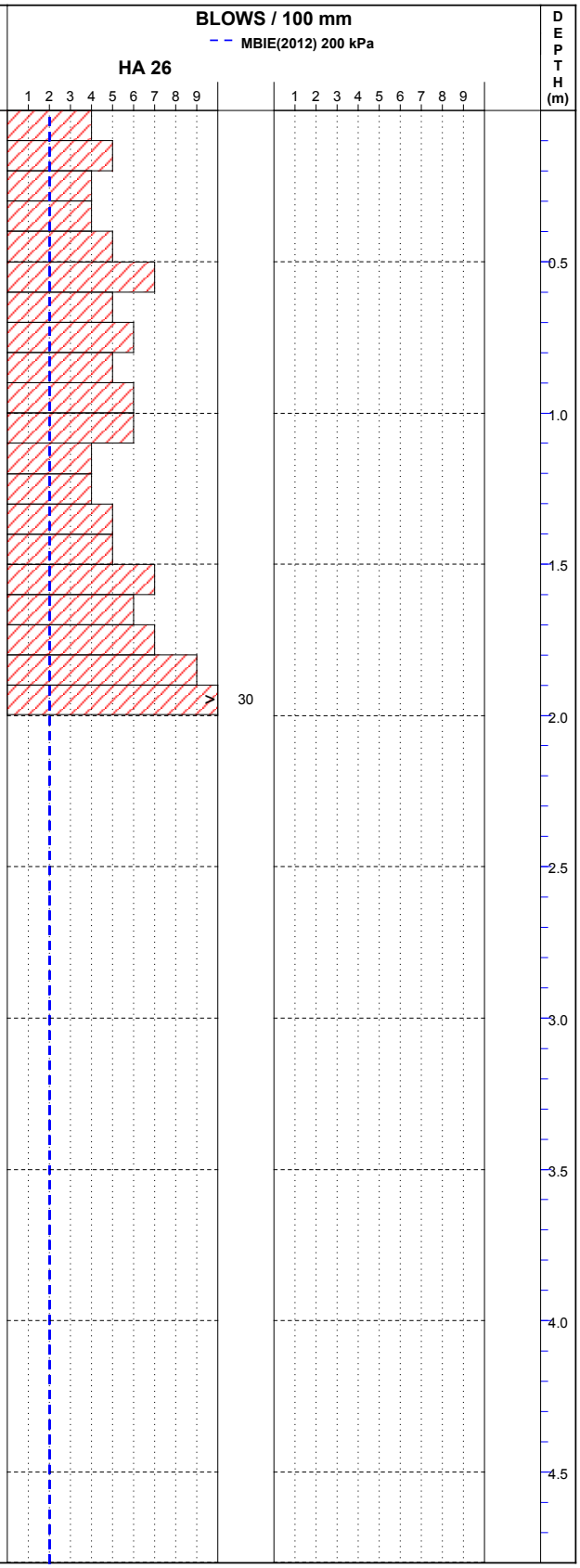
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **HA 26 + HA**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	09/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	9:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	HA

DEPTH (m)	STRATA DESCRIPTION Auger at HA 26	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.50m]	TS		Groundwater Not Encountered
0.5	SILT with some fine sand; grey mottled orangey brown. Stiff, moist, low plasticity, iron oxide staining. [0.40m]	ML		
1.0	Fine to medium SAND trace silt; greyish brown. Medium dense, dry to moist, trace iron oxide staining. [0.30m]	SP		
1.5	Silty fine to medium SAND; grey mottled orangey brown. Medium dense, wet, iron oxide staining in bands. [0.40m]	SM		
1.8	Fine to medium SAND; greyish brown. Medium dense to dense, wet, trace iron oxide staining. [0.30m]	SP		
2.0	Auger terminated at 2.00m - Refusal on gravel.			



Logged By:	KT+BP	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:	MS		

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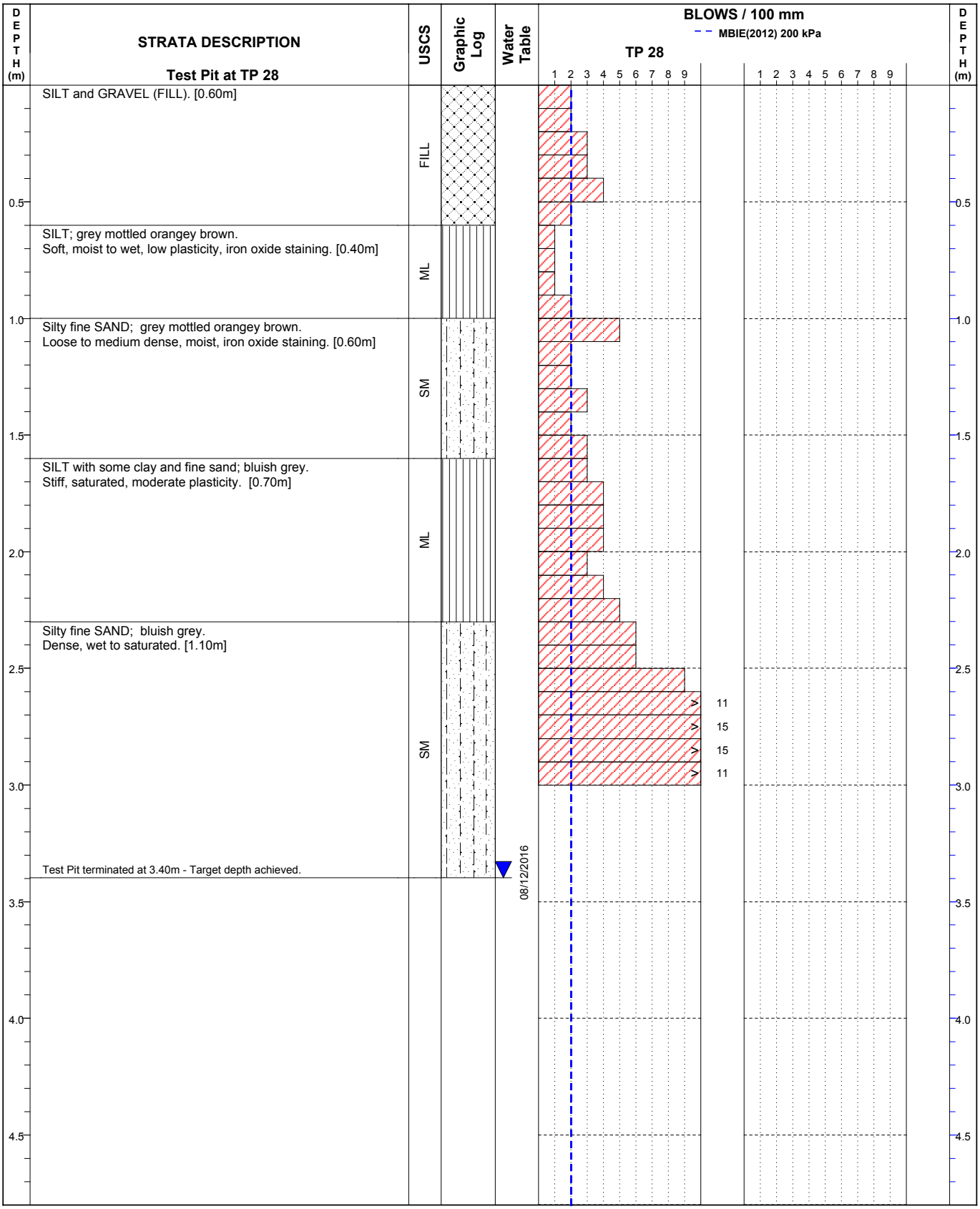
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 28**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	water ingress at base.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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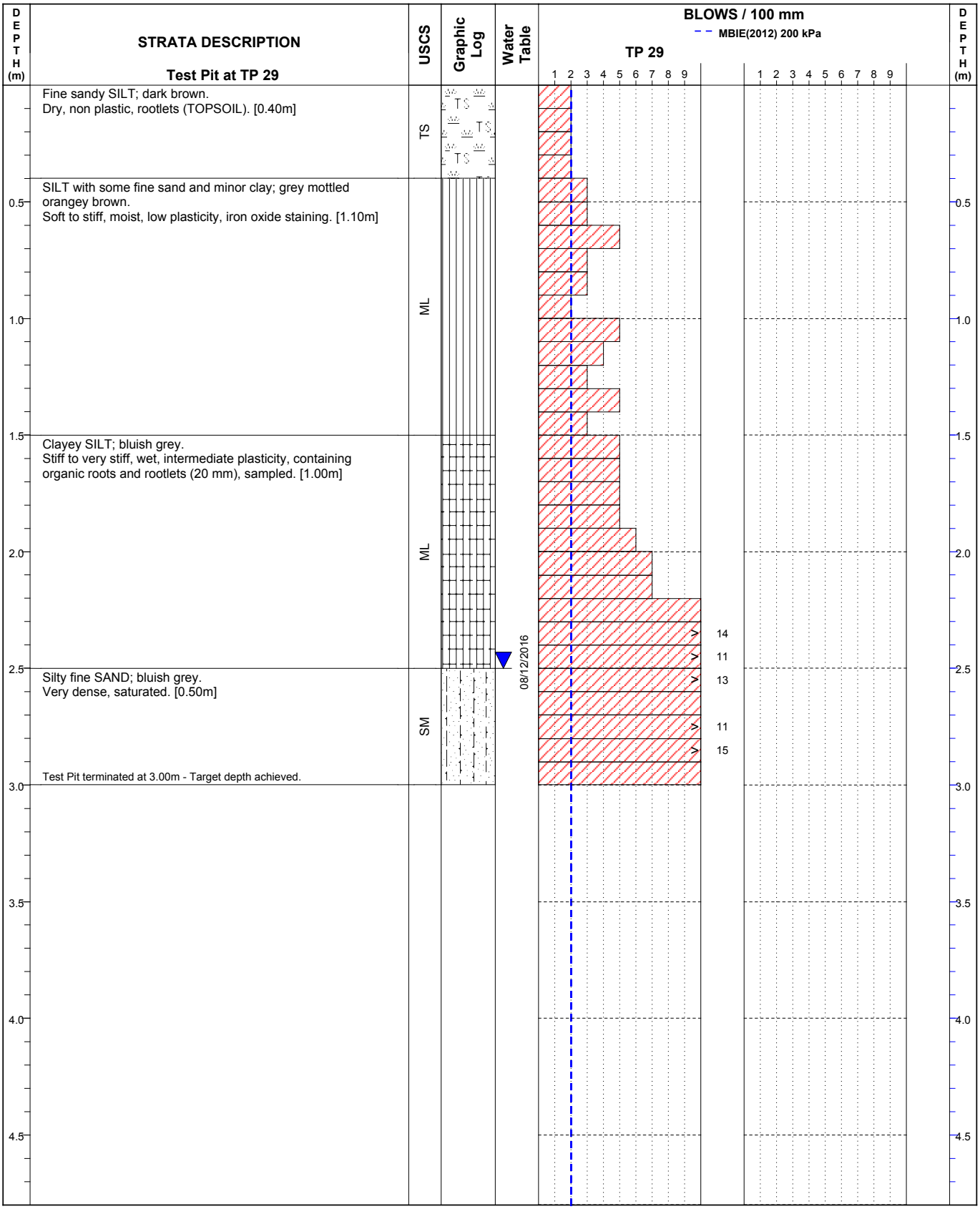
Job Nº / **34300**
Test Nº / **TP 29**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Rapid upwelling of groundwater.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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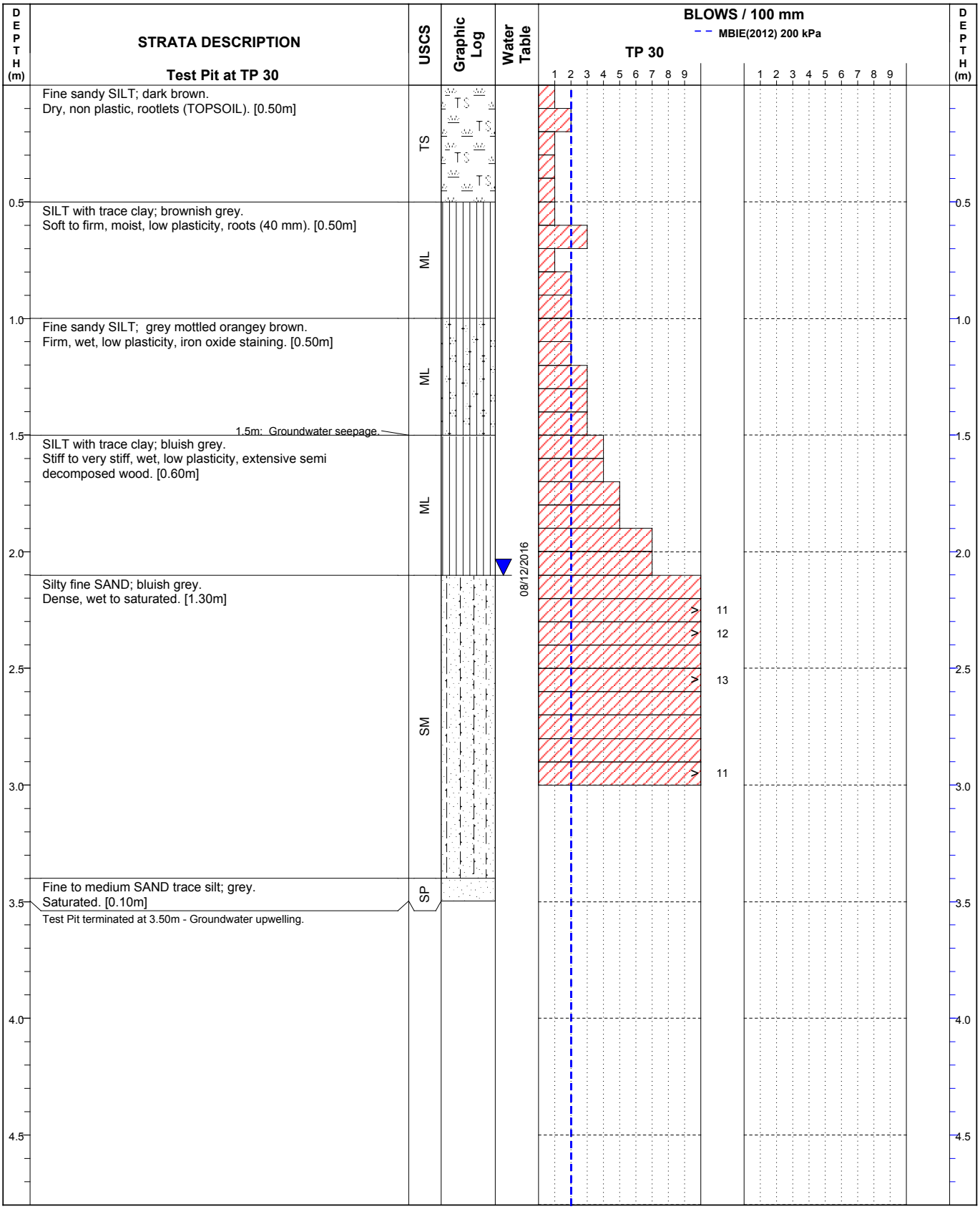
Job Nº / **34300**
Test Nº / **TP 30**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	07/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+BP	**Notes:**	Groundwater strike at 3.5 m, rises to 3.3 m below EGL.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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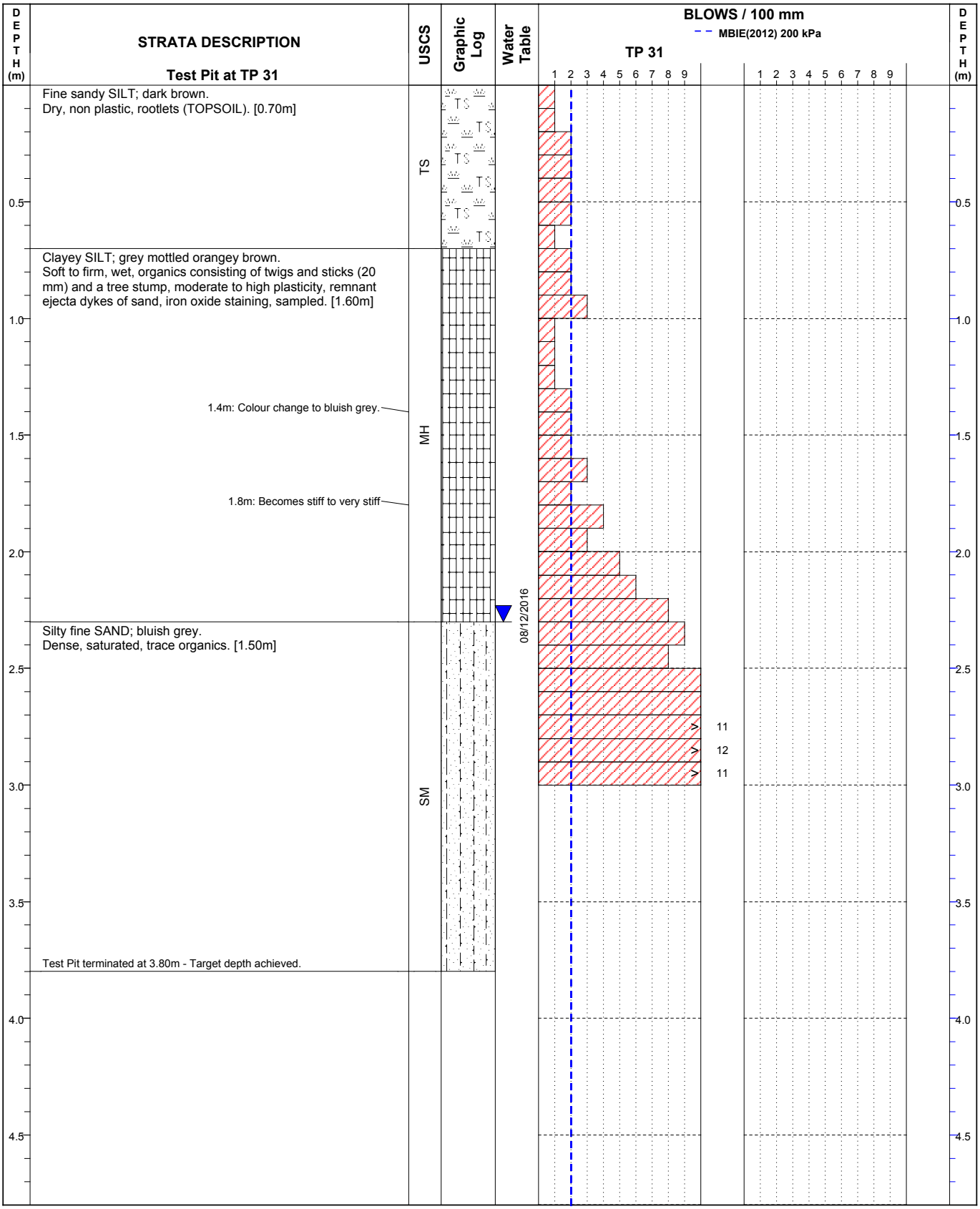
Job Nº / **34300**
Test Nº / **TP 31**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 32**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 32	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		
	SILT with some fine sand; grey mottled orangey brown. Stiff, dry, low plasticity, iron oxide staining. [1.20m]	ML		
0.5	0.8m: Becomes soft to firm.			
1.0				
1.5	SILT with some clay and fine sand; grey mottled orangey brown. Firm, moist, moderate plasticity, iron oxide staining. [0.20m]	ML		
	Silty fine SAND; bluish grey. Medium dense to dense, wet to saturated, organic odour, roots and rootlets (<50 mm). [2.00m]	SM		
2.0				
2.5				
3.0				
3.5				08/12/2016
	Fine to coarse sandy fine to coarse GRAVEL; greyish brown. Saturated, gravel is subrounded greywacke, rapid water ingress. [0.10m]	GW		
4.0	Test Pit terminated at 3.80m - Rapid water ingress.			
4.5				

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 32

DEPTH (m)	1	2	3	4	5	6	7	8	9
0.0									
0.5									
1.0									
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									

Depth (m)	Blows / 100 mm
2.3	11
2.4	13
2.5	12
3.0	12

Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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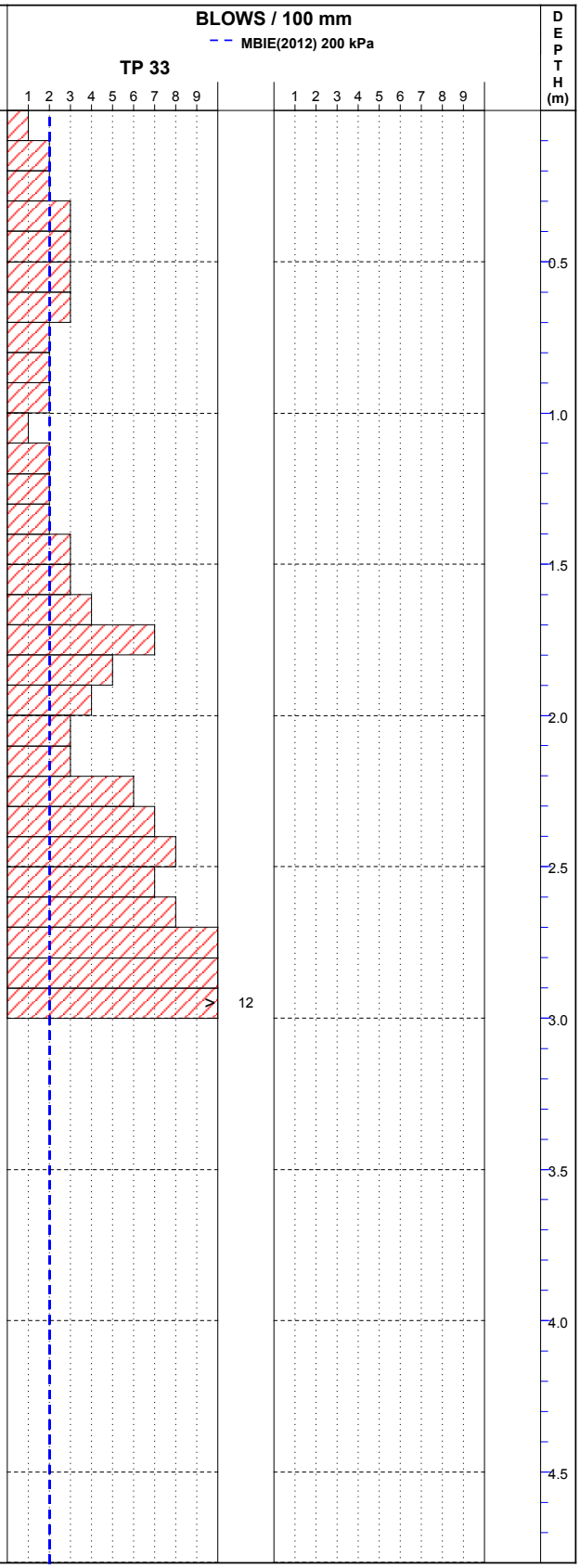
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 33**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 33	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS		
0.5	SILT with some fine sand trace clay; grey mottled orangey brown. Soft to firm, moist, intermediate plasticity, iron oxide staining. [1.00m]	ML		
1.5	SILT; grey. Firm, moist, moderate plasticity, sampled. [0.20m]	ML		08/12/2016
2.0	Silty fine SAND; bluish grey. Medium dense to dense, saturated, organic odour, roots and rootlets (<50 mm), occasional lenses of SILT. [2.10m]	SM		
3.5	Test Pit terminated at 3.70m - Target depth achieved.			



Logged By:	KT+MS	**Notes:**	Test Pit stable throughout.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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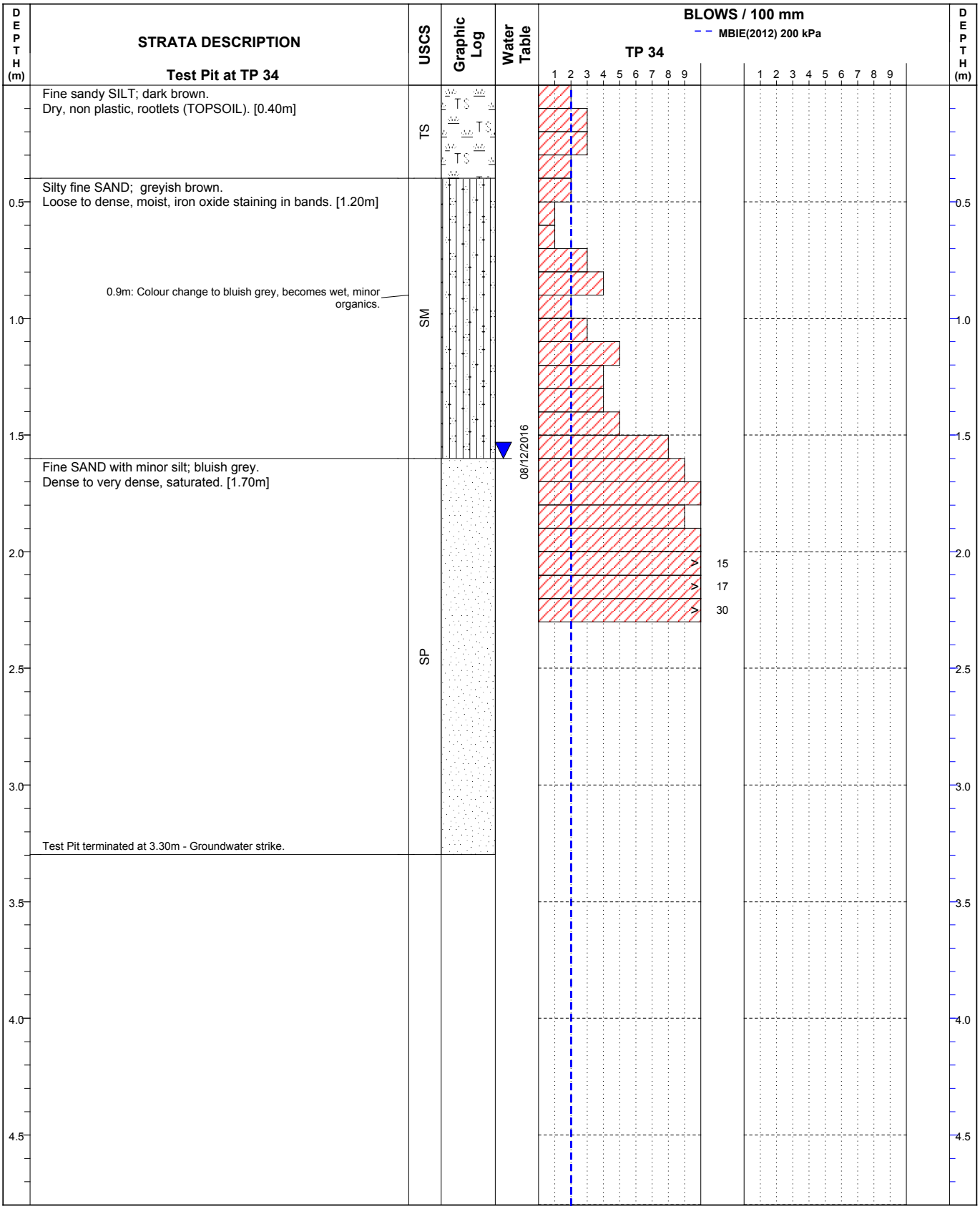
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 34**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test pit instability upon intersection with groundwater.Rapid water ingress, raises 0.4 m after 2 min.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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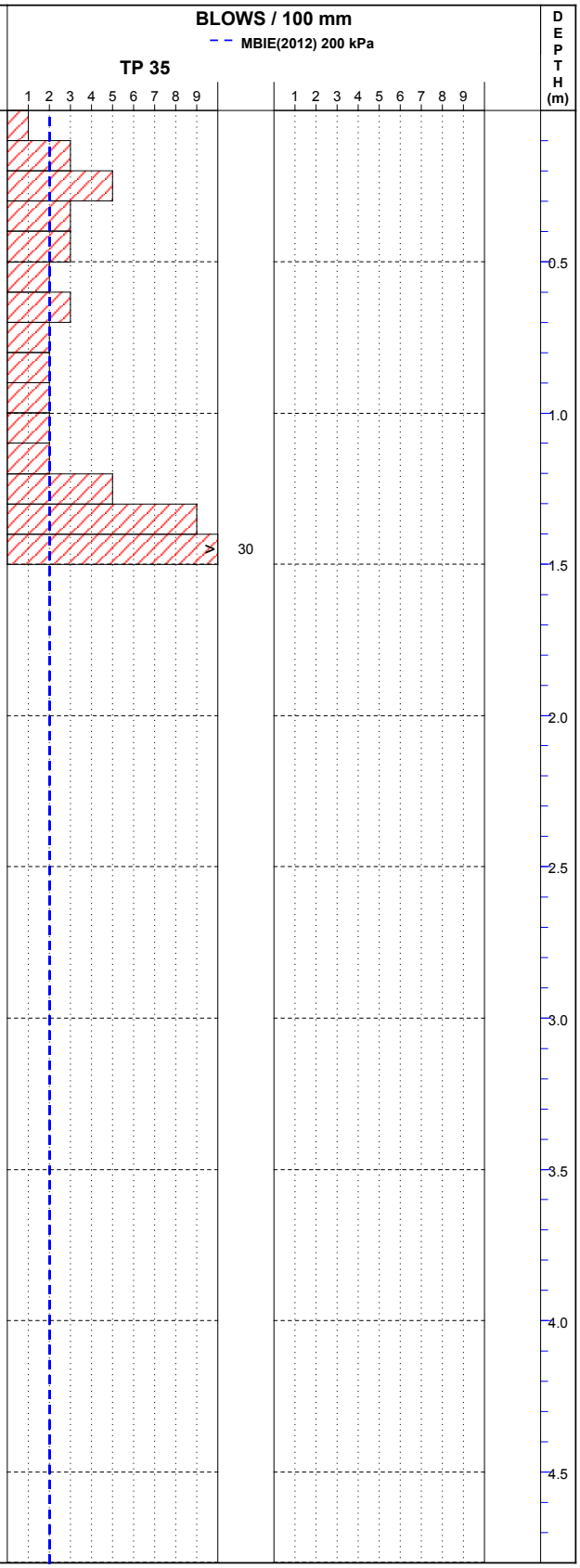
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 35**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 35	USCS	Graphic Log	Water Table
0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		
0.5	SILT with some fine sand; grey mottled orangey brown. Soft to firm, moist, low plasticity, iron oxide staining. [0.30m]	ML		
1.0	Fine SAND with minor silt; brownish grey. Medium dense, moist to wet, trace iron oxide staining. [0.70m]	SP		
1.5	Fine to coarse sandy fine to coarse GRAVEL; grey. Dense to very dense, saturated, gravel is subrounded greywacke. [1.60m]	GW		
2.0	1.9m: Groundwater seepage.			
2.5	Test Pit terminated at 2.90m - Groundwater strike.			08/12/2016
3.0				
3.5				
4.0				
4.5				



Logged By:	KT+MS	**Notes:**	Test pit instability upon intersection with groundwater.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 36**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 36	USCS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		
0.5	Fine to medium SAND; yellowish brown. Loose to dense, dry to moist, trace iron oxide staining, trace organics. [1.10m]	SP		
1.5	Silty fine SAND; bluish grey. Dense to very dense, wet to saturated, organics consisting of twigs and sticks. [1.60m]	SM		
3.0	3.0m: Groundwater ooze, woody material. Fine to coarse sandy fine to coarse GRAVEL; grey. Saturated, gravel is subrounded greywacke. [0.10m]	GW		08/12/2016
	Test Pit terminated at 3.10m - Groundwater strike.			

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 36
1 2 3 4 5 6 7 8 9

11
13
30

Logged By:	KT+MS	**Notes:**	Test pit instability upon intersection with groundwater.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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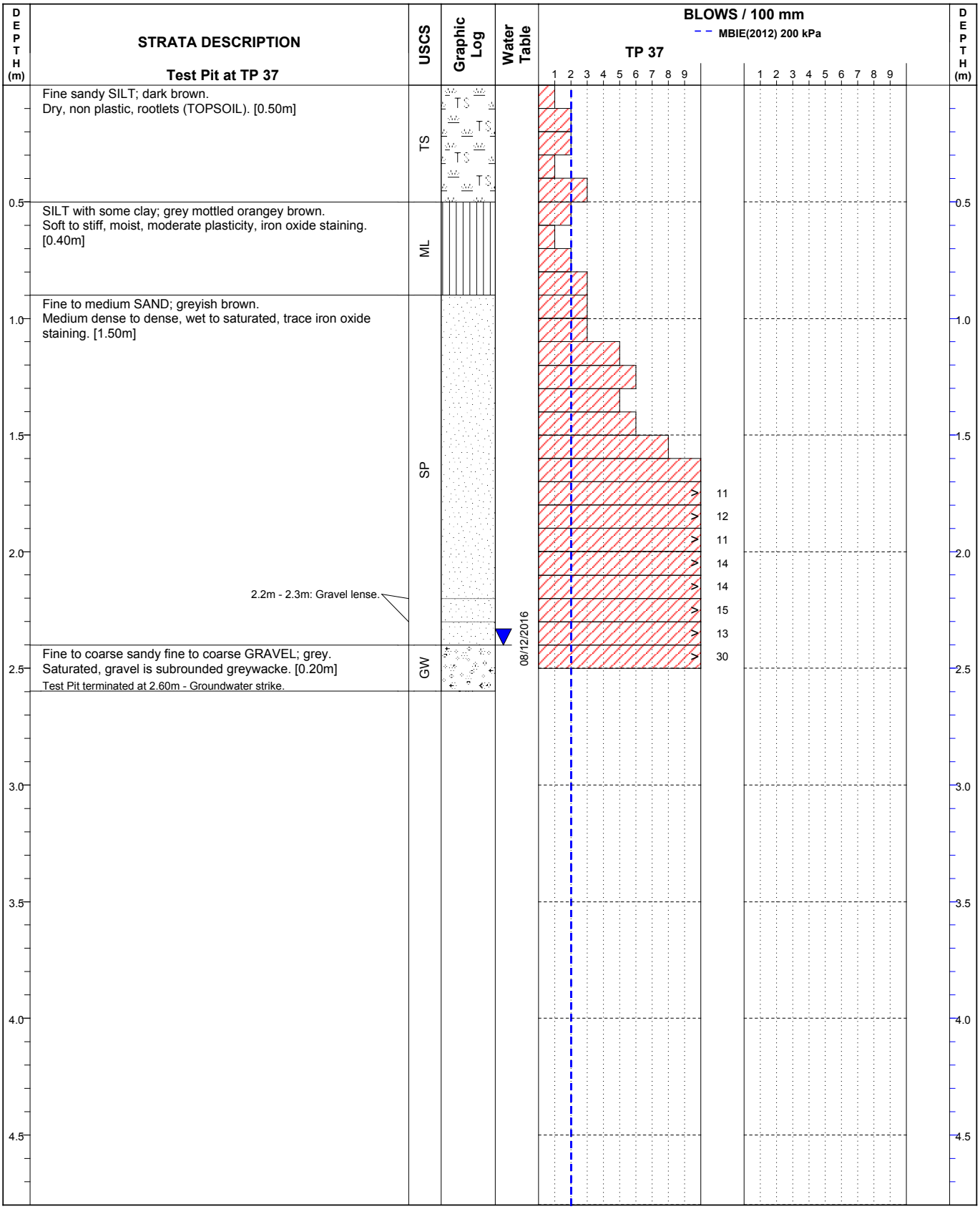
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 37**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	08/12/16
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	24 t Excavator



Logged By:	KT+MS	**Notes:**	Test pit instability upon intersection with groundwater.
Plotted By:	KT		
Checked By:	MS		

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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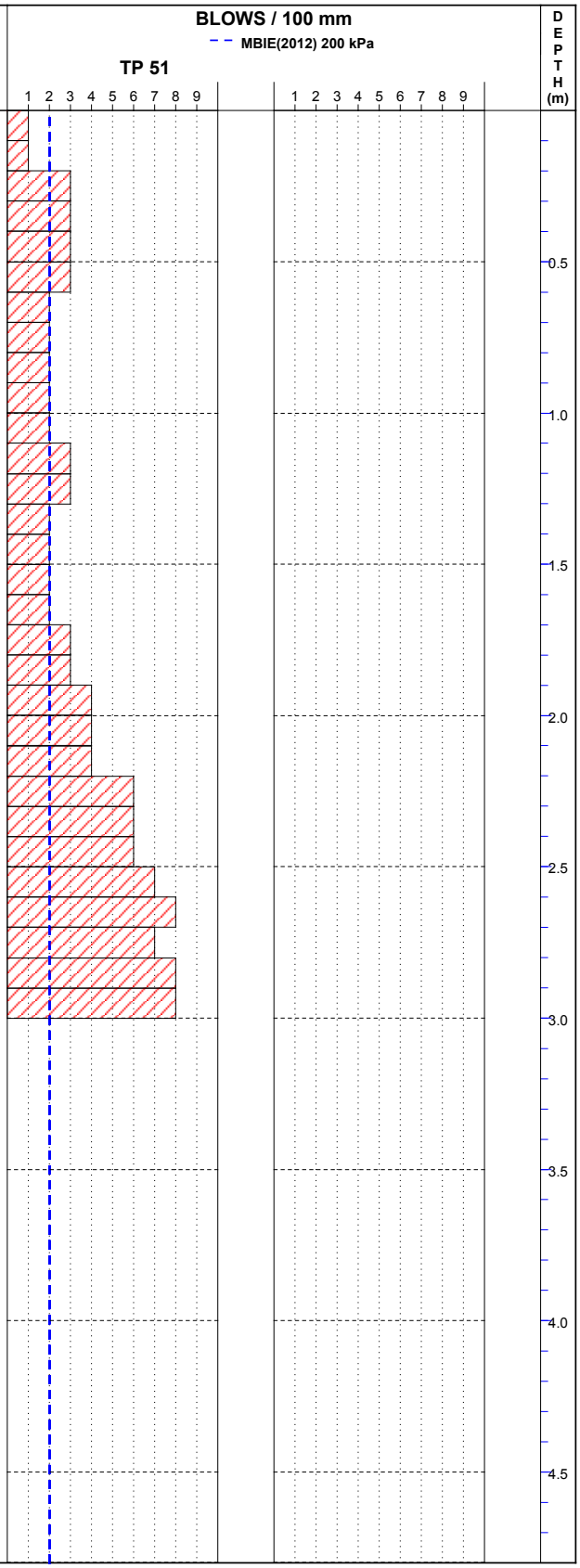
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 51**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 51	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		
0.5	SILT with some clay; brownish grey. Moist, moderate plasticity, trace iron oxide staining (POSSIBLE FILL). [1.00m]	ML		
1.0				
1.5	Slightly ORGANIC SILT; brown. Moist (POSSIBLE BURIED TOPSOIL). [0.30m]	TS		
2.0	SILT with some clay; brownish grey. Soft to stiff, wet, moderate plasticity, trace iron oxide staining, trace semi decomposed to decomposed wood. [0.50m] Test Pit terminated at 2.10m - Groundwater strike.	ML		03/05/2017
2.5				
3.0				
3.5				
4.0				
4.5				



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 52**

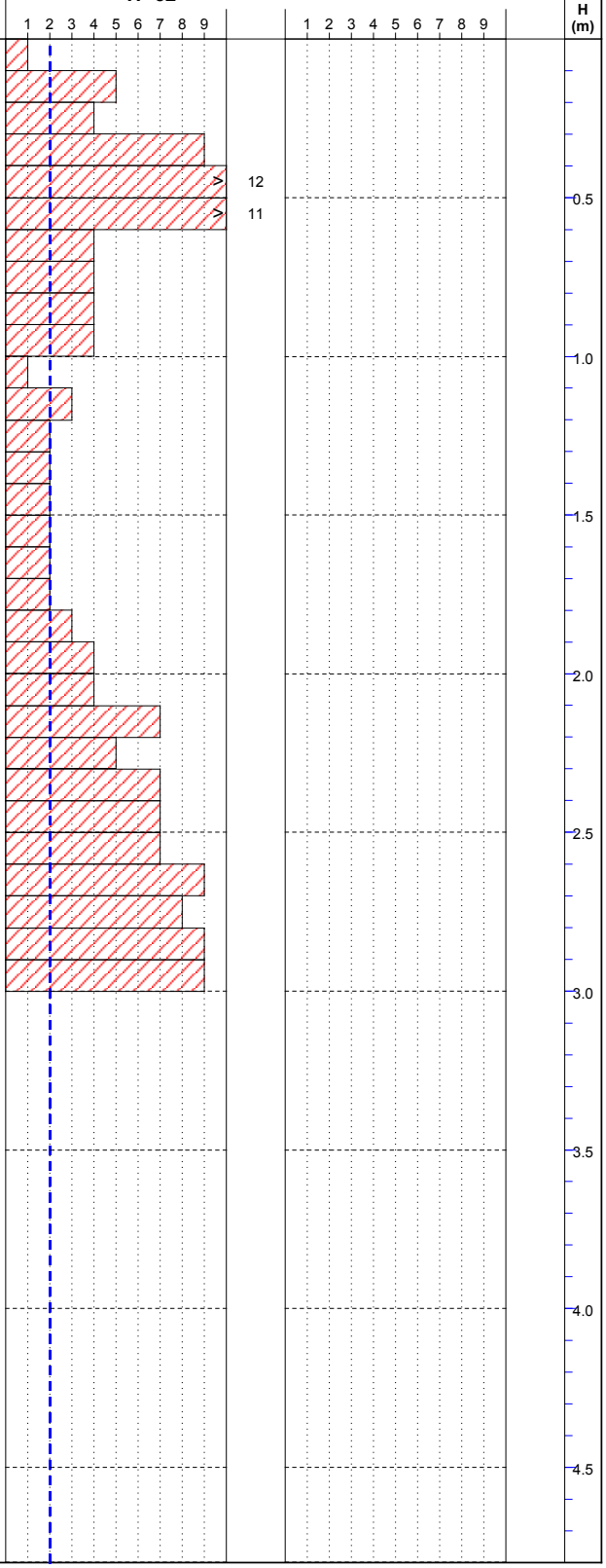
Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 52	USGS
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS
0.5	Clayey SILT; grey mottled brown. Dry, moderate plasticity, trace iron oxide staining (POSSIBLE FILL). [0.50m]	FILL
1.0	SILT; dark brown. Moist, fresh to decomposed roots and rootlets (POSSIBLE BURIED TOPSOIL). [0.40m]	TS
1.5	Fine sandy SILT; brownish grey mottled orangey brown. Soft to stiff, moist, roots and rootlets [0.80m]	ML
2.0	Organic SILT with lenses of PEAT; dark brown/black. Saturated, moderate plasticity, peat is semi decomposed, organic material comprises slightly decomposed, tightly packed, highly fibrous and easily identifiable (structures well preserved) ferns, cabbage tree, flax, sphagnum moss bed (>150 mm). [0.30m]	OL
2.5	Test Pit terminated at 2.30m - Groundwater strike.	
3.0		
3.5		
4.0		
4.5		

Graphic Log

Water Table: 03/05/2017

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 52



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

Produced with Core-GS by Geroc

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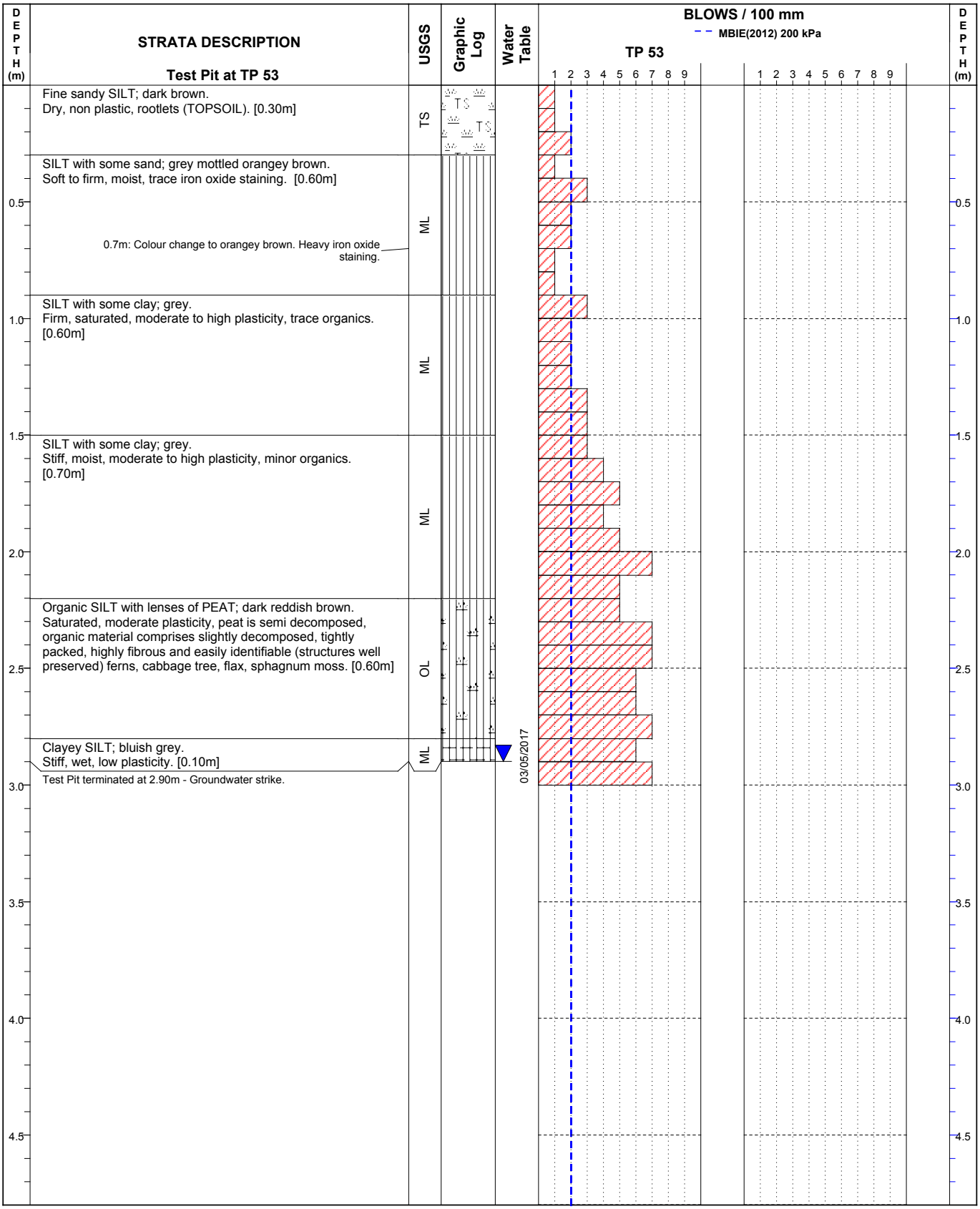
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 53**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 53	USGS
0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS
0.5	SILT with some sand; grey mottled orangey brown. Soft to firm, moist, trace iron oxide staining. [0.60m] 0.7m: Colour change to orangey brown. Heavy iron oxide staining.	ML
1.0	SILT with some clay; grey. Firm, saturated, moderate to high plasticity, trace organics. [0.60m]	ML
1.5	SILT with some clay; grey. Stiff, moist, moderate to high plasticity, minor organics. [0.70m]	ML
2.0	Organic SILT with lenses of PEAT; dark reddish brown. Saturated, moderate plasticity, peat is semi decomposed, organic material comprises slightly decomposed, tightly packed, highly fibrous and easily identifiable (structures well preserved) ferns, cabbage tree, flax, sphagnum moss. [0.60m]	OL
2.5	Clayey SILT; bluish grey. Stiff, wet, low plasticity. [0.10m]	ML
3.0	Test Pit terminated at 2.90m - Groundwater strike.	



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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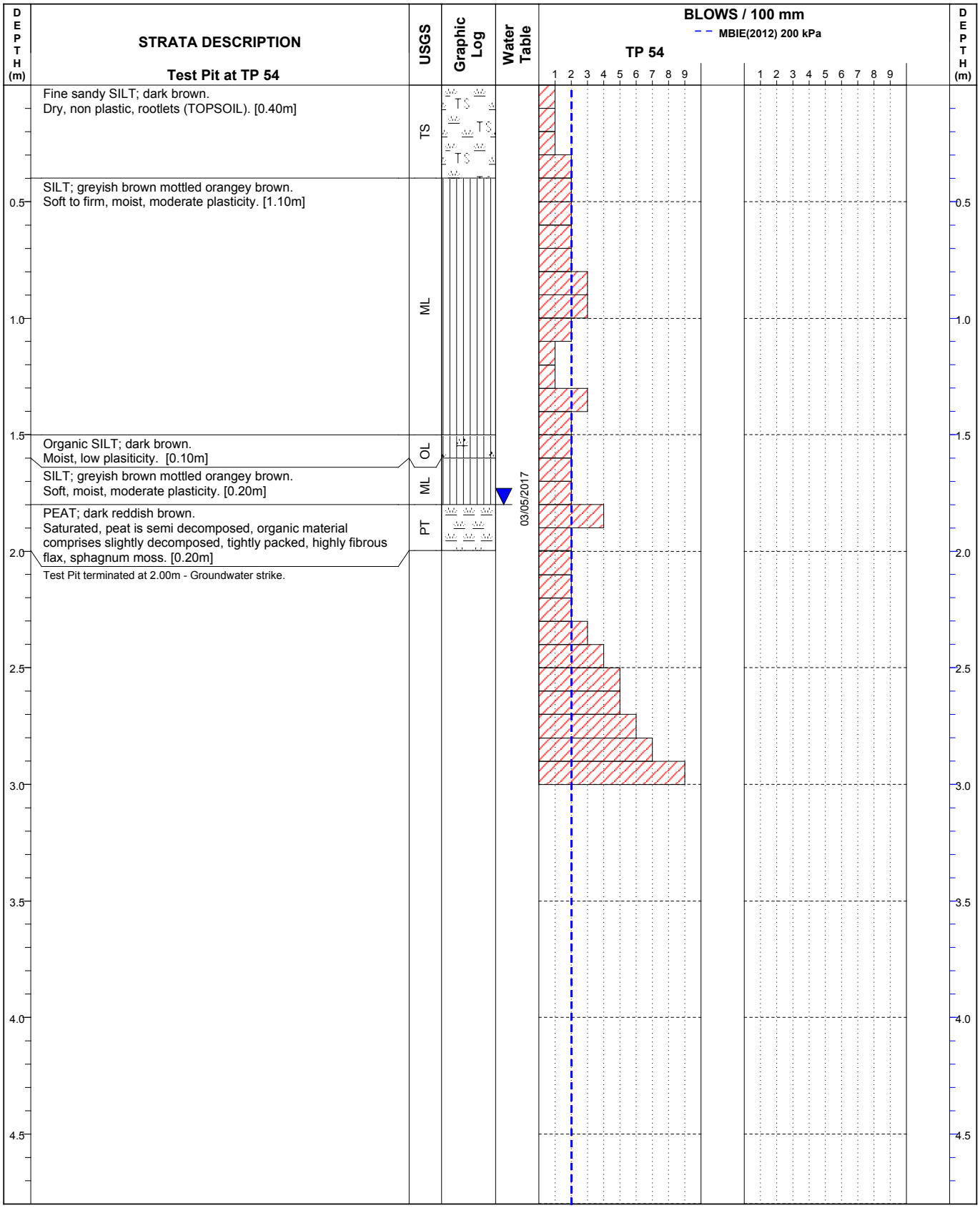
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 54**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 54	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS		
0.5	SILT; greyish brown mottled orangey brown. Soft to firm, moist, moderate plasticity. [1.10m]	ML		
1.0				
1.5	Organic SILT; dark brown. Moist, low plasiticity. [0.10m]	OL		
	SILT; greyish brown mottled orangey brown. Soft, moist, moderate plasticity. [0.20m]	ML		03/05/2017
2.0	PEAT; dark reddish brown. Saturated, peat is semi decomposed, organic material comprises slightly decomposed, tightly packed, highly fibrous flax, sphagnum moss. [0.20m]	PT		
	Test Pit terminated at 2.00m - Groundwater strike.			
2.5				
3.0				
3.5				
4.0				
4.5				



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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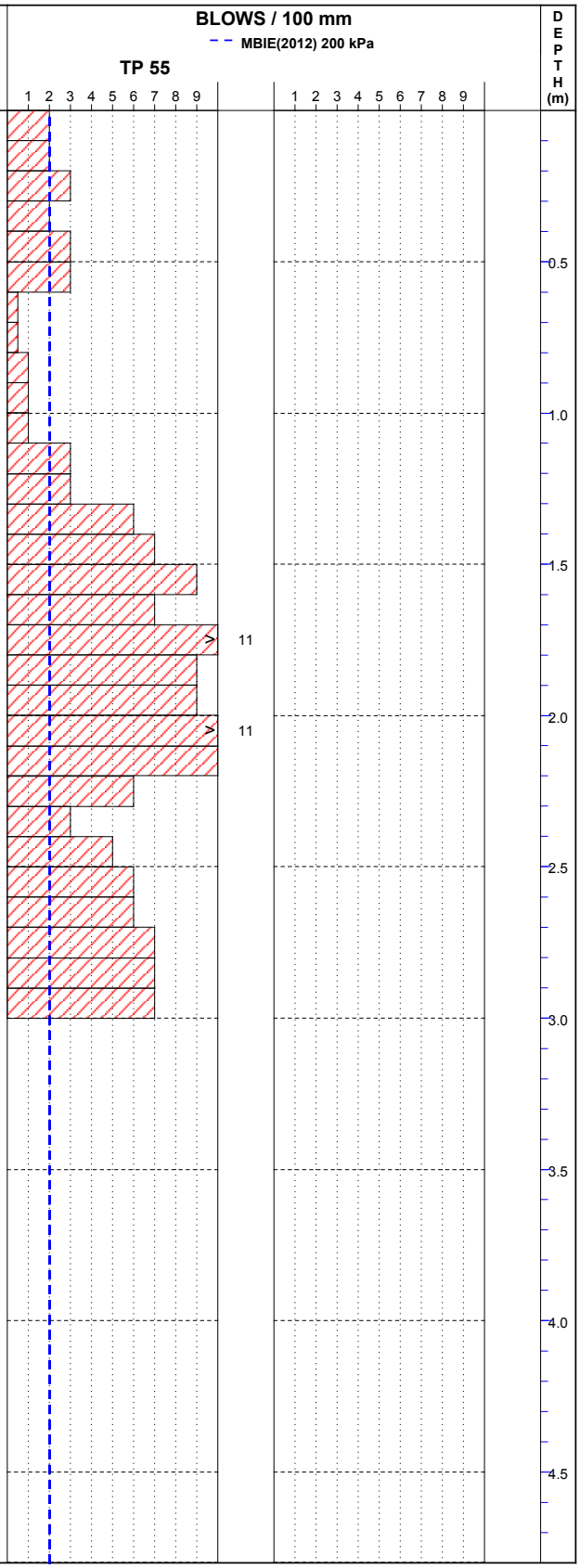
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 55**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 55	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS		
0.5	SILT with some fine sand; light grey. Very soft to stiff, moist, low plasticity. [1.80m]	ML		Groundwater Not Encountered
1.5	1.5m: Becomes stiff to very stiff.			
2.0	Test Pit terminated at 2.20m - Target depth achieved.			



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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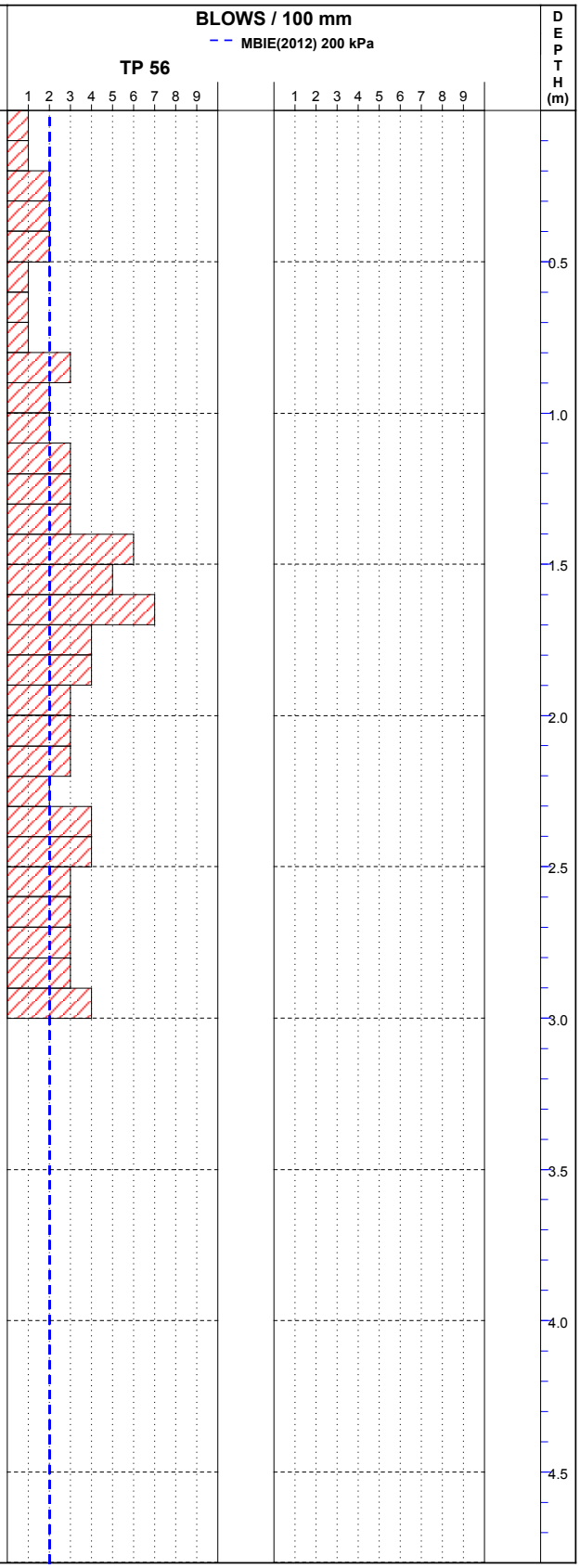
Job Nº / **34300**
Test Nº / **TP 56**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 56	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.50m]	TS		Groundwater Not Encountered
0.5	SILT with some fine sand; brownish grey. Very soft to stiff, moist, low plasticity, trace carbonised wood. [2.10m]	ML		
1.0	1.1m: Colour change to mottled orangey brown (iron oxide staining).			
2.5	Test Pit terminated at 2.60m - Target depth achieved.			



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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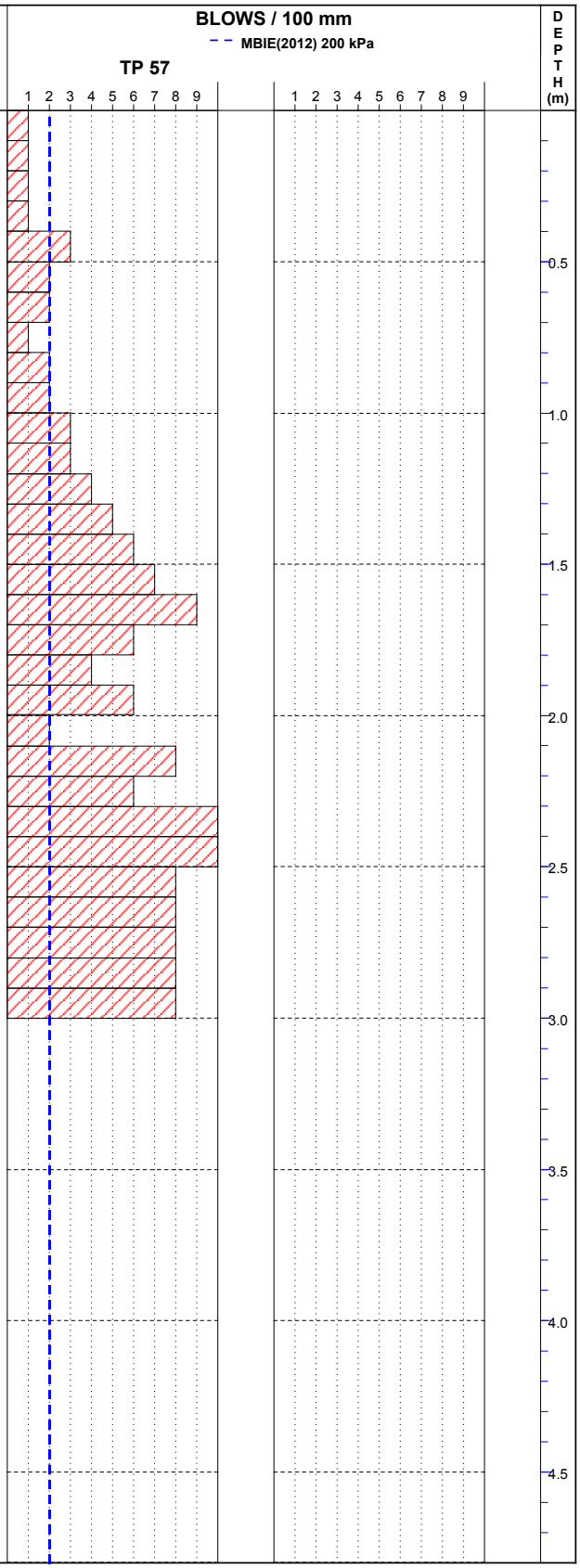
Job Nº / **34300**
Test Nº / **TP 57**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 57	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		Groundwater Not Encountered
0.5	SILT with some fine sand; light grey. Very soft to stiff, moist, low plasticity. [0.70m]	ML		
1.0	Fine to medium SAND with some silt; grey mottled orangey brown. Medium dense to dense, moist, iron oxide staining. [0.70m]	SP		
1.5	SILT; orangey brown. Stiff to very stiff, moist, low plasticity, heavy iron oxide staining. [0.30m] 1.9m: Colour change to grey.	ML		
2.0	Test Pit terminated at 2.00m -			
2.5				
3.0				
3.5				
4.0				
4.5				



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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Job Nº / **34300**
Test Nº / **TP 58**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 58	USGS	Graphic Log	Water Table
0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		Groundwater Not Encountered
0.5	SILT with some fine sand; grey. Soft, moist, low plasticity. [1.00m]	ML		
1.0				
1.5	Fine SAND; orangey brown. Loose, moist, heavy iron staining. [0.30m]	SP		
2.0	Silty fine SAND; grey mottled orangey brown. Loose to medium dense, wet, rootlets, iron oxide staining. [0.80m] 2.3m: Colour change to bluish grey. Test Pit terminated at 2.40m - Target depth achieved.	SM		
2.5				
3.0				
3.5				
4.0				
4.5				

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 58
1 2 3 4 5 6 7 8 9

Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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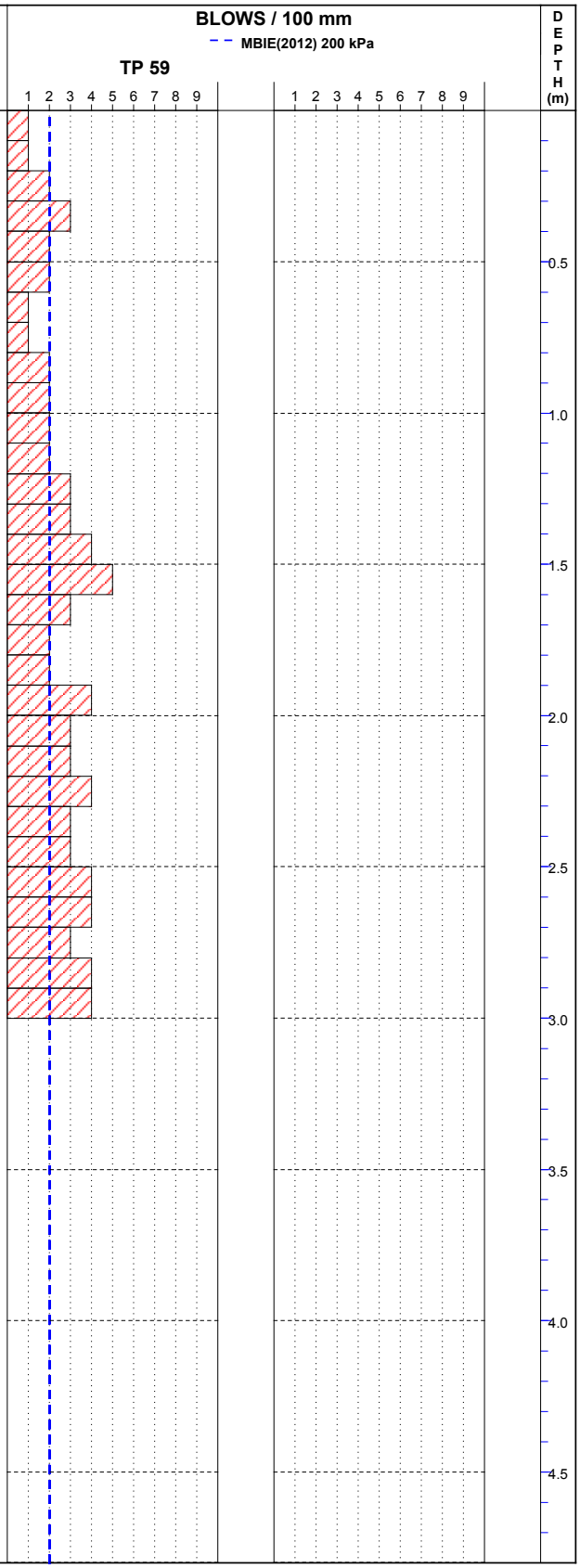
SHALLOW INVESTIGATION RESULTS

Job Nº / **34300**
Test Nº / **TP 59**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 59	USGS	Graphic Log
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.40m]	TS	
0.5	Fine sandy SILT; grey. Soft, moist, low plasticity, trace carbonised wood. [0.60m]	ML	
1.0	Silty fine SAND; yellowish brown. Loose to medium dense, moist. [0.50m]	SM	
1.5	SILT some clay and fine sand; grey mottled orangey brown. Soft to stiff/loose to medium dense, intermediate plasticity, iron oxide staining bands. [0.60m]	ML	
2.0	Silty fine SAND; grey. Medium dense, wet. [0.60m]	SM	
2.5	SILT with some fine sand and clay interbedded with silty fine SAND; bluish grey. Stiff, wet, minor organics, silt is low plasticity, minor organics consisting of semi decomposed wood and organic odour. [0.50m]	ML	
3.0	Test Pit terminated at 3.20m - Target depth achieved.		
3.5			
4.0			
4.5			

Water Table: Groundwater Not Encountered



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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Job Nº / **34300**
Test Nº / **TP 60**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 60	USGS	Graphic Log	Water Table
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS		Groundwater Not Encountered
0.3	SILT; yellowish brown. Firm, moist, low plasticity. [0.30m]	ML		
0.5	Silty fine SAND; orangey brown. Medium dense, moist, heavy iron oxide staining. [0.50m]	SM		
1.0	SILT; grey mottled orangey brown. Stiff, moist, low plasticity, trace twigs and roots. [0.40m]	ML		
1.5	Fine to medium SAND; grey. Medium dense to very dense, moist to wet, containing roots and twigs. Occasional lenses of SILT. [0.80m]	SP		
2.3	Test Pit terminated at 2.30m - Target depth achieved.			

BLOWS / 100 mm
MBIE(2012) 200 kPa
TP 60

DEPTH (m)	Blows / 100 mm
0.0	
0.3	
0.5	
1.0	
1.5	
2.0	12
2.1	12
2.2	13
2.3	14
2.4	19
2.5	21
2.6	21
2.7	21
2.8	21
2.9	30

Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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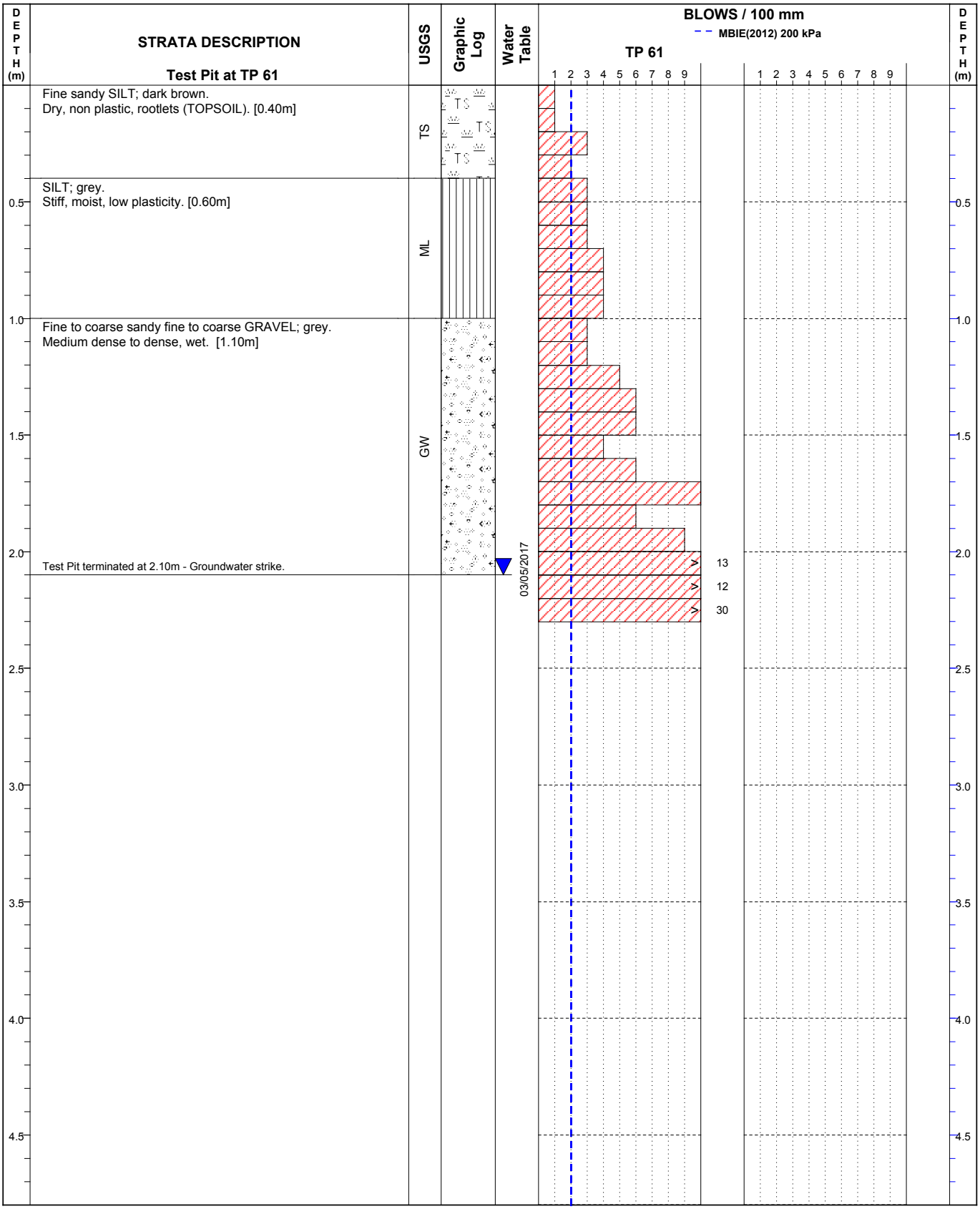
Job Nº / **34300**
Test Nº / **TP 61**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator



Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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Job Nº / **34300**
Test Nº / **TP 62**

Project:	Oakbridge Subdivison, Prestons Road, Christchurch (Various Lots and DPs)	**Date:**	03/05/17
Client:	KB Contracting and Quarries Ltd.	**Time:**	10:00
Test Location:	Refer to attached Geotechnical Site Plan (G01B).	**Excavation Method:**	9 t Excavator

DEPTH (m)	STRATA DESCRIPTION Test Pit at TP 62	USGS	Graphic Log	Water Table	BLOWS / 100 mm MBIE(2012) 200 kPa TP 62	DEPTH (m)
0.0	Fine sandy SILT; dark brown. Dry, non plastic, rootlets (TOPSOIL). [0.30m]	TS				0.0
0.5	SILT with some fine sand; brownish grey. Stiff, moist, moderate plasticity, trace iron oxide staining. [0.80m]	ML				0.5
1.0						1.0
1.5	Silty fine SAND; grey mottled orangey brown. Loose to medium dense, moist, iron oxide staining. [0.50m]	SM				1.5
2.0	Fine to medium SAND; bluish grey. Medium dense to dense, wet. [1.10m]	SP		03/05/2017		2.0
2.5	Test Pit terminated at 2.70m - Target depth achieved.				11 13 14 12 12 13 14	2.5
3.0						3.0
3.5						3.5
4.0						4.0
4.5						4.5

Logged By:	KT+AB	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KT		
Checked By:			

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Appendix C

Cone Penetration Tests and Liquefaction Analysis Results

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Christchurch 8140

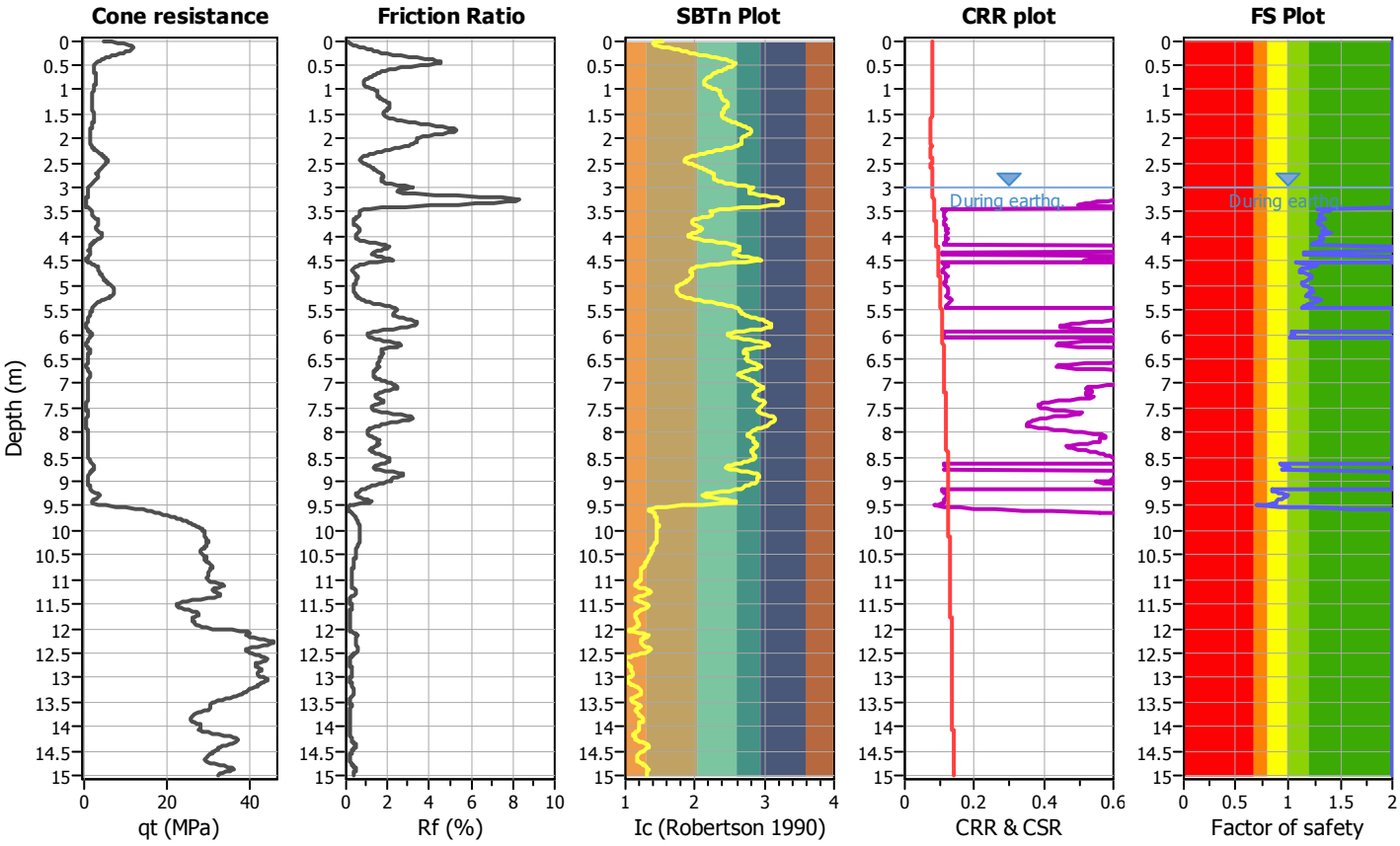
LIQUEFACTION ANALYSIS REPORT

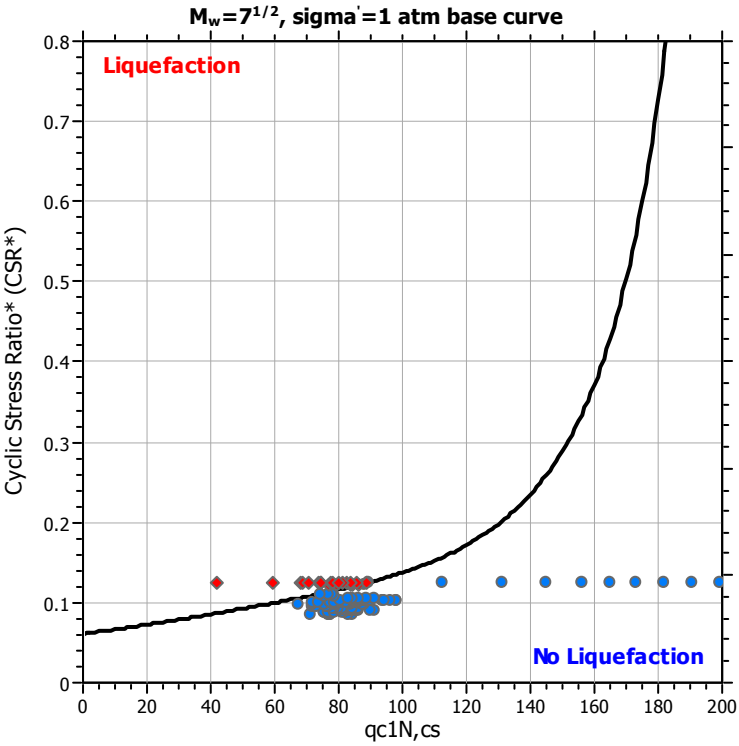
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

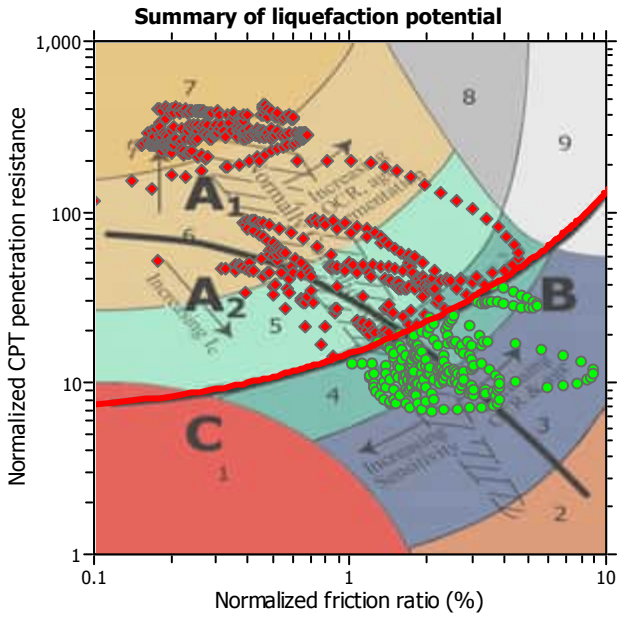
CPT file : CPT_01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

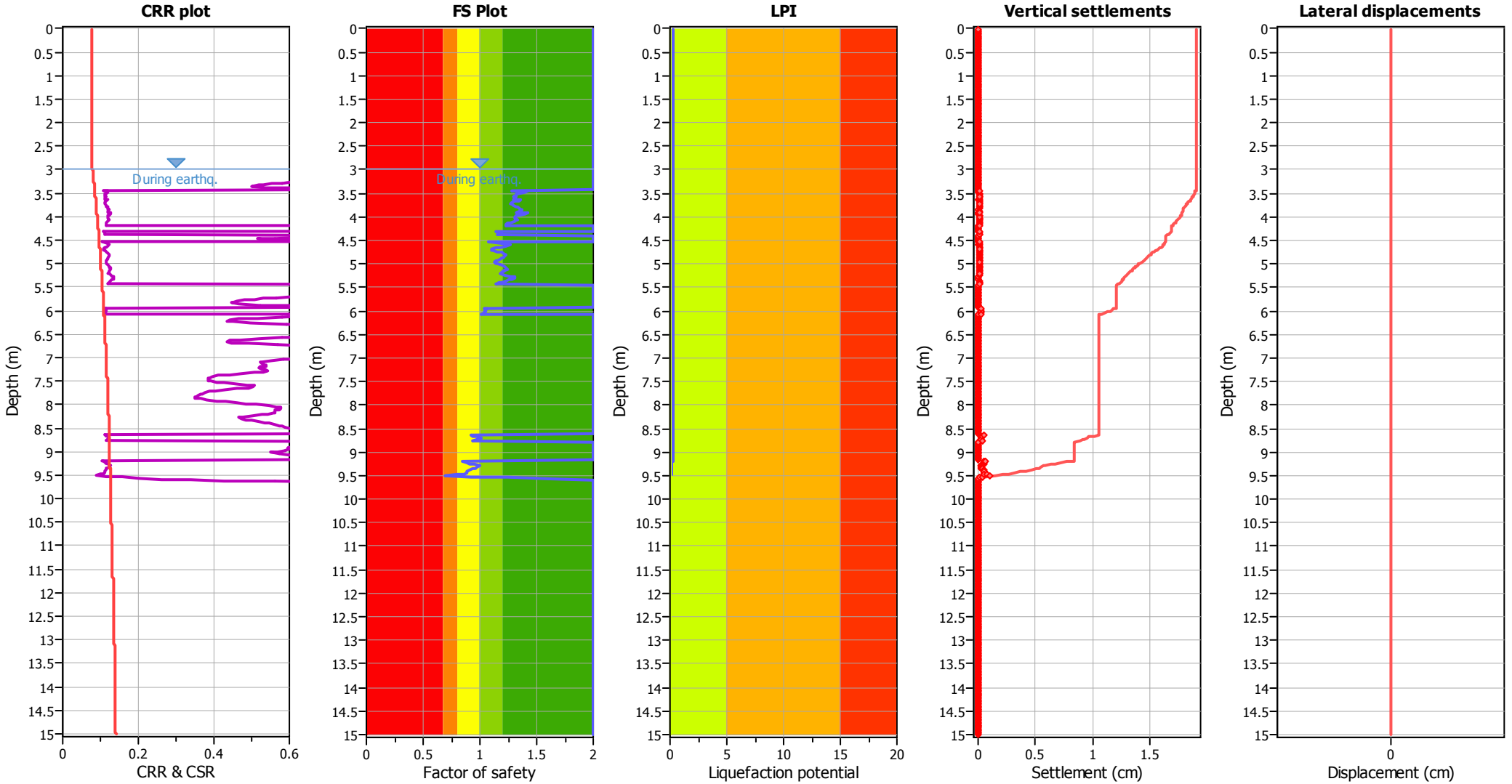






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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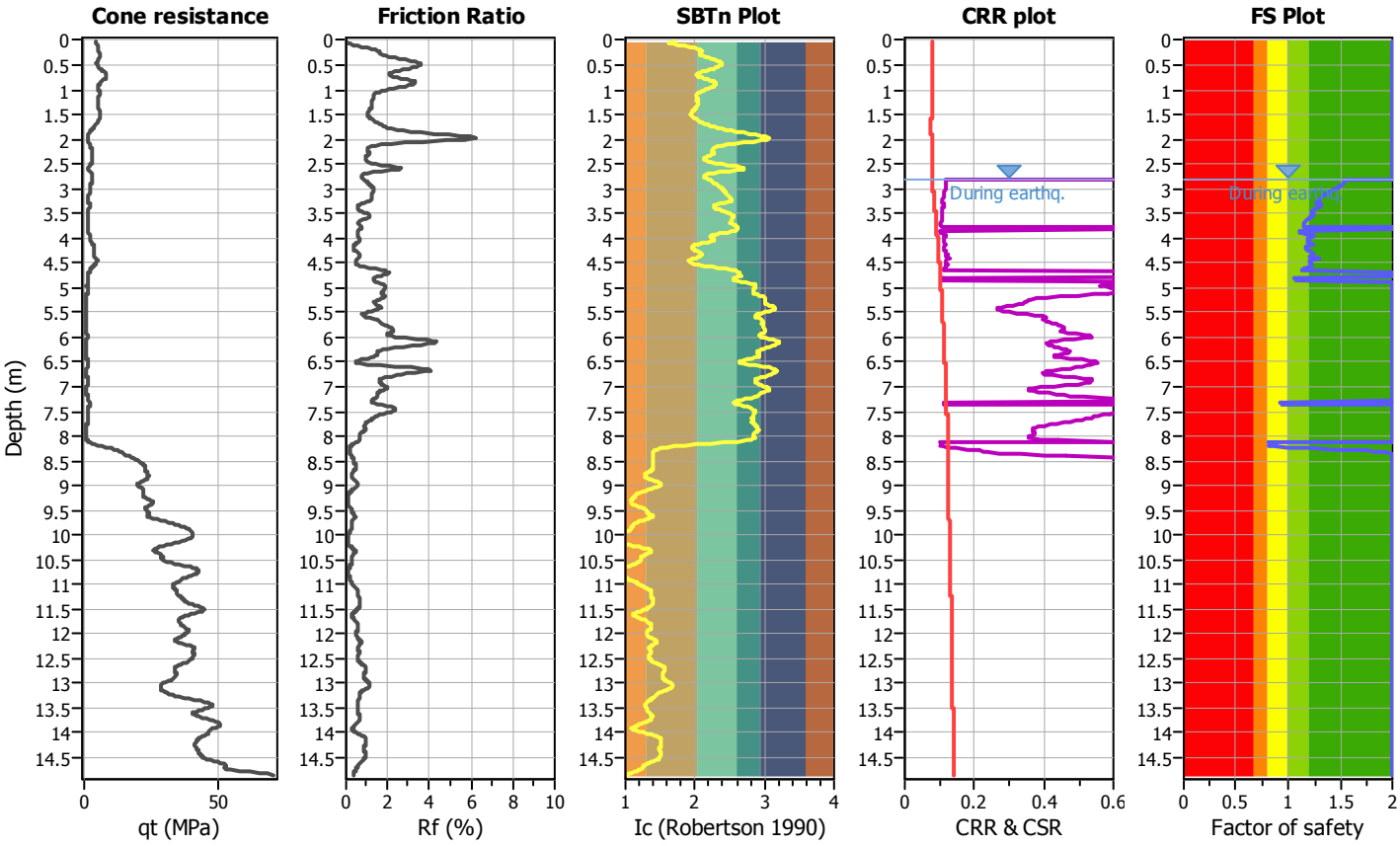
LIQUEFACTION ANALYSIS REPORT

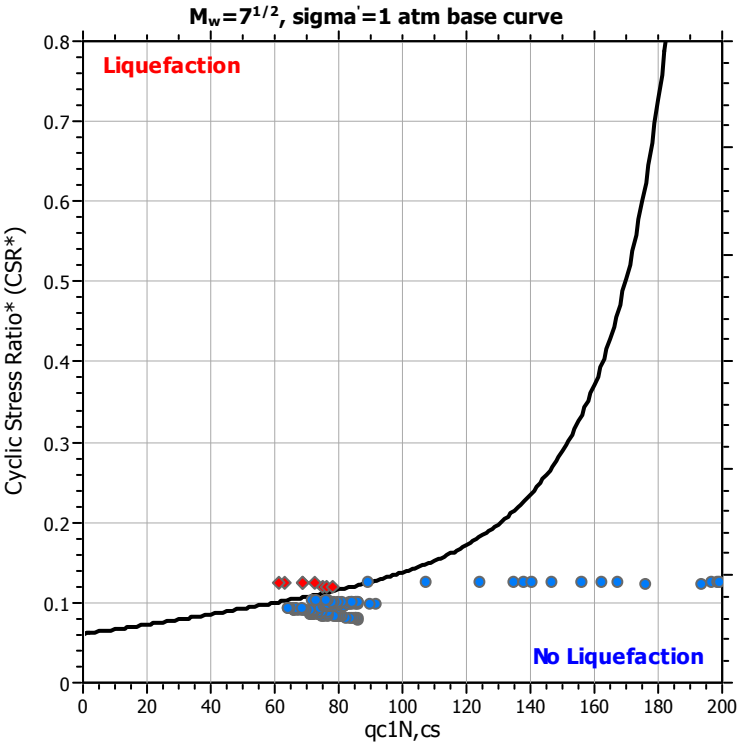
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

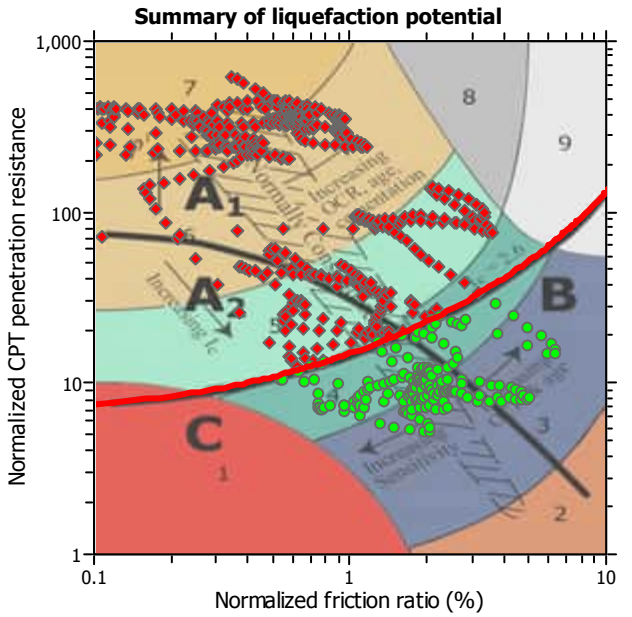
CPT file : CPT_02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

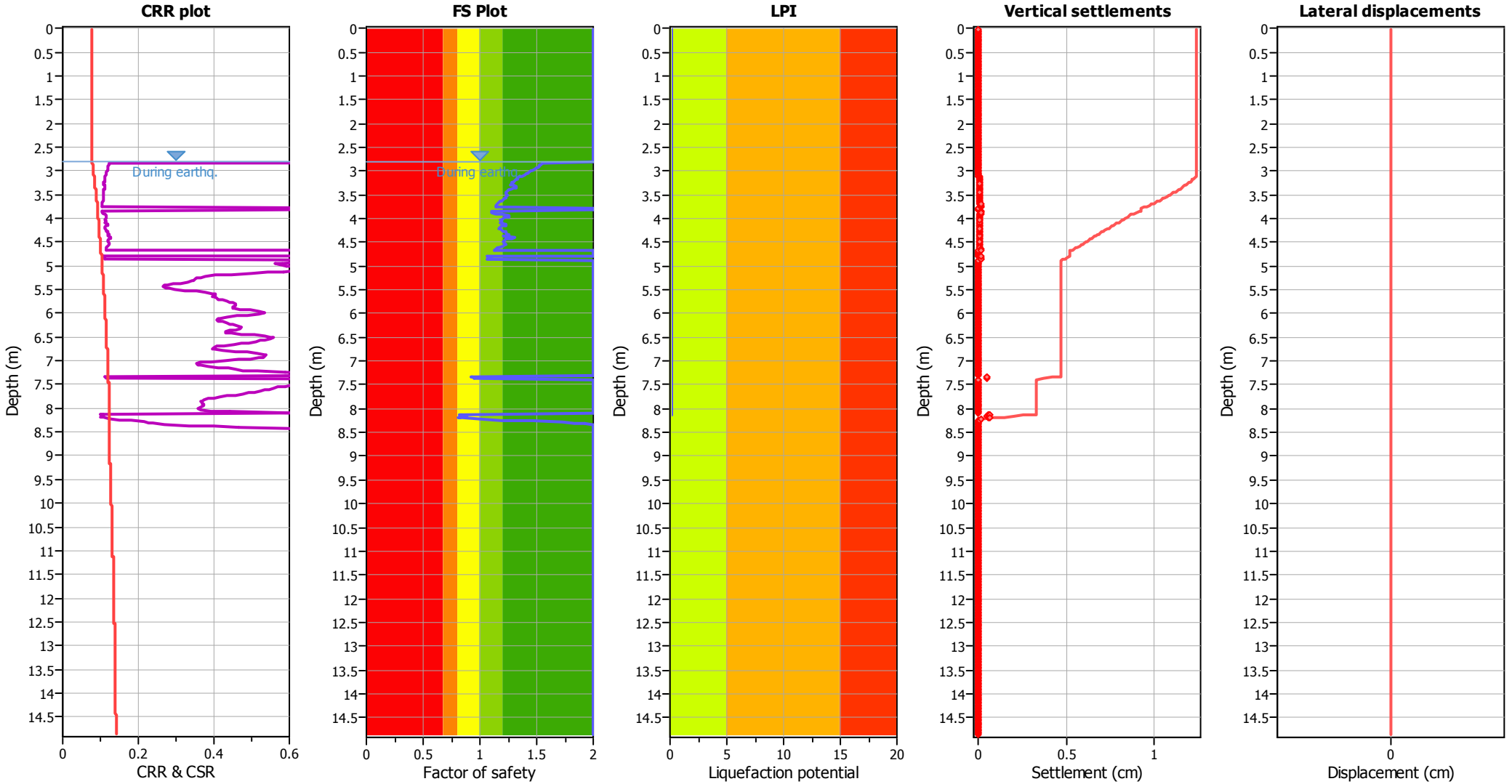






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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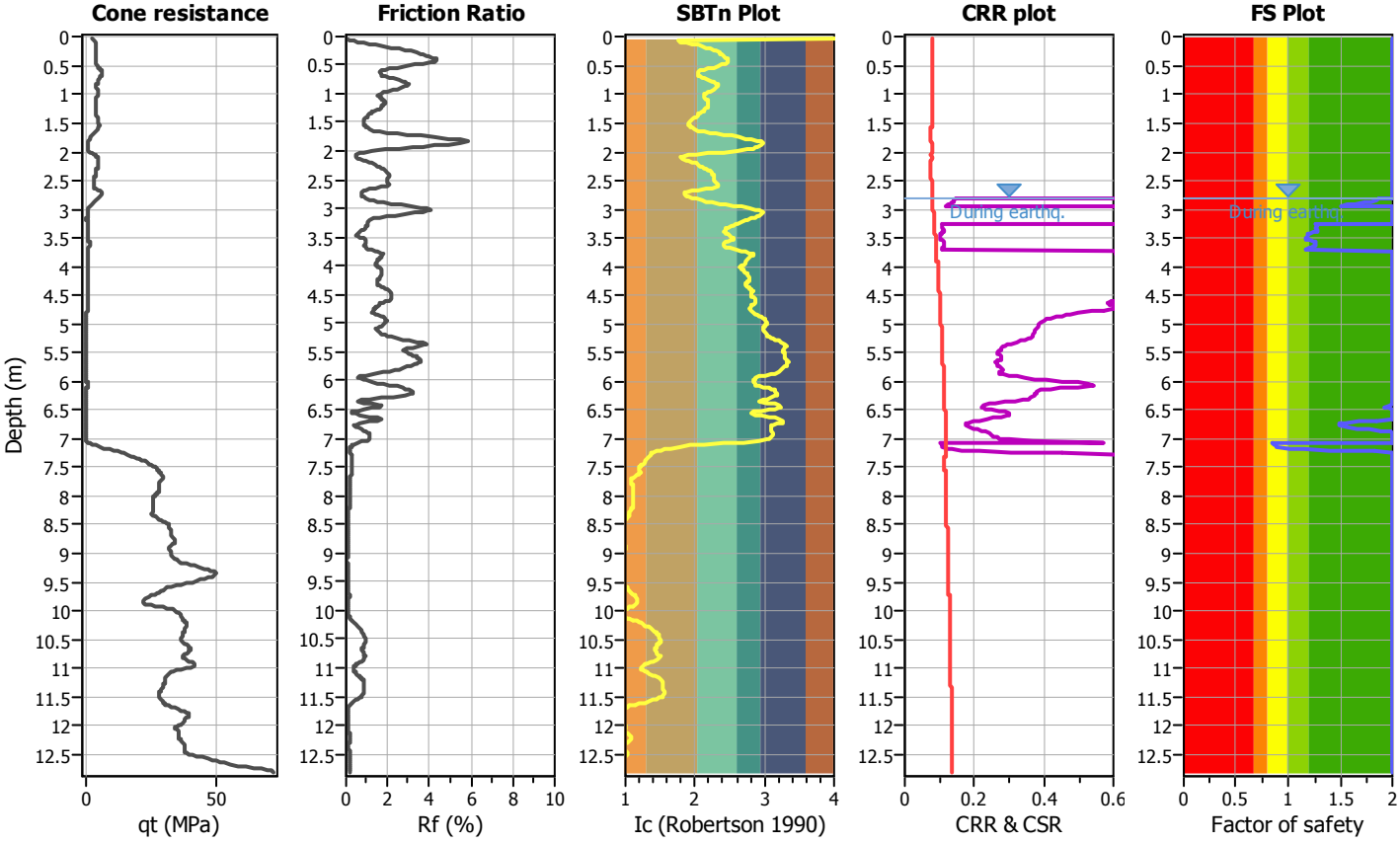
LIQUEFACTION ANALYSIS REPORT

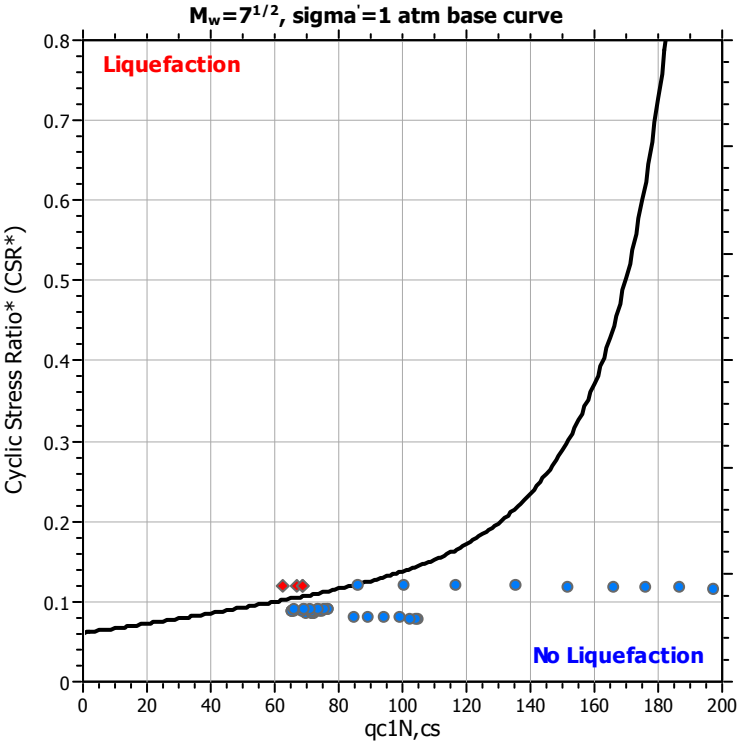
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

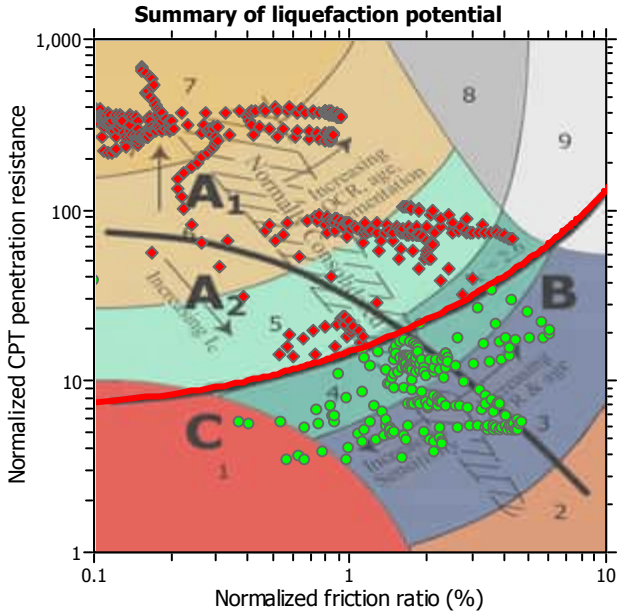
CPT file : CPT_03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

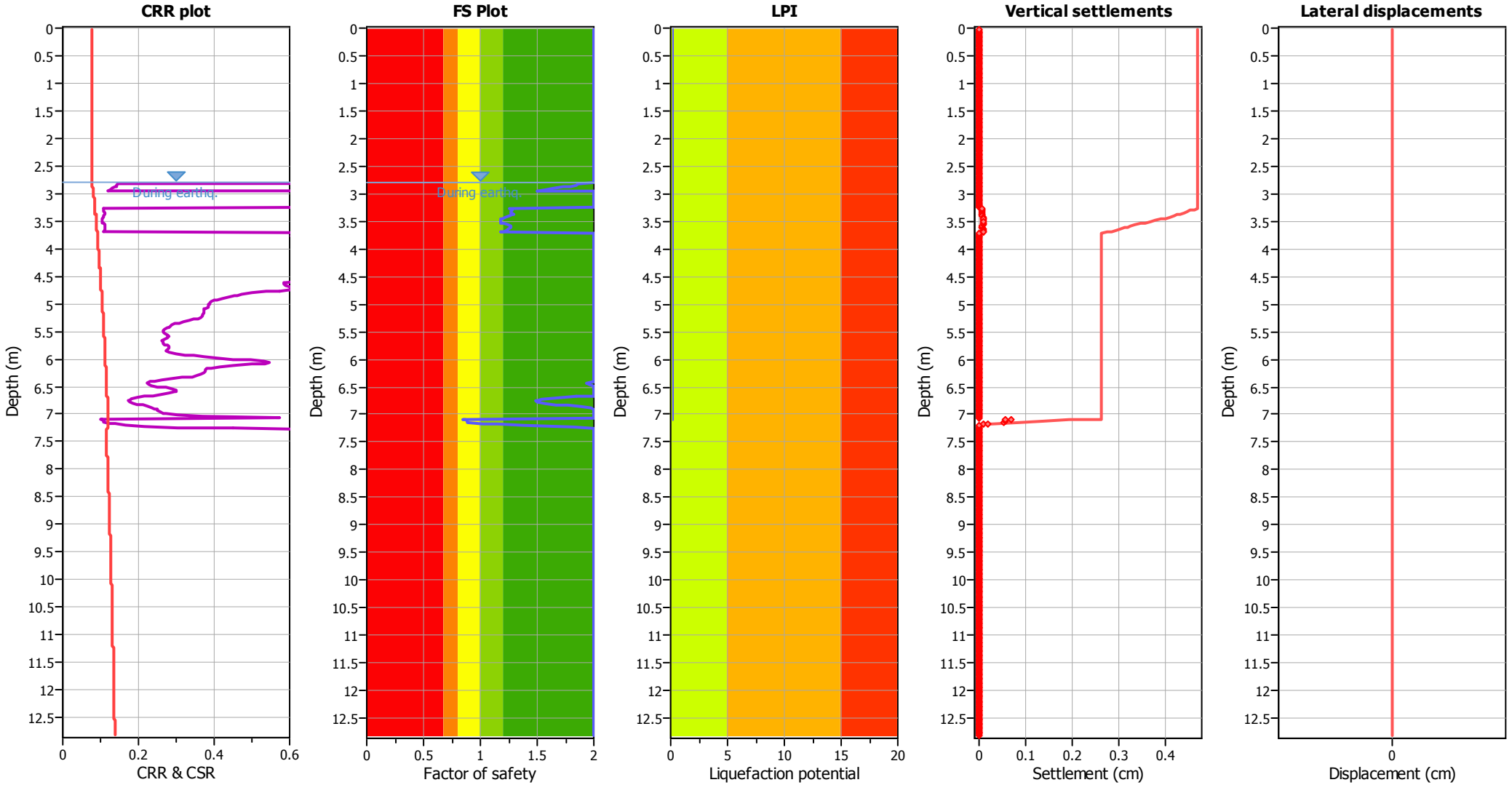






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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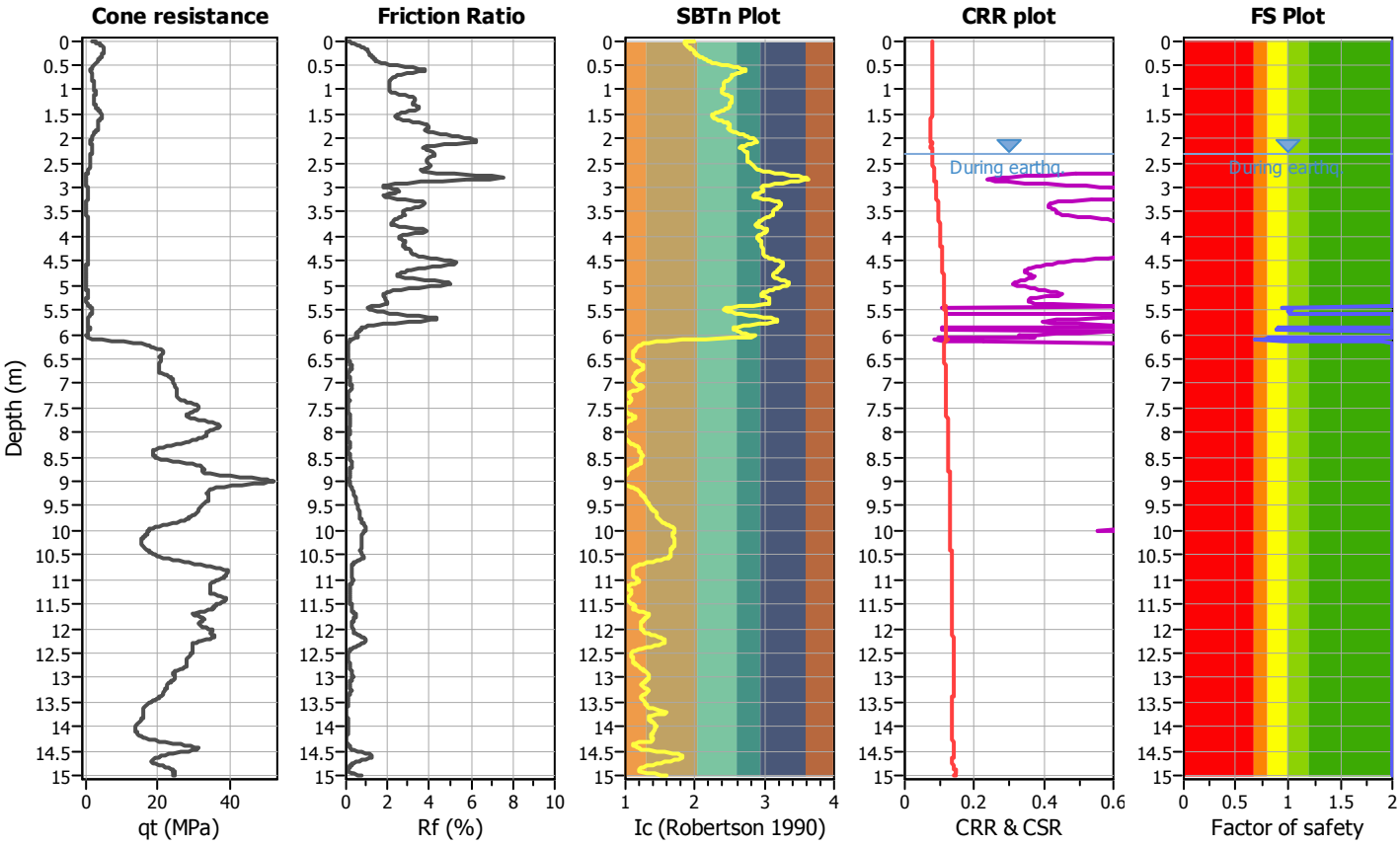
LIQUEFACTION ANALYSIS REPORT

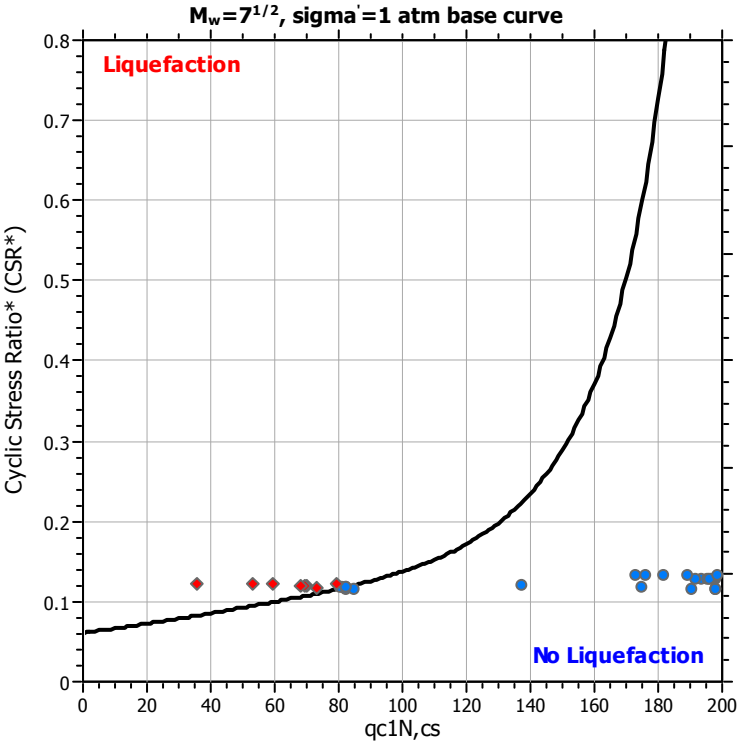
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

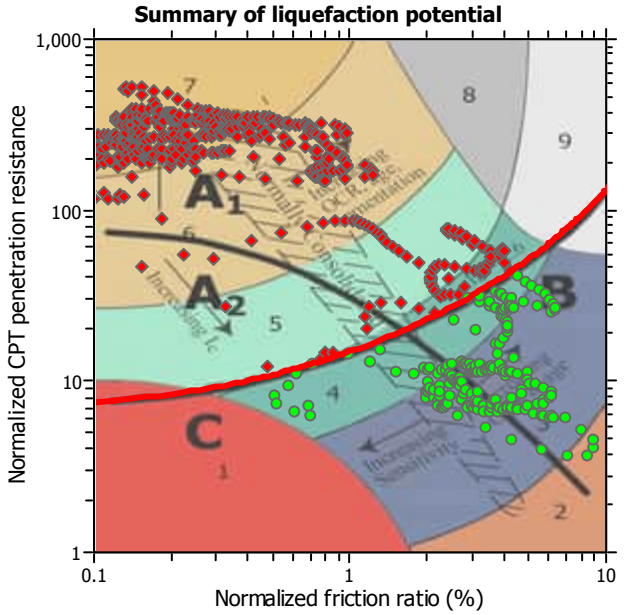
CPT file : CPT_04

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

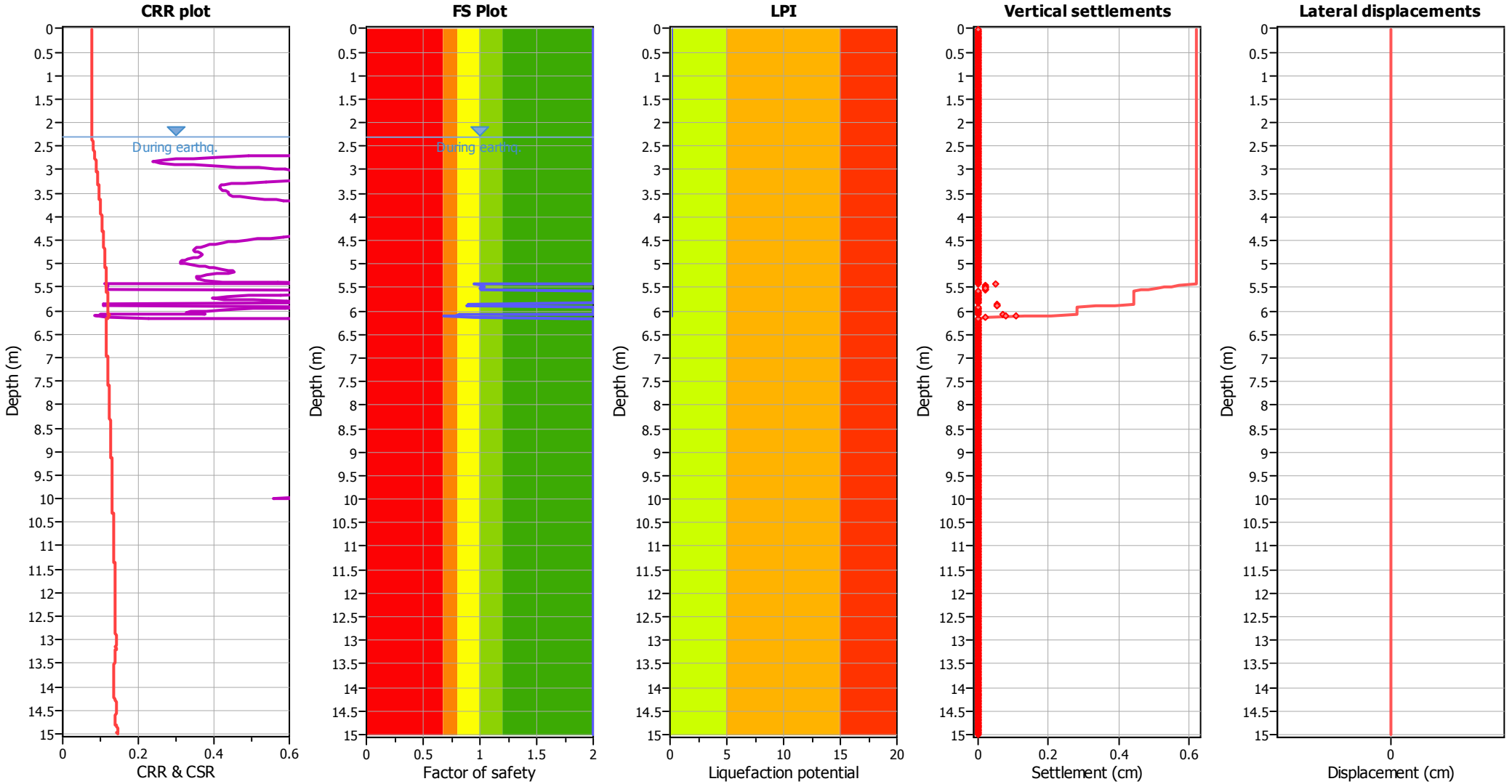






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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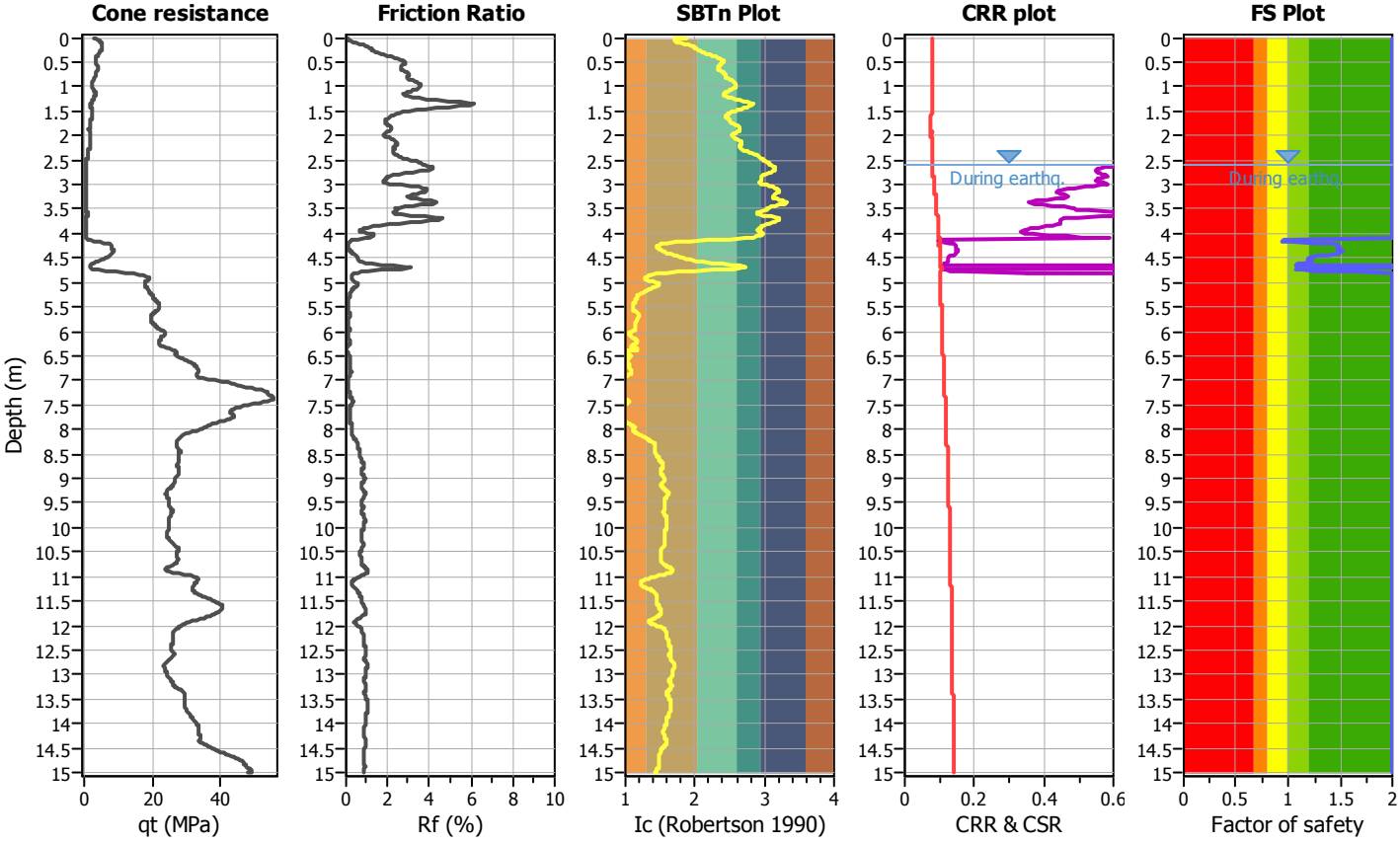
LIQUEFACTION ANALYSIS REPORT

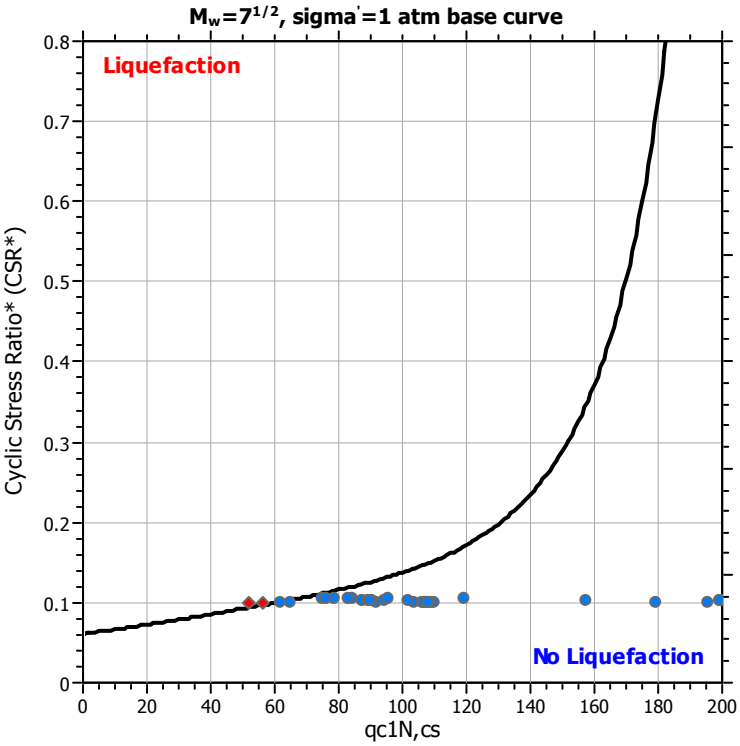
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

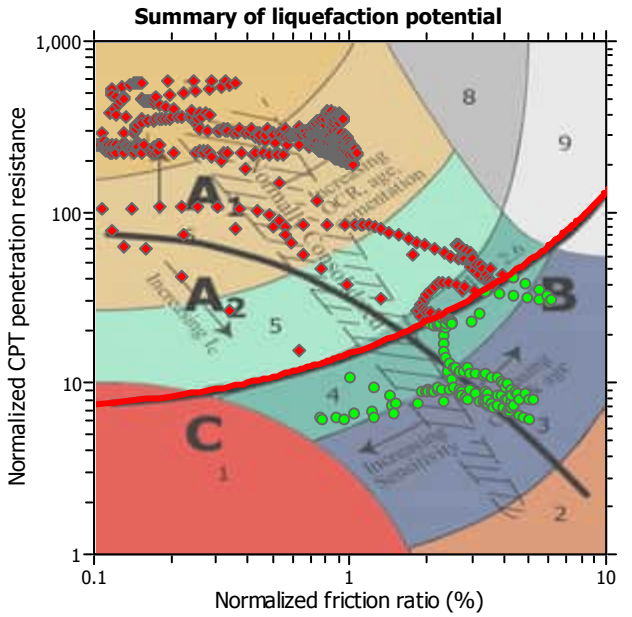
CPT file : CPT_05

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

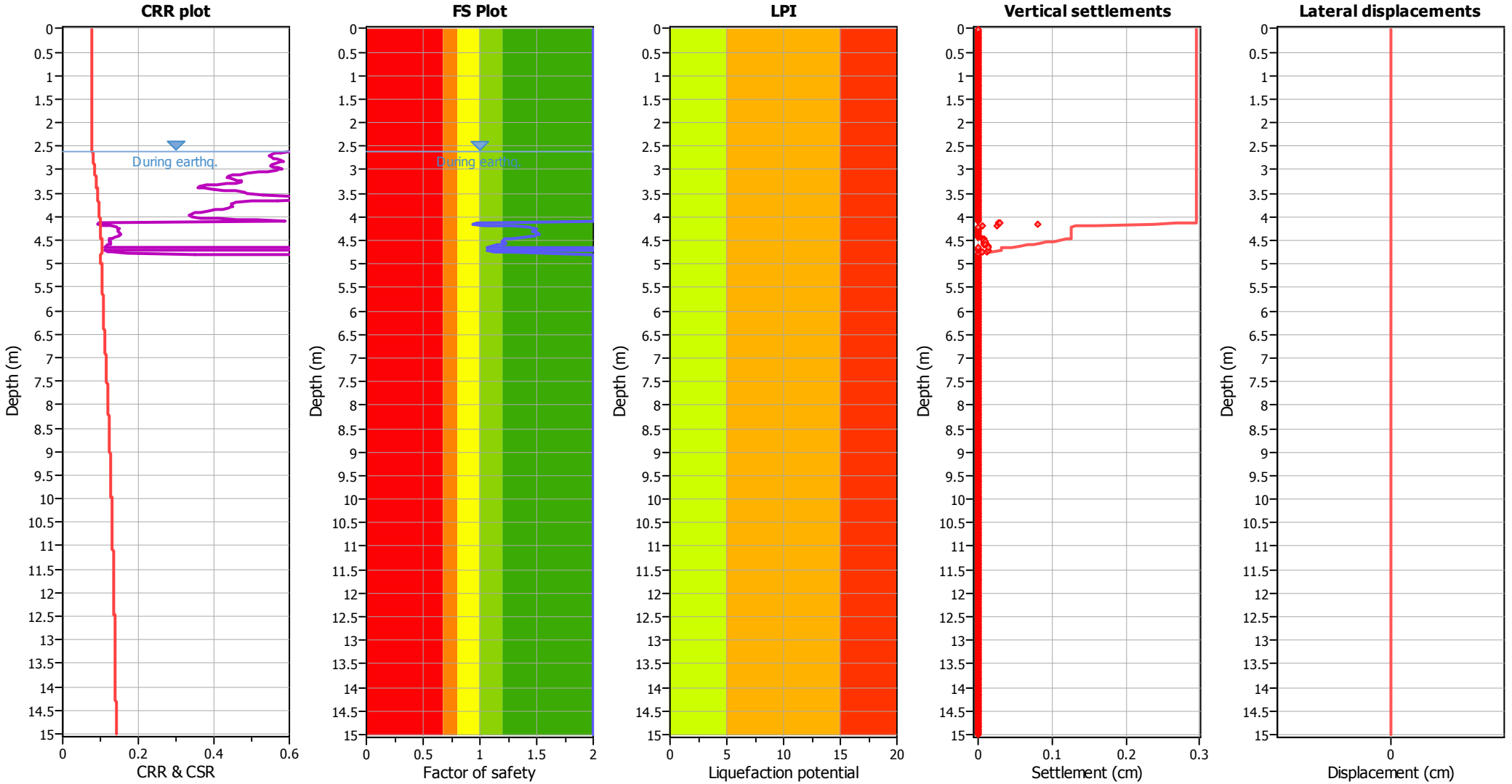






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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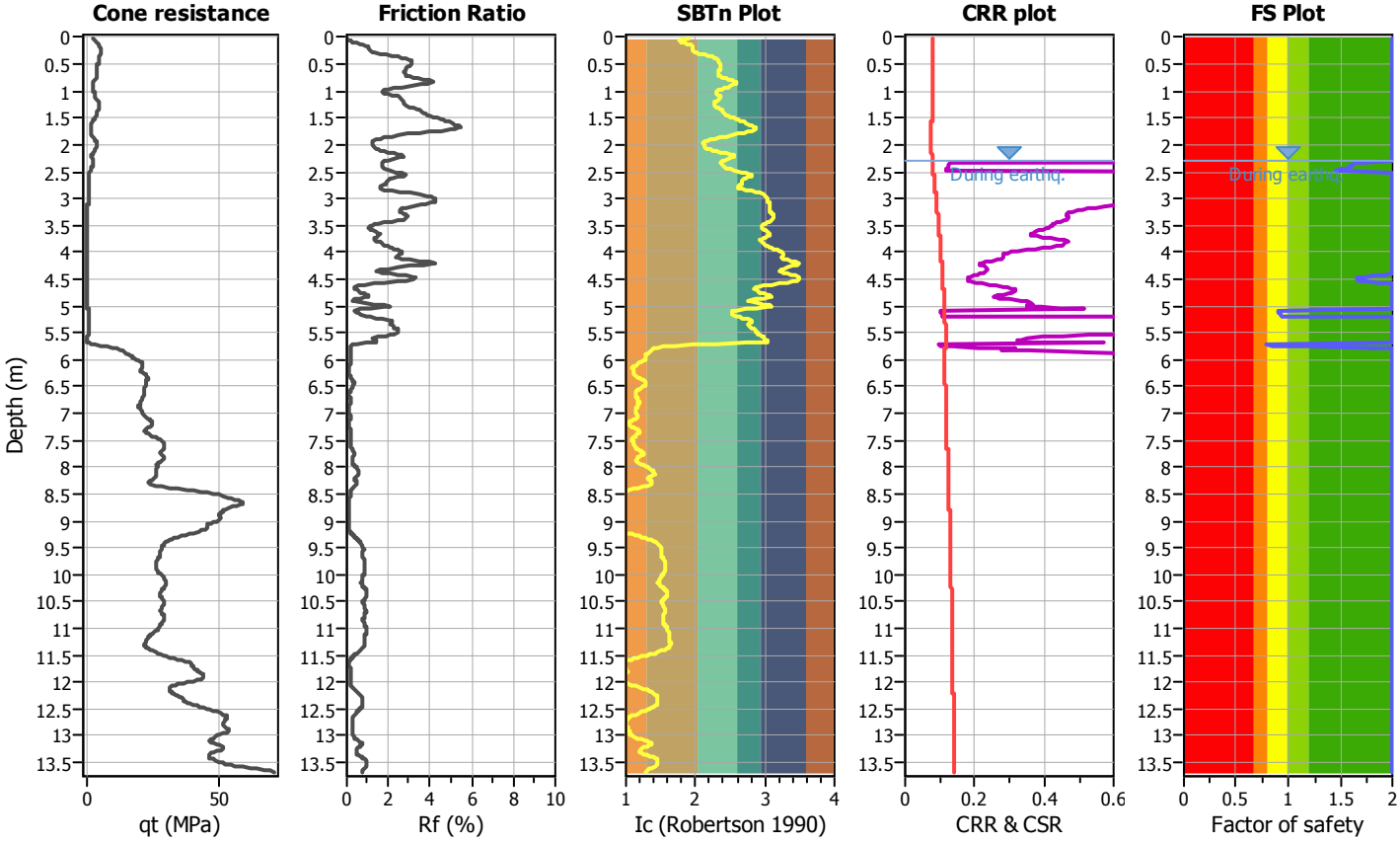
LIQUEFACTION ANALYSIS REPORT

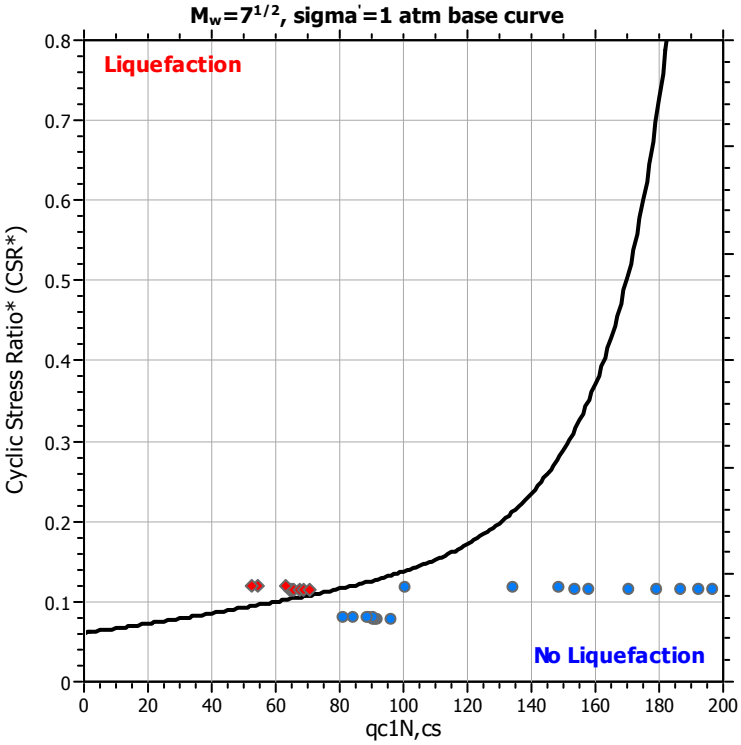
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

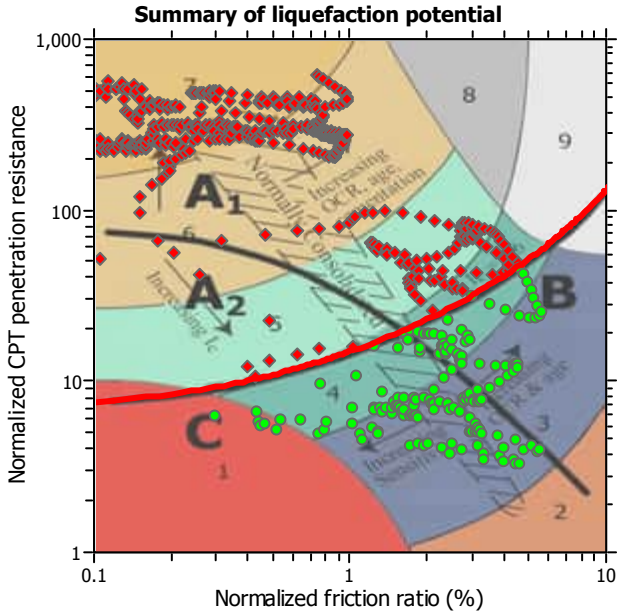
CPT file : CPT_06

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

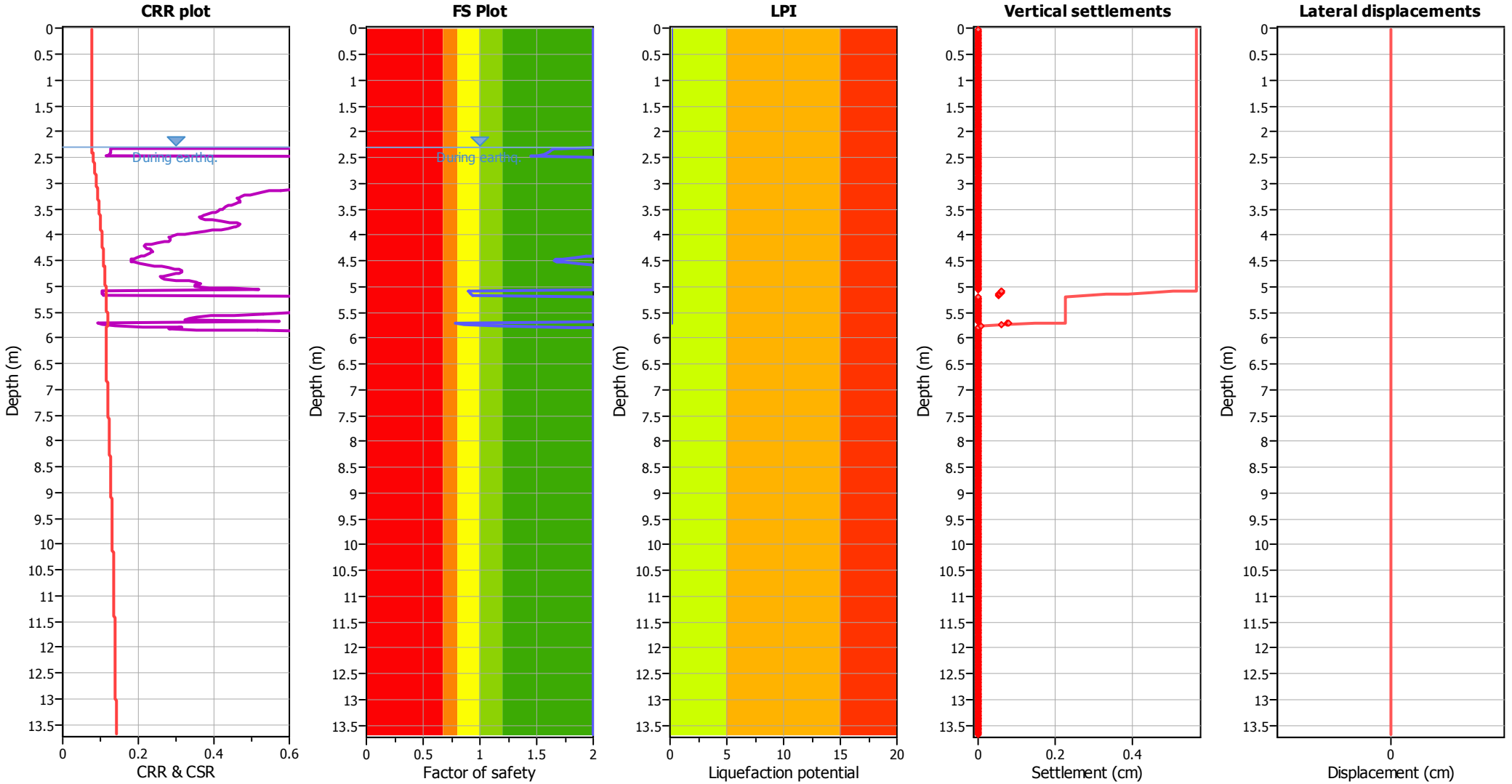






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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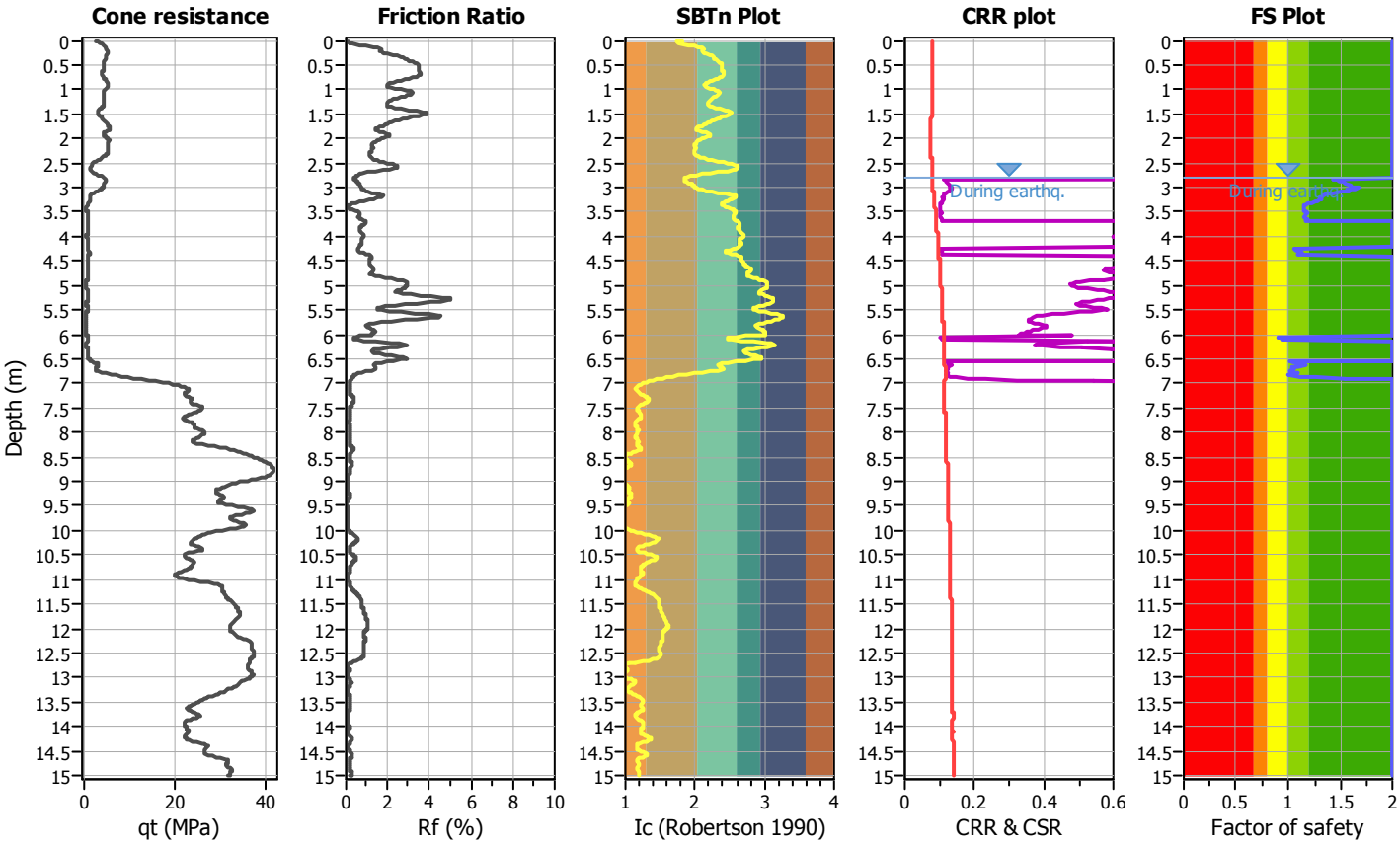
LIQUEFACTION ANALYSIS REPORT

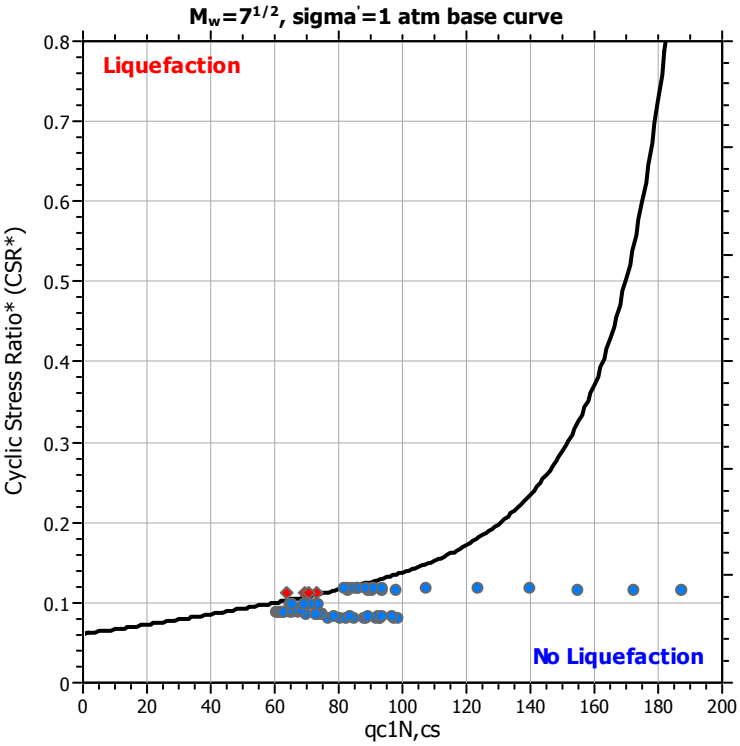
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

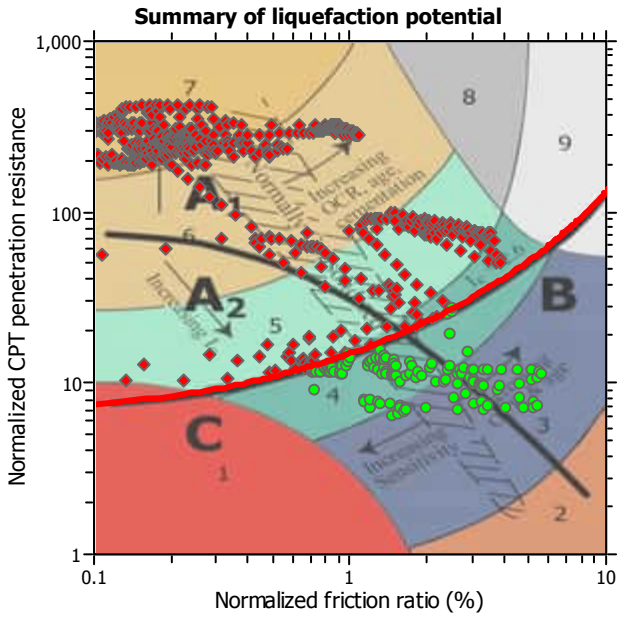
CPT file : CPT_07

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

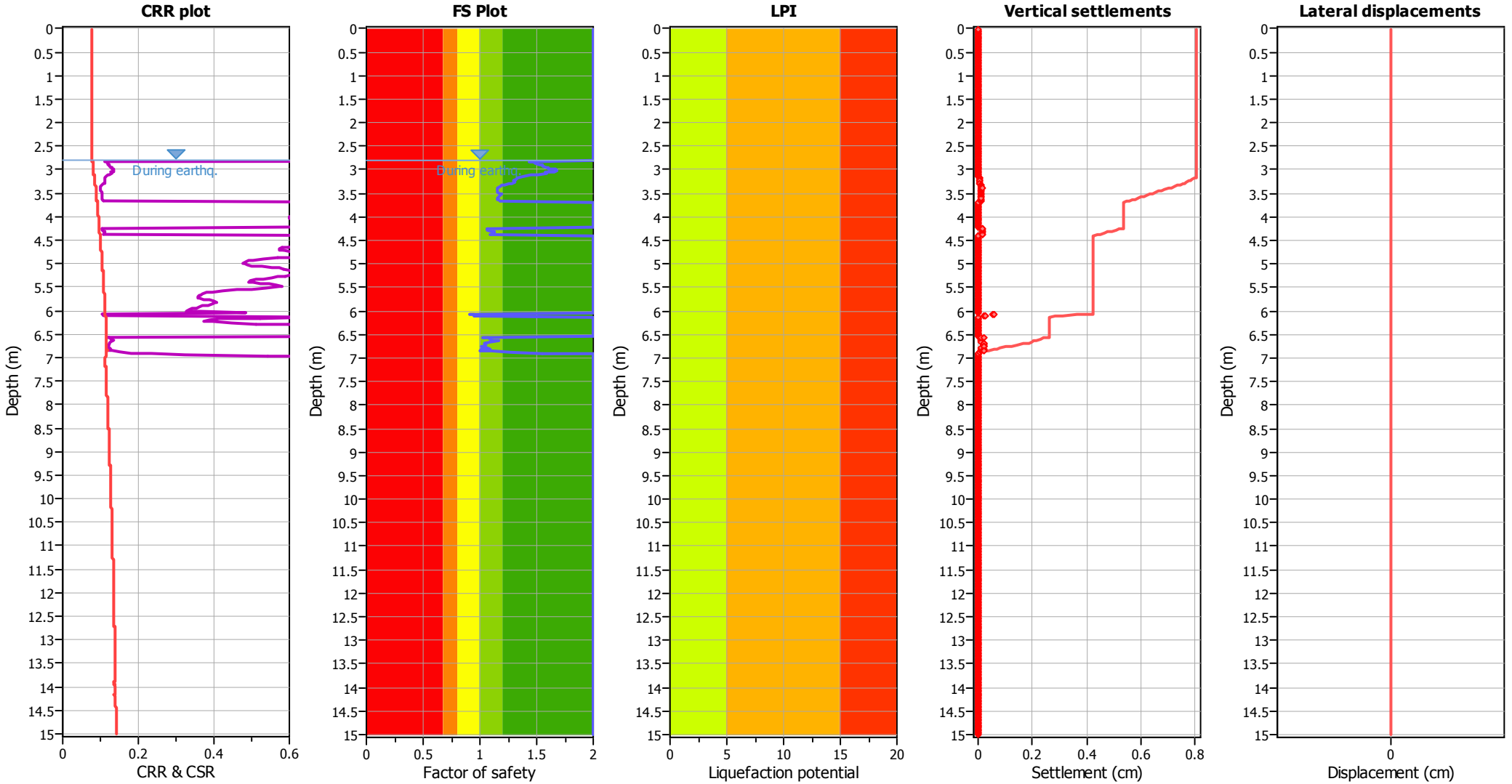






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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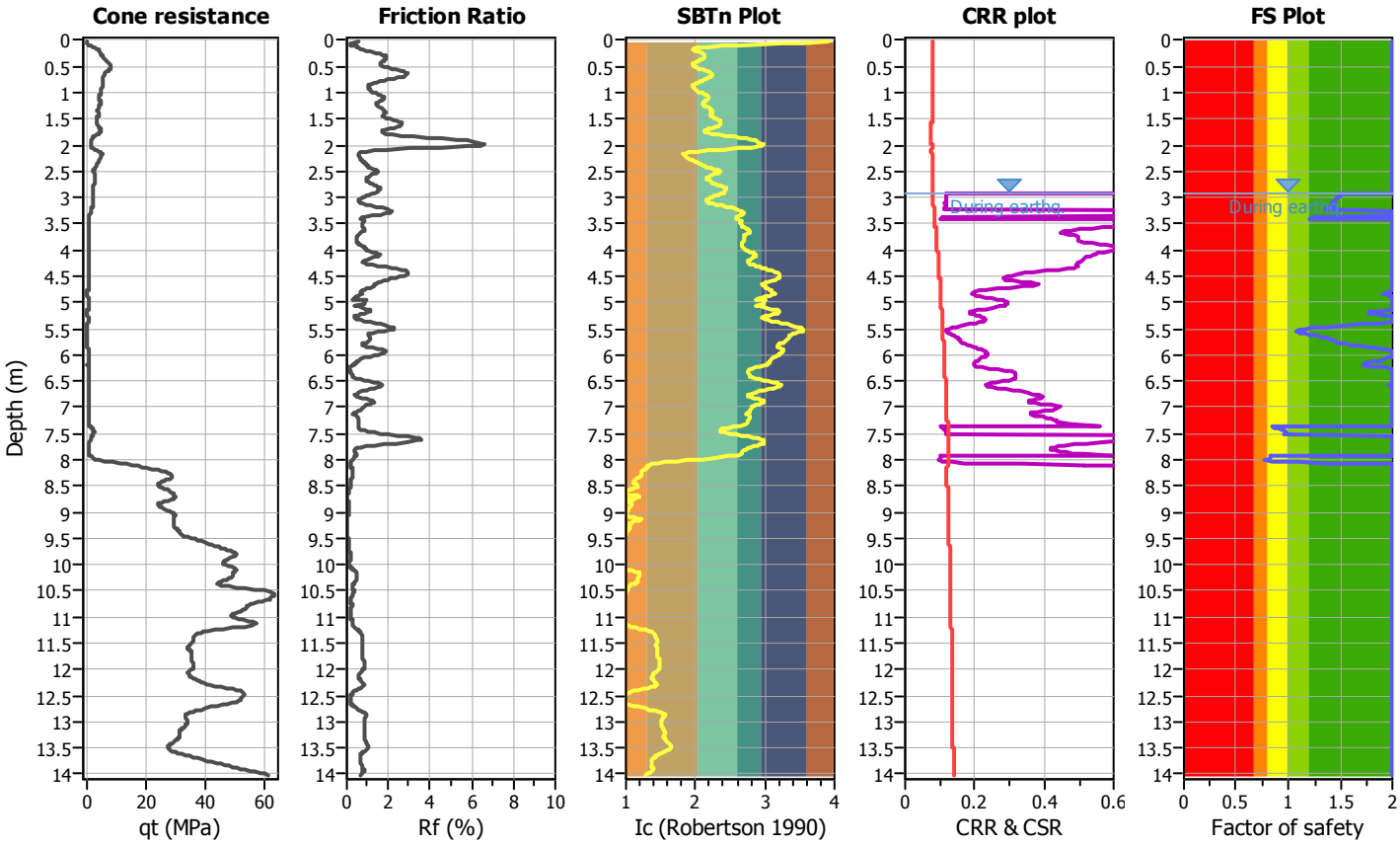
LIQUEFACTION ANALYSIS REPORT

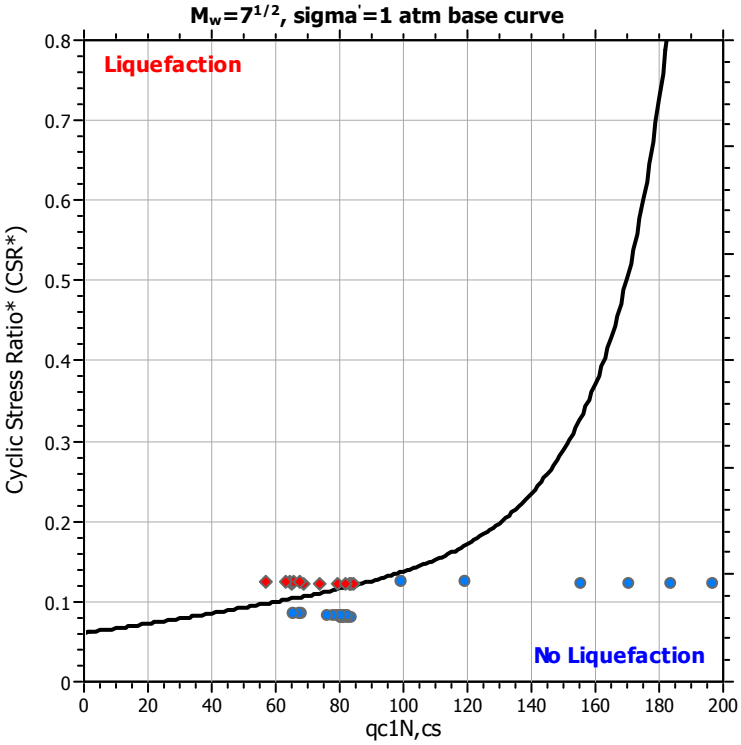
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

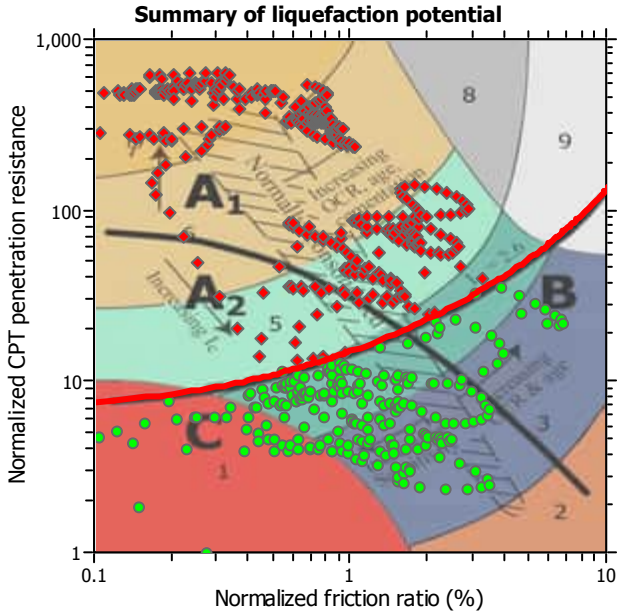
CPT file : CPT_08

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

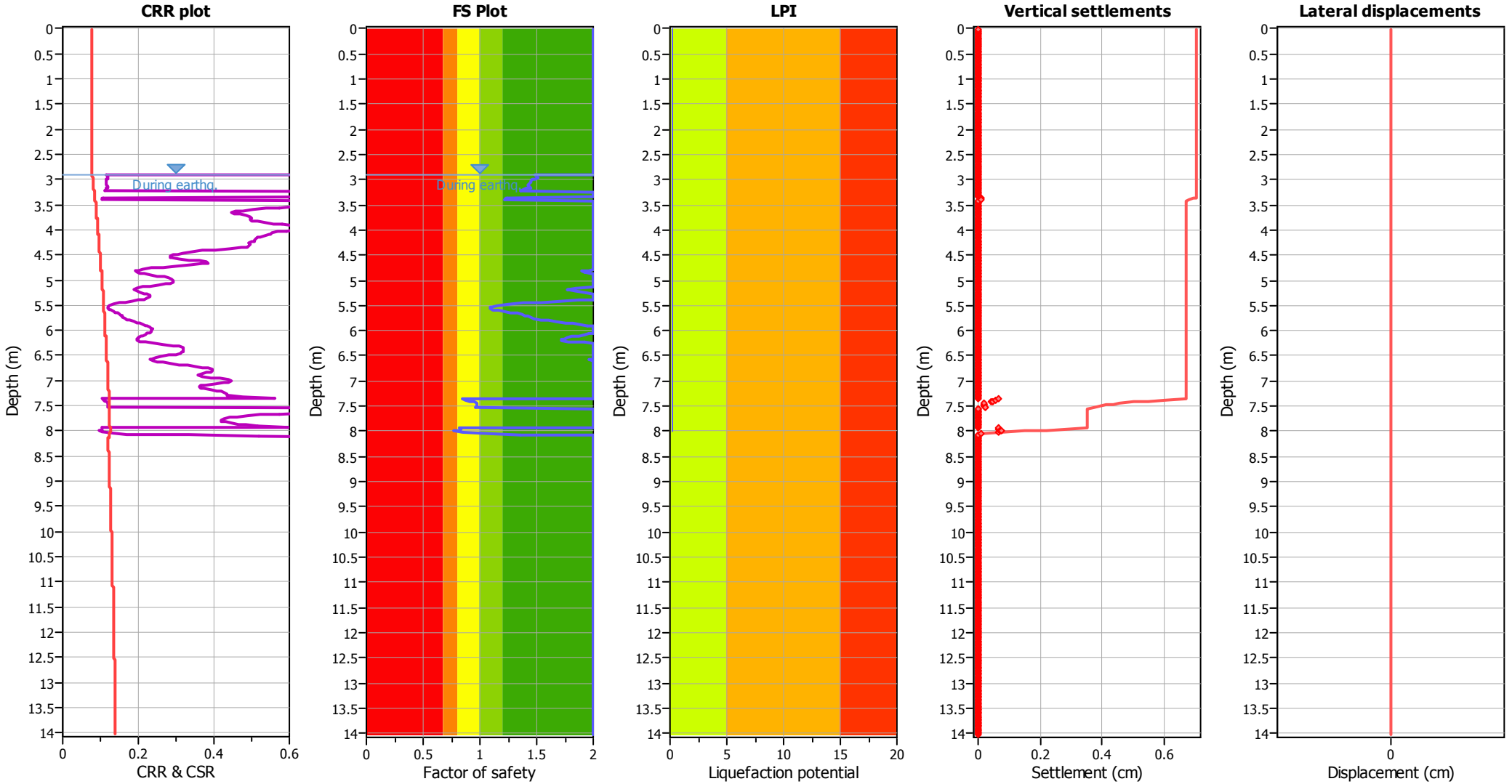






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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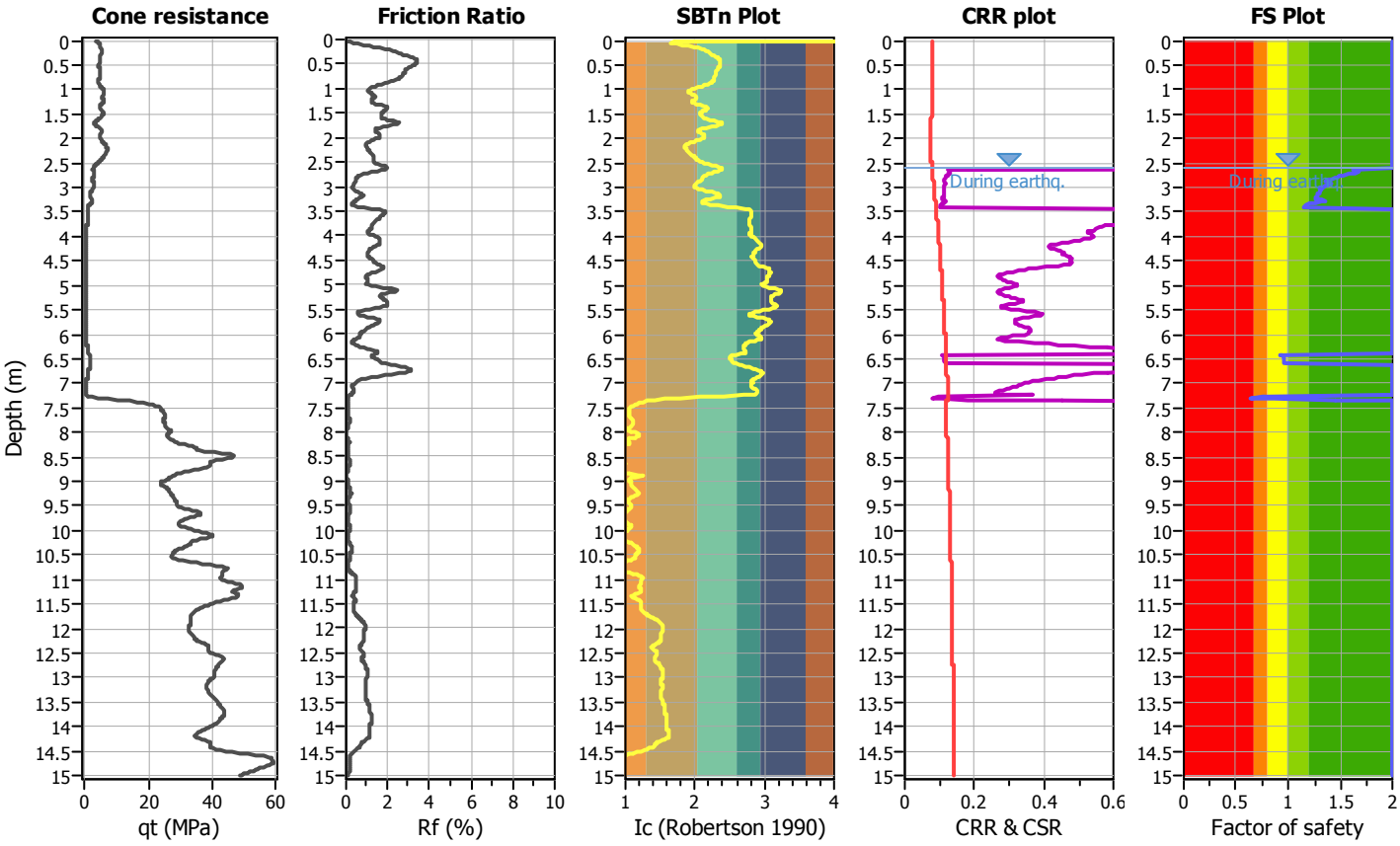
LIQUEFACTION ANALYSIS REPORT

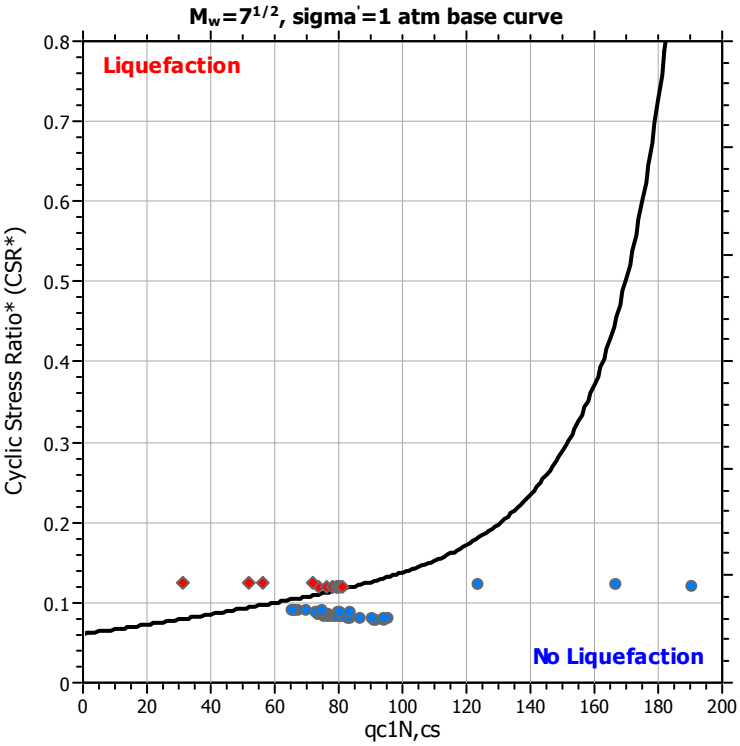
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

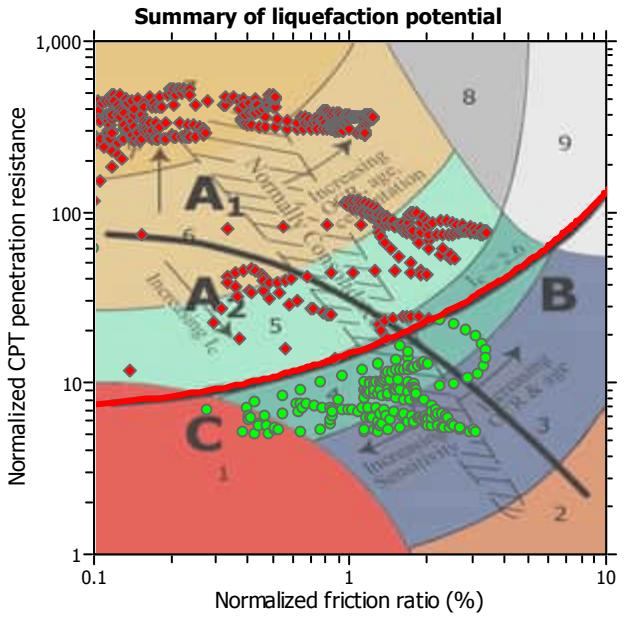
CPT file : CPT_09

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

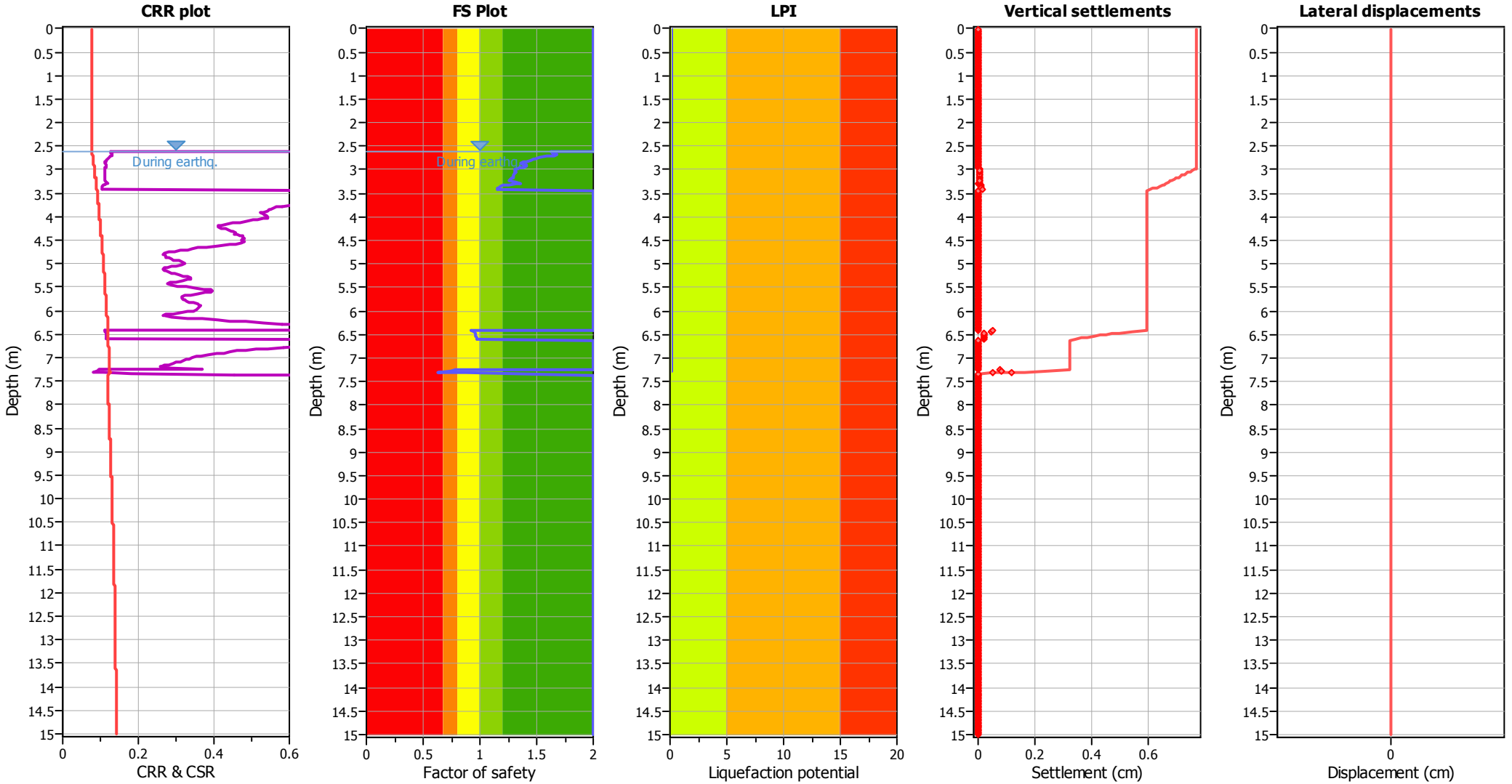






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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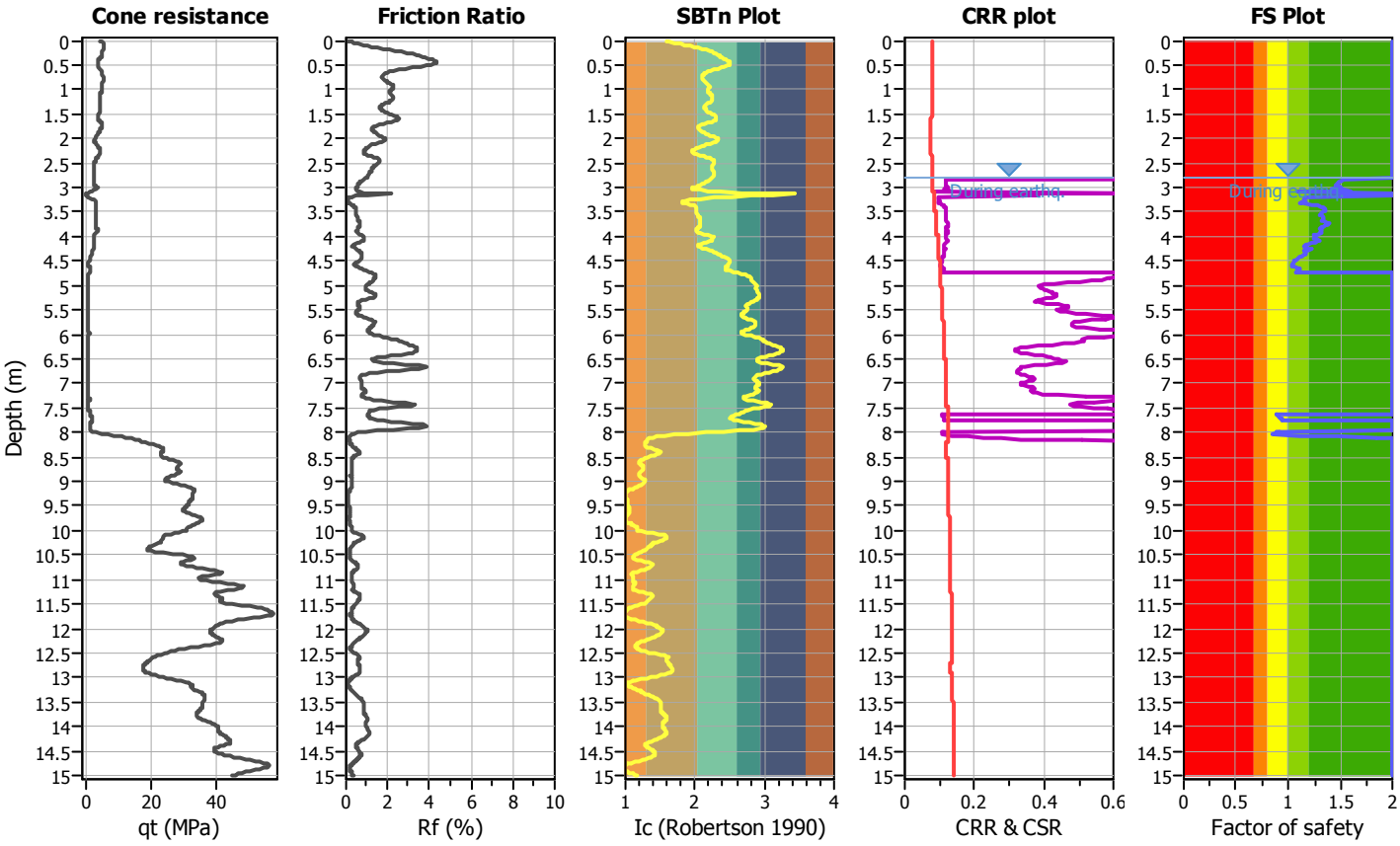
LIQUEFACTION ANALYSIS REPORT

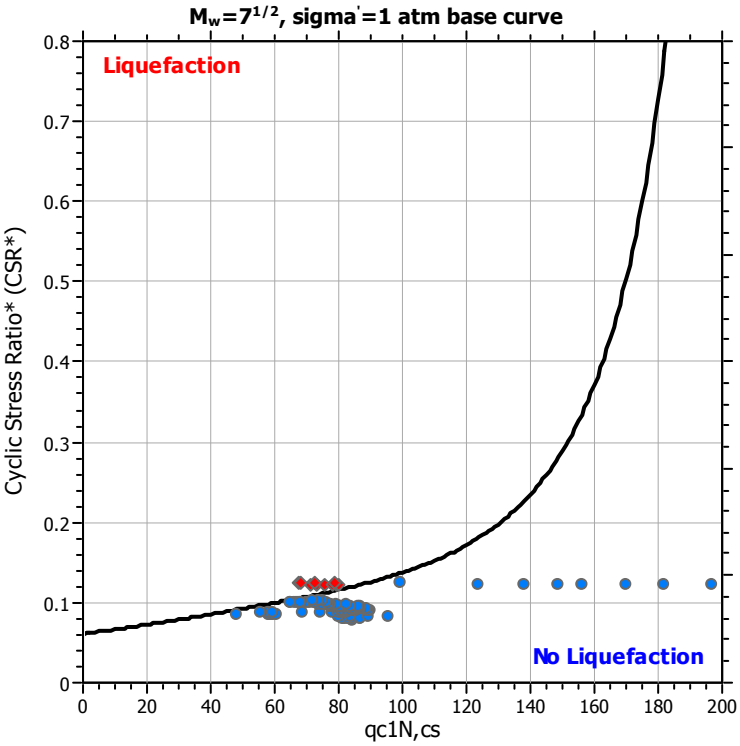
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

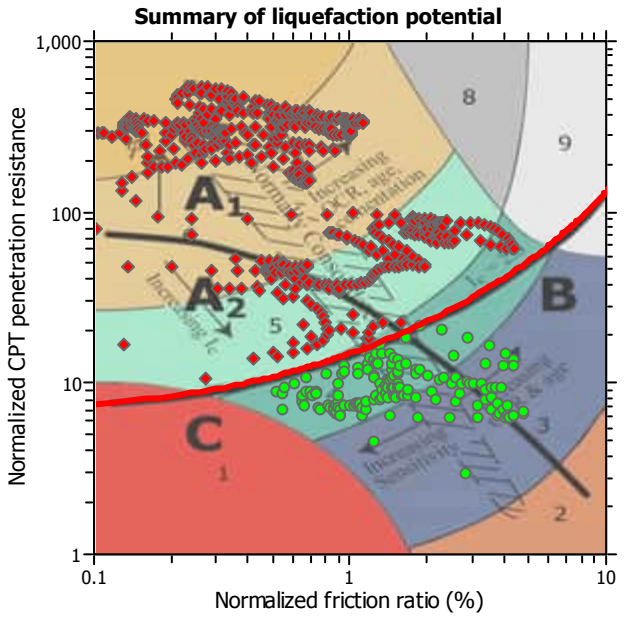
CPT file : CPT_10

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

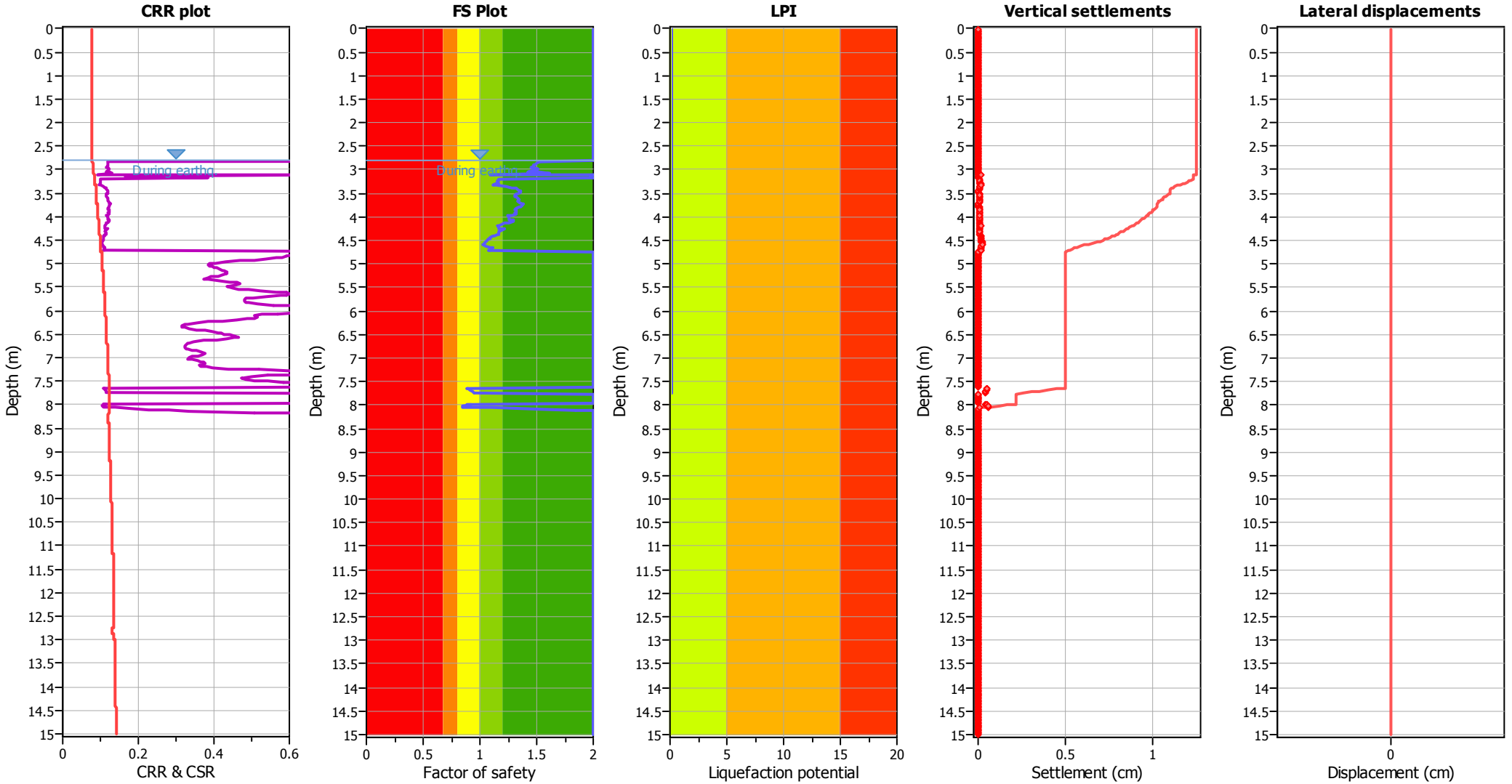






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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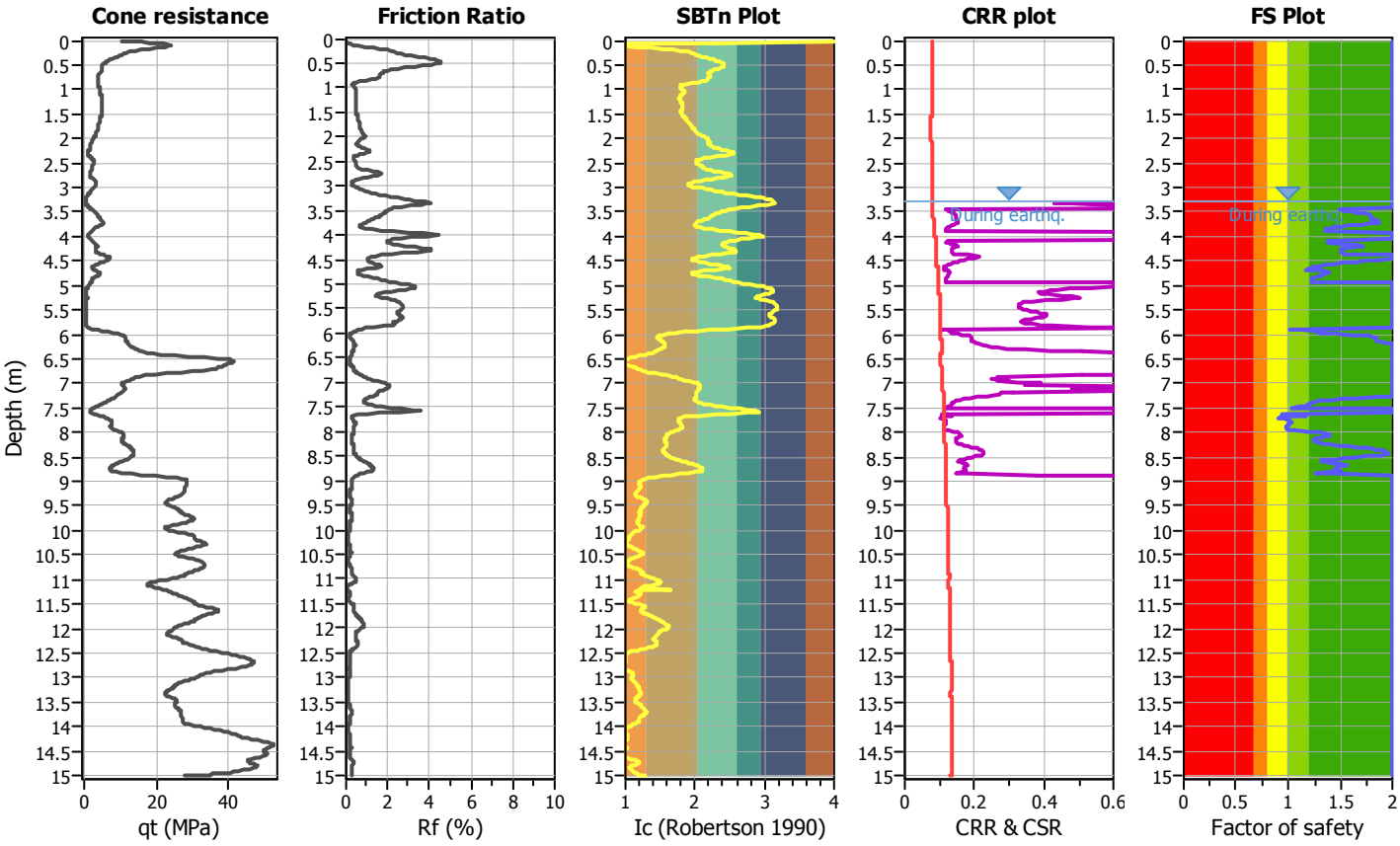
LIQUEFACTION ANALYSIS REPORT

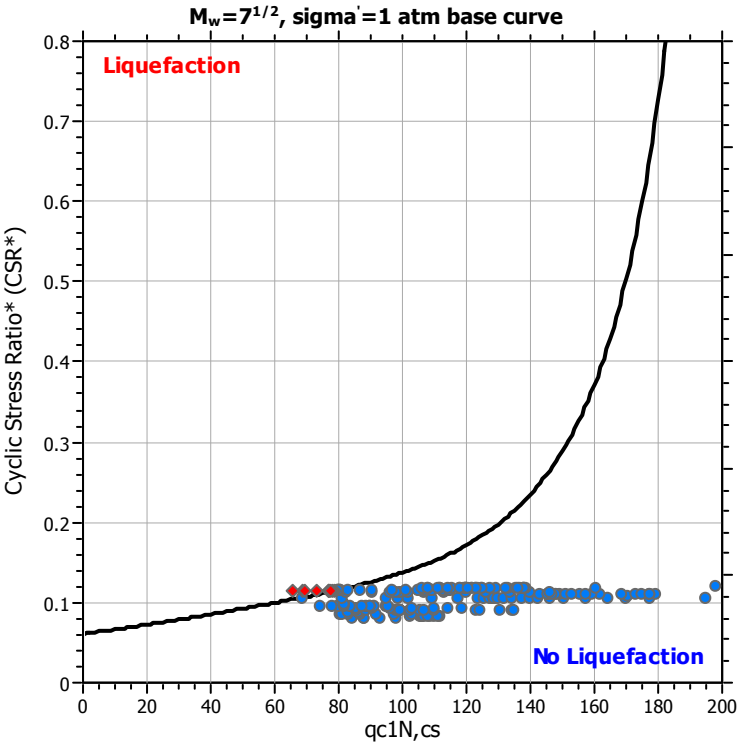
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

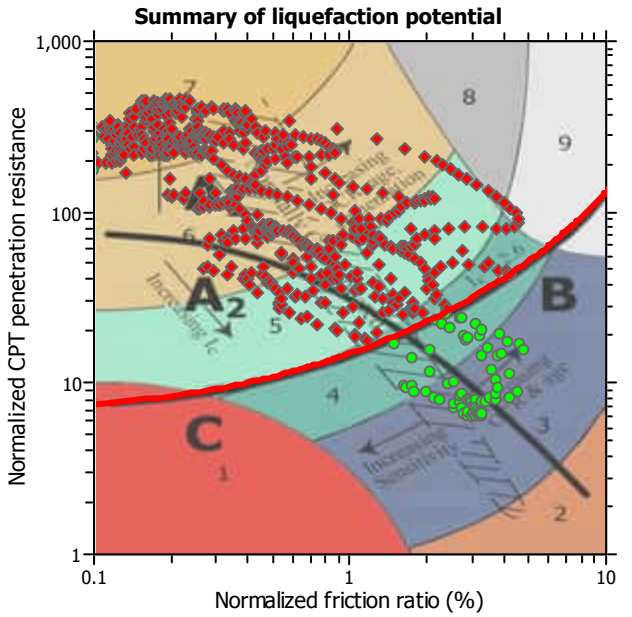
CPT file : CPT_11

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

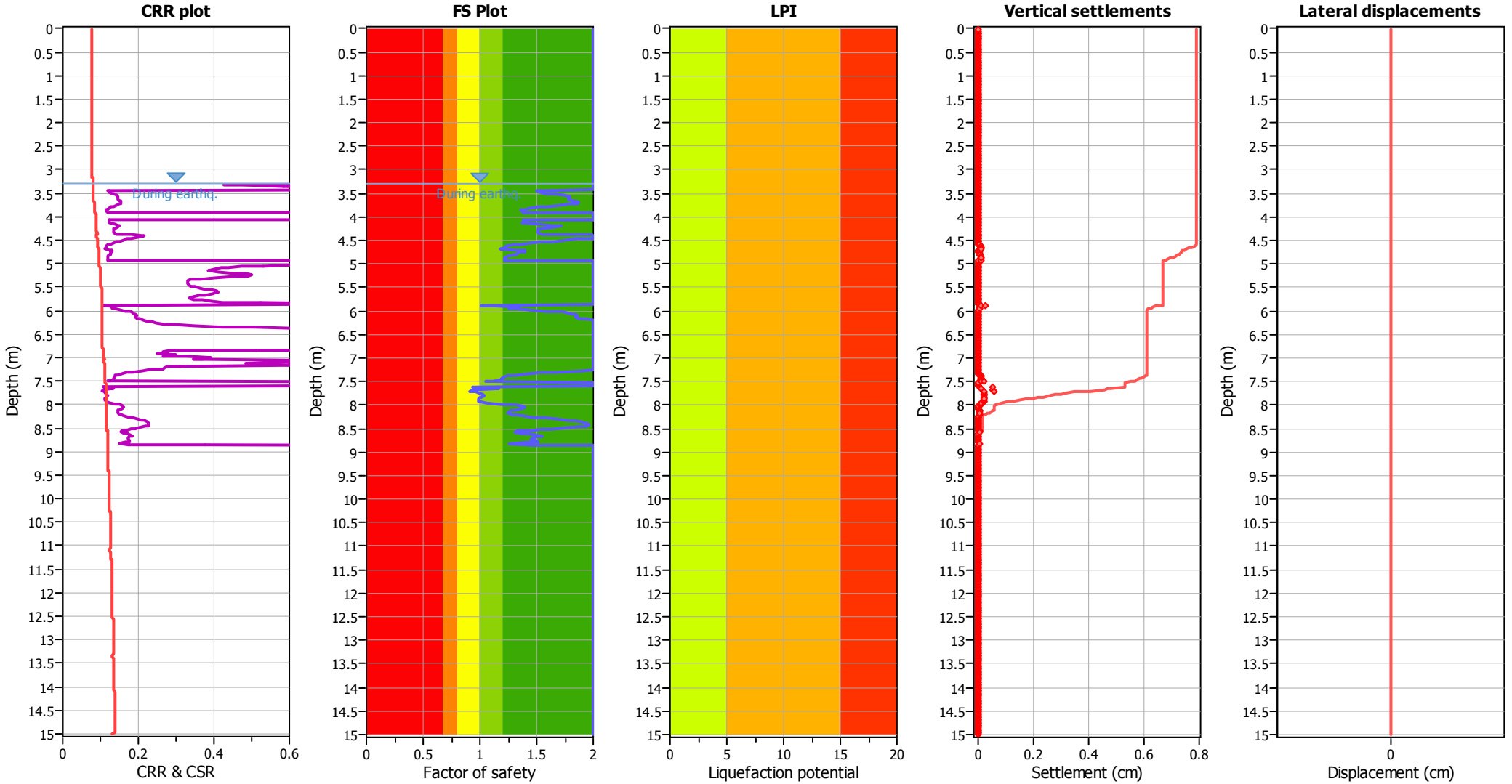






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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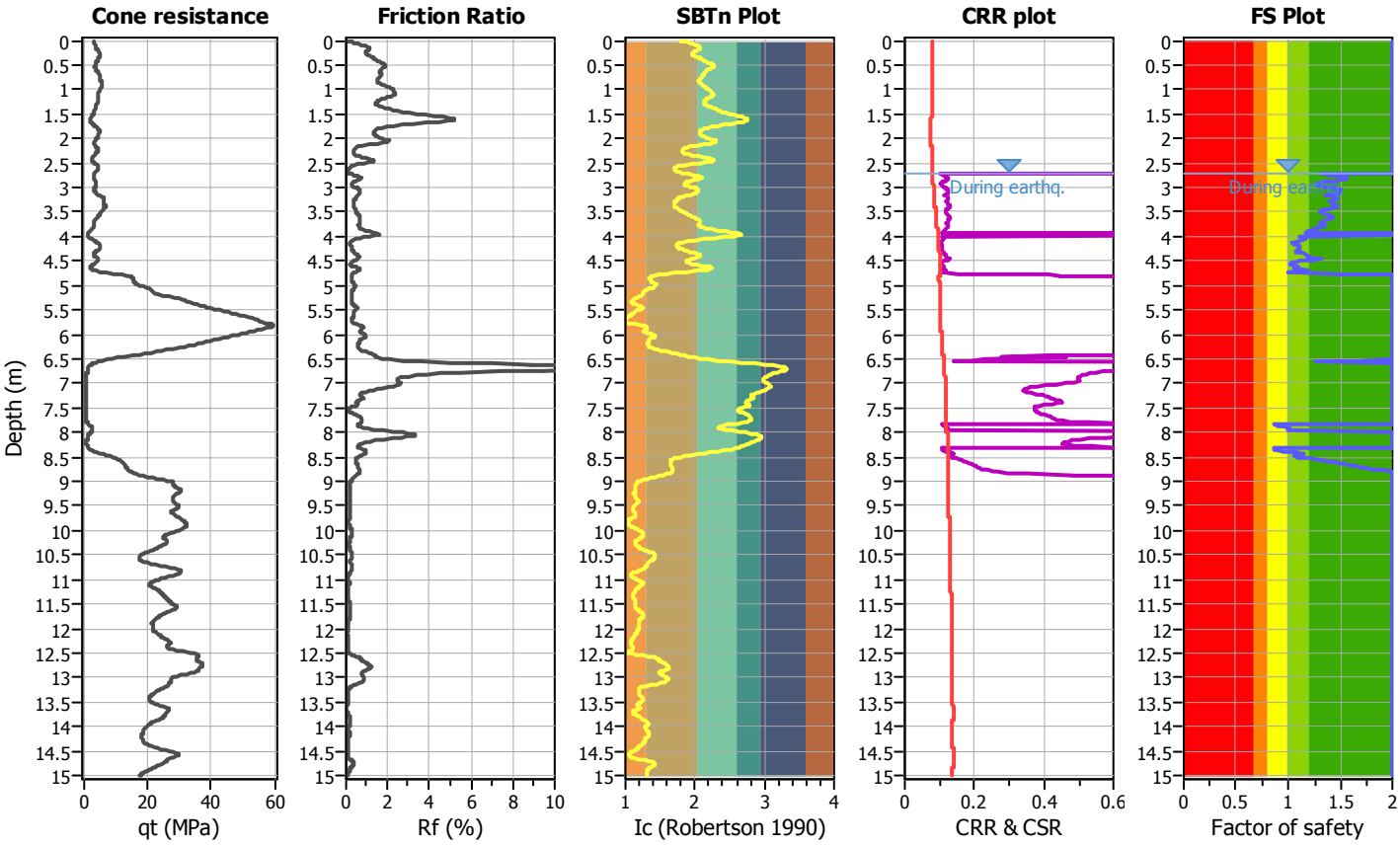
LIQUEFACTION ANALYSIS REPORT

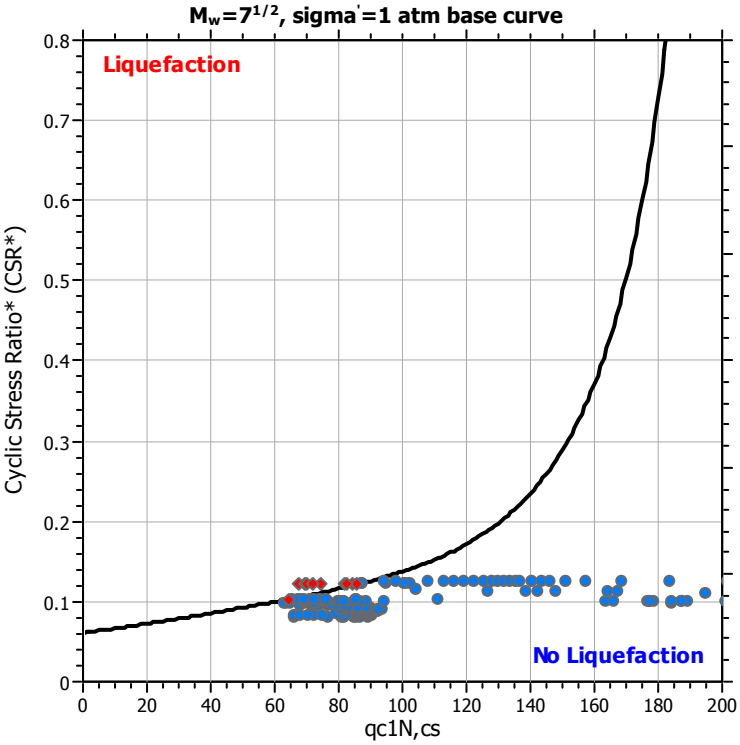
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

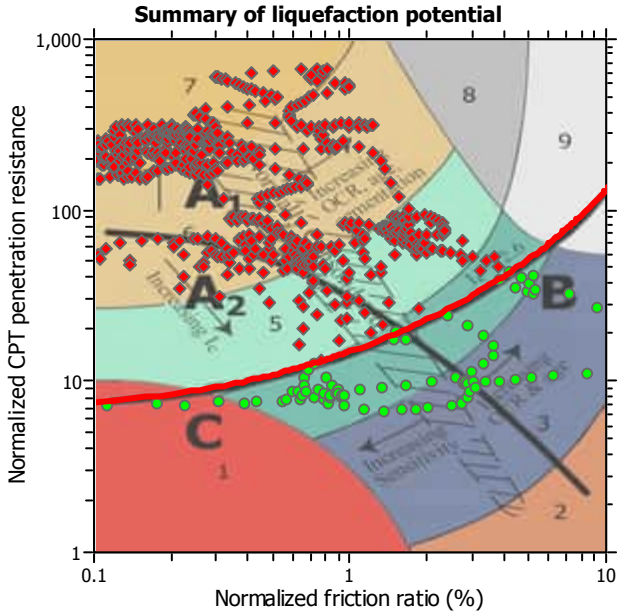
CPT file : CPT_12

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

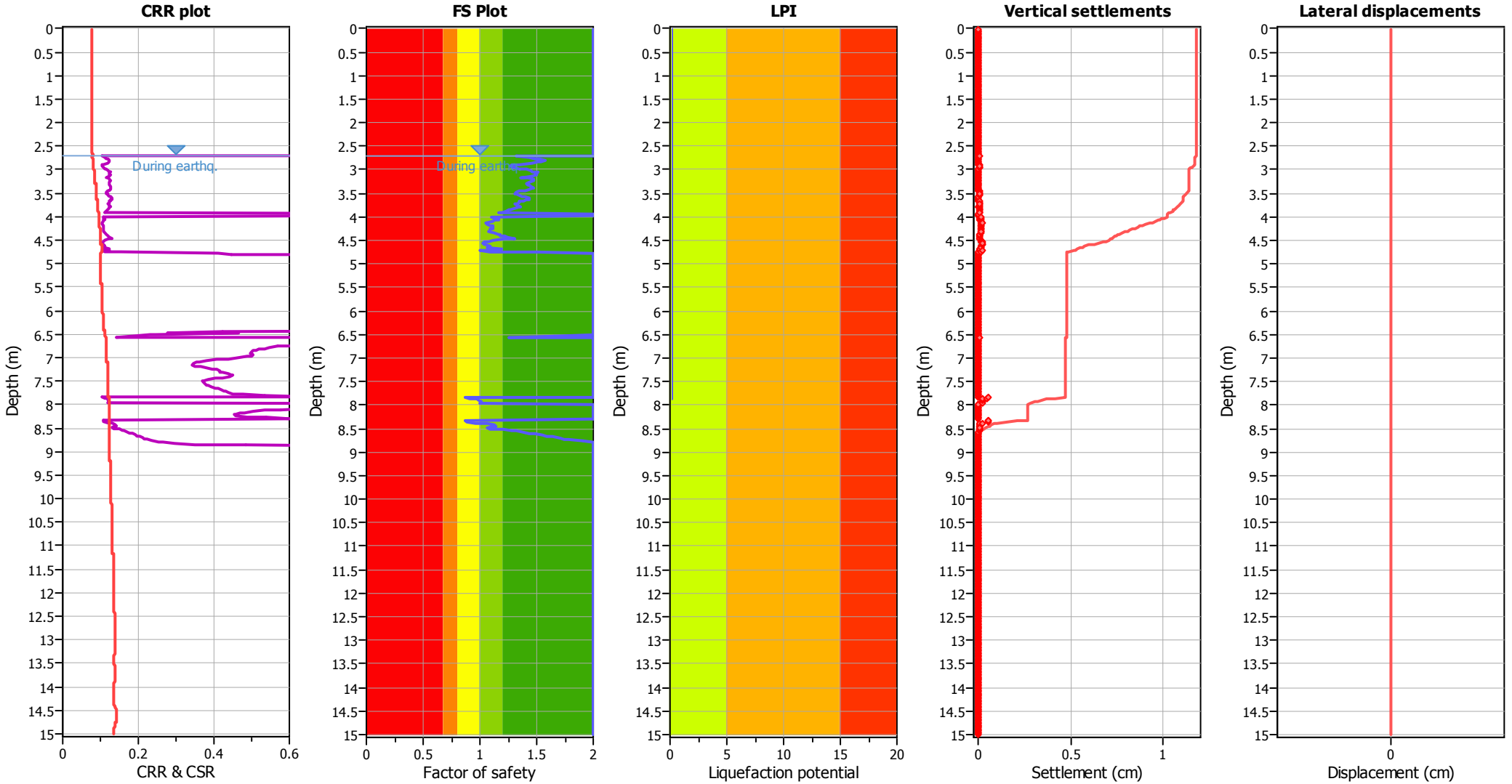






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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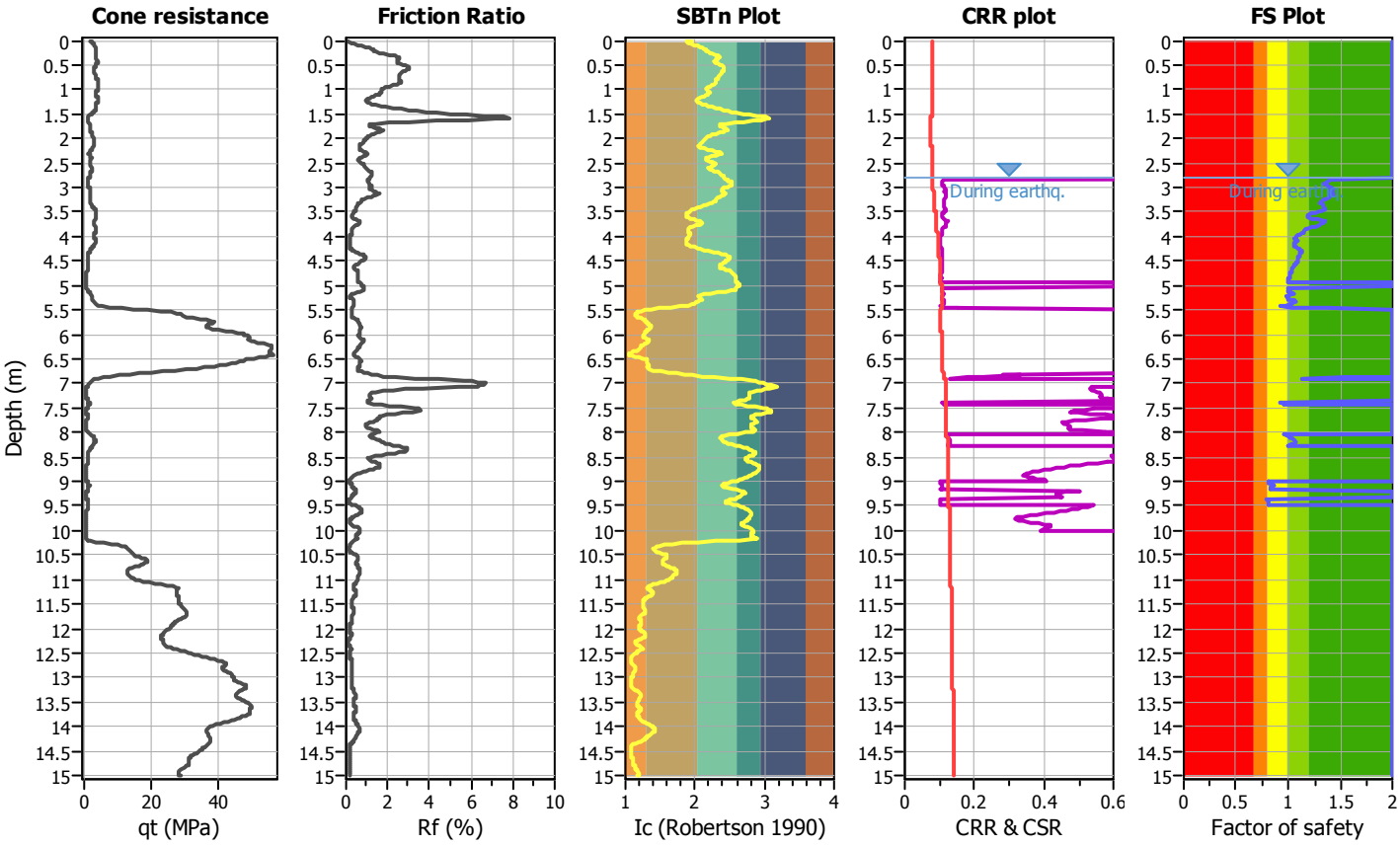
LIQUEFACTION ANALYSIS REPORT

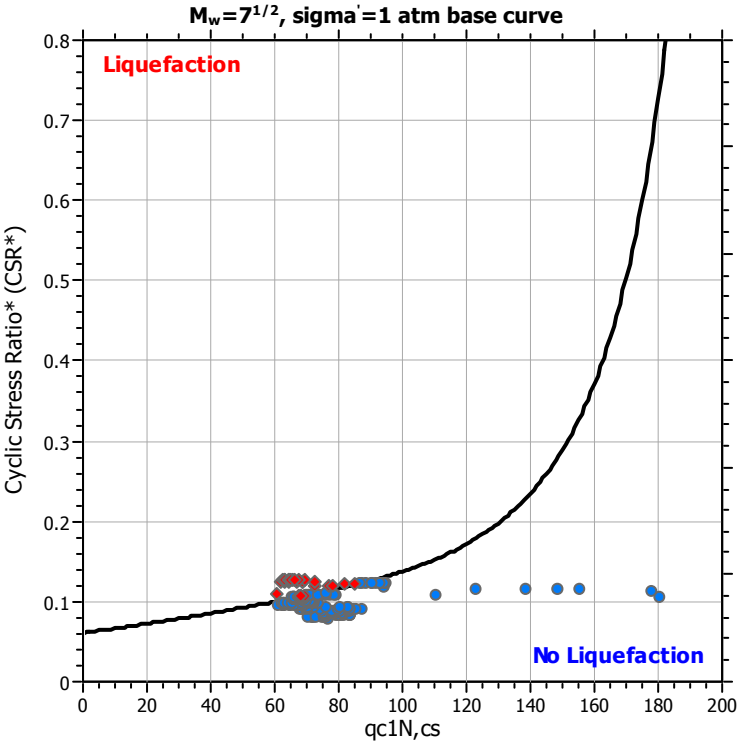
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

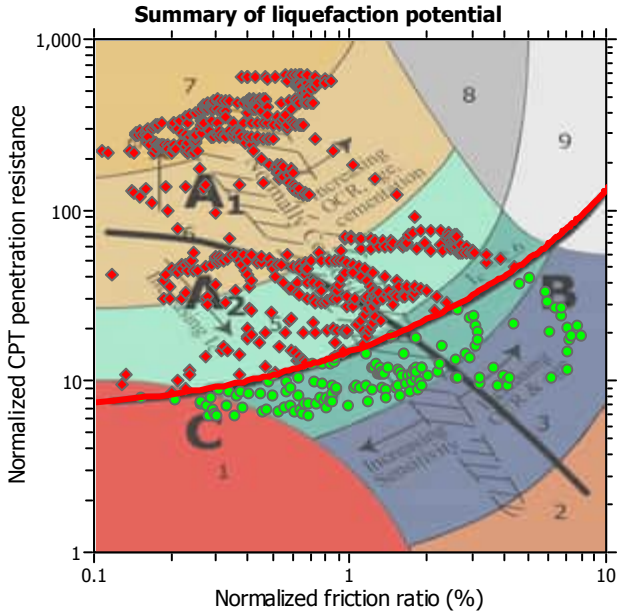
CPT file : CPT_13

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

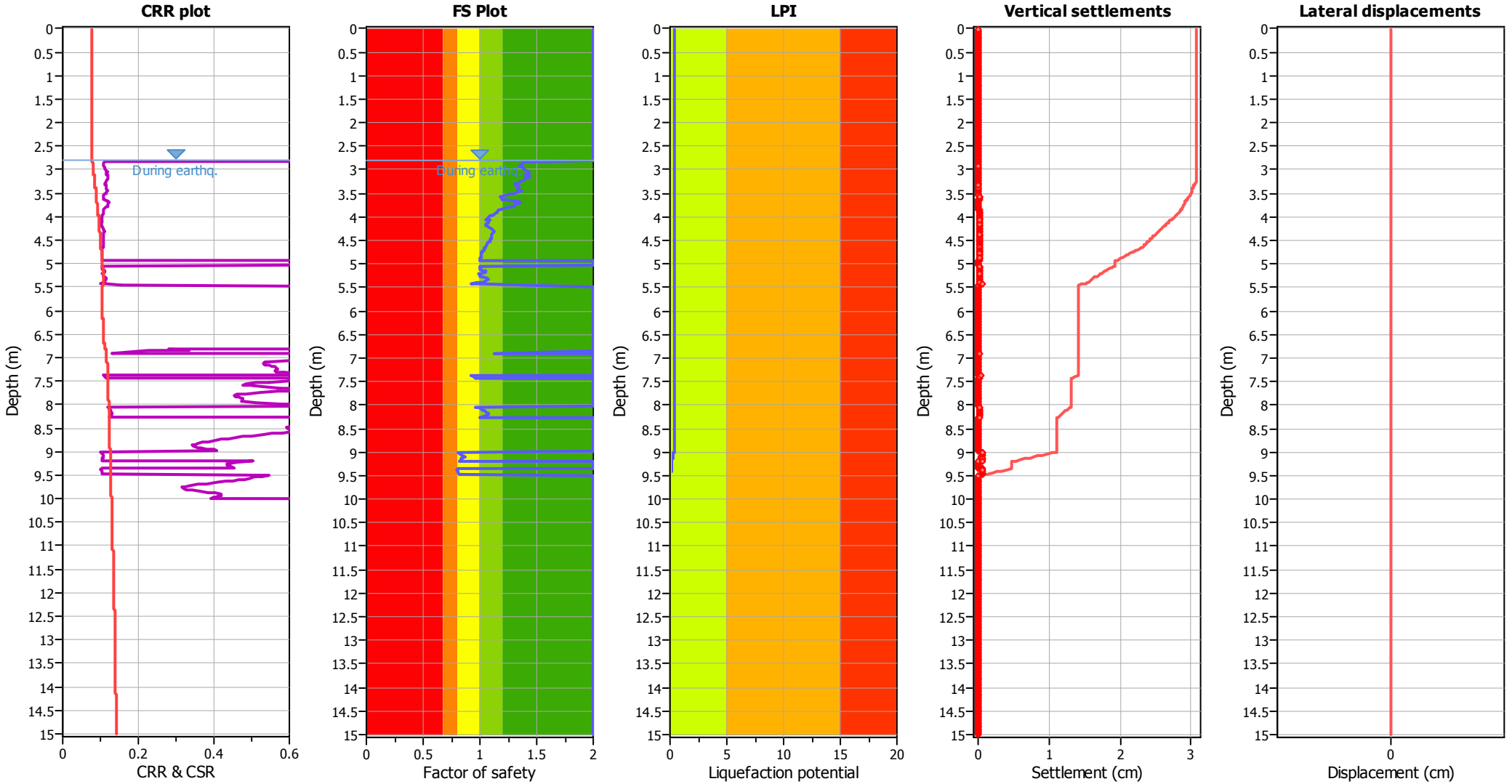






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
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LPI color scheme

- Very high risk
- High risk
- Low risk

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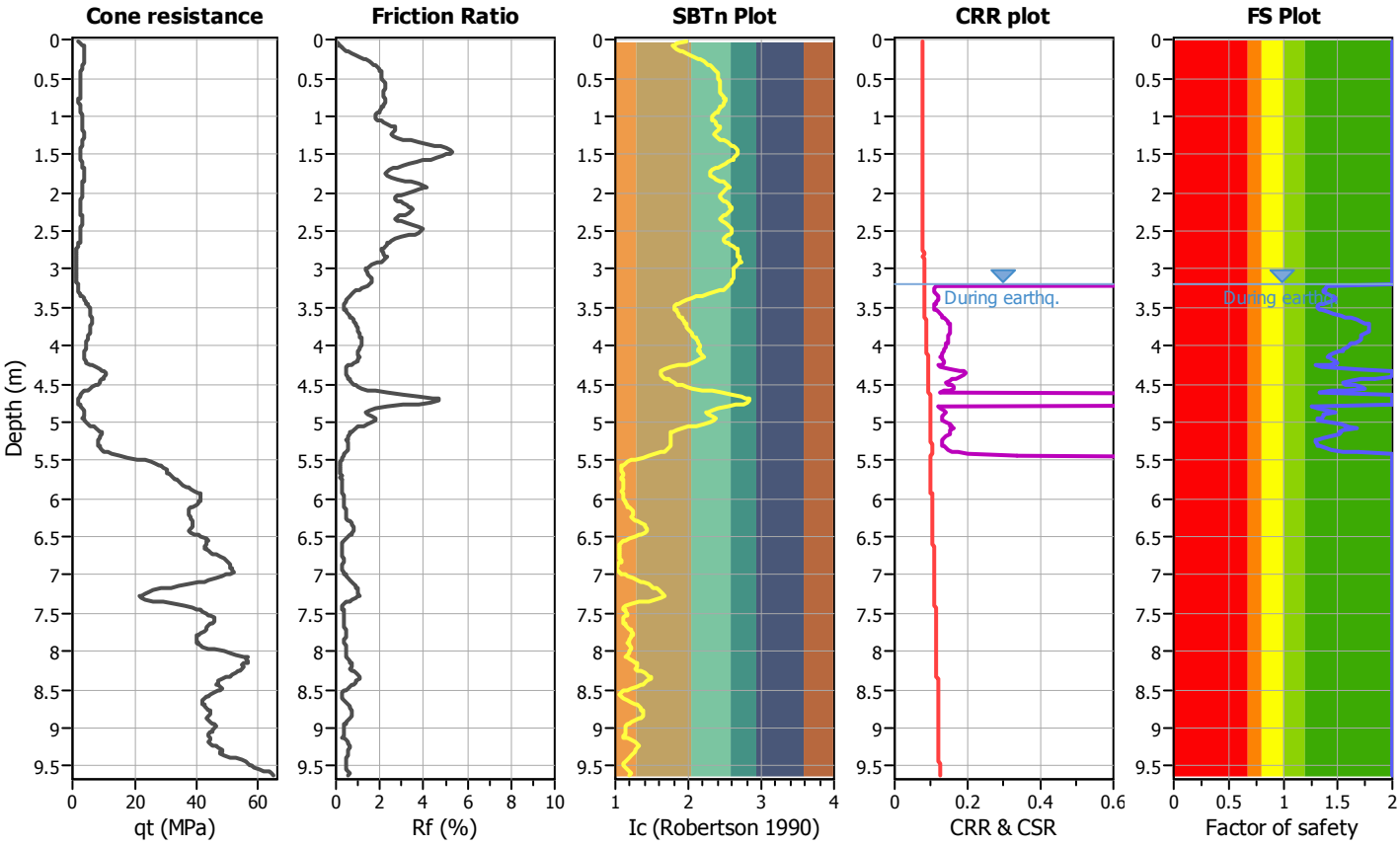
LIQUEFACTION ANALYSIS REPORT

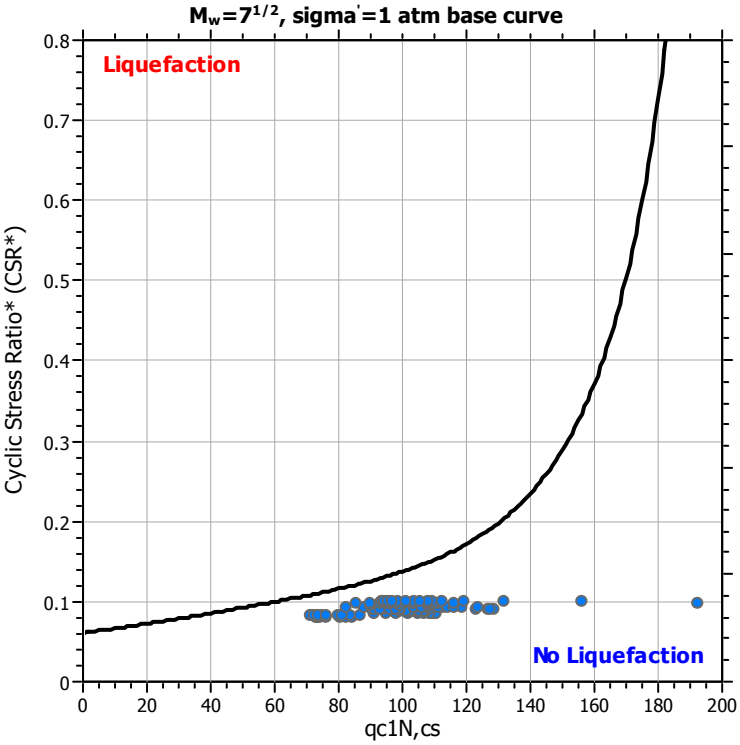
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

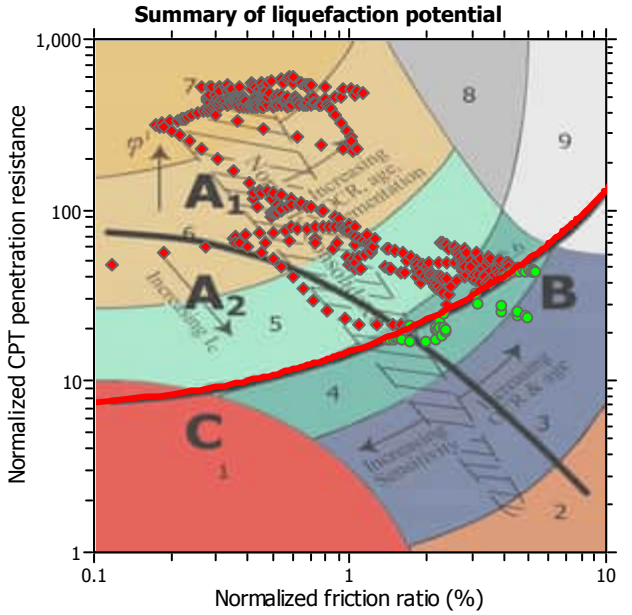
CPT file : CPT_14

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

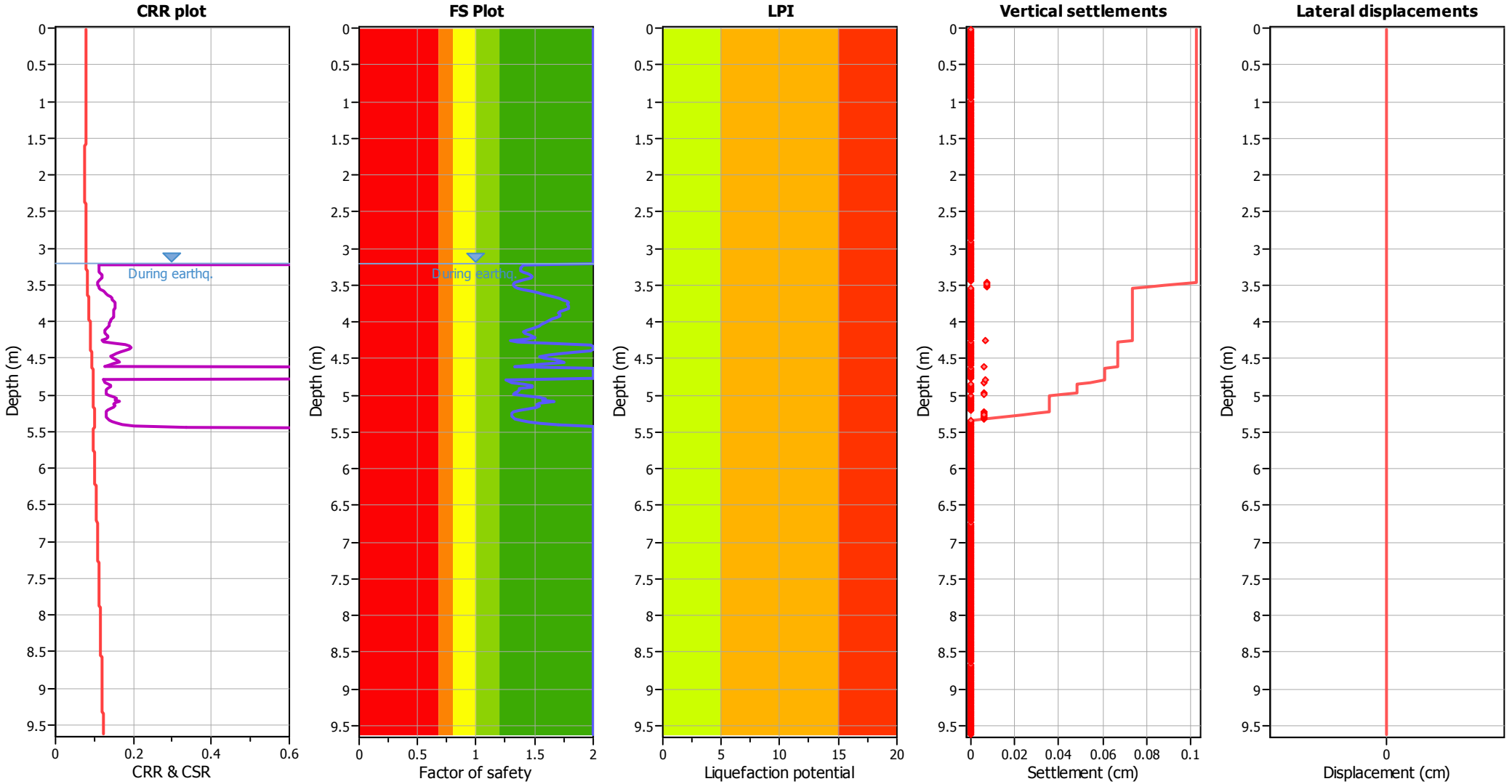






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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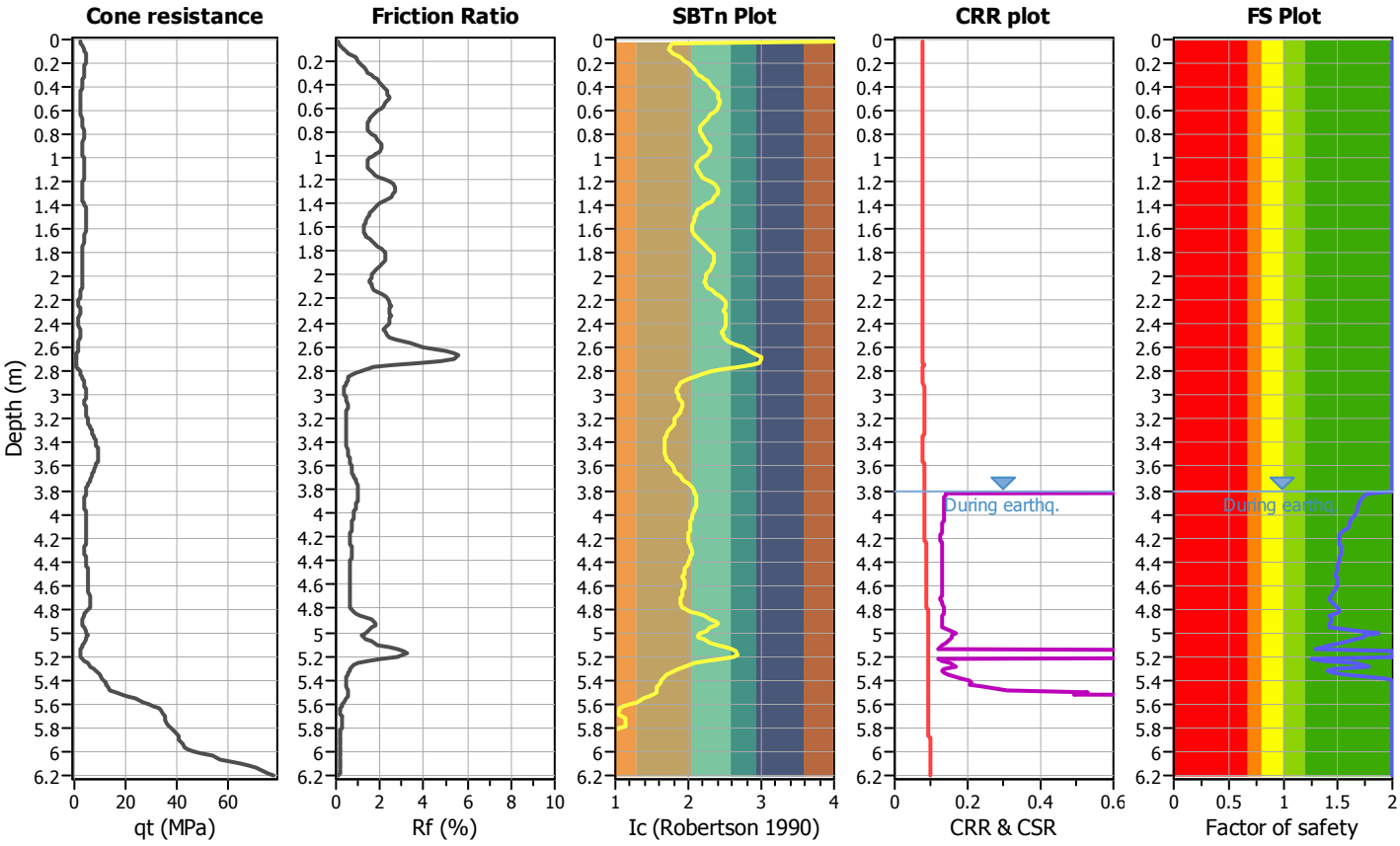
LIQUEFACTION ANALYSIS REPORT

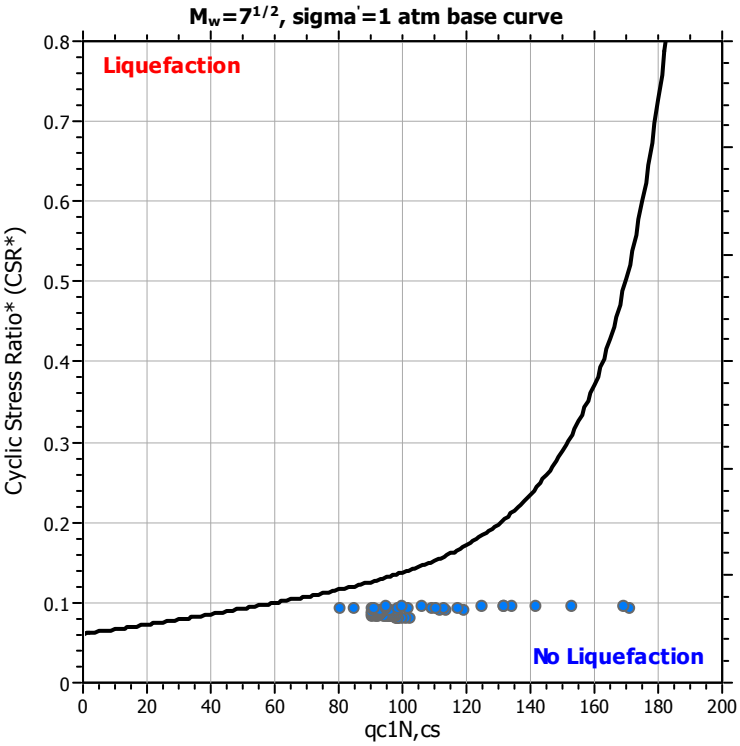
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

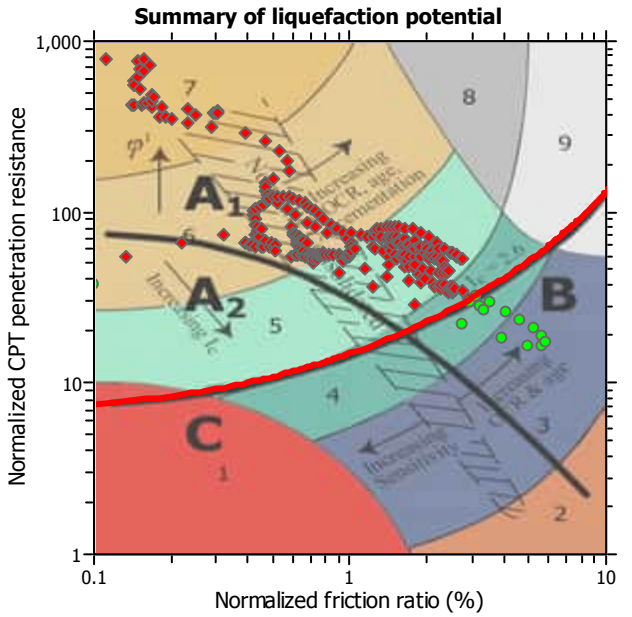
CPT file : CPT_15

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

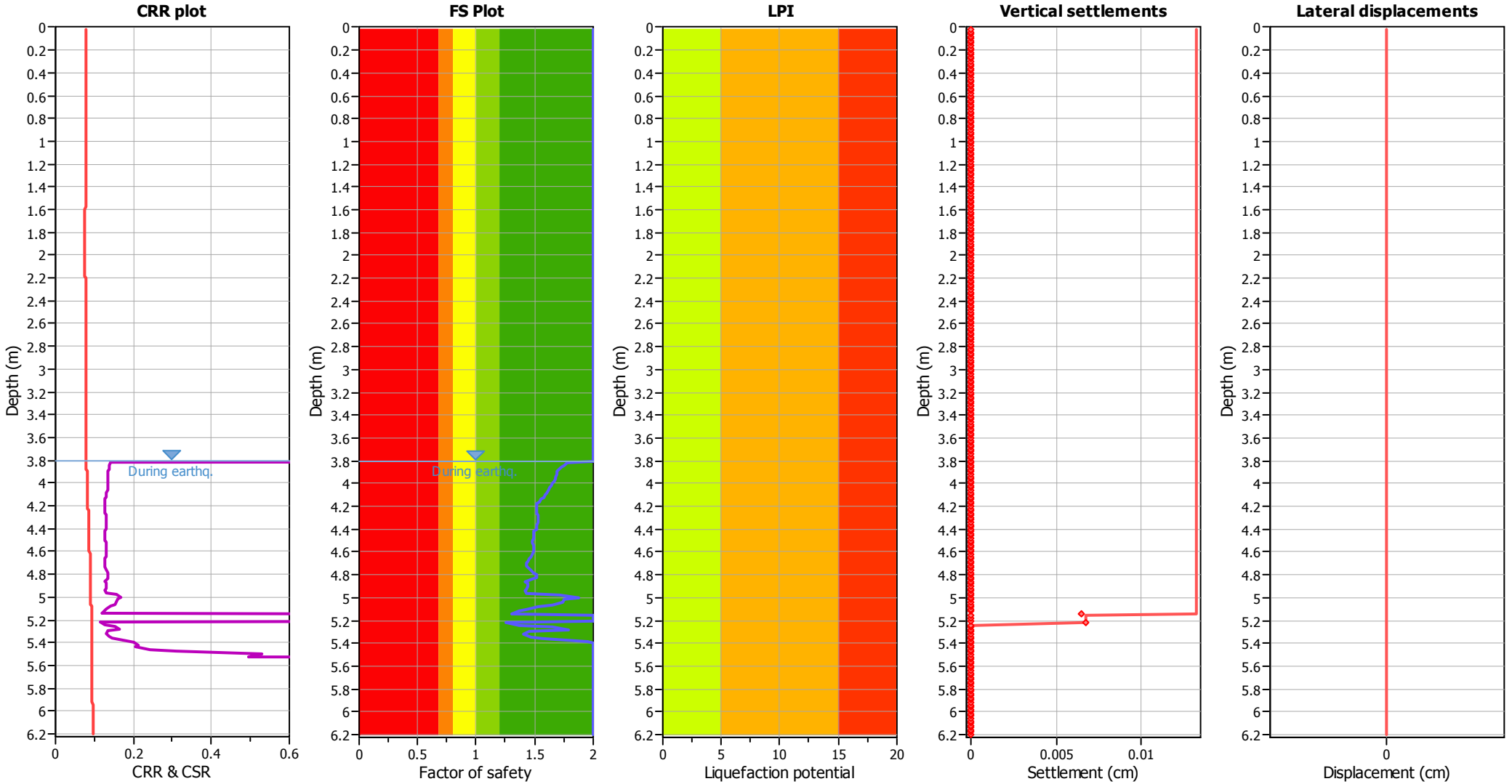






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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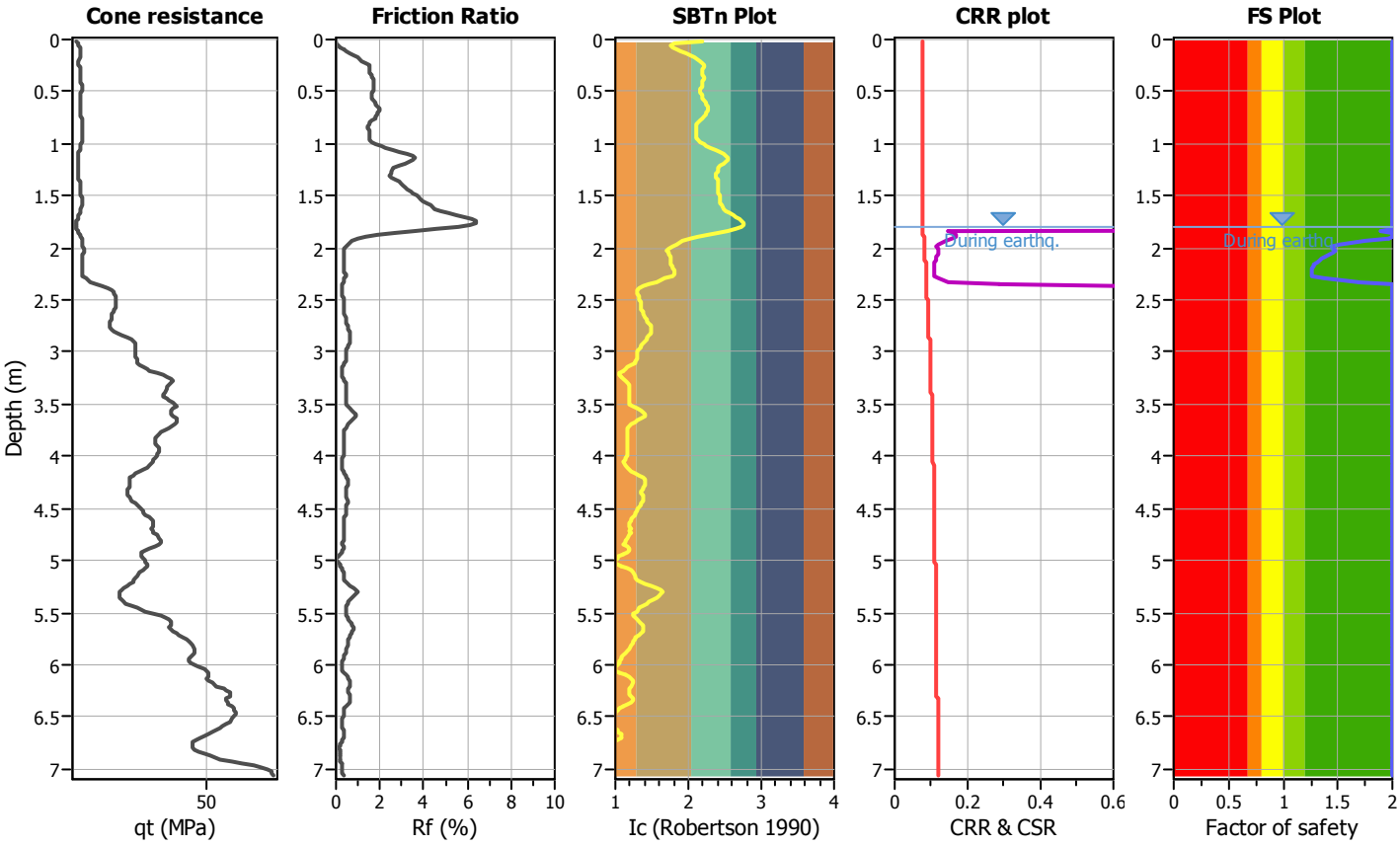
LIQUEFACTION ANALYSIS REPORT

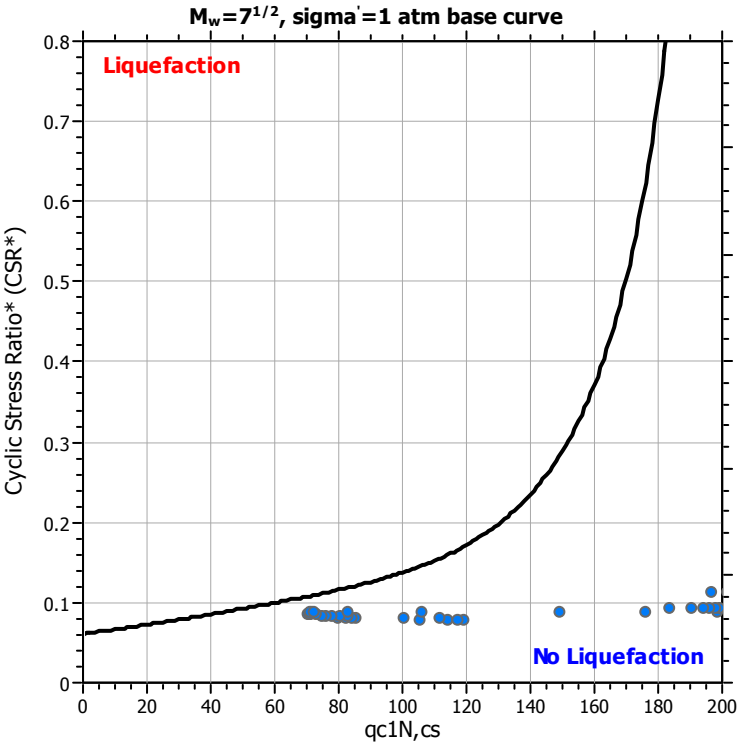
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

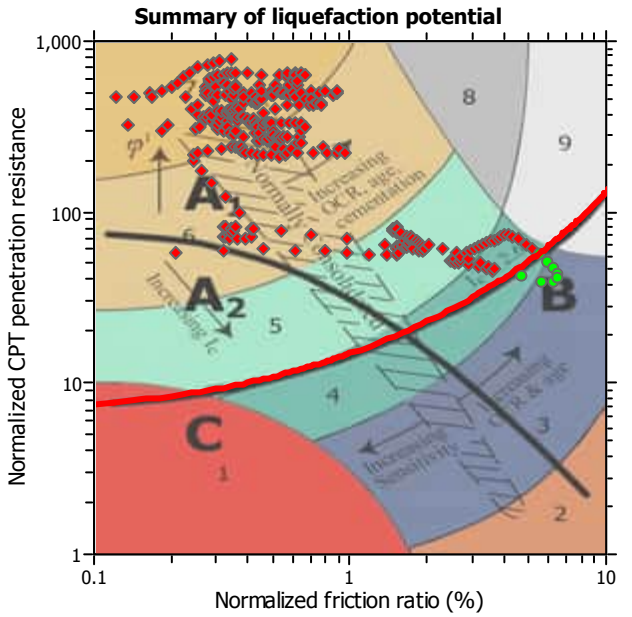
CPT file : CPT_16

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

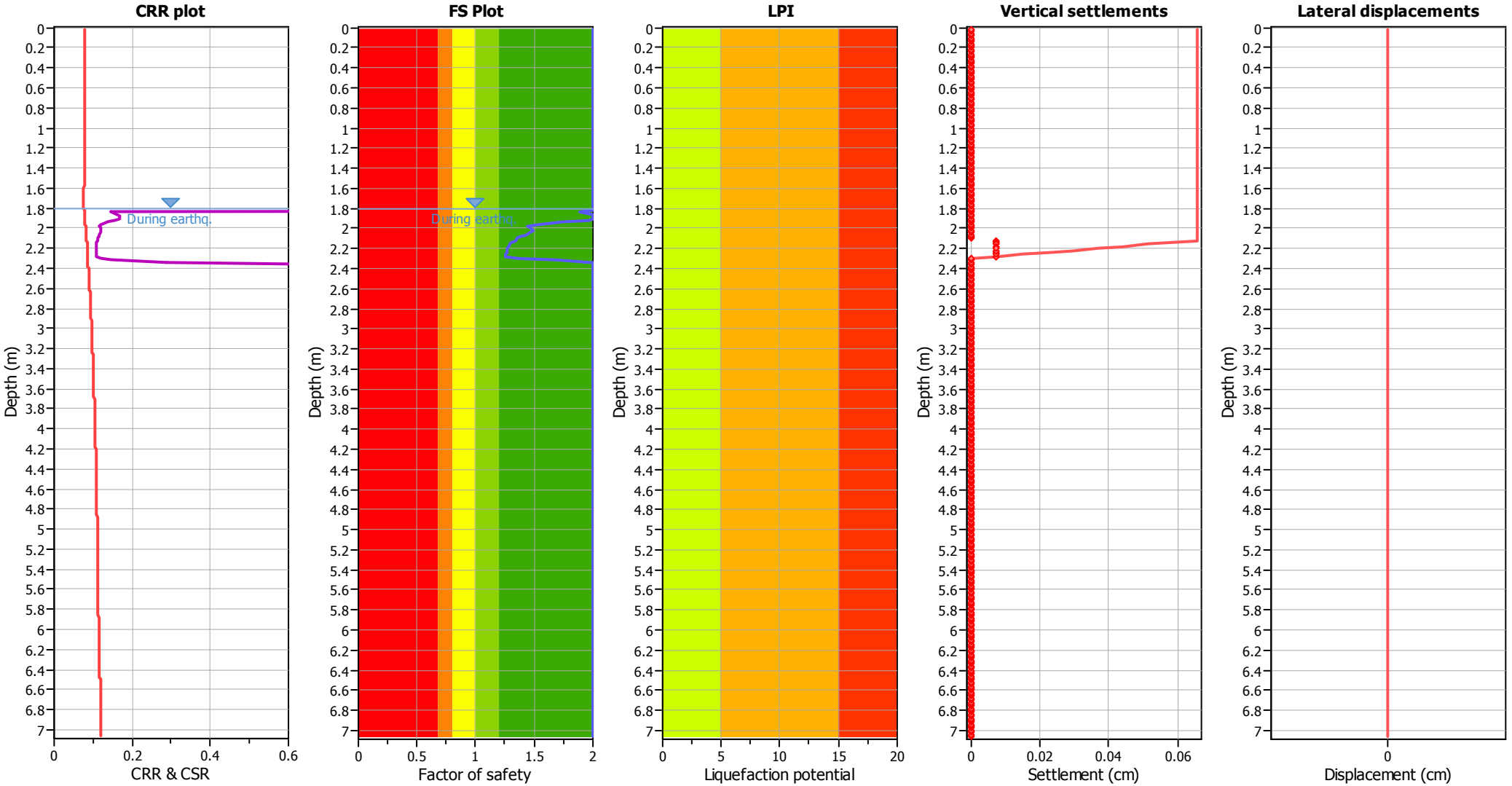






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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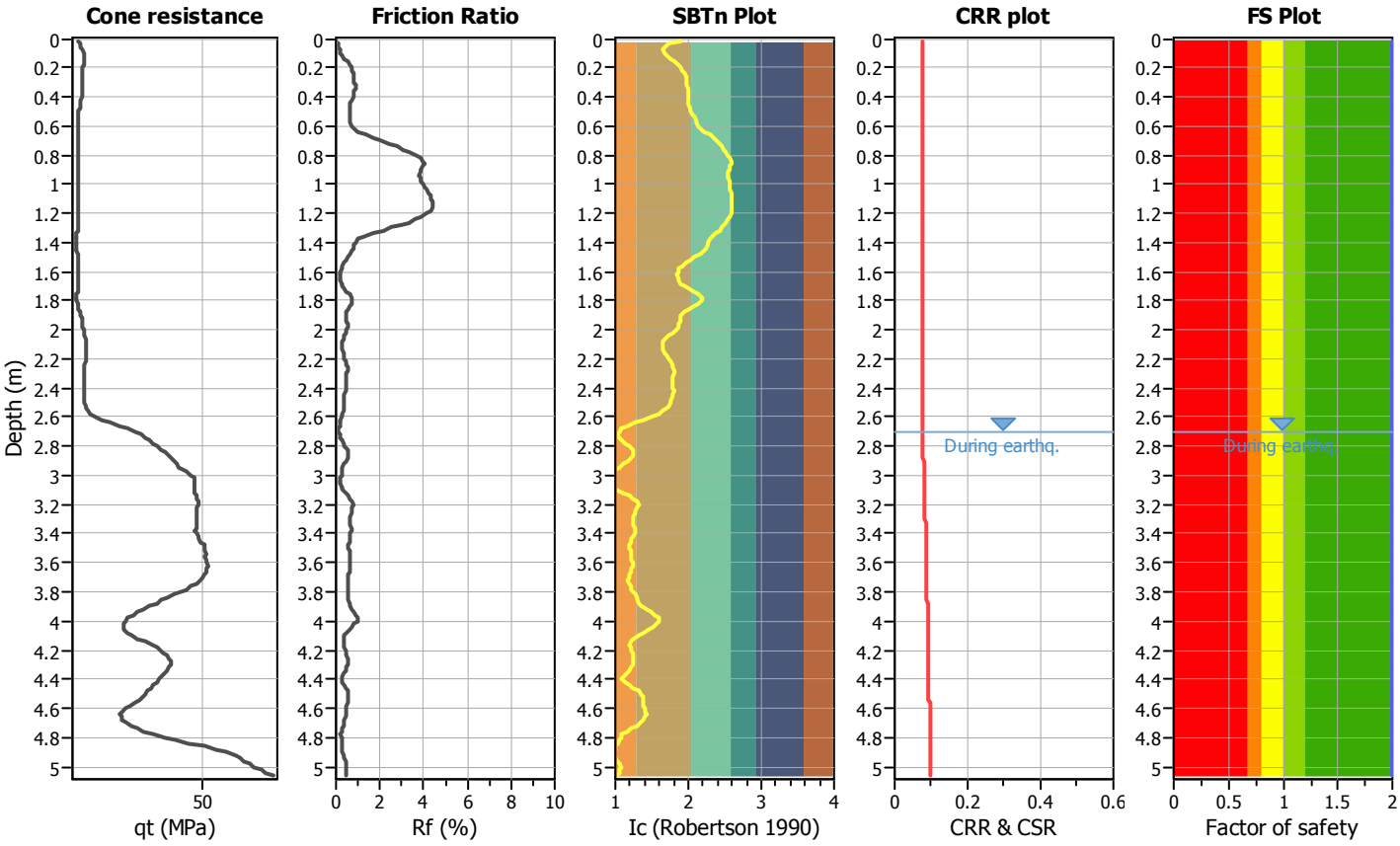
LIQUEFACTION ANALYSIS REPORT

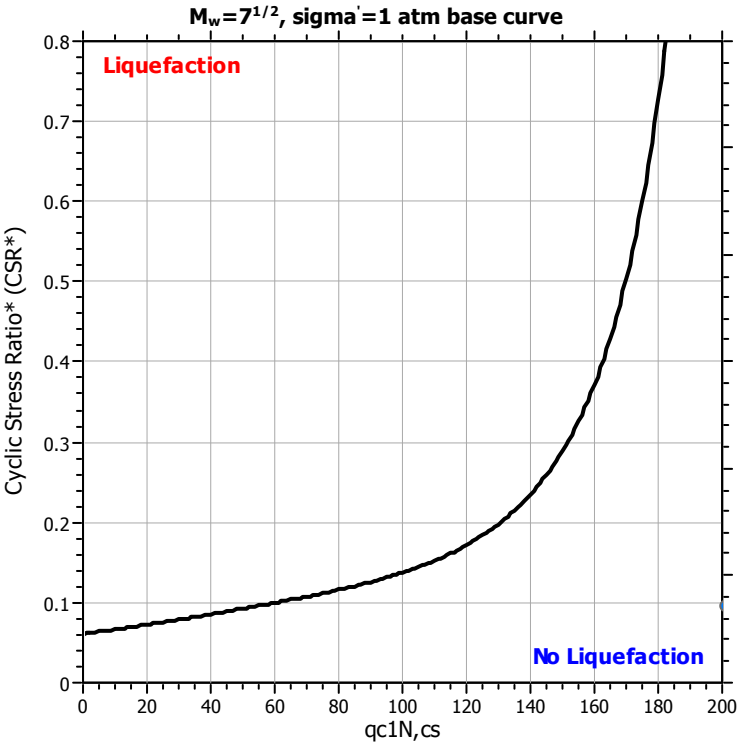
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

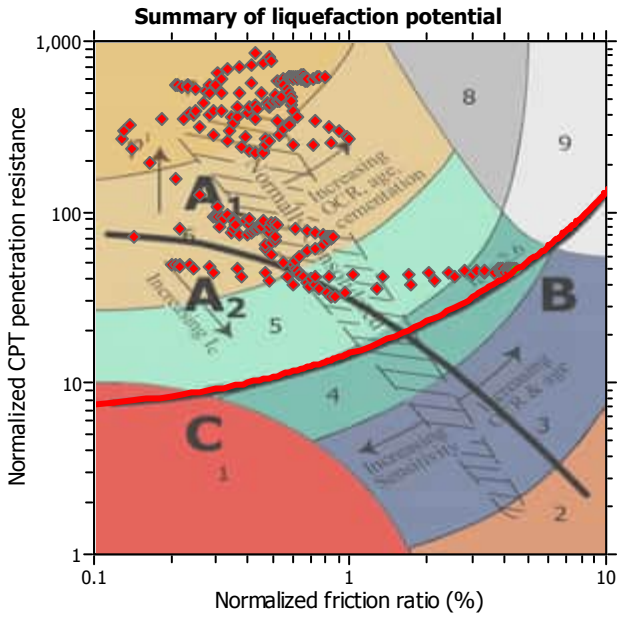
CPT file : CPT_17

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

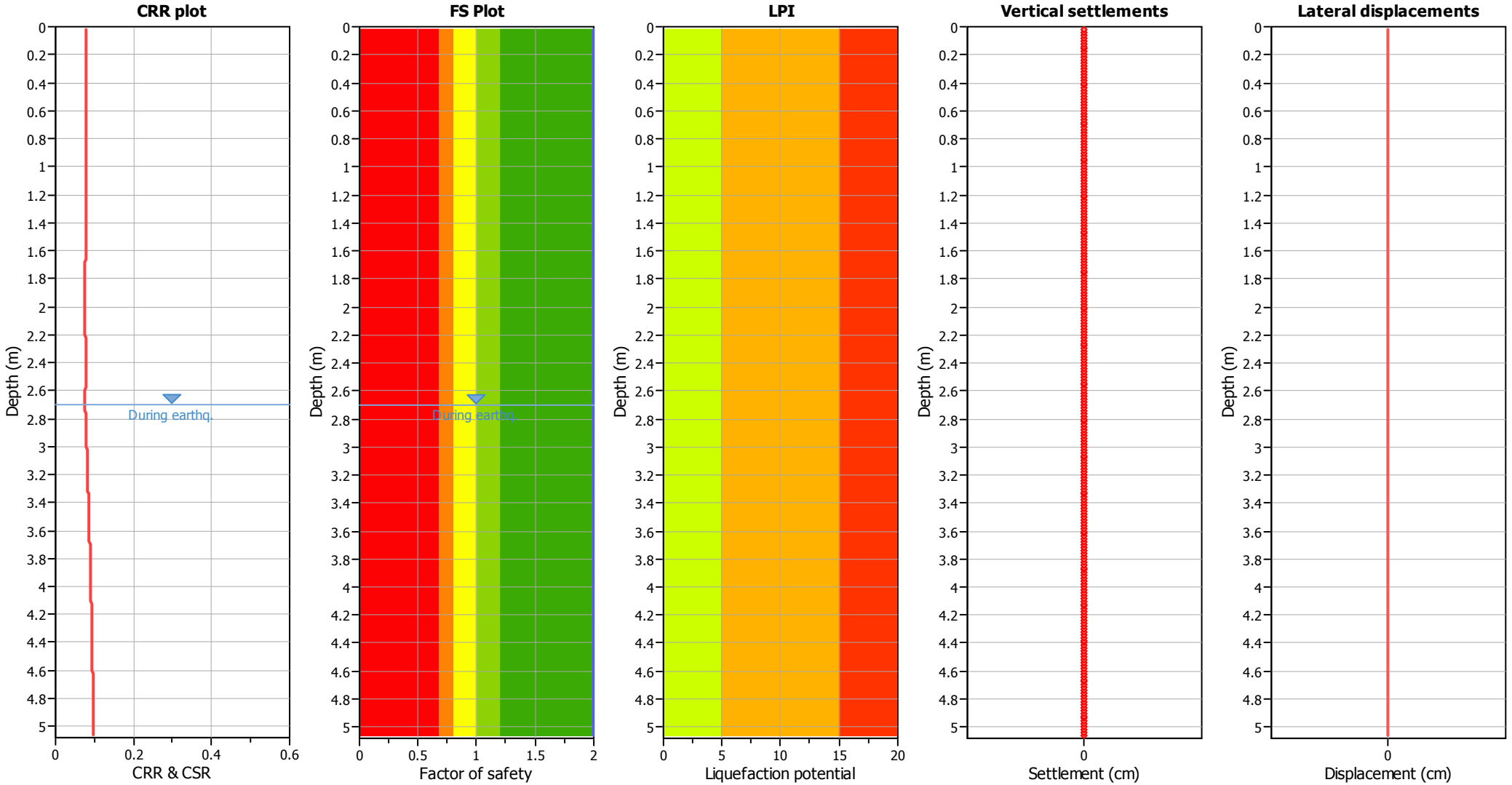






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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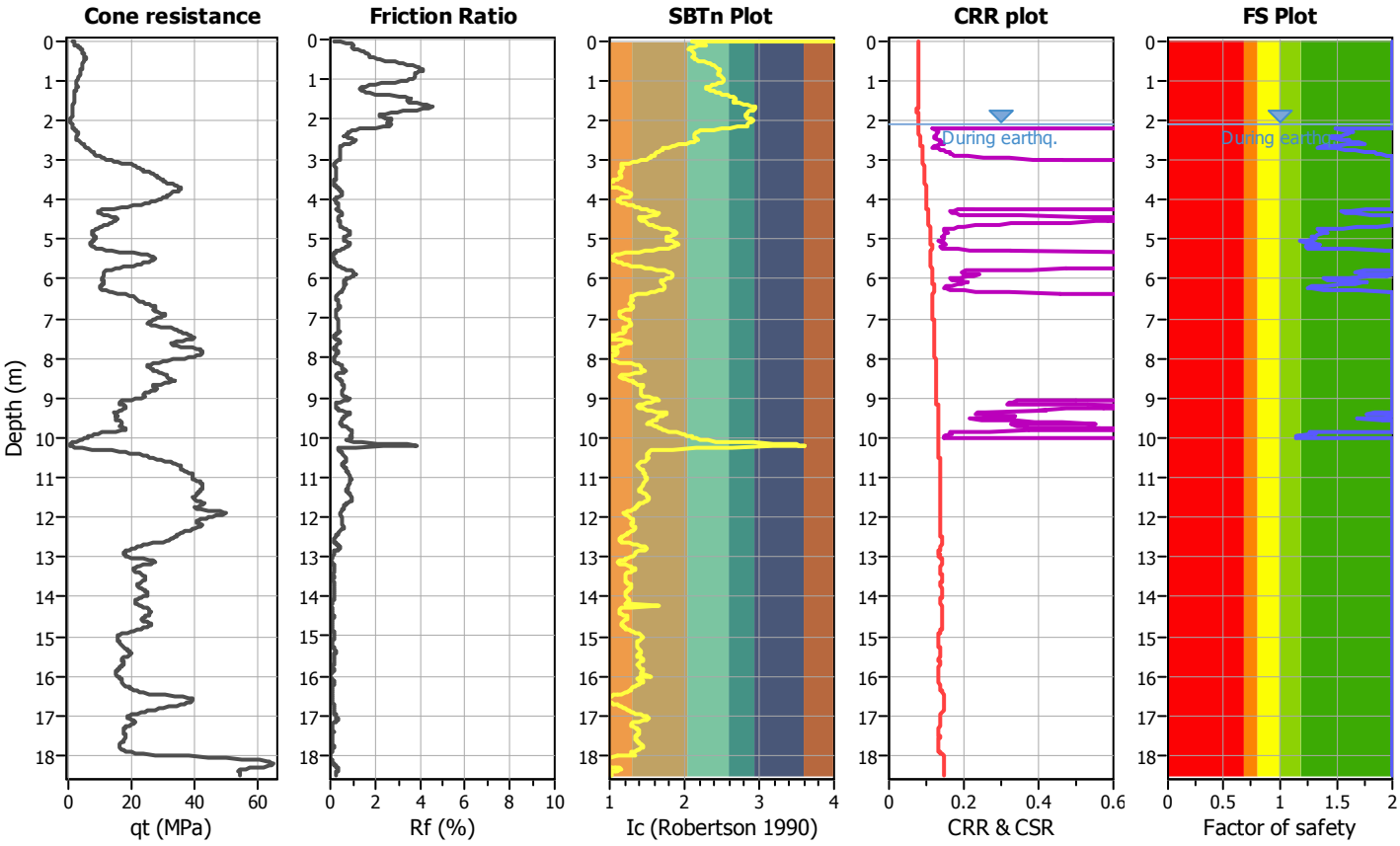
LIQUEFACTION ANALYSIS REPORT

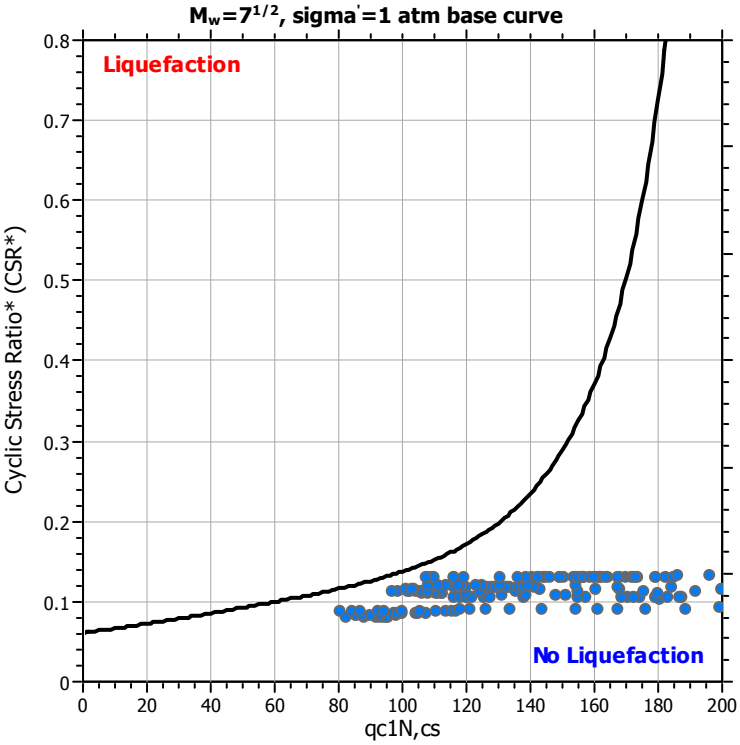
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

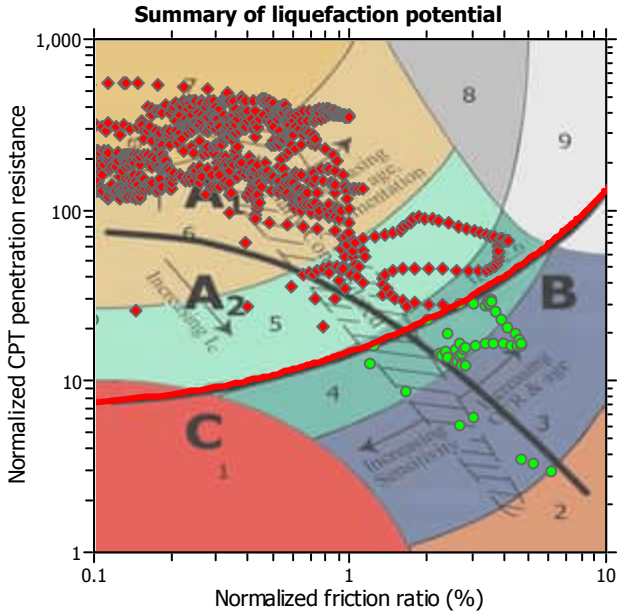
CPT file : CPT_18

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

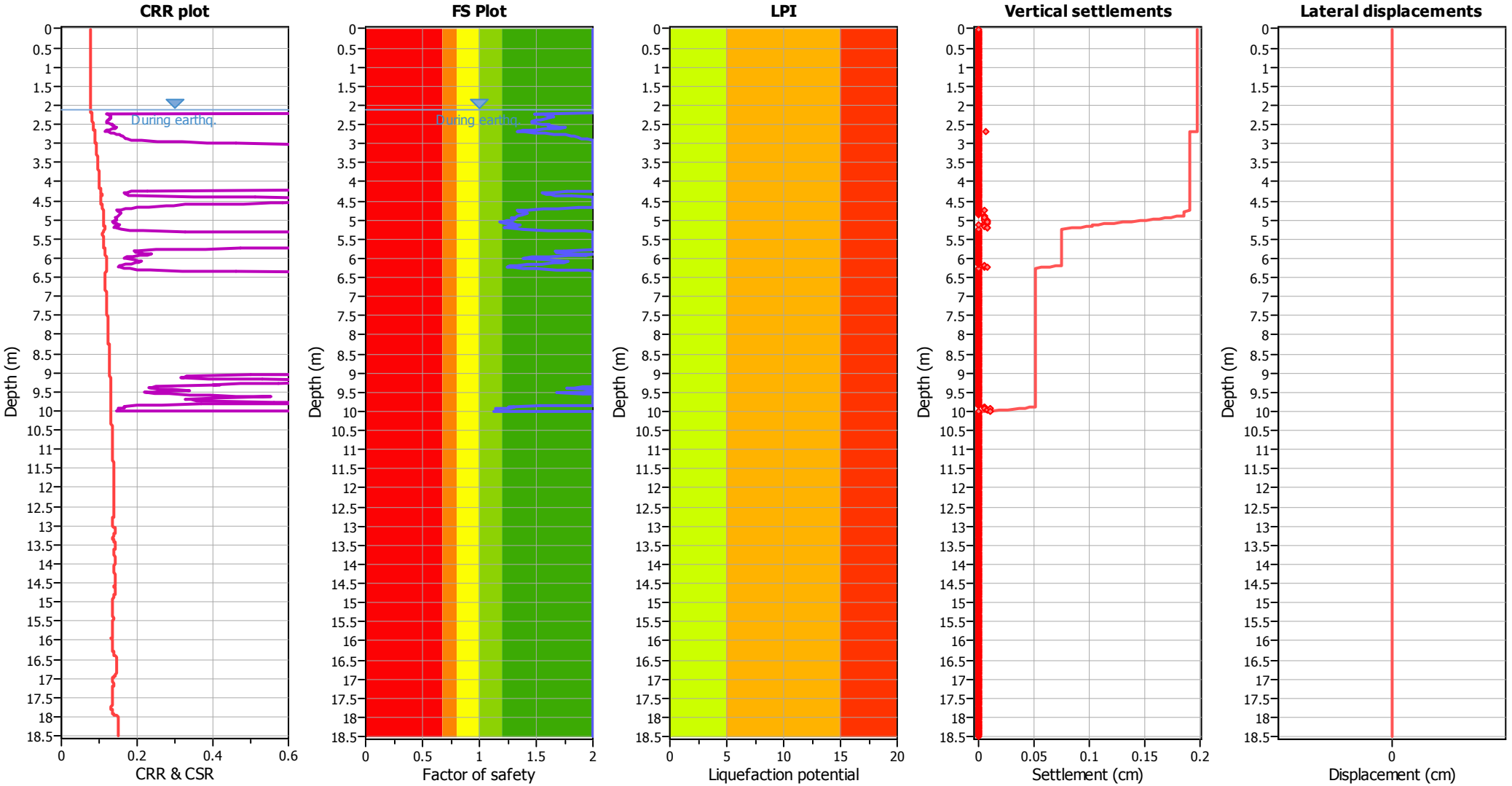






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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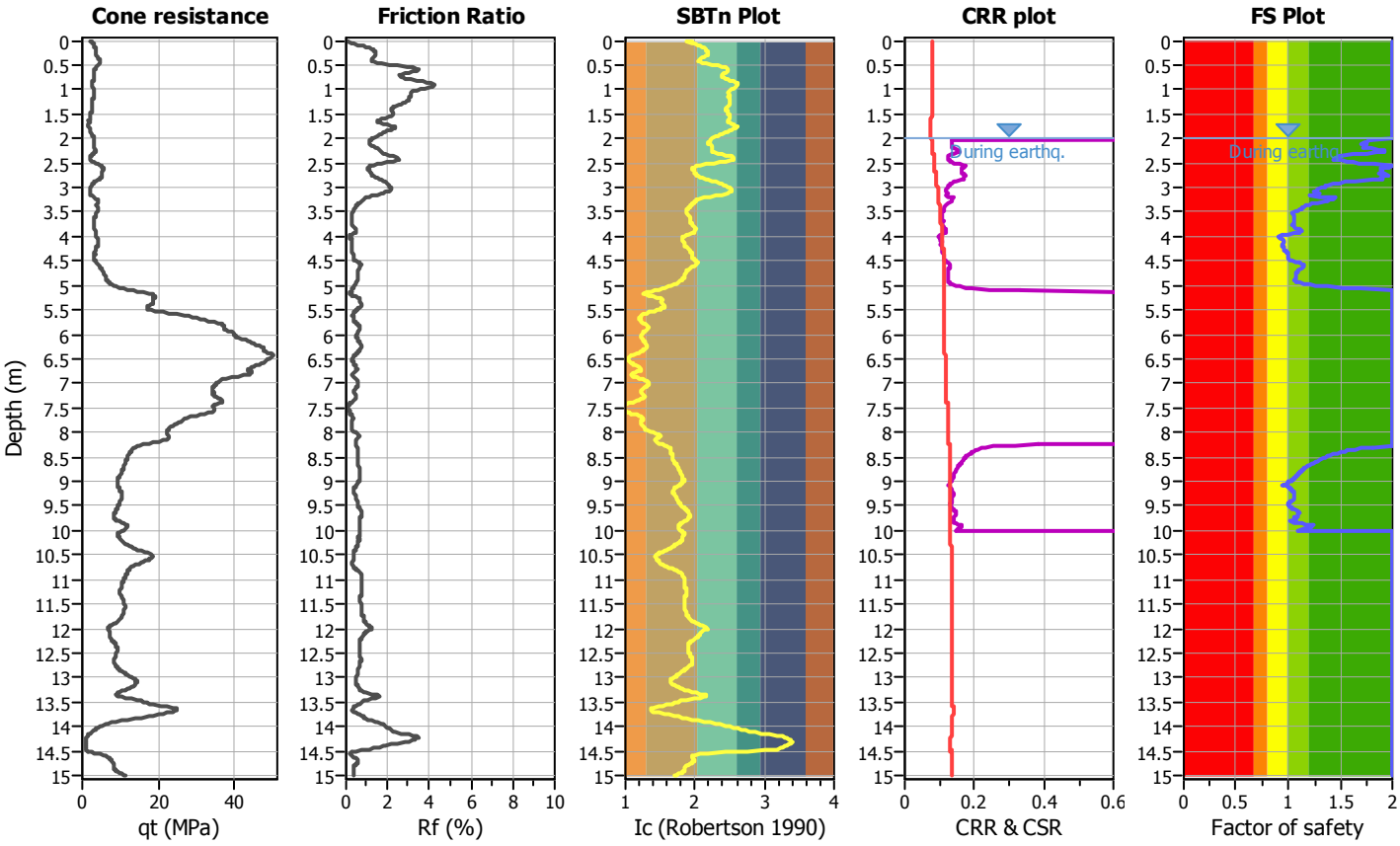
LIQUEFACTION ANALYSIS REPORT

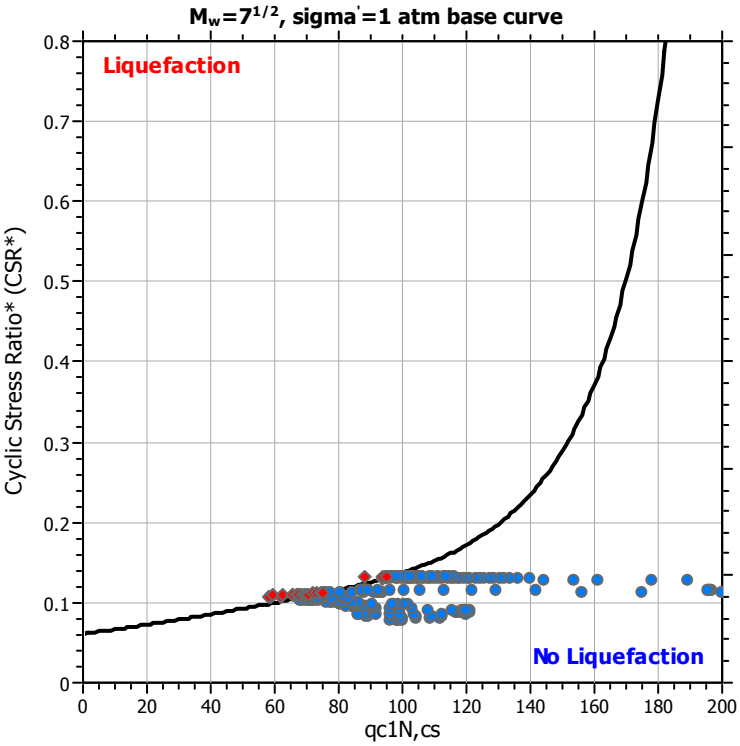
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

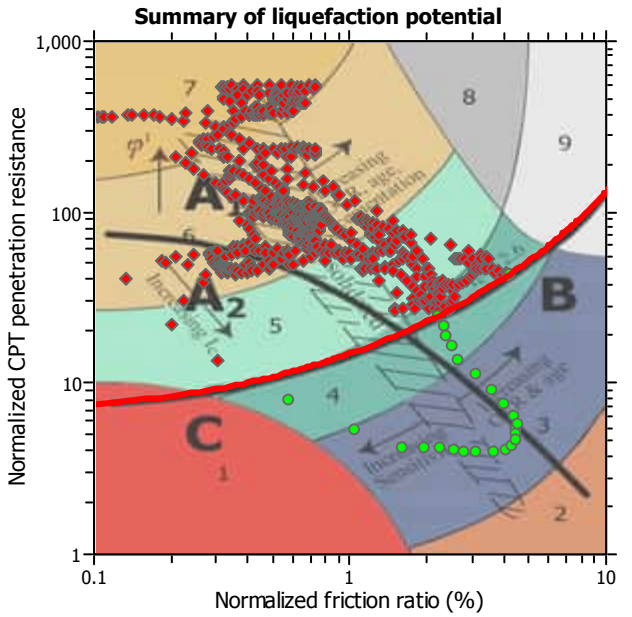
CPT file : CPT_19

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

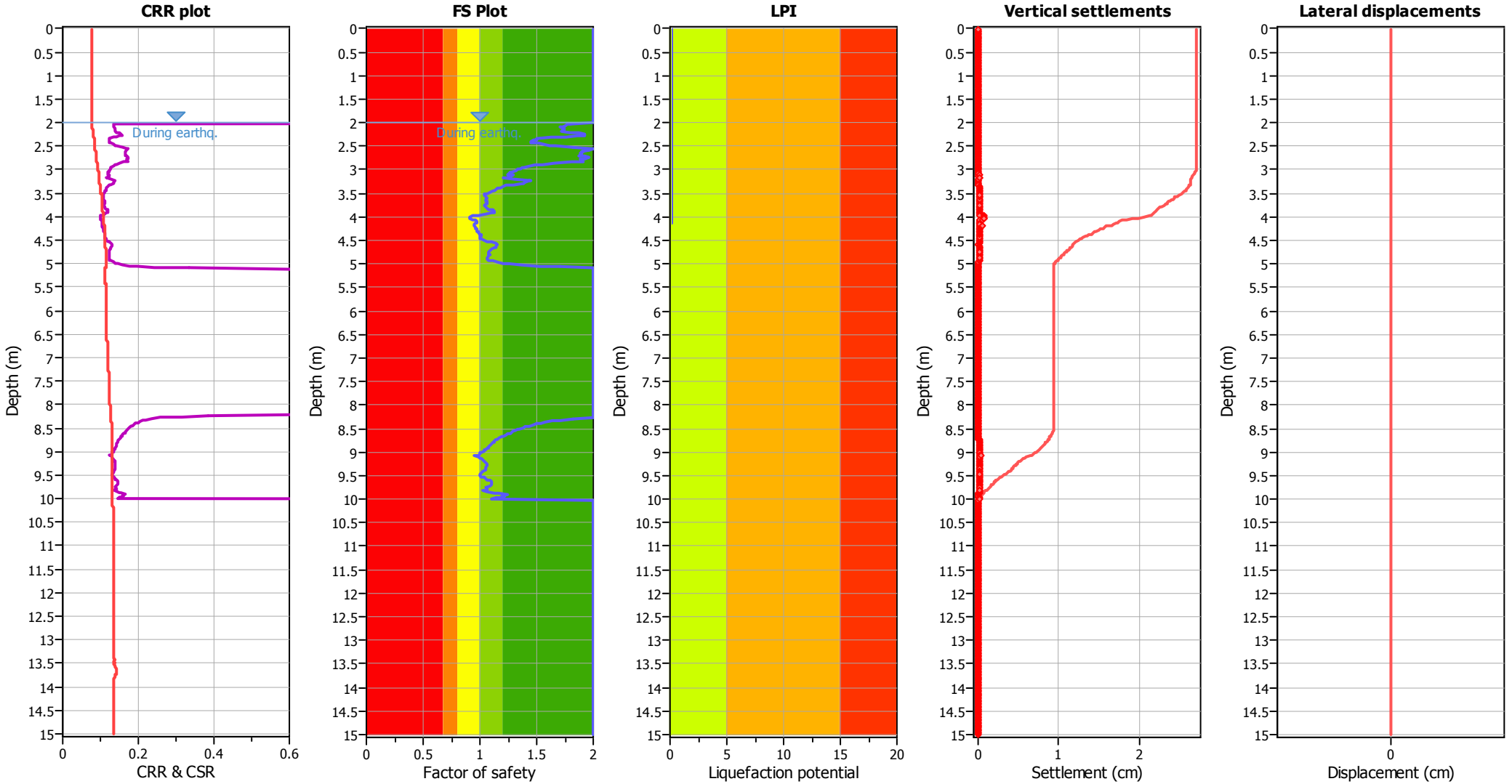






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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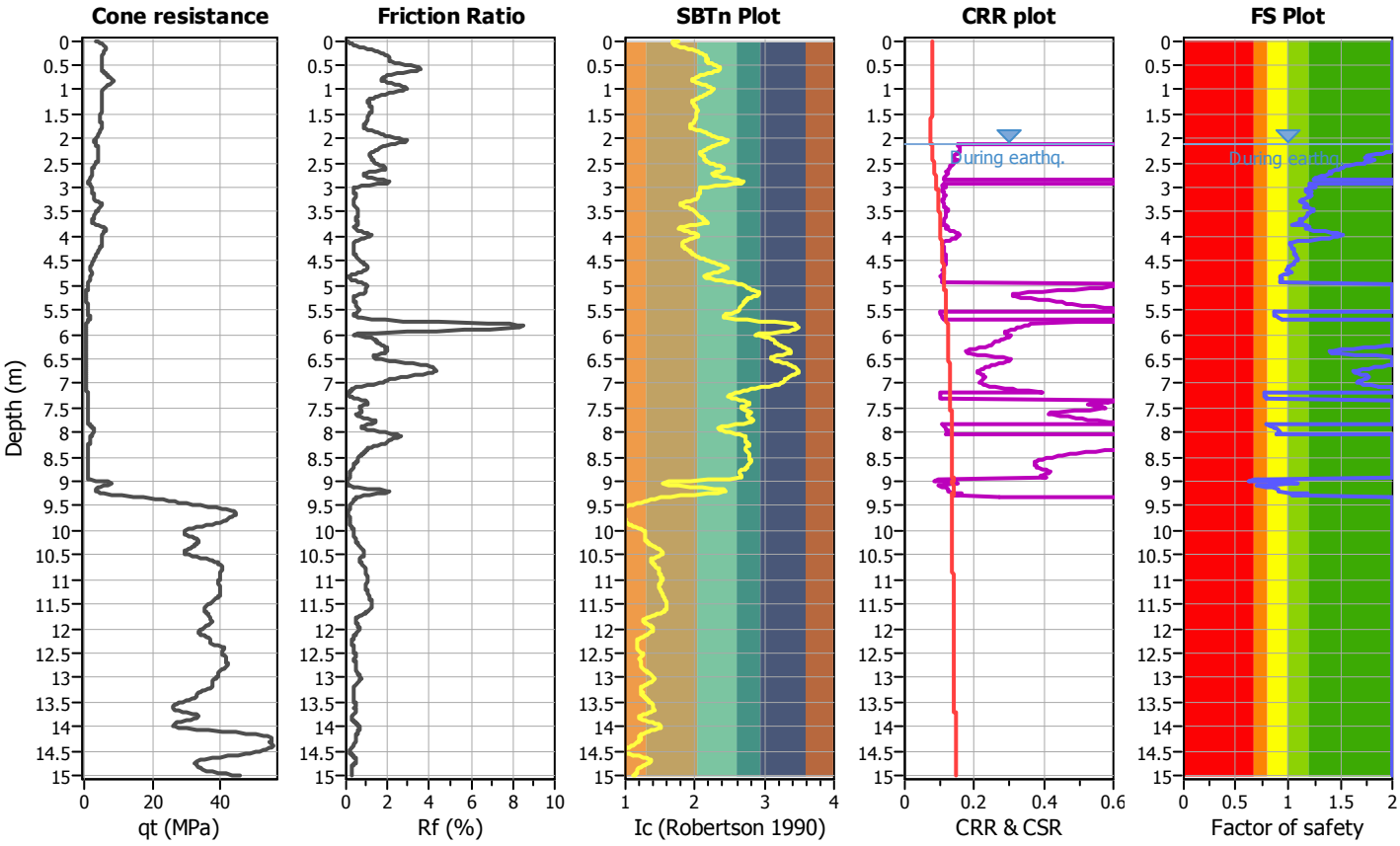
LIQUEFACTION ANALYSIS REPORT

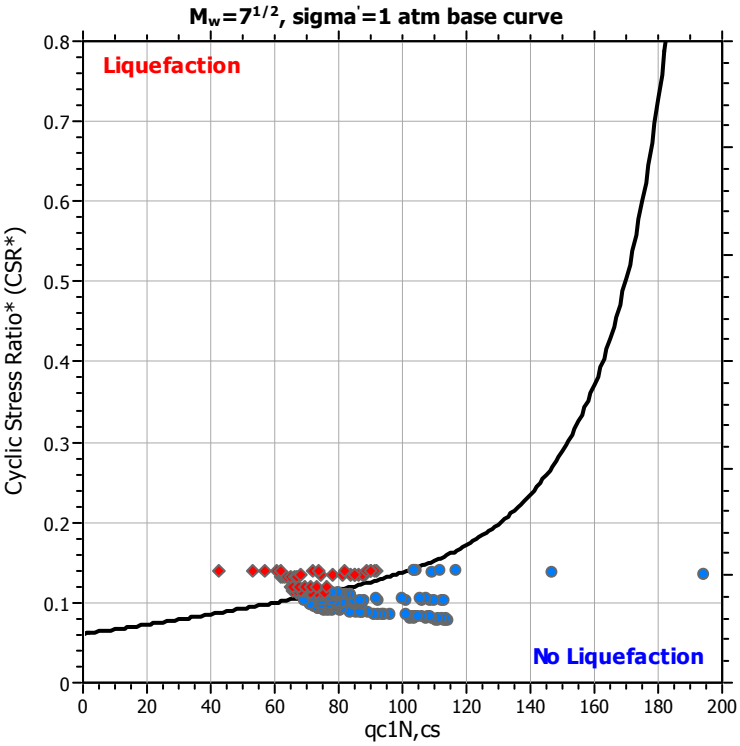
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

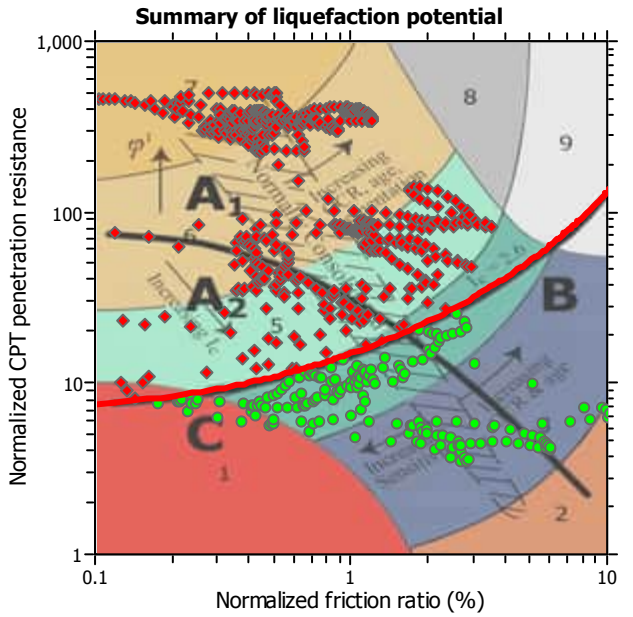
CPT file : CPT_20

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

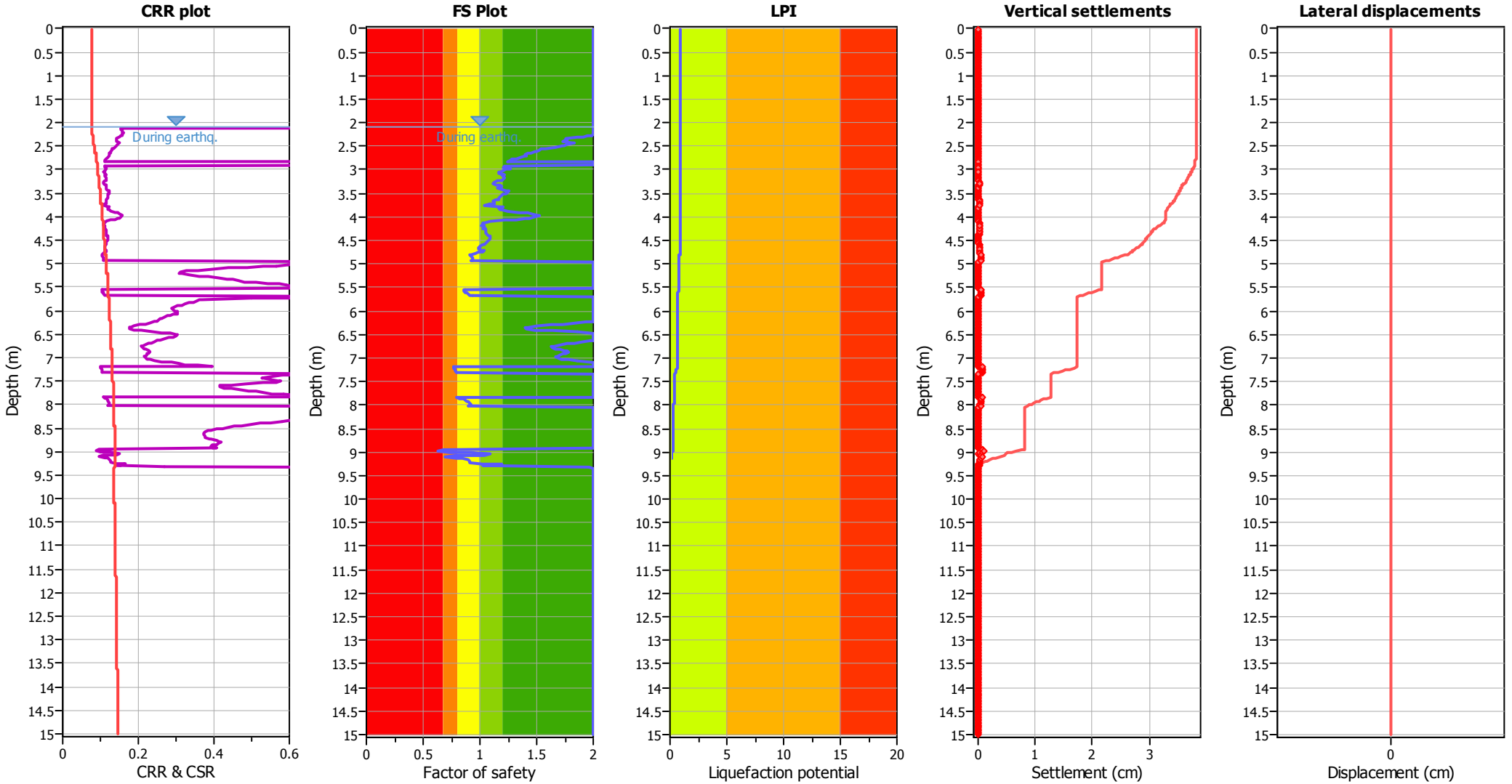






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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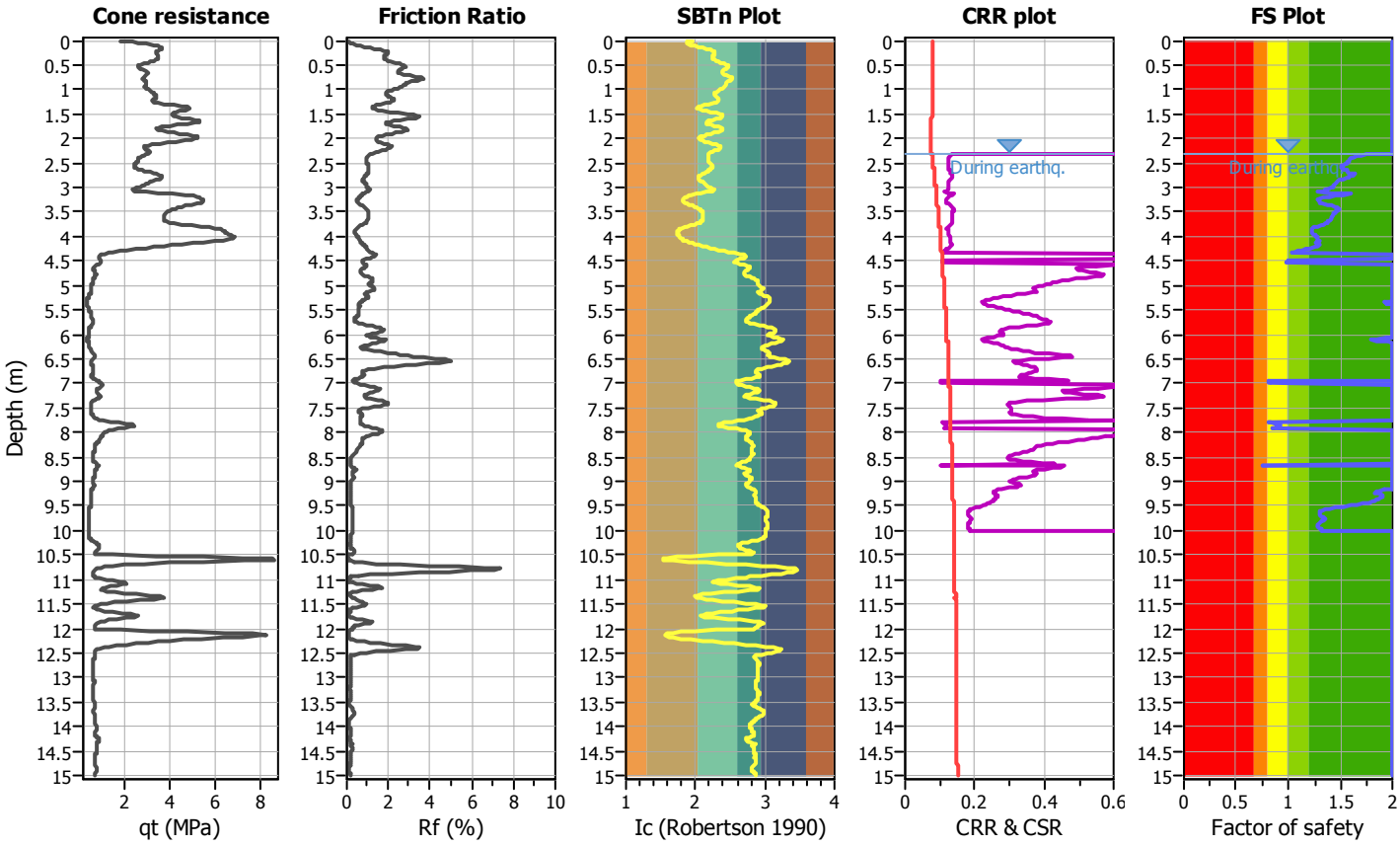
LIQUEFACTION ANALYSIS REPORT

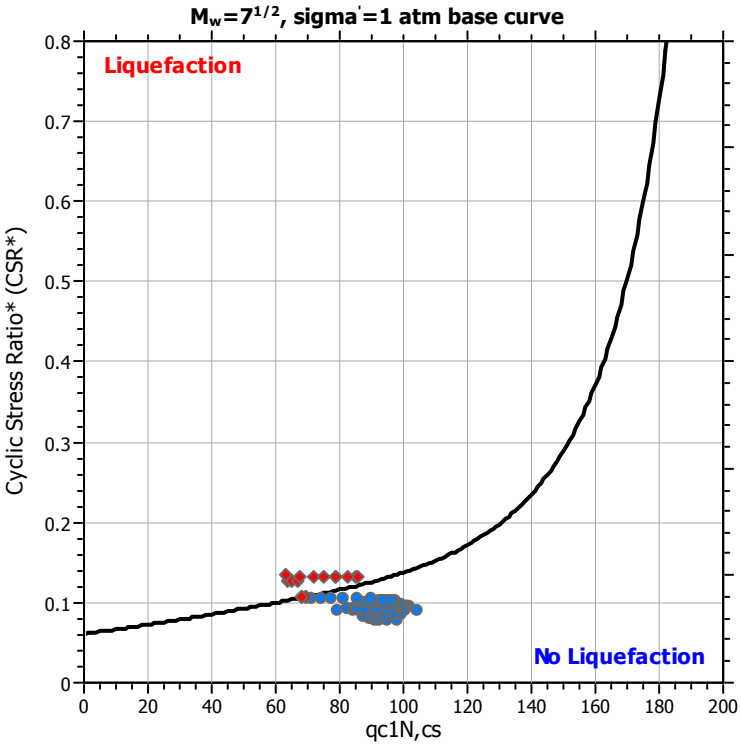
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

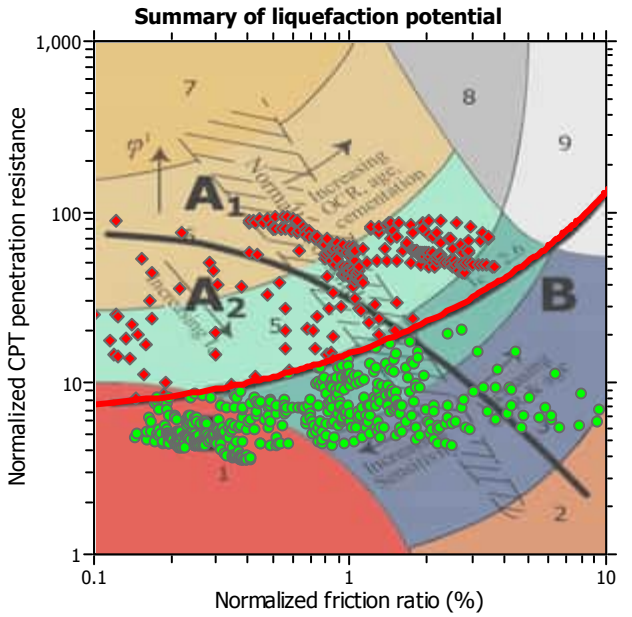
CPT file : CPT_21

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

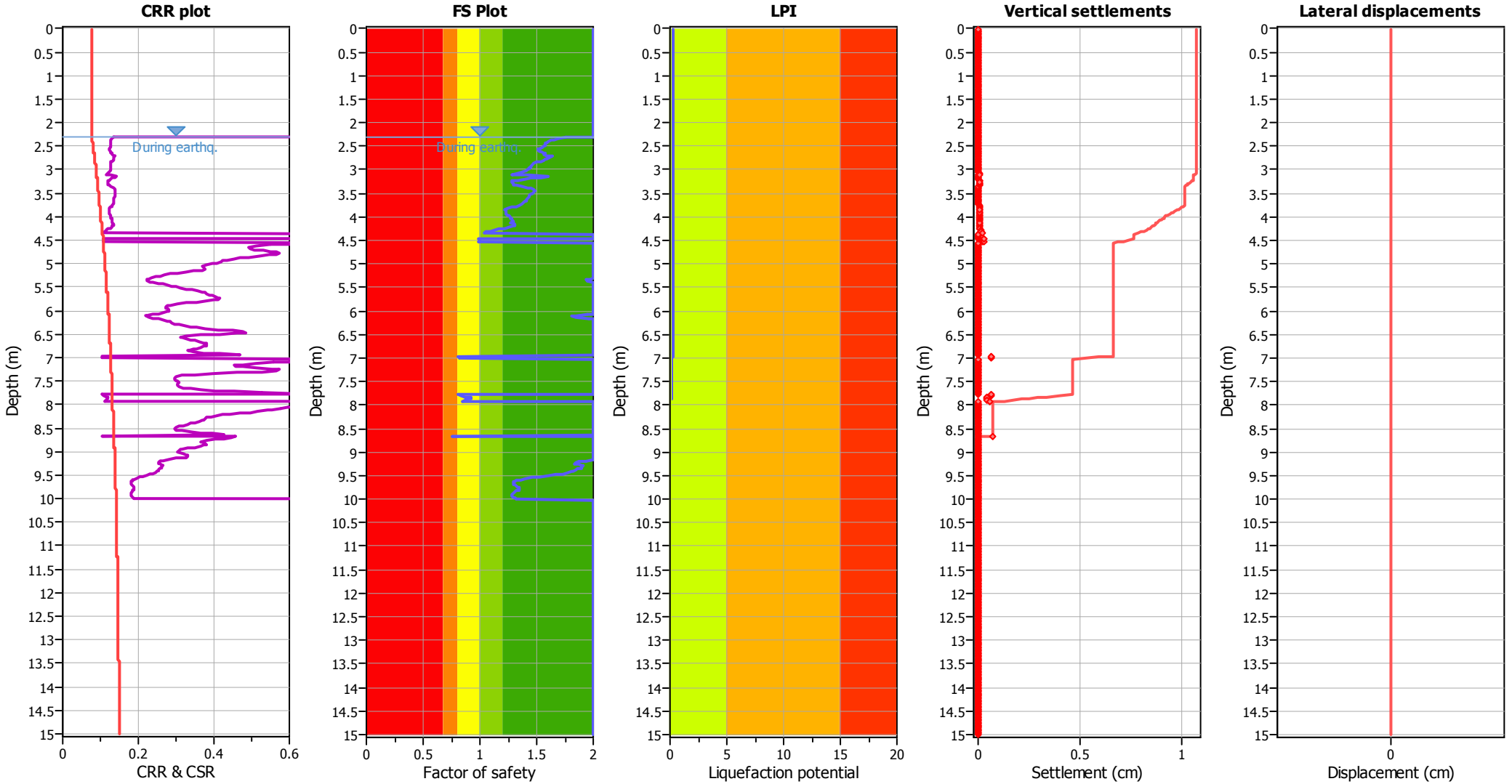






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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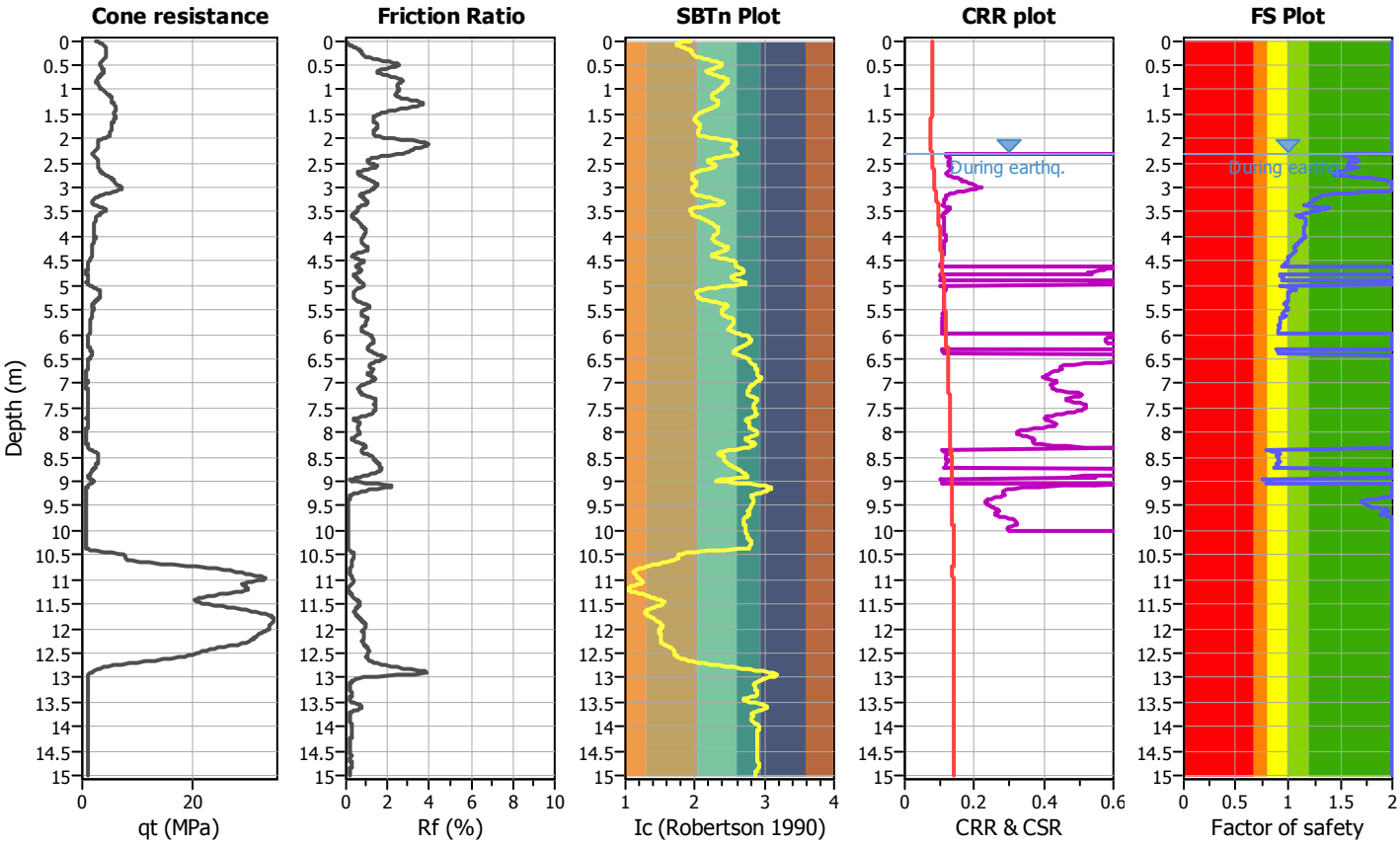
LIQUEFACTION ANALYSIS REPORT

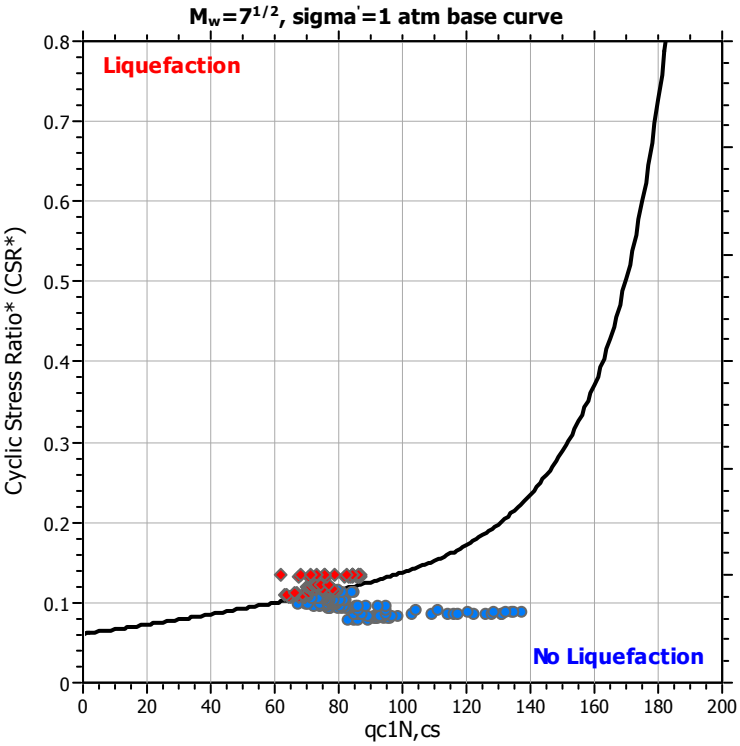
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

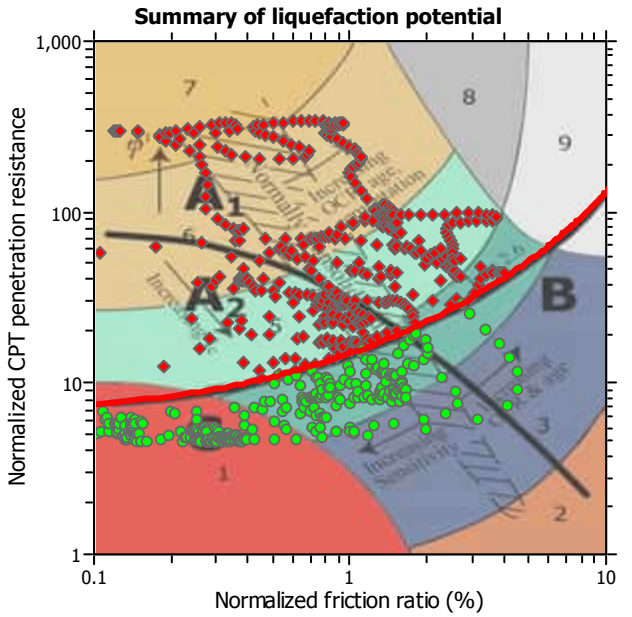
CPT file : CPT_22

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

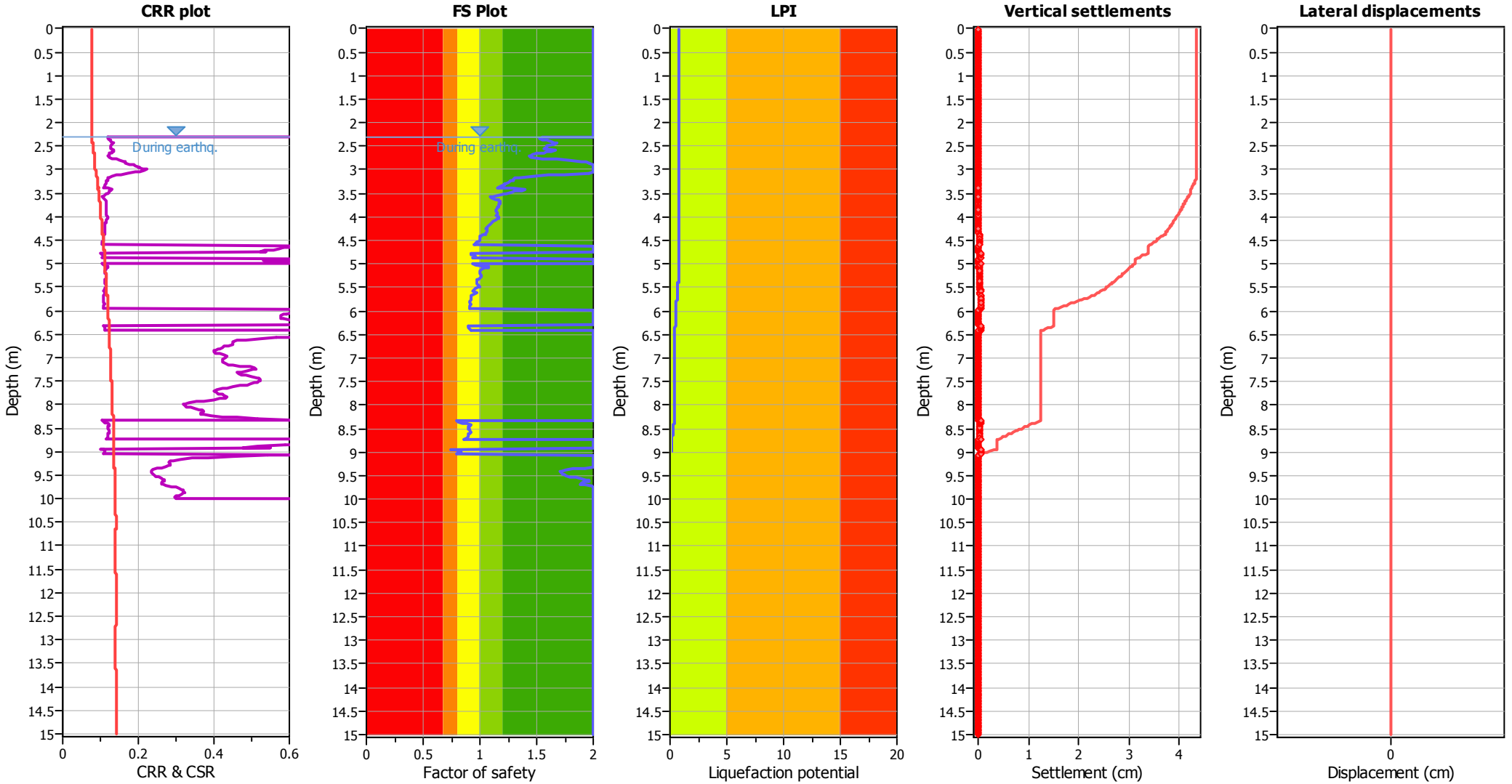






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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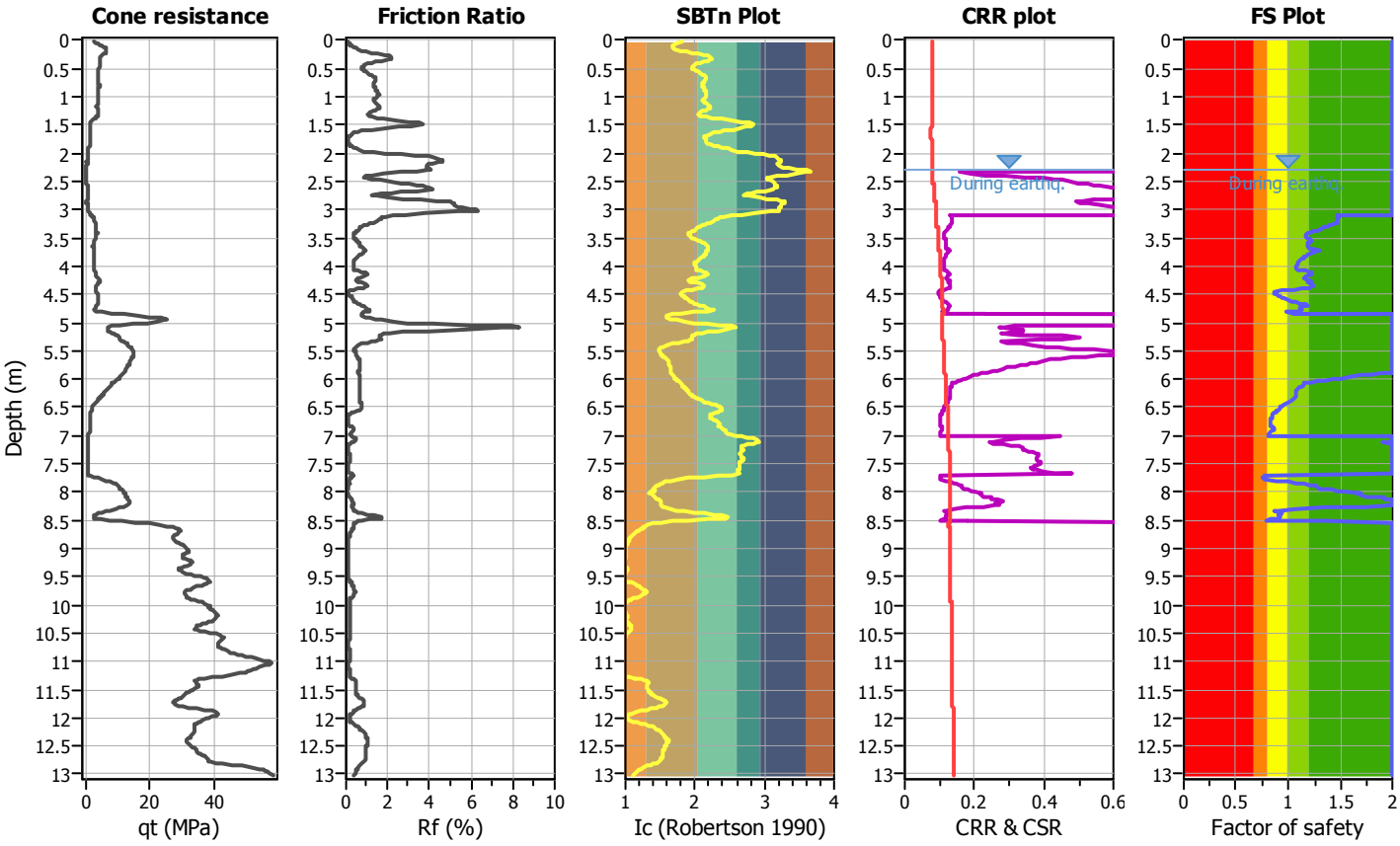
LIQUEFACTION ANALYSIS REPORT

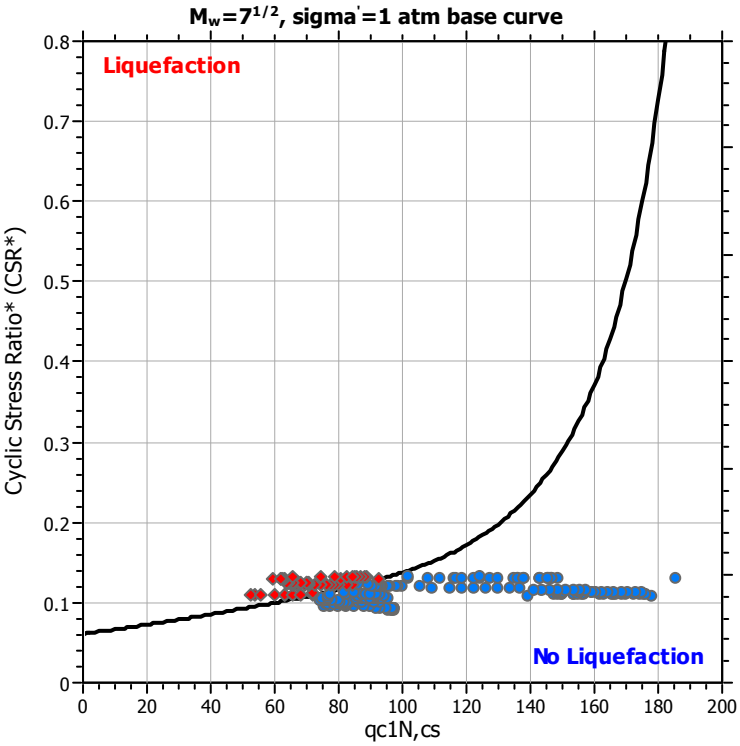
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

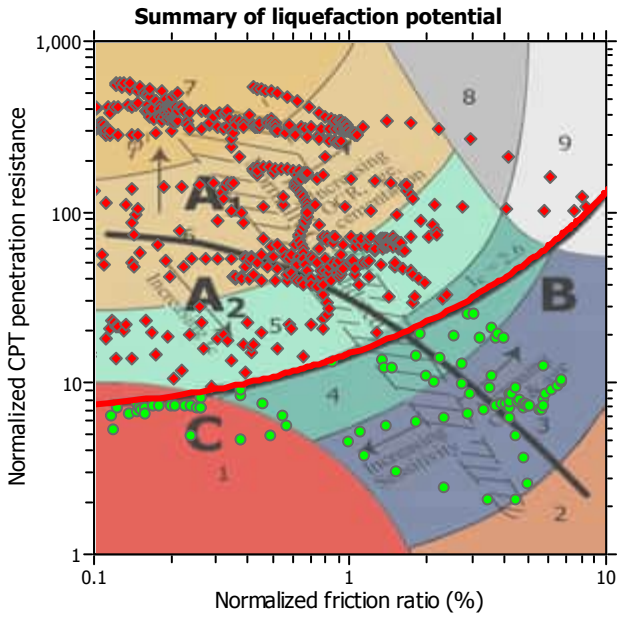
CPT file : CPT_23

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

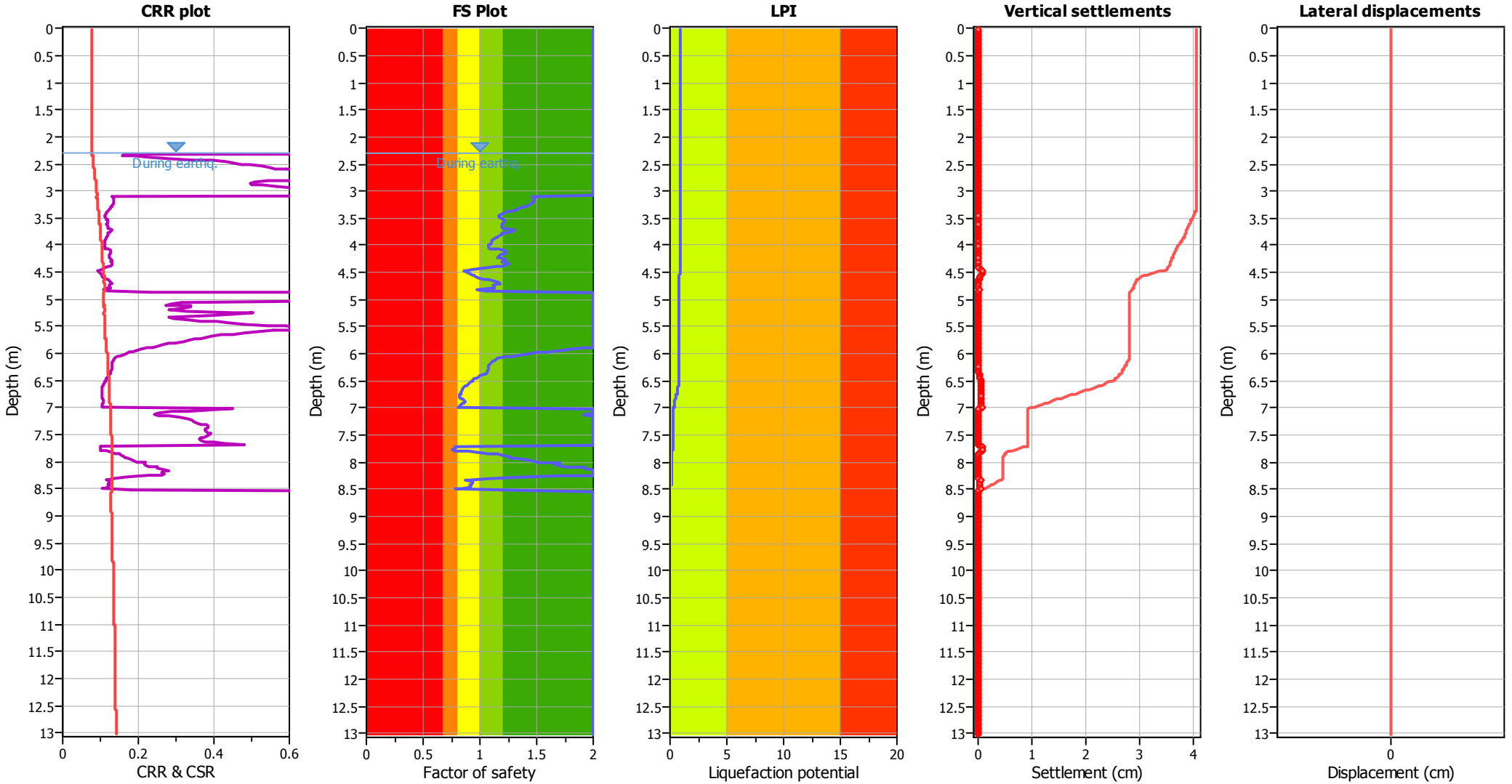






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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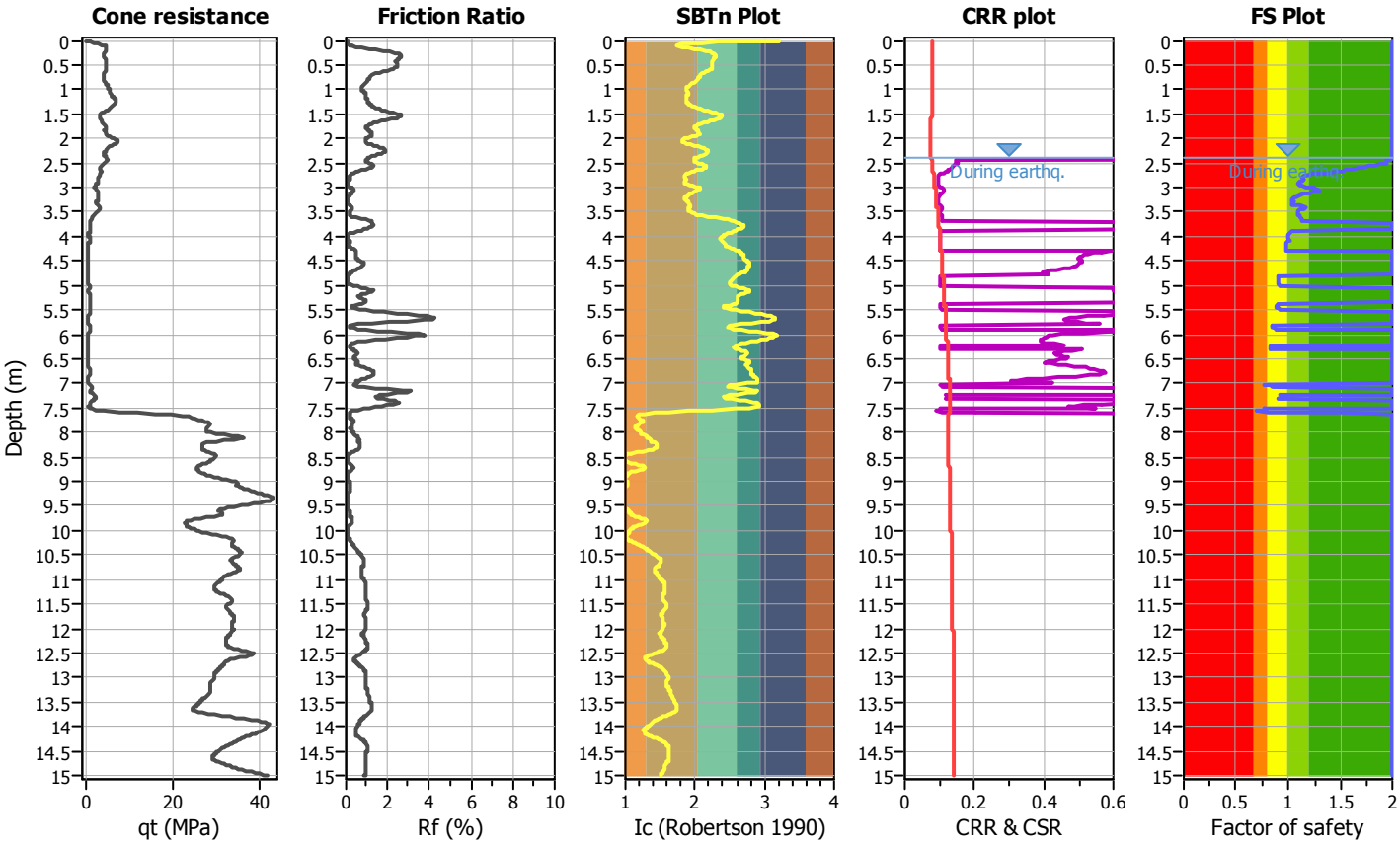
LIQUEFACTION ANALYSIS REPORT

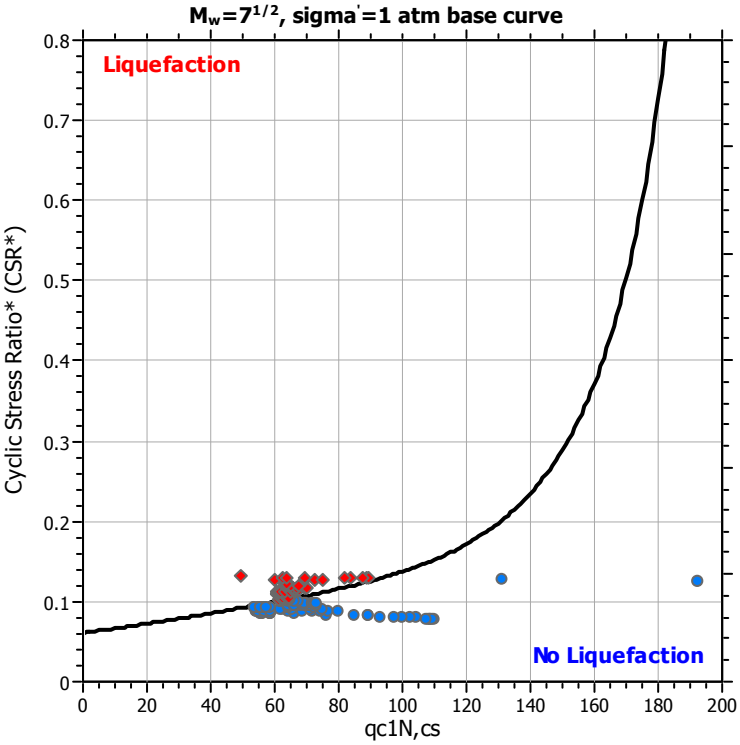
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

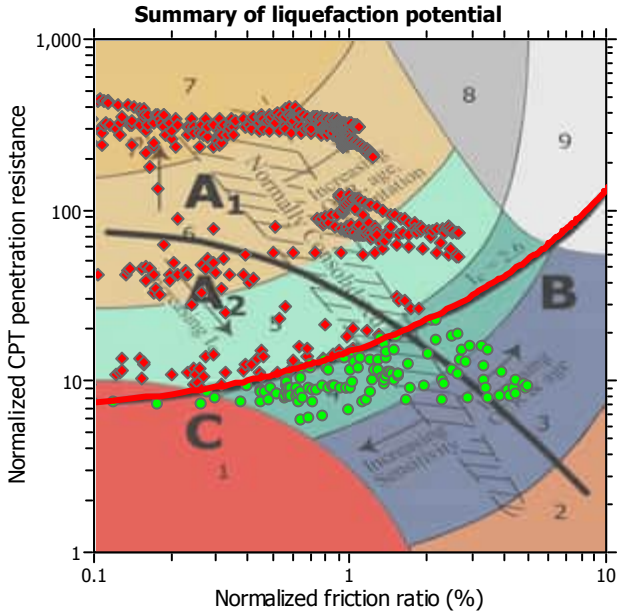
CPT file : CPT_24

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

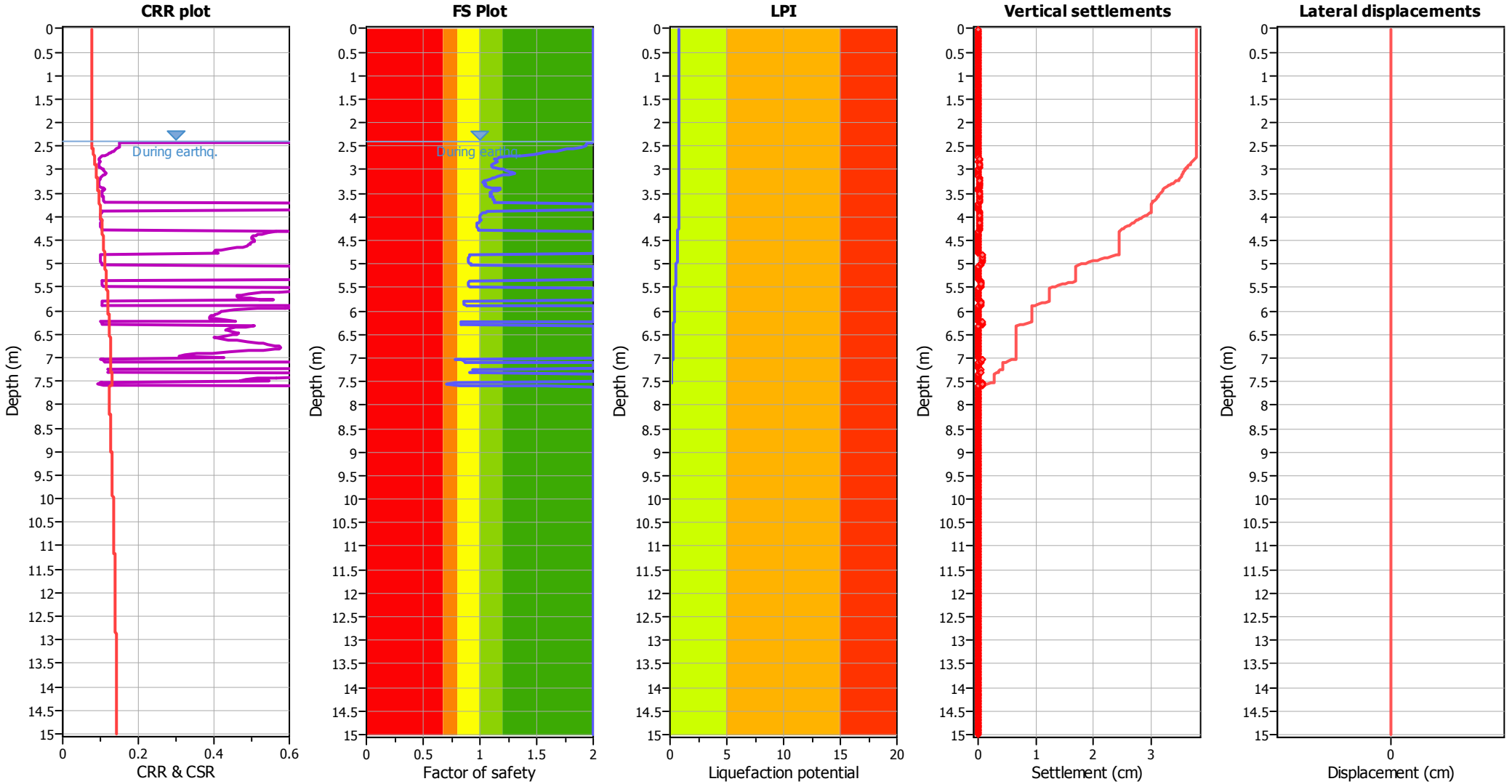






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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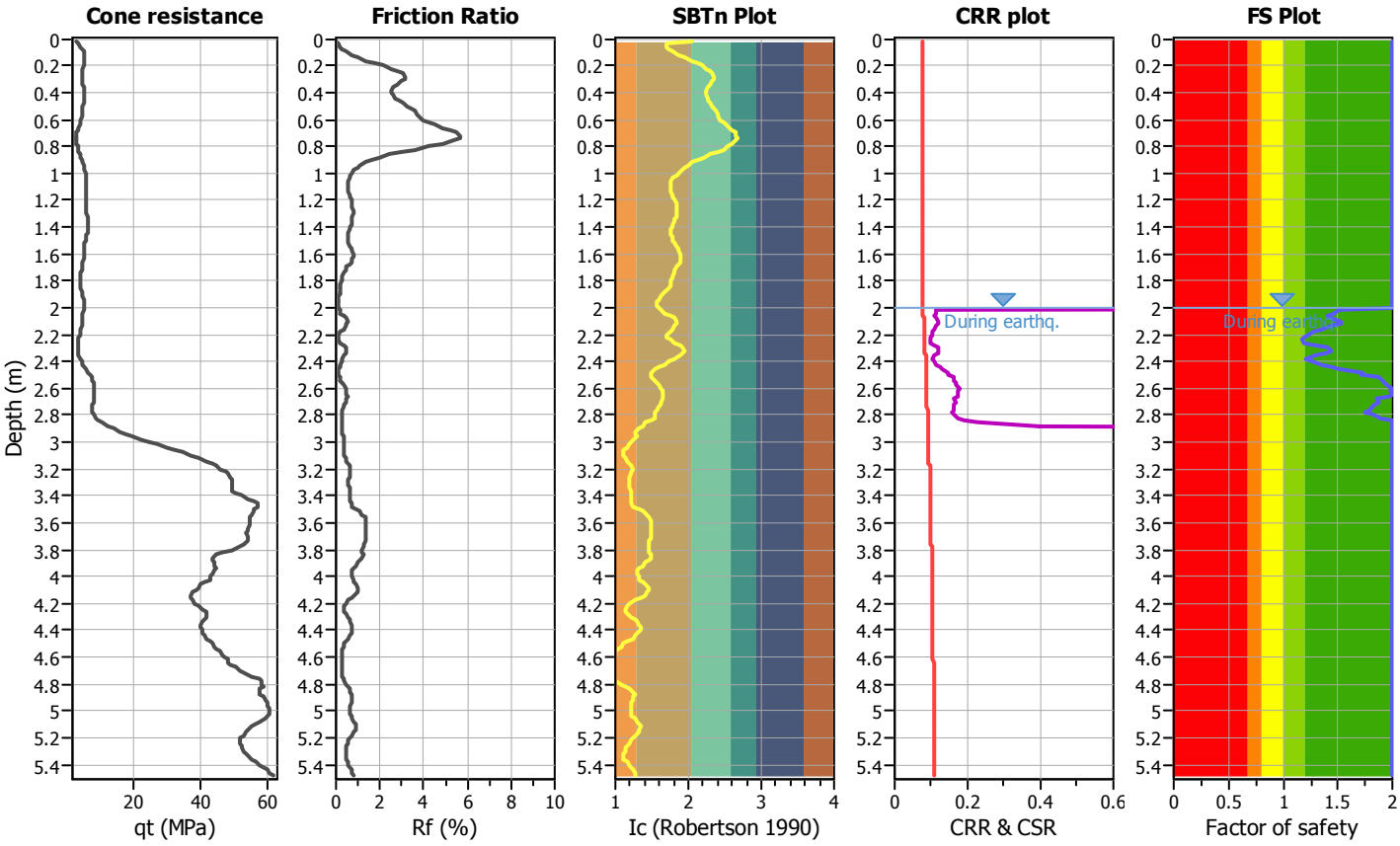
LIQUEFACTION ANALYSIS REPORT

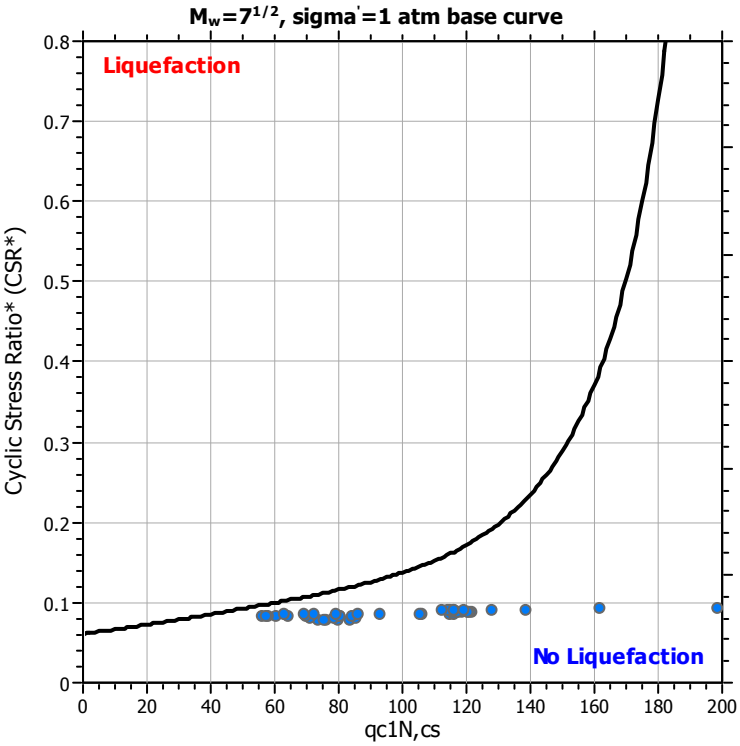
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

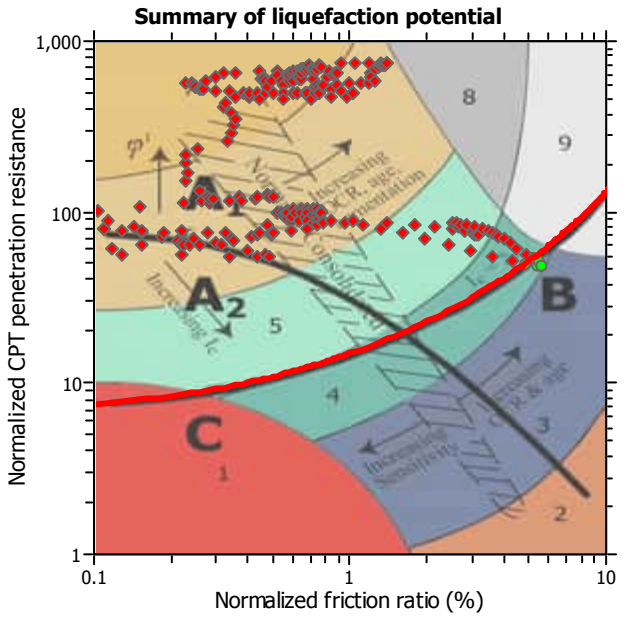
CPT file : CPT_25

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

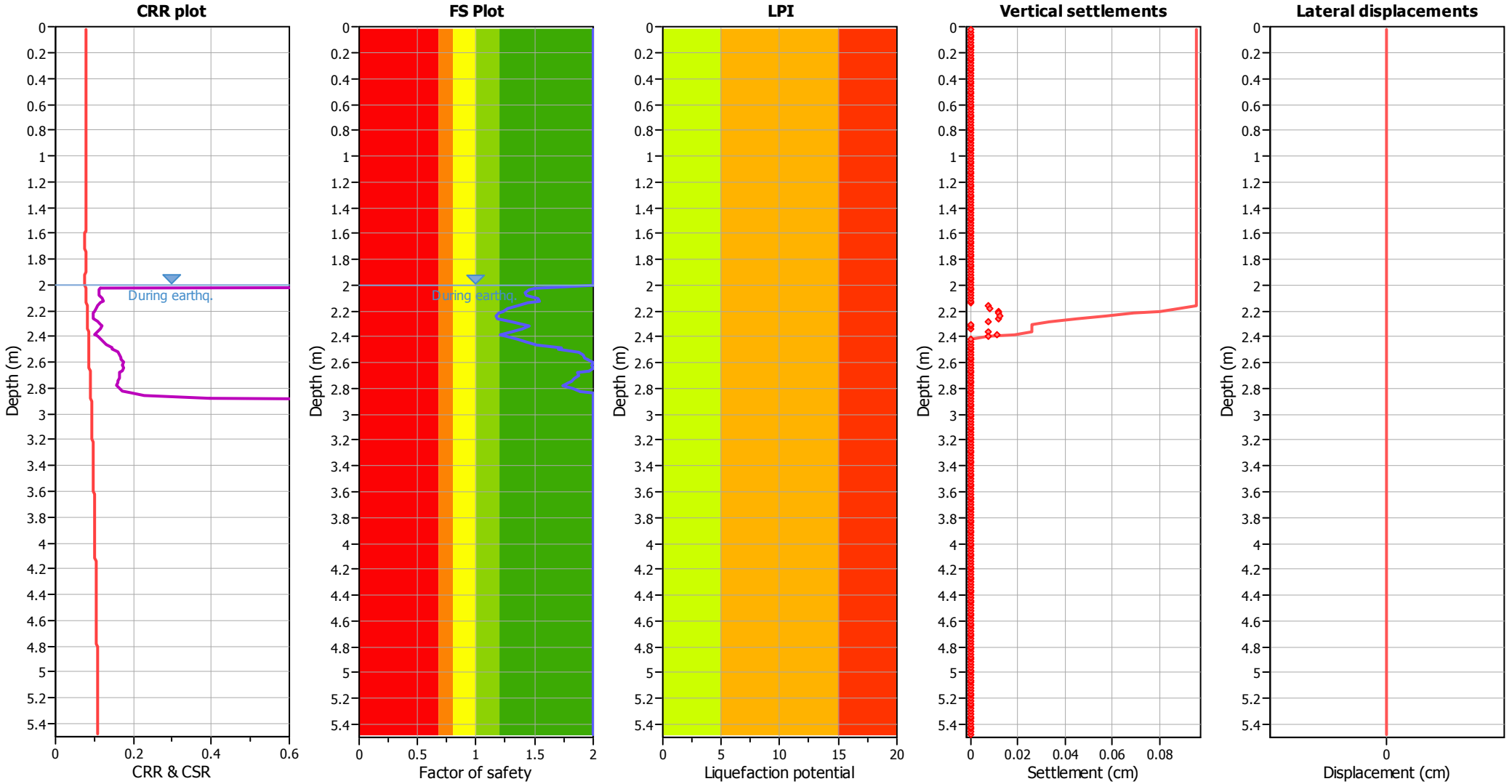






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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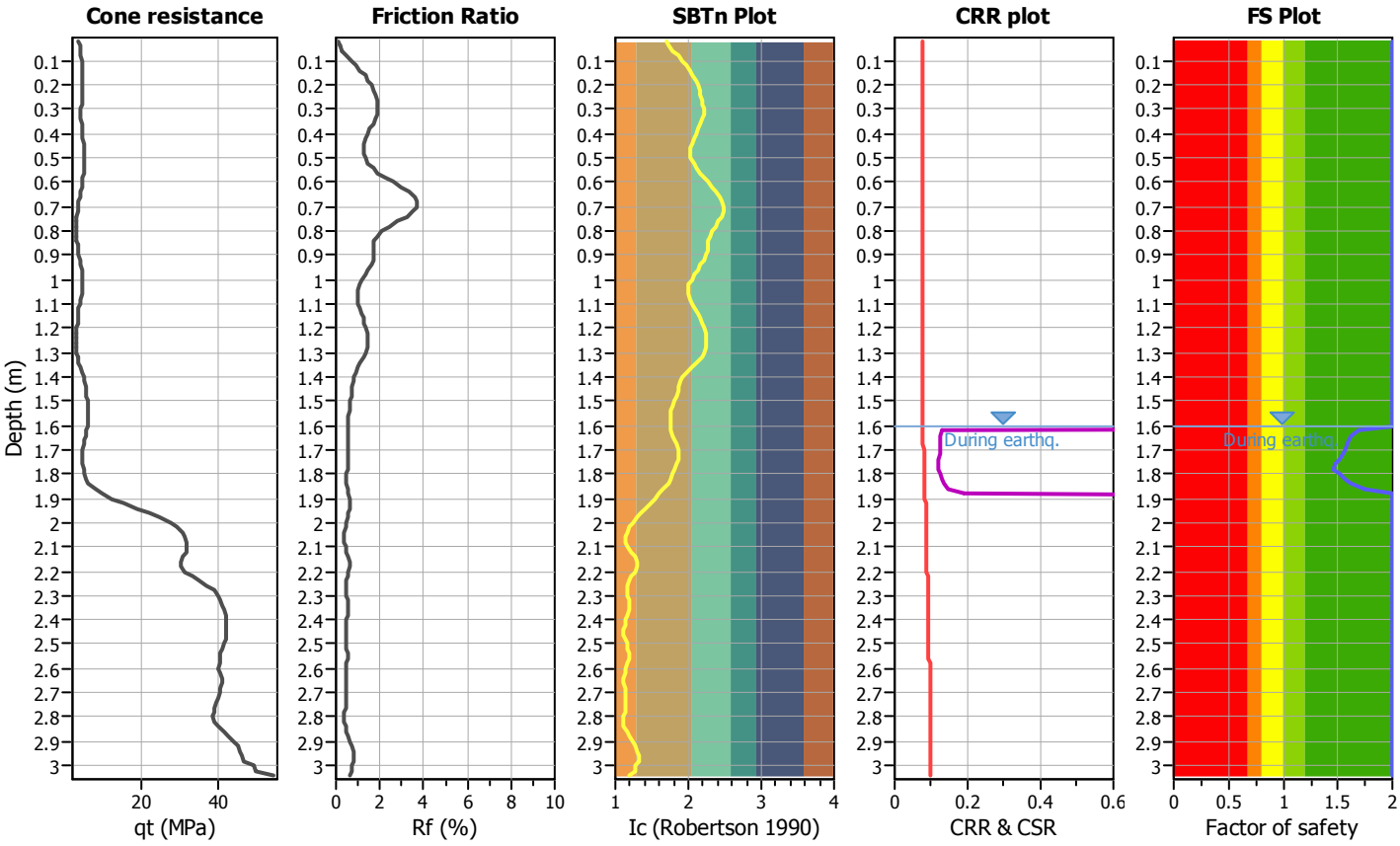
LIQUEFACTION ANALYSIS REPORT

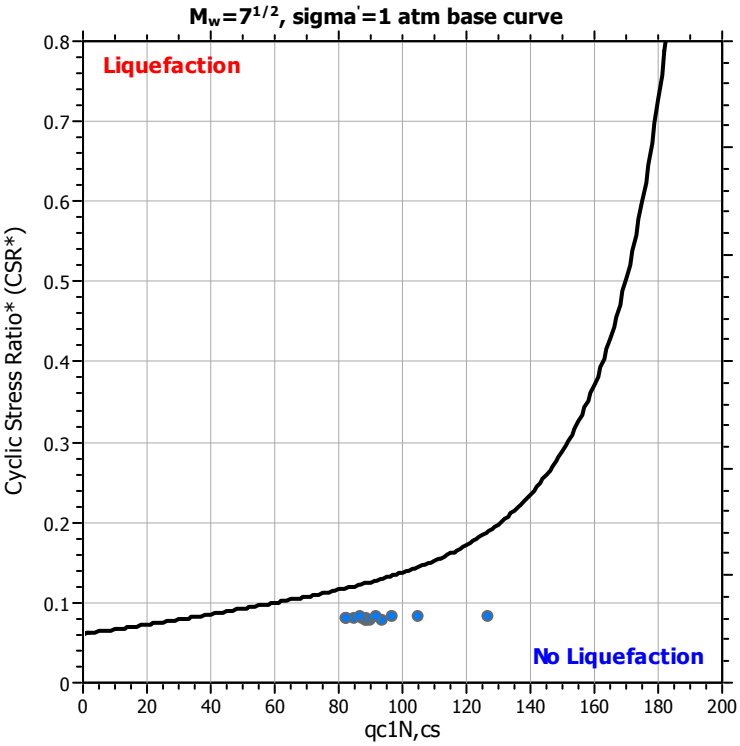
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

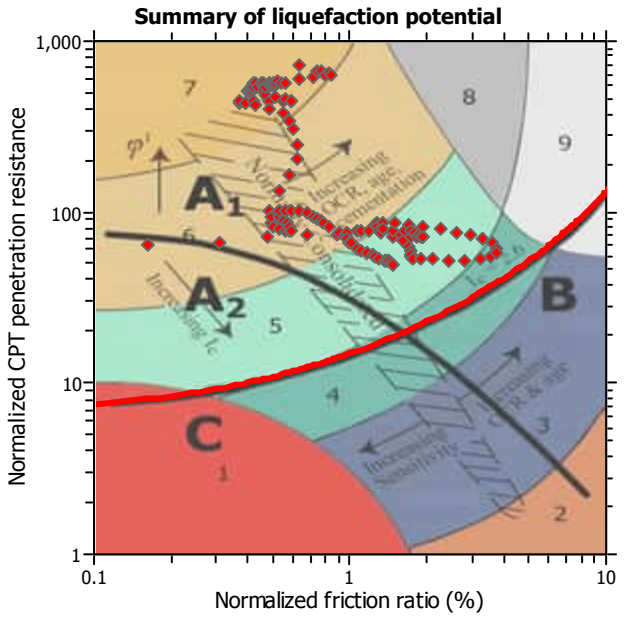
CPT file : CPT_26

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

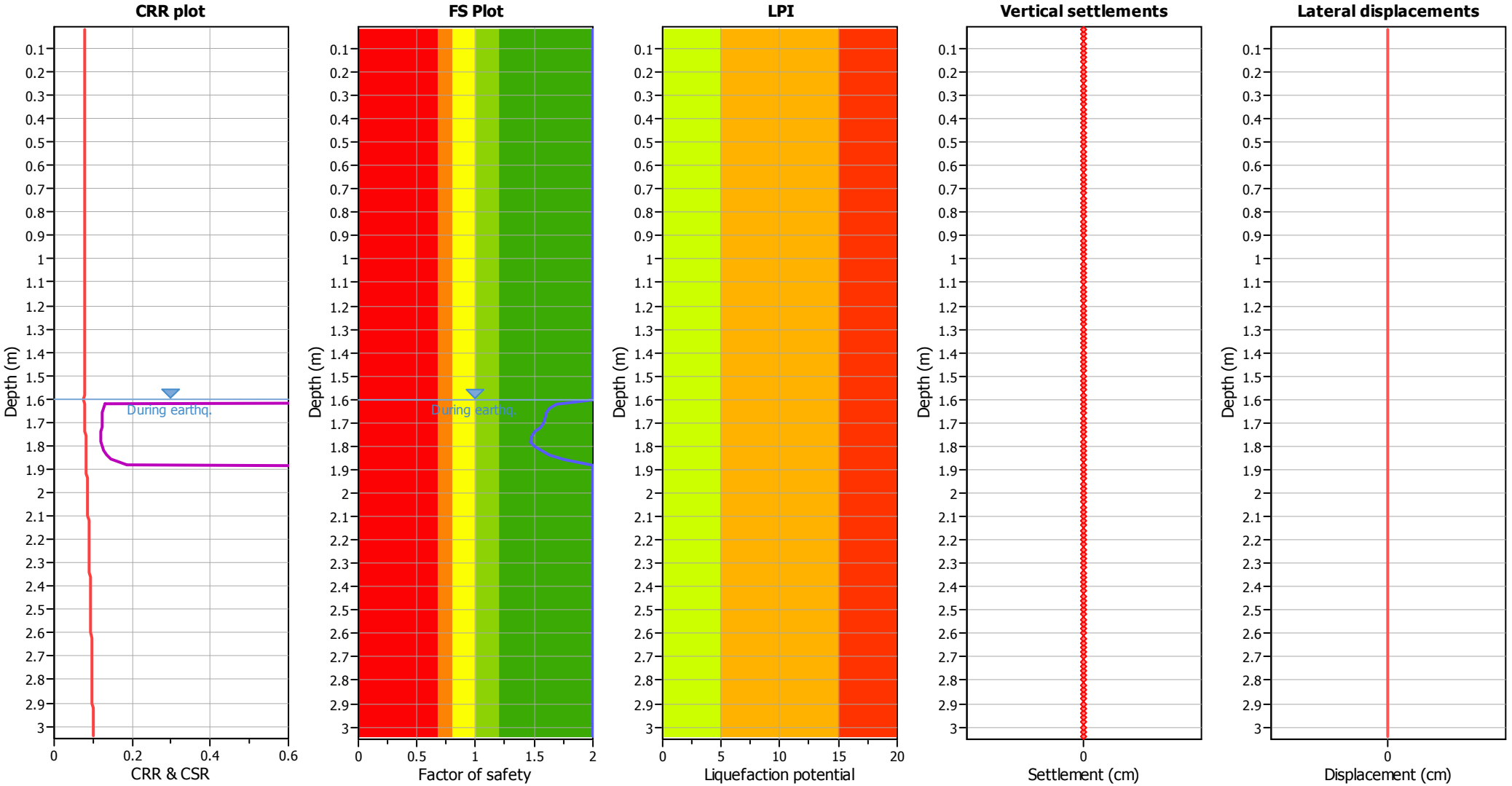






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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LPI color scheme

- Very high risk
- High risk
- Low risk

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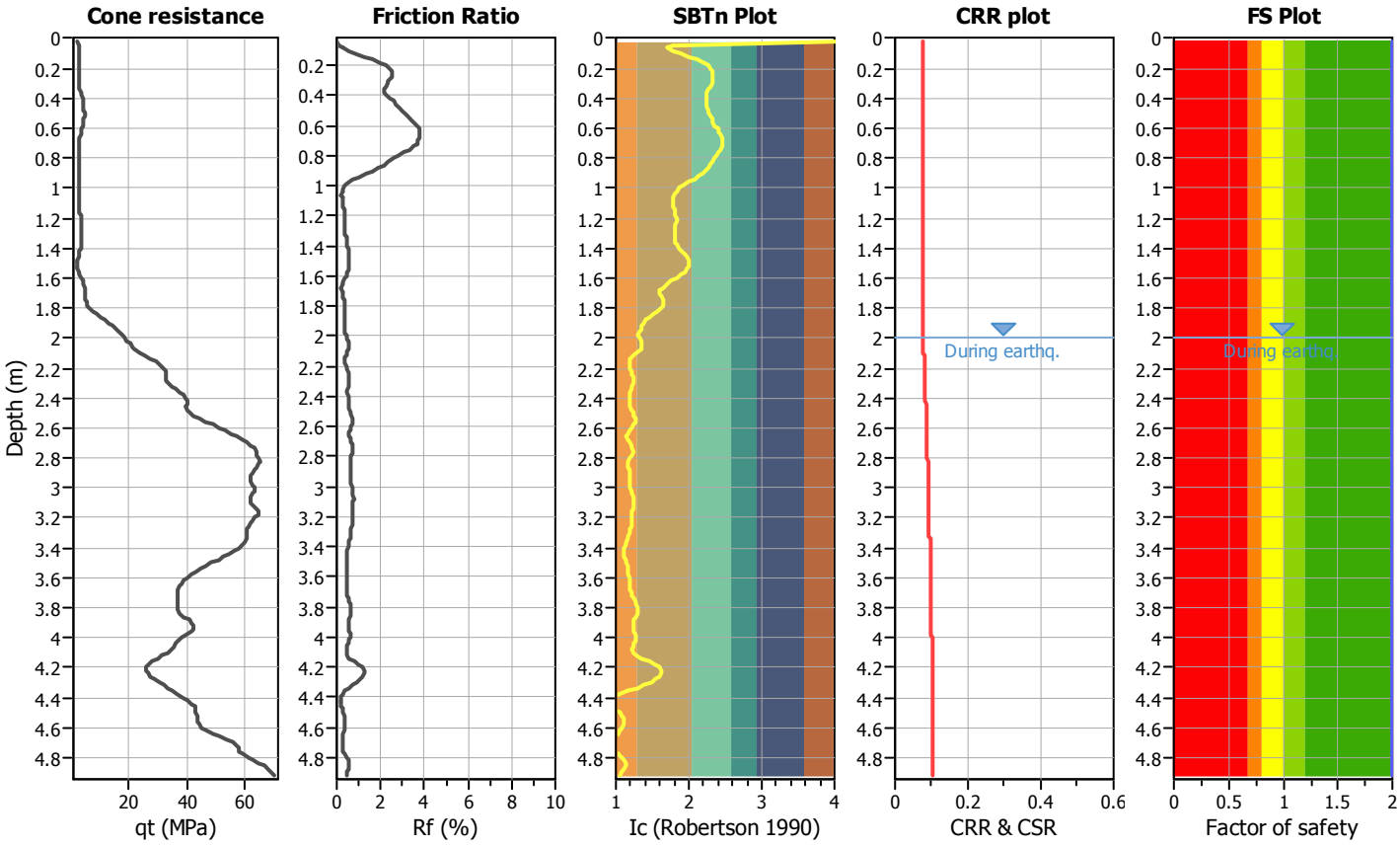
LIQUEFACTION ANALYSIS REPORT

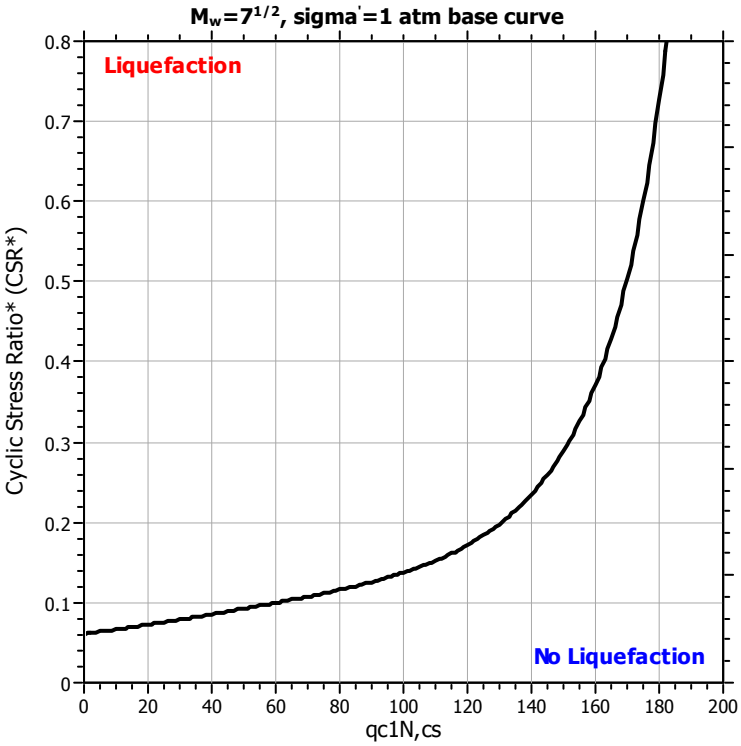
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

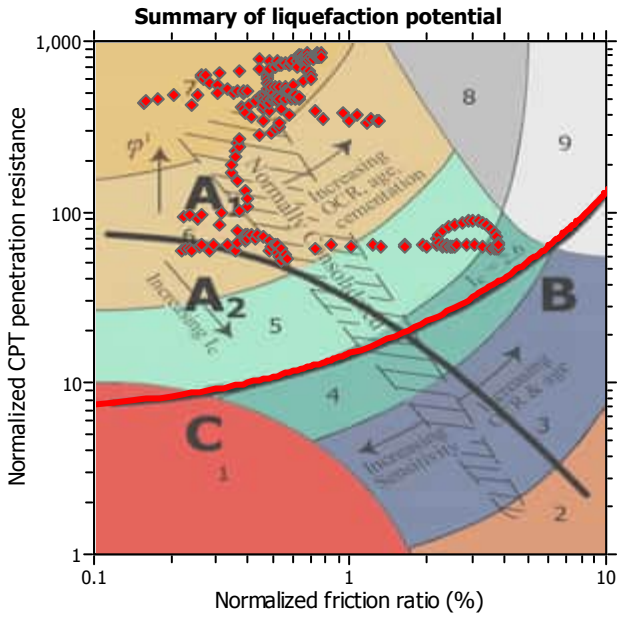
CPT file : CPT_27

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

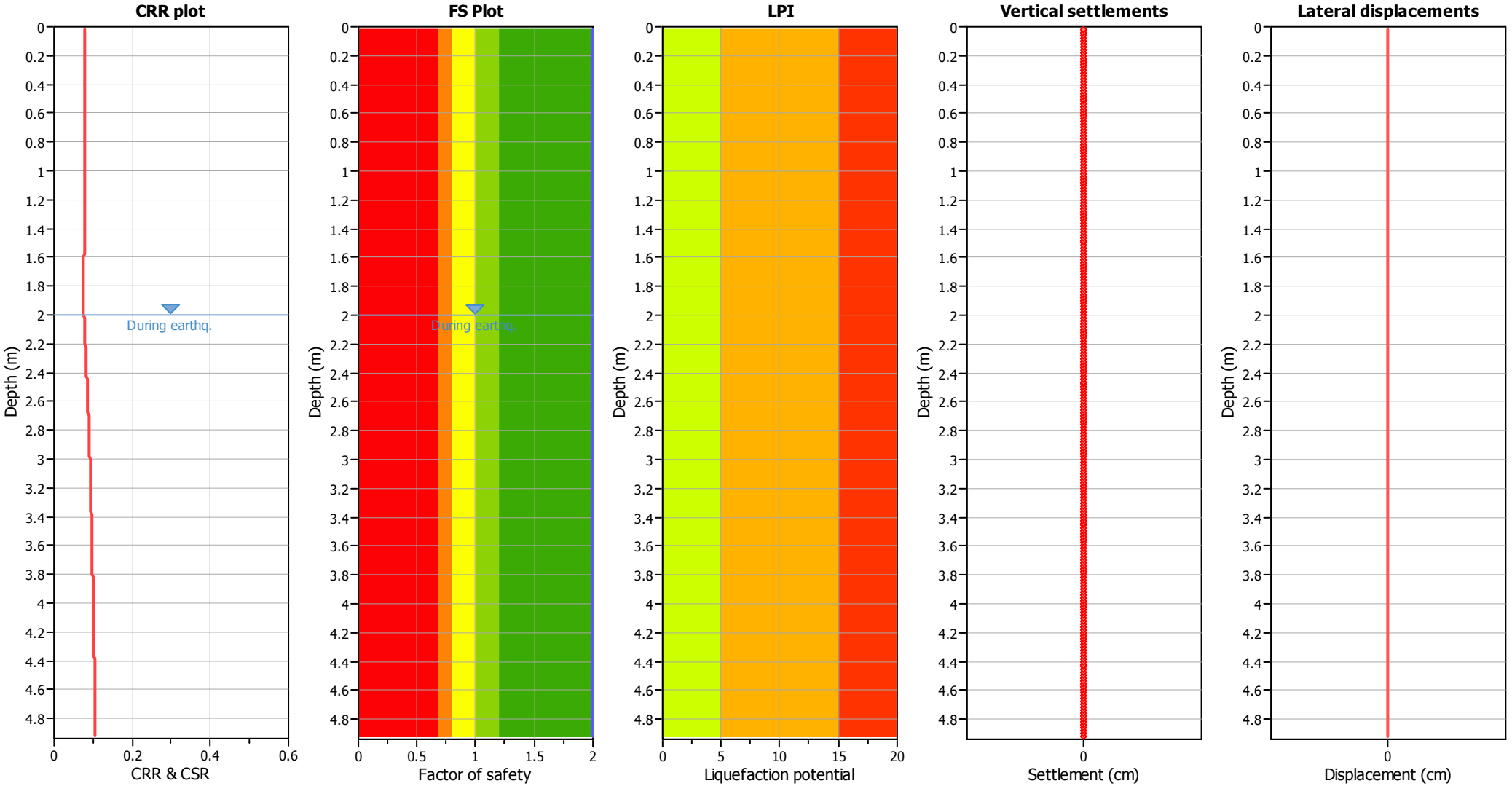






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
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LPI color scheme

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- High risk
- Low risk

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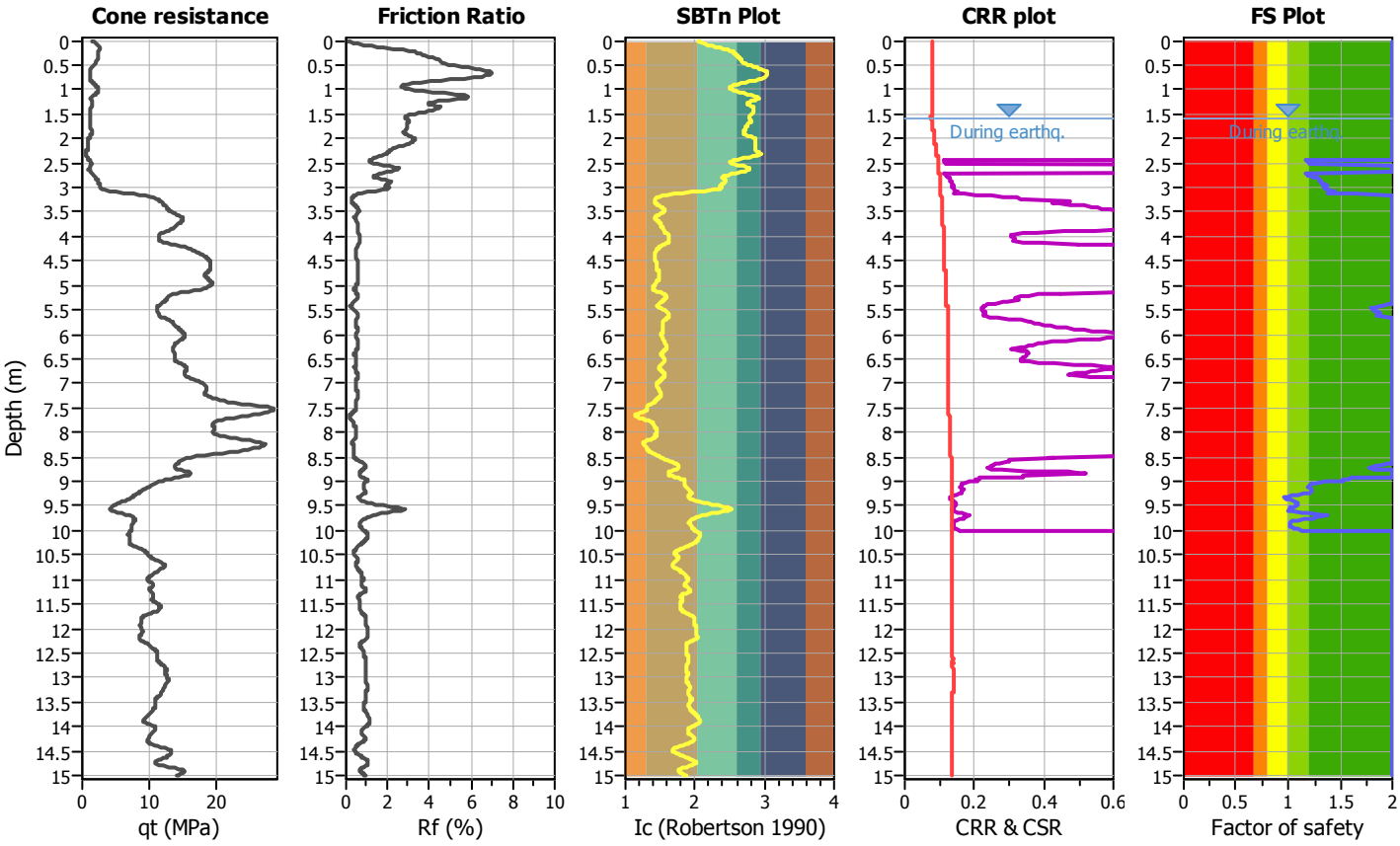
LIQUEFACTION ANALYSIS REPORT

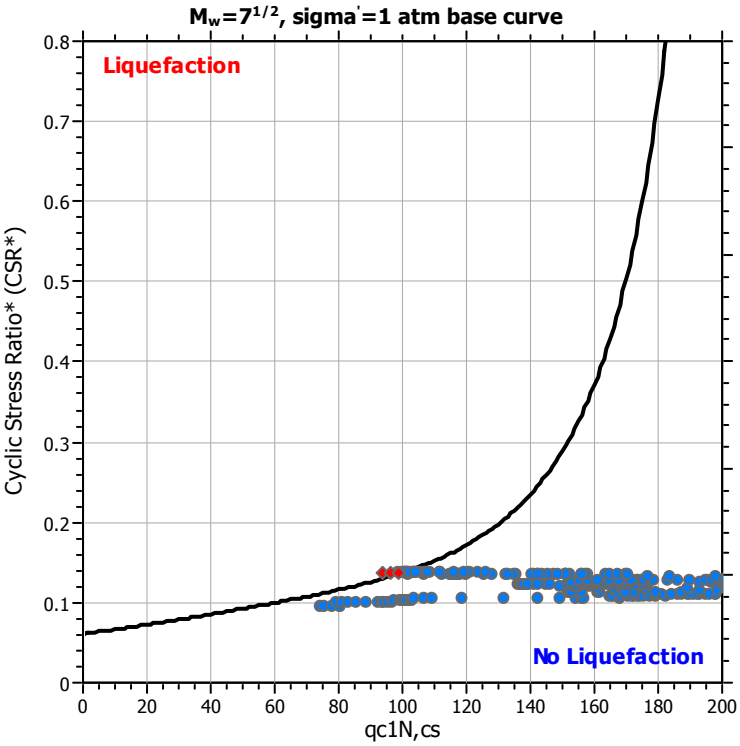
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

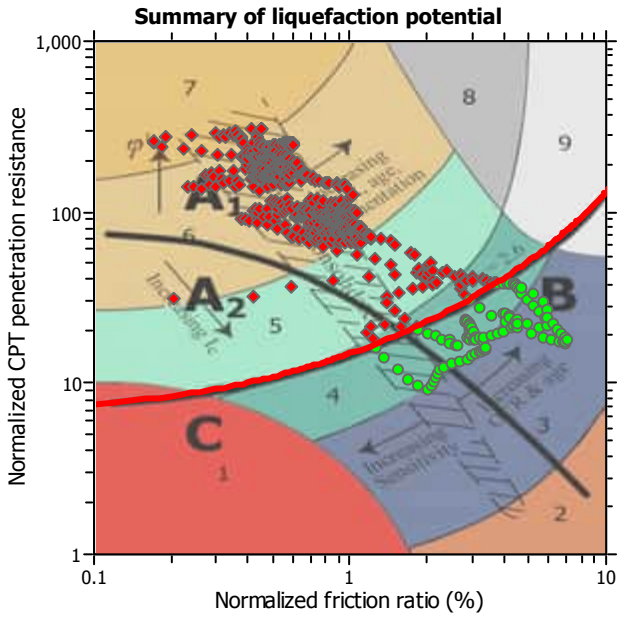
CPT file : CPT_28

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

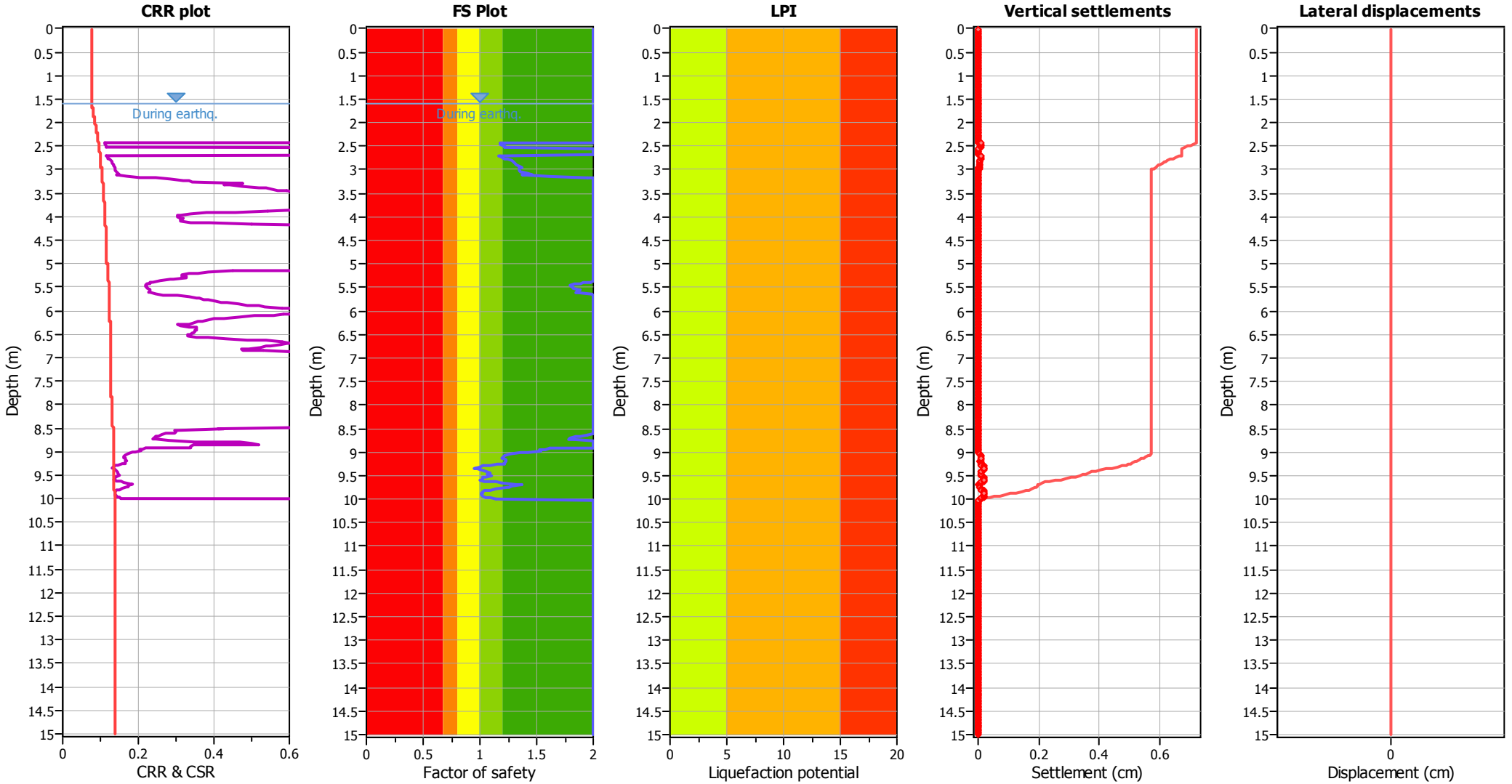






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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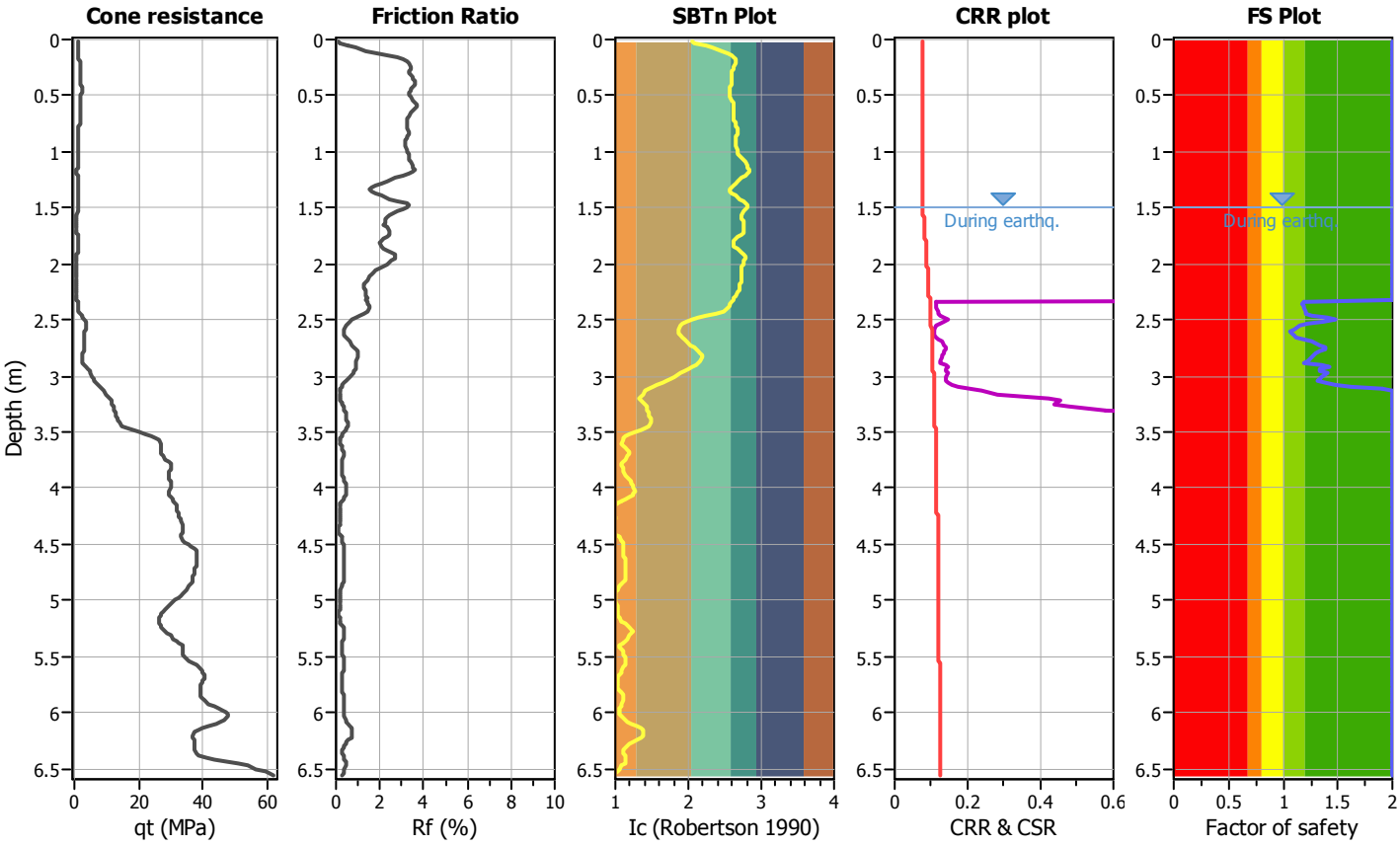
LIQUEFACTION ANALYSIS REPORT

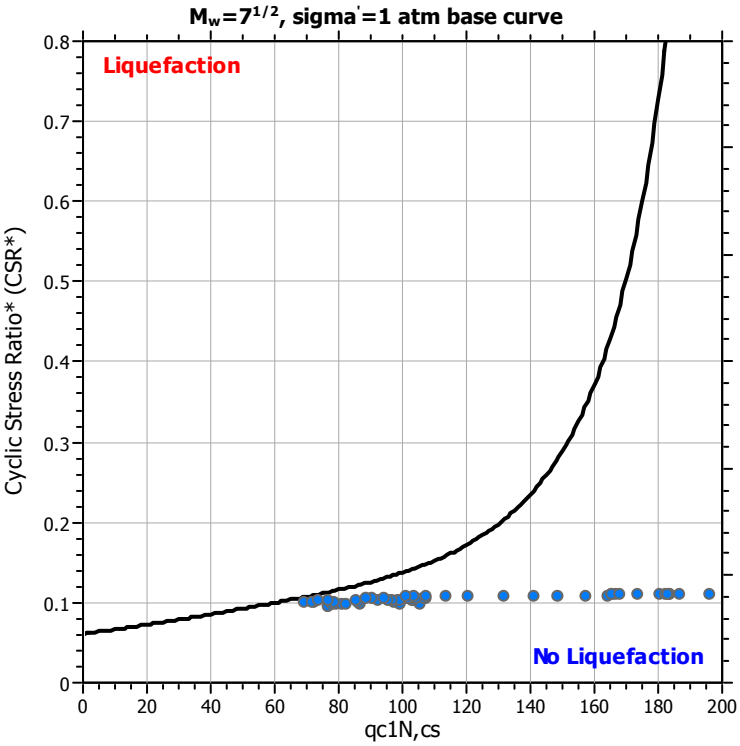
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

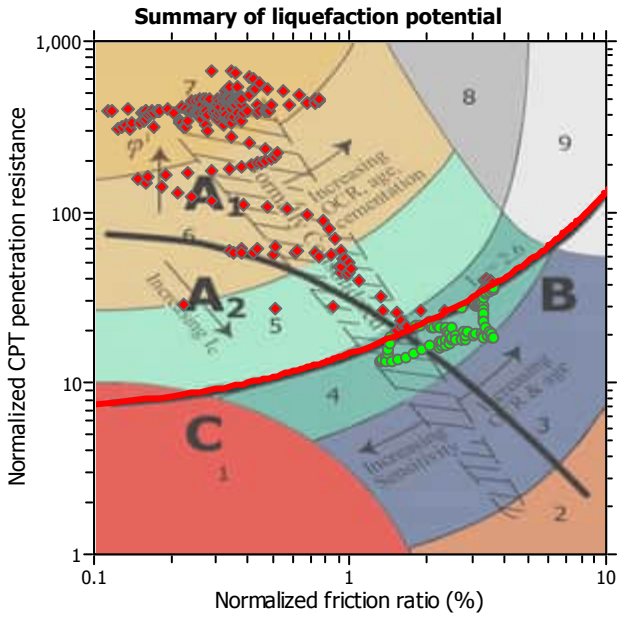
CPT file : CPT_29

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

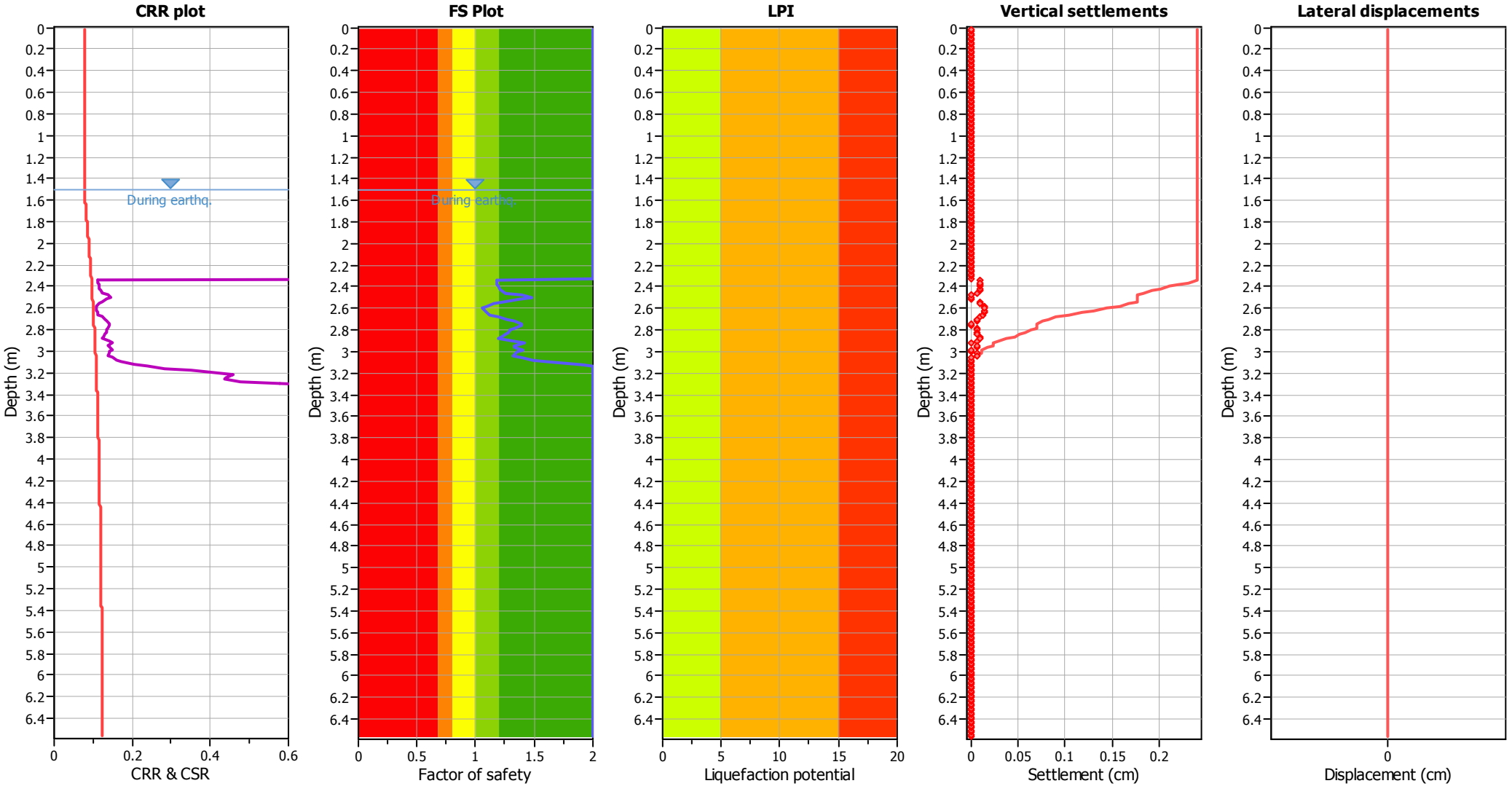






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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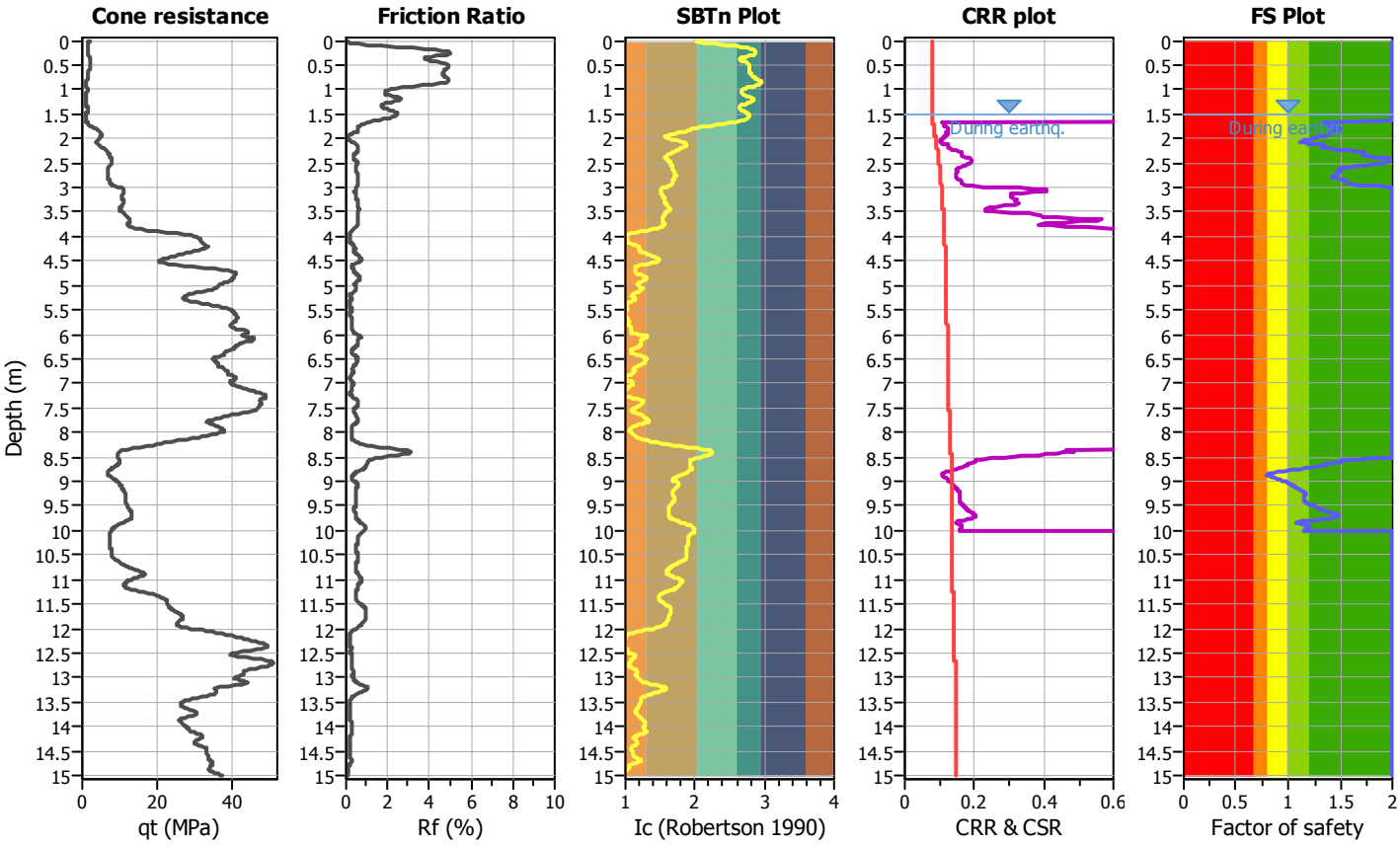
LIQUEFACTION ANALYSIS REPORT

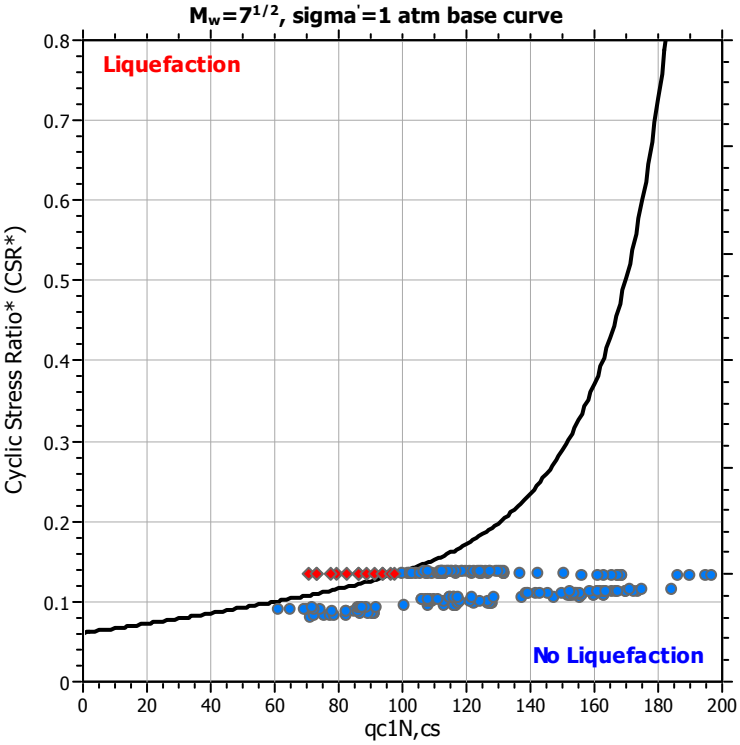
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

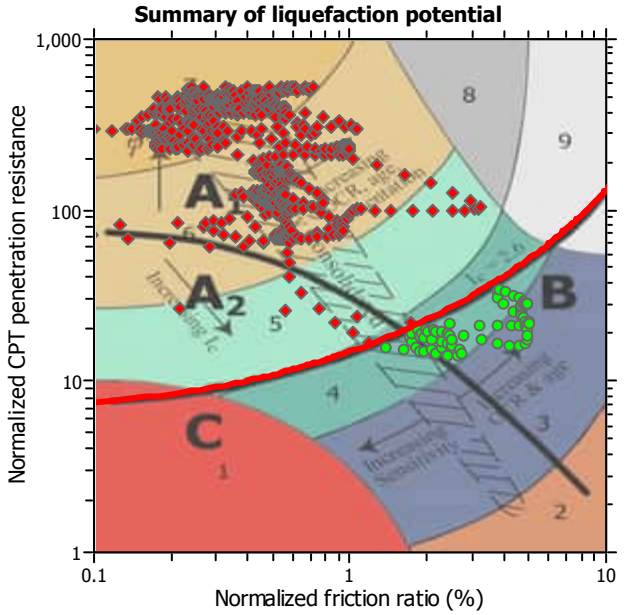
CPT file : CPT_30

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

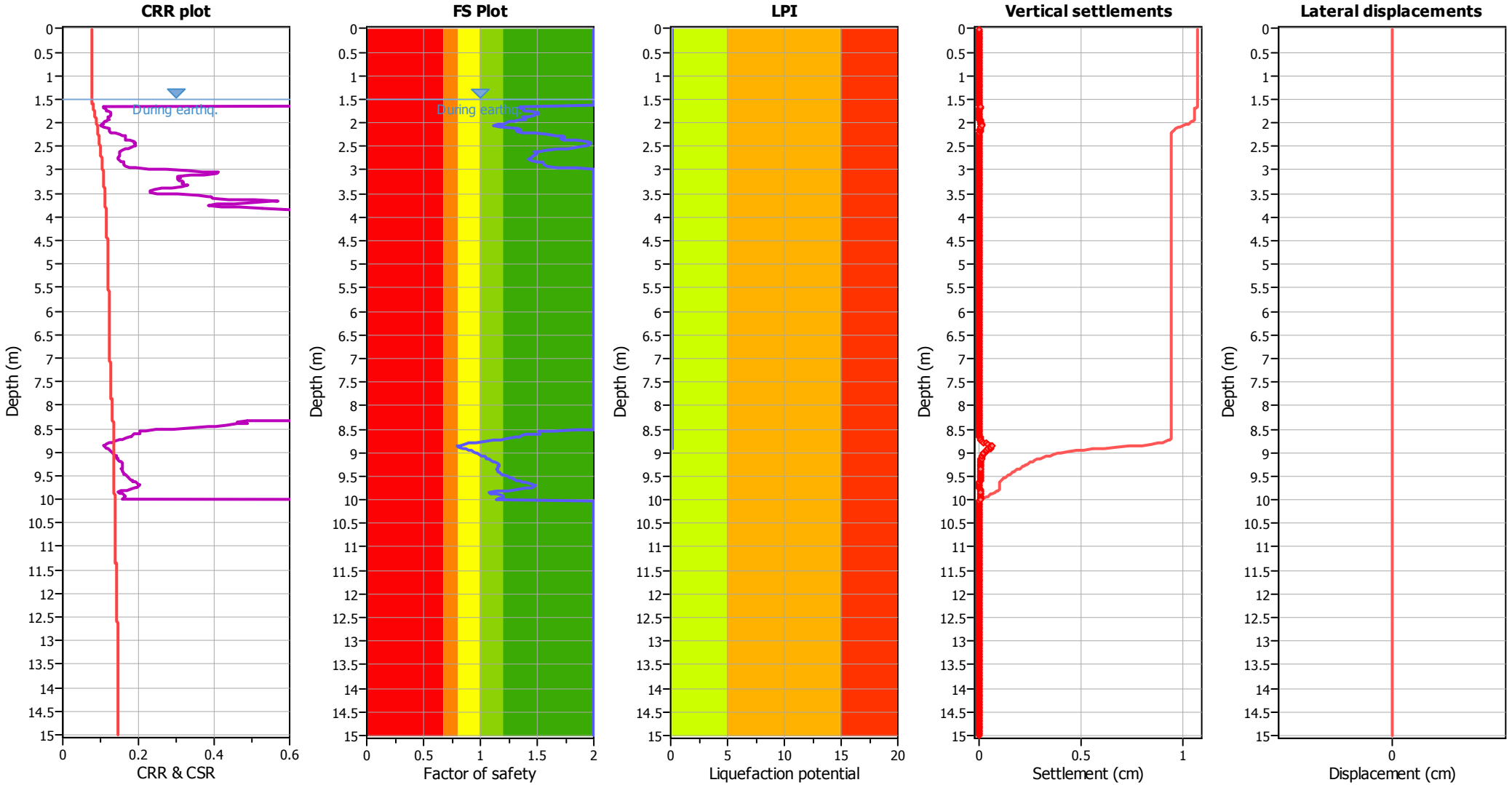






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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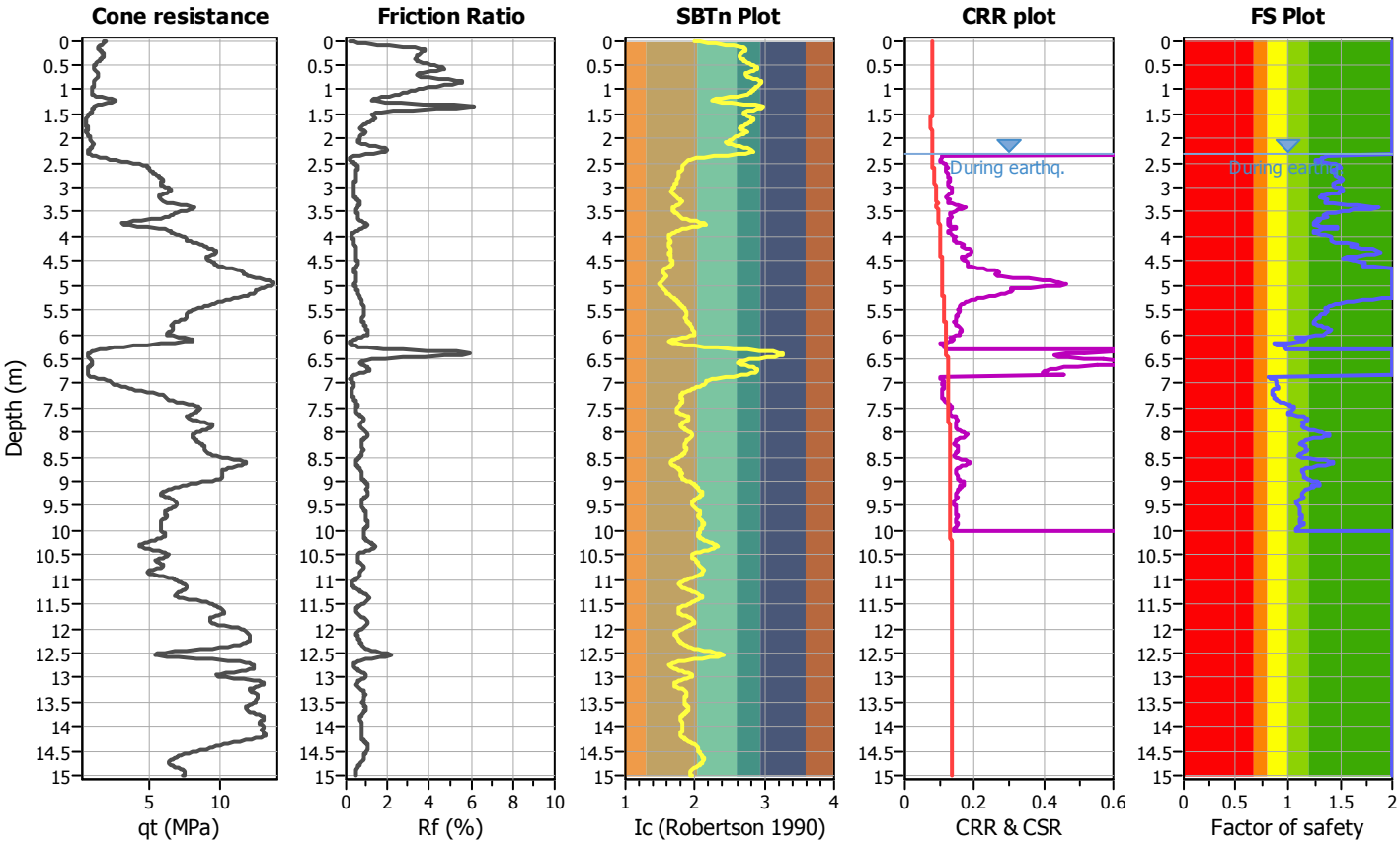
LIQUEFACTION ANALYSIS REPORT

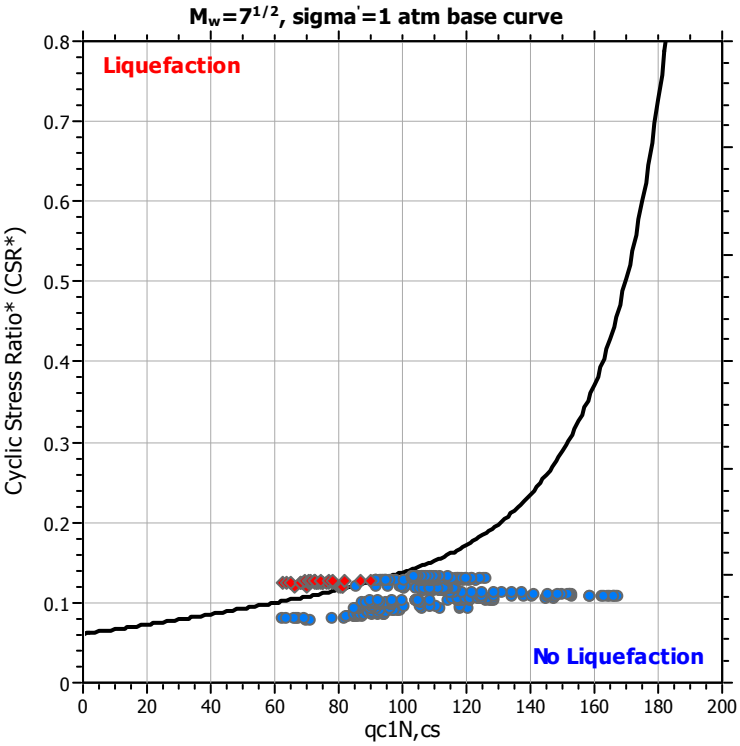
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

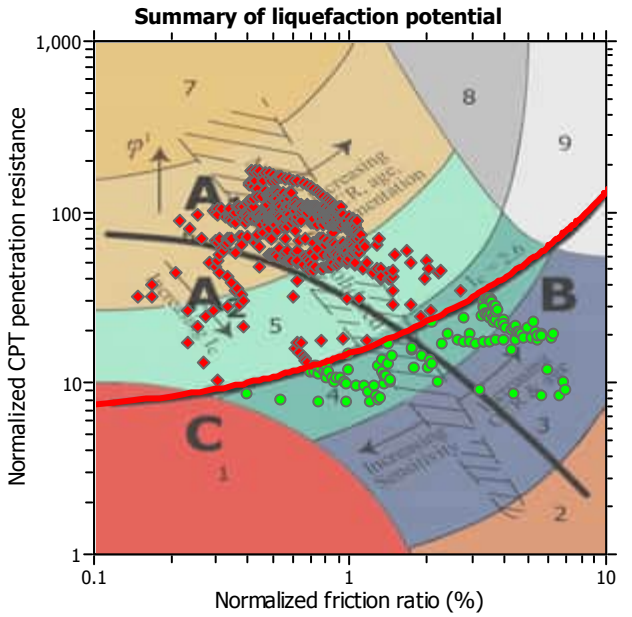
CPT file : CPT_31

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

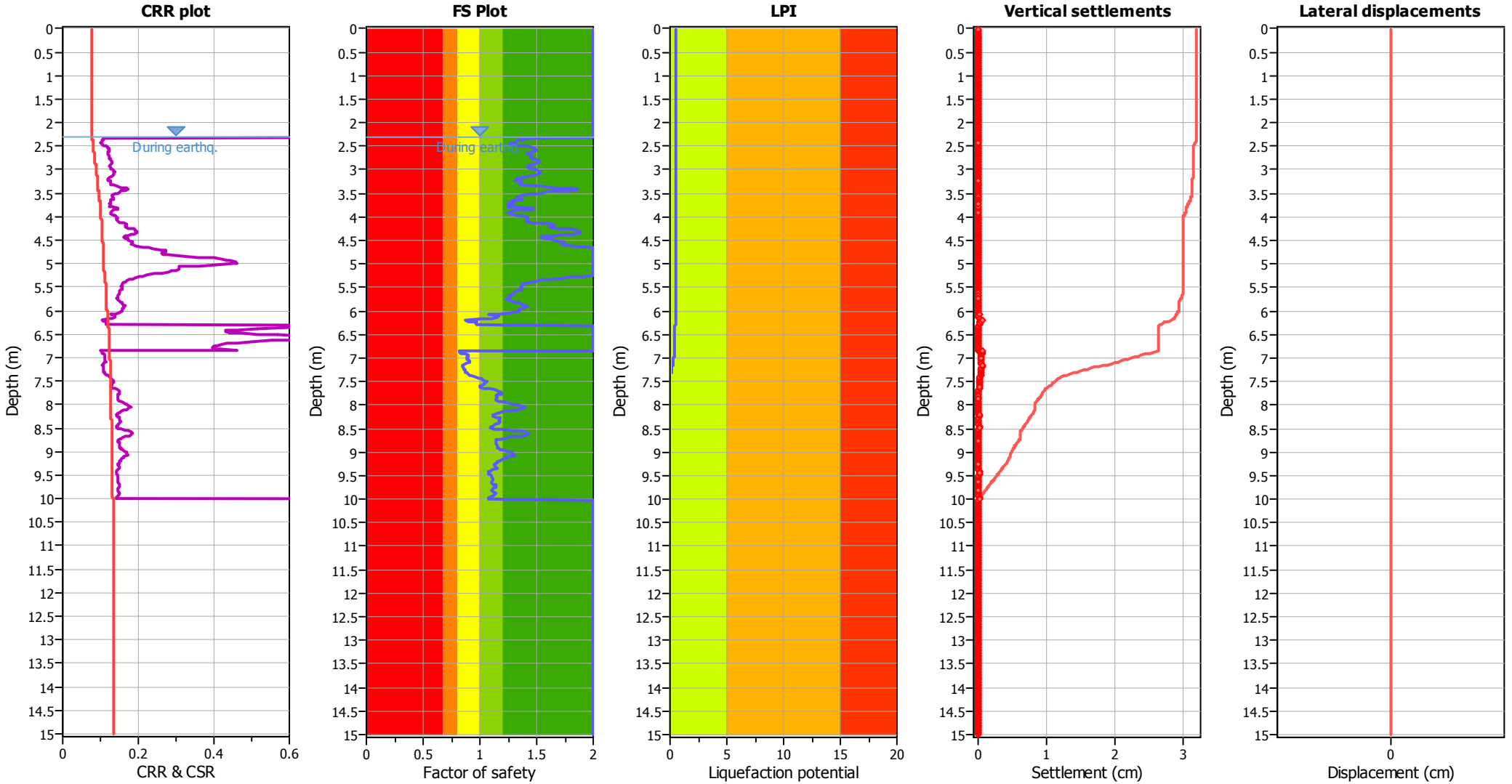






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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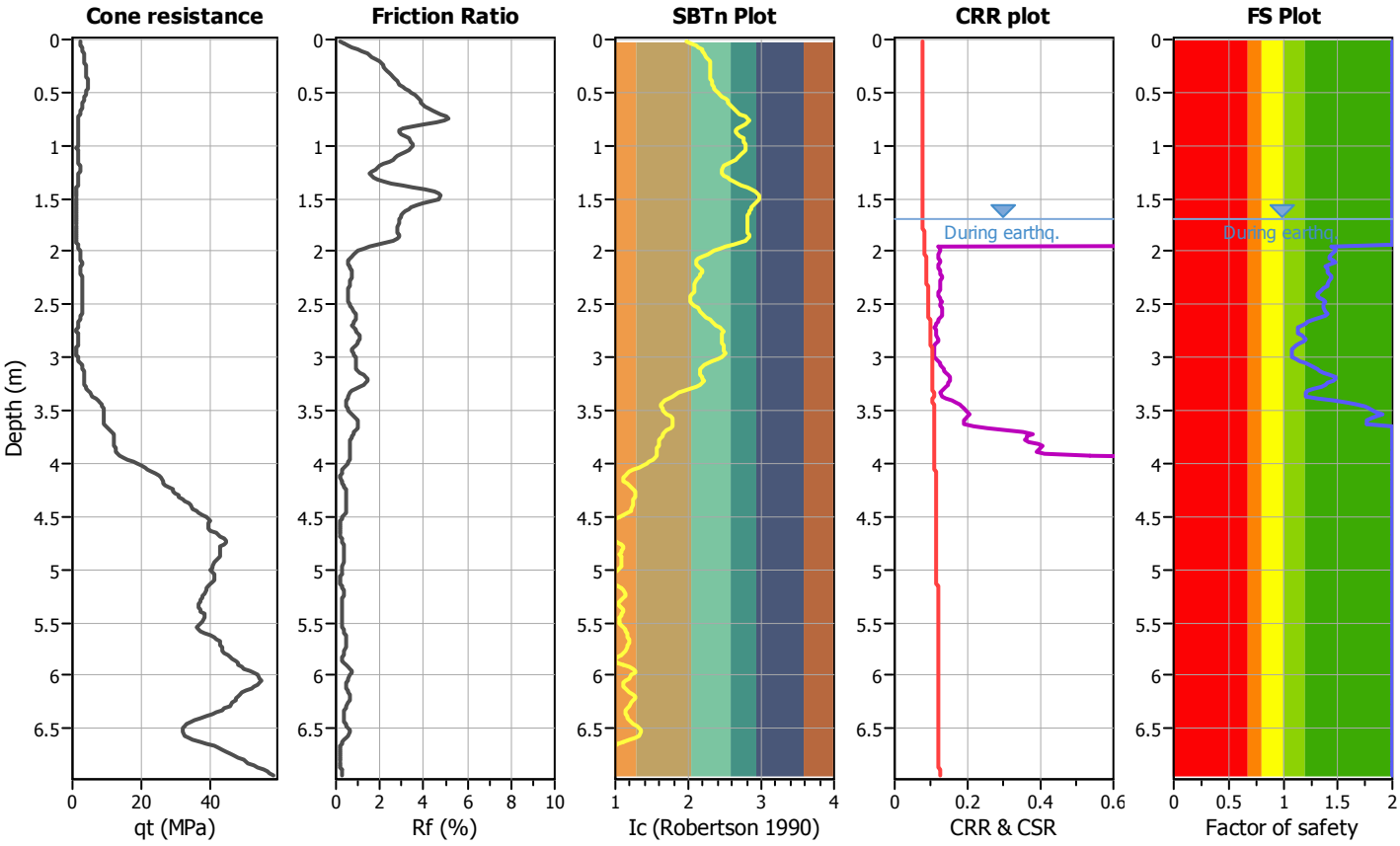
LIQUEFACTION ANALYSIS REPORT

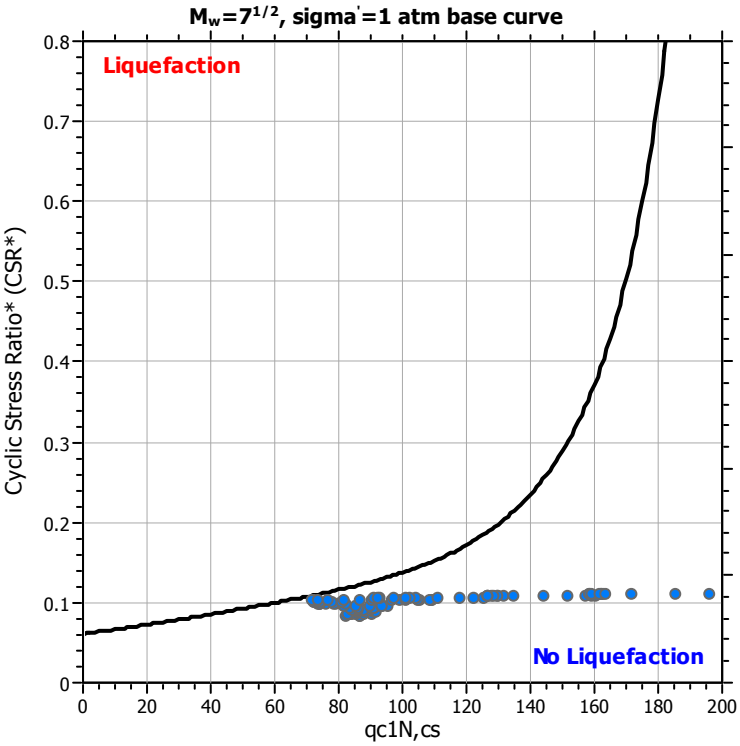
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

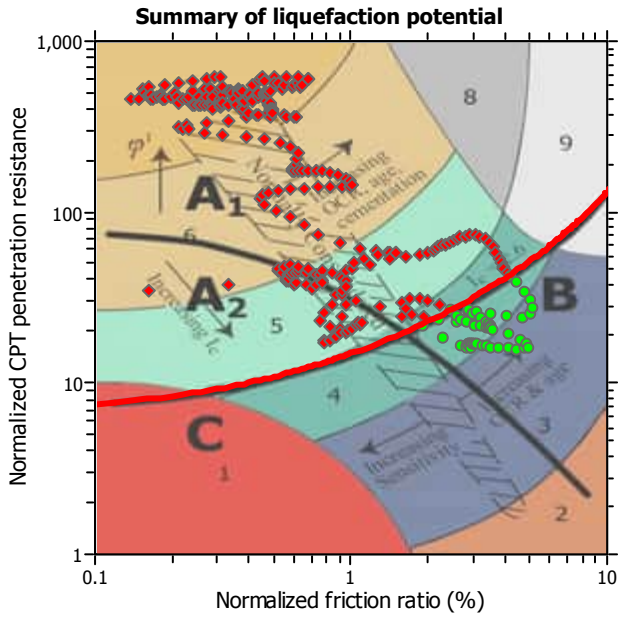
CPT file : CPT_32

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

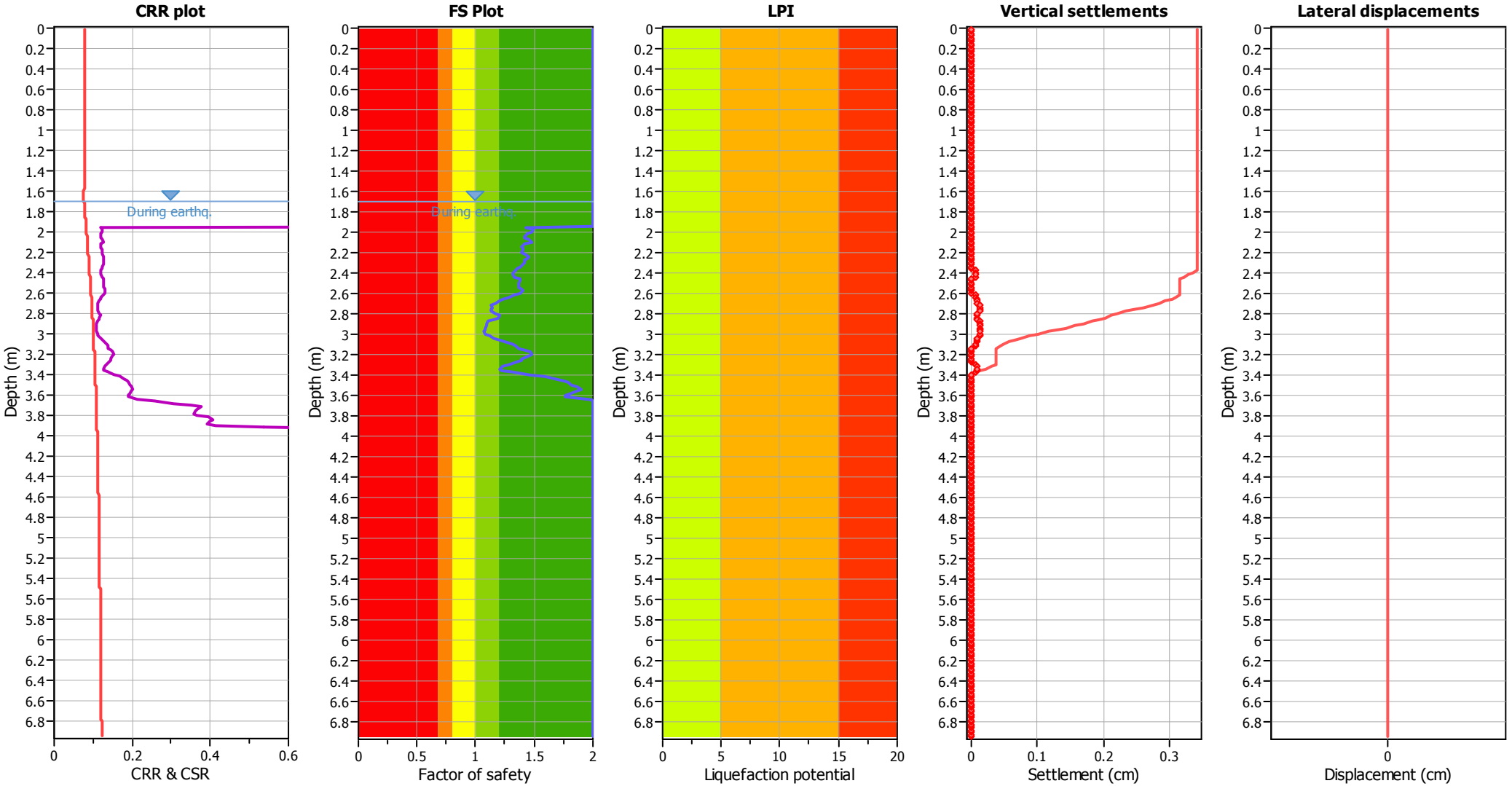






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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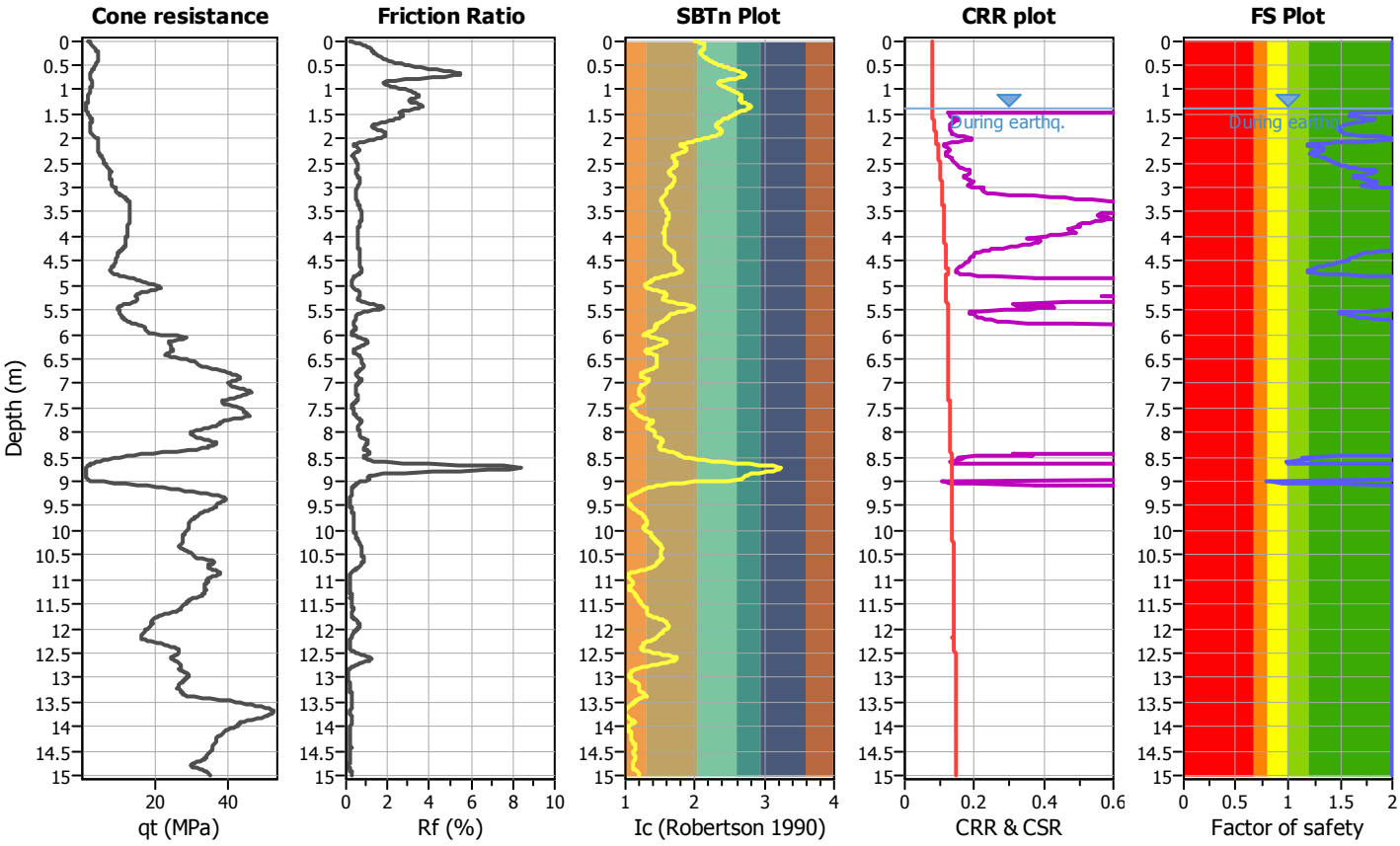
LIQUEFACTION ANALYSIS REPORT

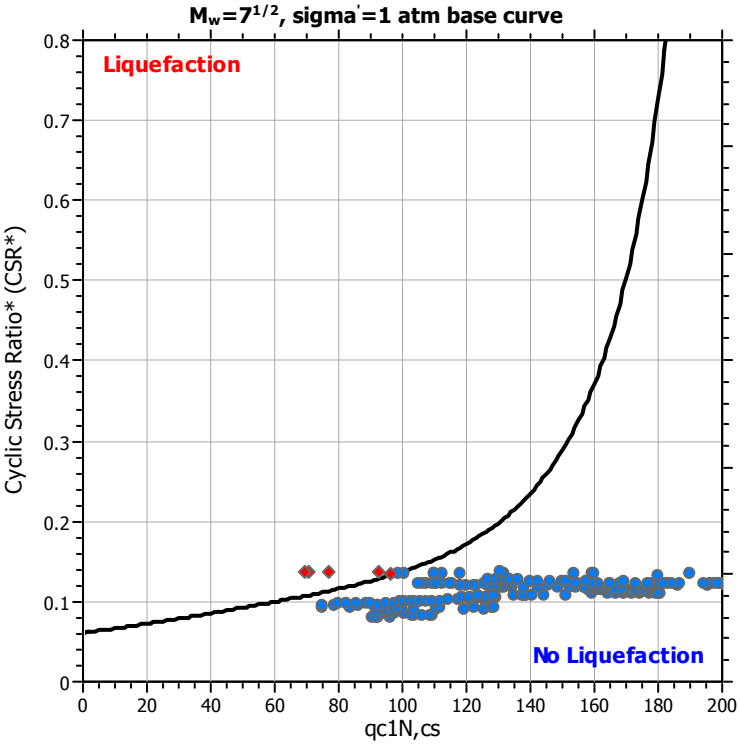
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

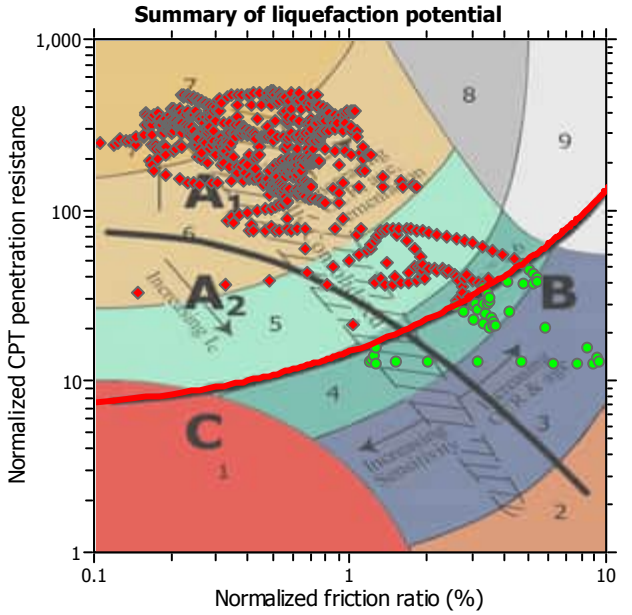
CPT file : CPT_33

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

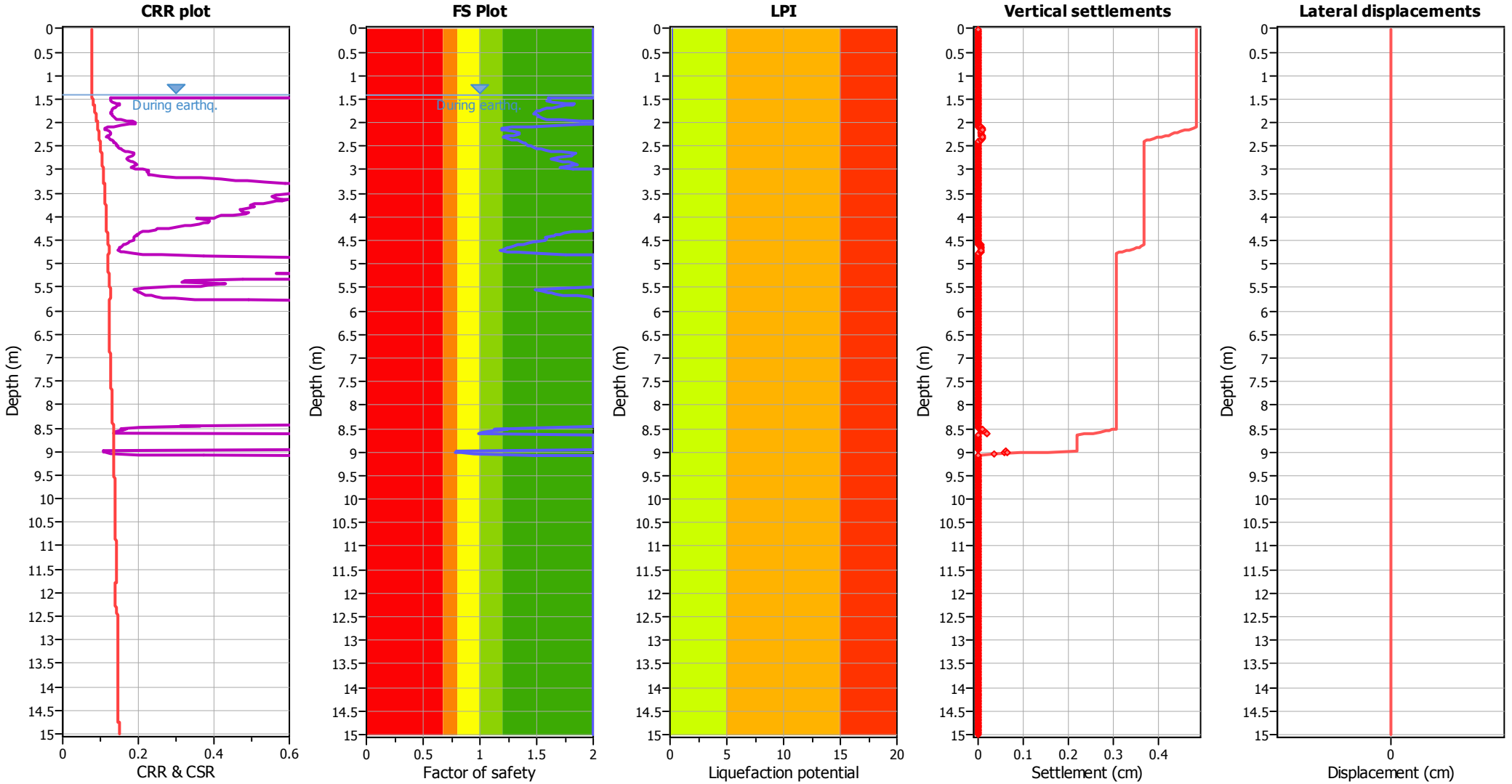






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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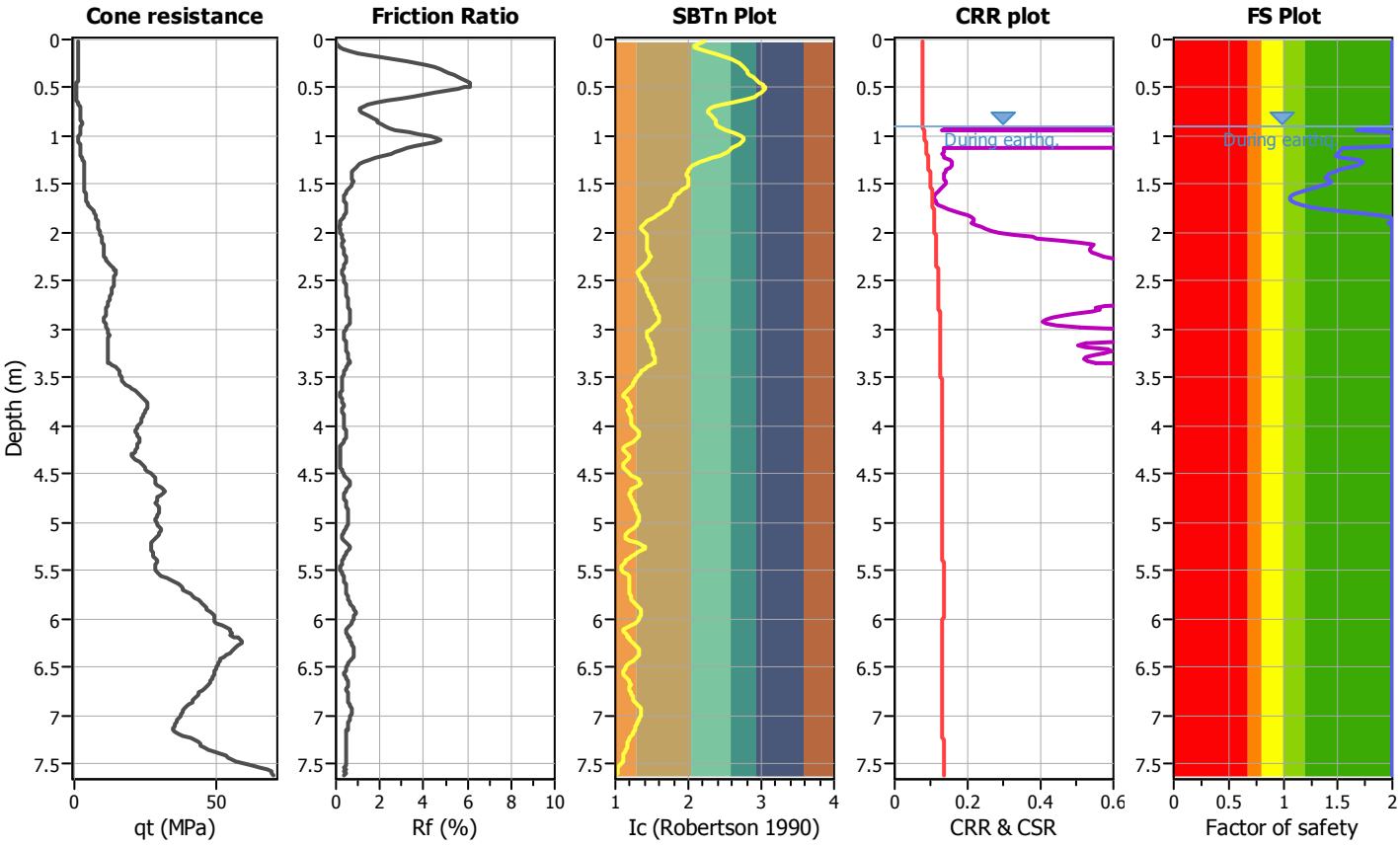
LIQUEFACTION ANALYSIS REPORT

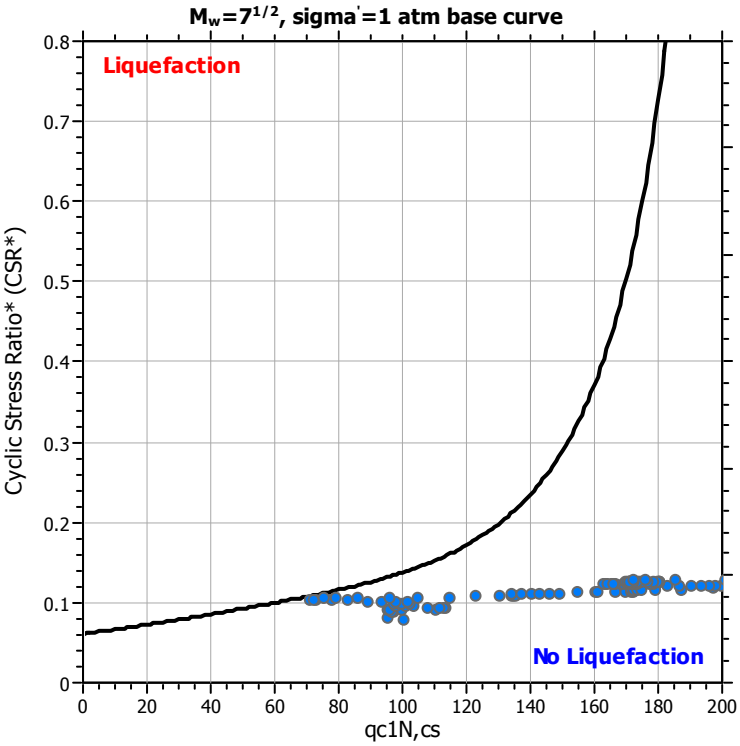
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

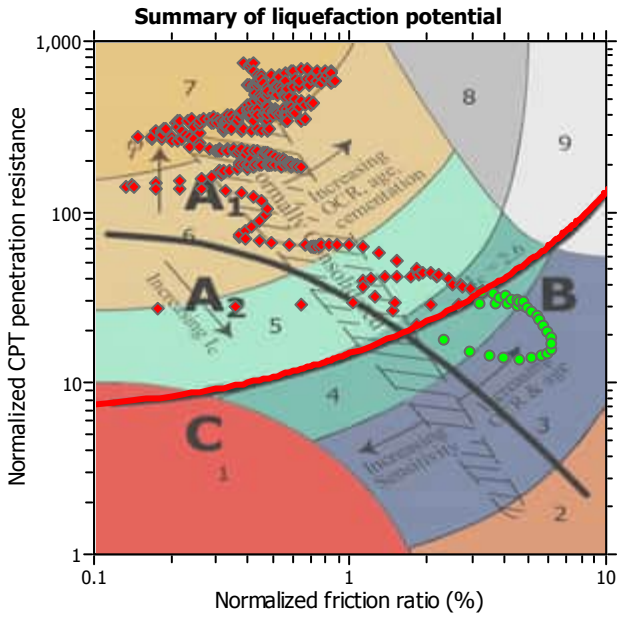
CPT file : CPT_34

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

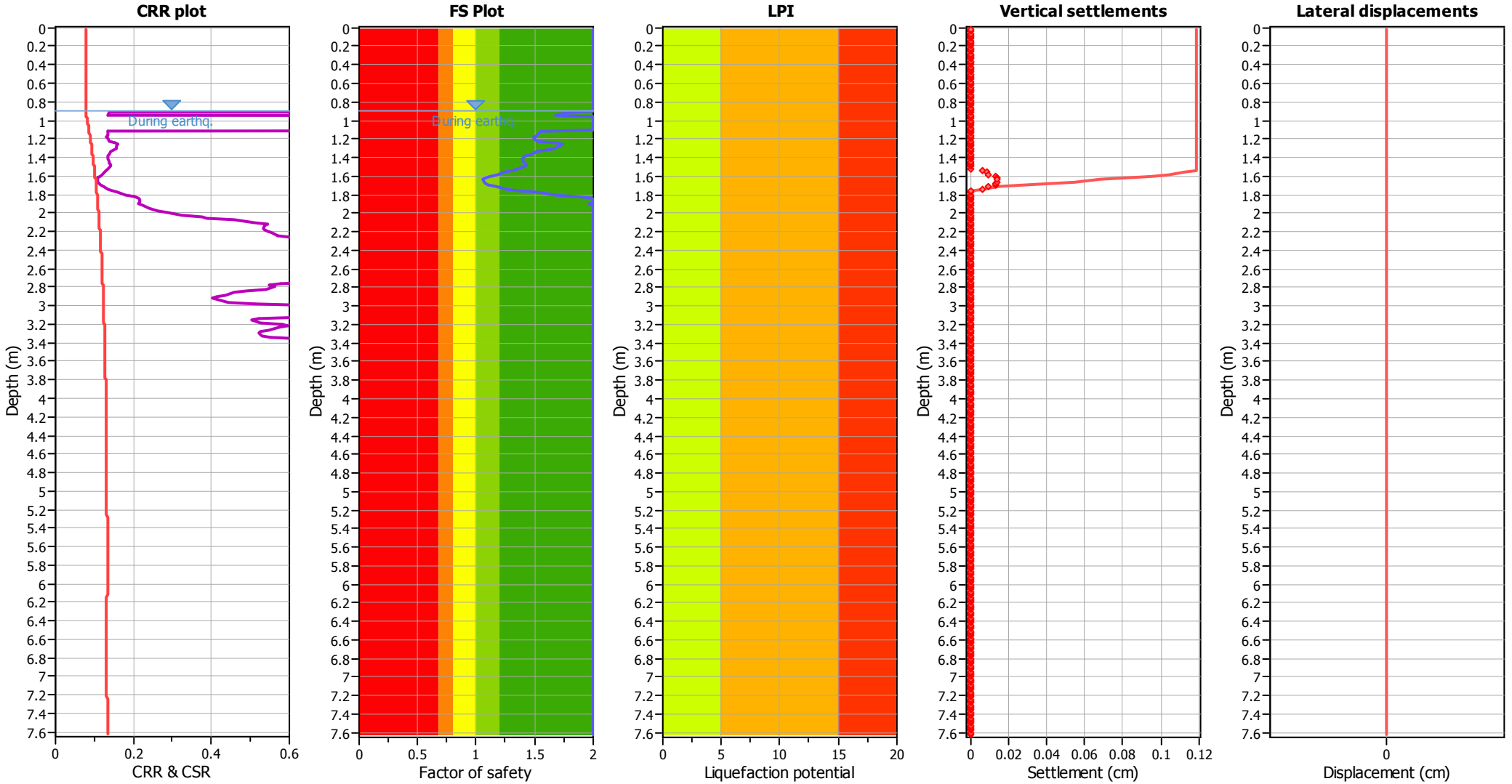






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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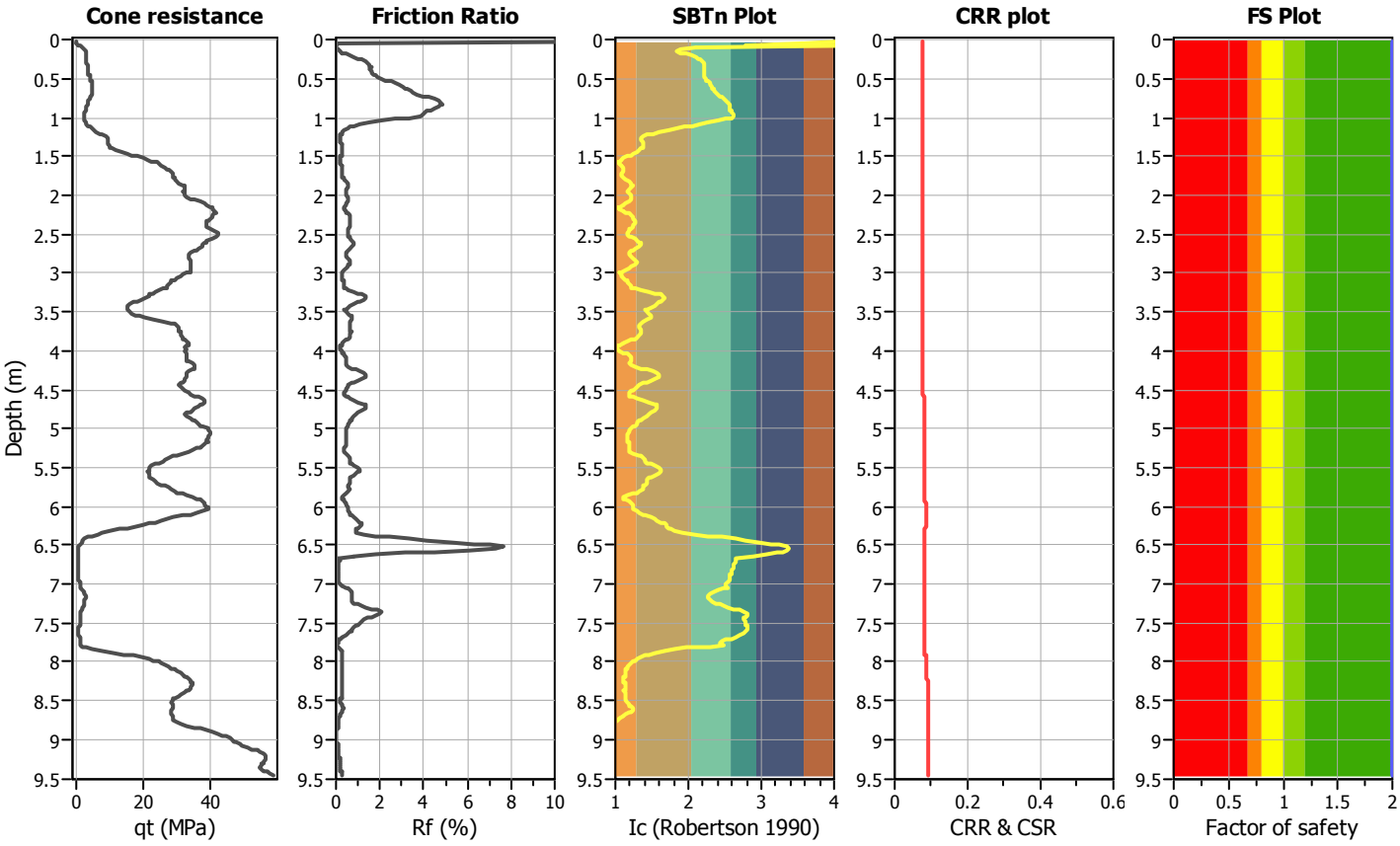
LIQUEFACTION ANALYSIS REPORT

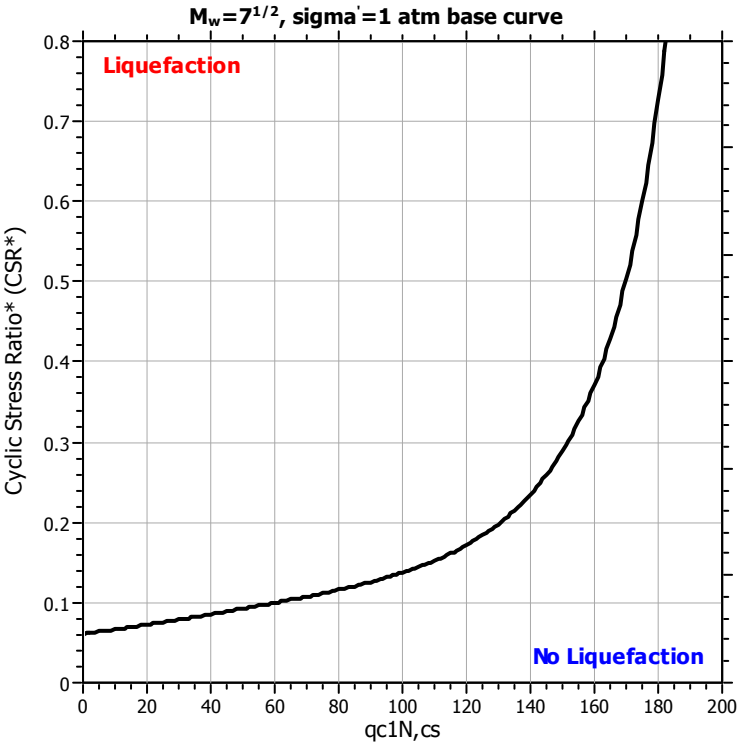
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

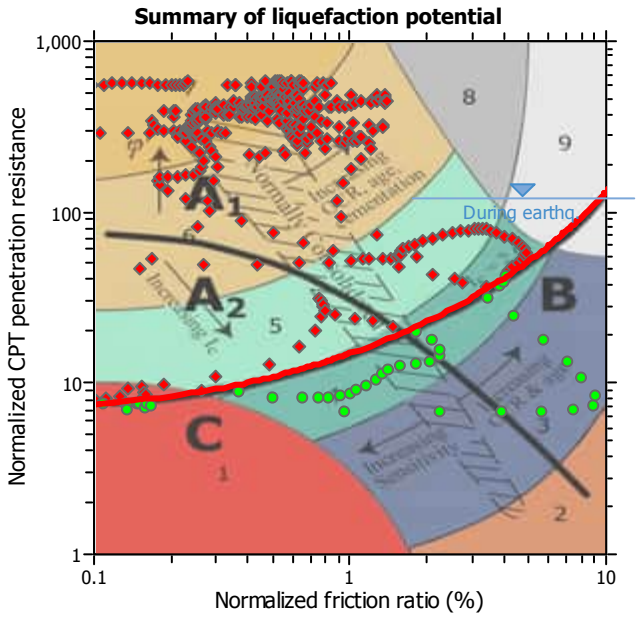
CPT file : CPT_35

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	13.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

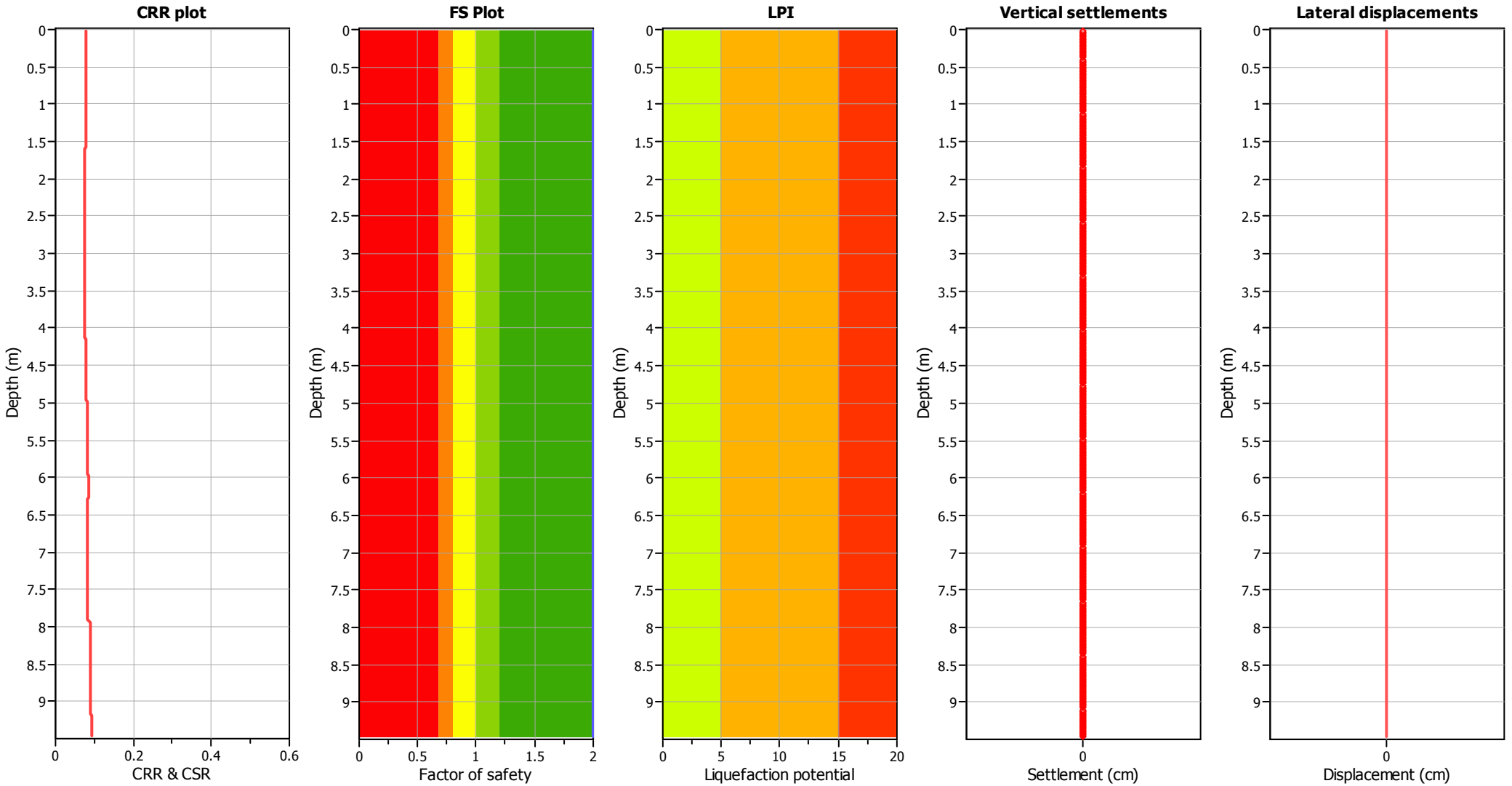






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	13.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

During earthq. During earthq.

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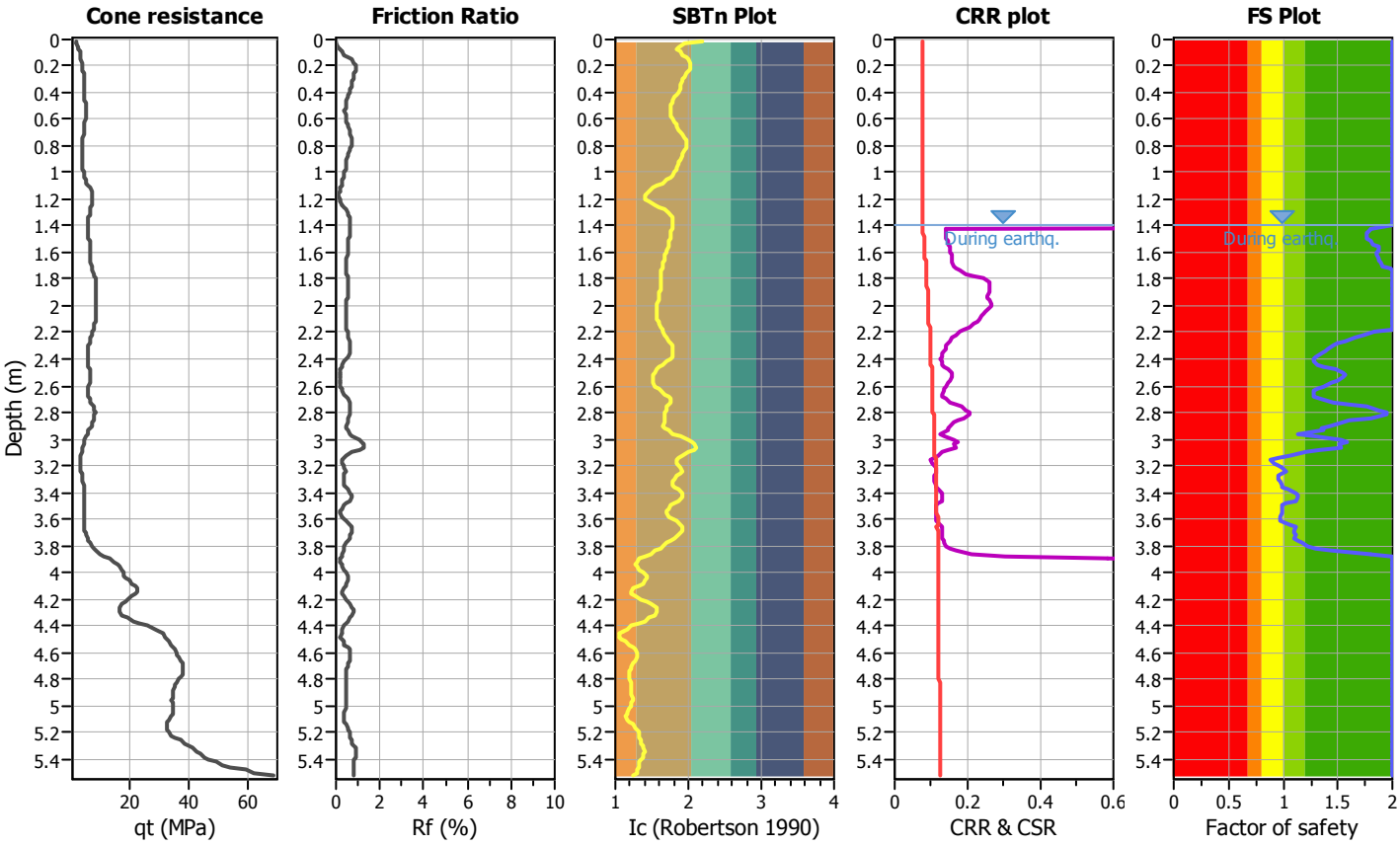
LIQUEFACTION ANALYSIS REPORT

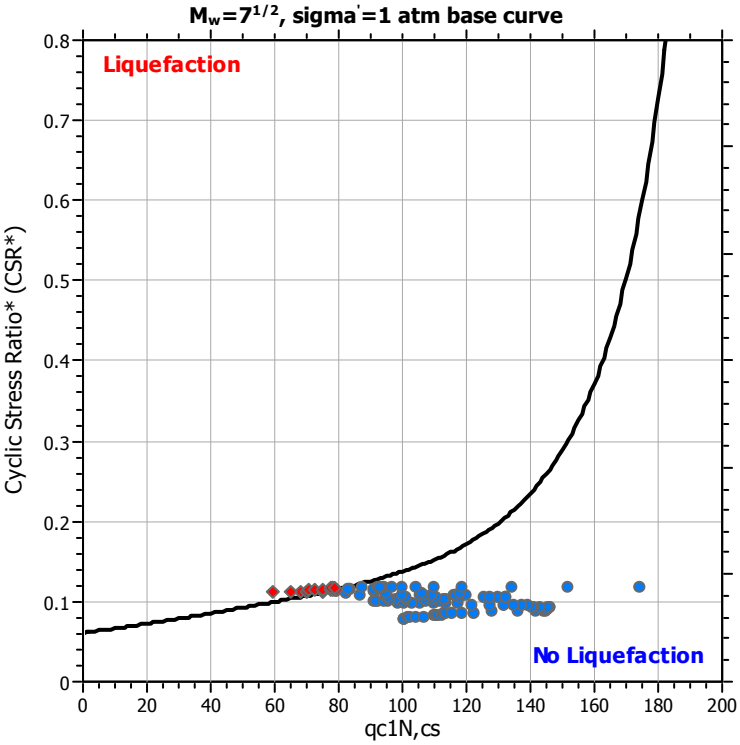
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

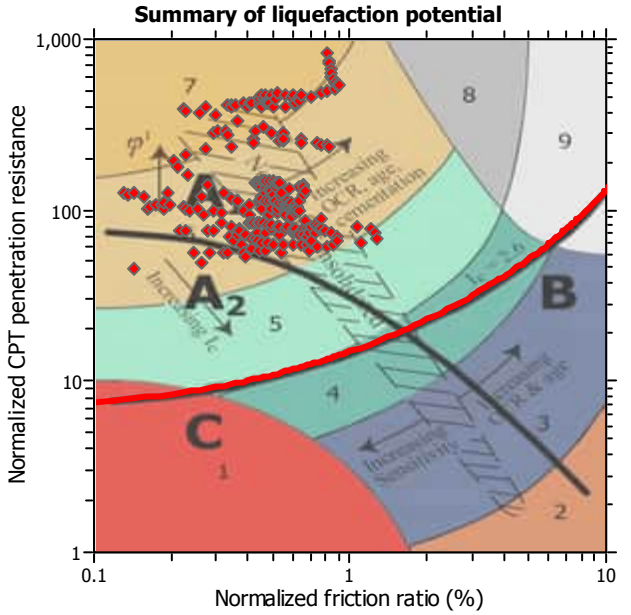
CPT file : CPT_36

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

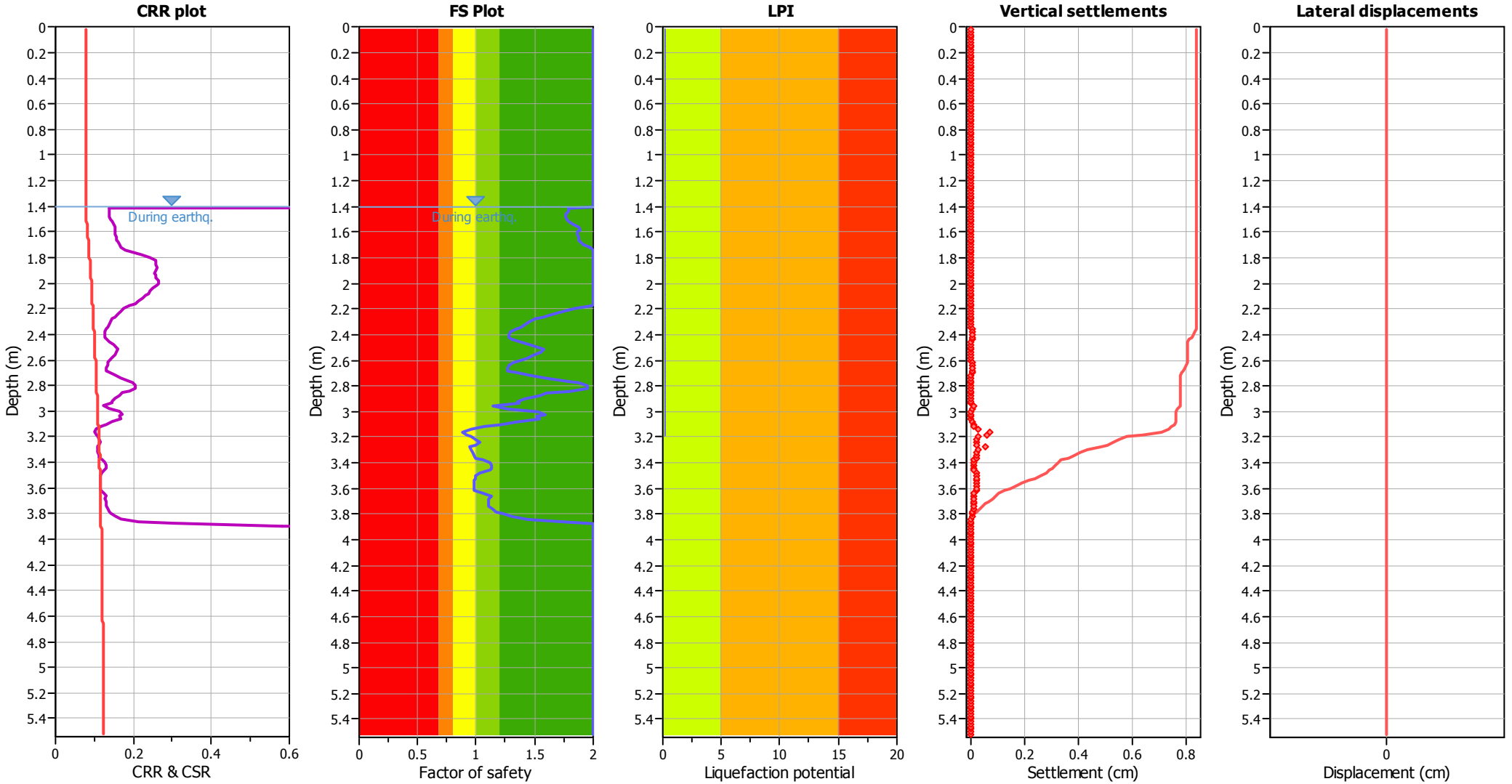






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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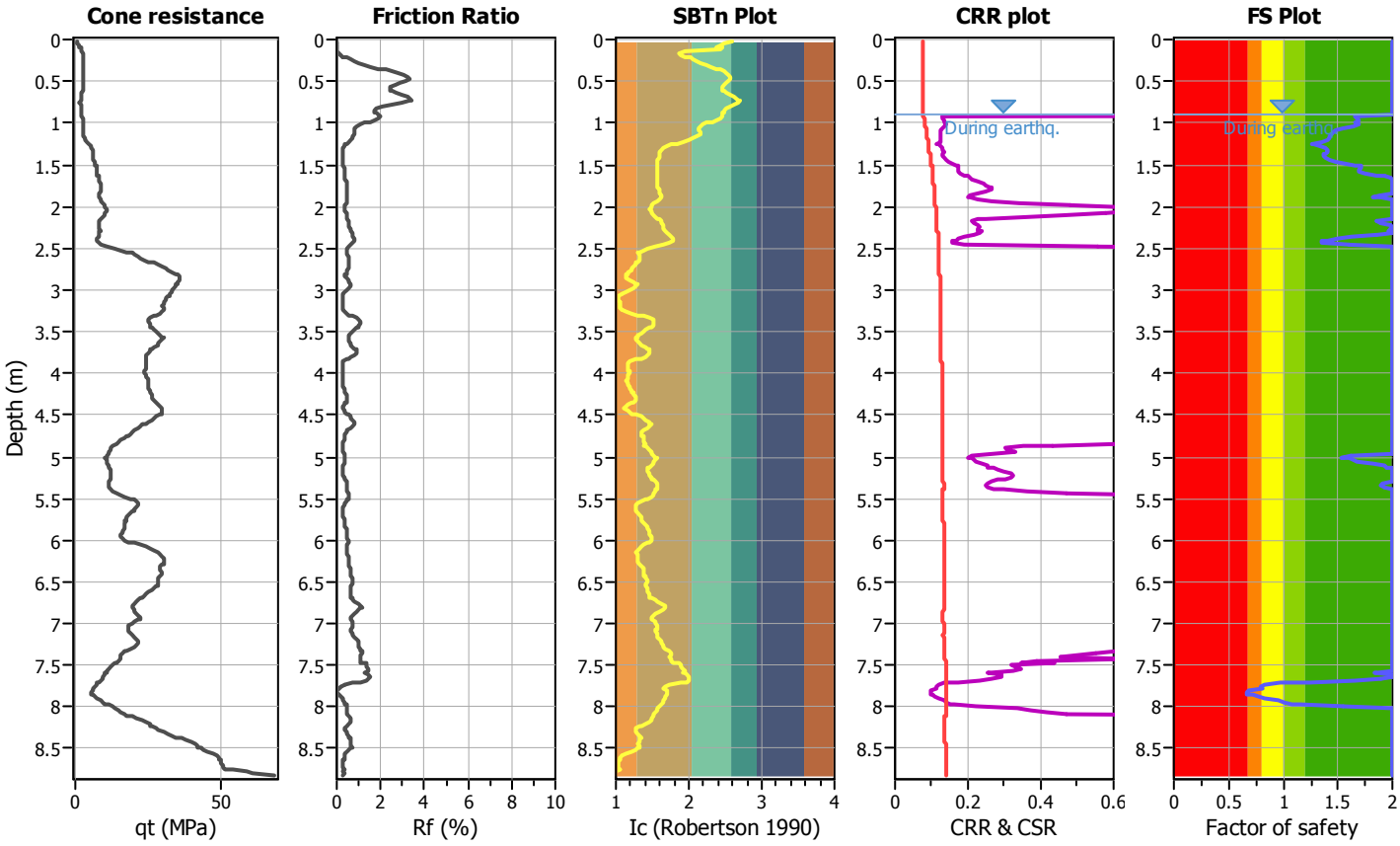
LIQUEFACTION ANALYSIS REPORT

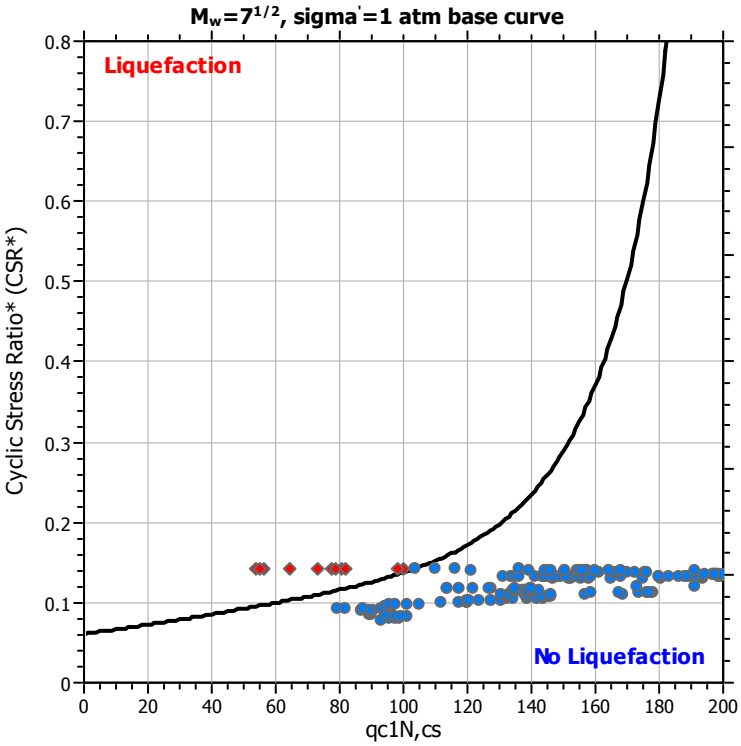
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

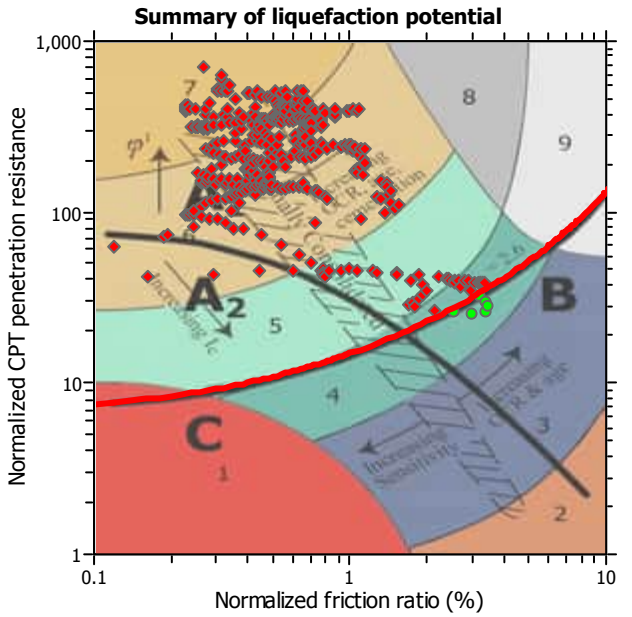
CPT file : CPT_37

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

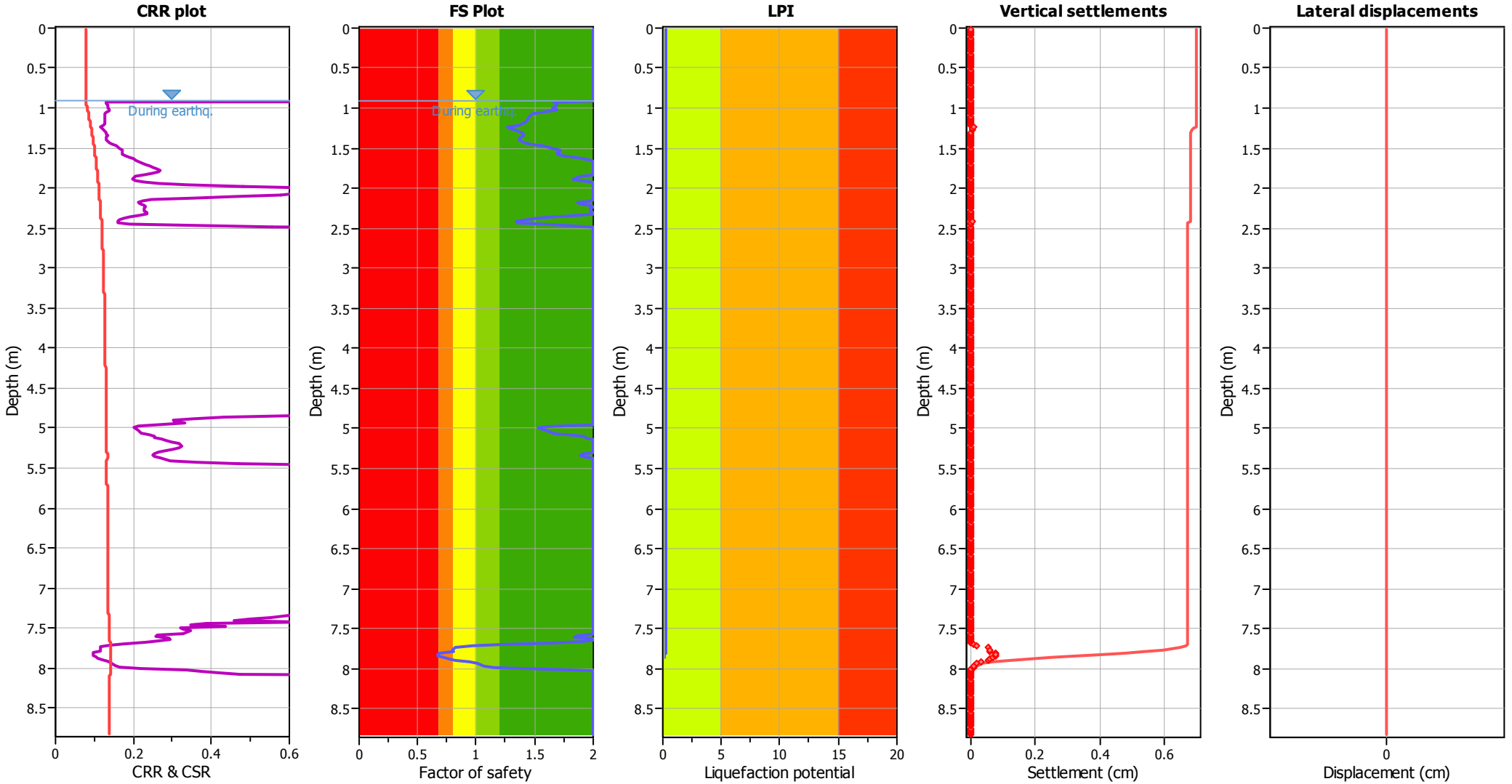






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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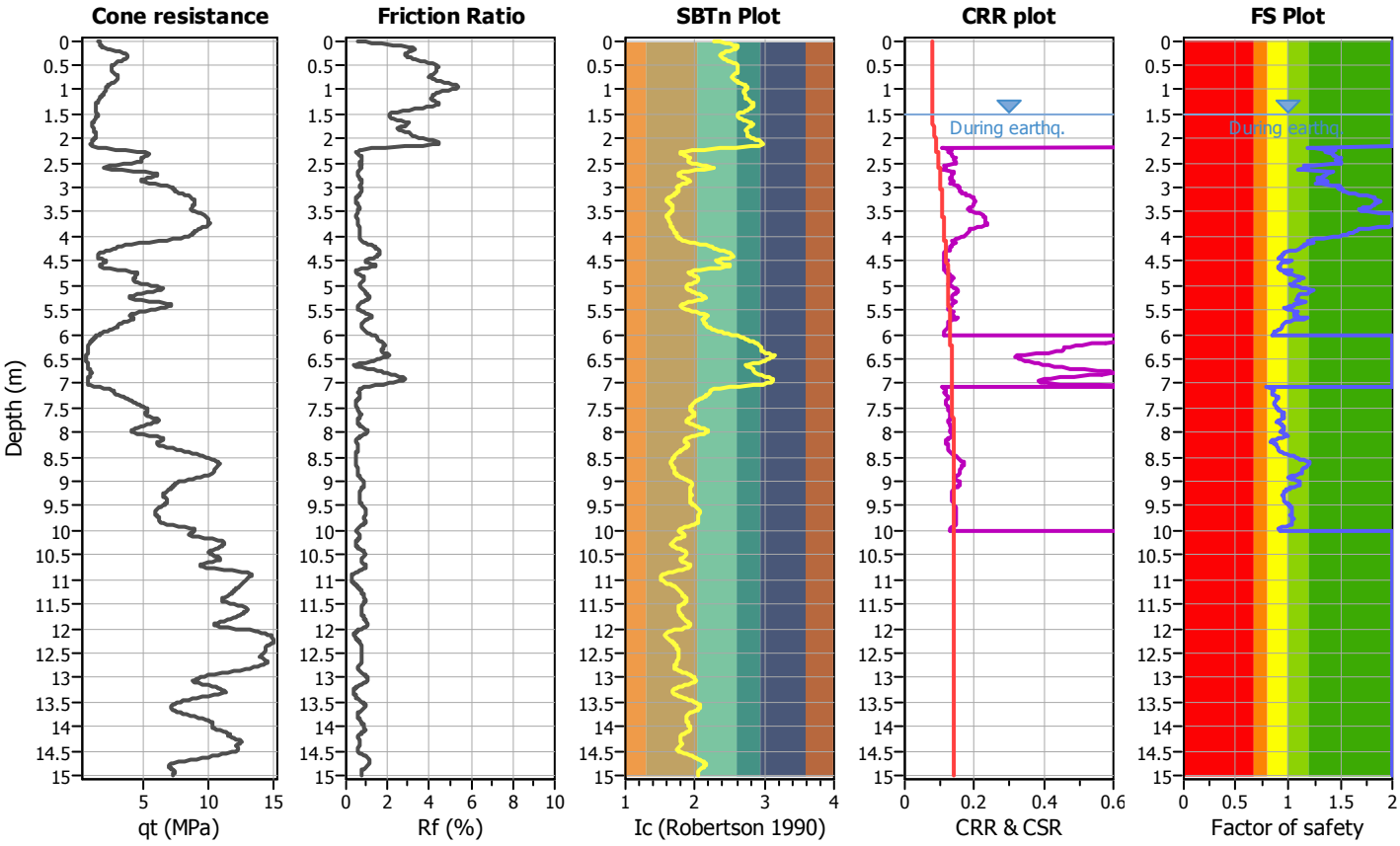
LIQUEFACTION ANALYSIS REPORT

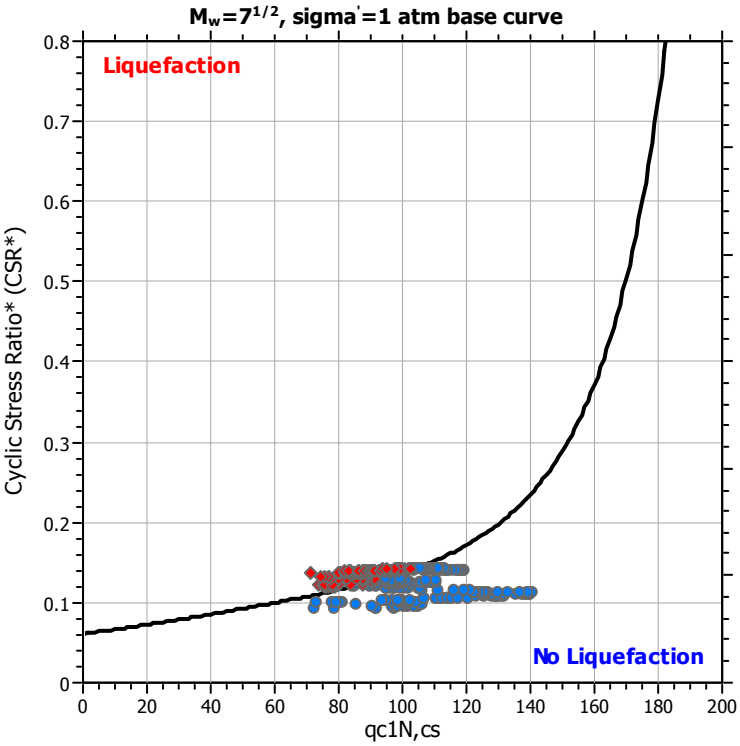
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

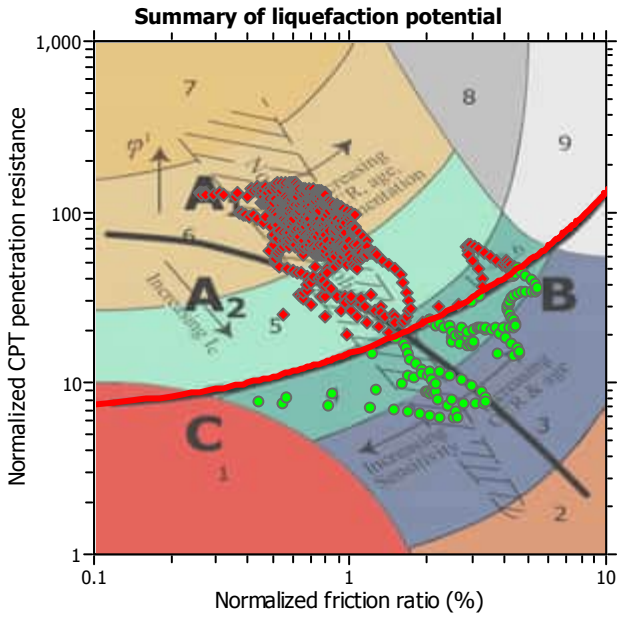
CPT file : CPT_38

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

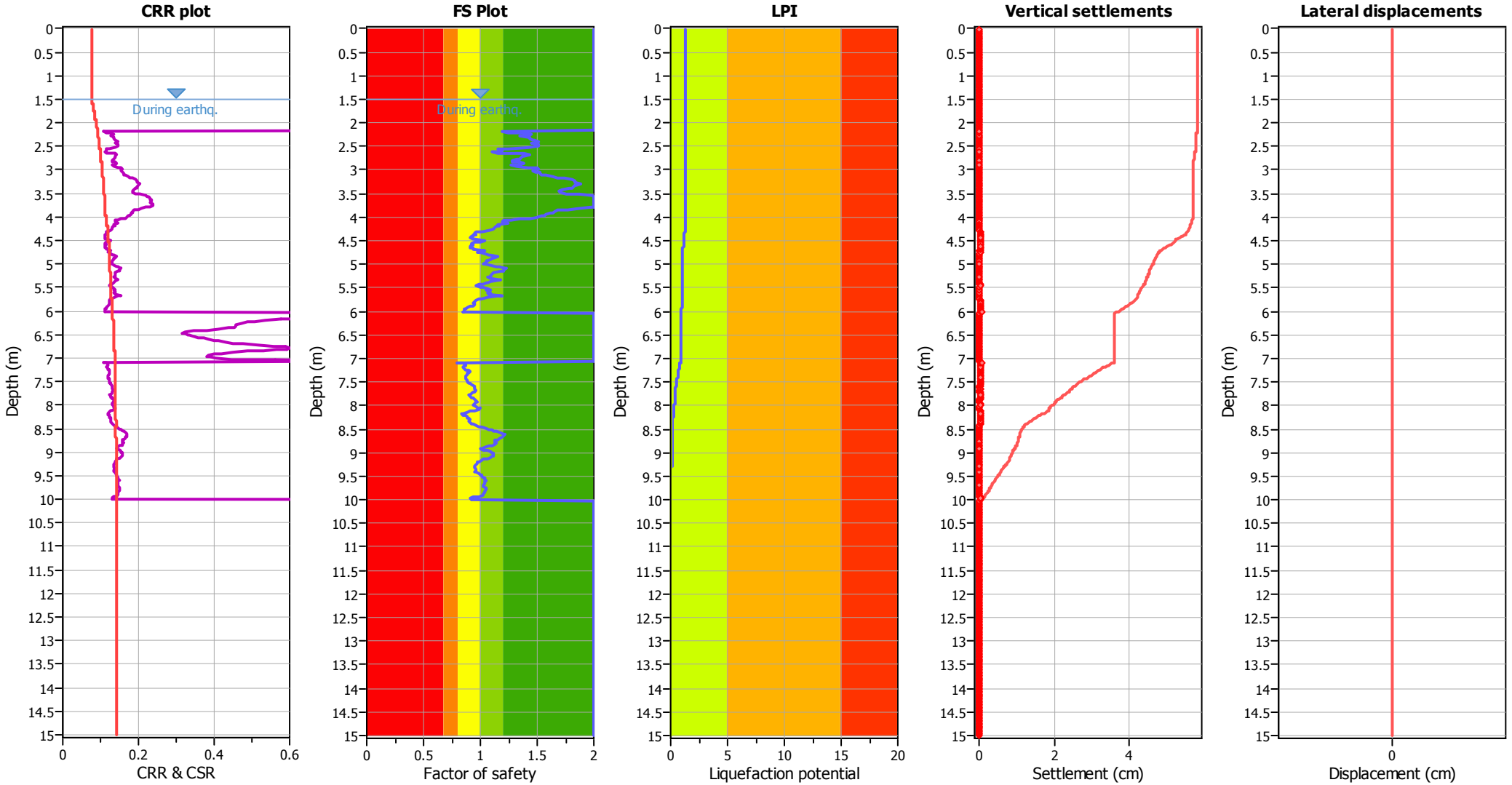






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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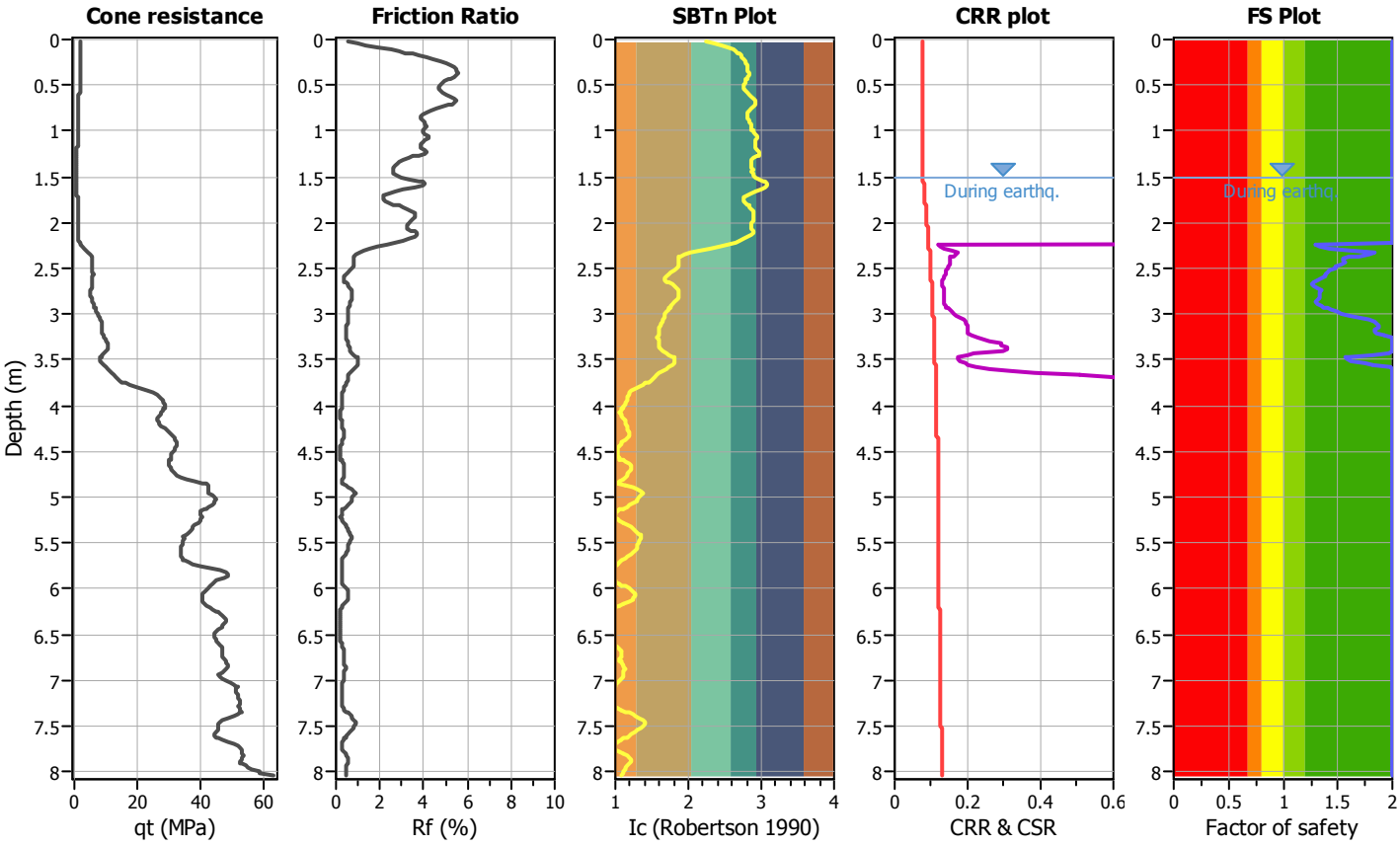
LIQUEFACTION ANALYSIS REPORT

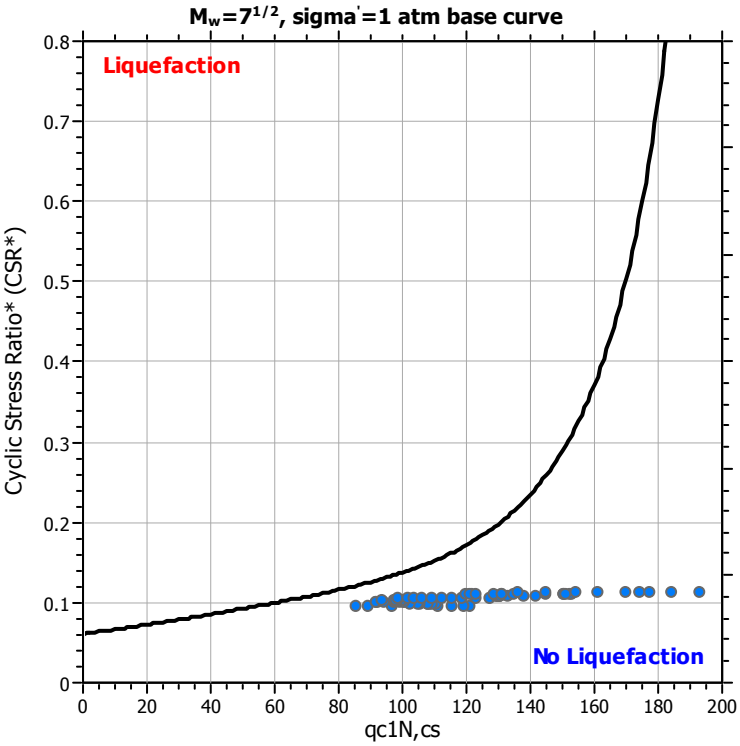
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

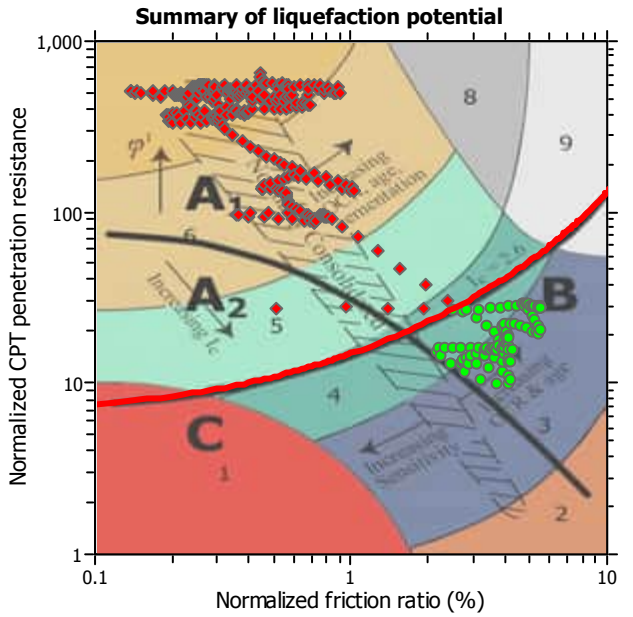
CPT file : CPT_39

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

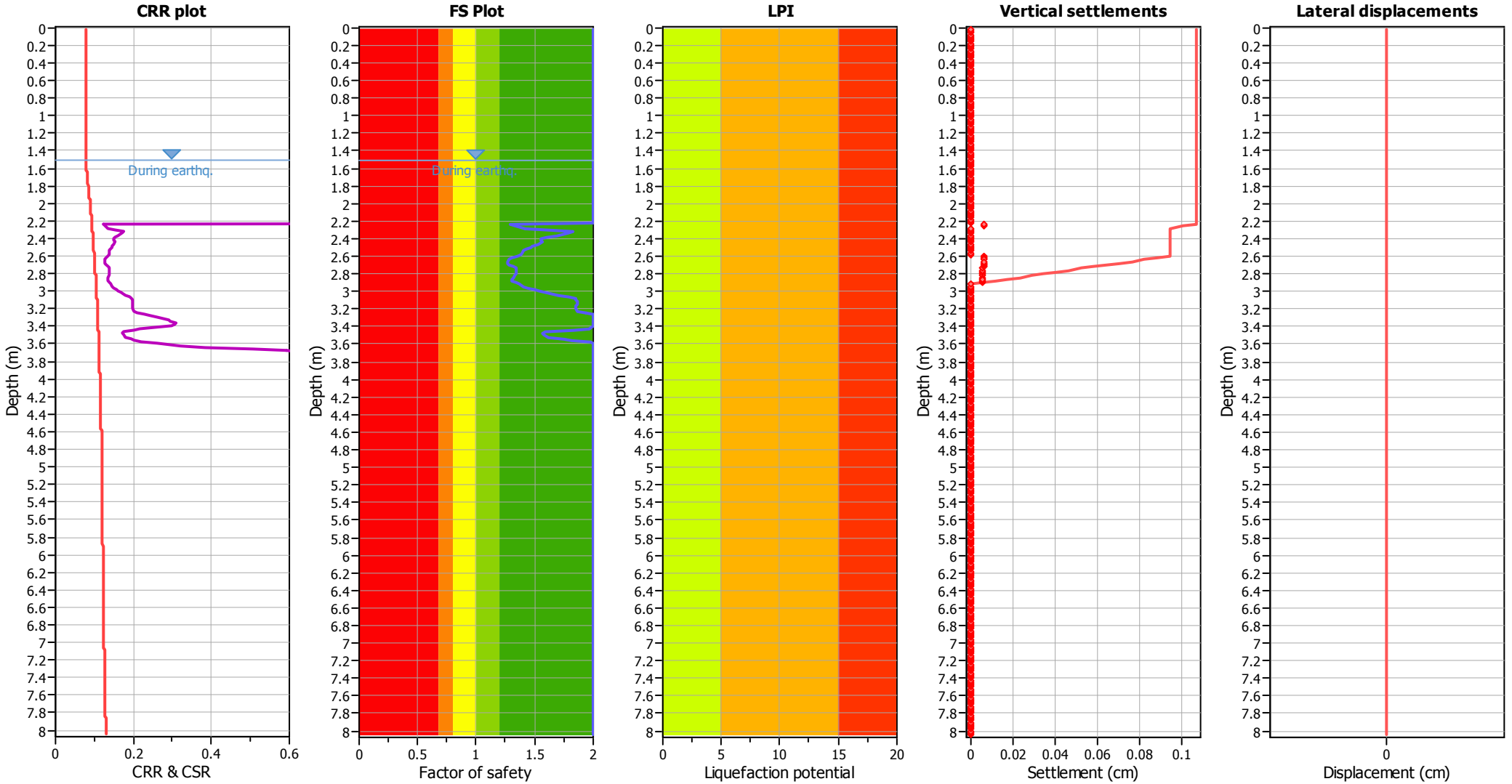






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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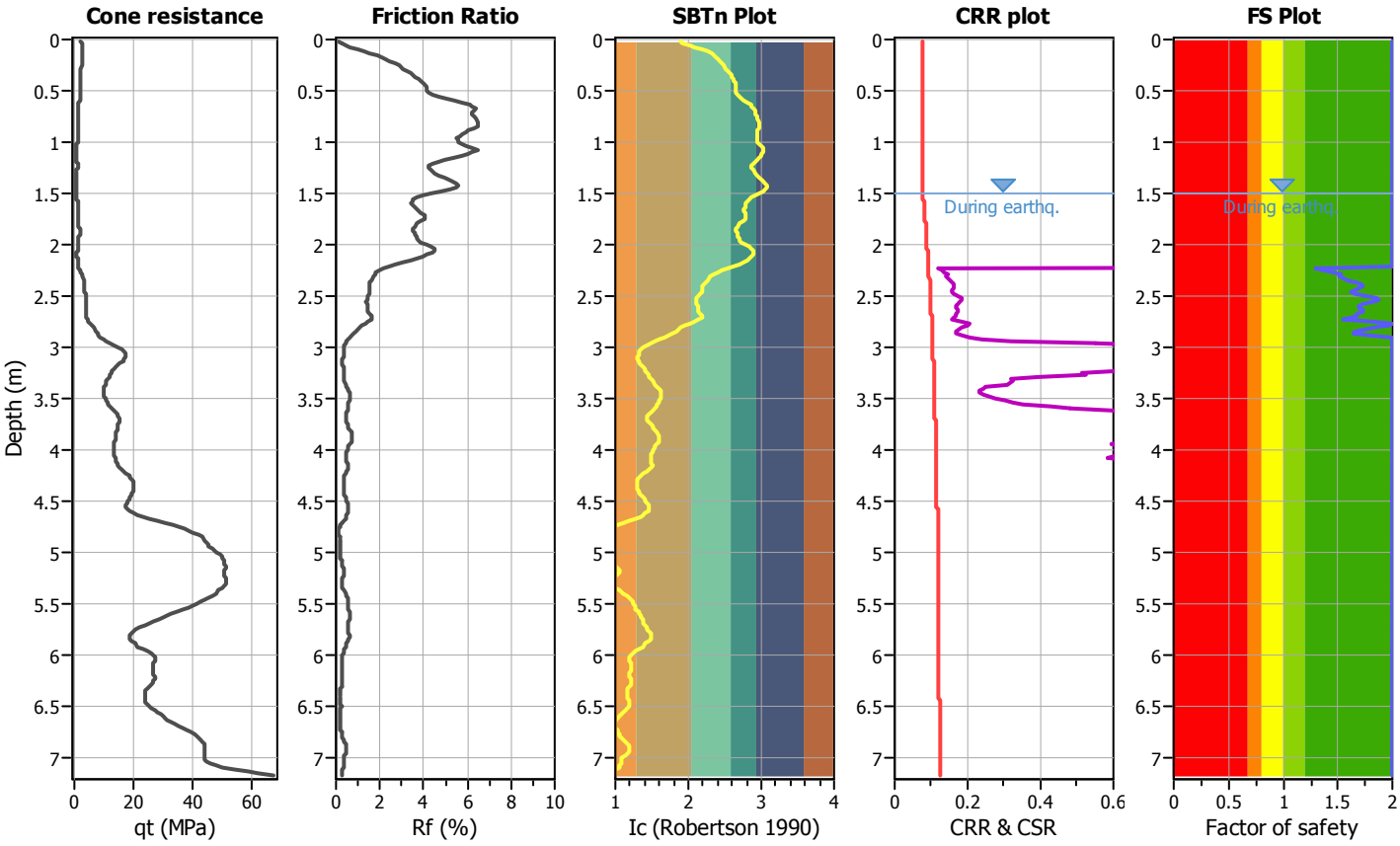
LIQUEFACTION ANALYSIS REPORT

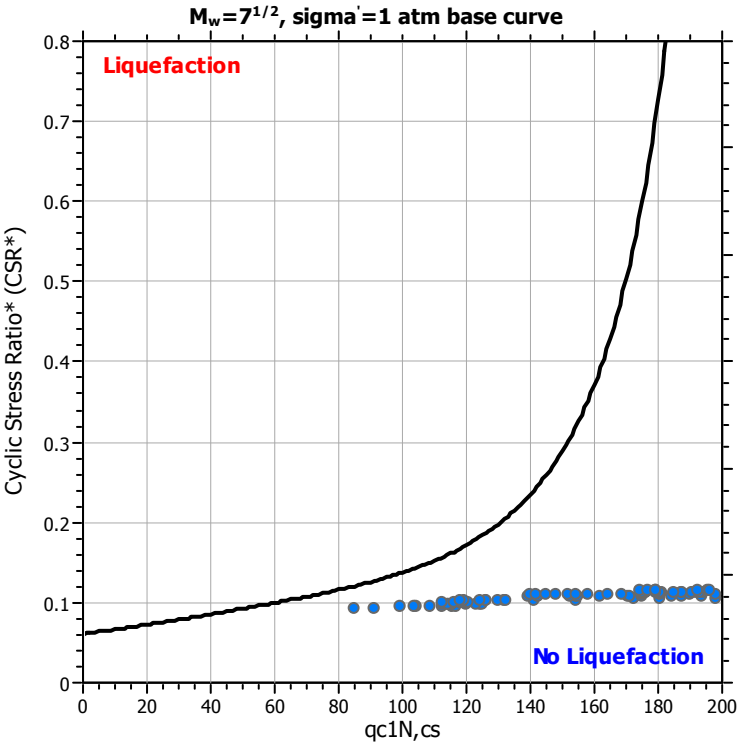
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

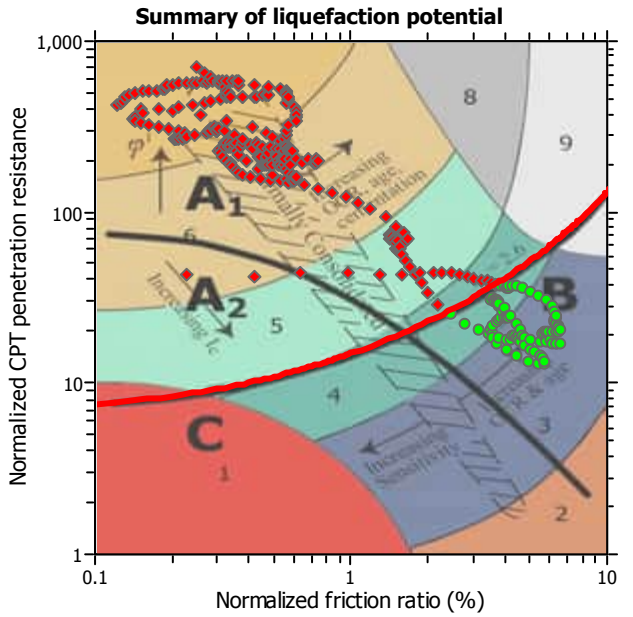
CPT file : CPT_40

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

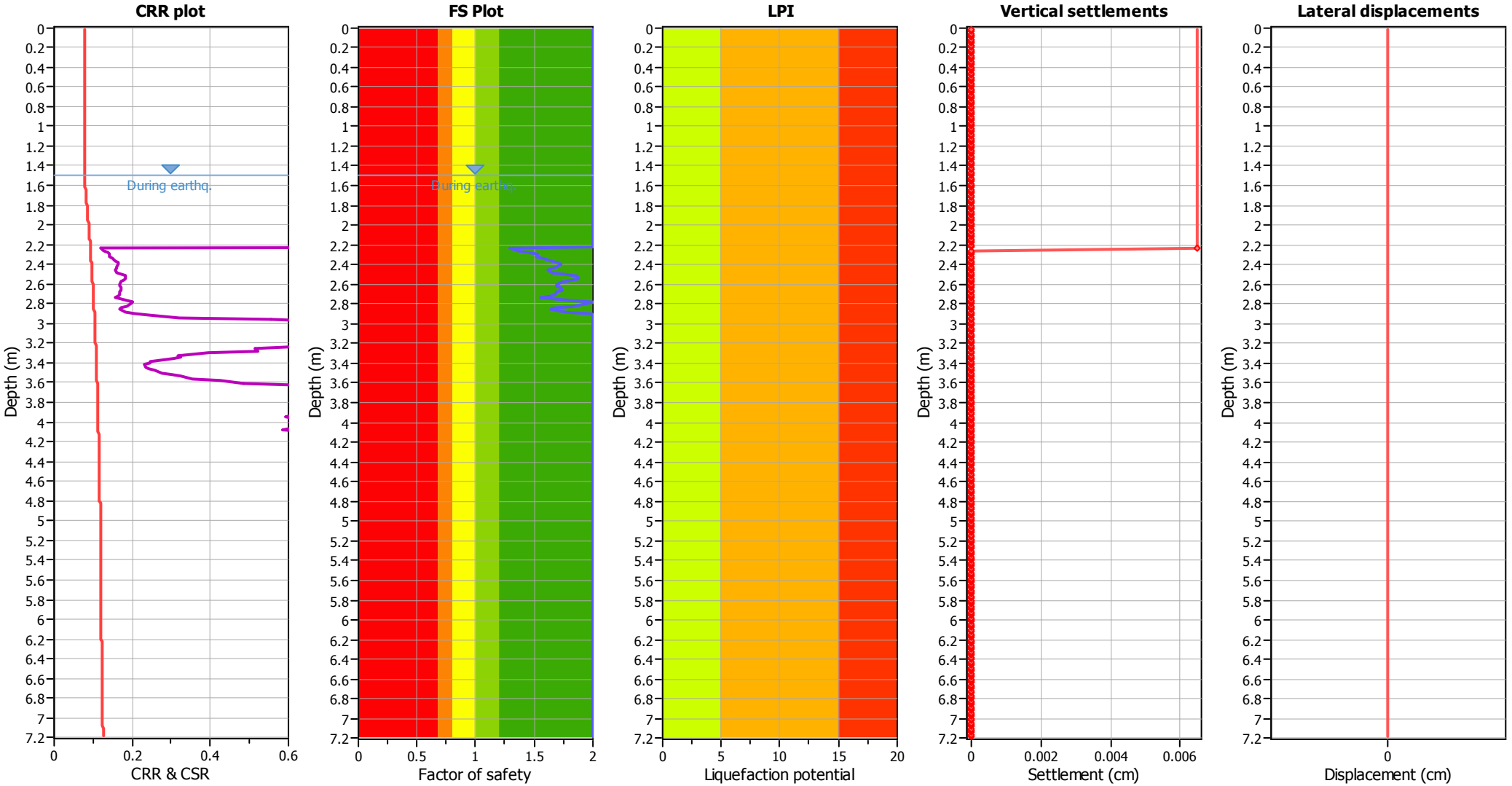






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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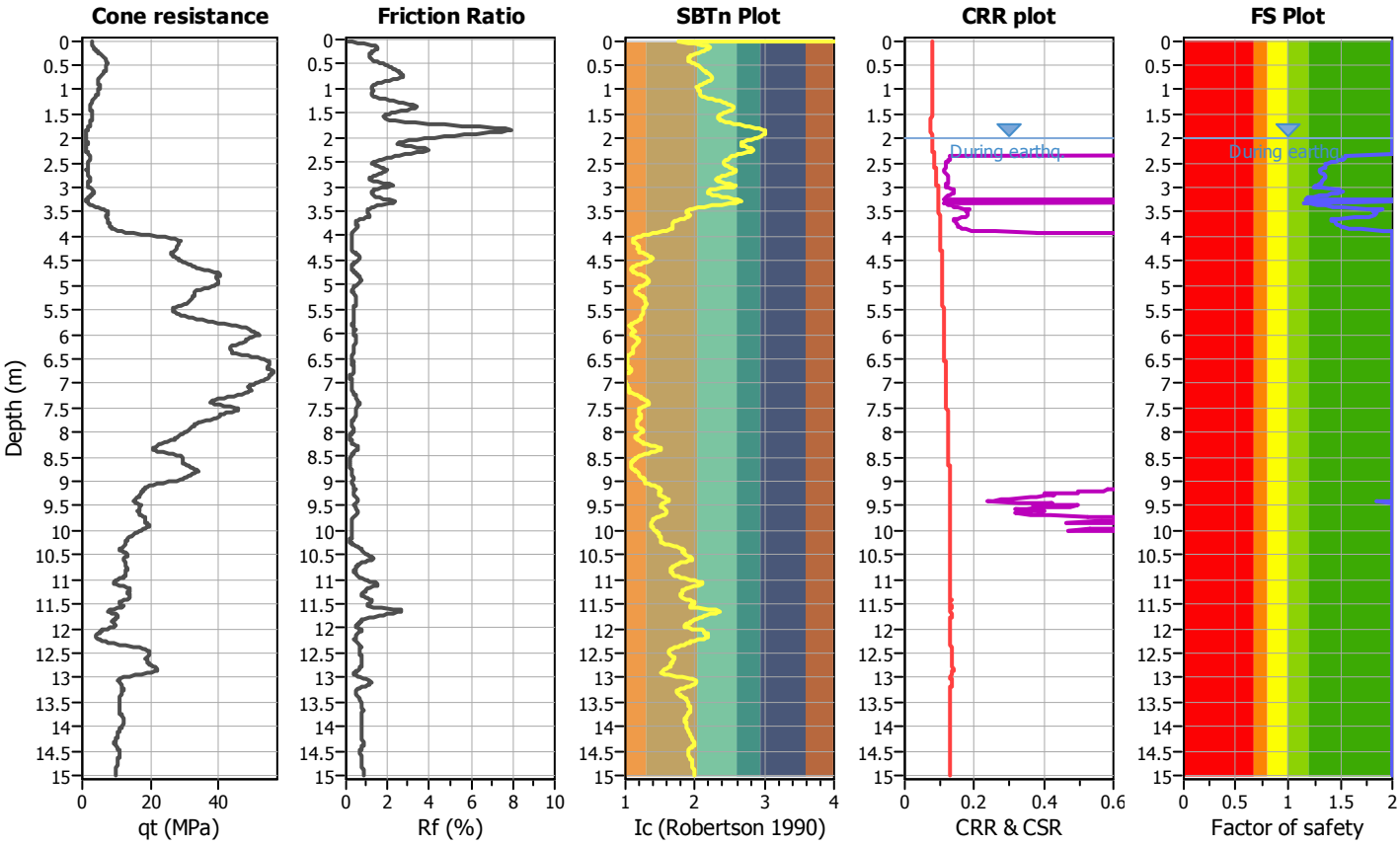
LIQUEFACTION ANALYSIS REPORT

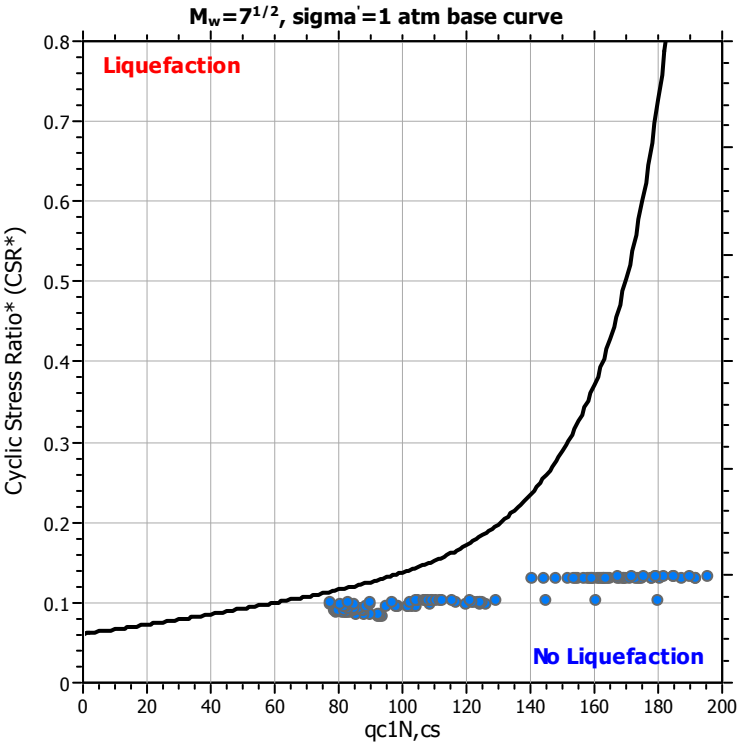
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

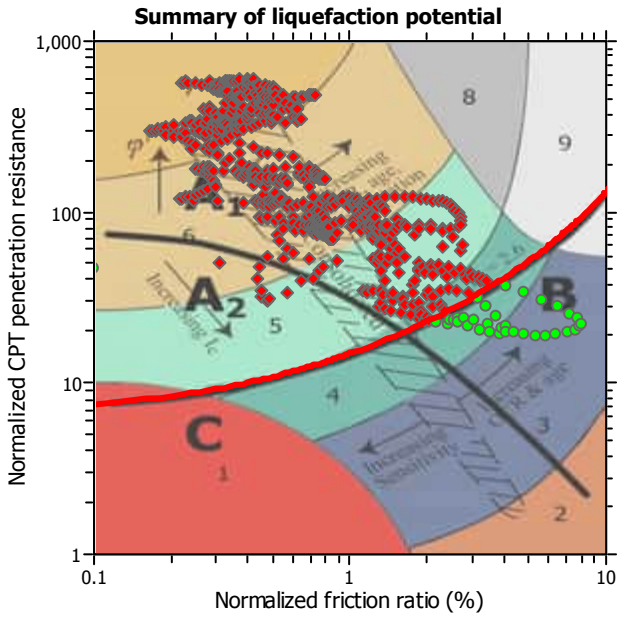
CPT file : CPT_41

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

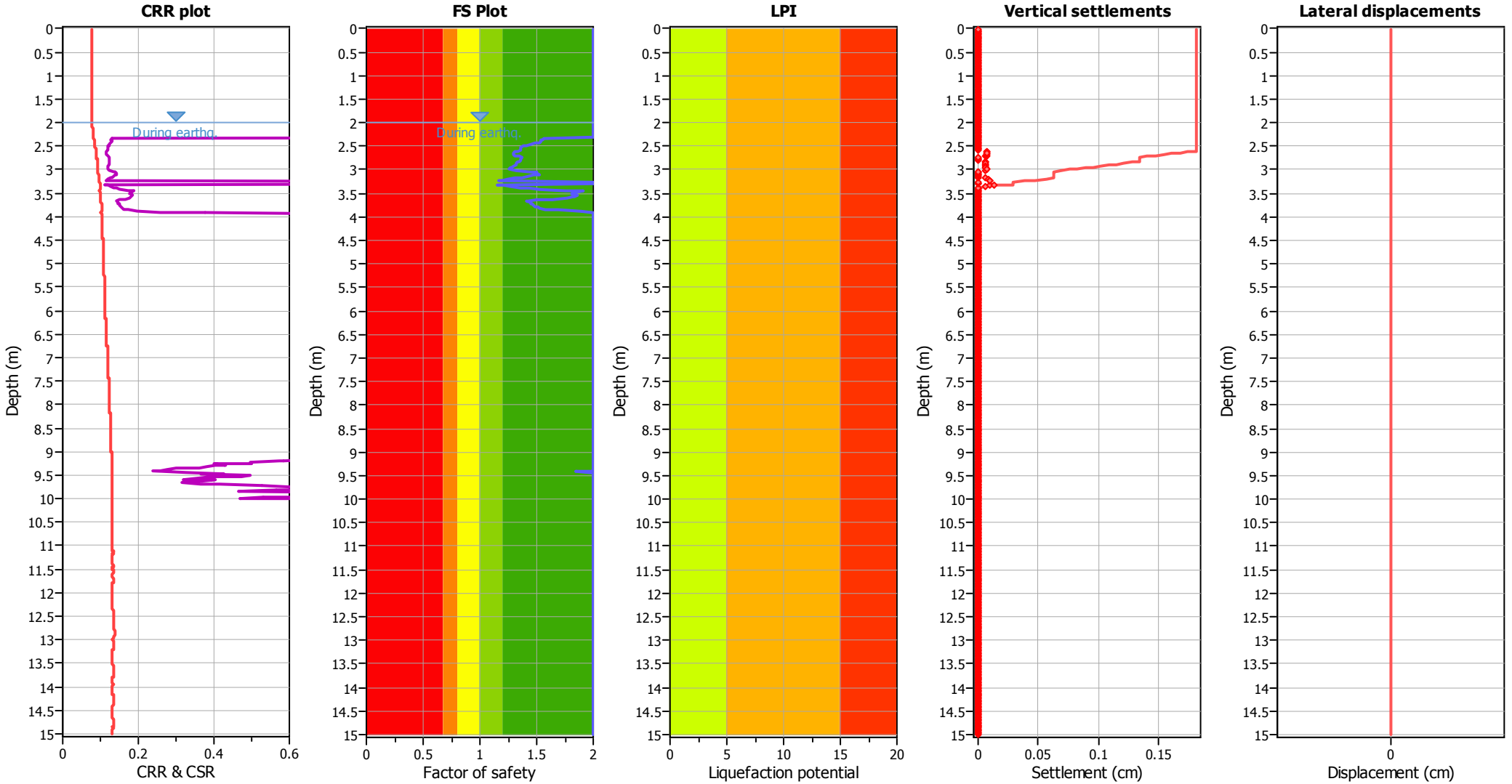






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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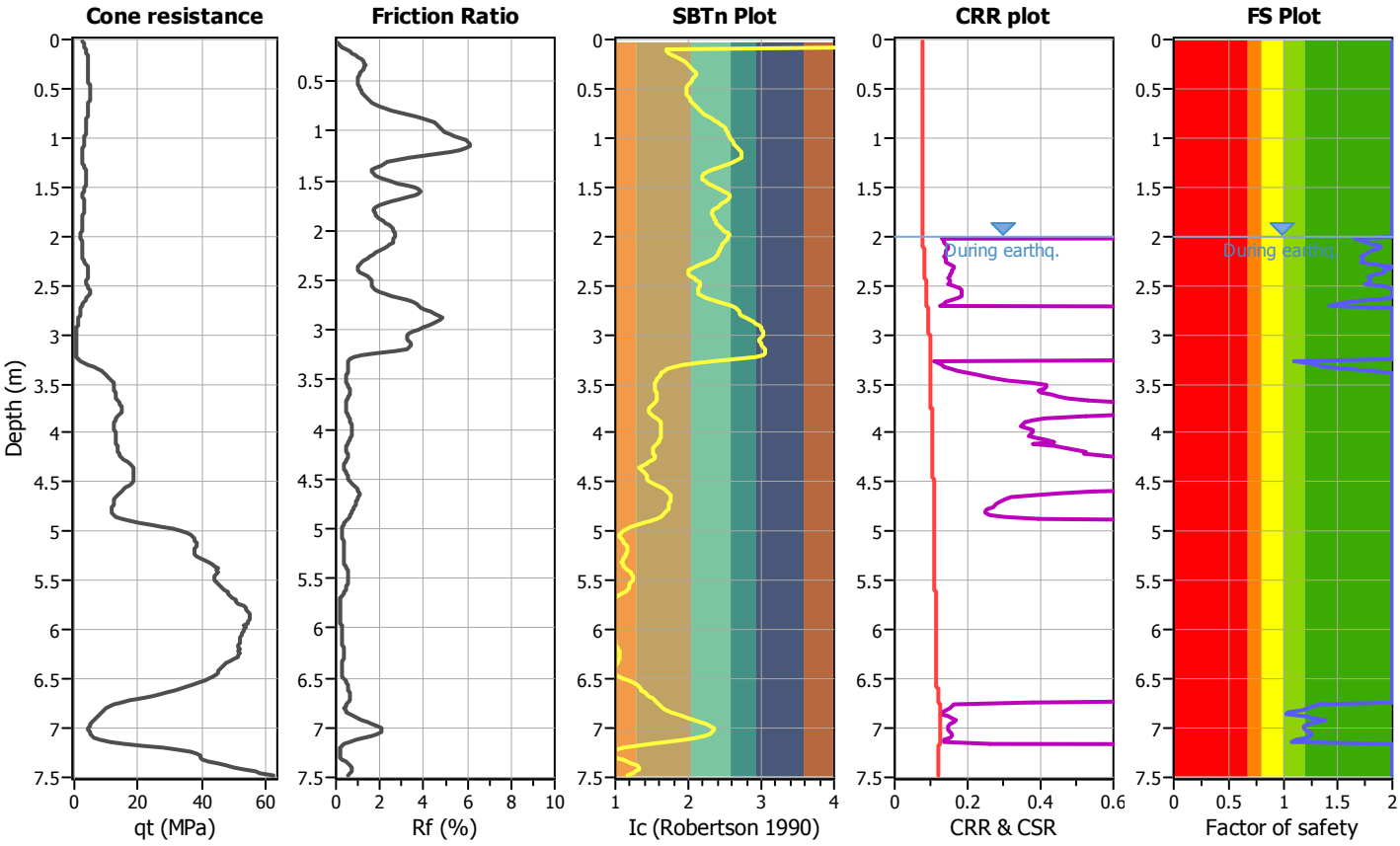
LIQUEFACTION ANALYSIS REPORT

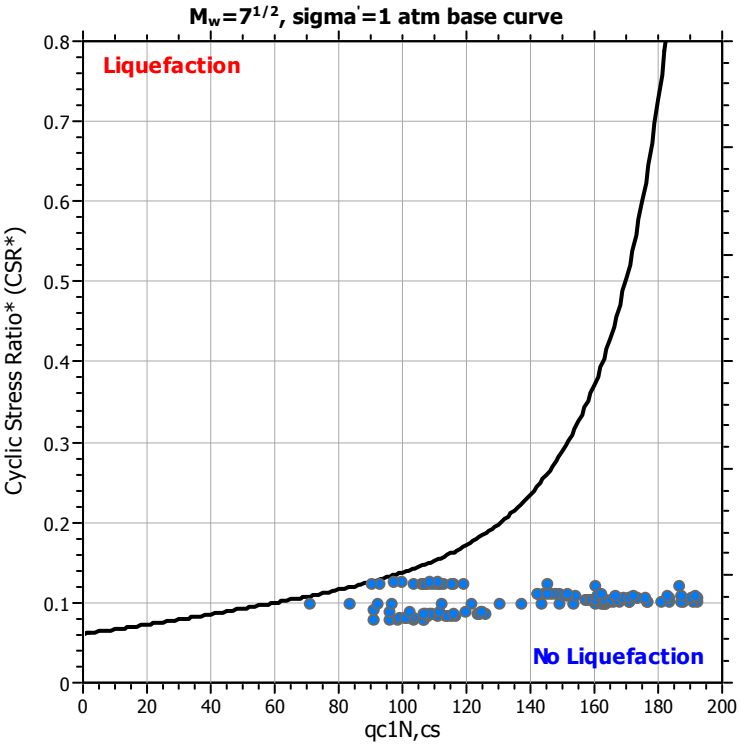
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

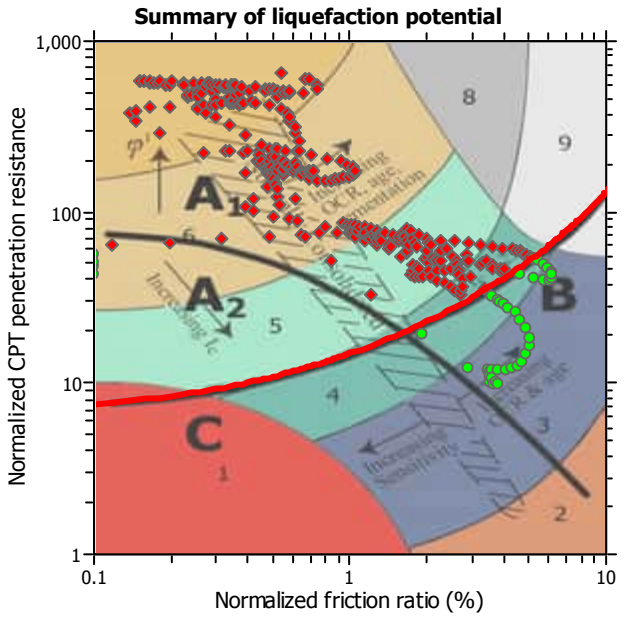
CPT file : CPT_42

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

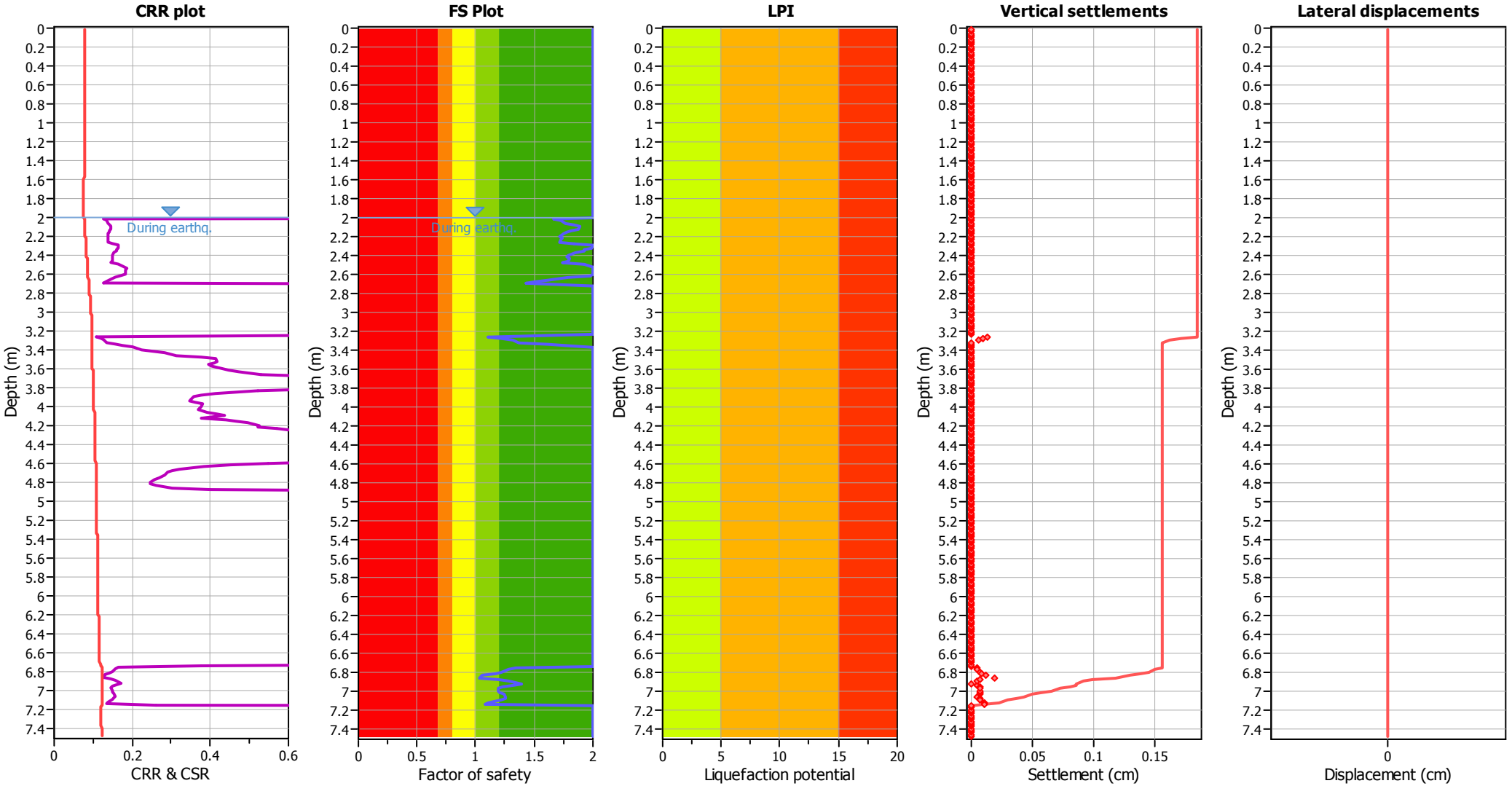






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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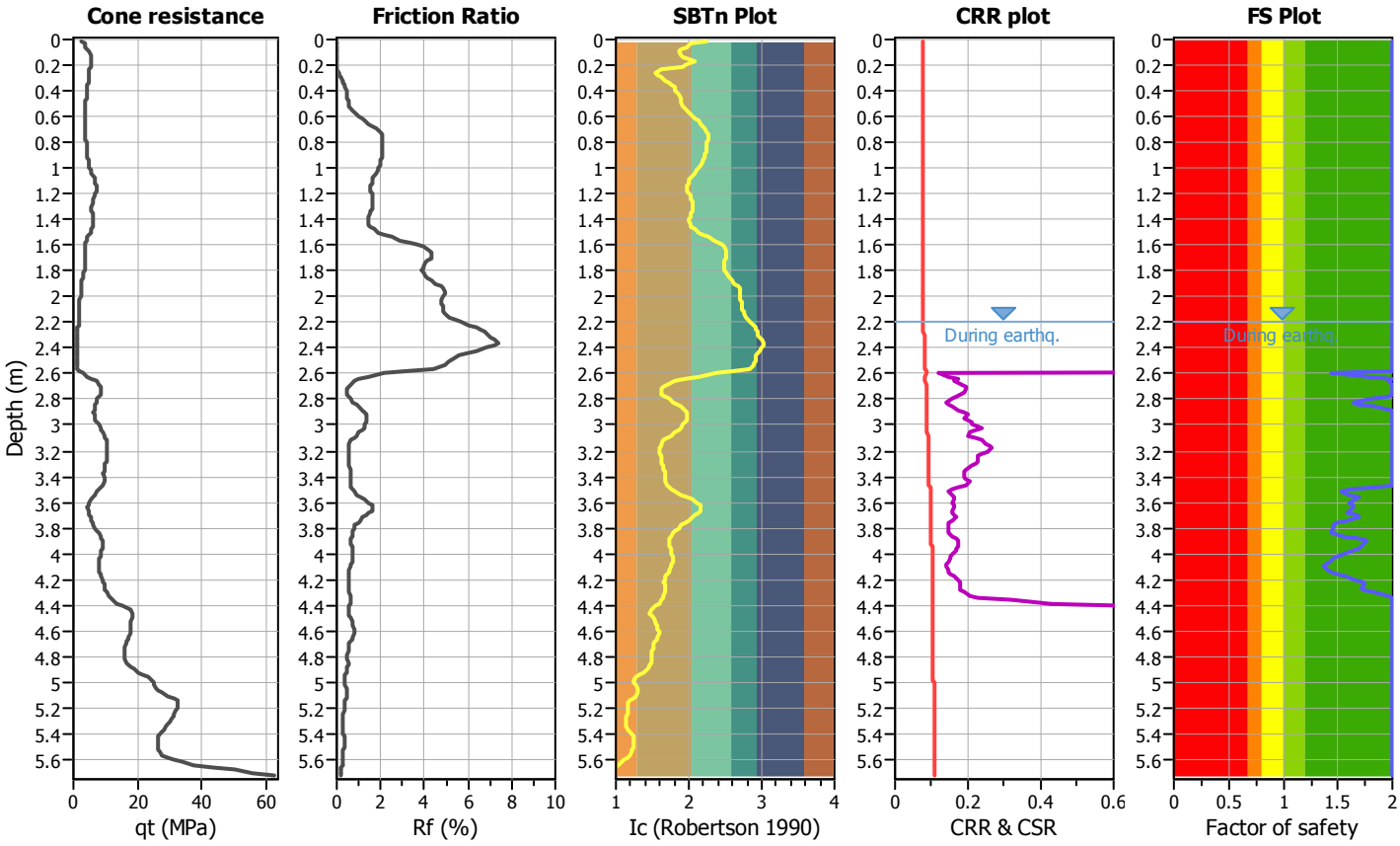
LIQUEFACTION ANALYSIS REPORT

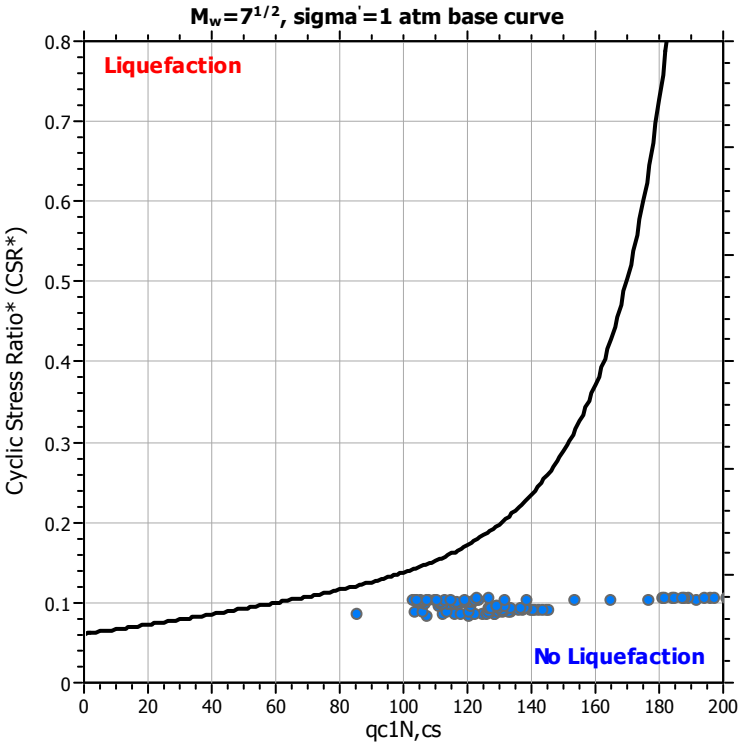
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

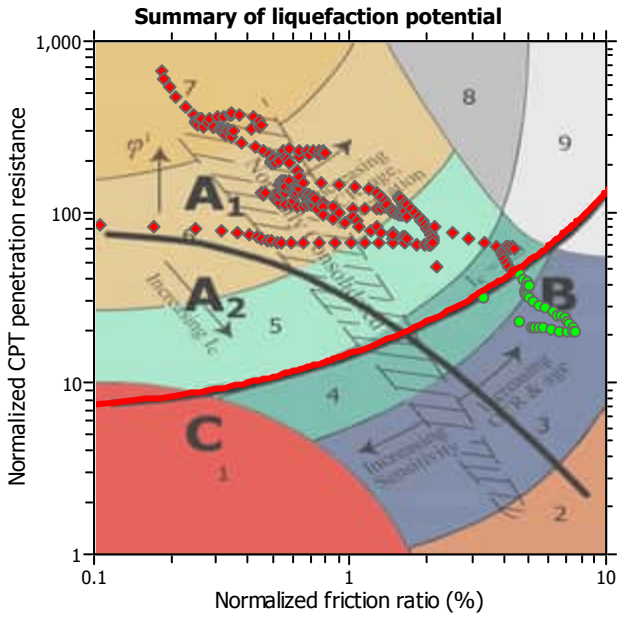
CPT file : CPT_43

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

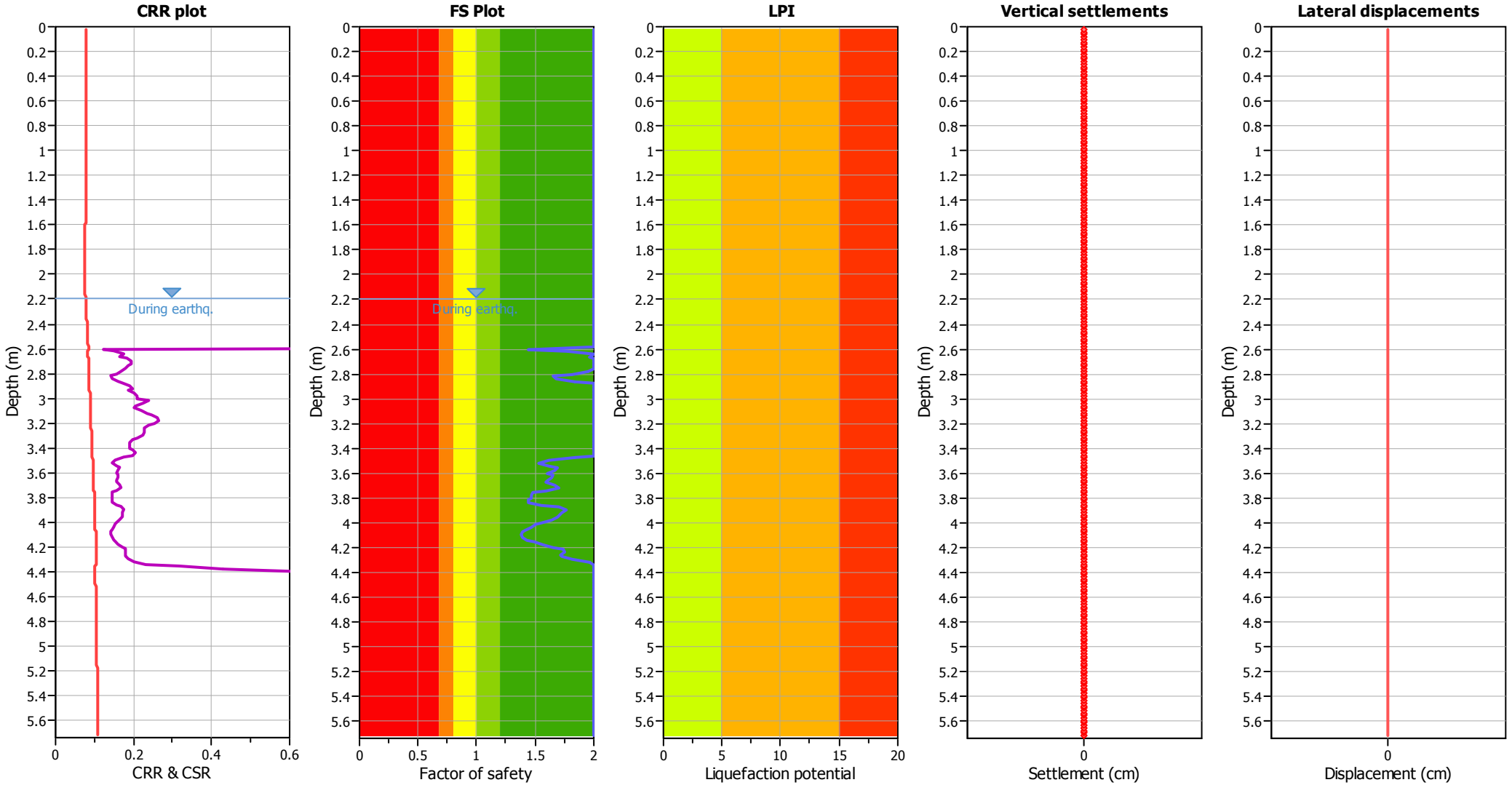






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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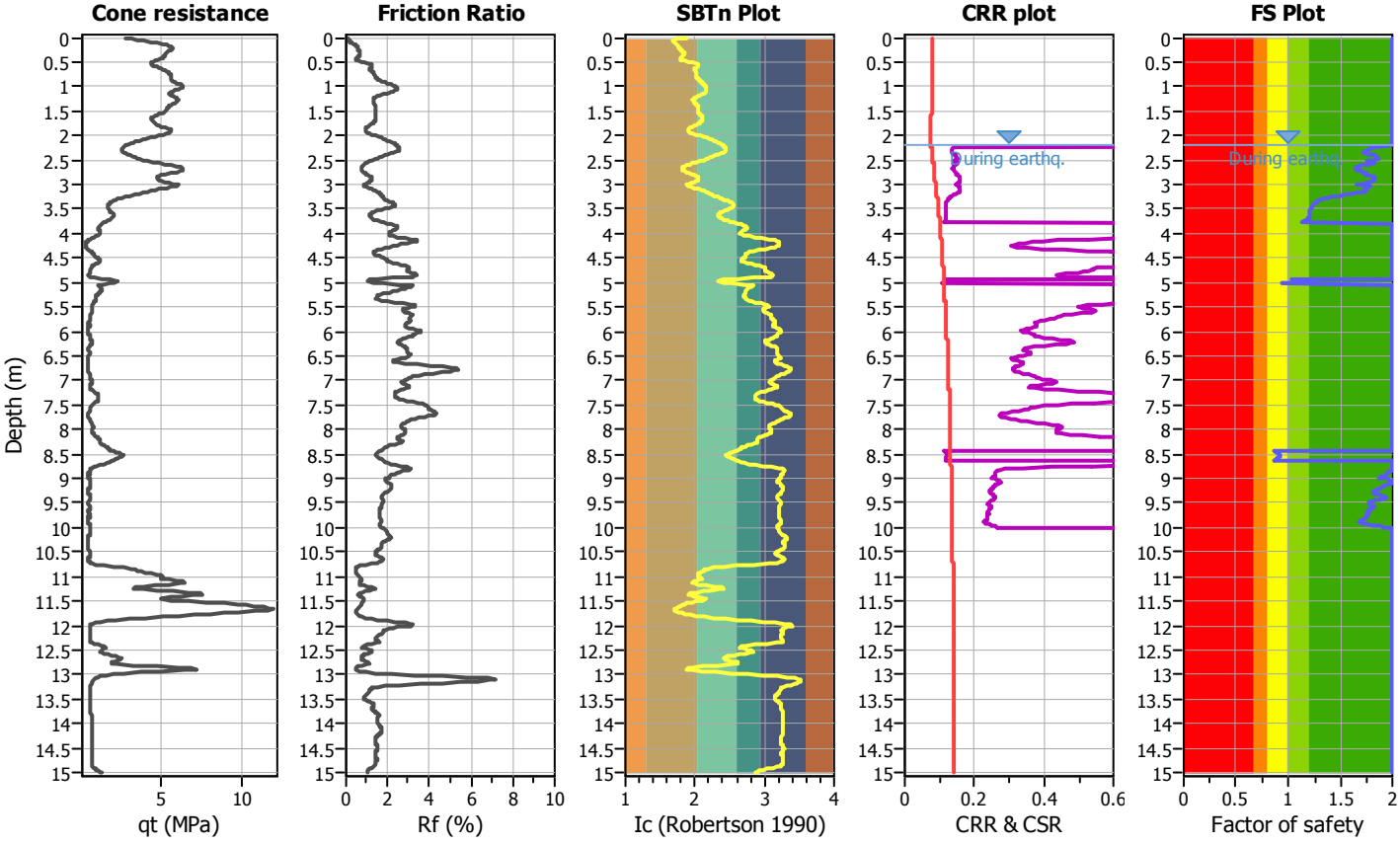
LIQUEFACTION ANALYSIS REPORT

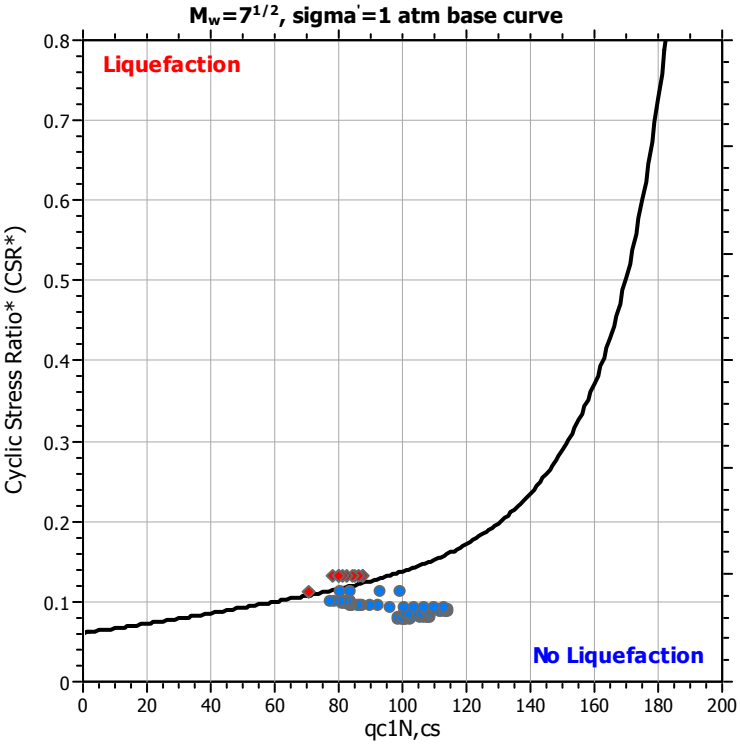
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

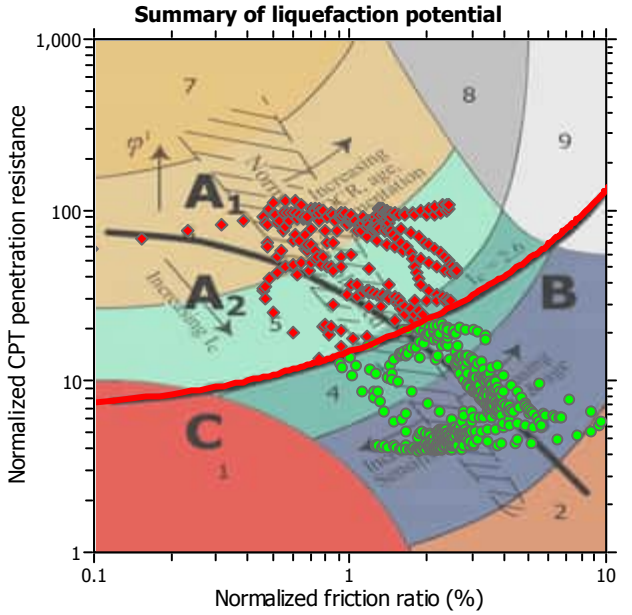
CPT file : CPT_44

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

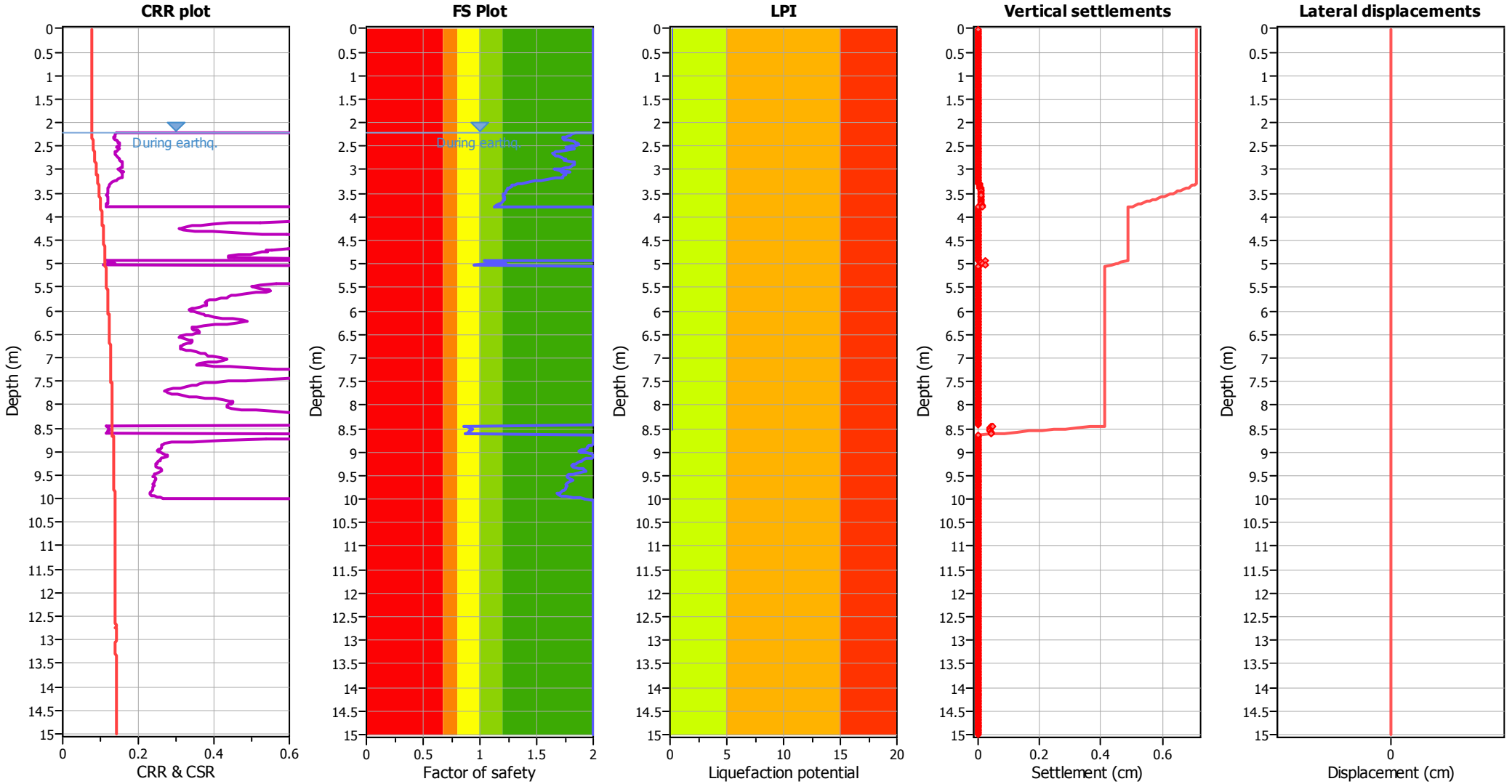






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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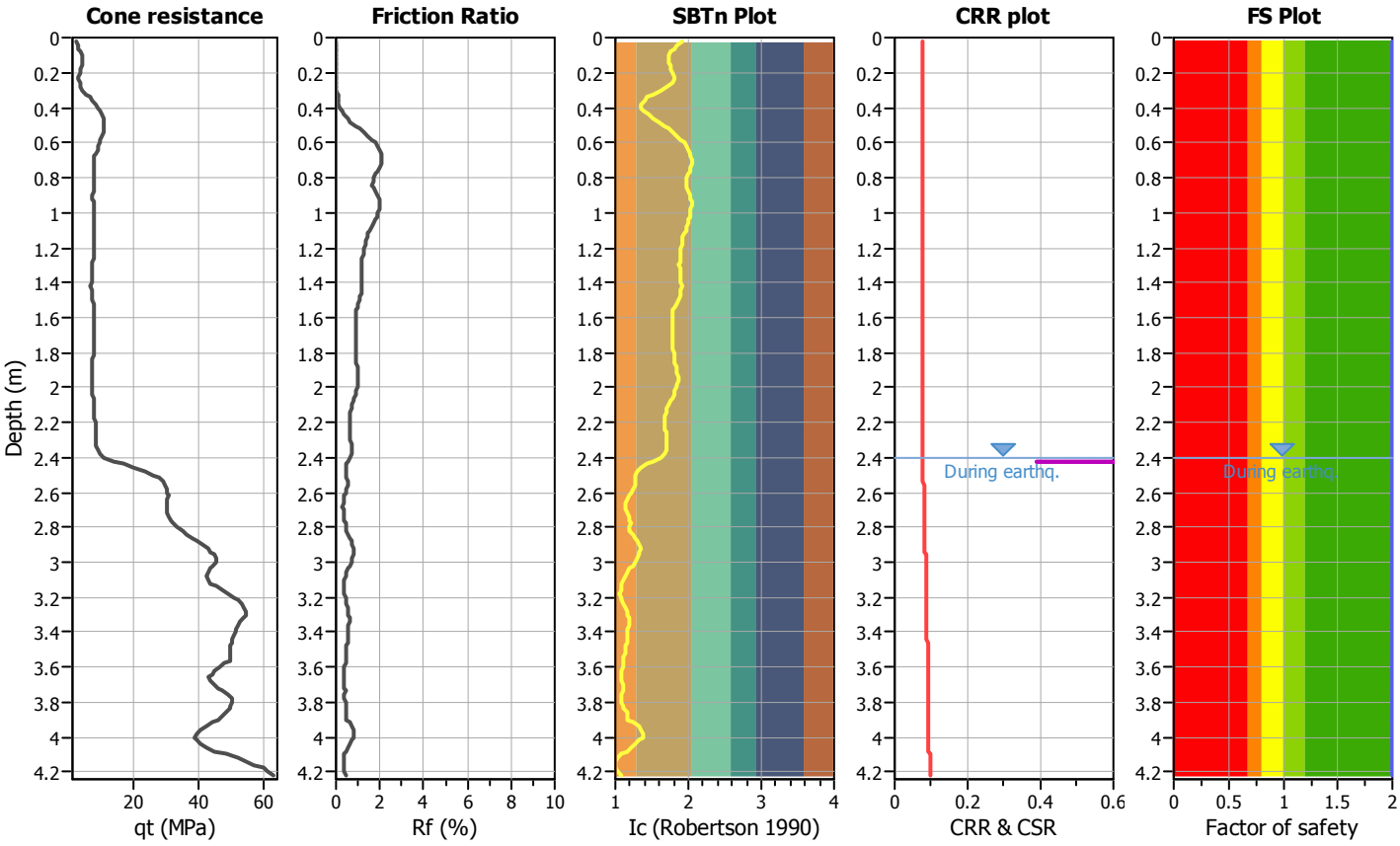
LIQUEFACTION ANALYSIS REPORT

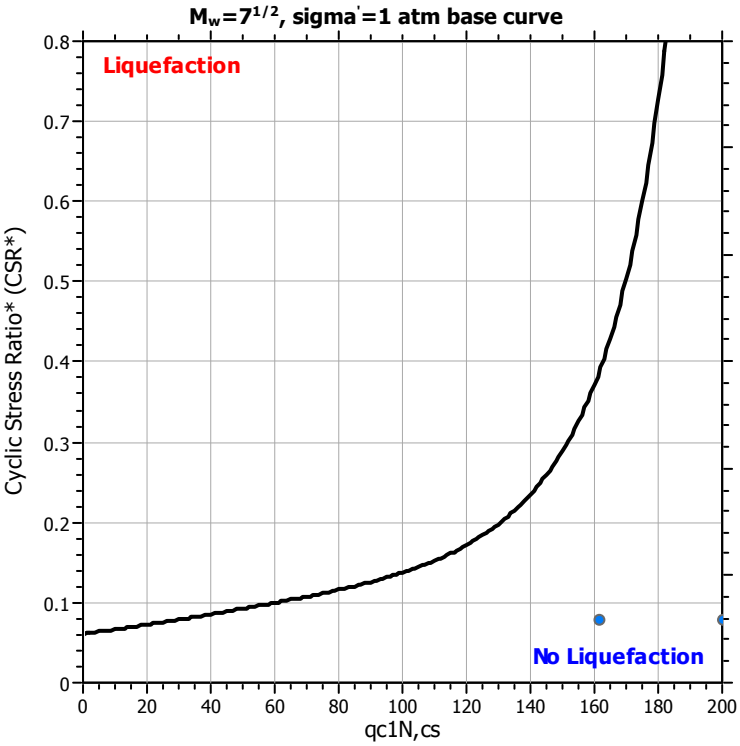
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

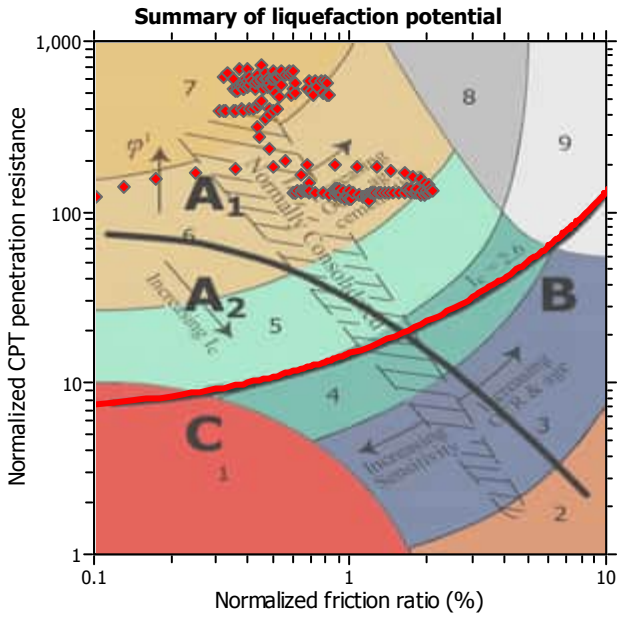
CPT file : CPT_45

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

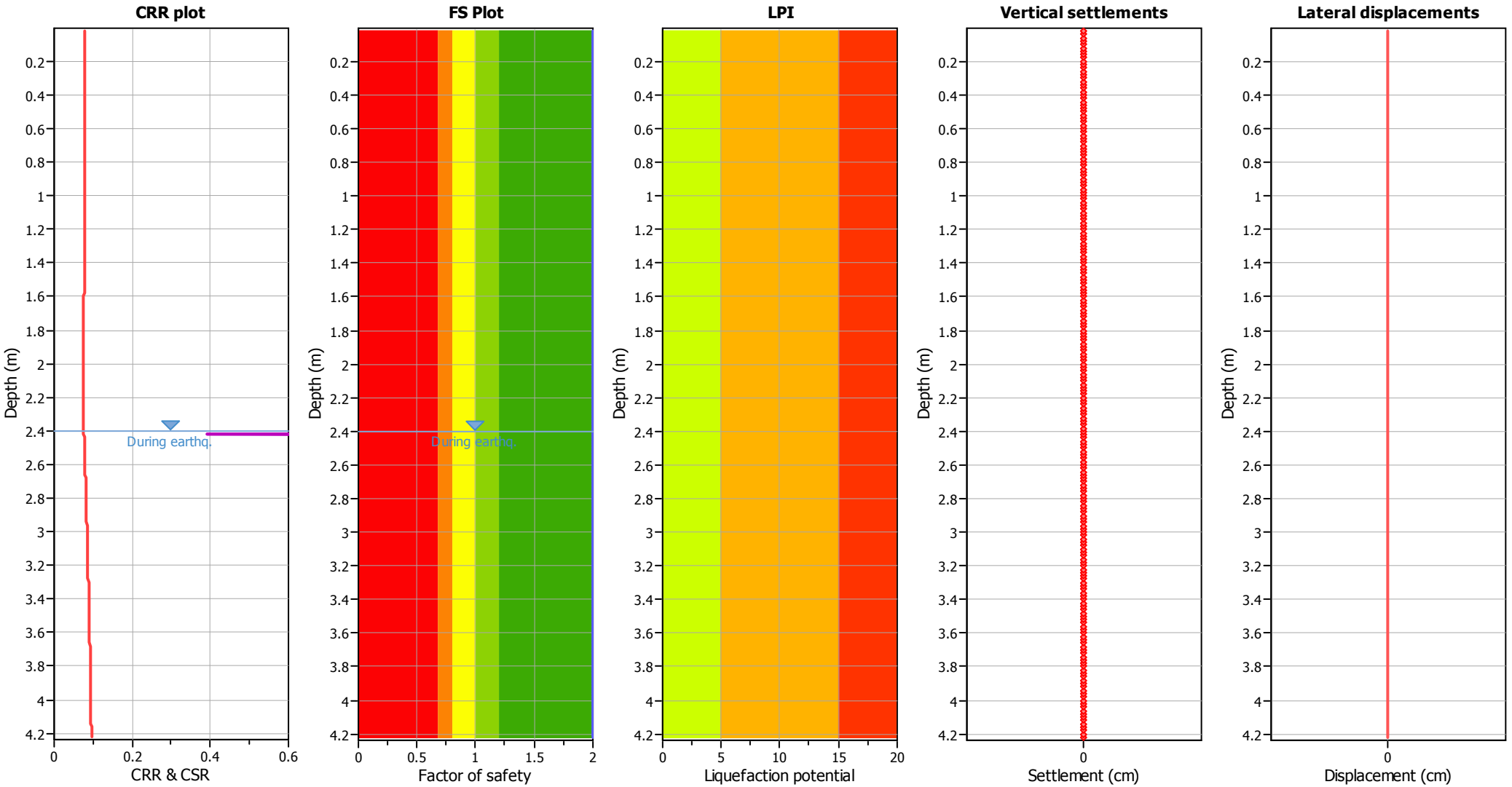






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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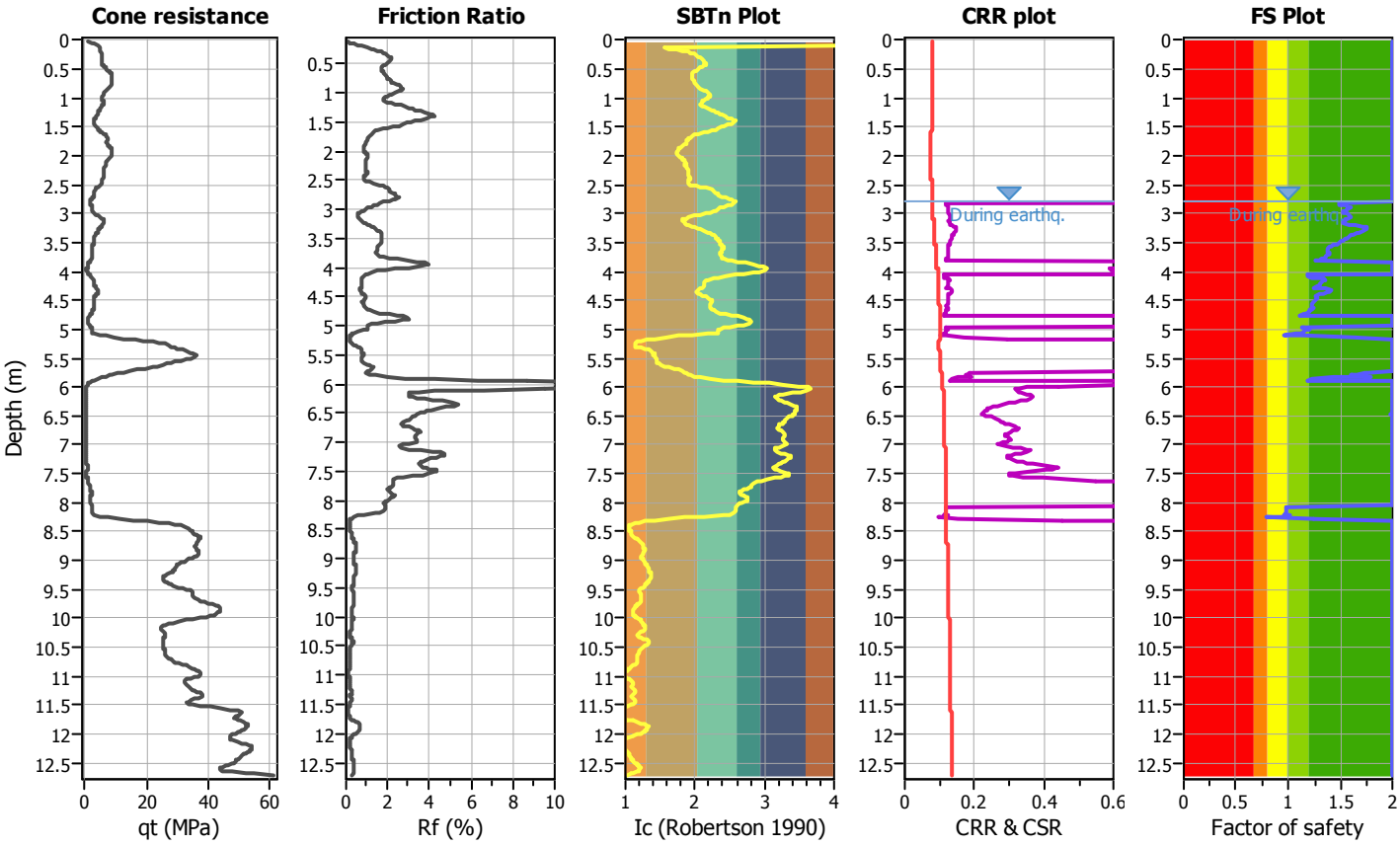
LIQUEFACTION ANALYSIS REPORT

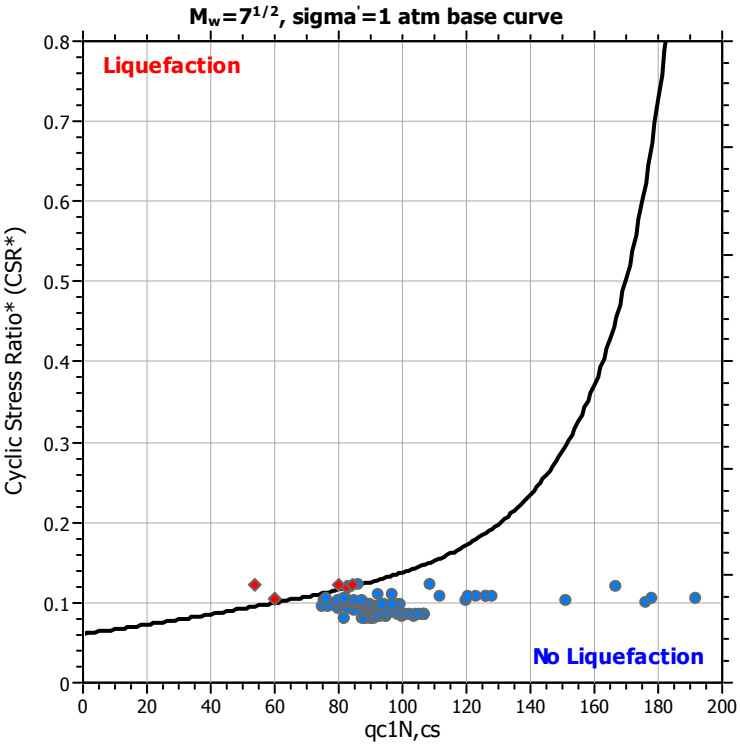
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

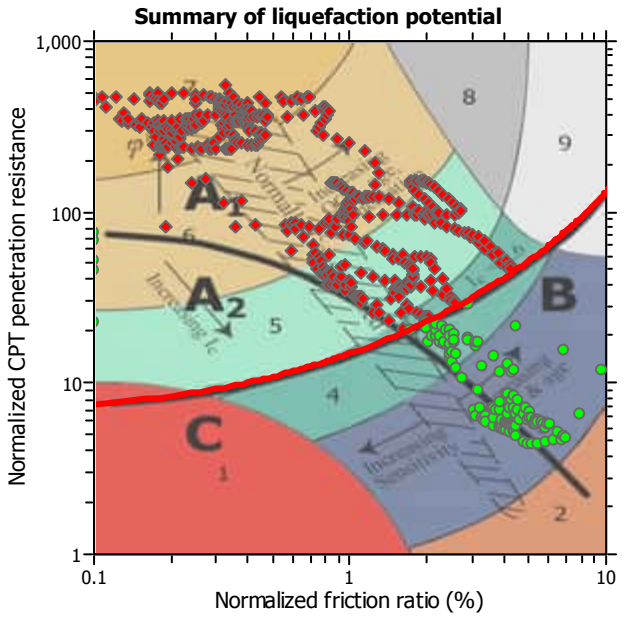
CPT file : CPT_46

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

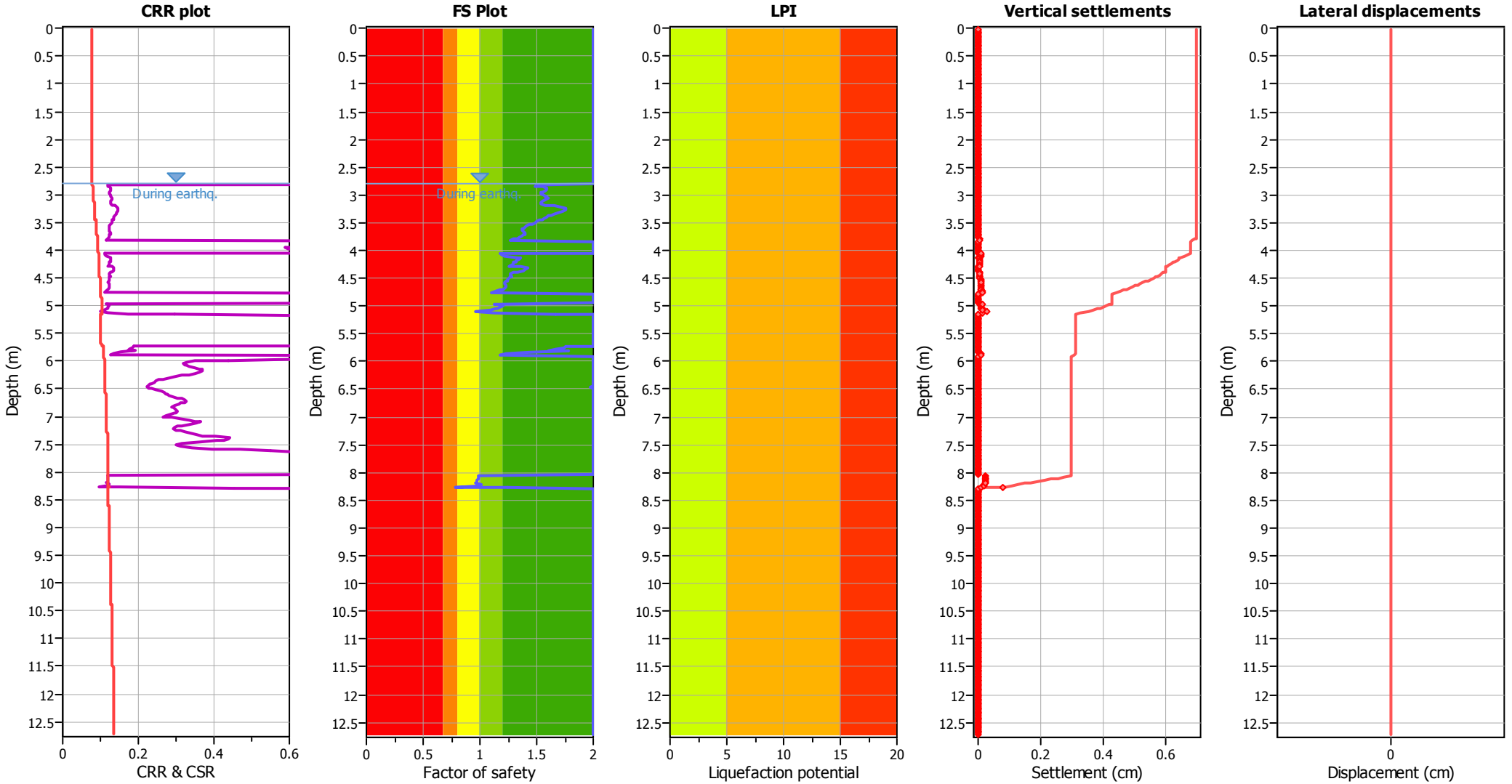






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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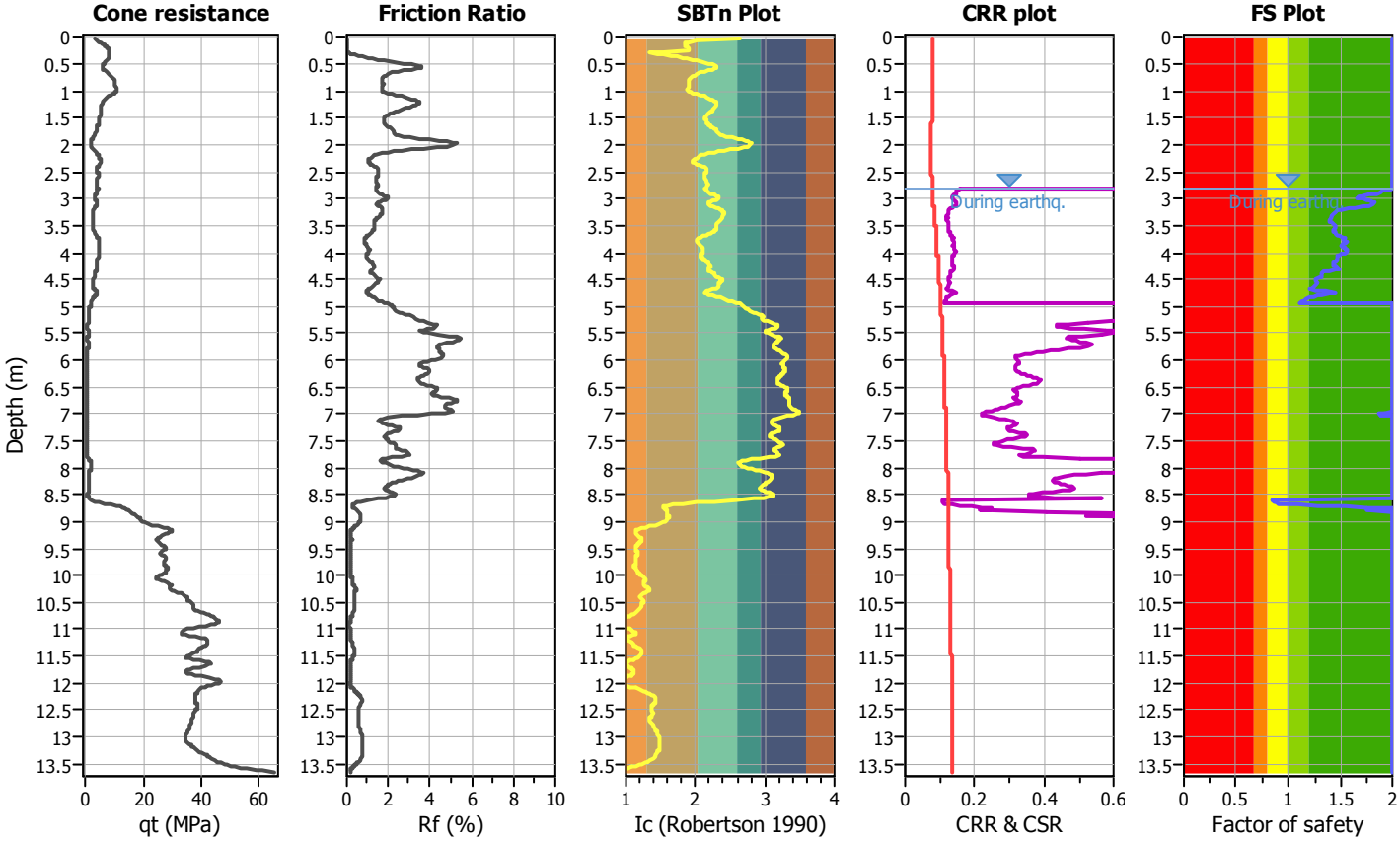
LIQUEFACTION ANALYSIS REPORT

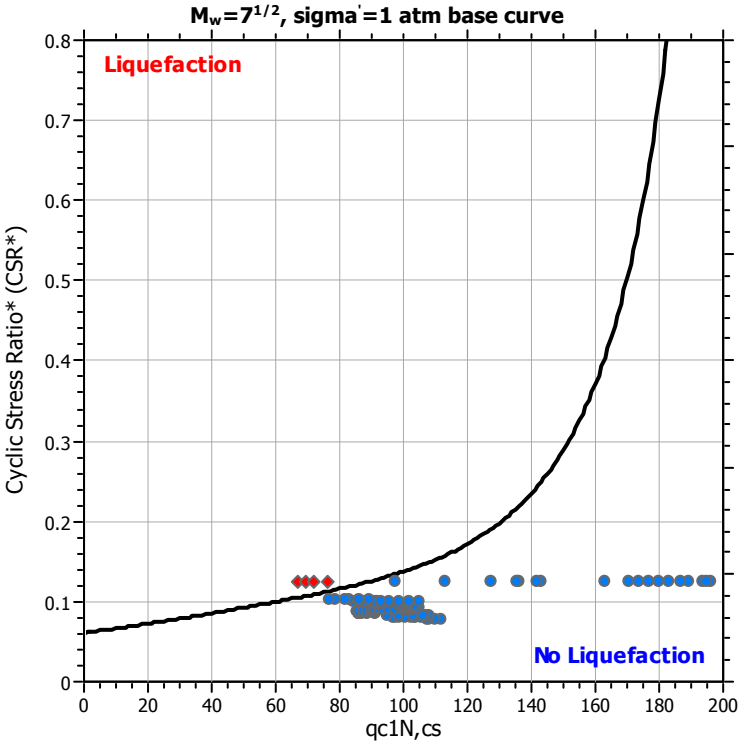
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

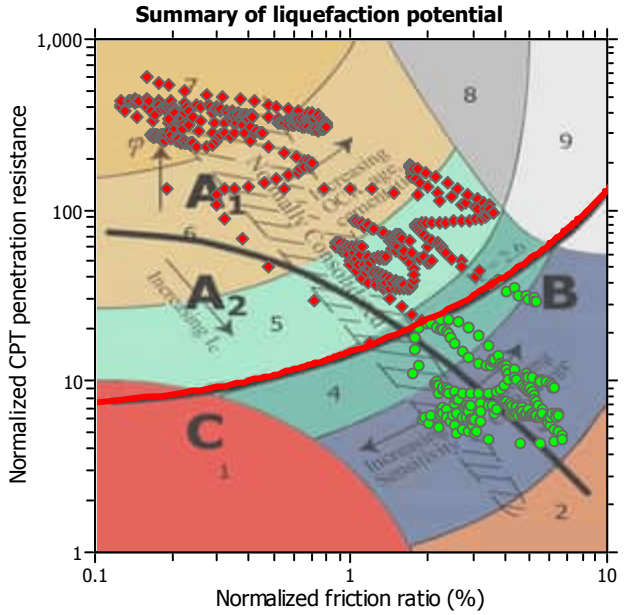
CPT file : CPT_47

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

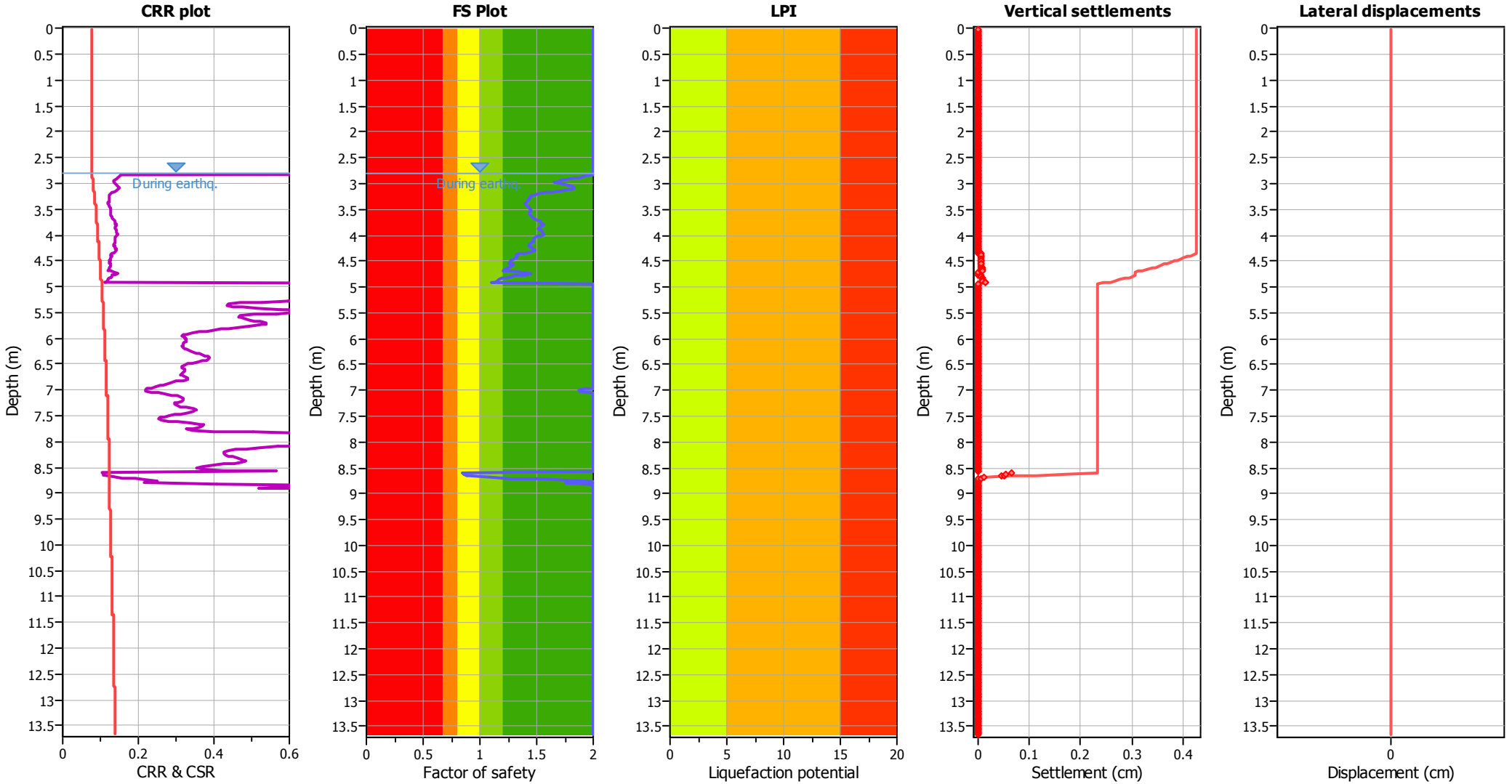






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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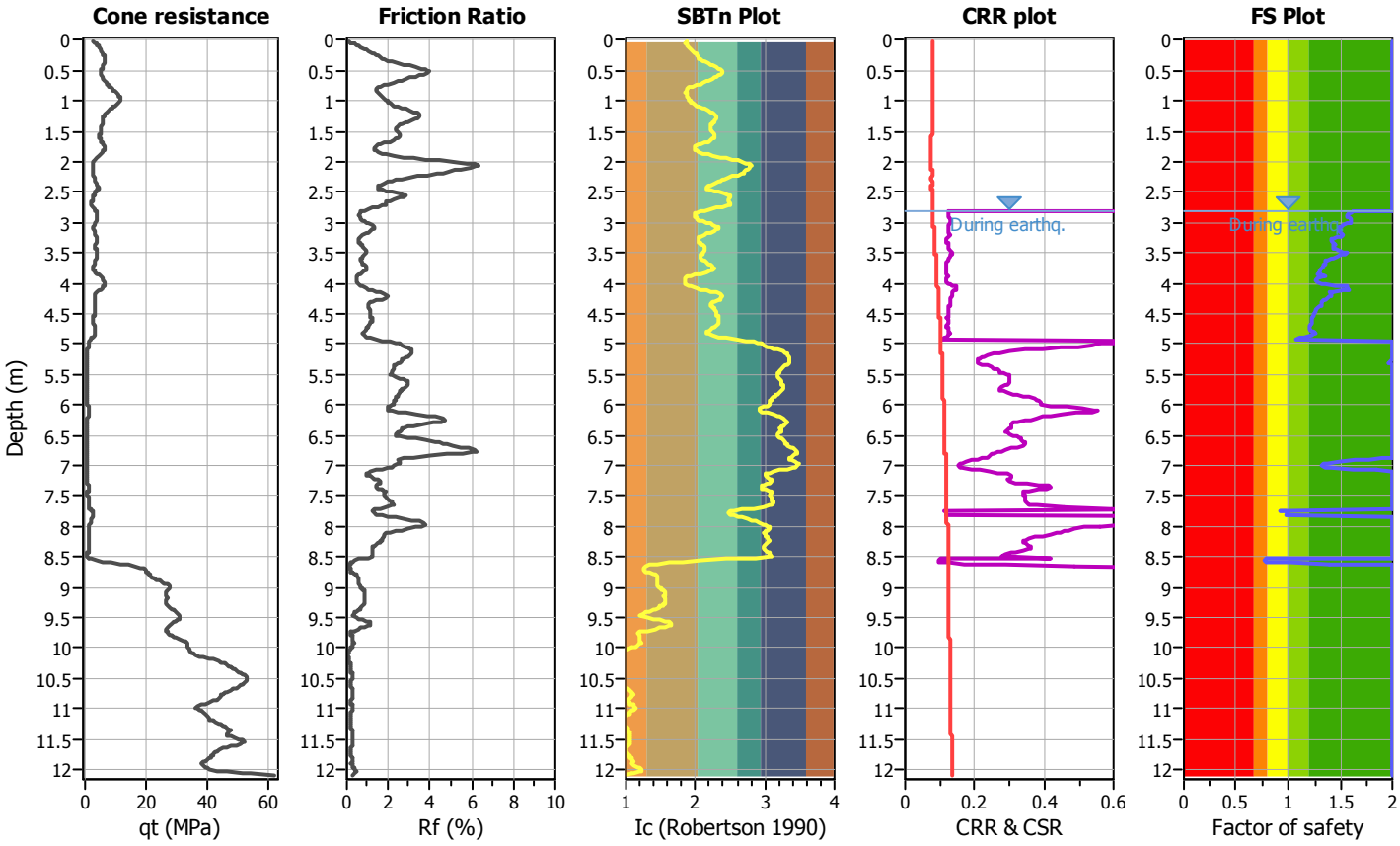
LIQUEFACTION ANALYSIS REPORT

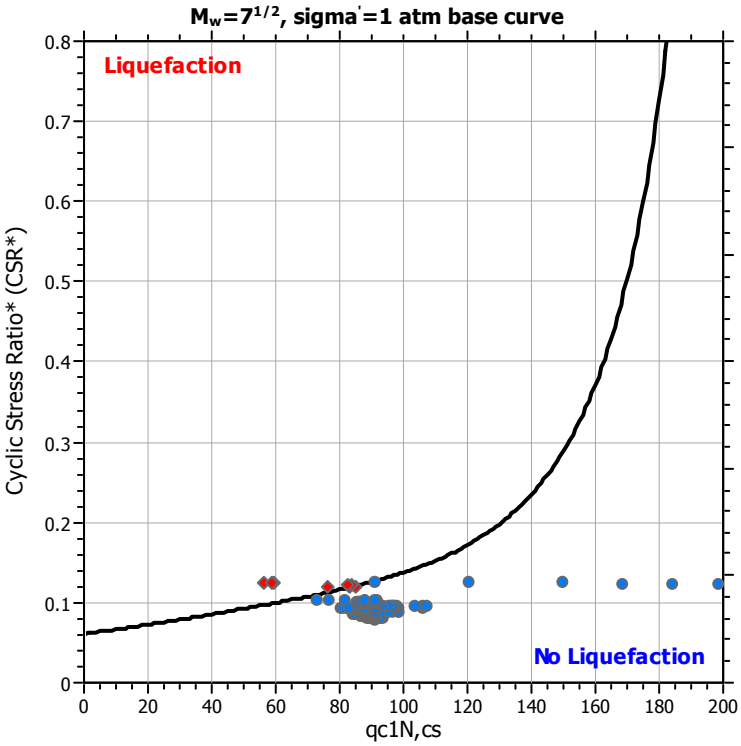
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

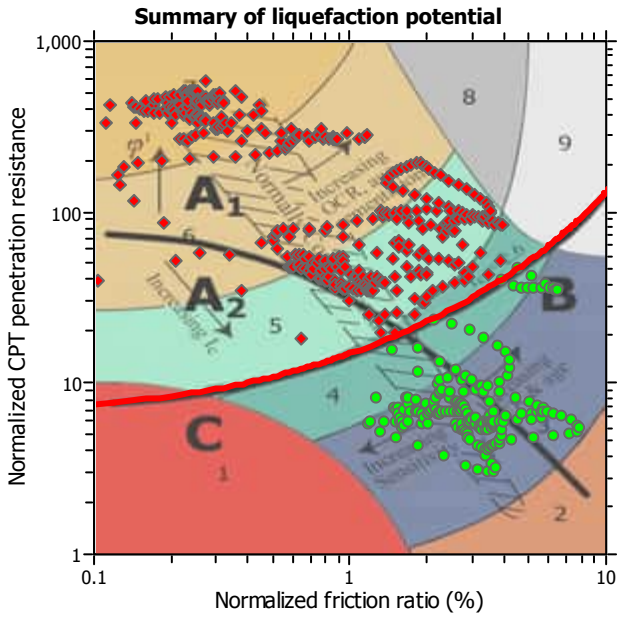
CPT file : CPT_48

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

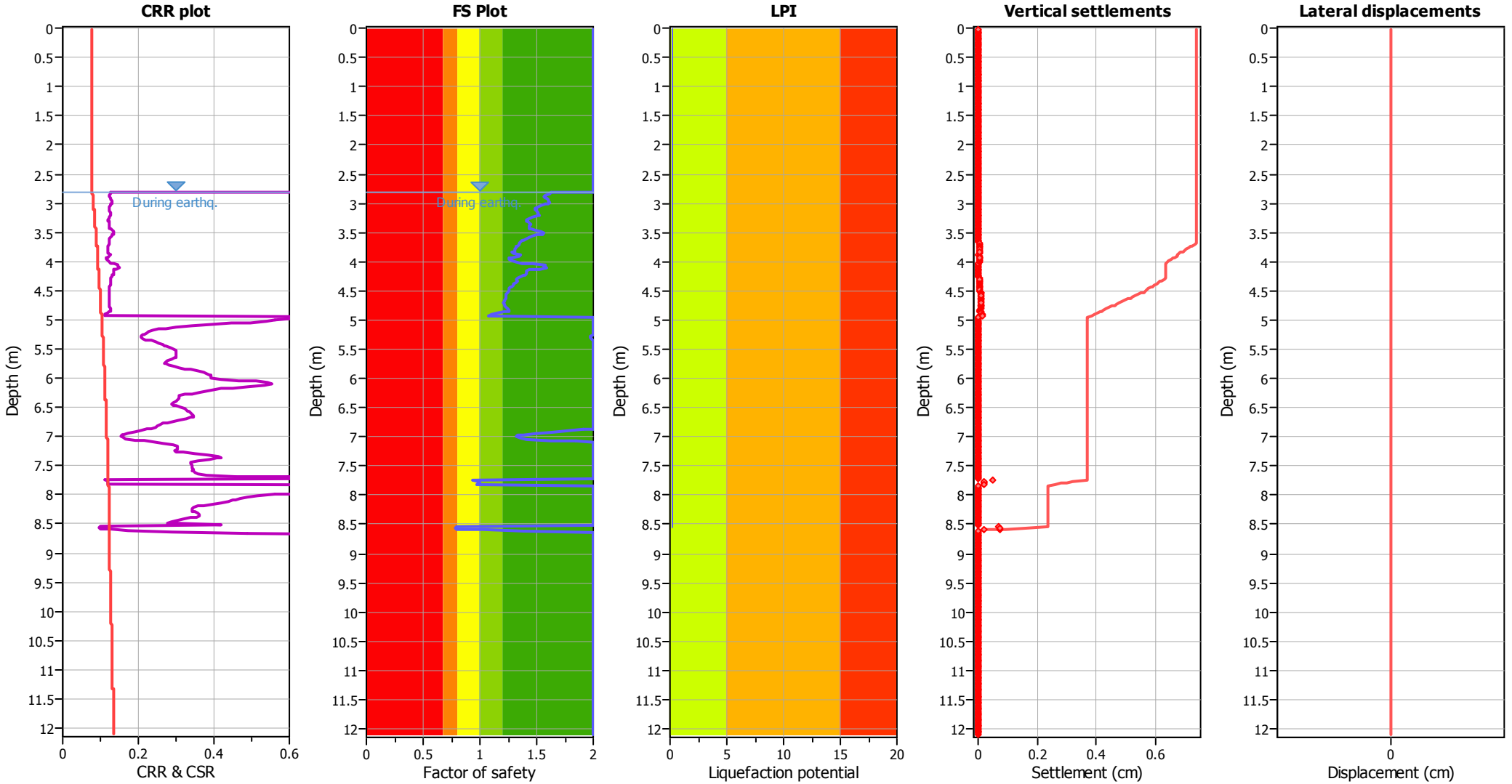






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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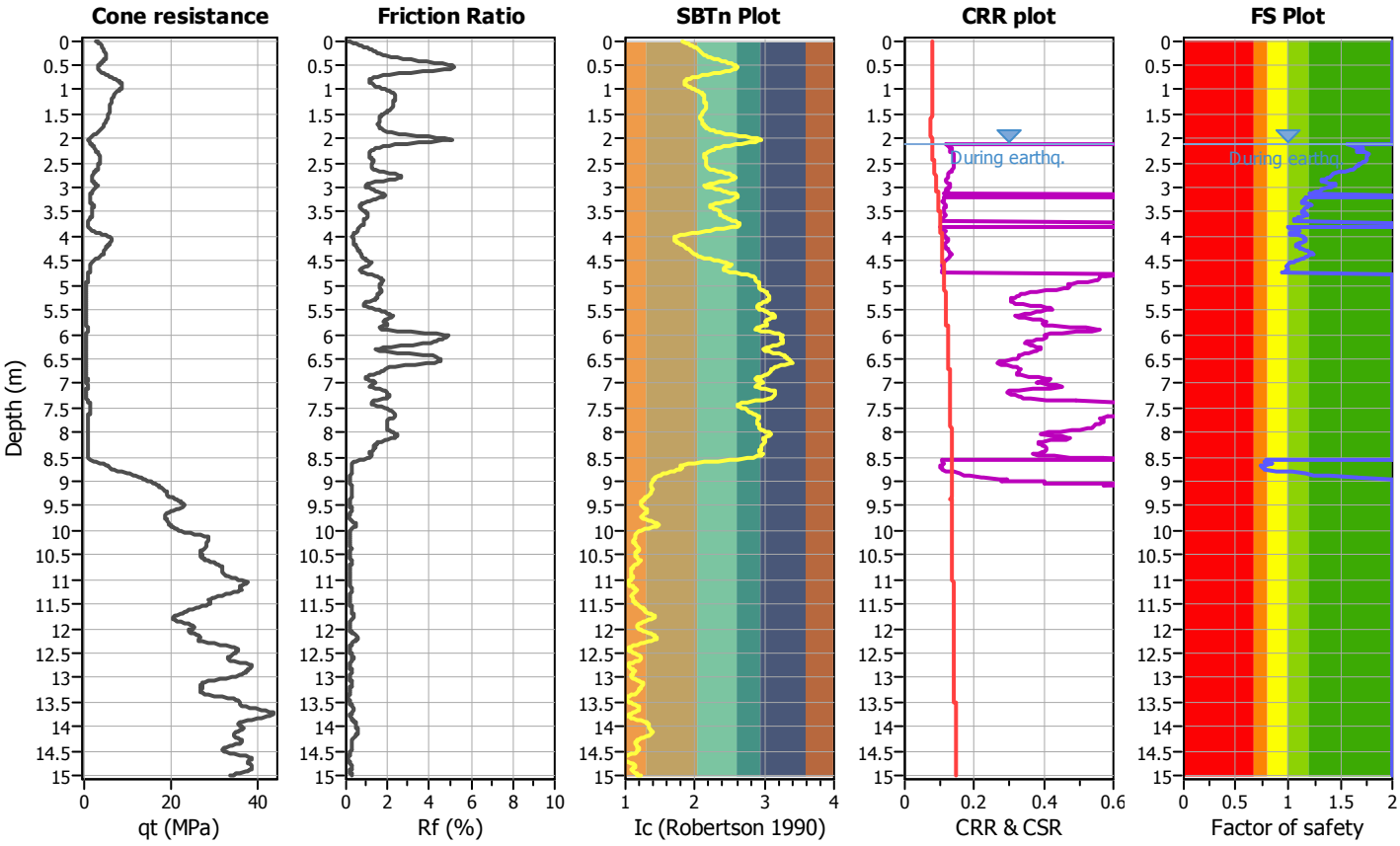
LIQUEFACTION ANALYSIS REPORT

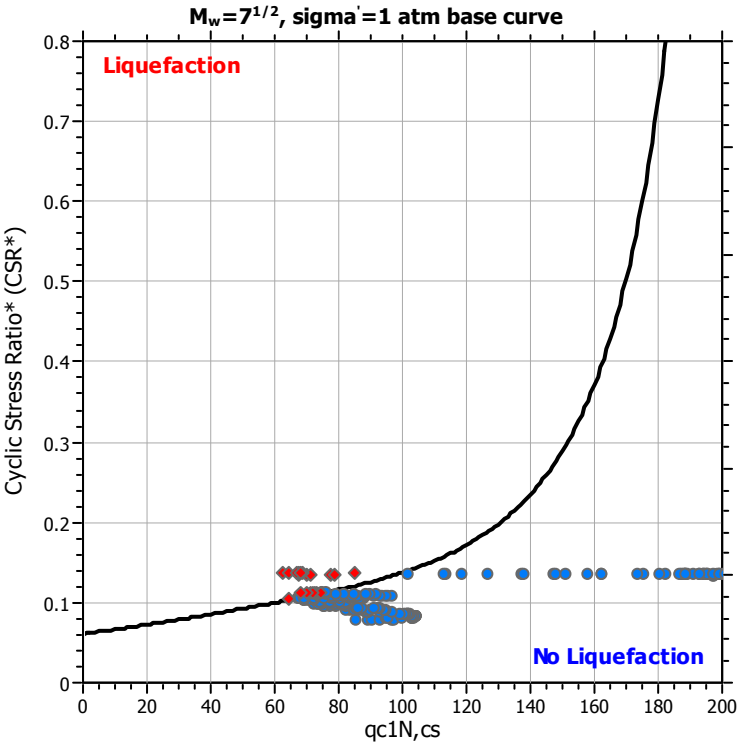
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

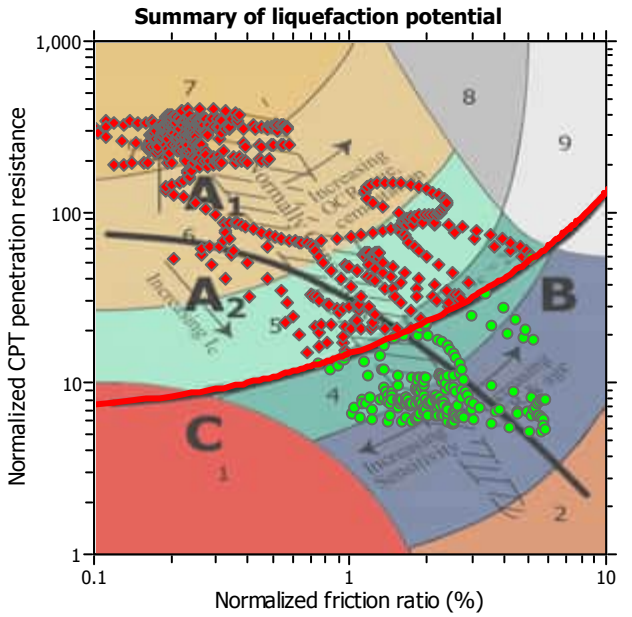
CPT file : CPT_49

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

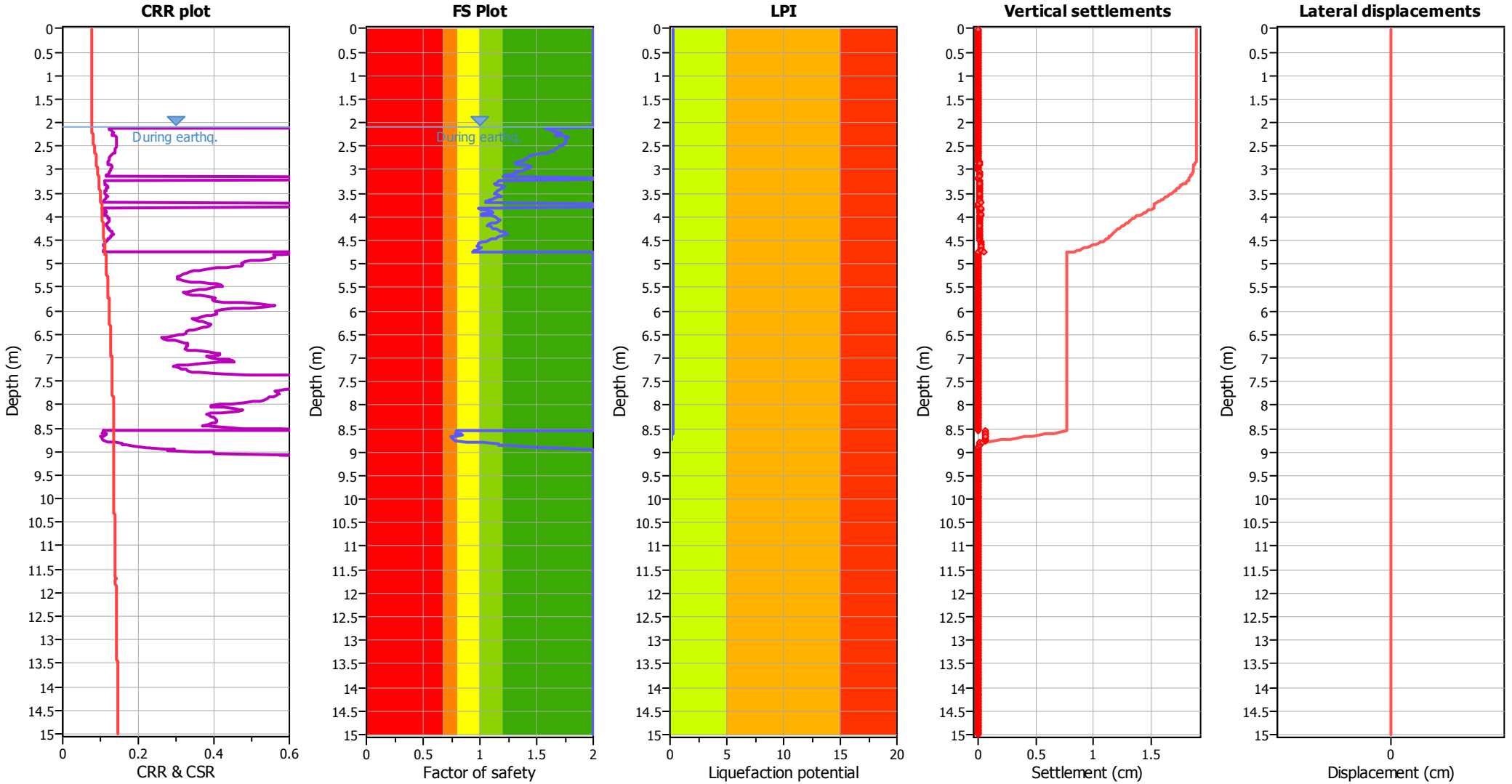






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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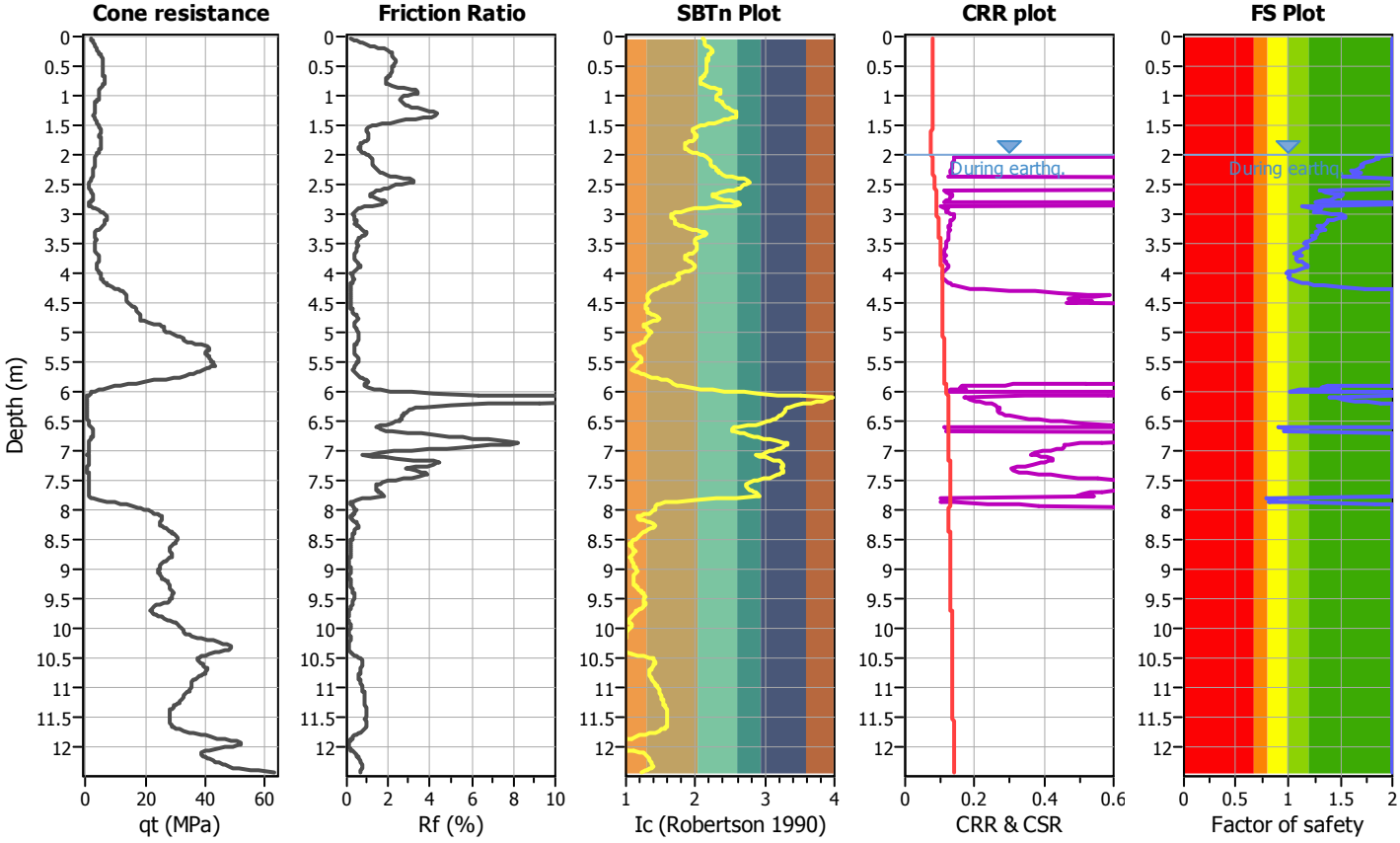
LIQUEFACTION ANALYSIS REPORT

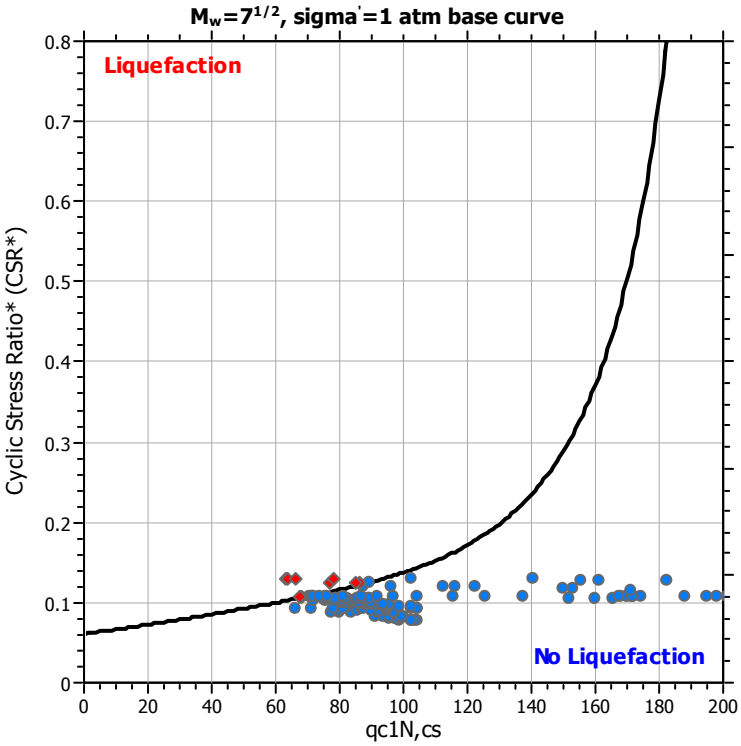
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

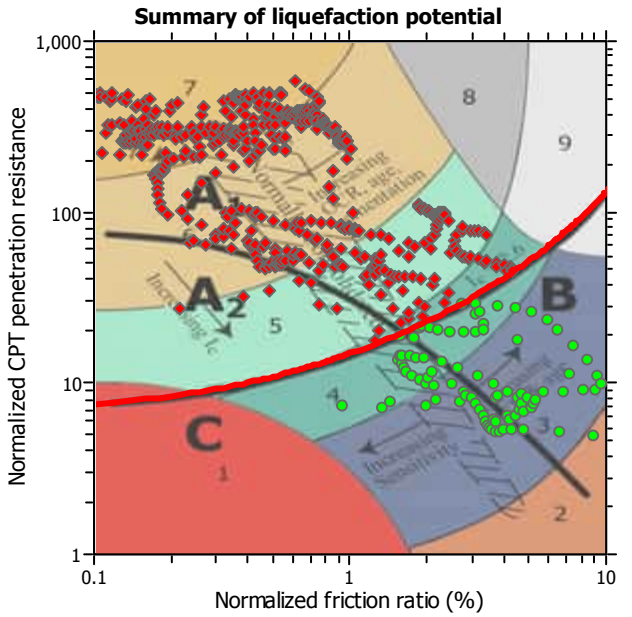
CPT file : CPT_50

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

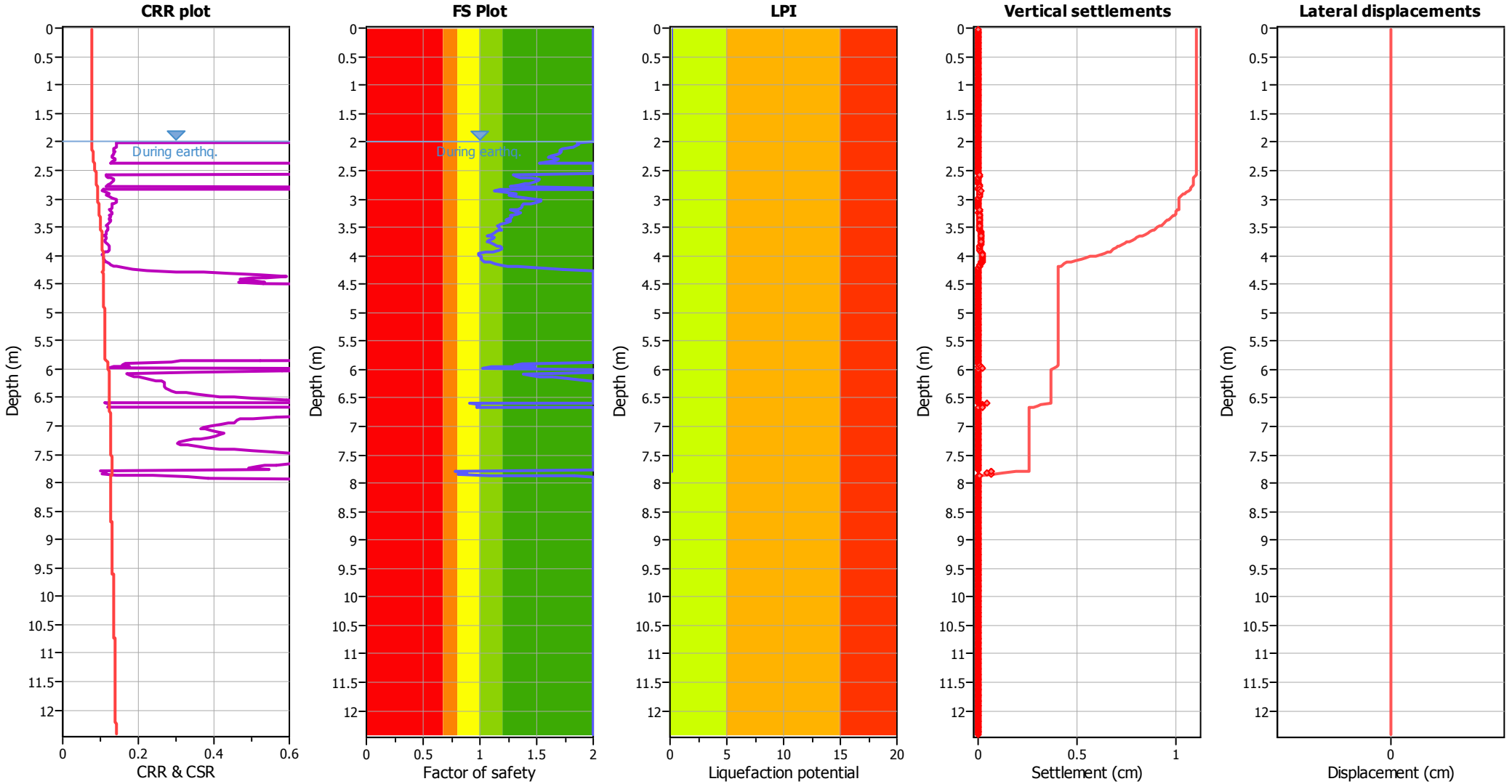






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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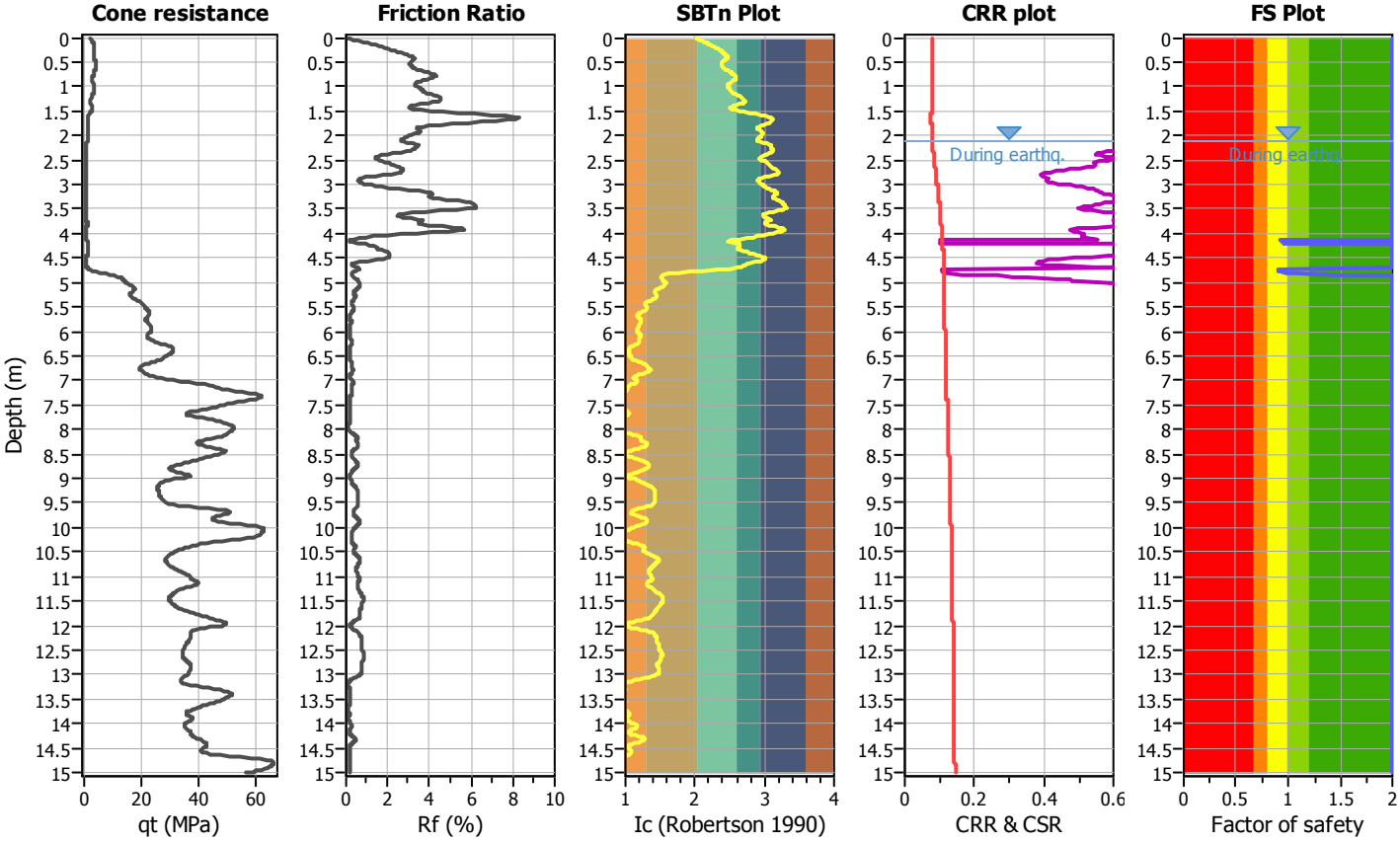
LIQUEFACTION ANALYSIS REPORT

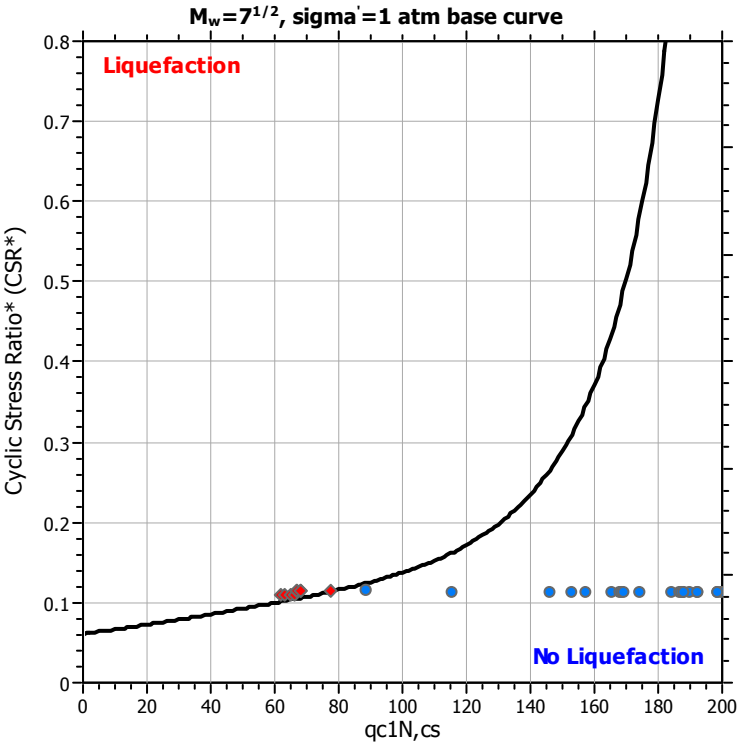
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

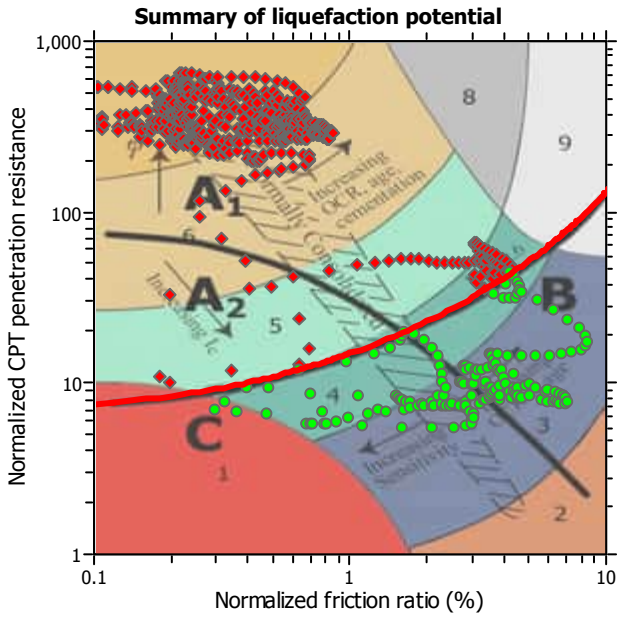
CPT file : CPT_51

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

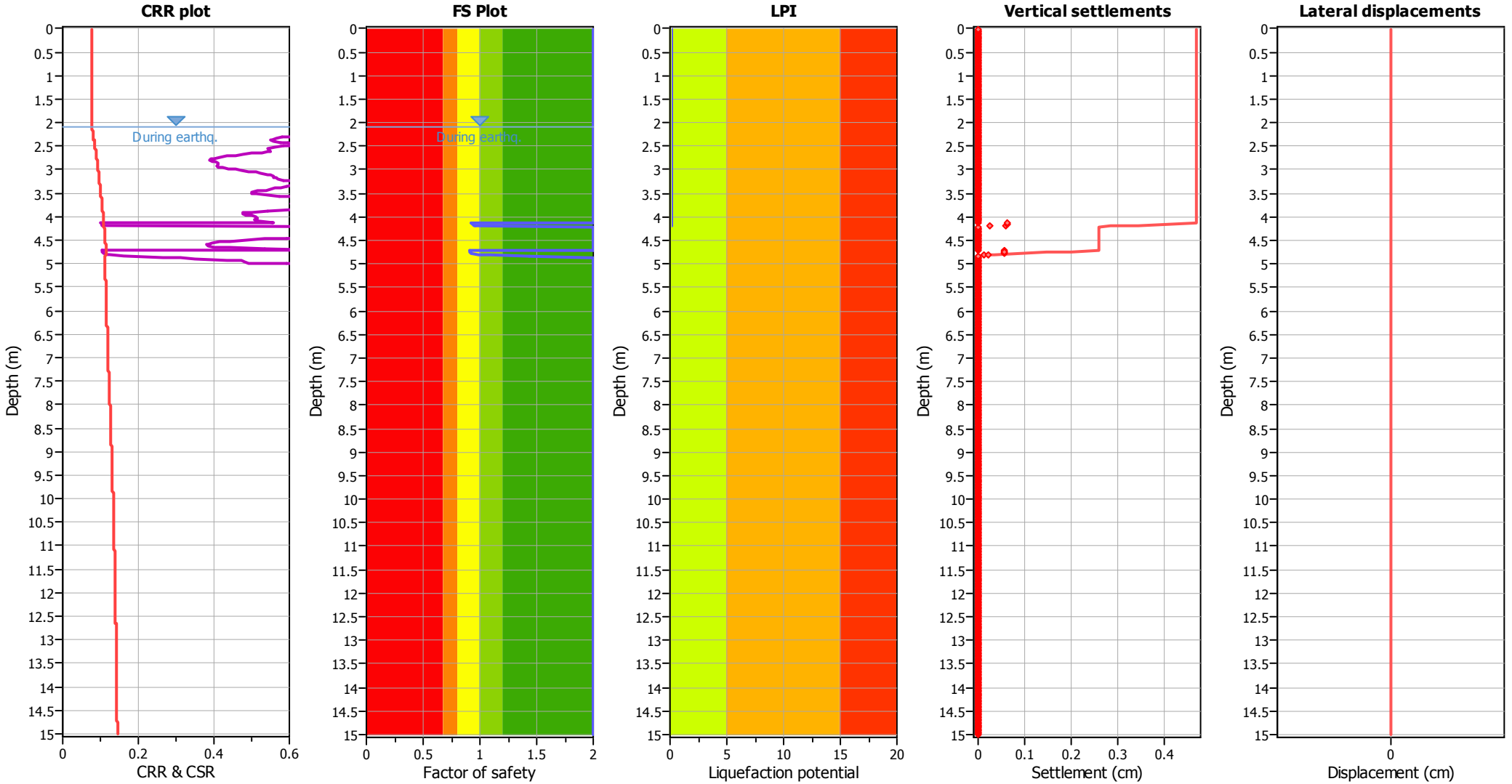






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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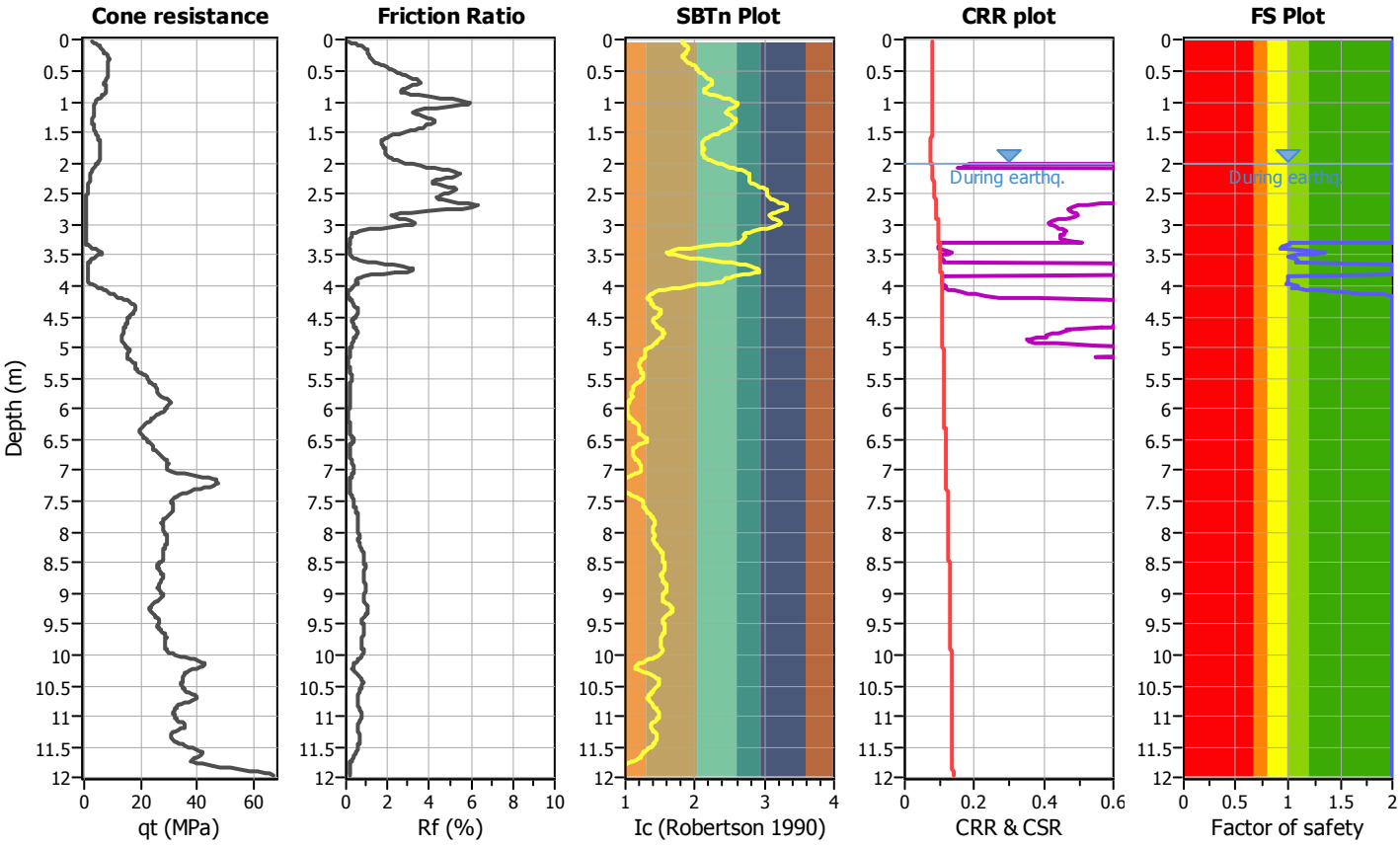
LIQUEFACTION ANALYSIS REPORT

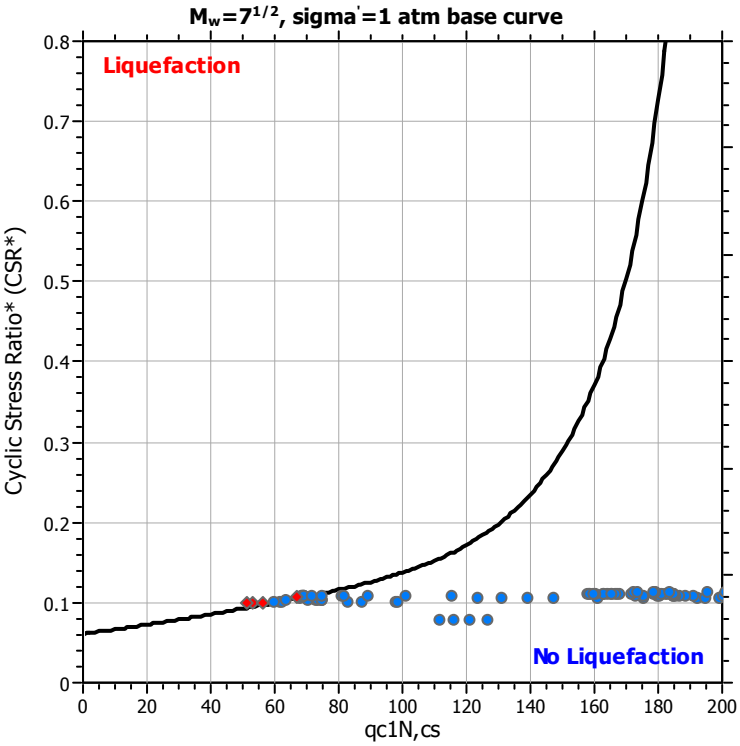
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

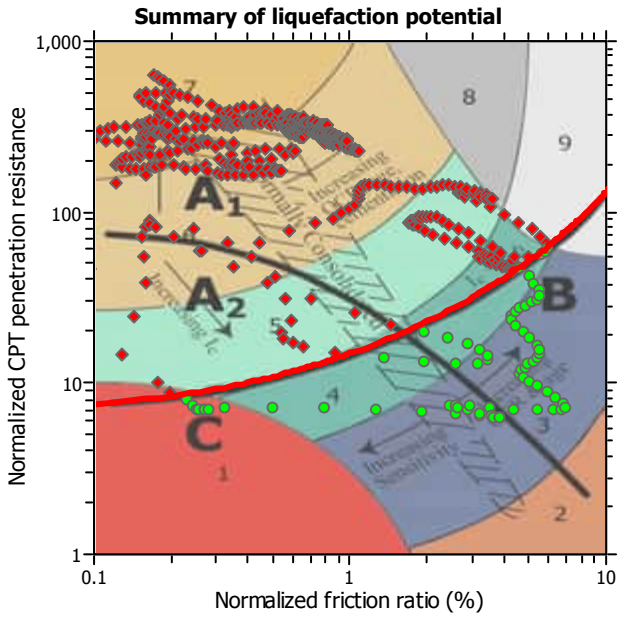
CPT file : CPT_52

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

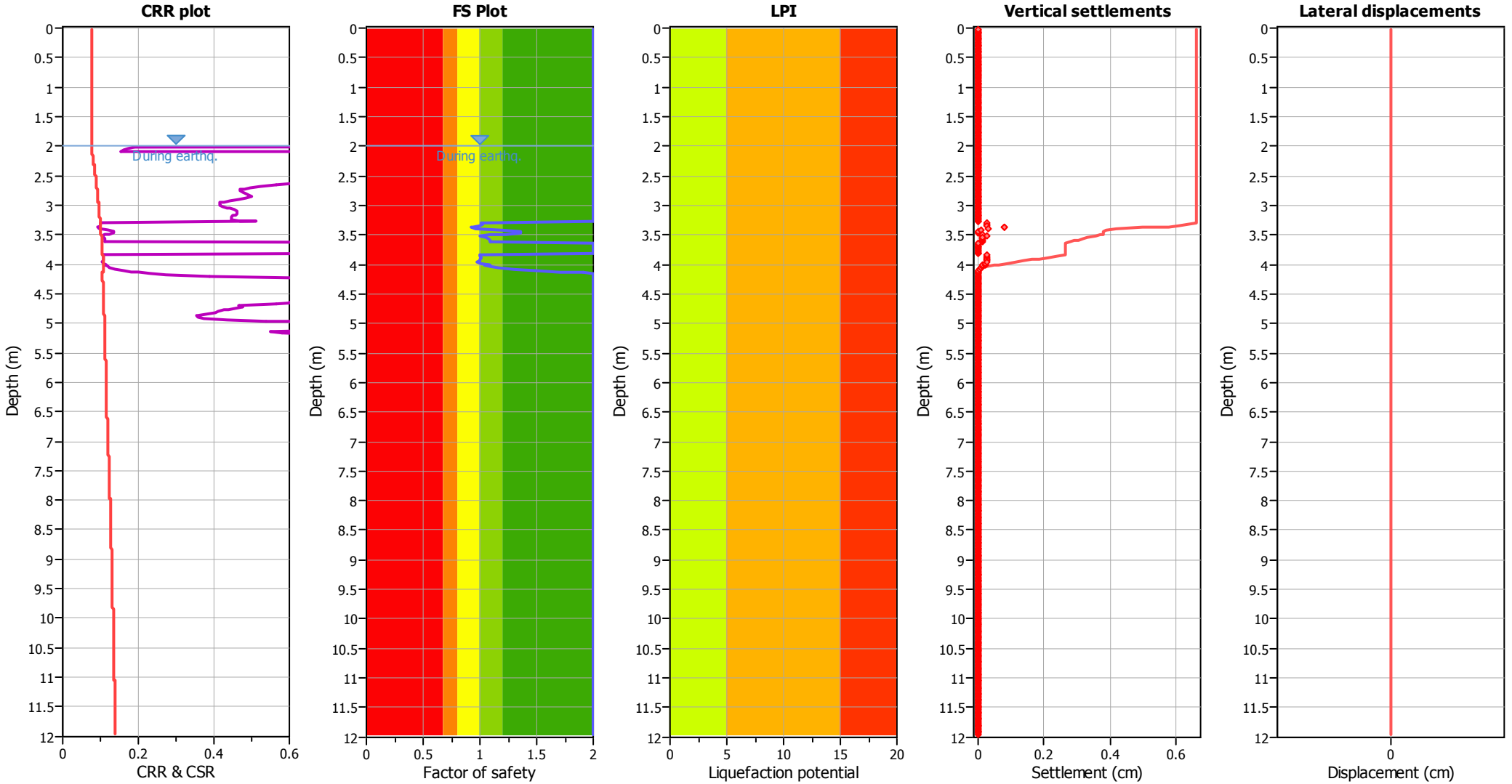






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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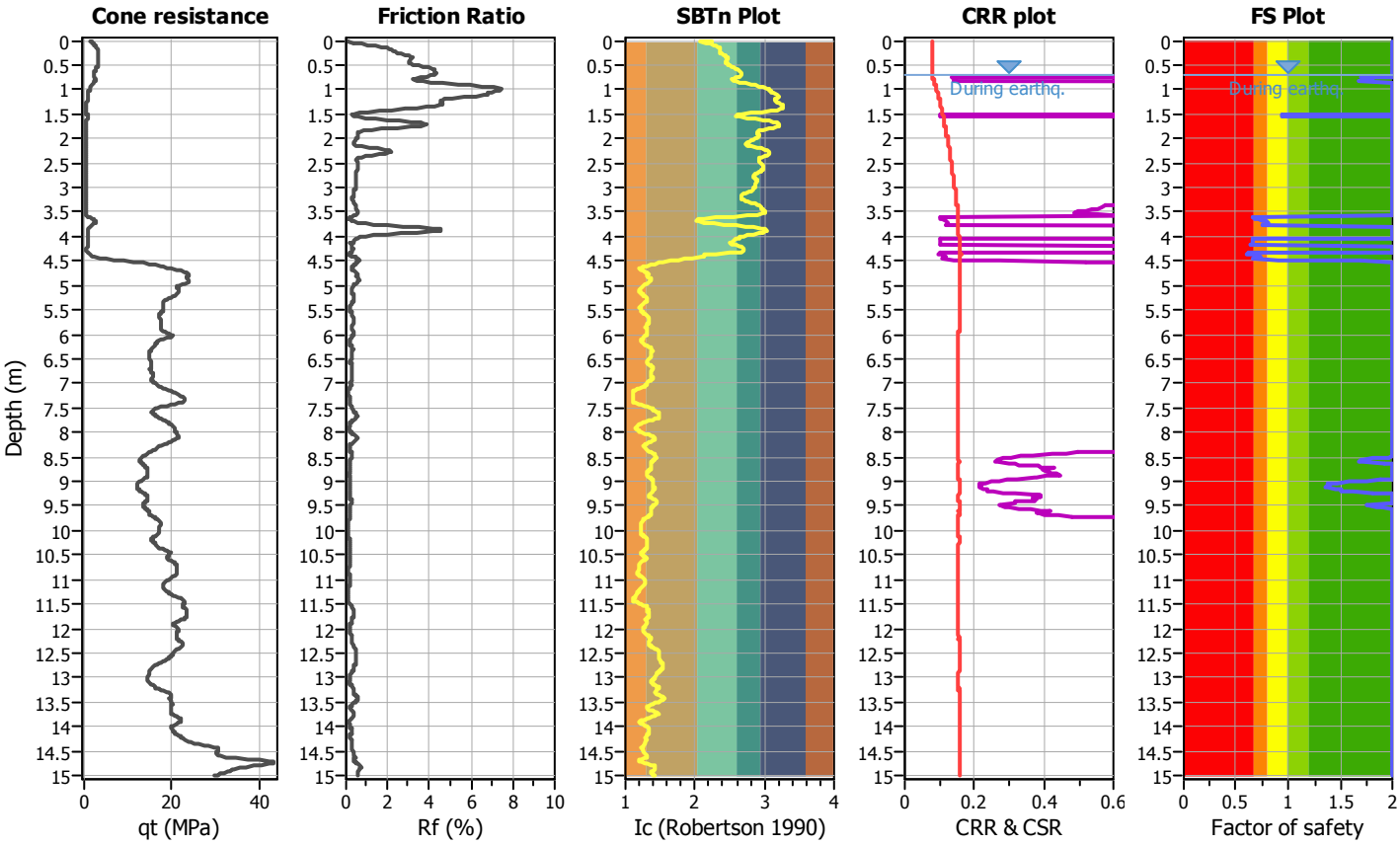
LIQUEFACTION ANALYSIS REPORT

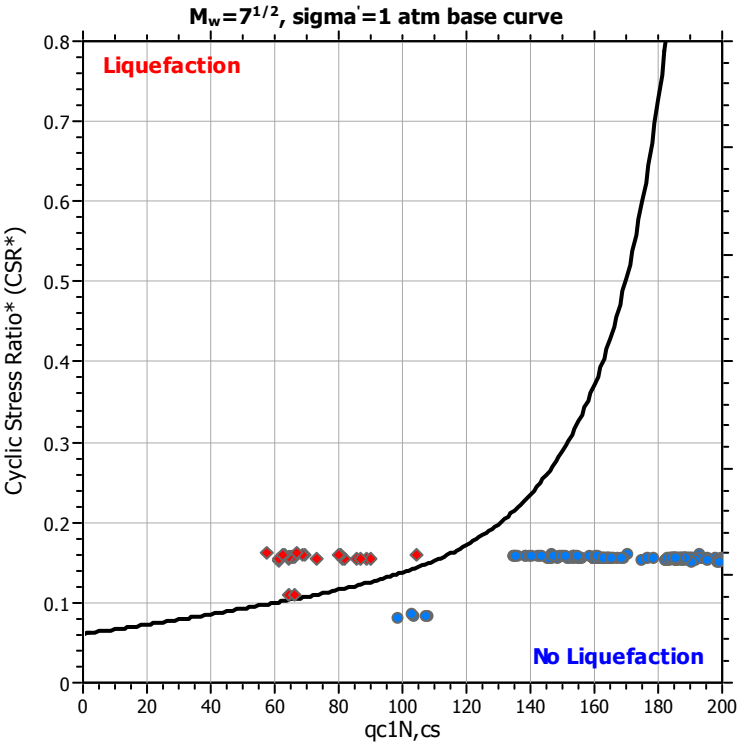
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

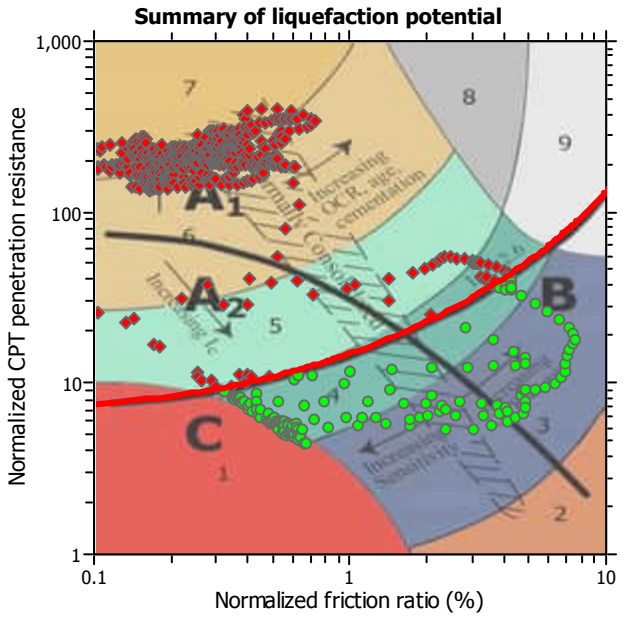
CPT file : CPT_53

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

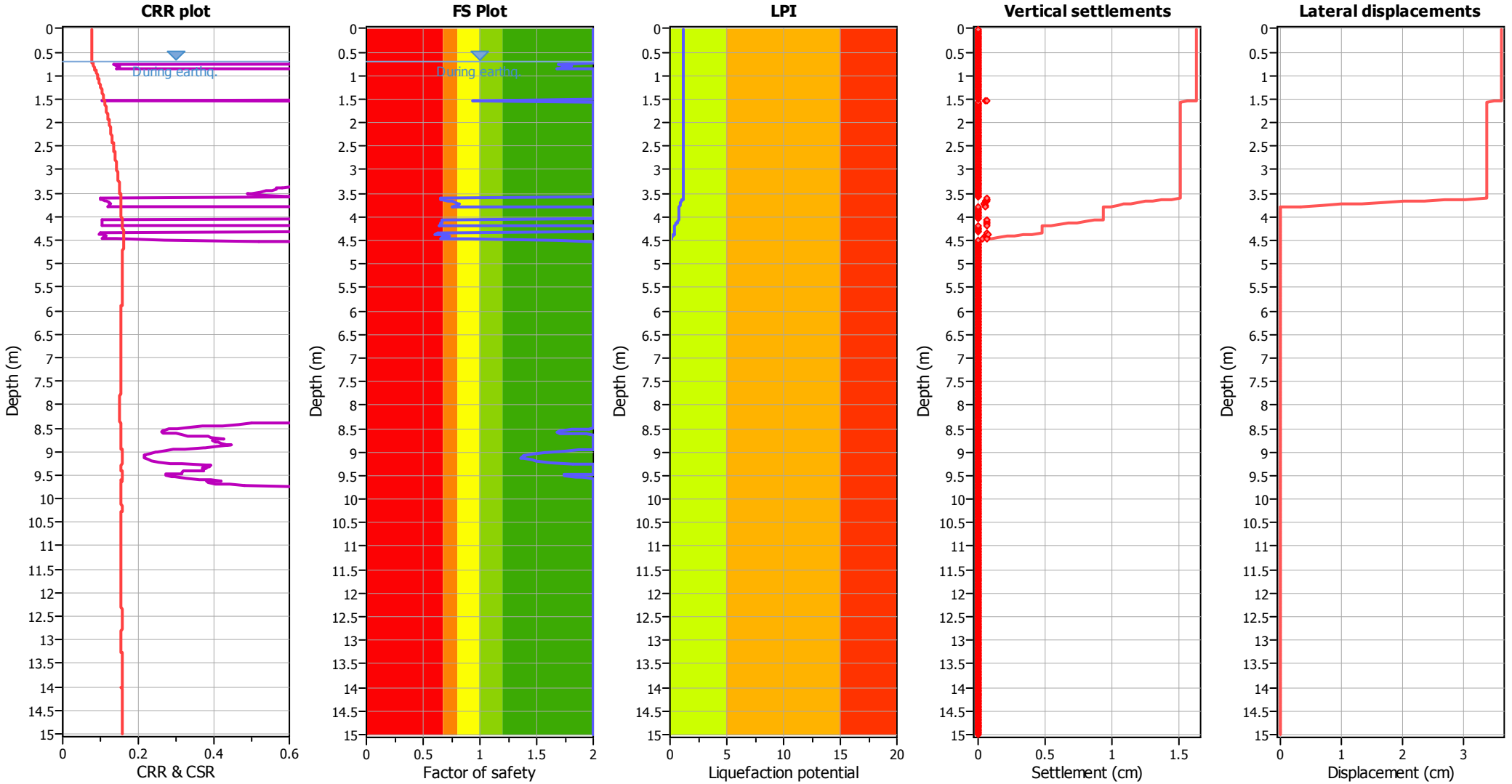






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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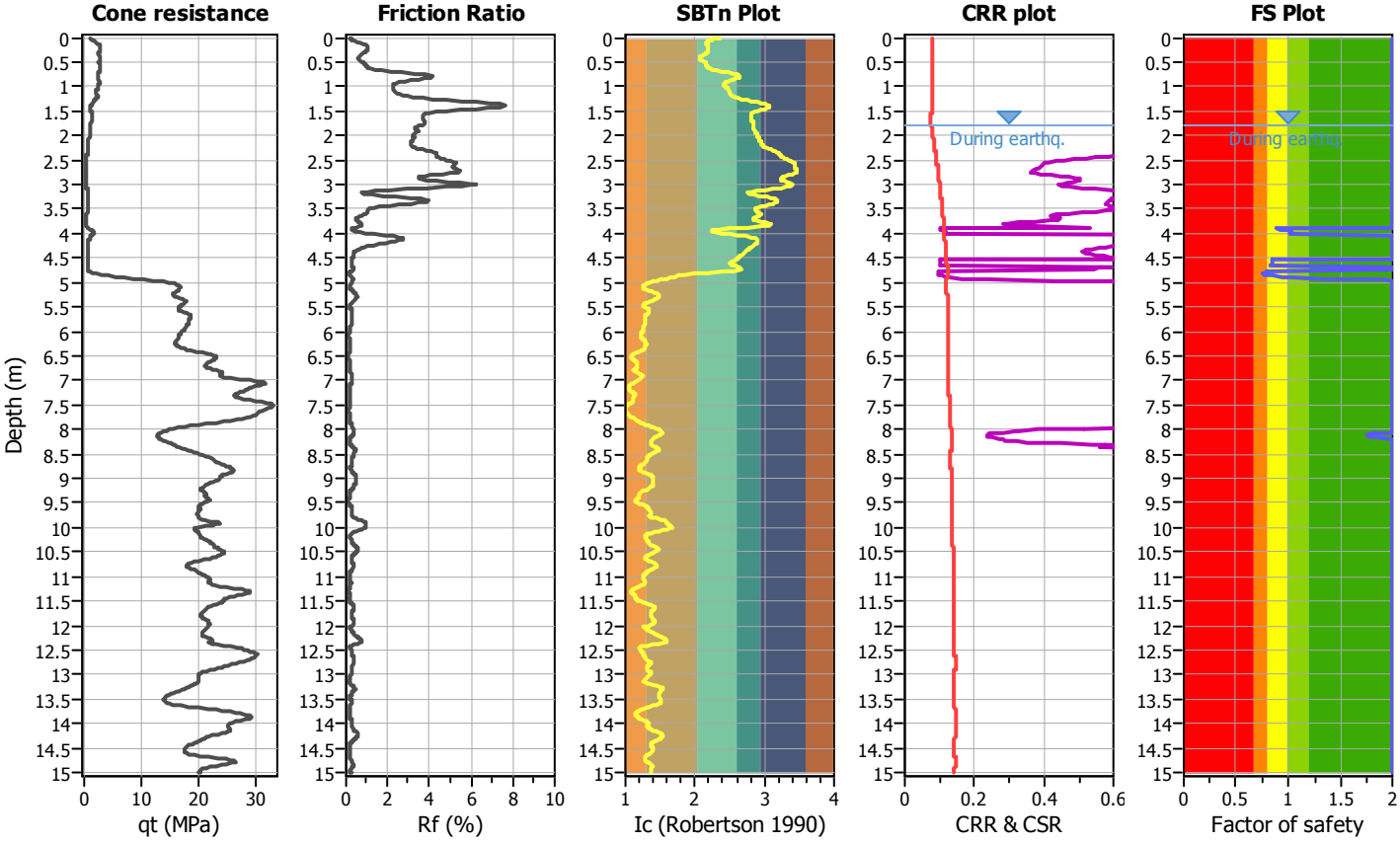
LIQUEFACTION ANALYSIS REPORT

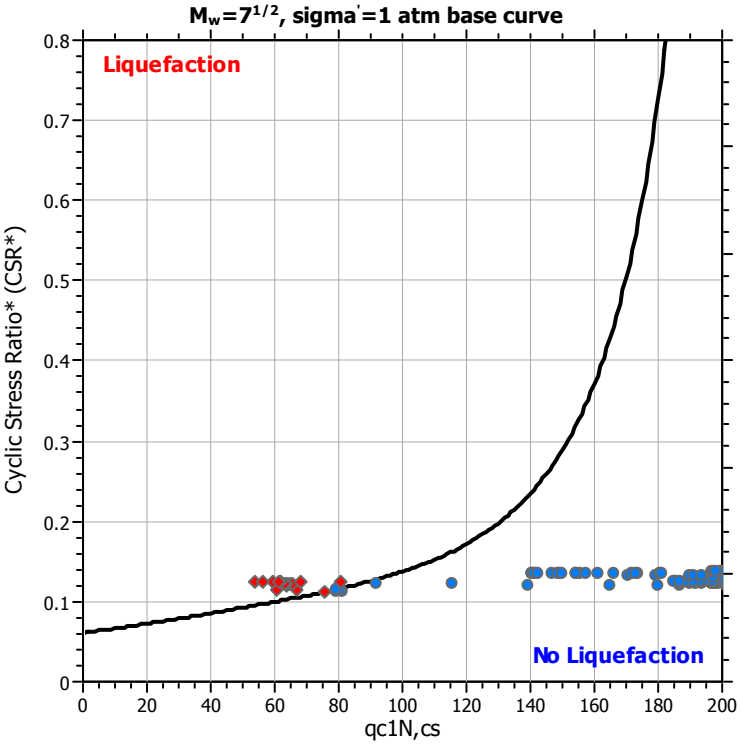
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

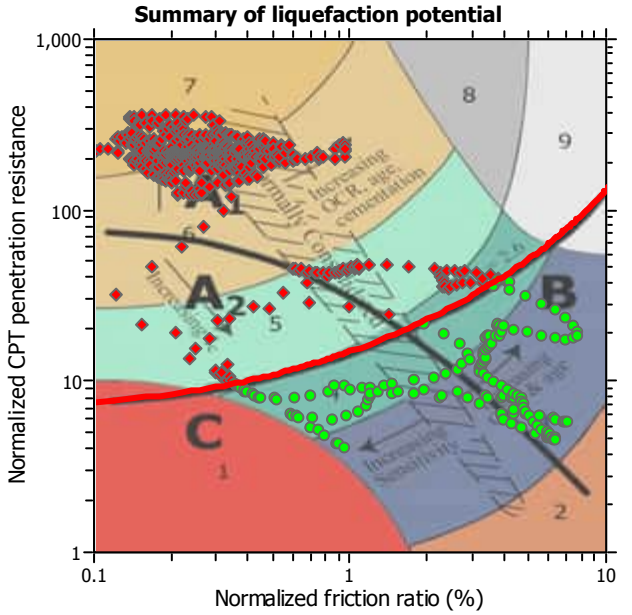
CPT file : CPT_54

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

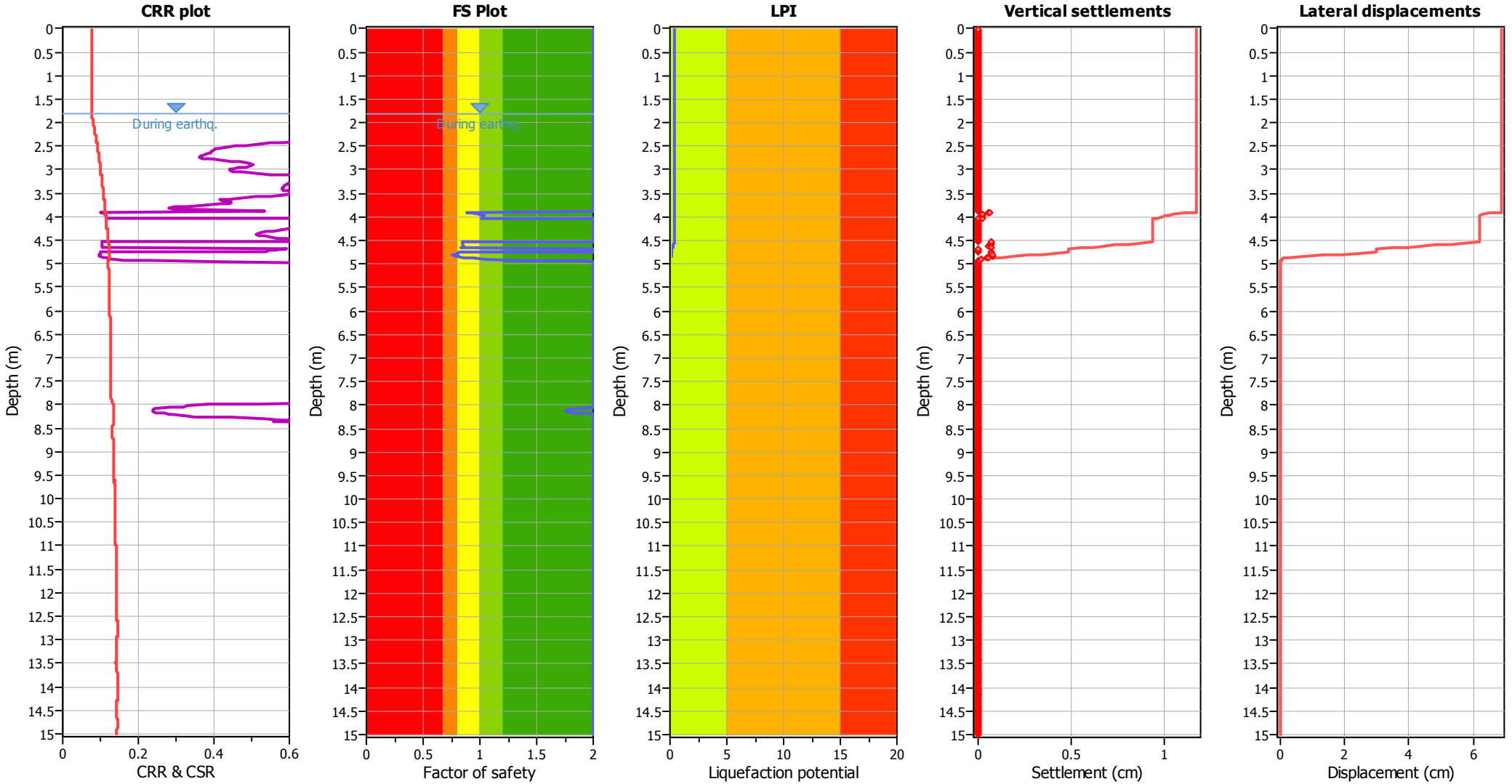






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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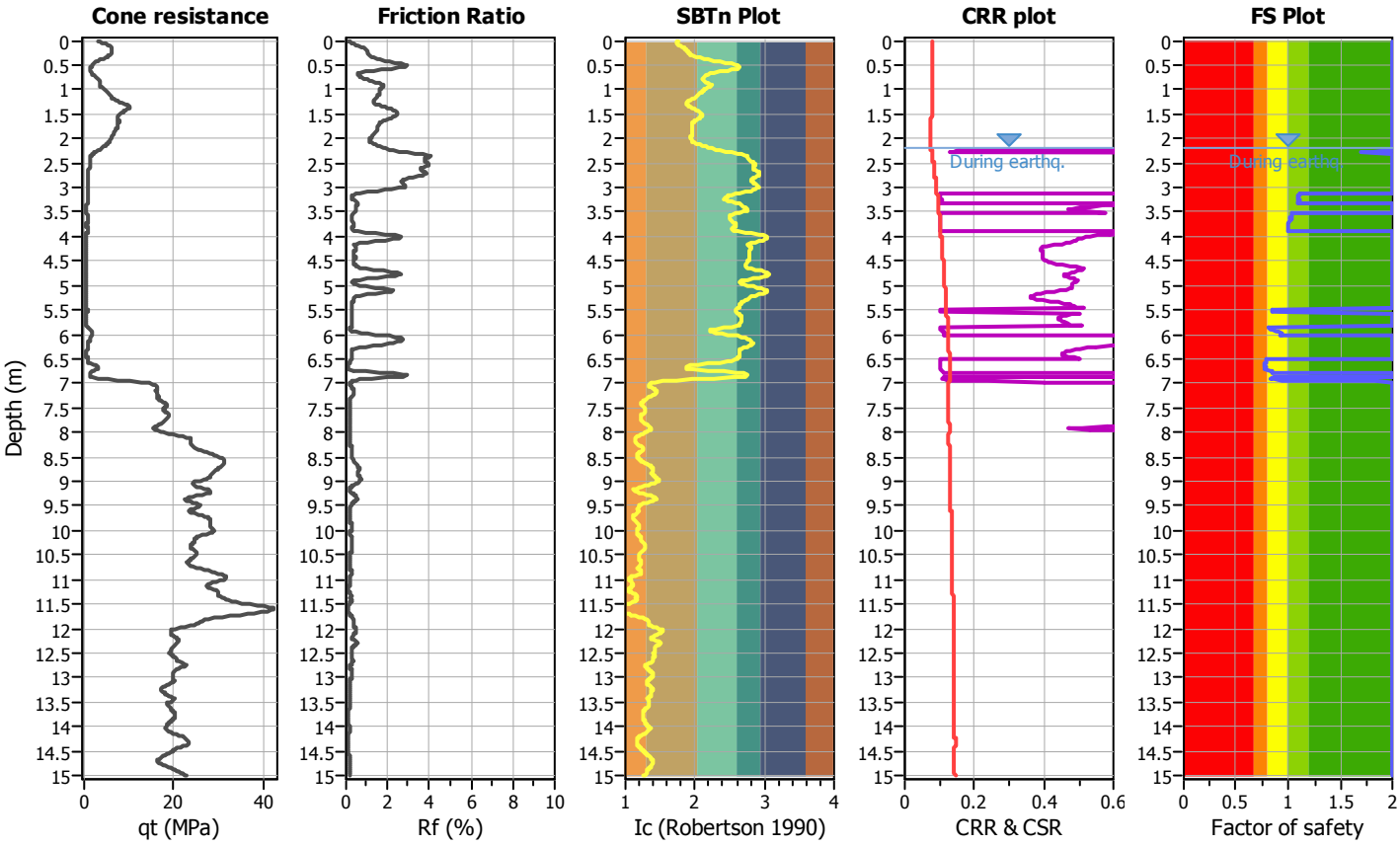
LIQUEFACTION ANALYSIS REPORT

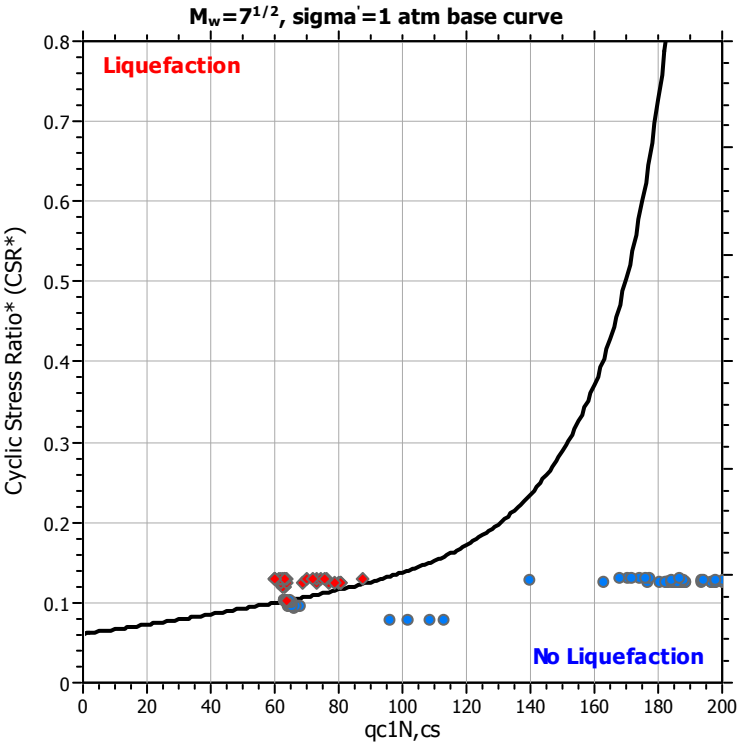
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

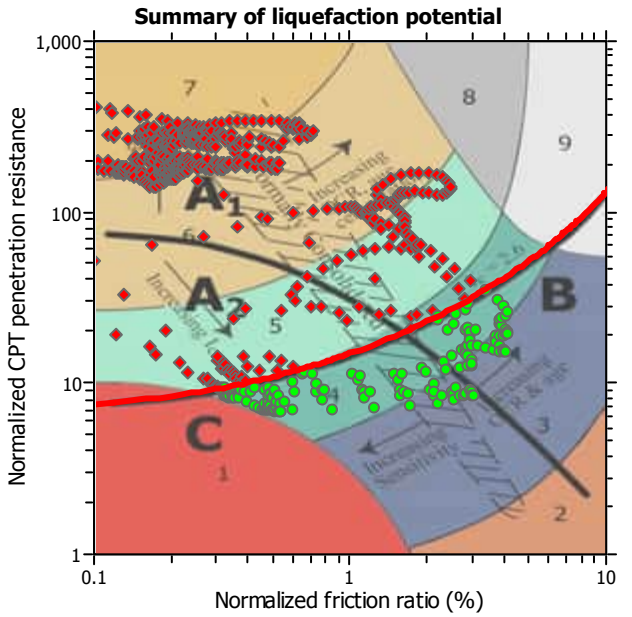
CPT file : CPT_55

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

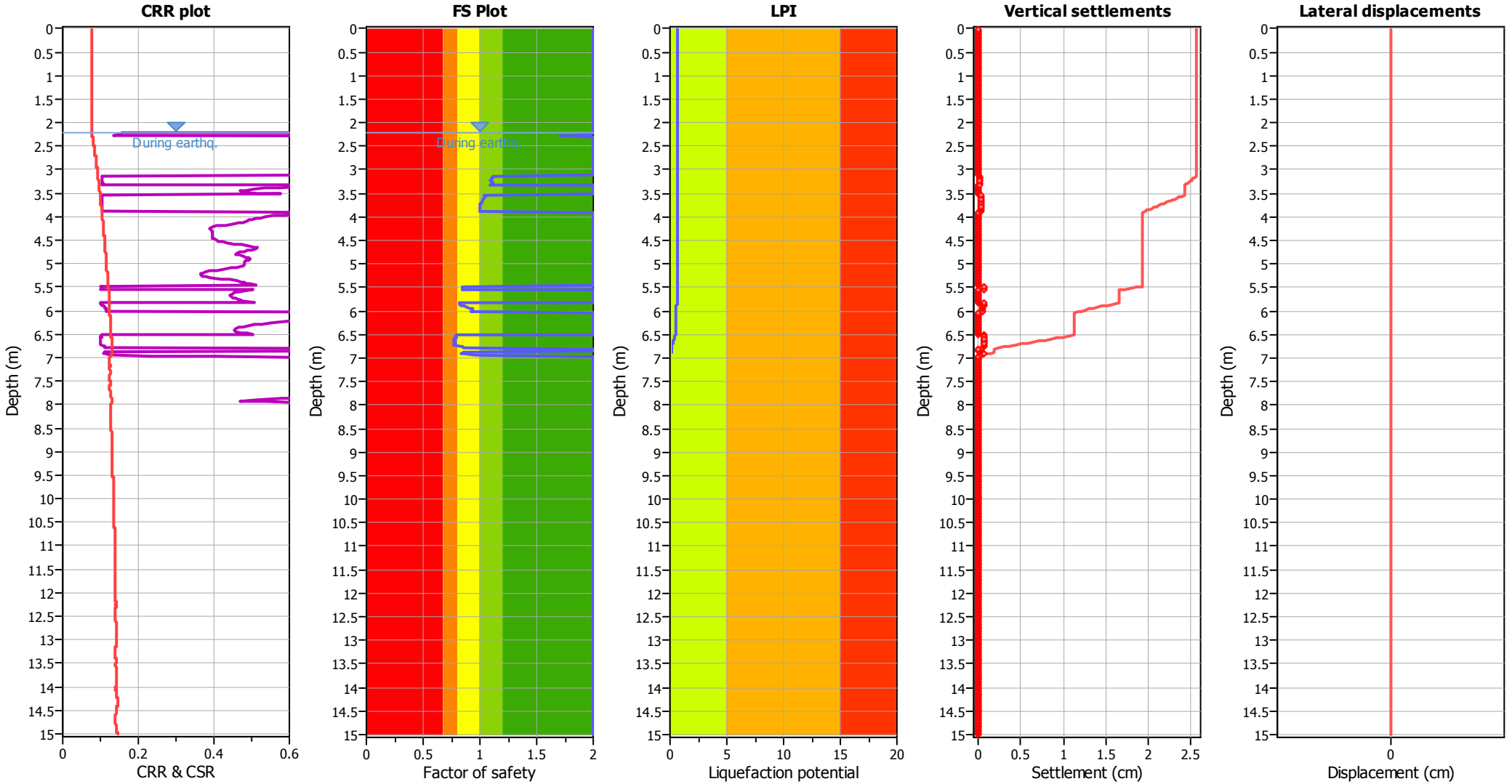






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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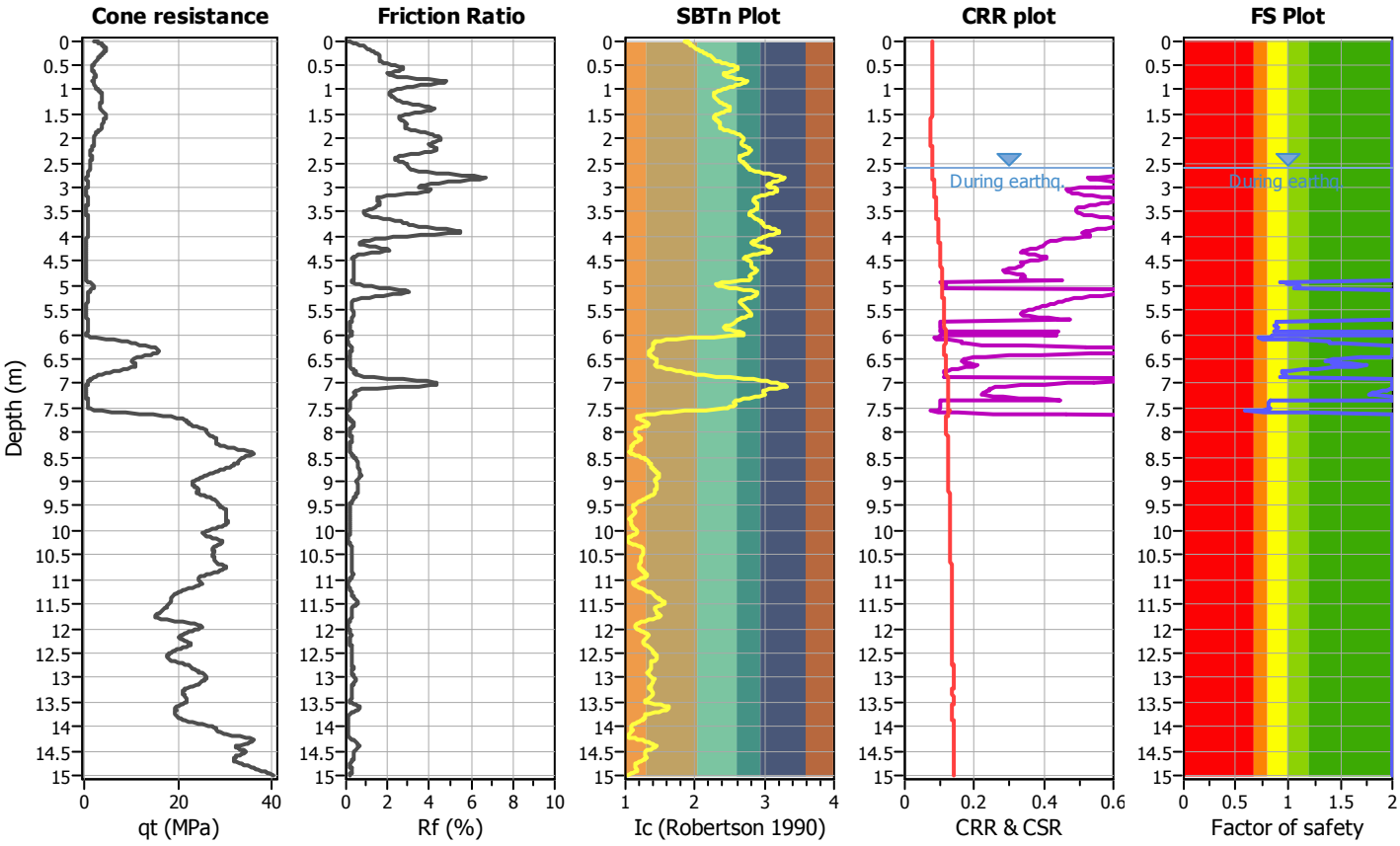
LIQUEFACTION ANALYSIS REPORT

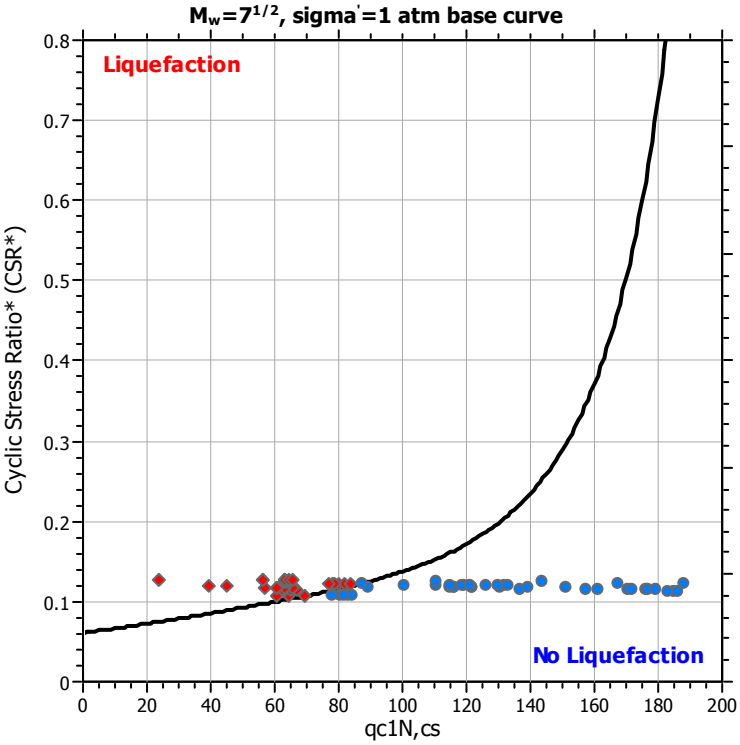
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

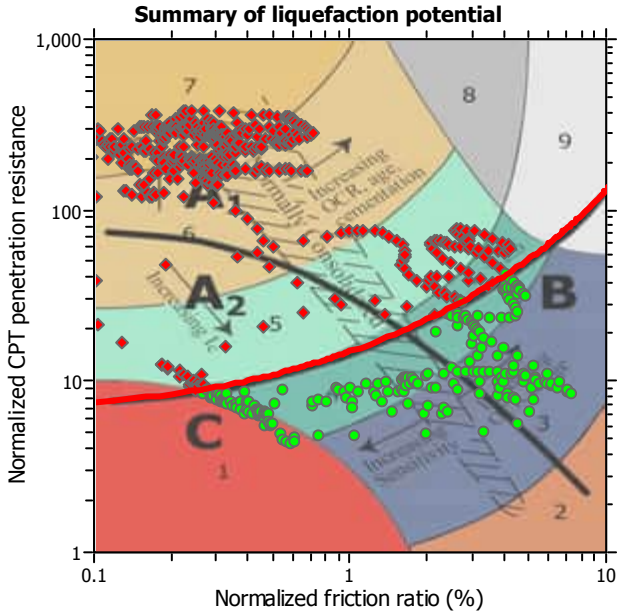
CPT file : CPT_56

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

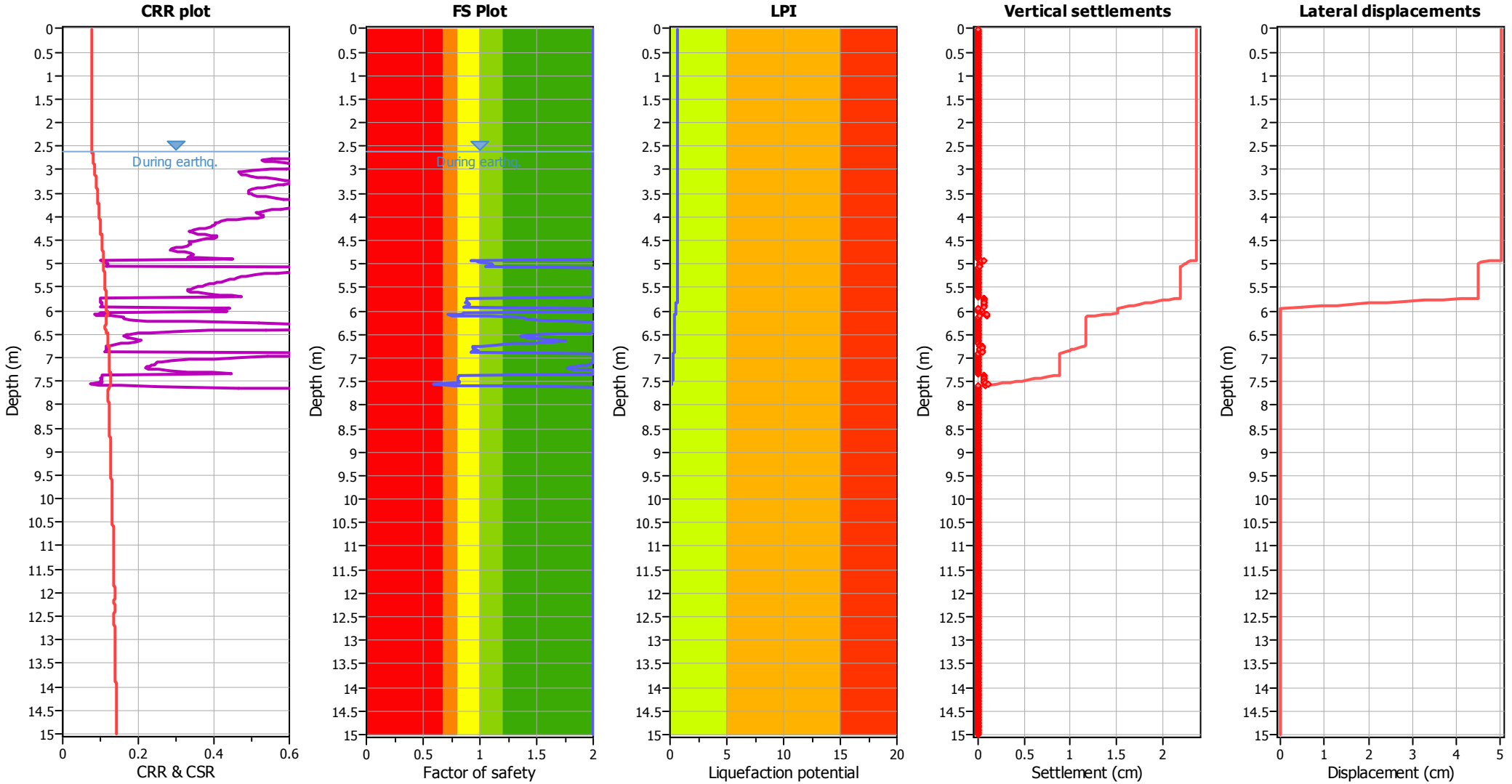






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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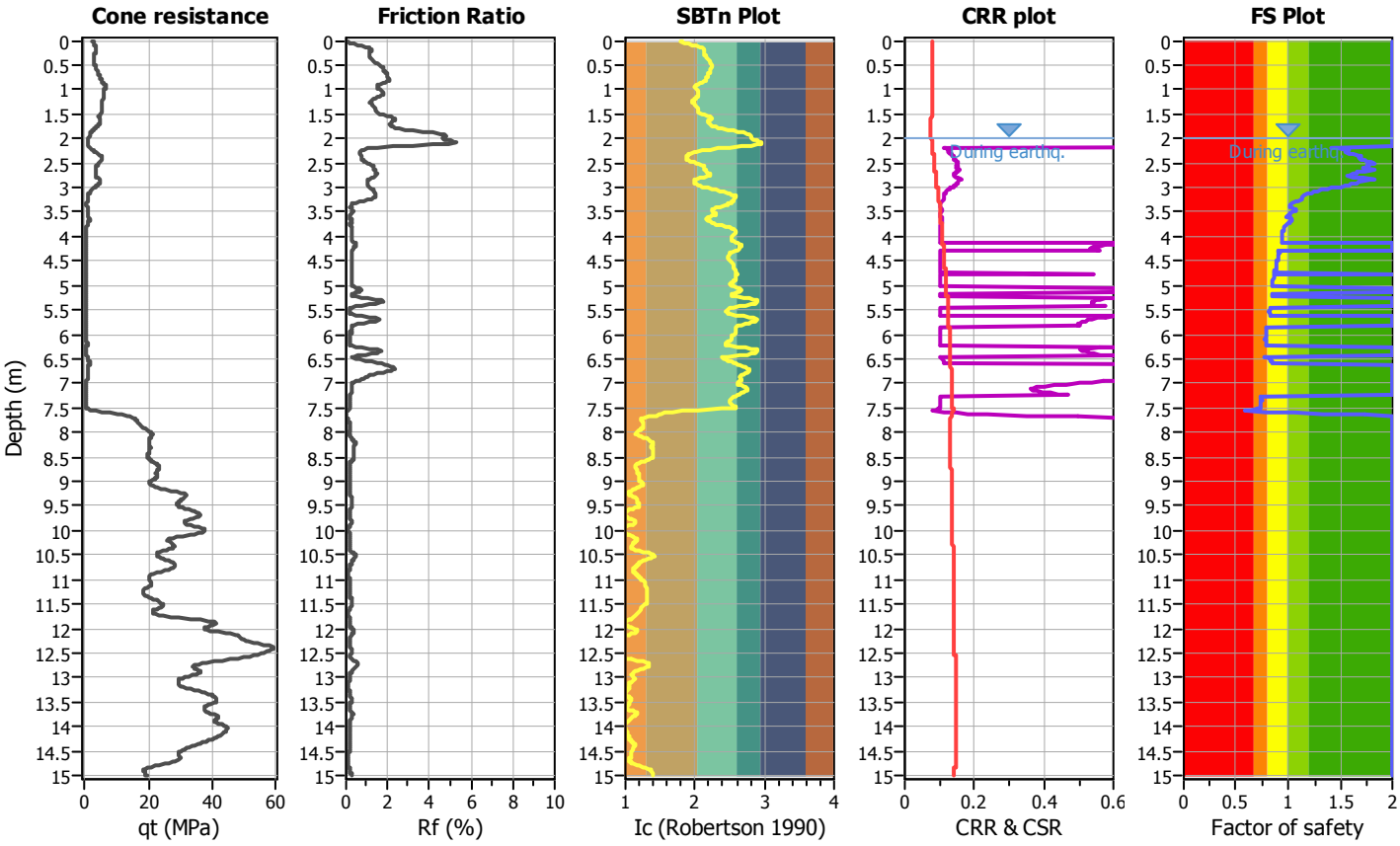
LIQUEFACTION ANALYSIS REPORT

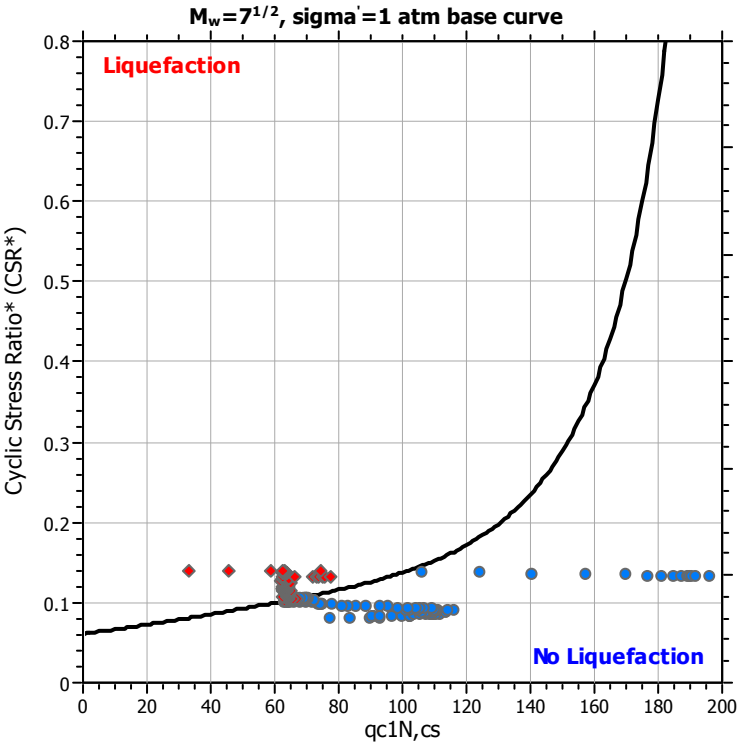
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

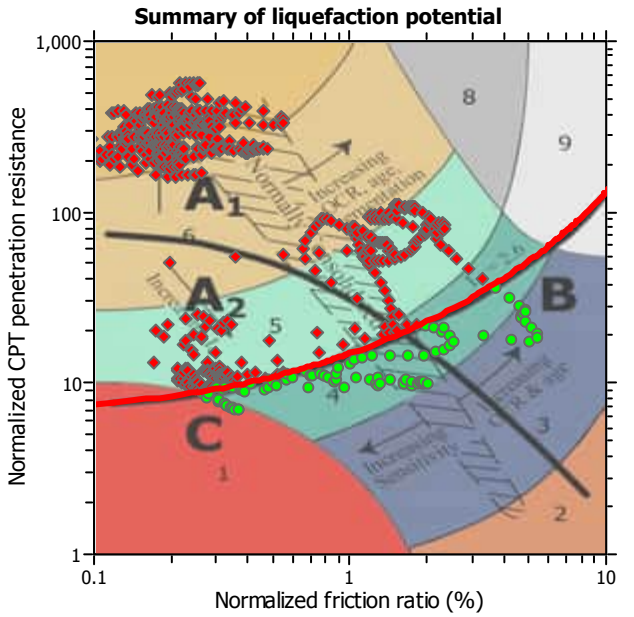
CPT file : CPT_57

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

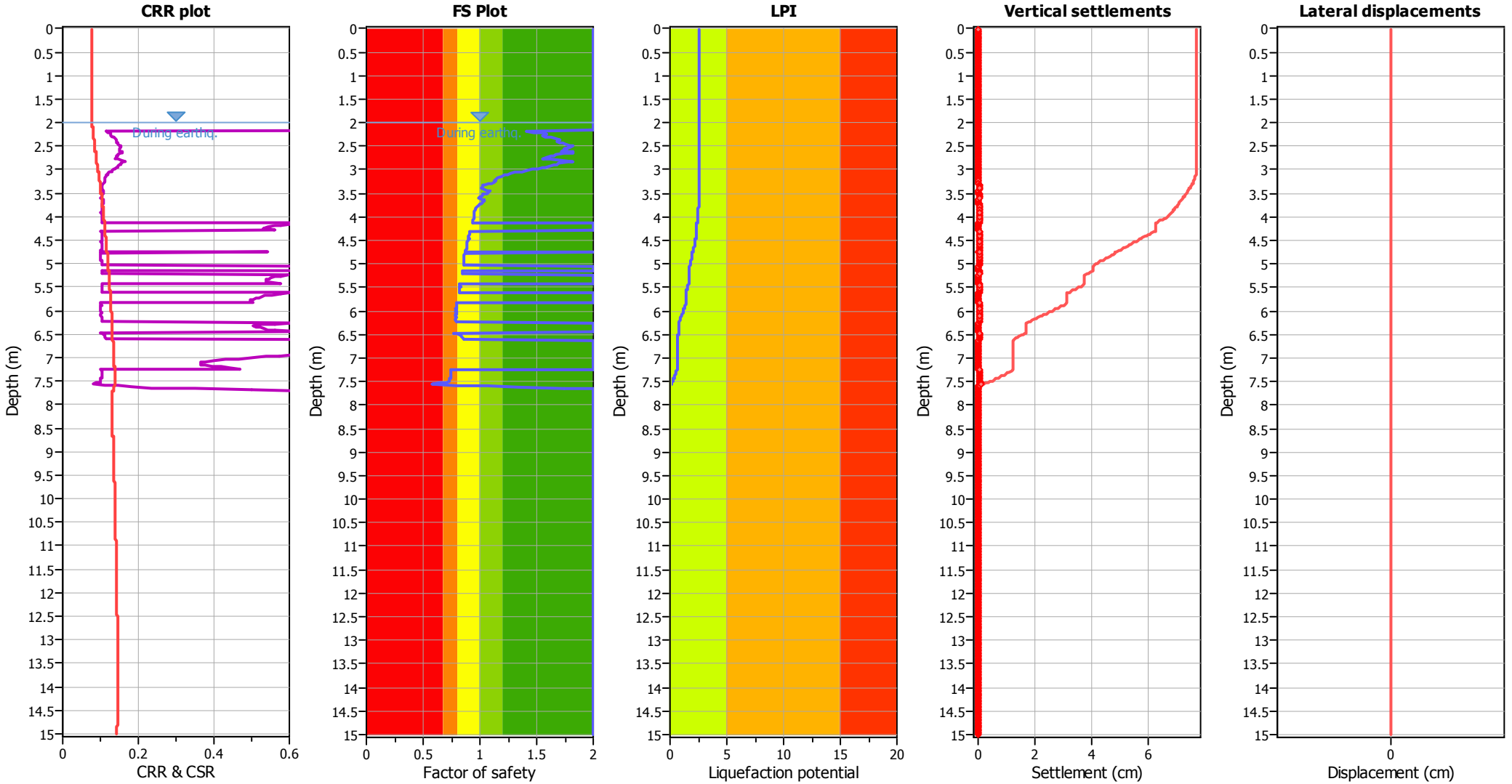






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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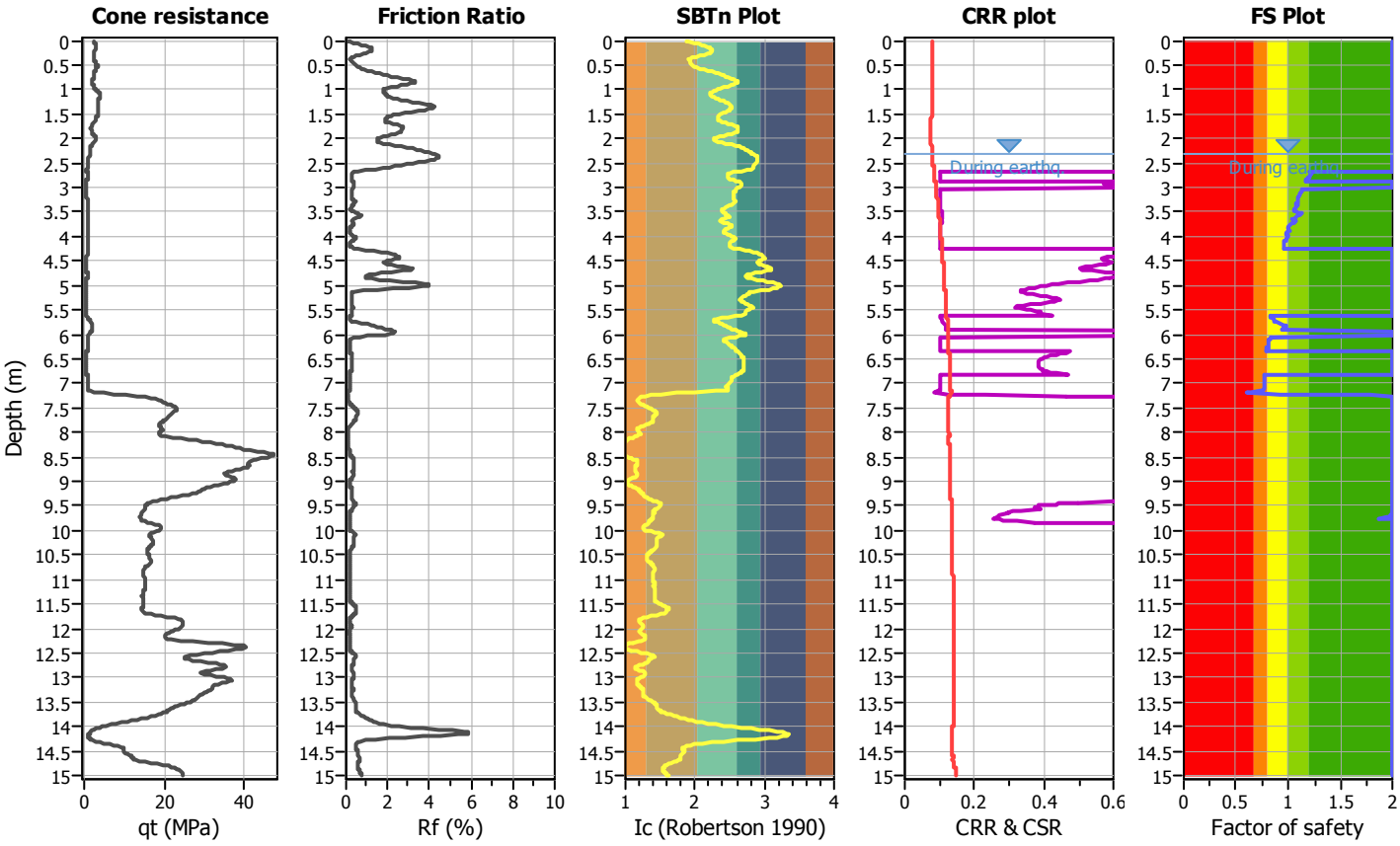
LIQUEFACTION ANALYSIS REPORT

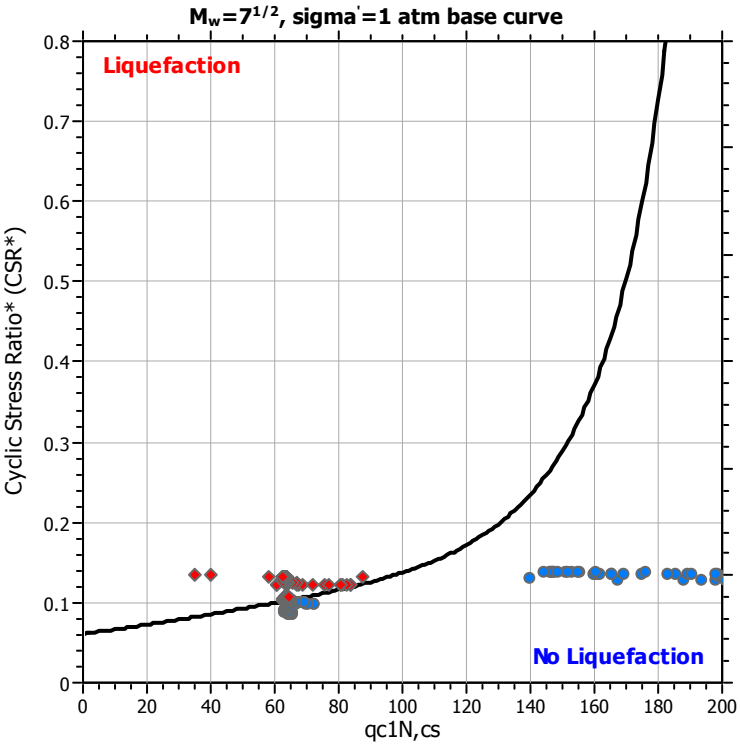
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

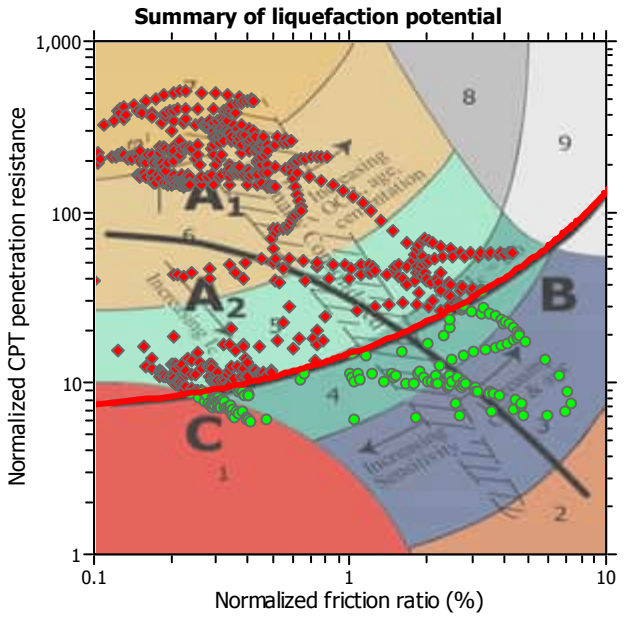
CPT file : CPT_58

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

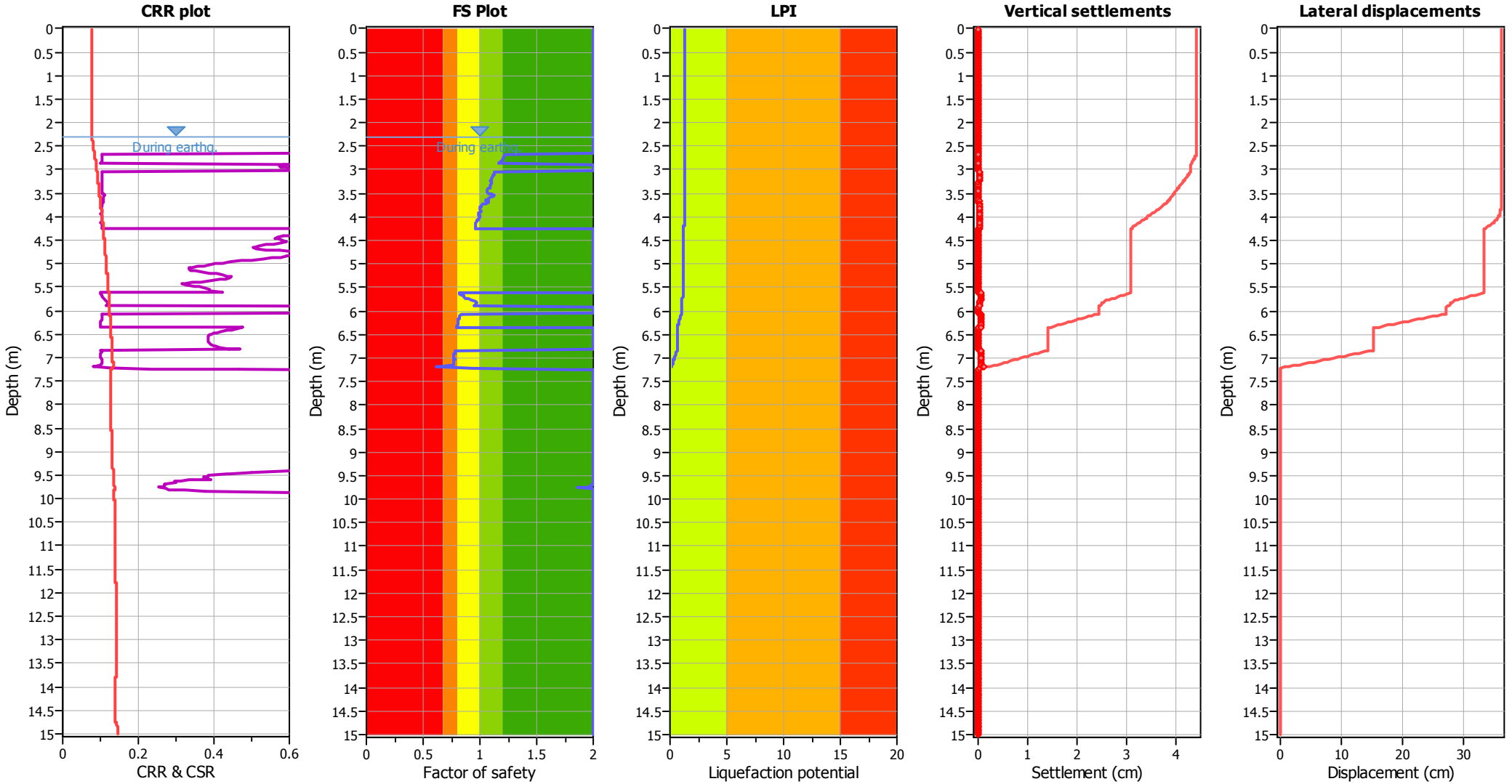






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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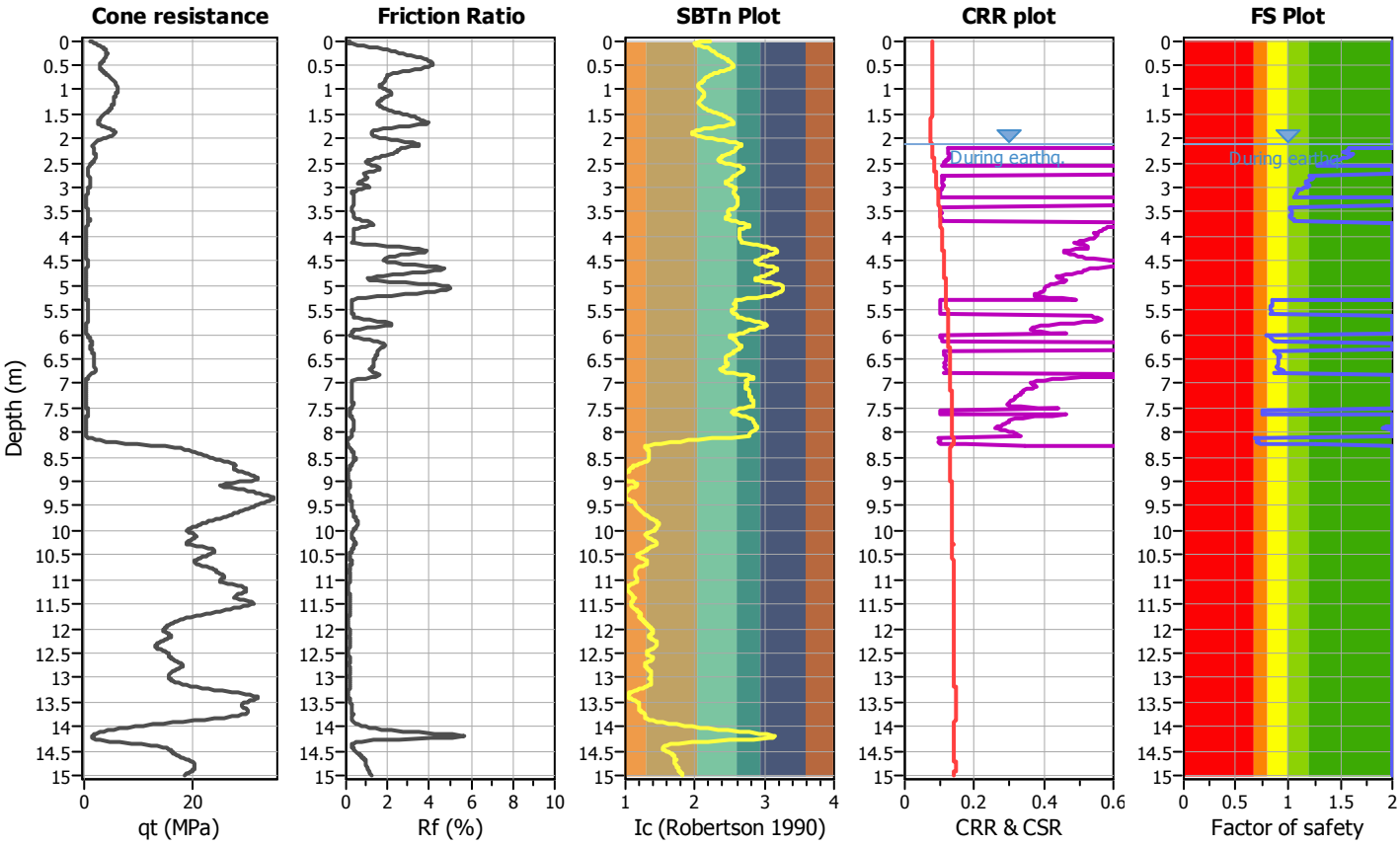
LIQUEFACTION ANALYSIS REPORT

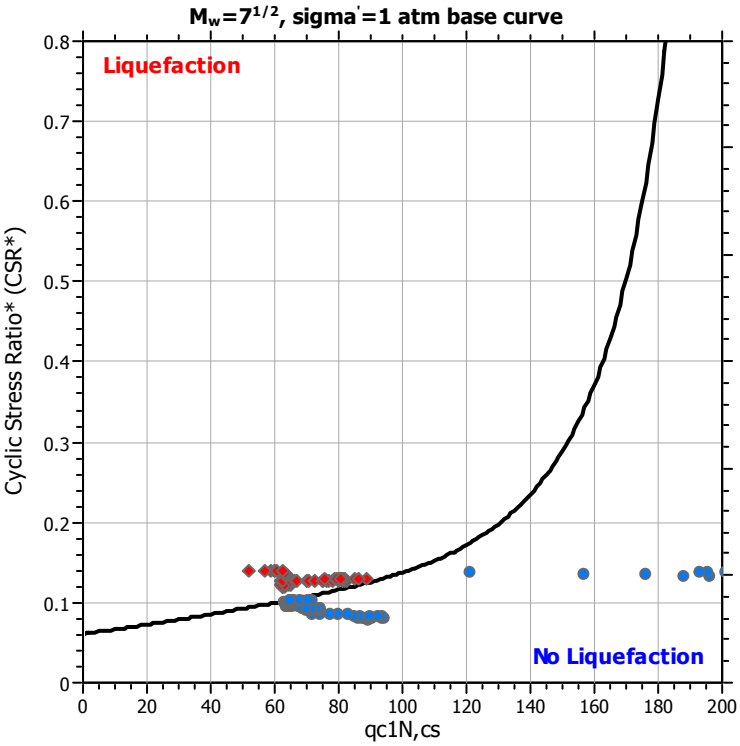
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

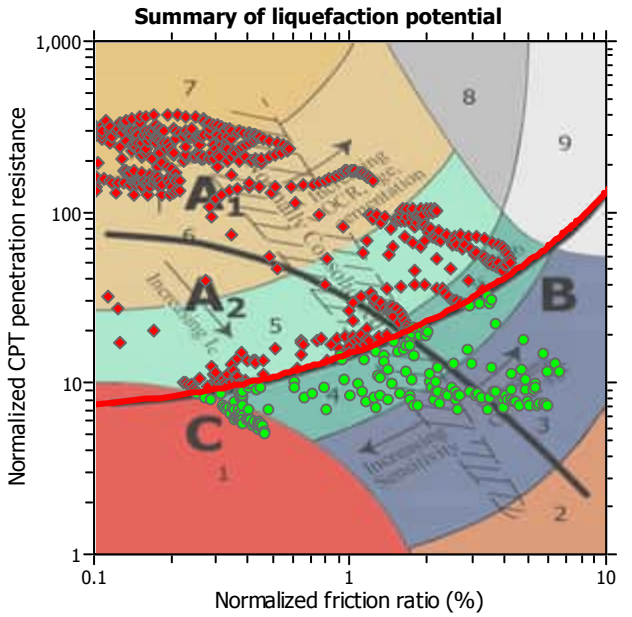
CPT file : CPT_59

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

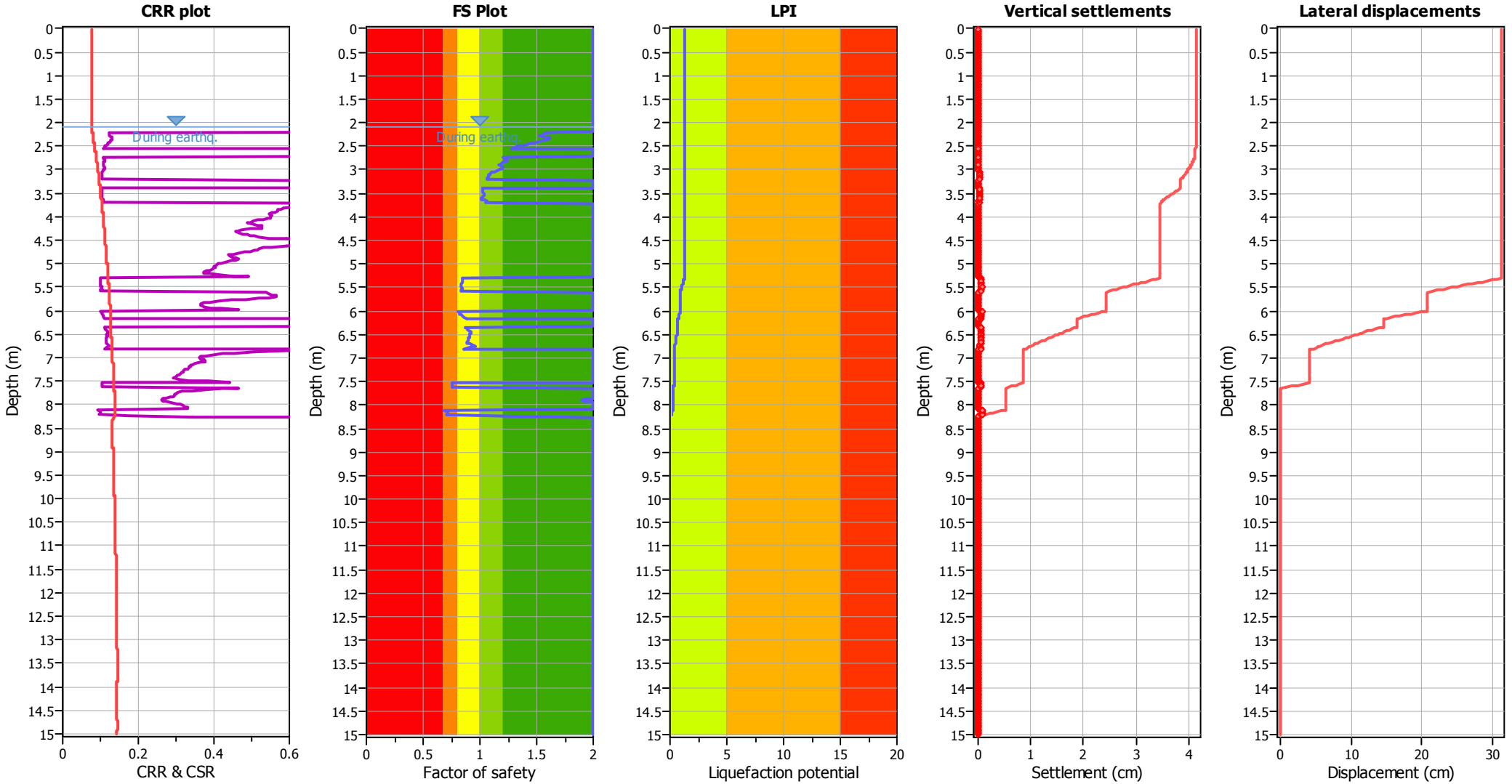






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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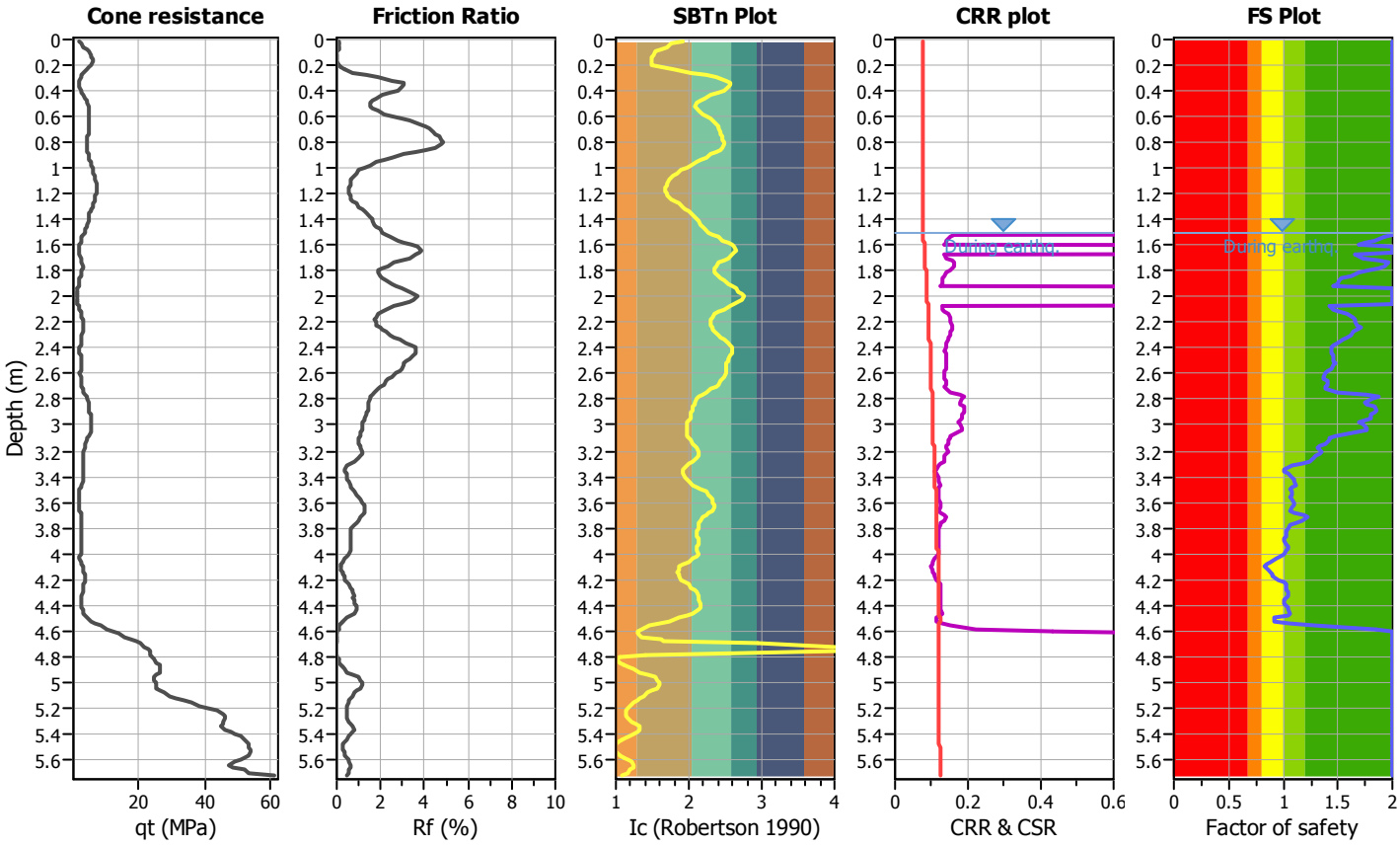
LIQUEFACTION ANALYSIS REPORT

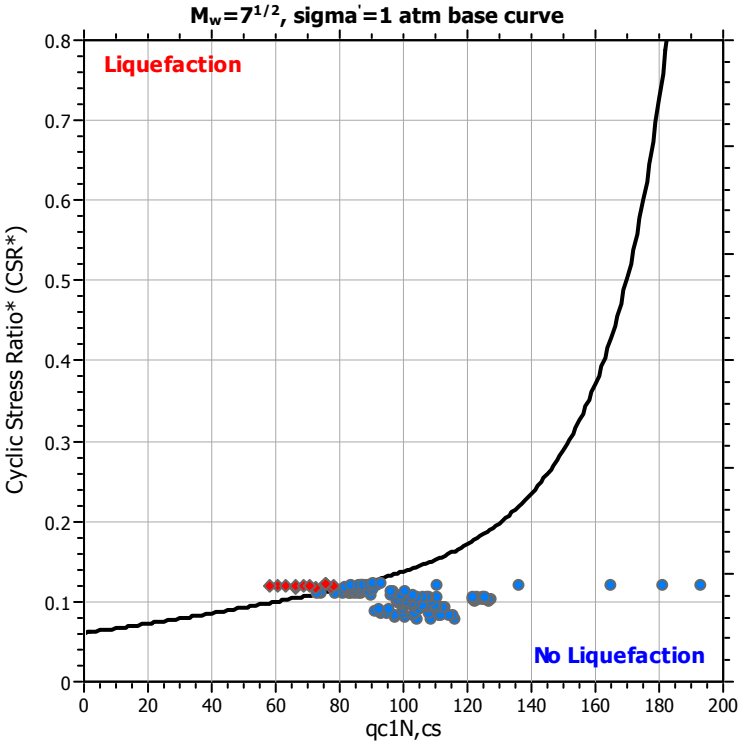
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

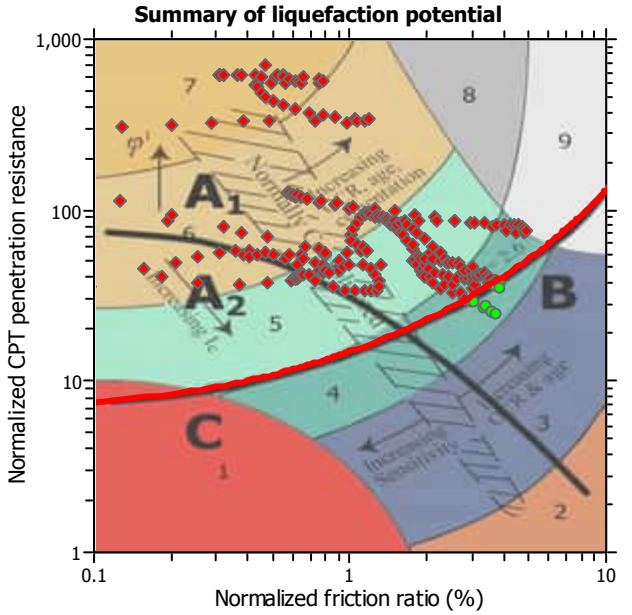
CPT file : CPT_60

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

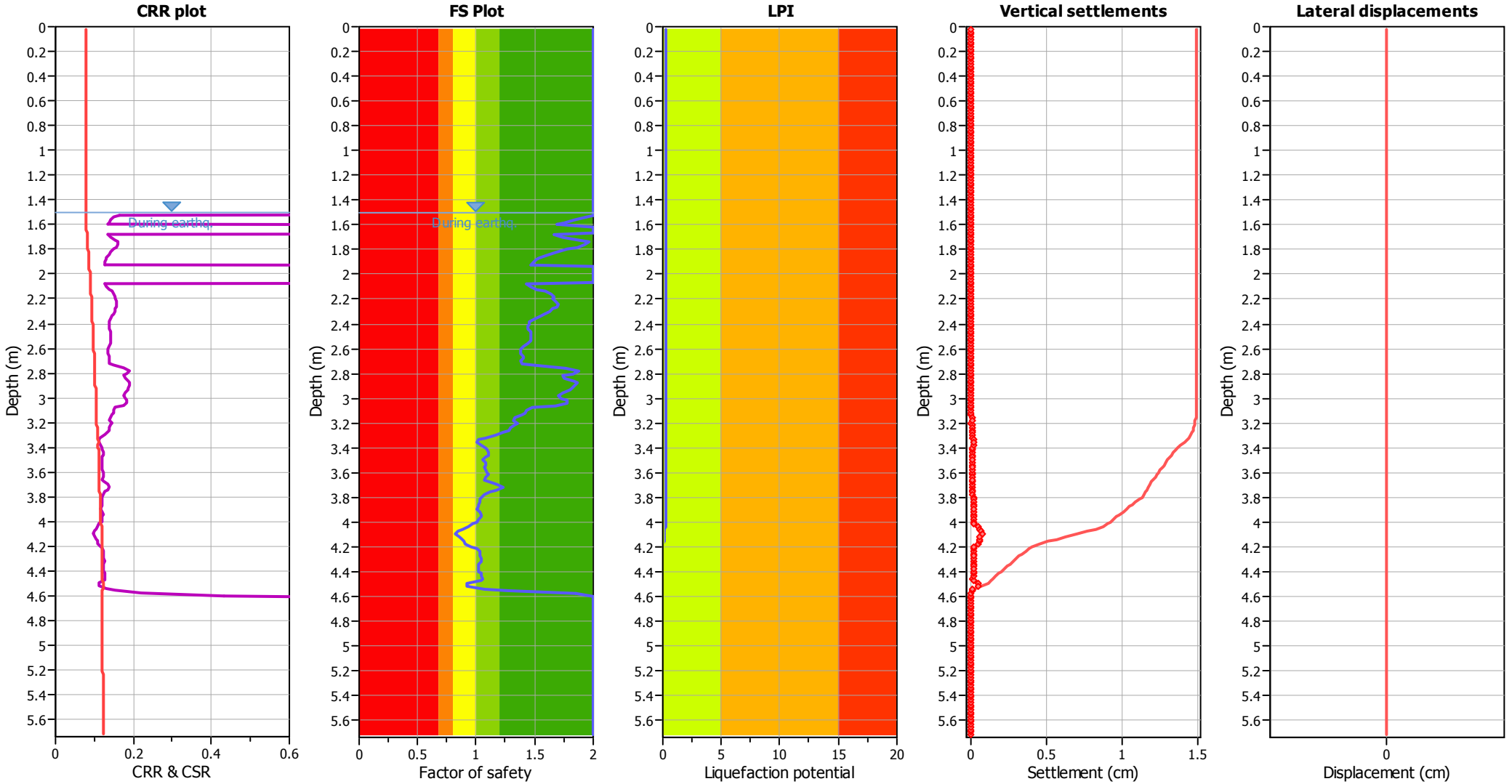






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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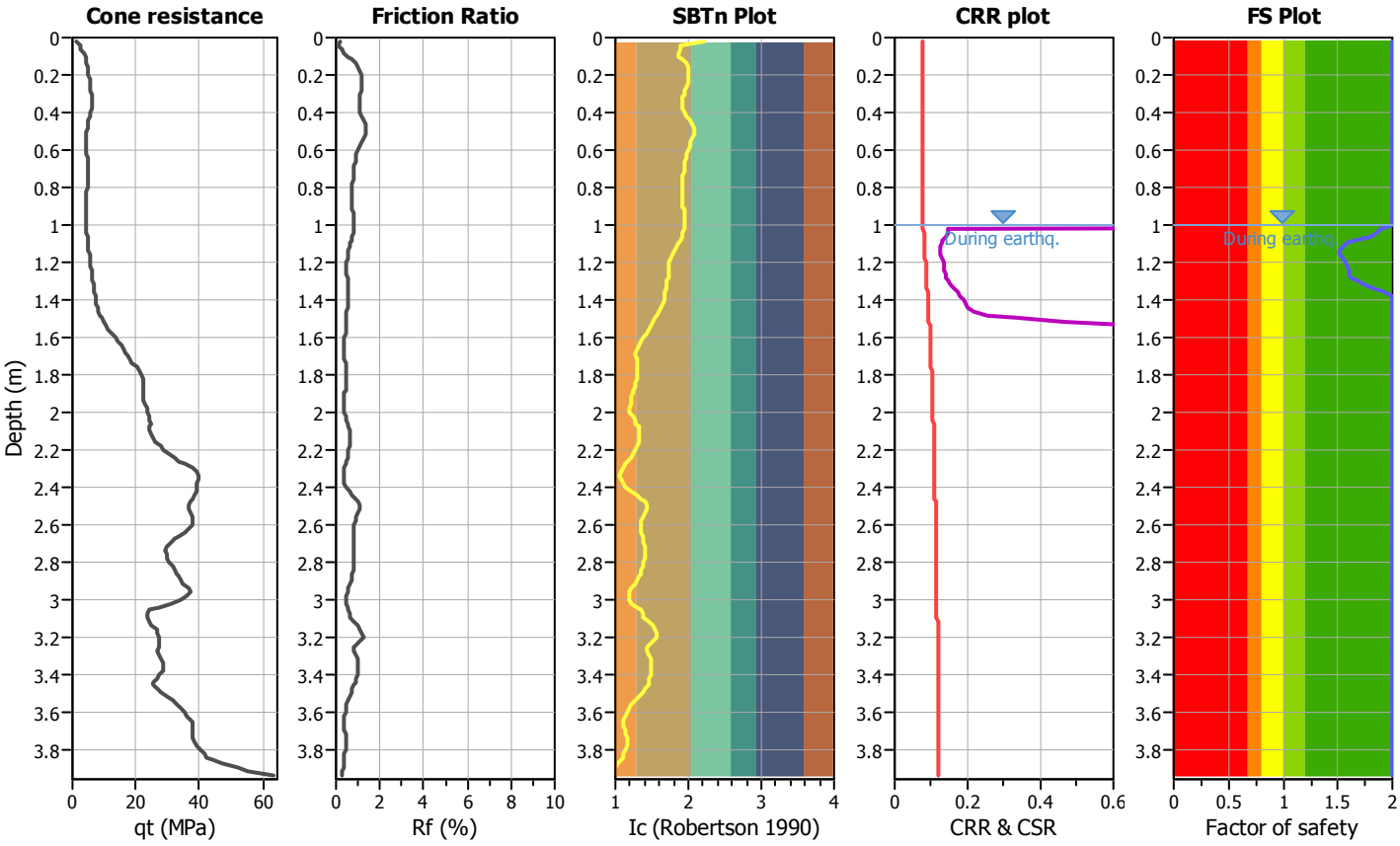
LIQUEFACTION ANALYSIS REPORT

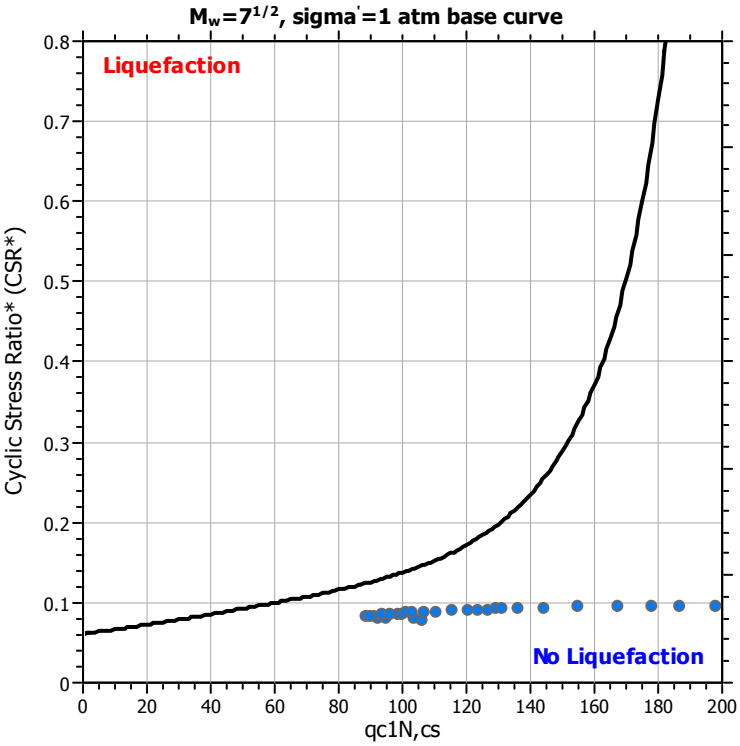
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

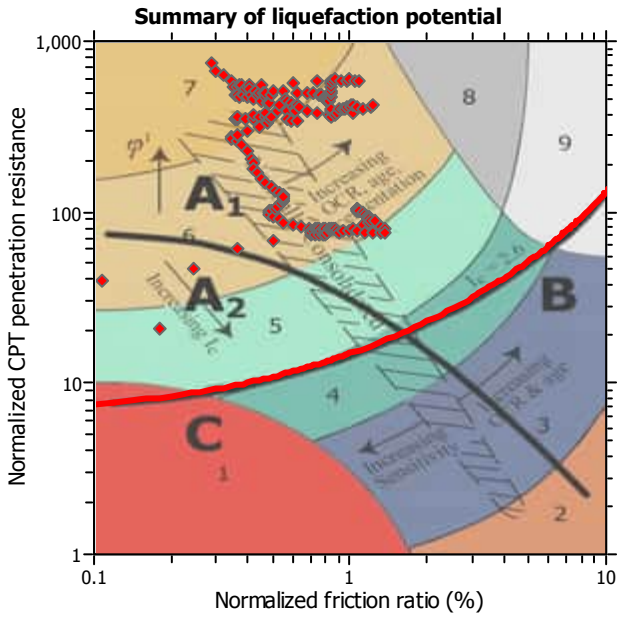
CPT file : CPT_61

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

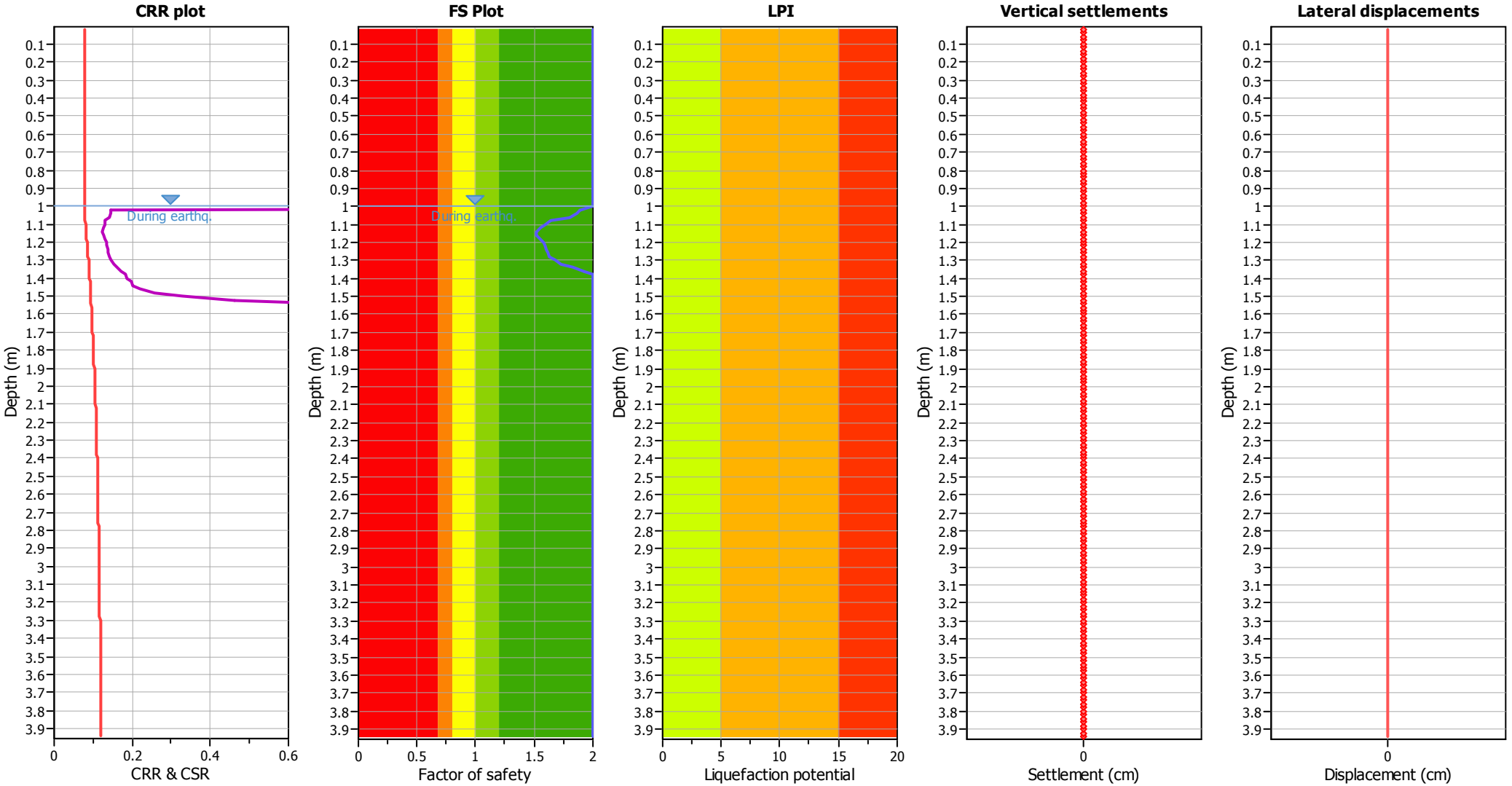






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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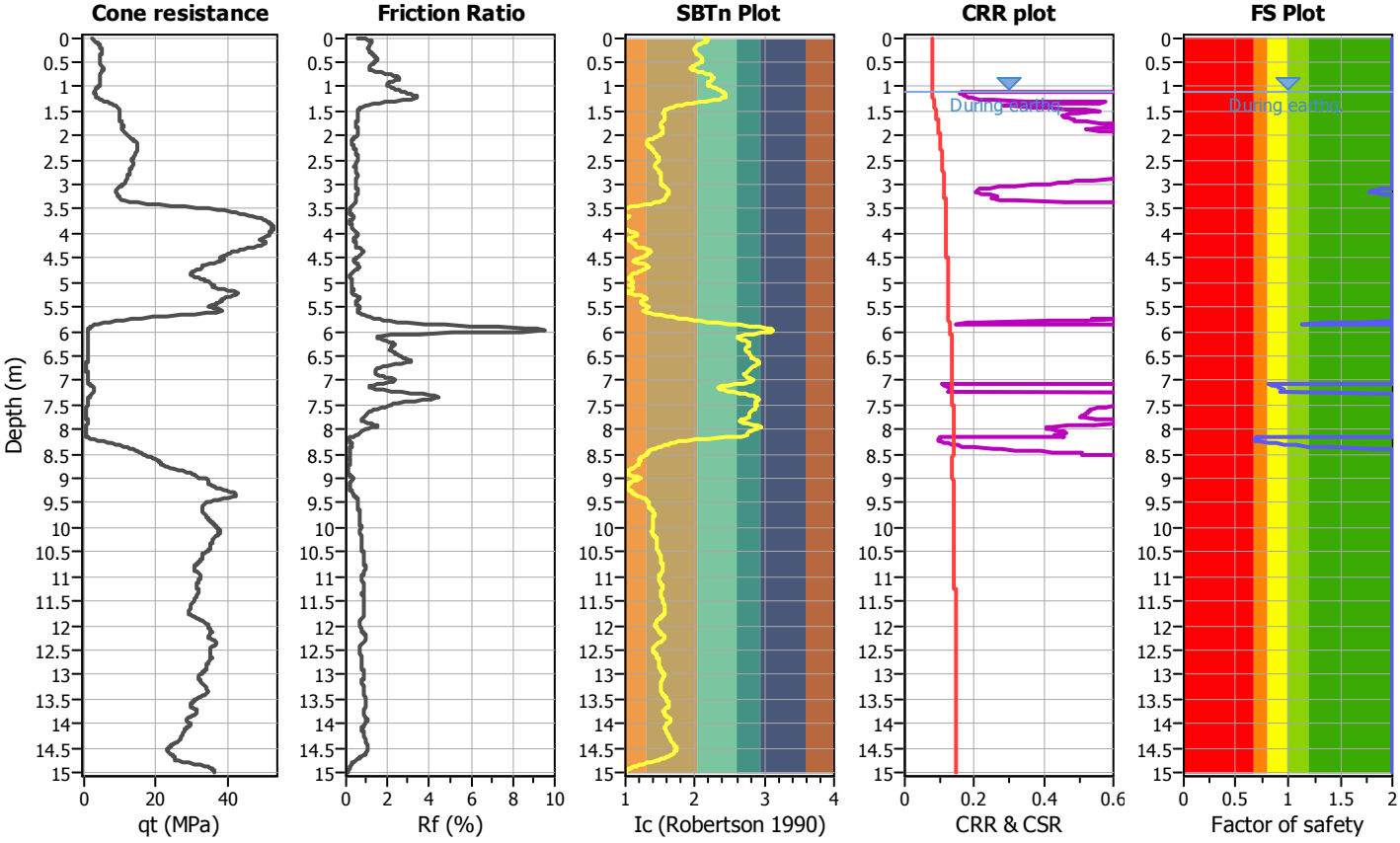
LIQUEFACTION ANALYSIS REPORT

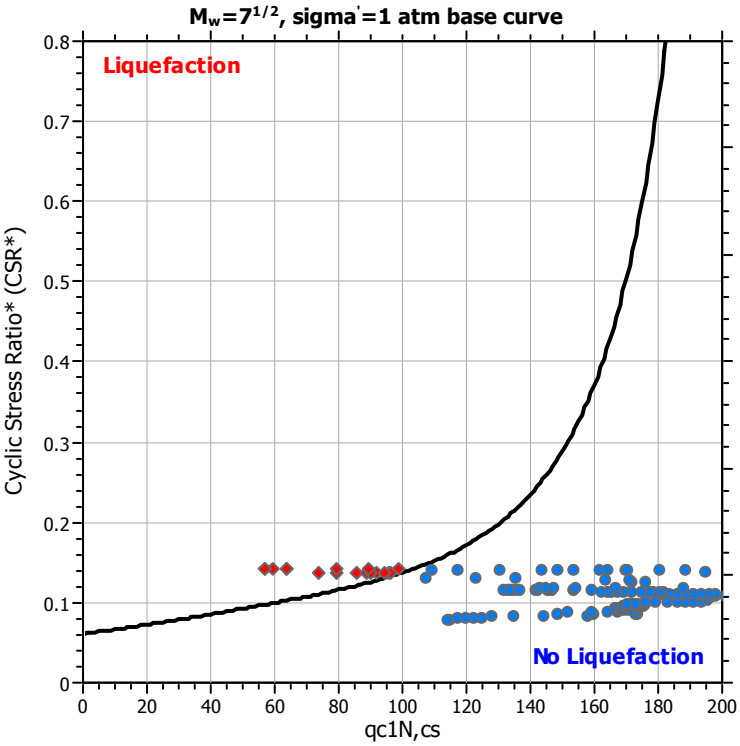
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

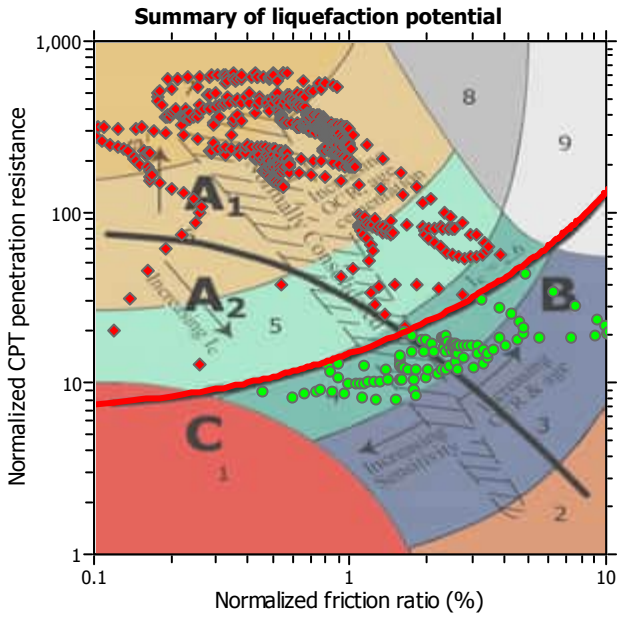
CPT file : CPT_62

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

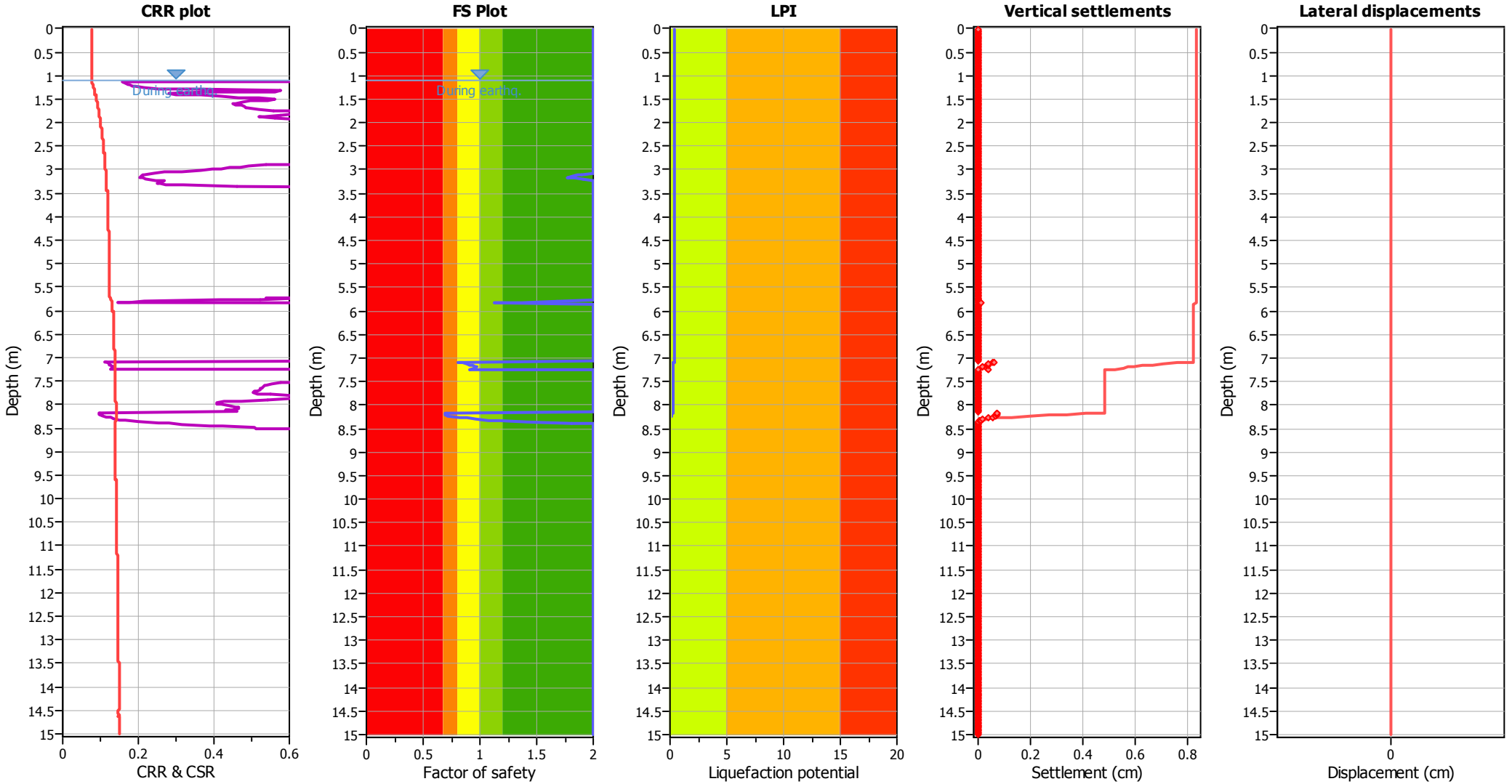






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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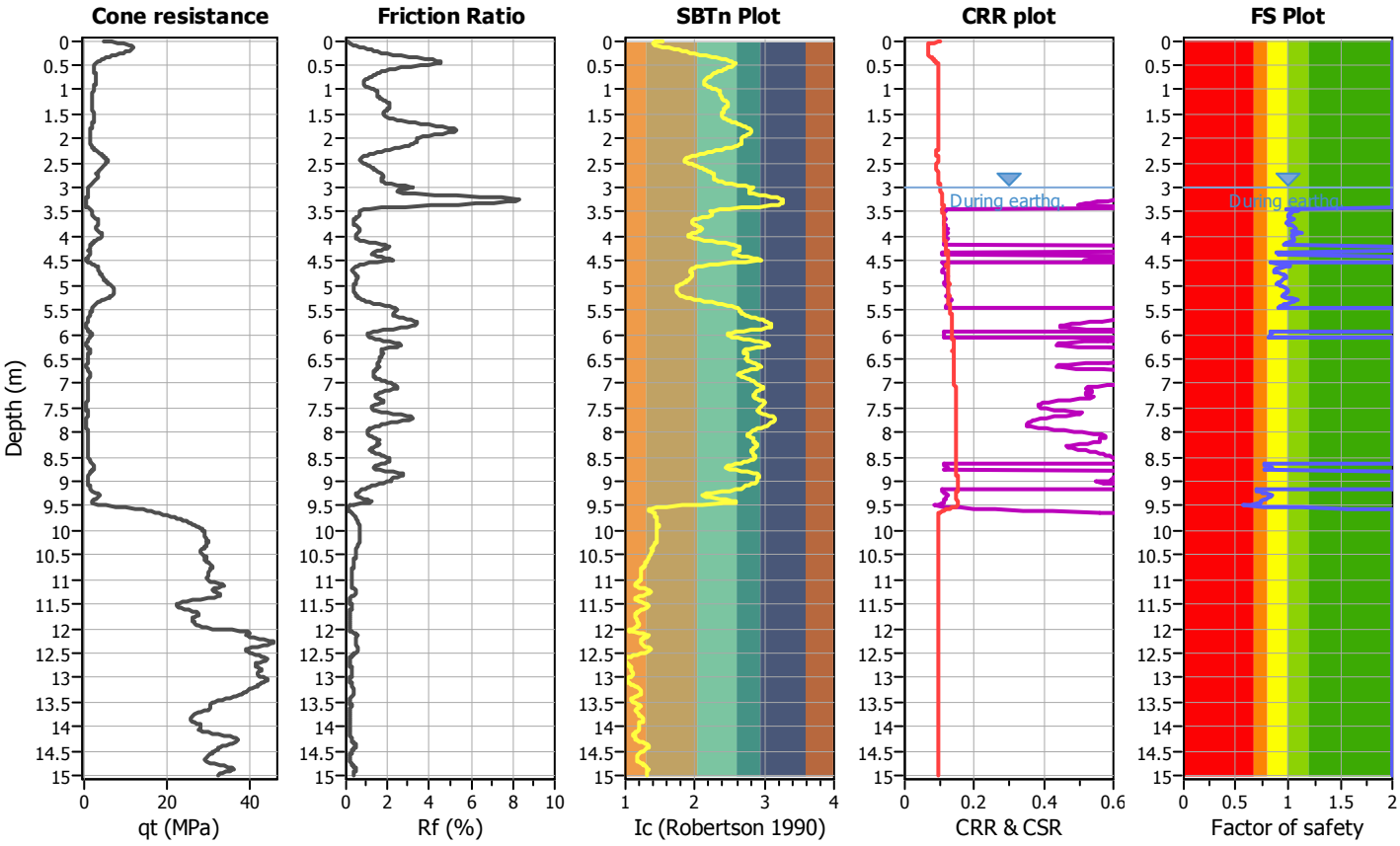
LIQUEFACTION ANALYSIS REPORT

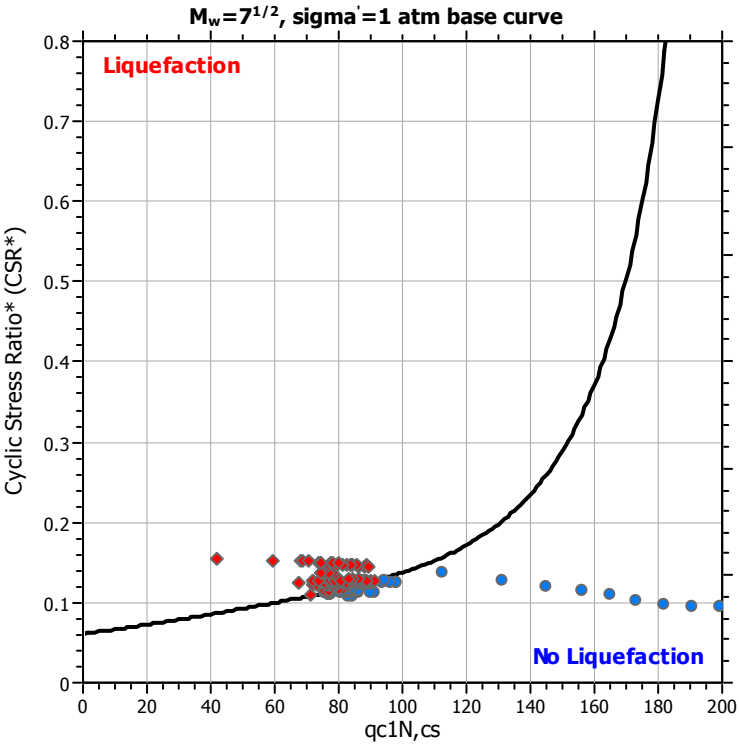
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

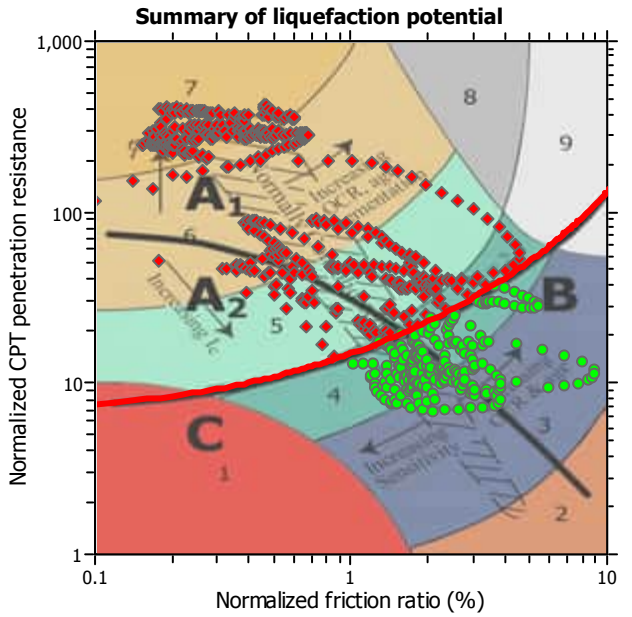
CPT file : CPT_01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

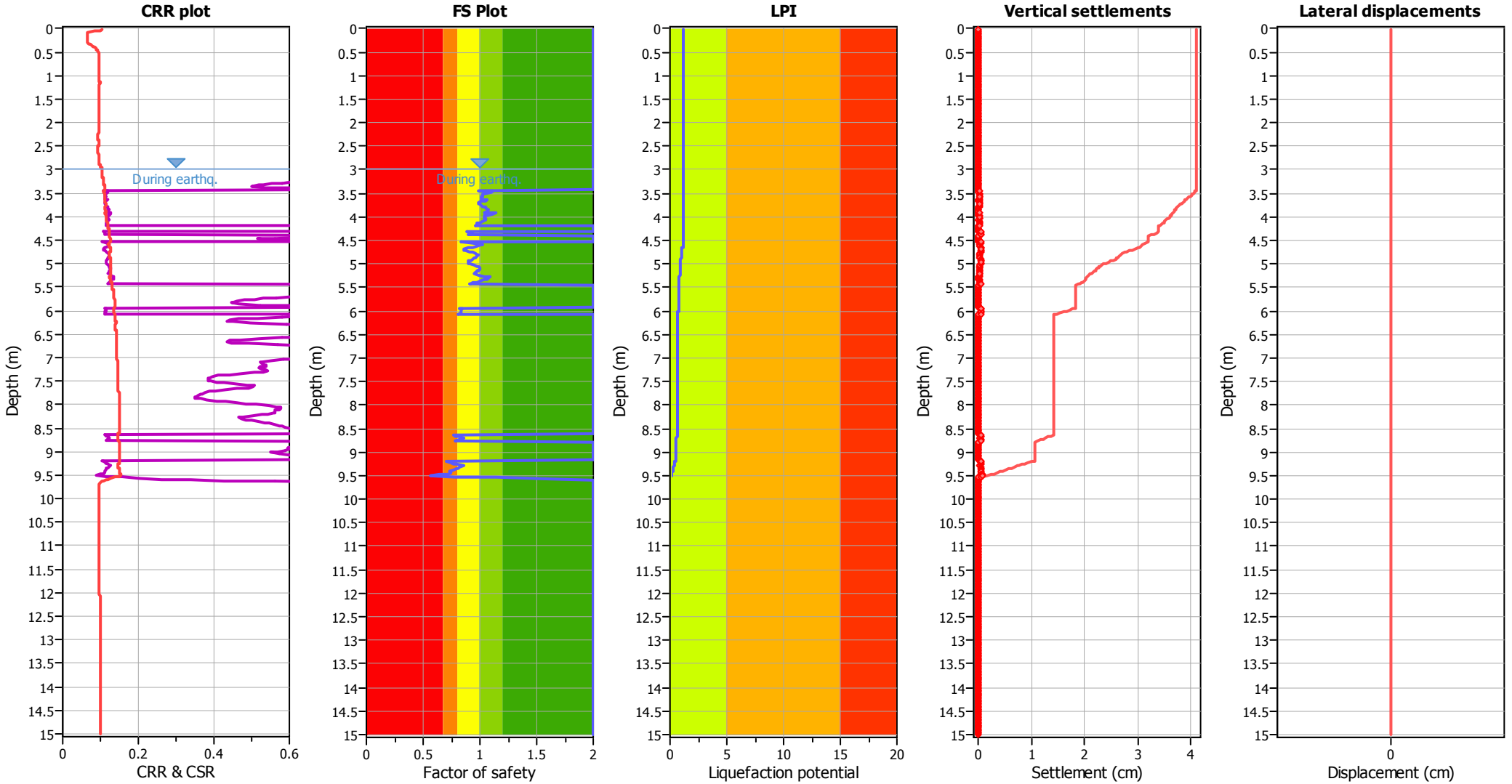






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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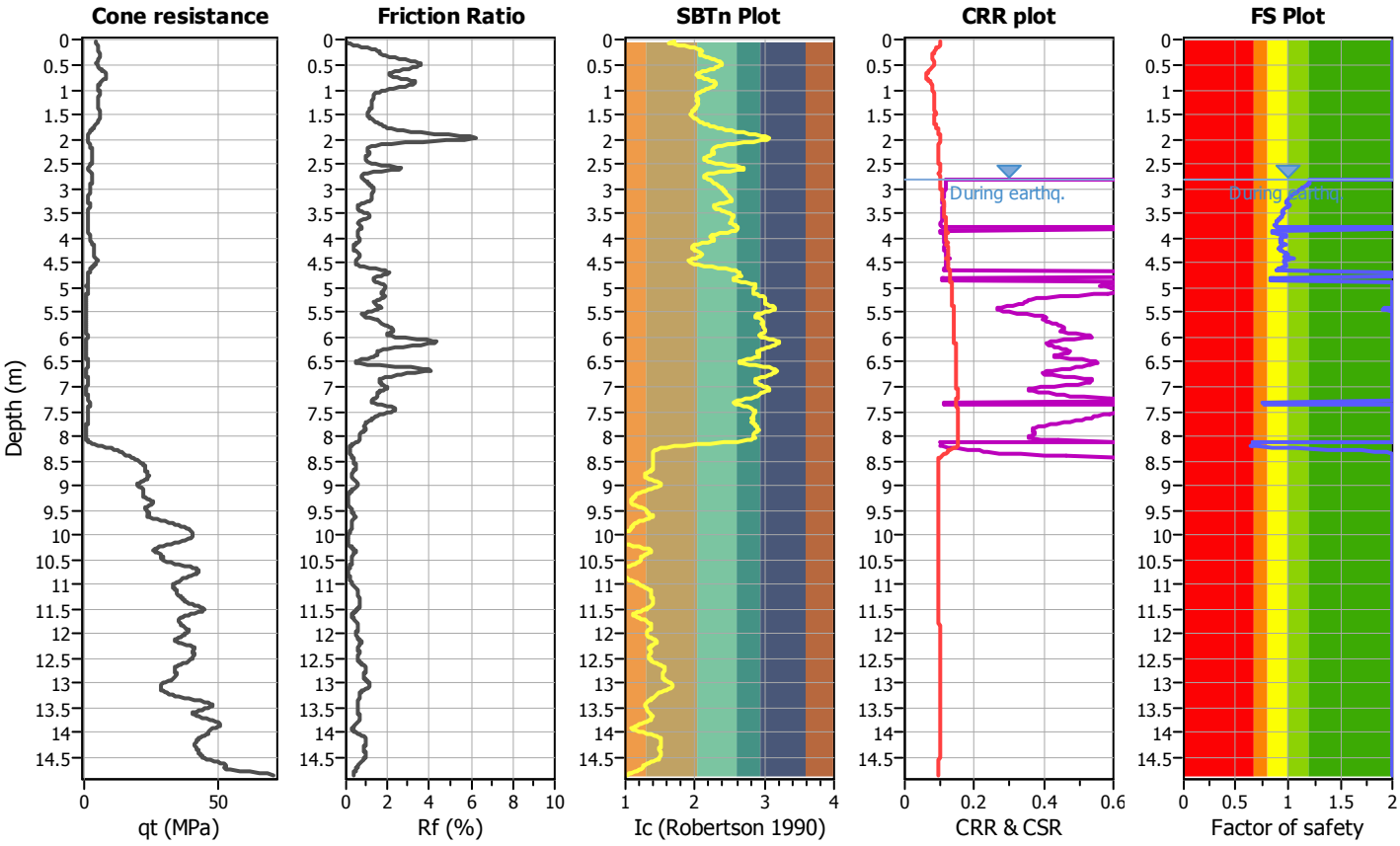
LIQUEFACTION ANALYSIS REPORT

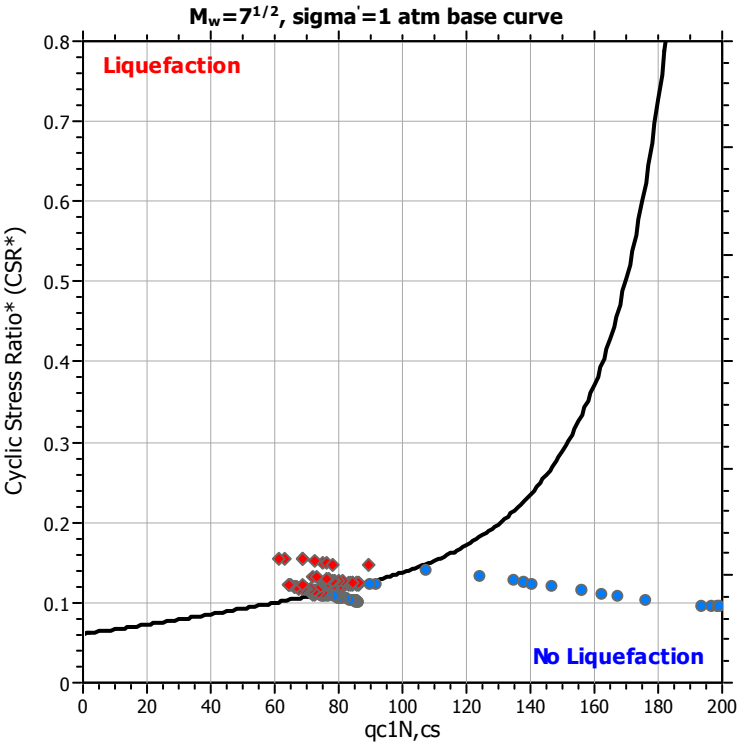
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

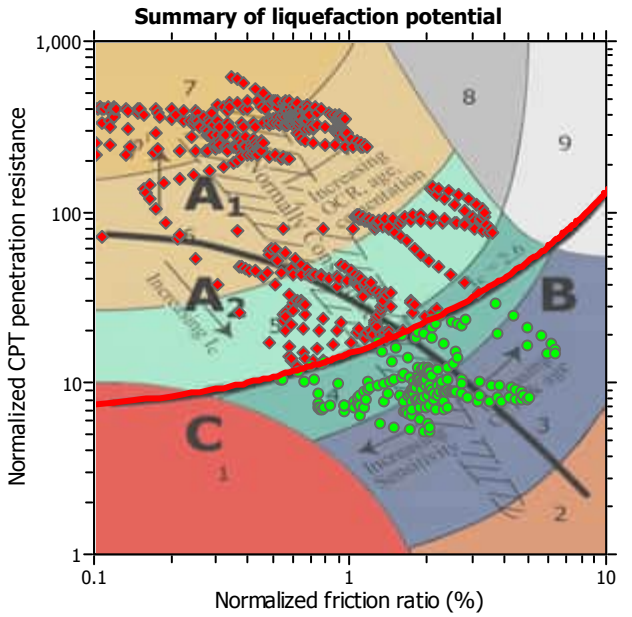
CPT file : CPT_02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

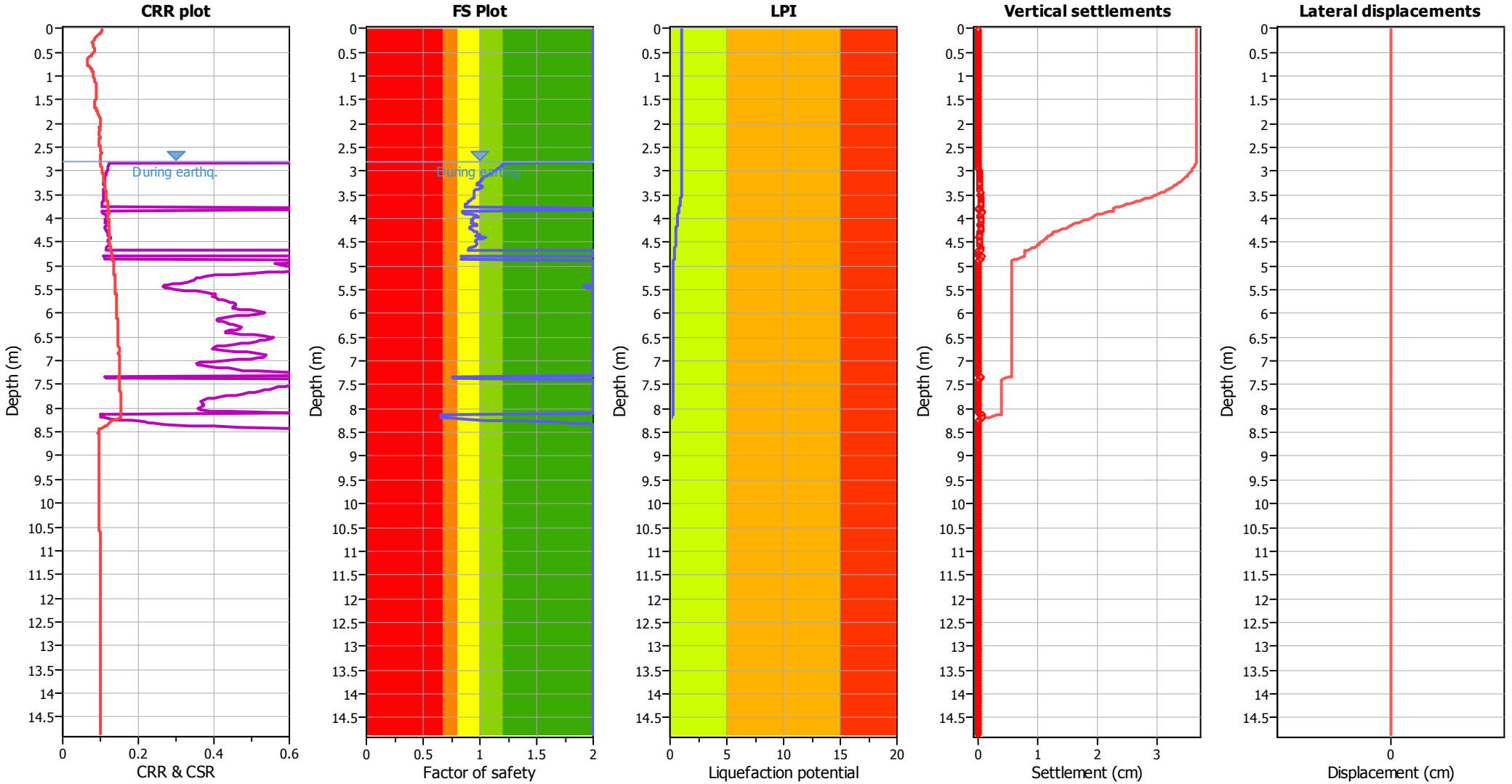






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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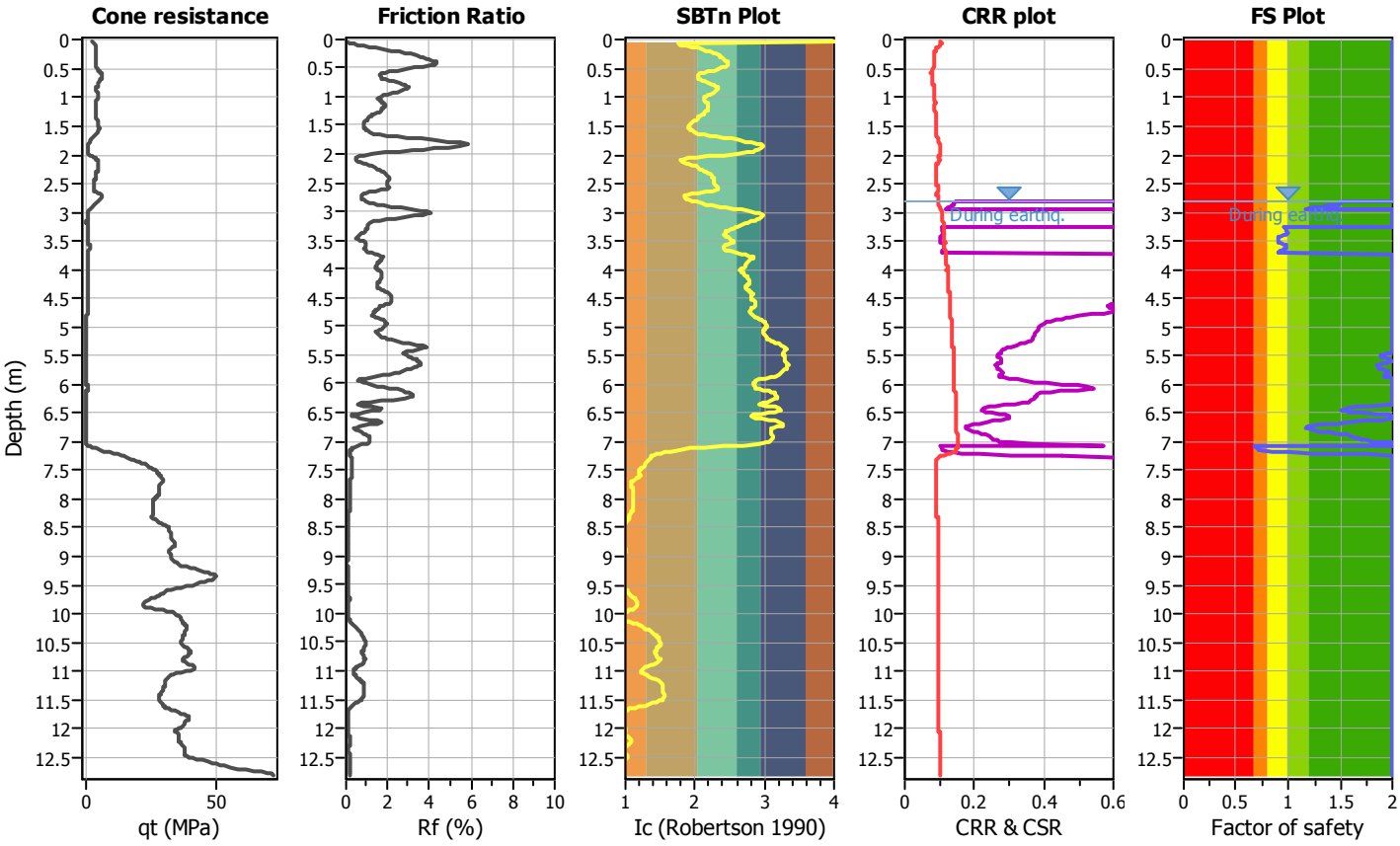
LIQUEFACTION ANALYSIS REPORT

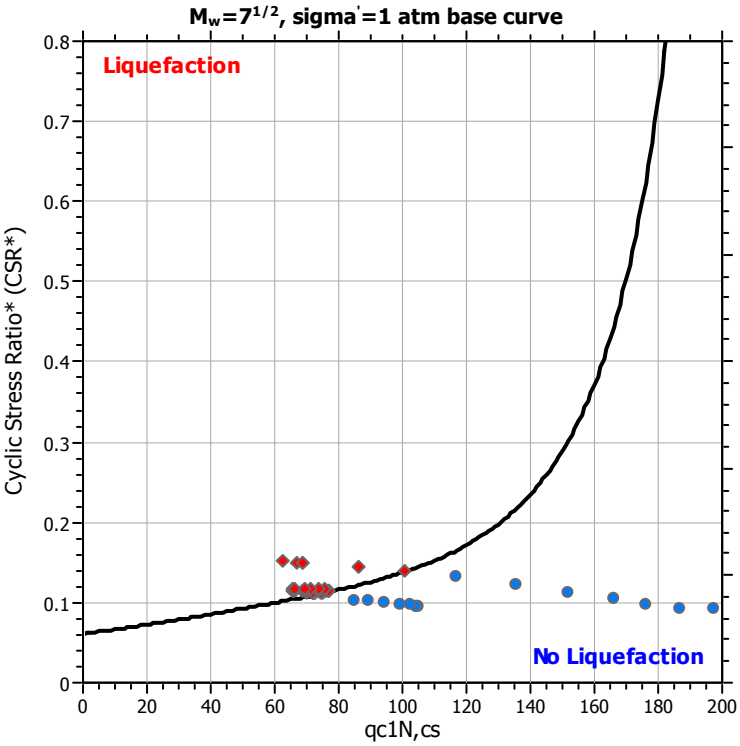
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

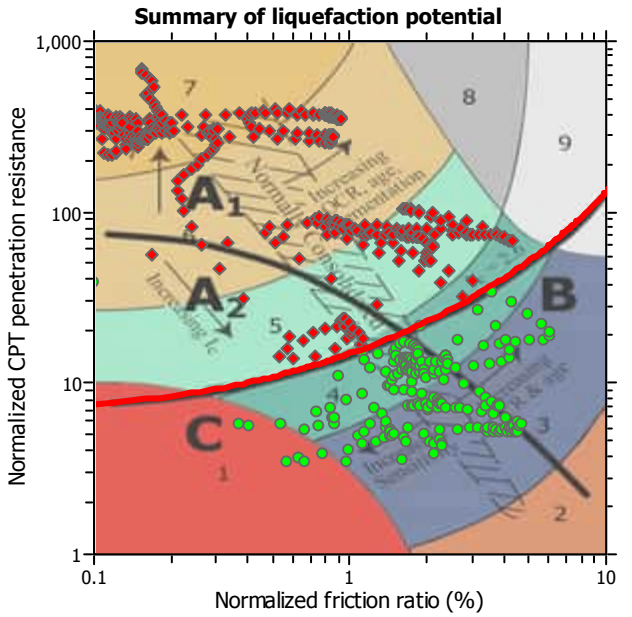
CPT file : CPT_03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

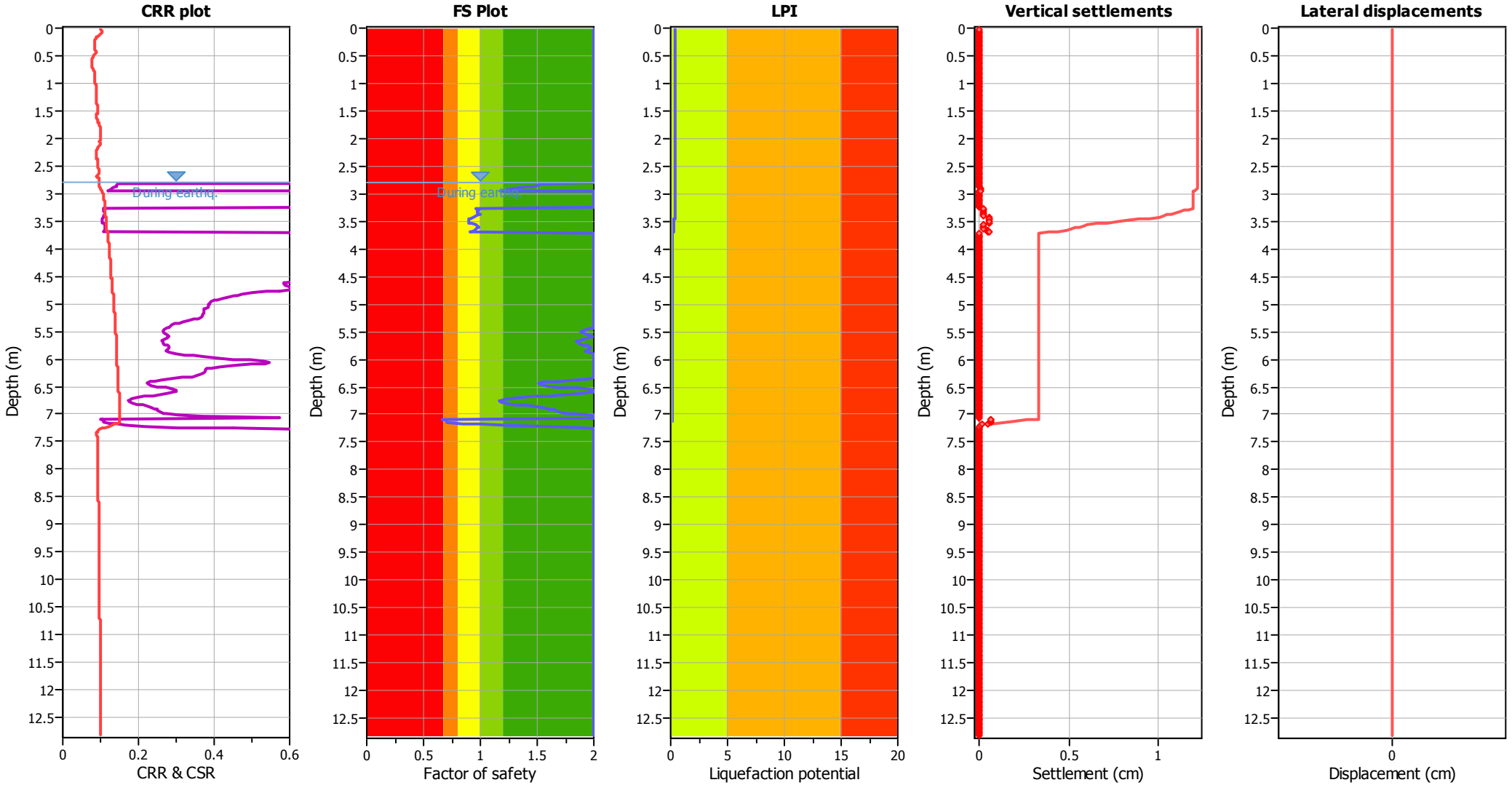






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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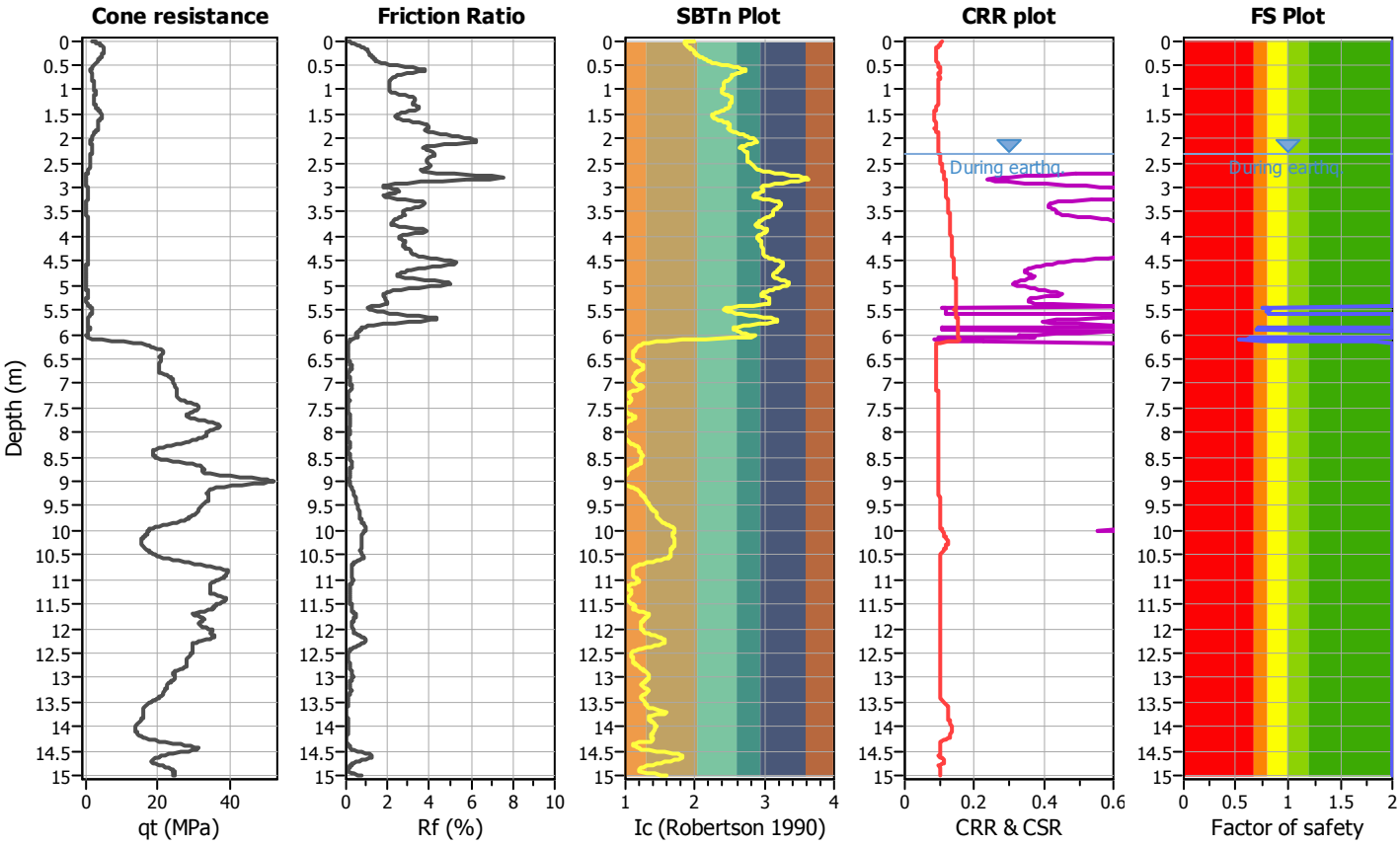
LIQUEFACTION ANALYSIS REPORT

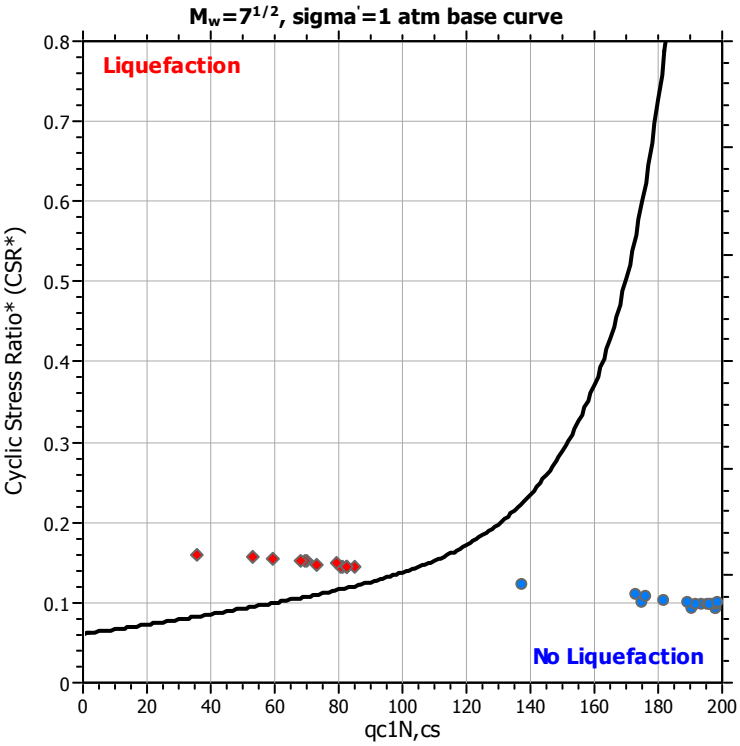
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

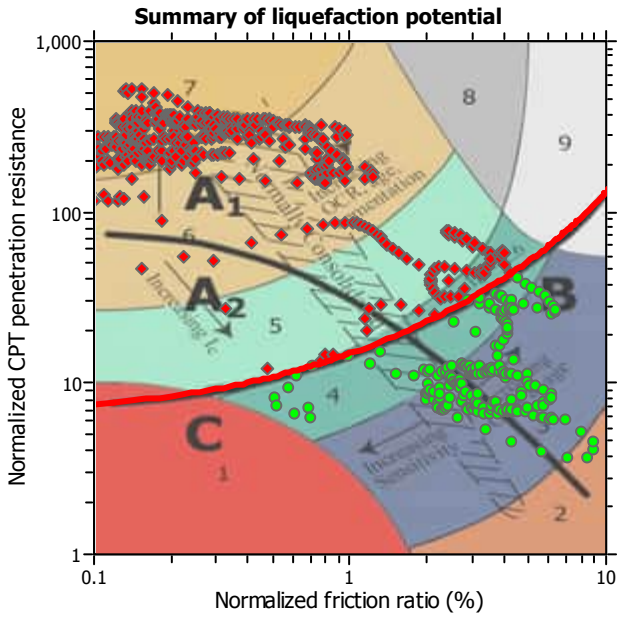
CPT file : CPT_04

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

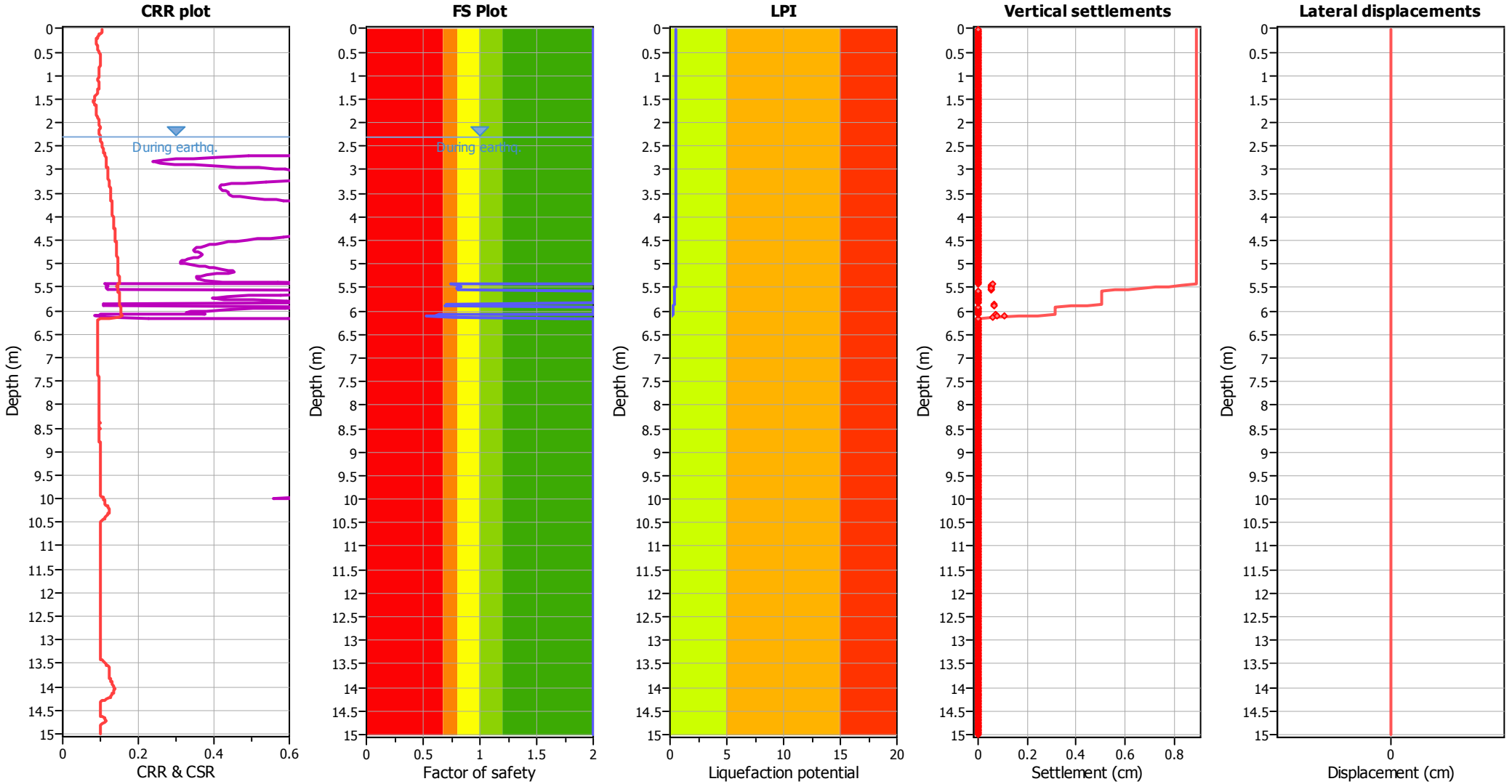






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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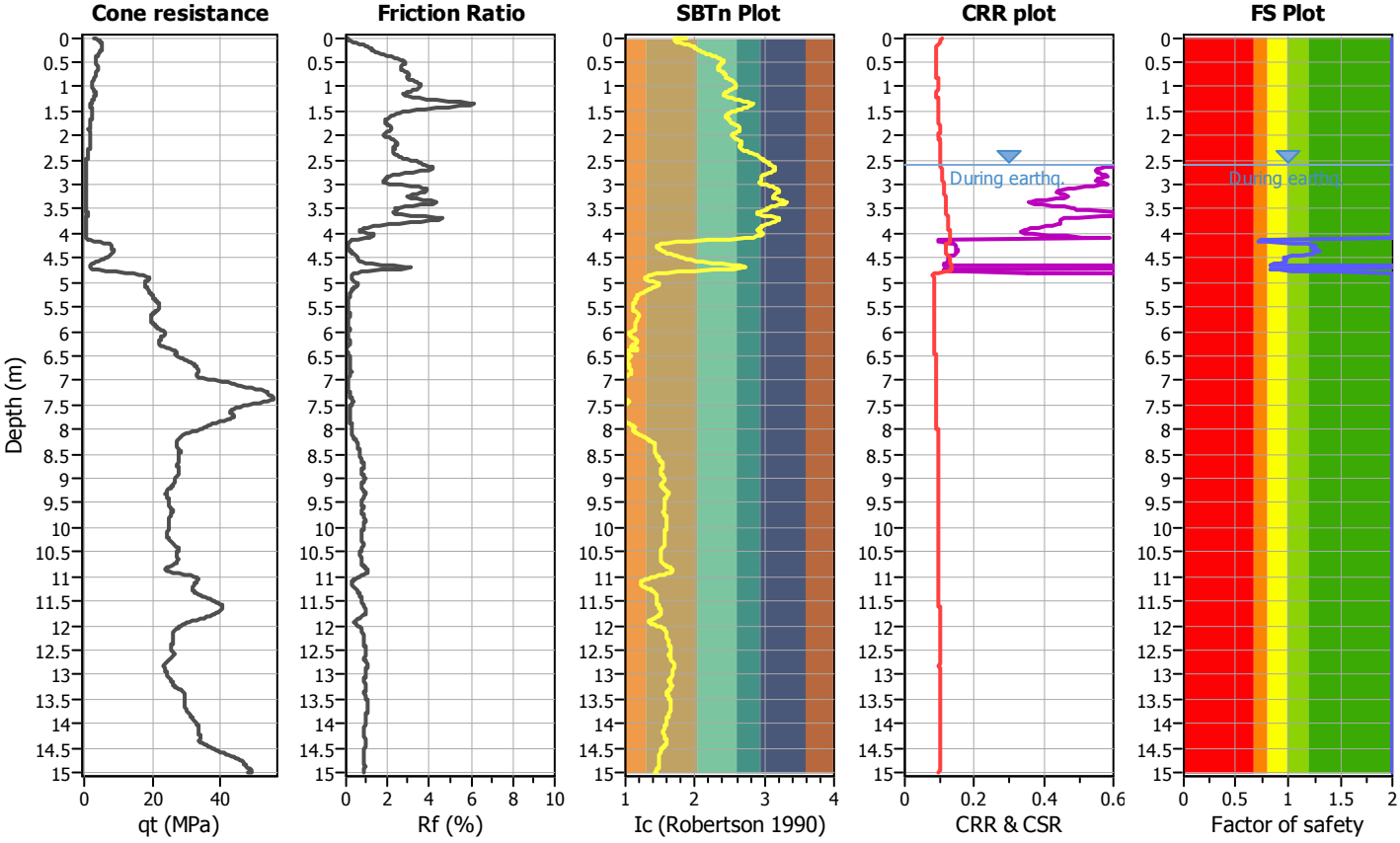
LIQUEFACTION ANALYSIS REPORT

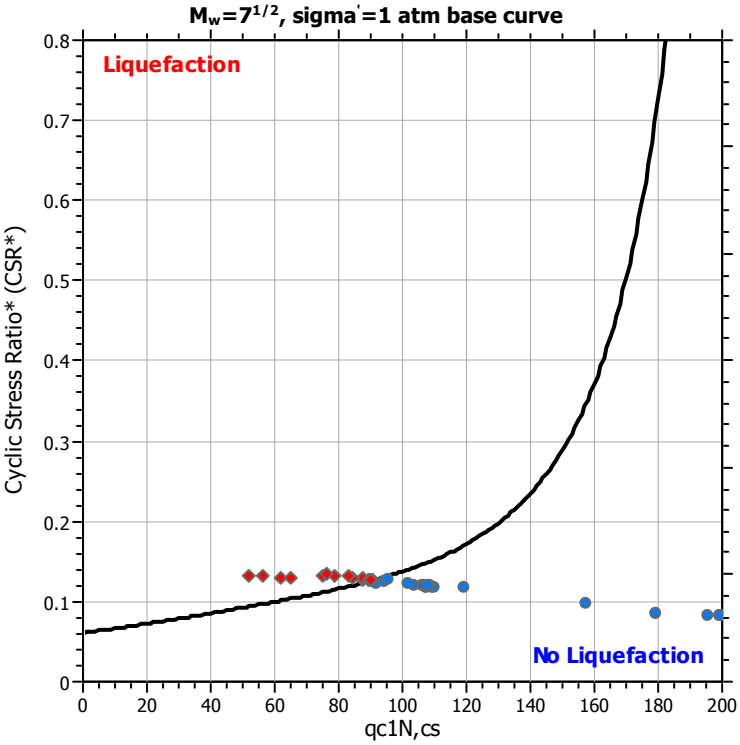
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

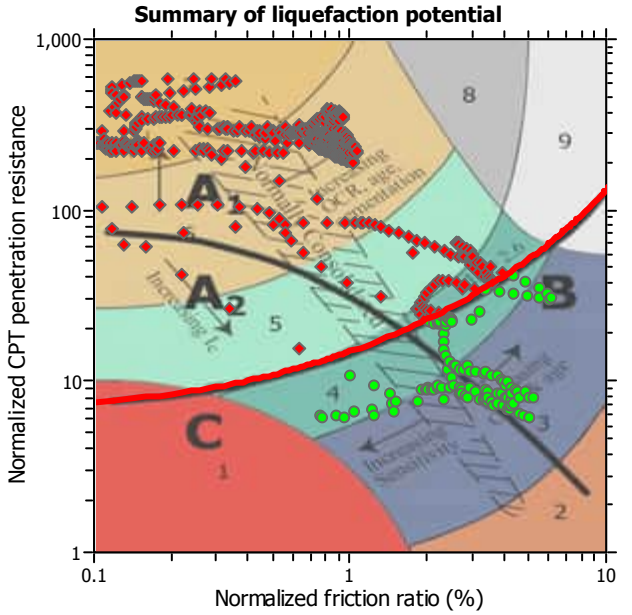
CPT file : CPT_05

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

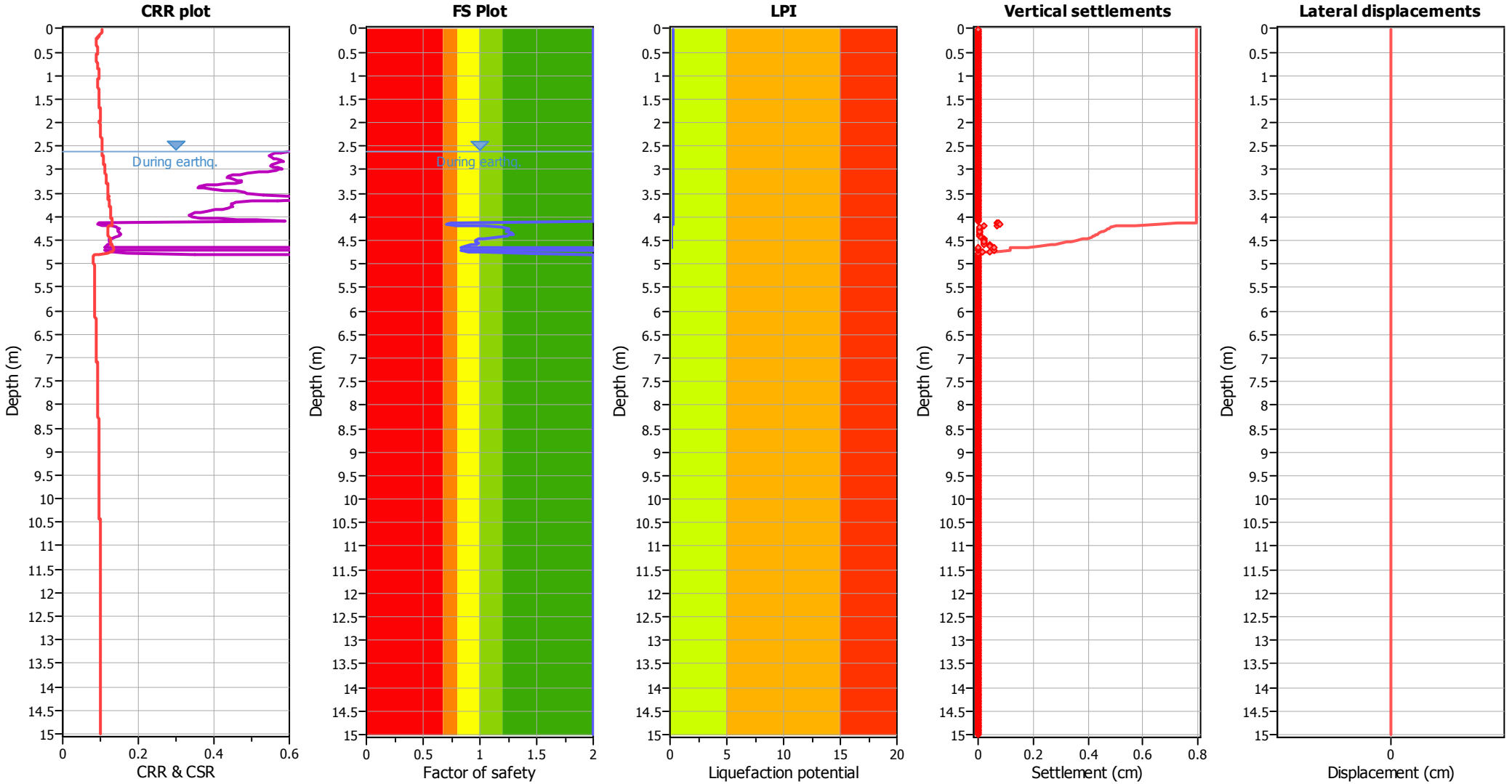






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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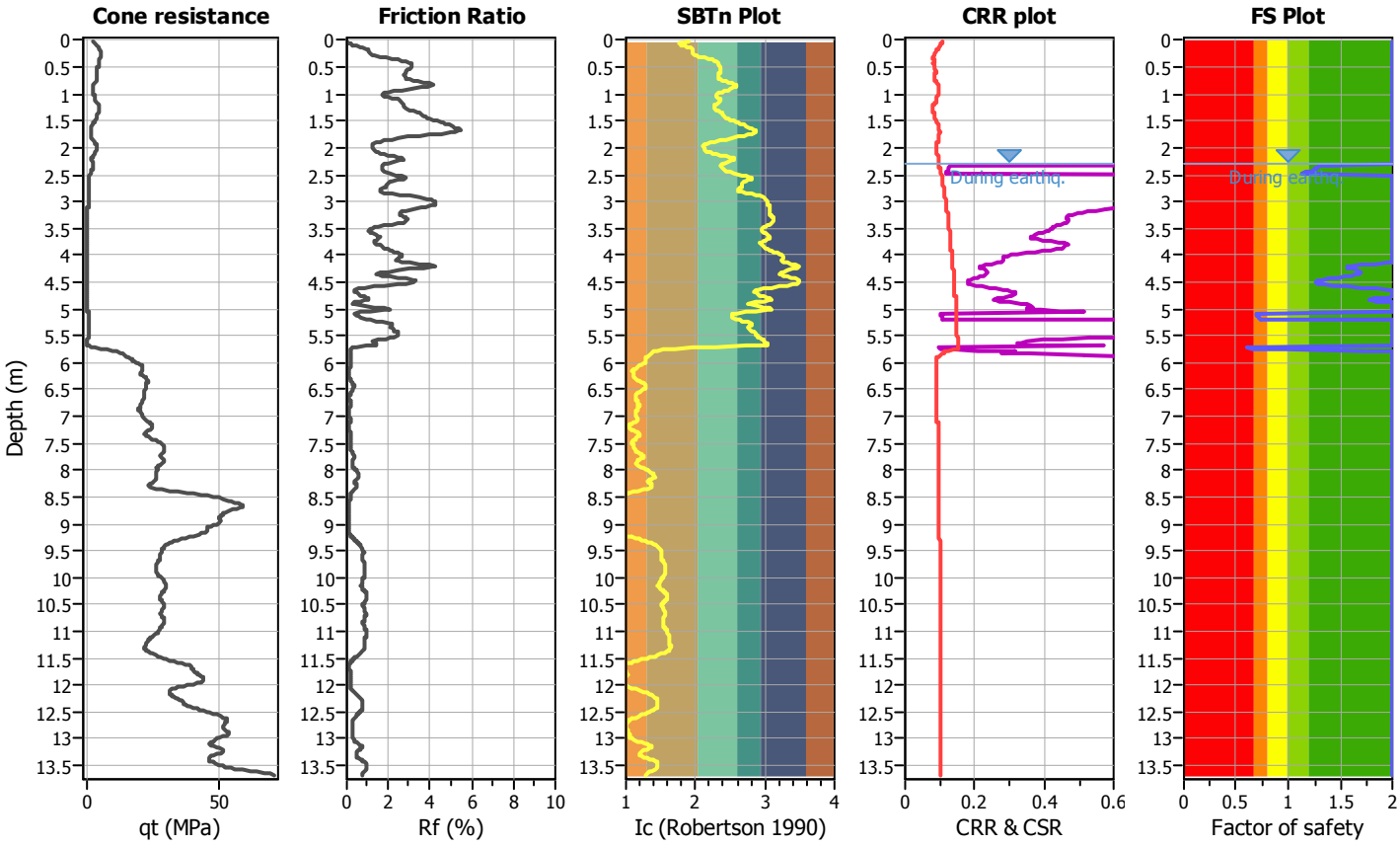
LIQUEFACTION ANALYSIS REPORT

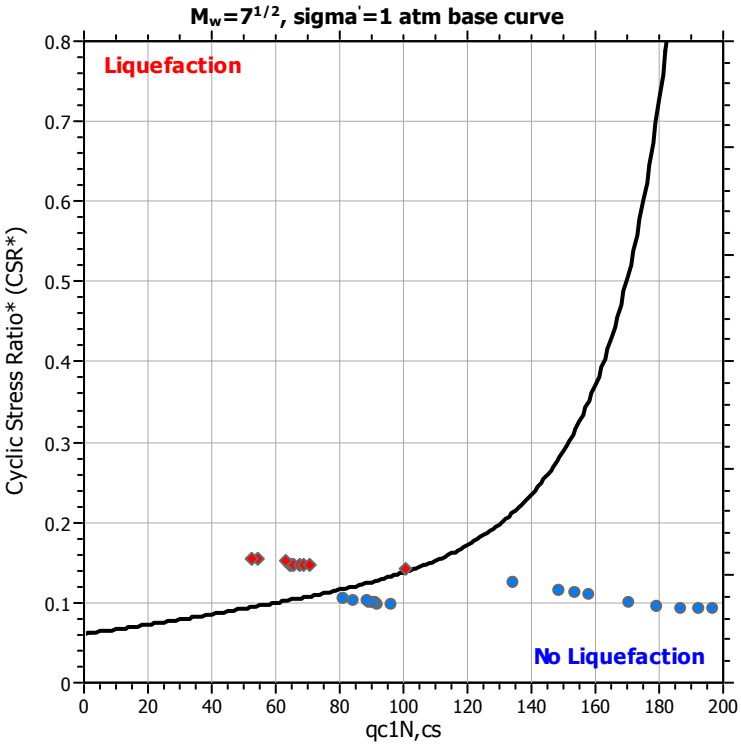
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

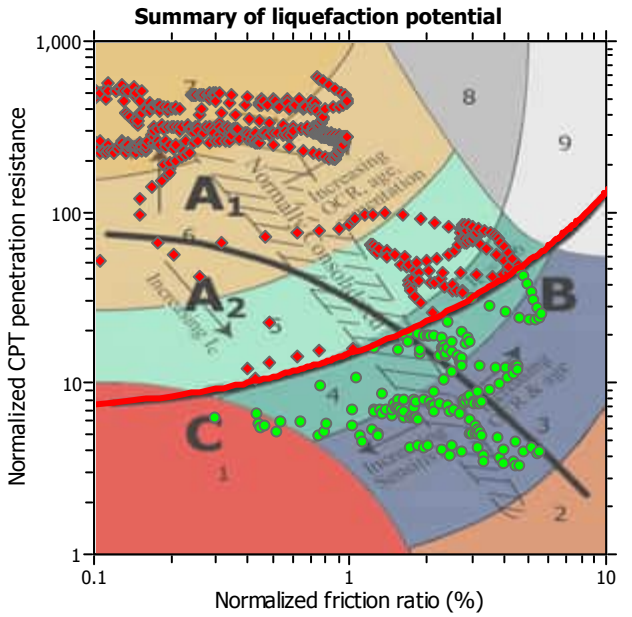
CPT file : CPT_06

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

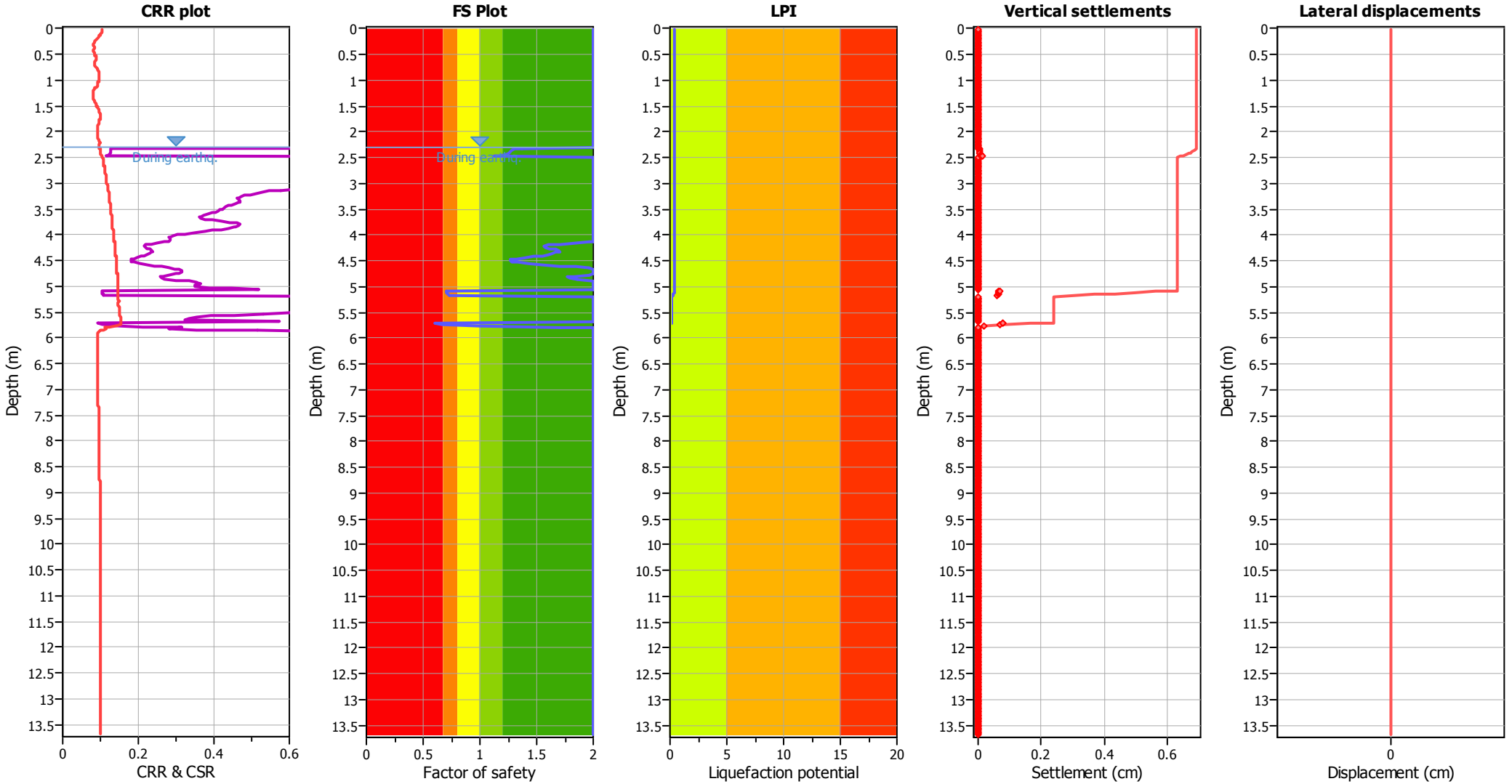






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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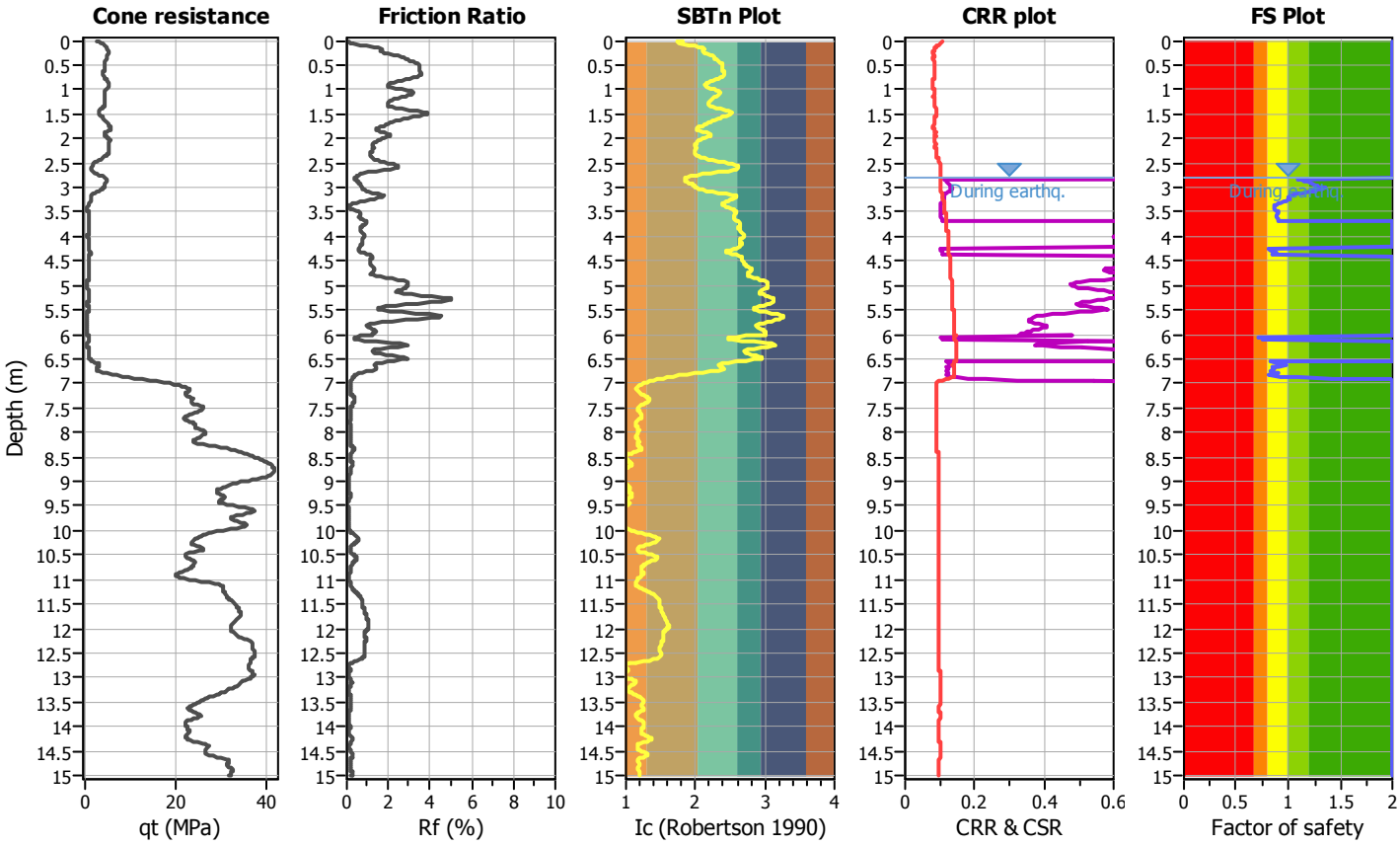
LIQUEFACTION ANALYSIS REPORT

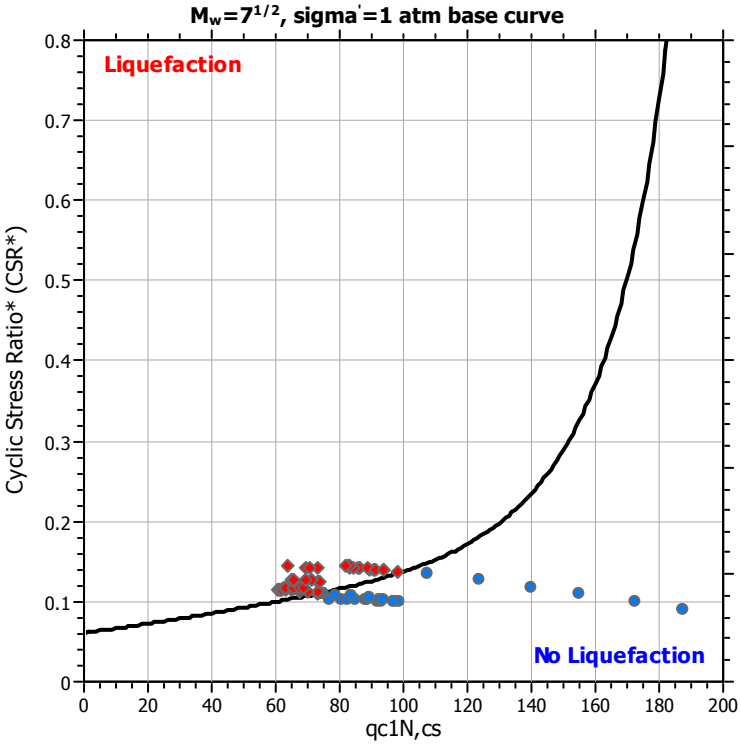
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

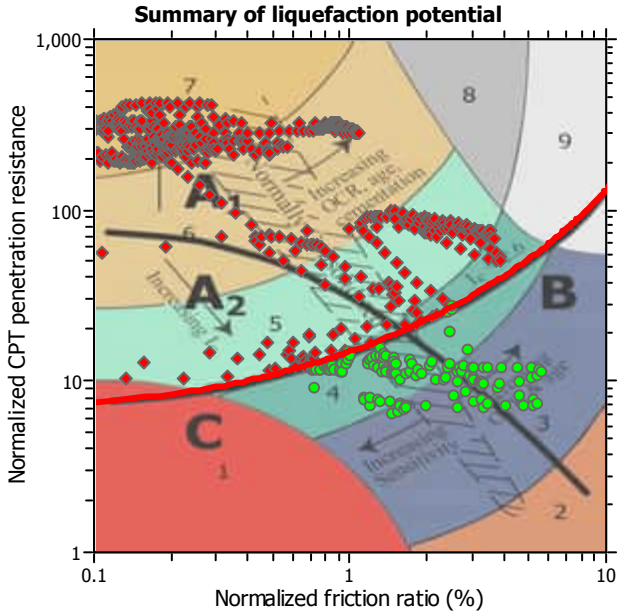
CPT file : CPT_07

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

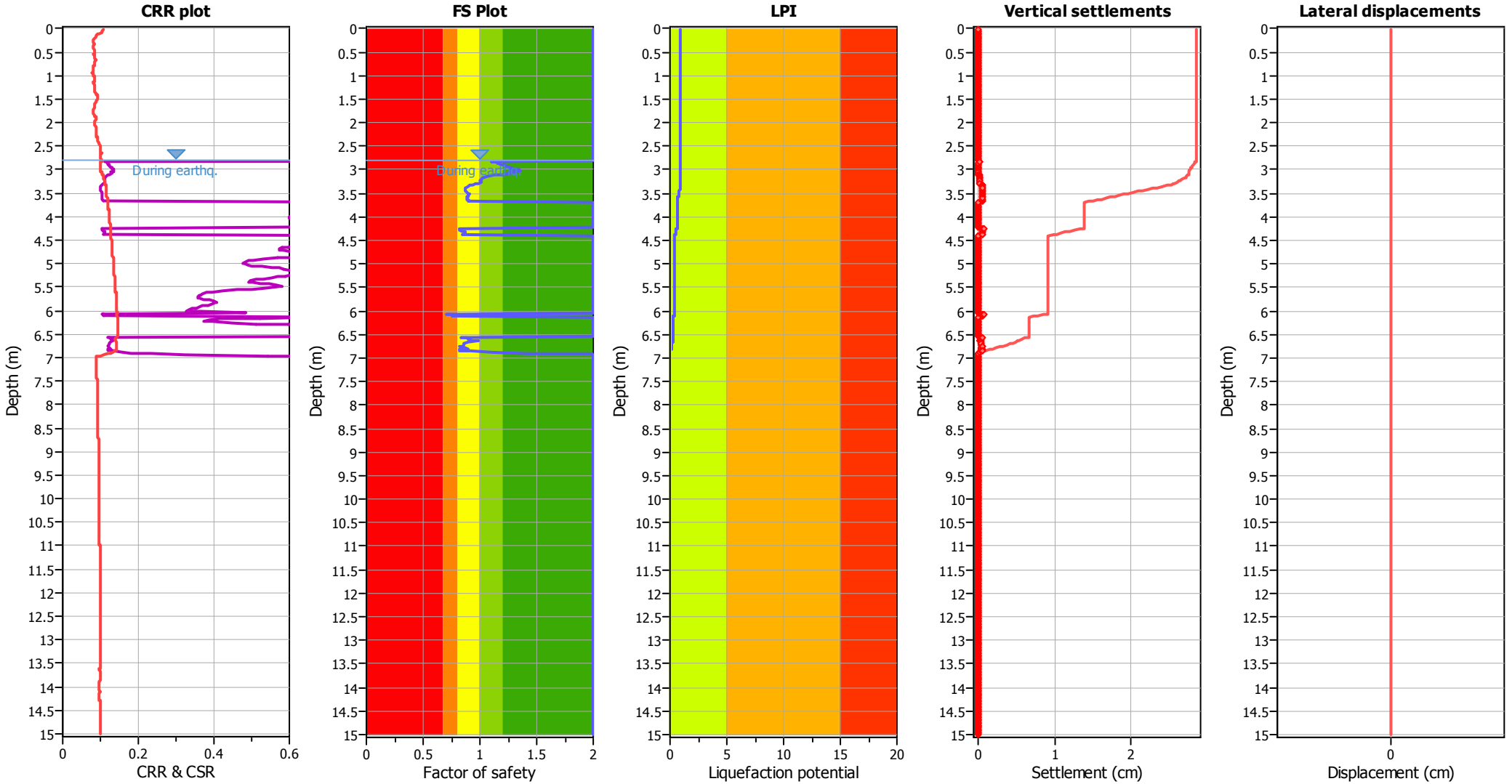






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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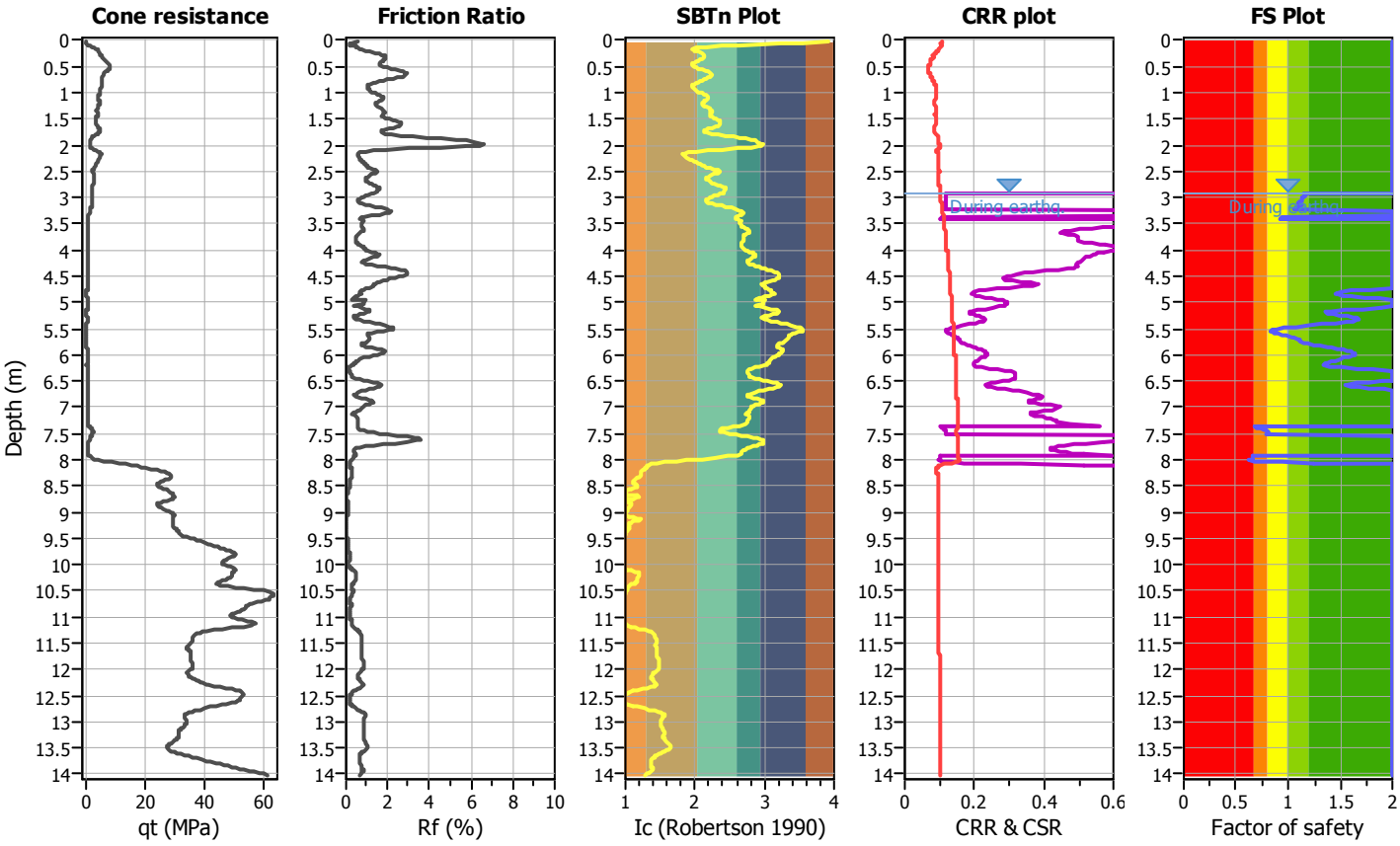
LIQUEFACTION ANALYSIS REPORT

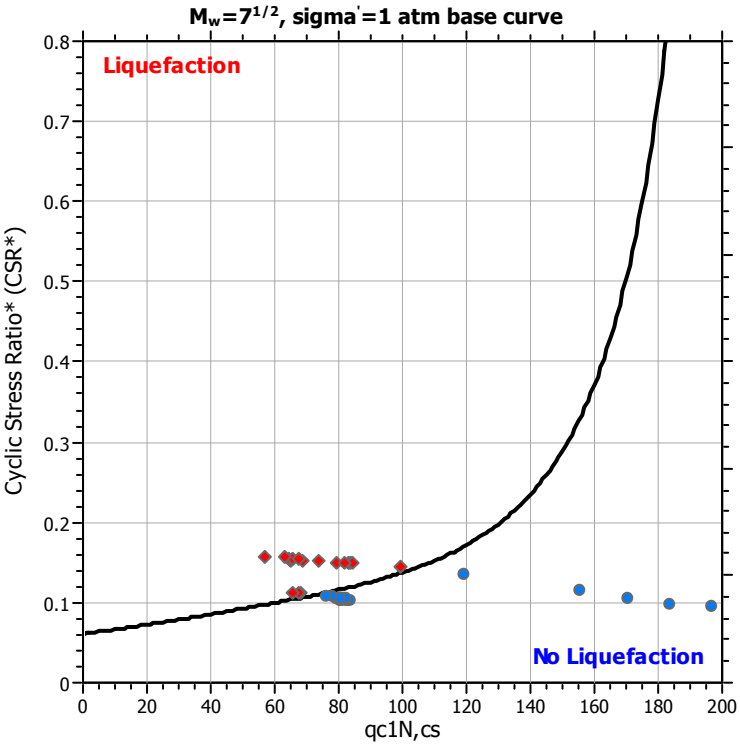
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

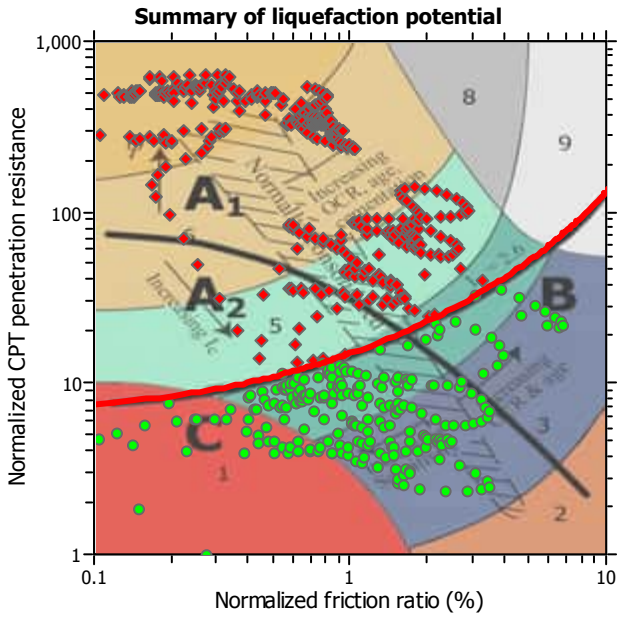
CPT file : CPT_08

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

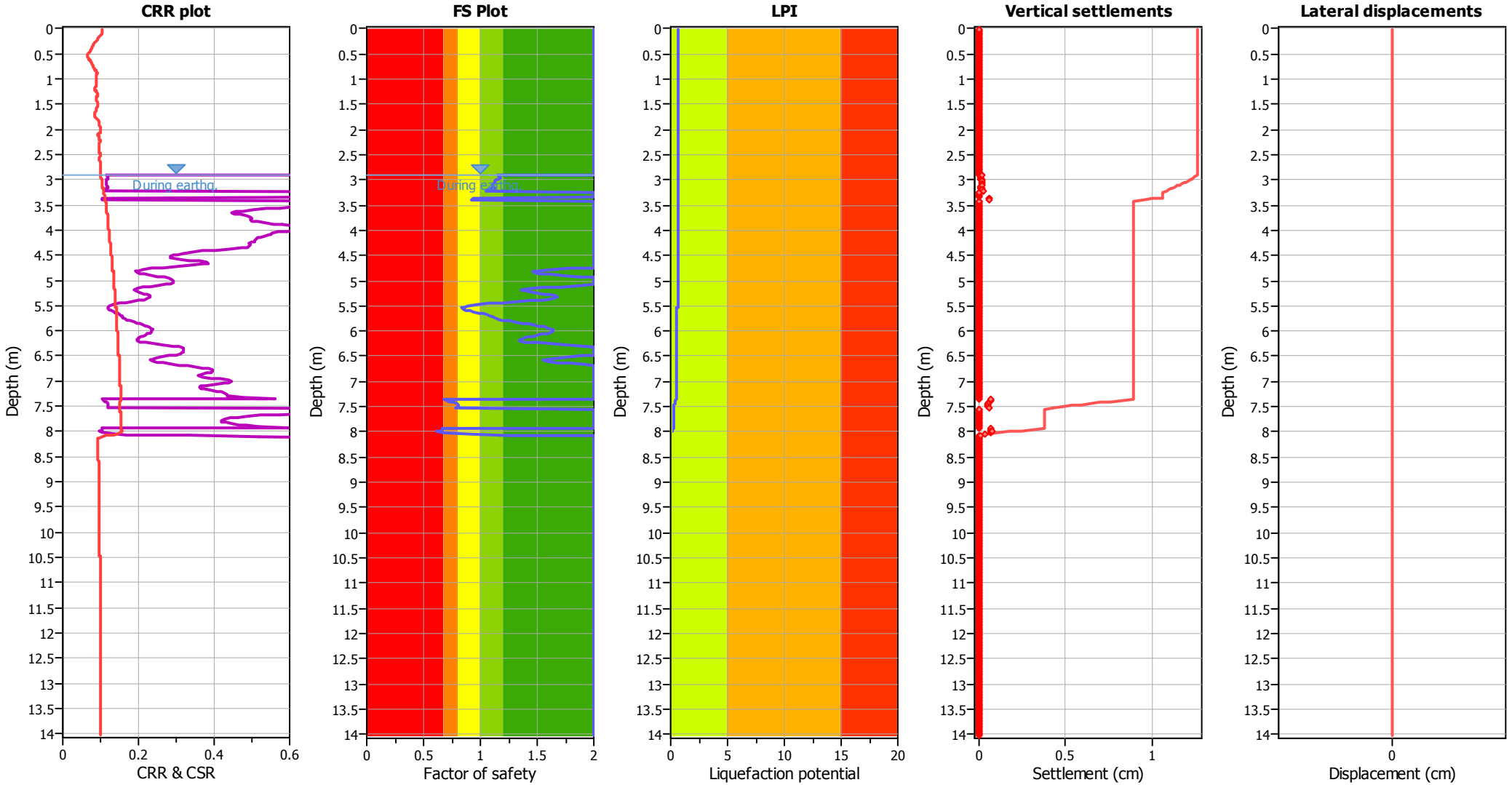






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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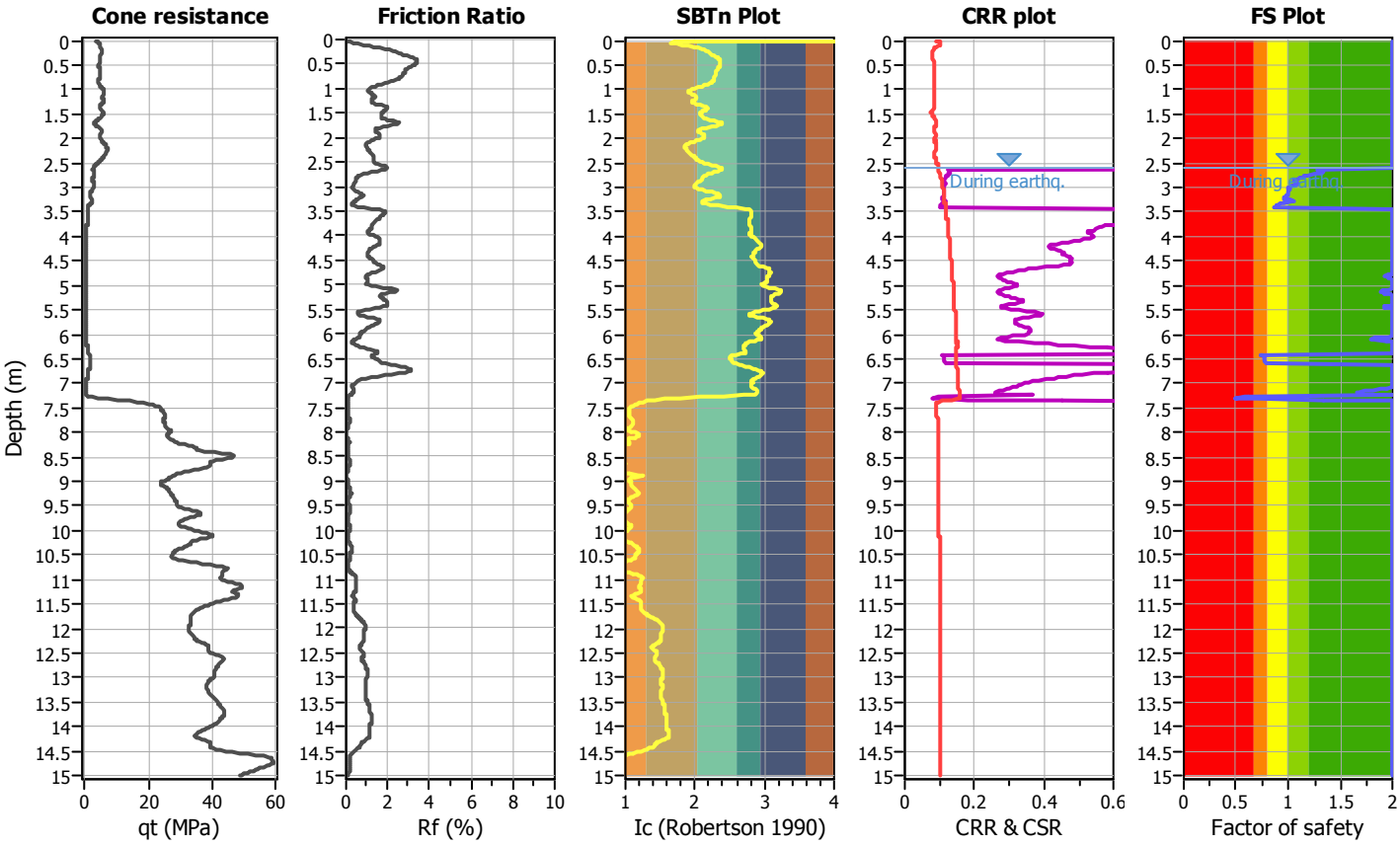
LIQUEFACTION ANALYSIS REPORT

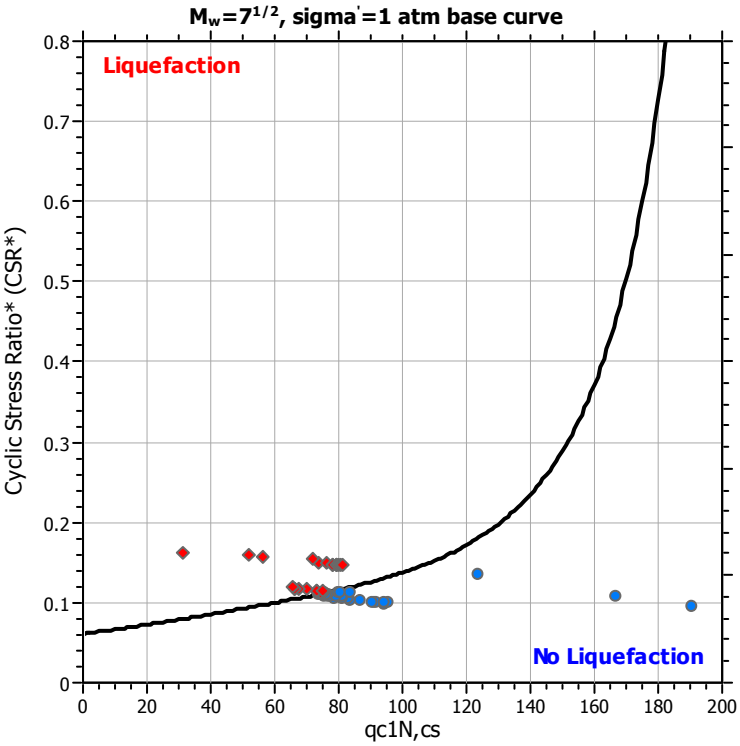
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

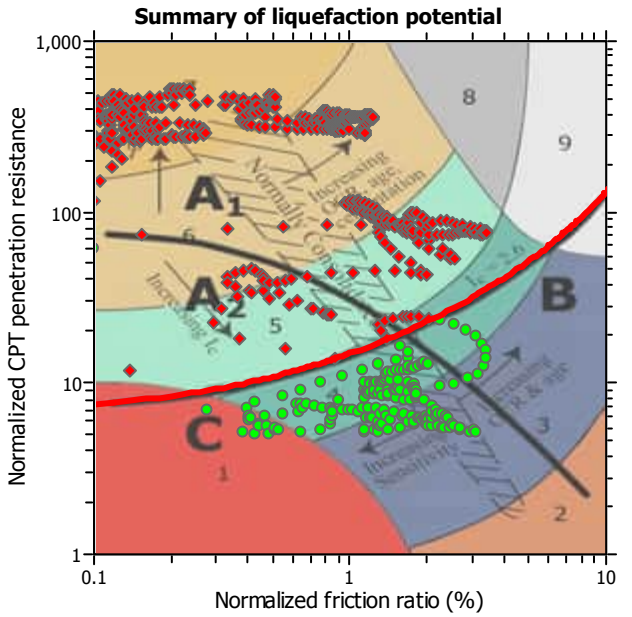
CPT file : CPT_09

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

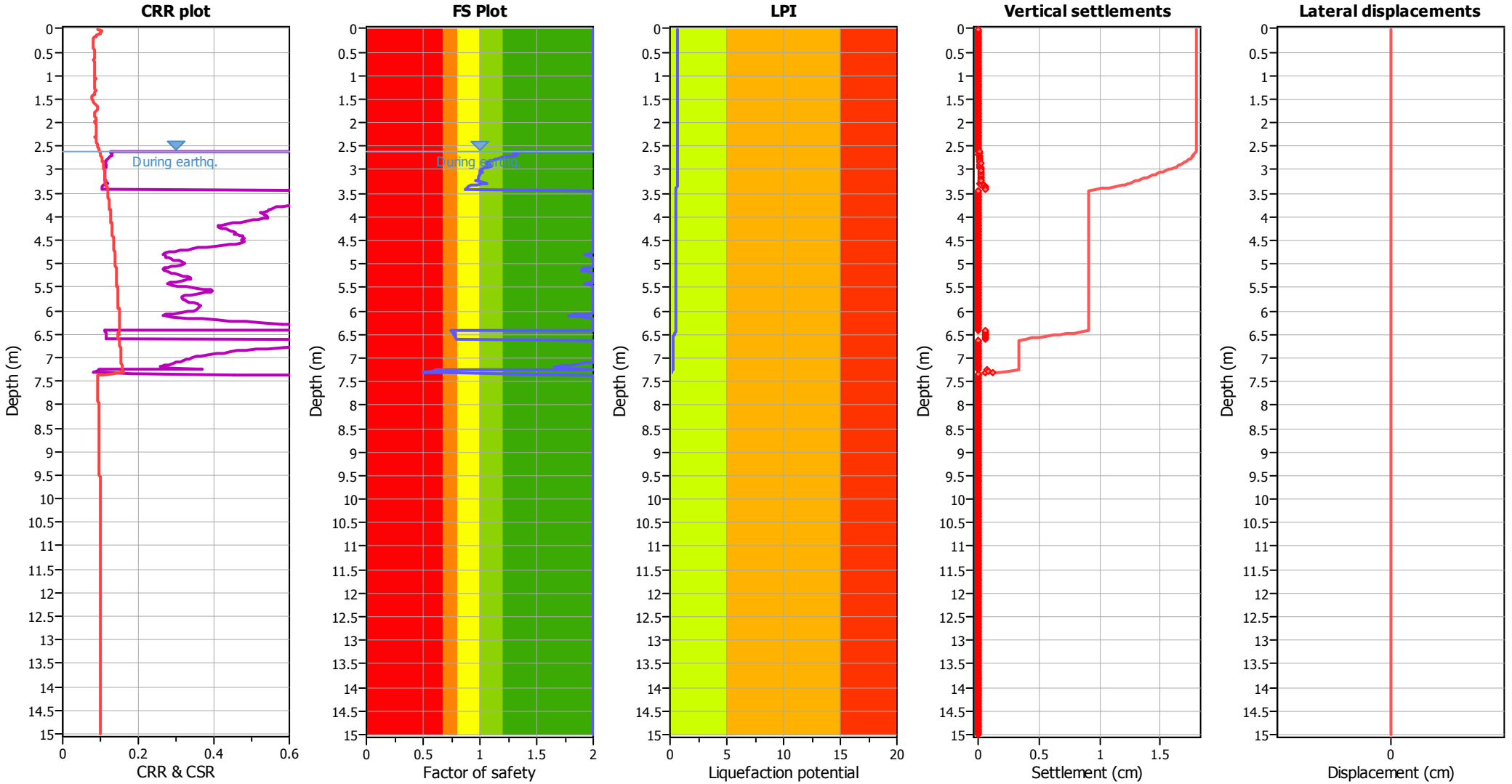






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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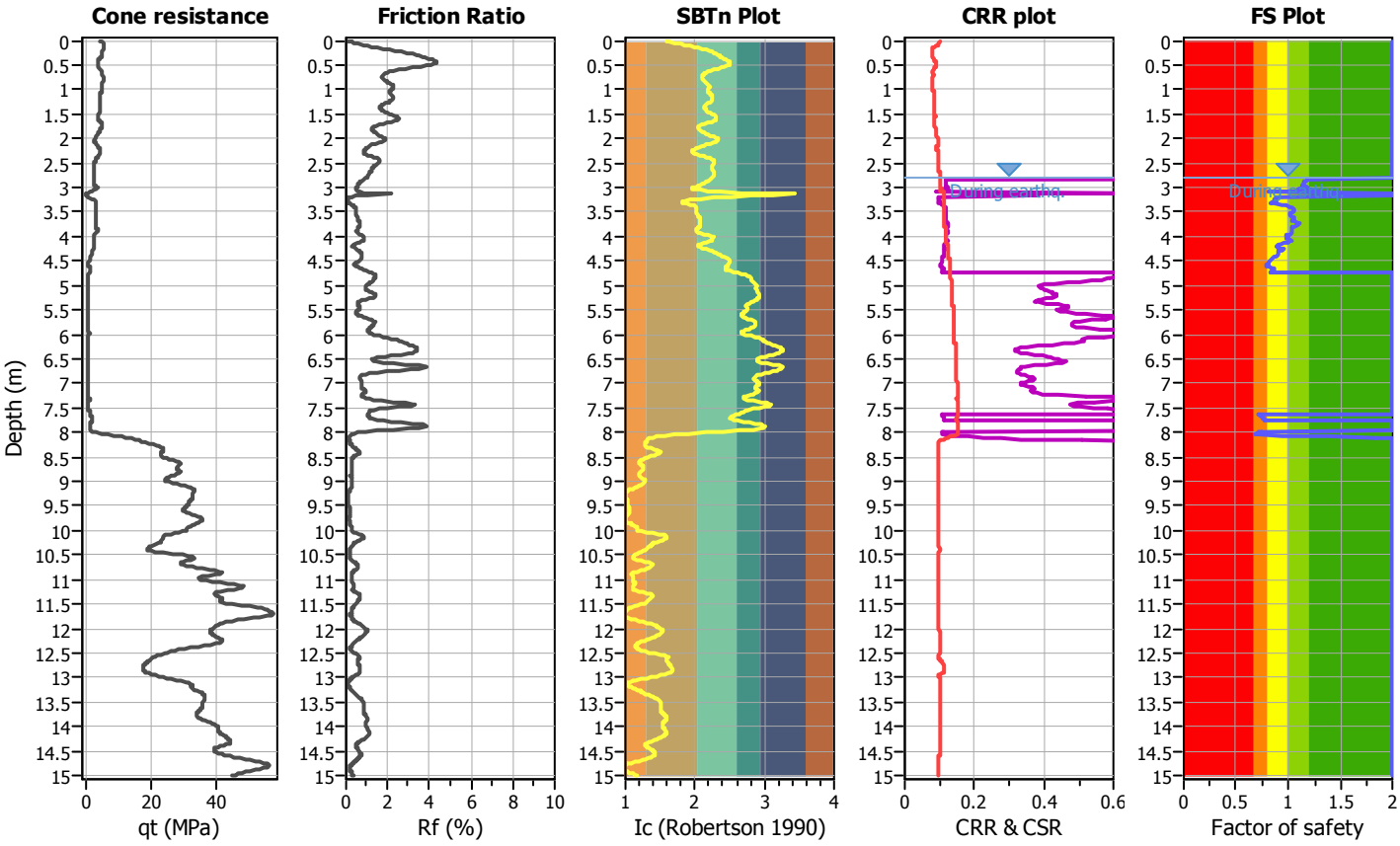
LIQUEFACTION ANALYSIS REPORT

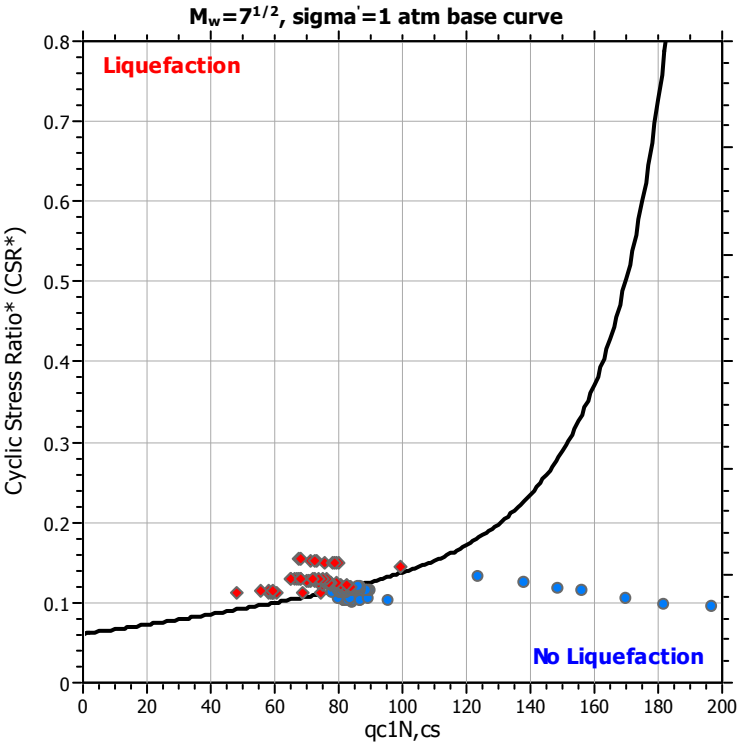
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

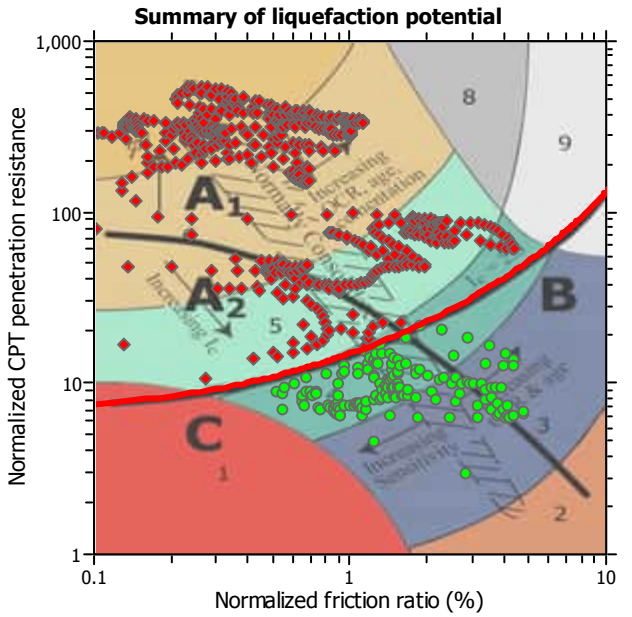
CPT file : CPT_10

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

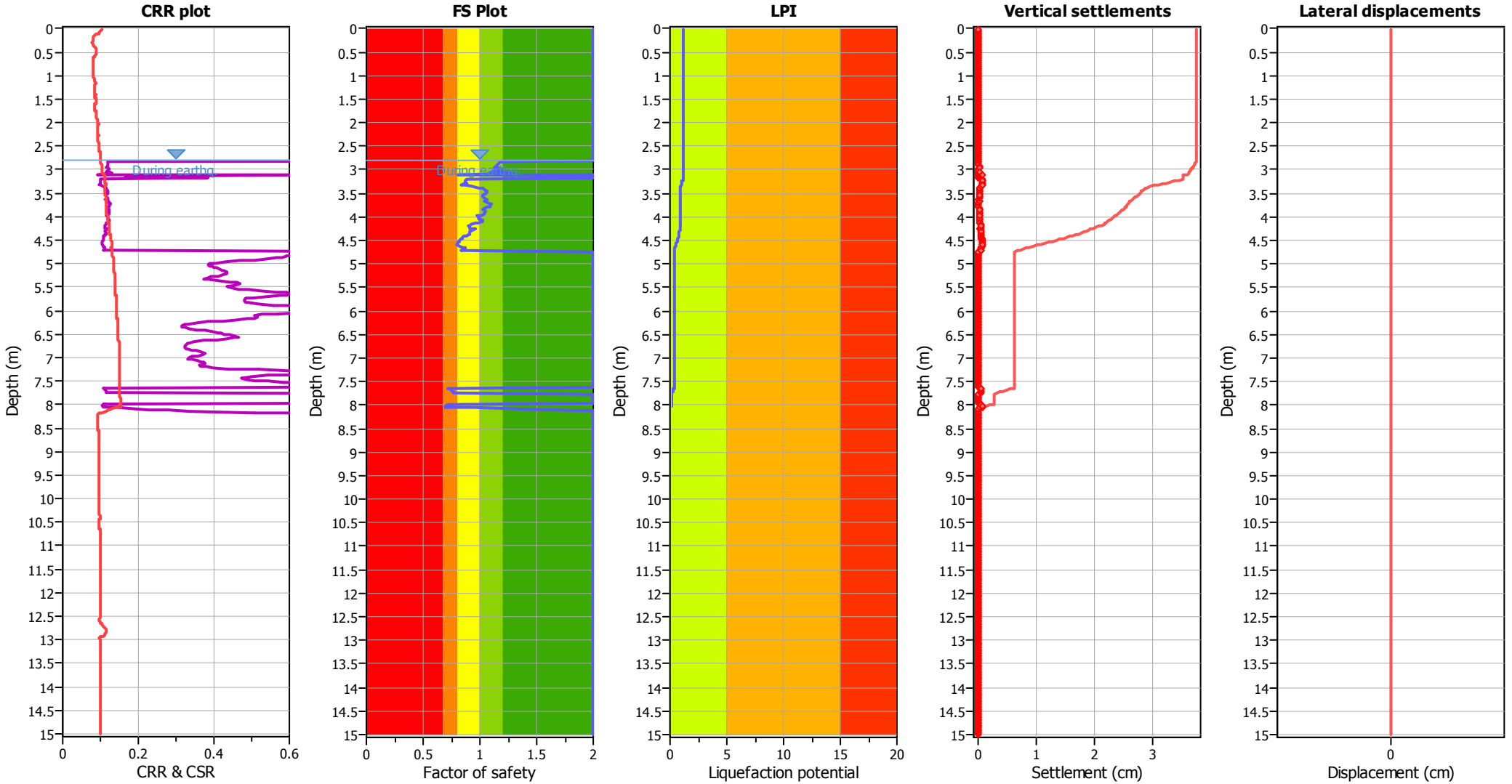






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

- Very high risk
- High risk
- Low risk

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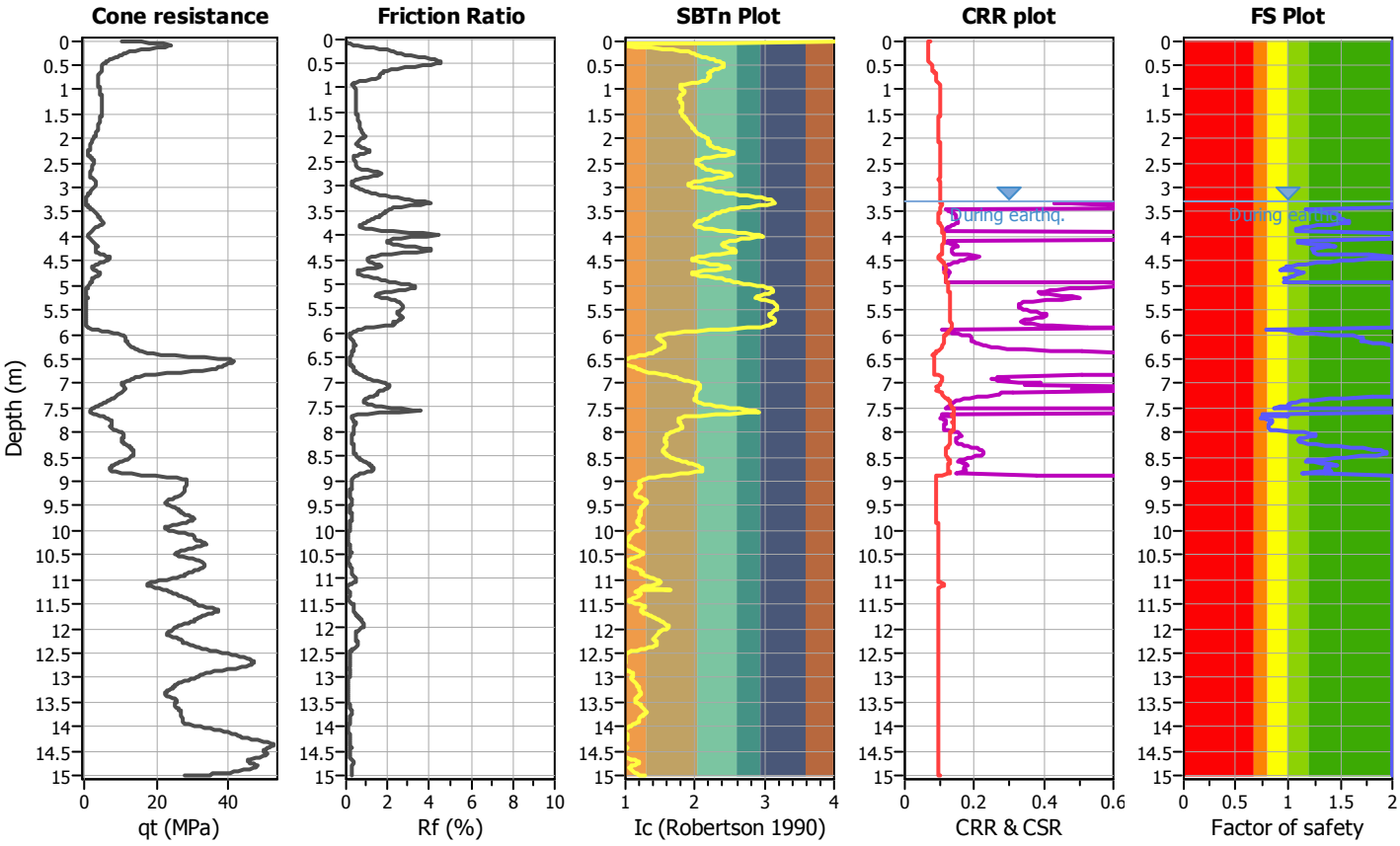
LIQUEFACTION ANALYSIS REPORT

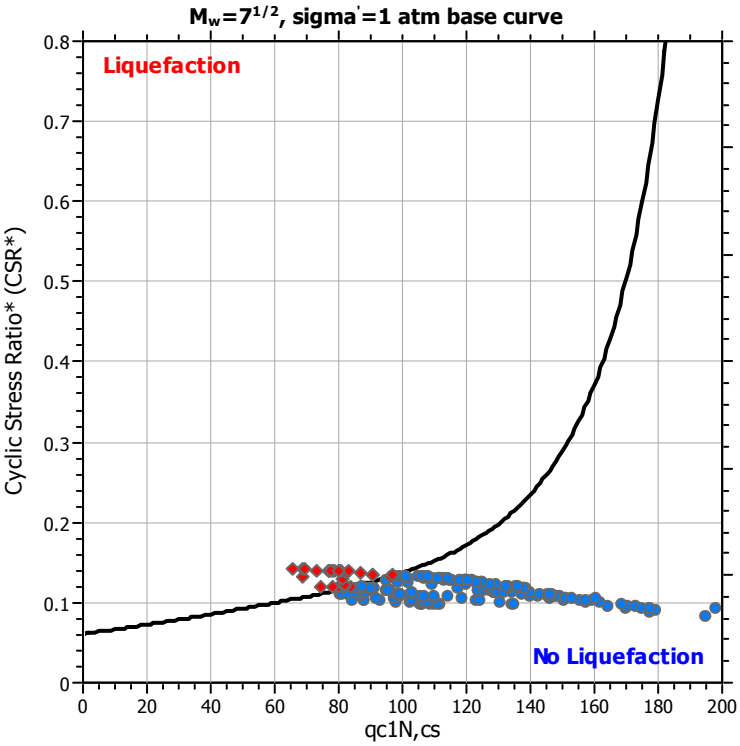
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

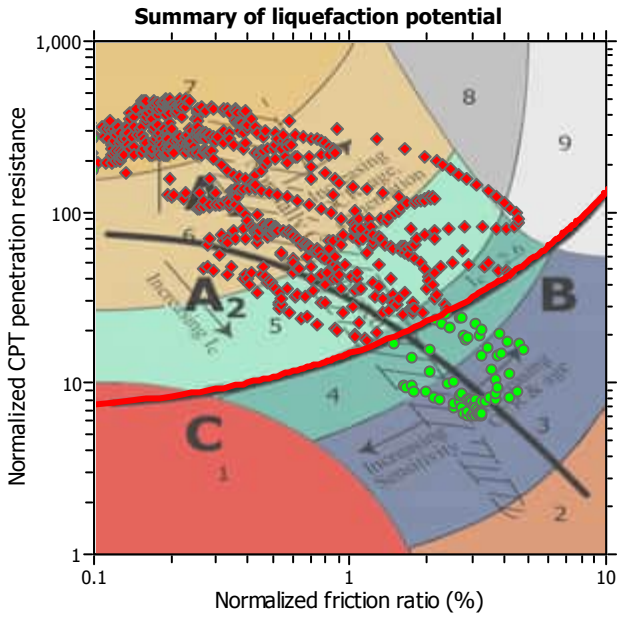
CPT file : CPT_11

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

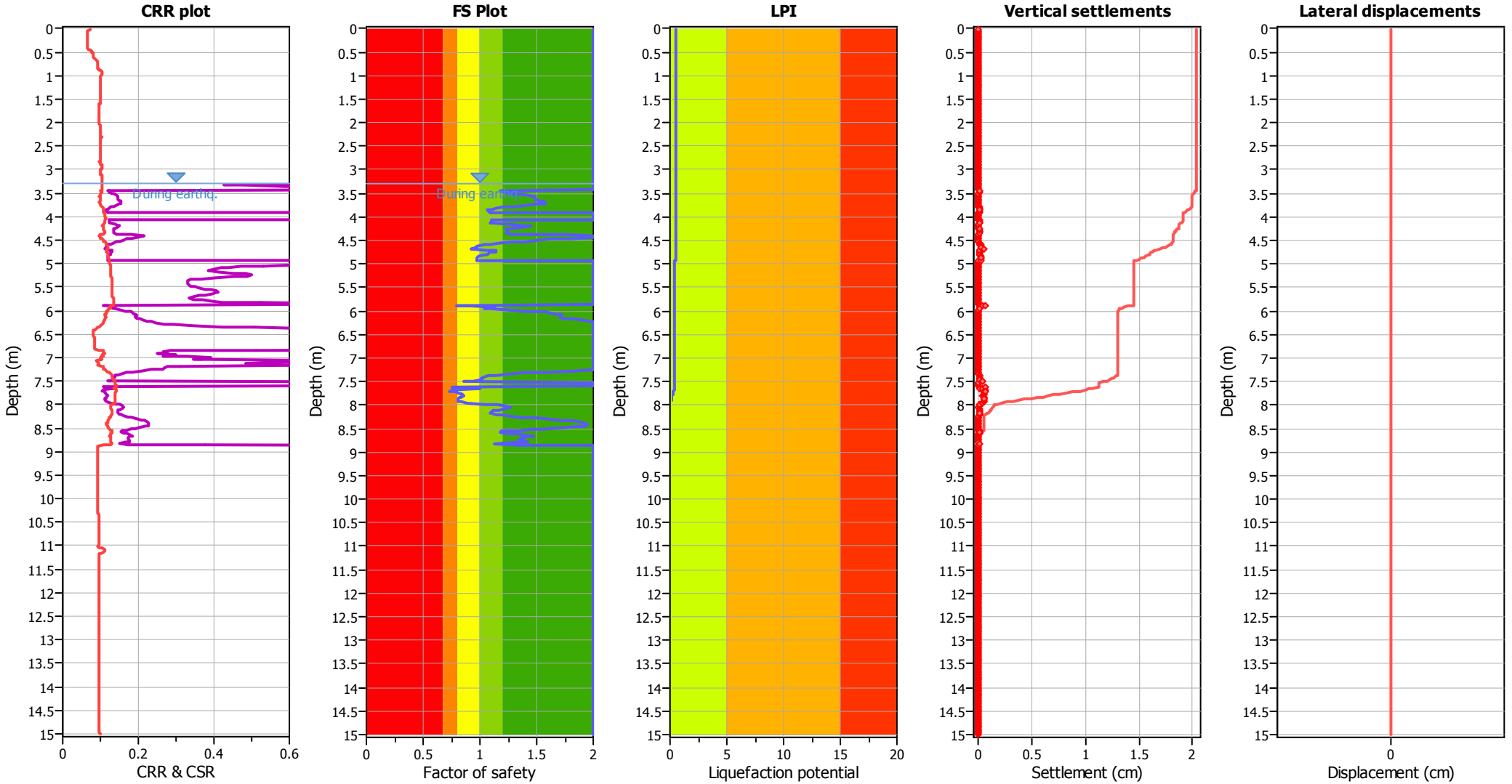






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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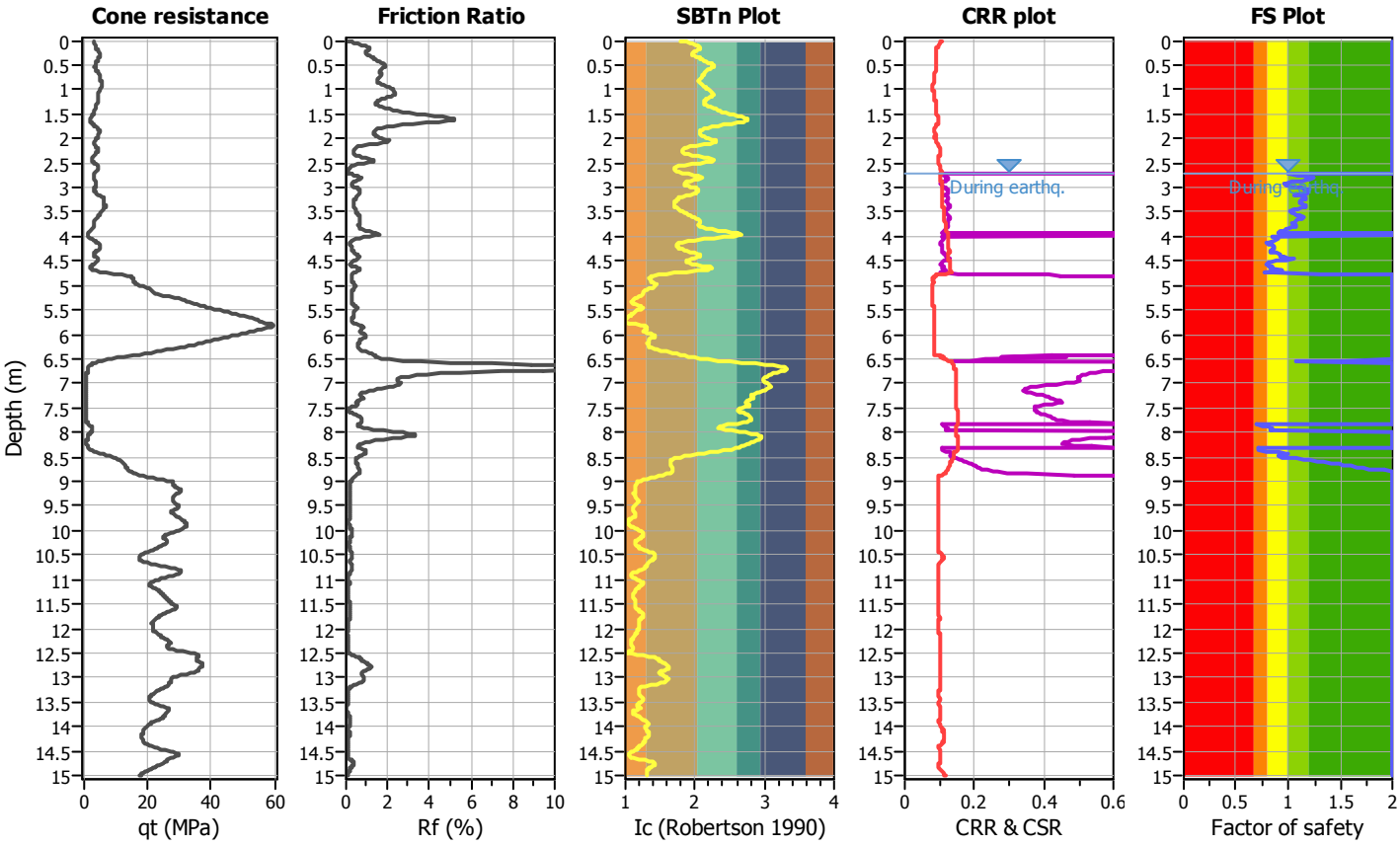
LIQUEFACTION ANALYSIS REPORT

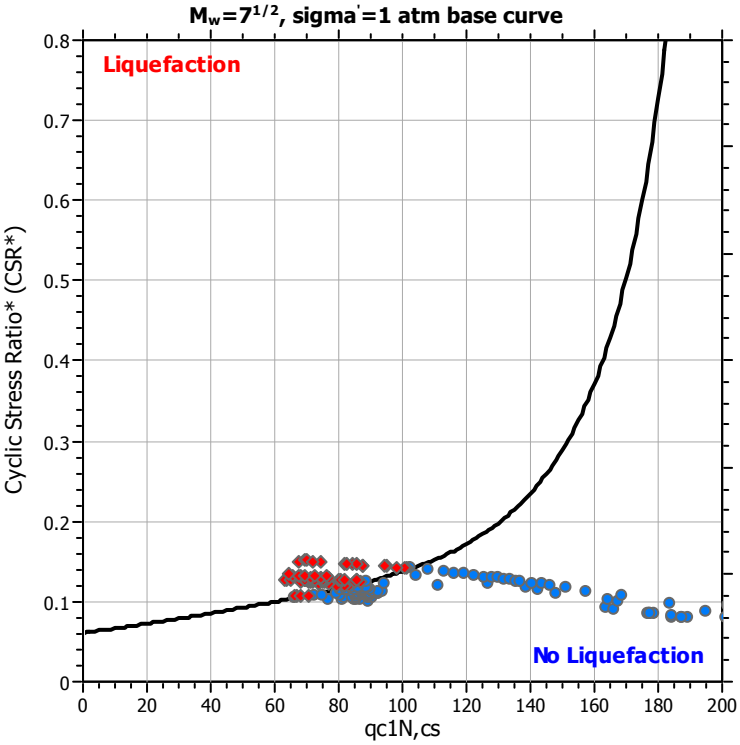
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

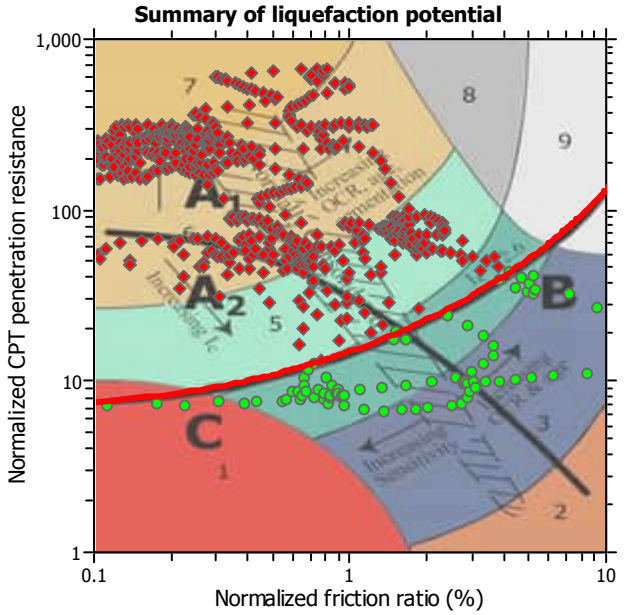
CPT file : CPT_12

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

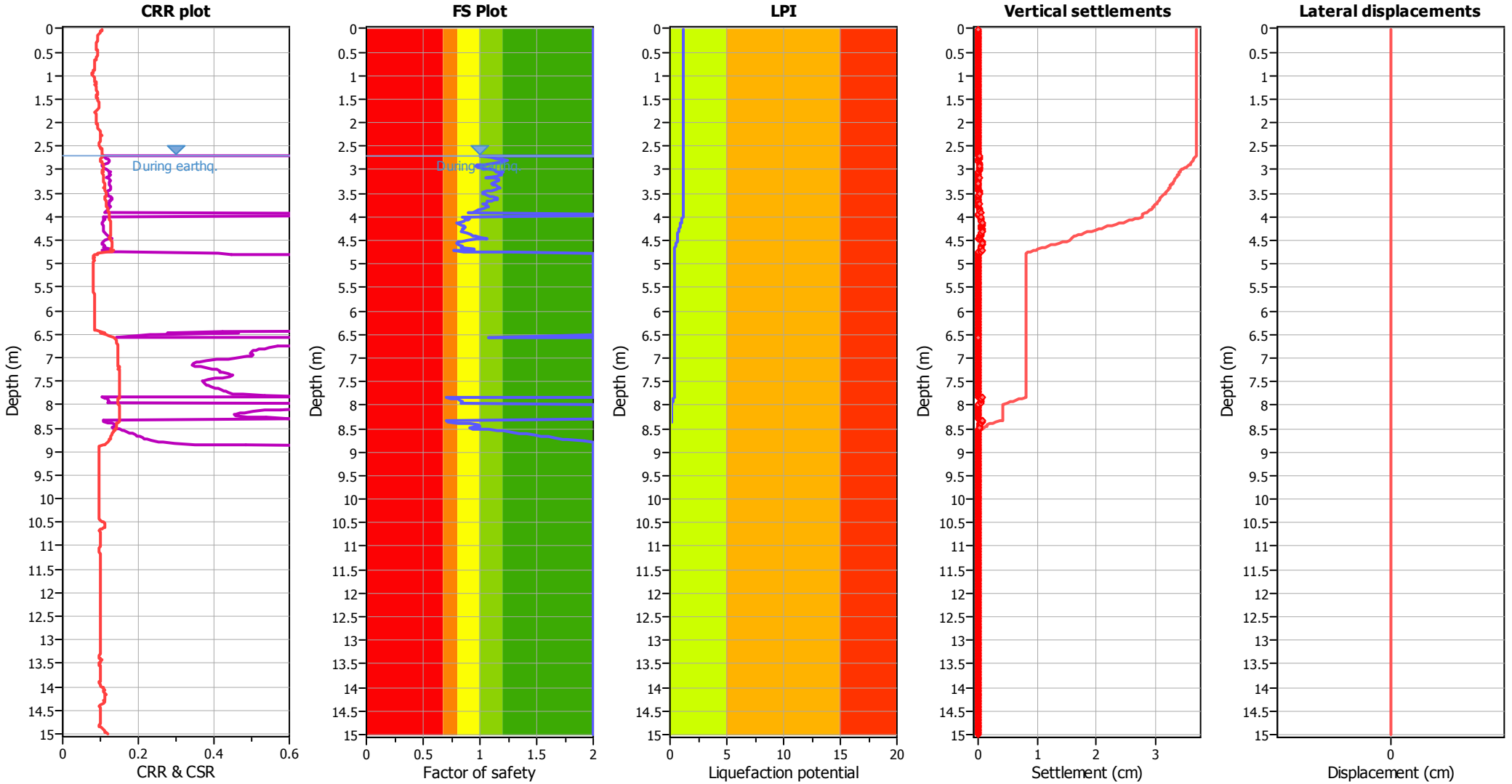






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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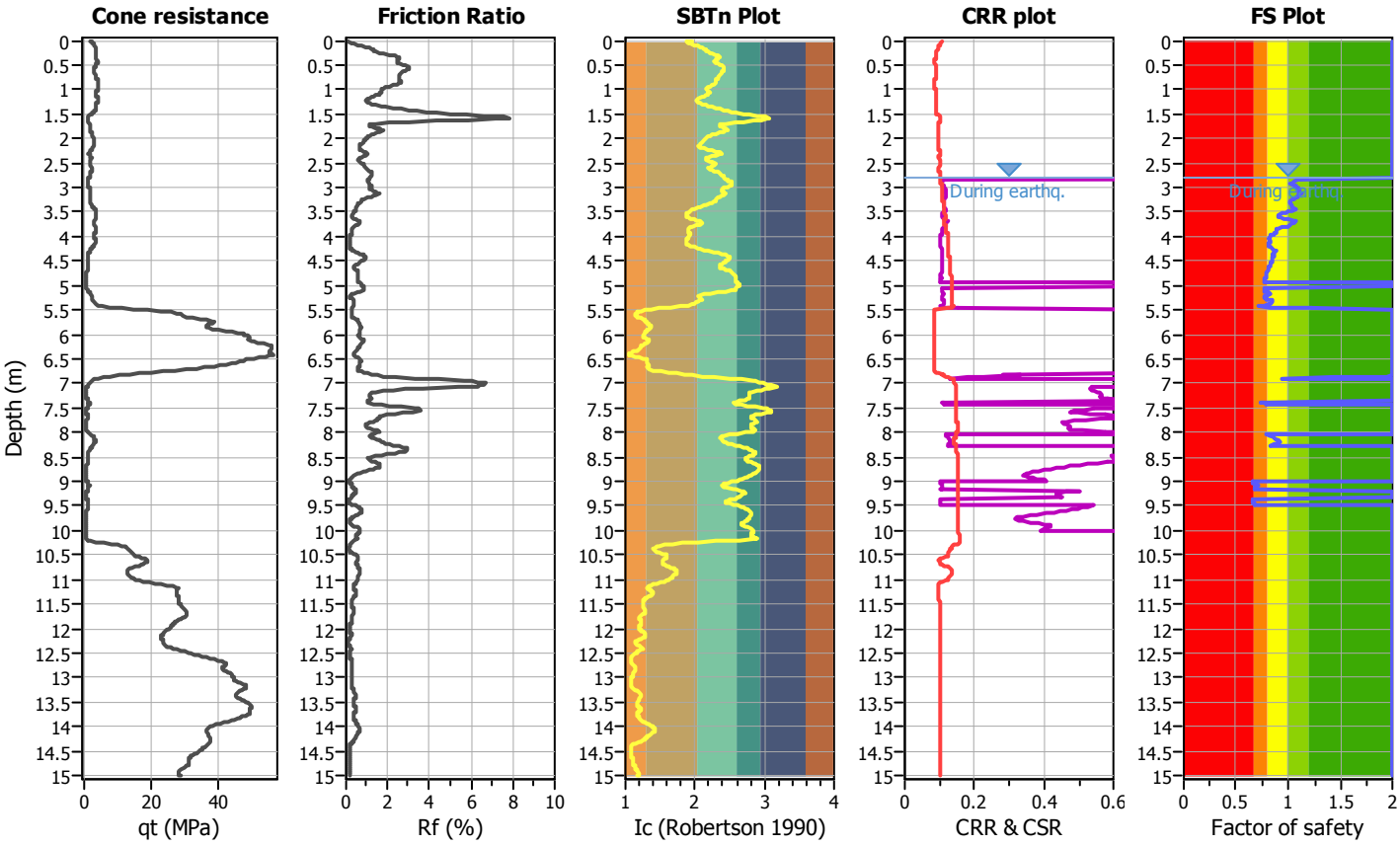
LIQUEFACTION ANALYSIS REPORT

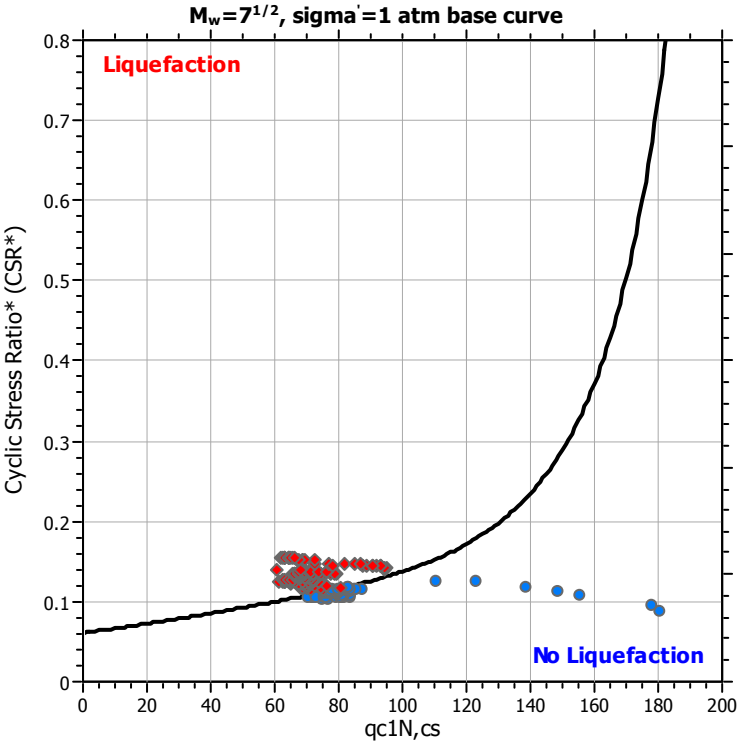
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

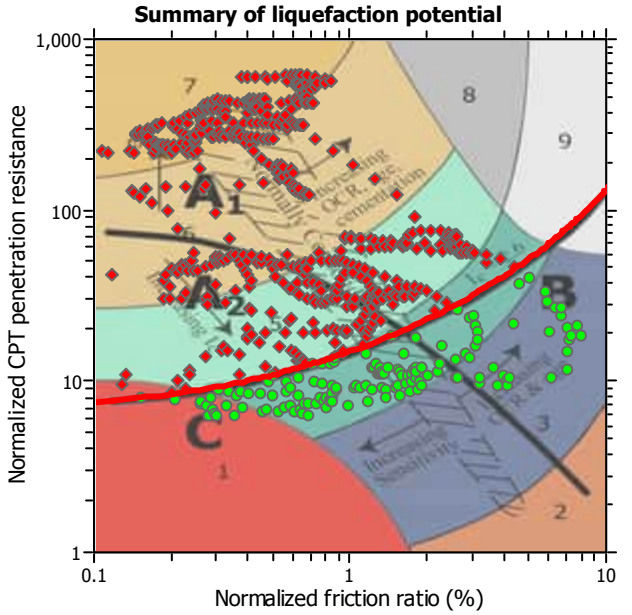
CPT file : CPT_13

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

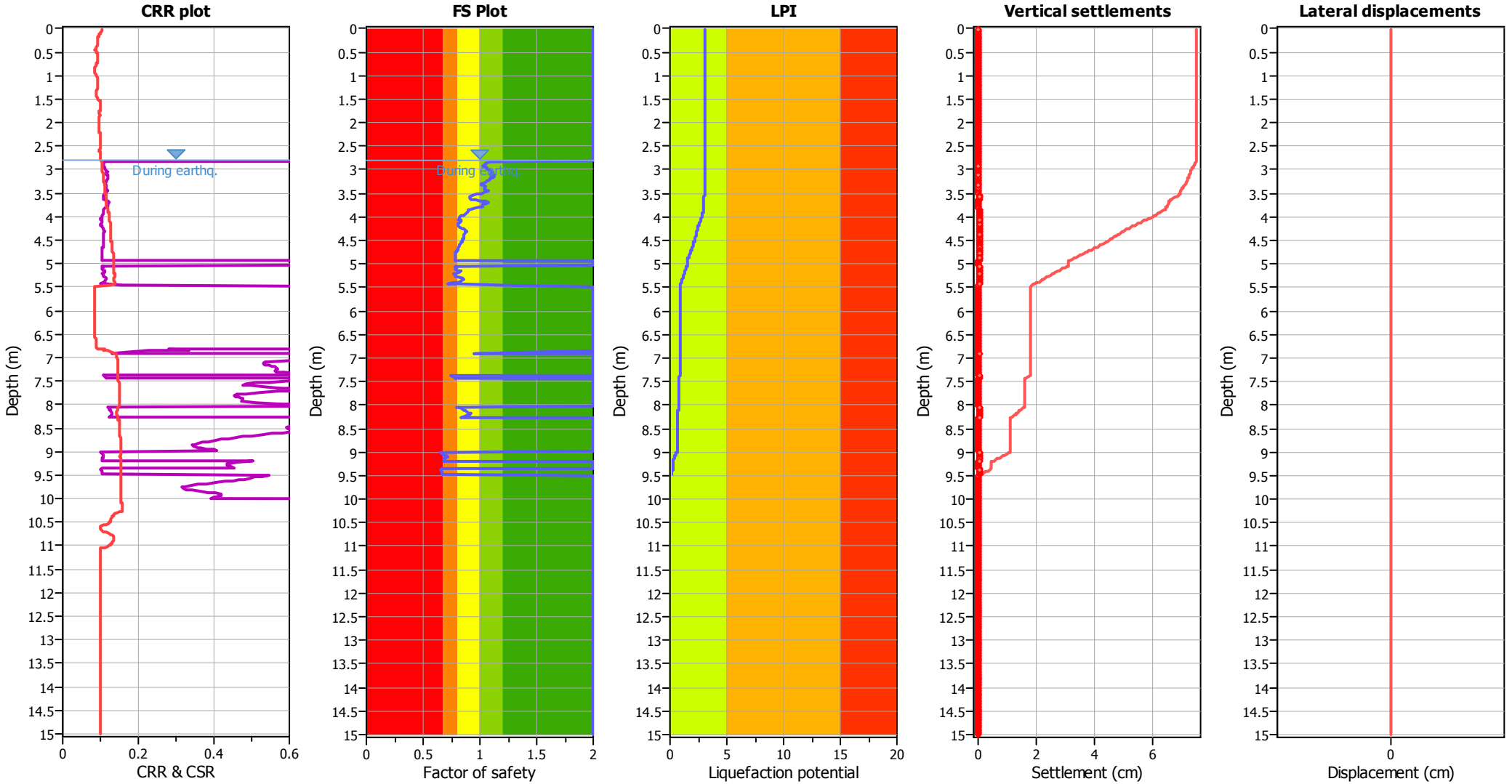






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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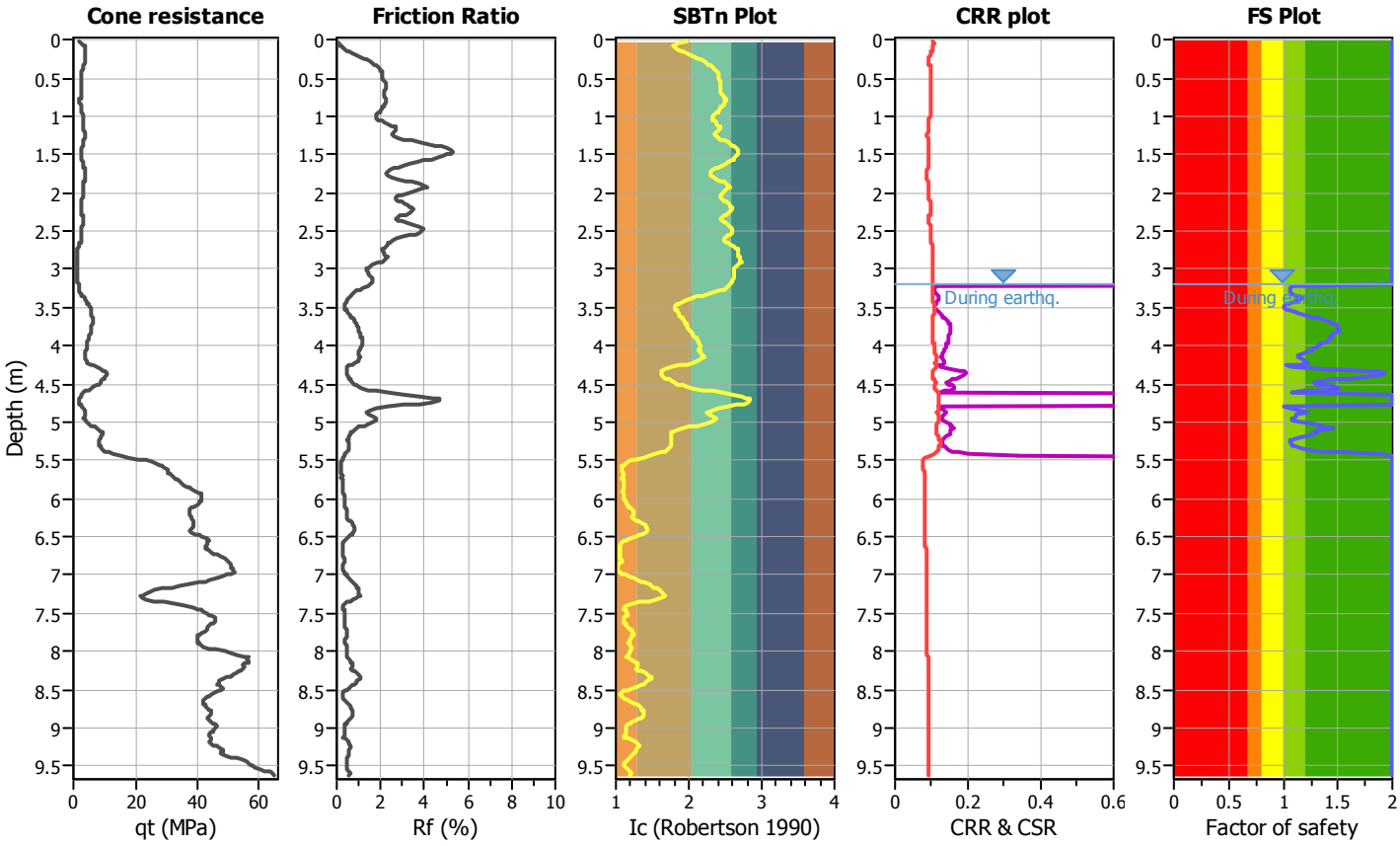
LIQUEFACTION ANALYSIS REPORT

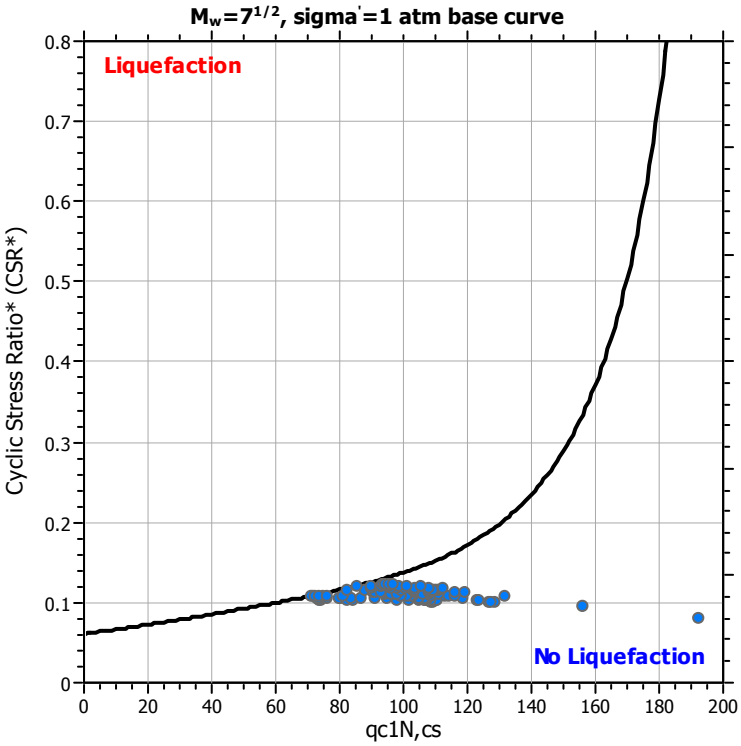
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

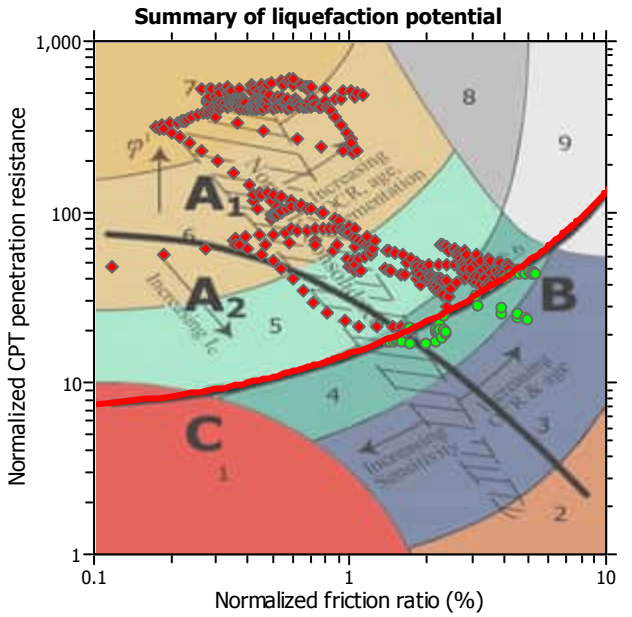
CPT file : CPT_14

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

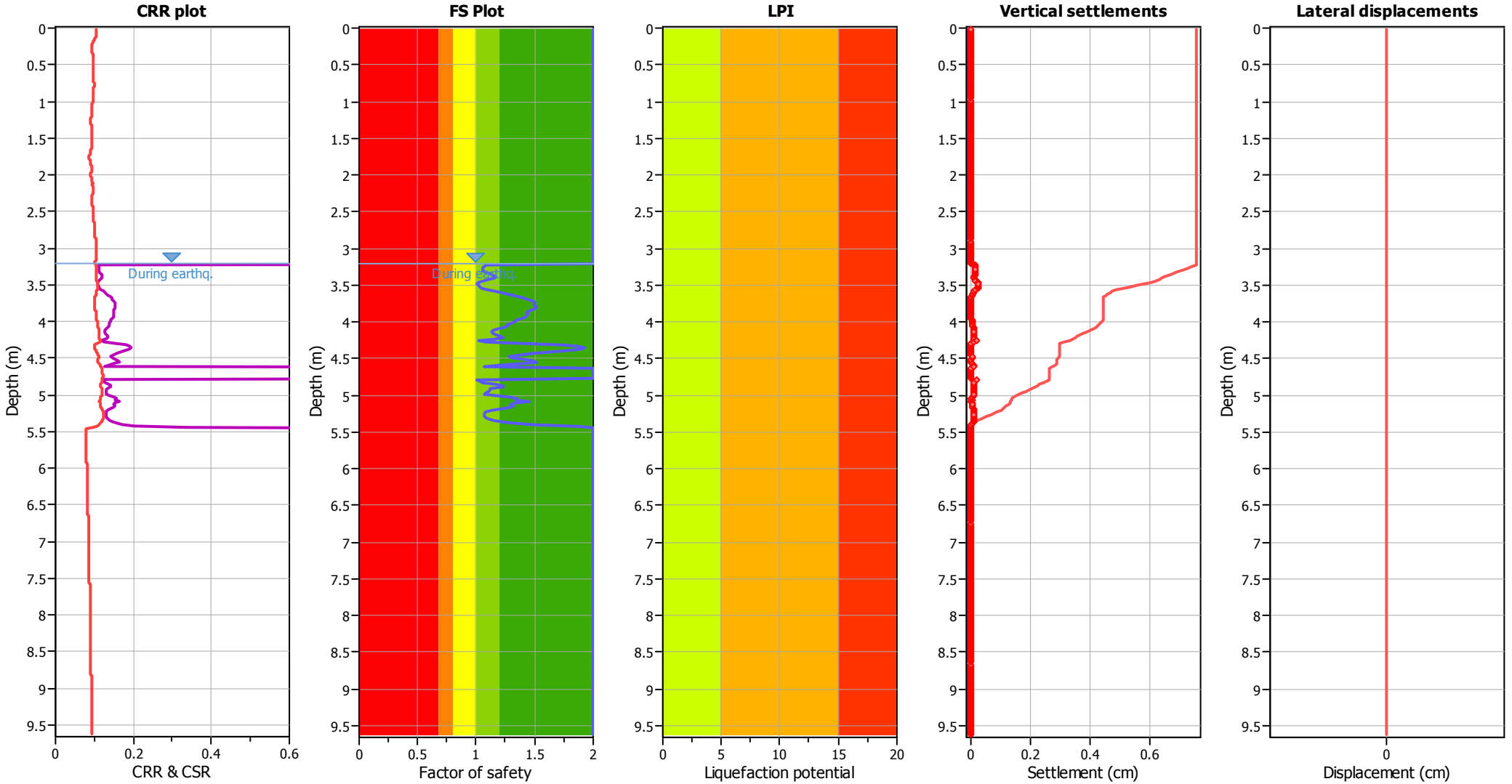






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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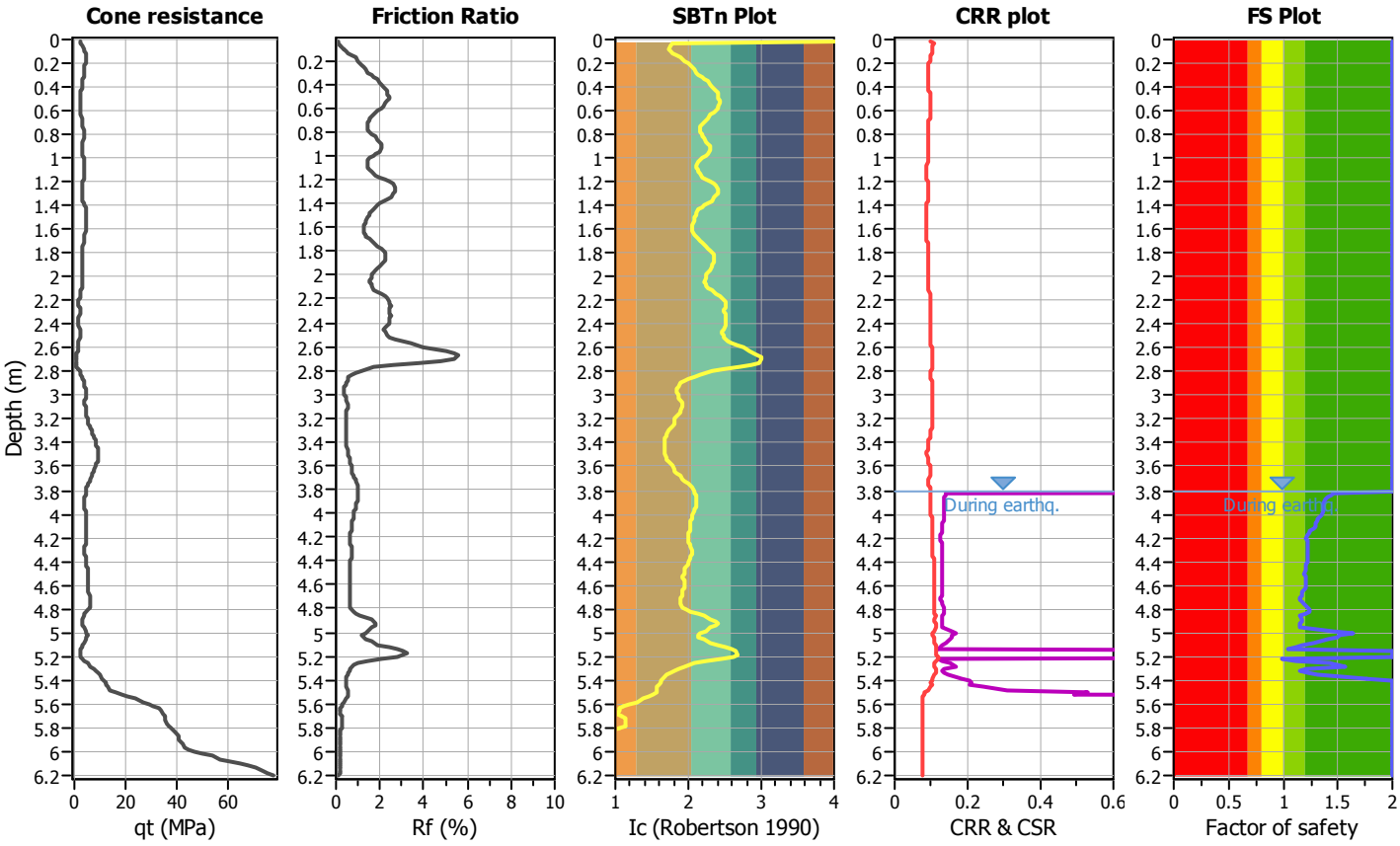
LIQUEFACTION ANALYSIS REPORT

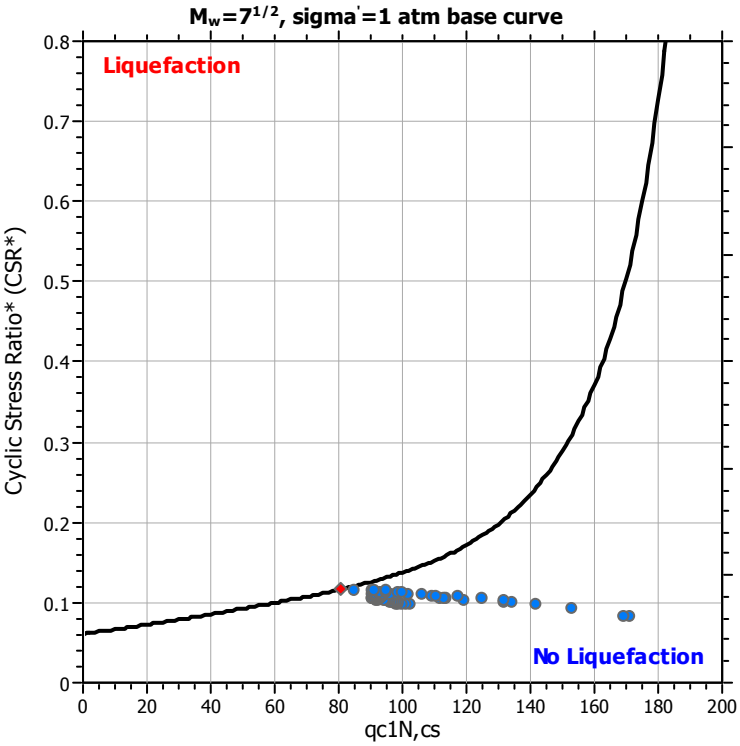
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

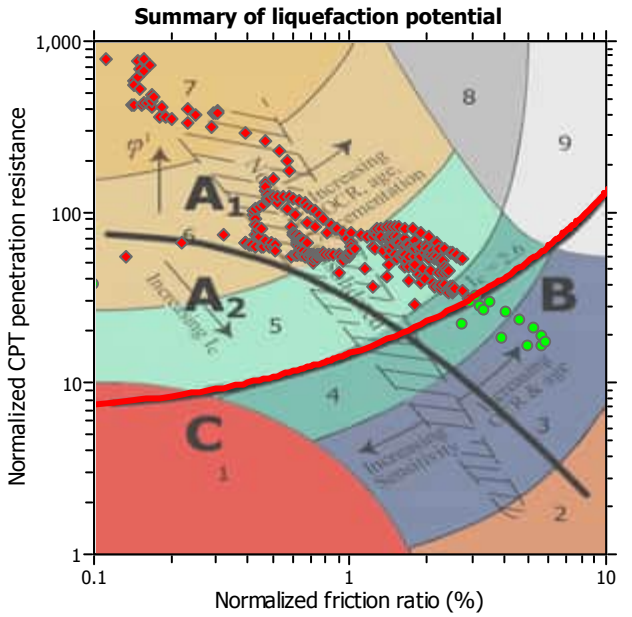
CPT file : CPT_15

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

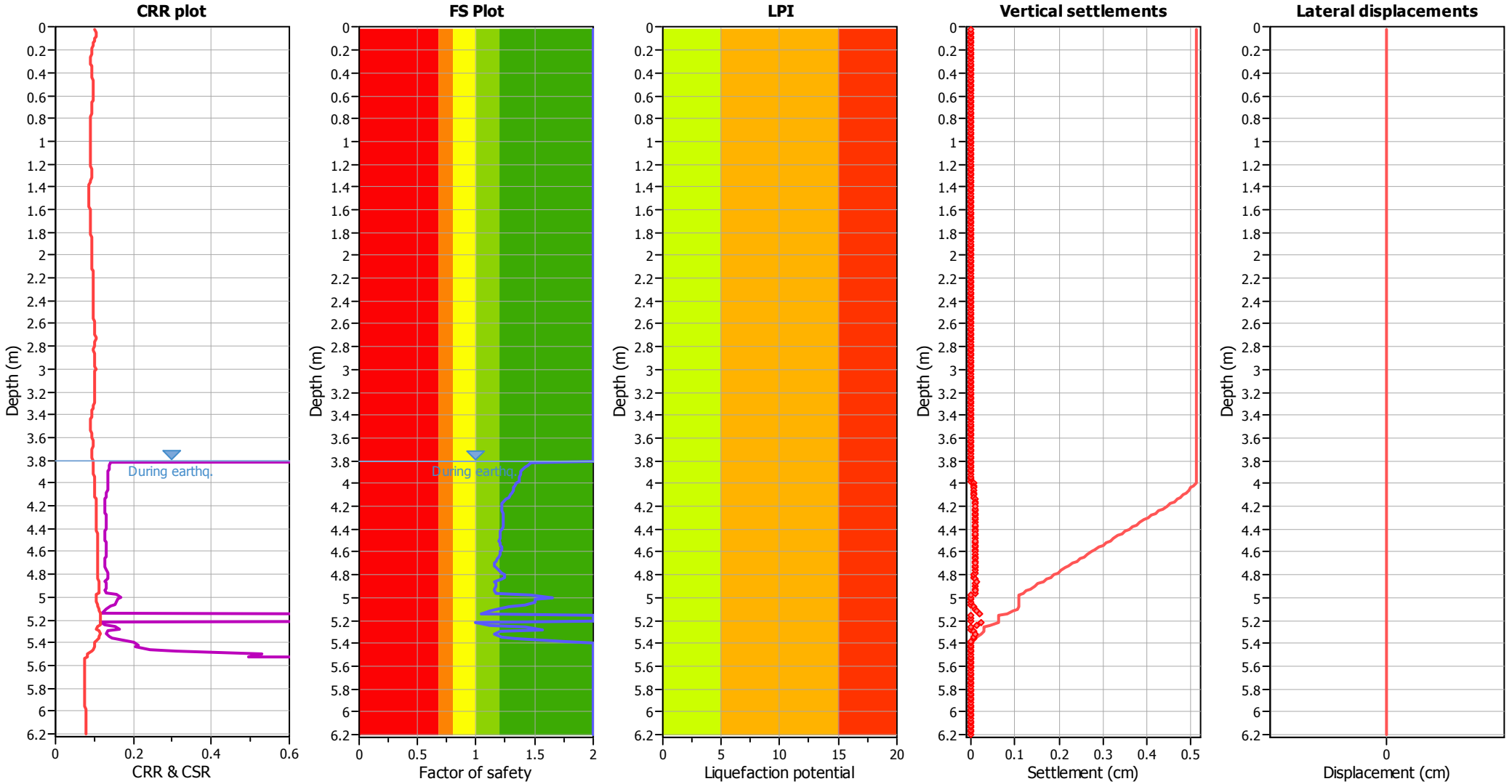






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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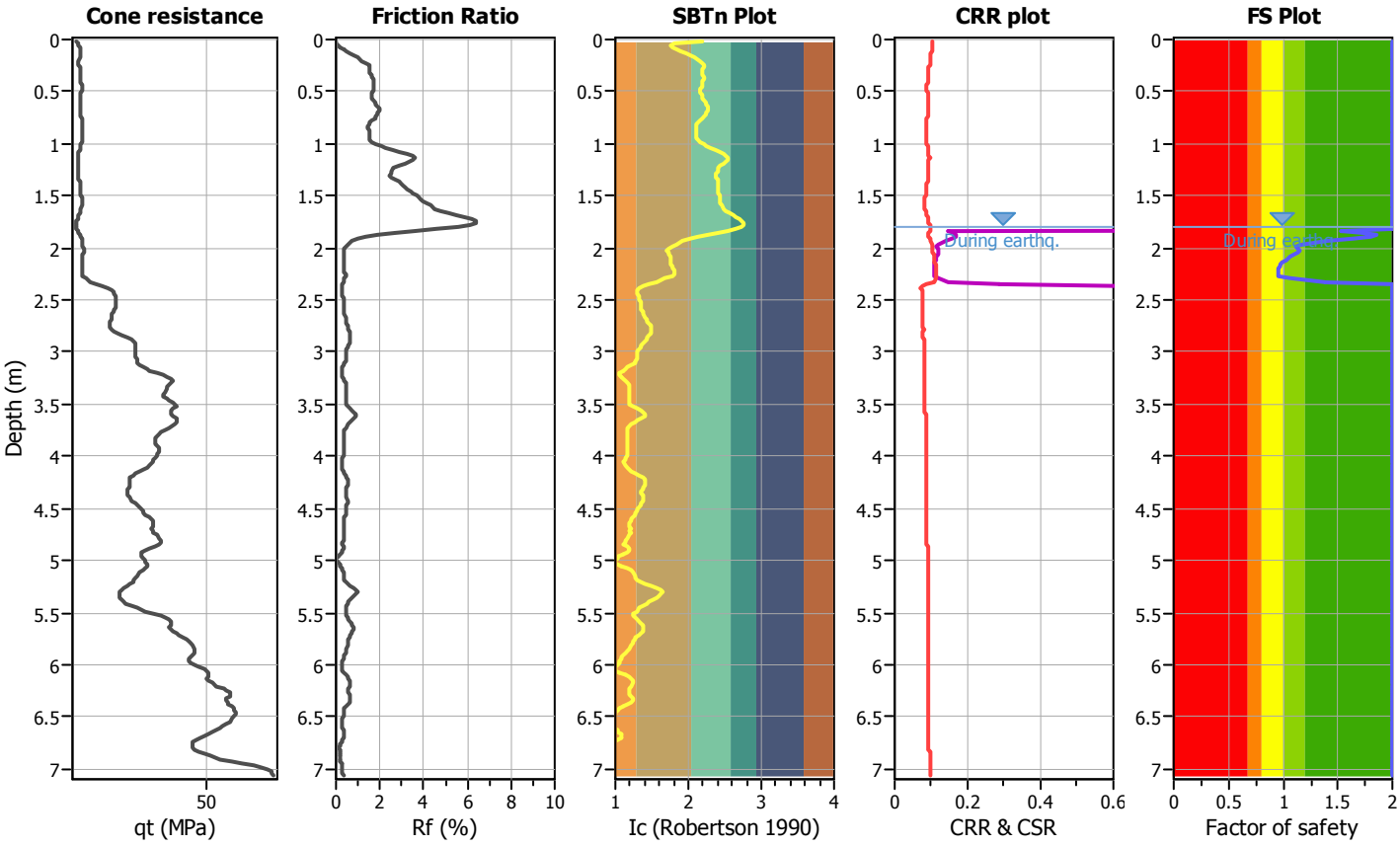
LIQUEFACTION ANALYSIS REPORT

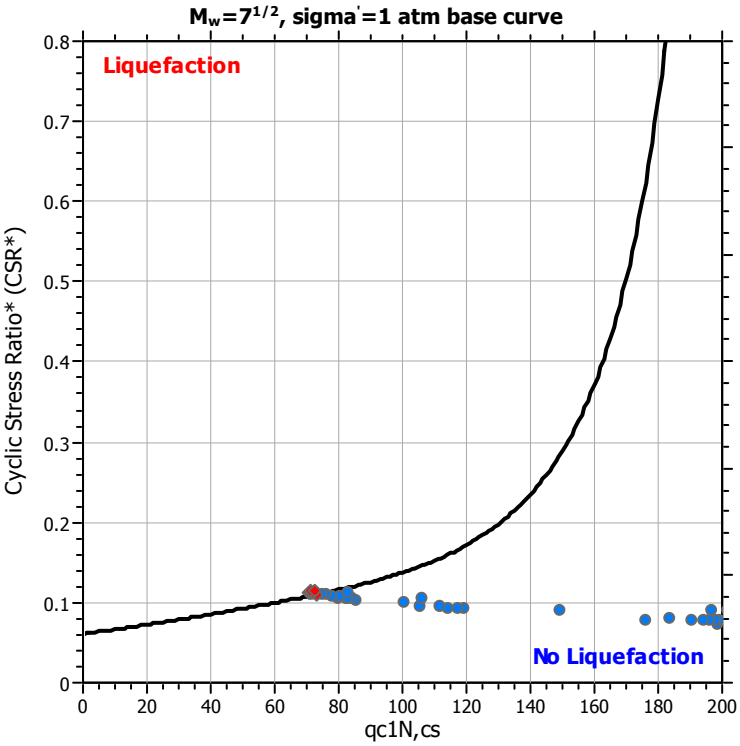
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

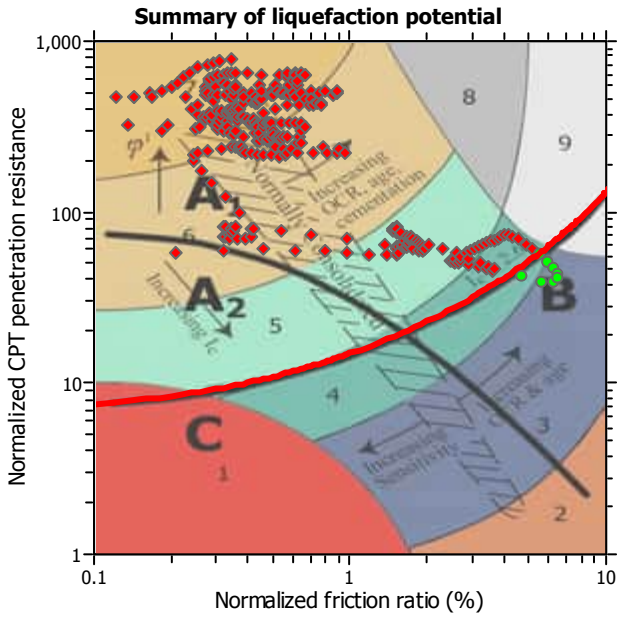
CPT file : CPT_16

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

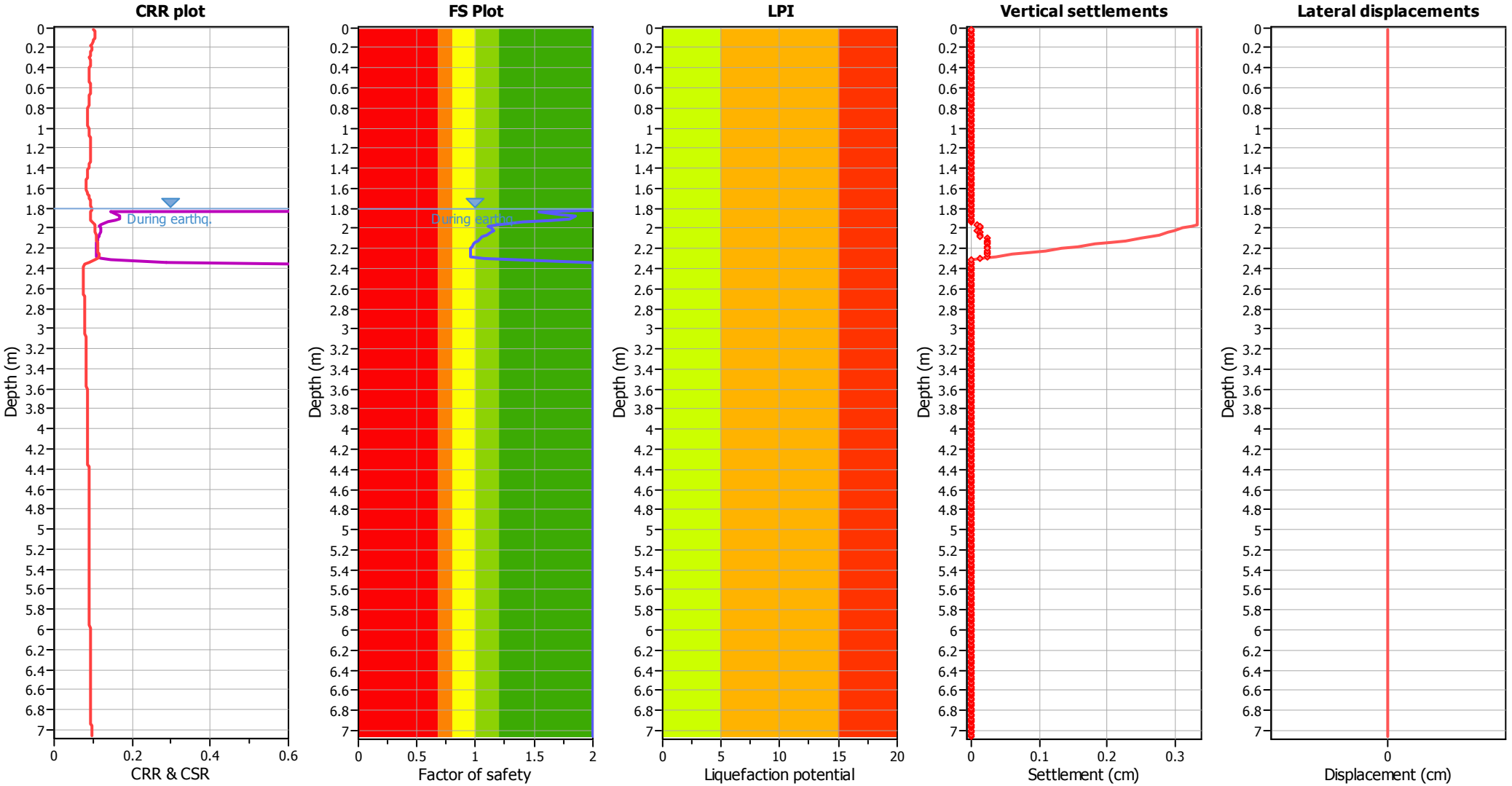






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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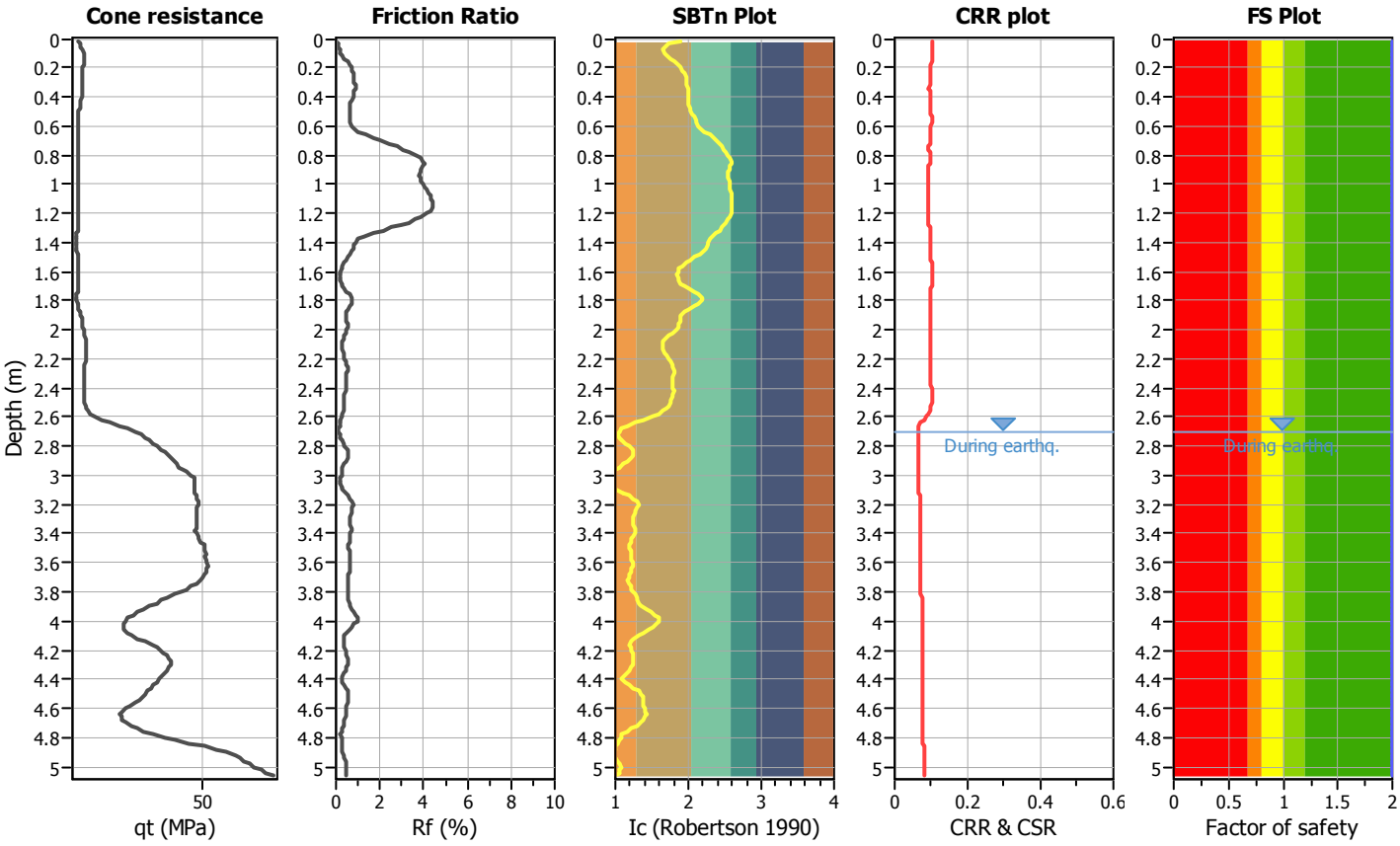
LIQUEFACTION ANALYSIS REPORT

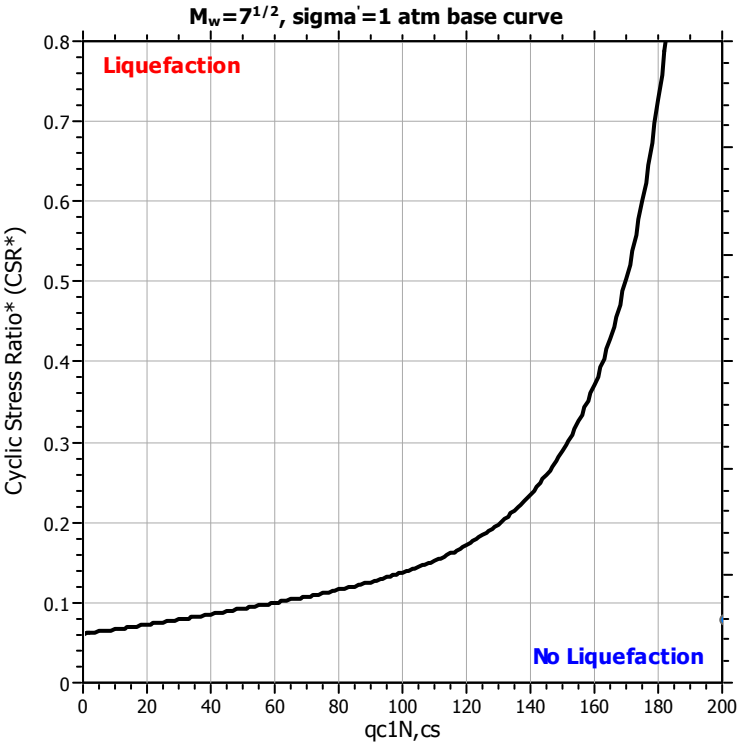
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

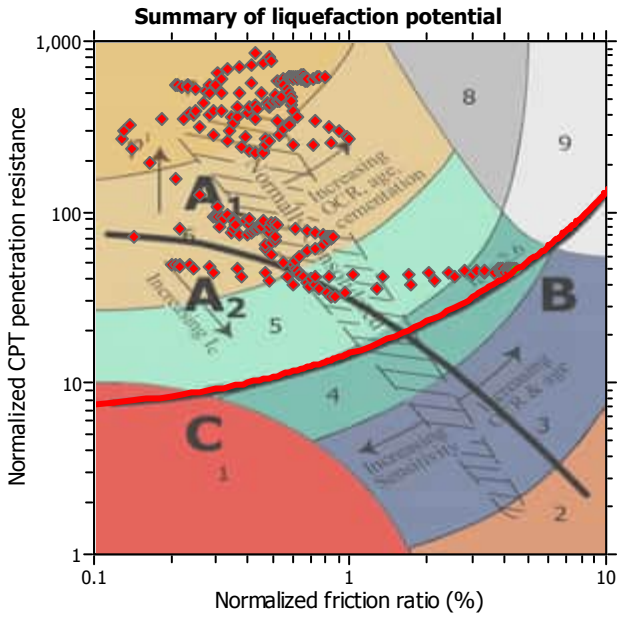
CPT file : CPT_17

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

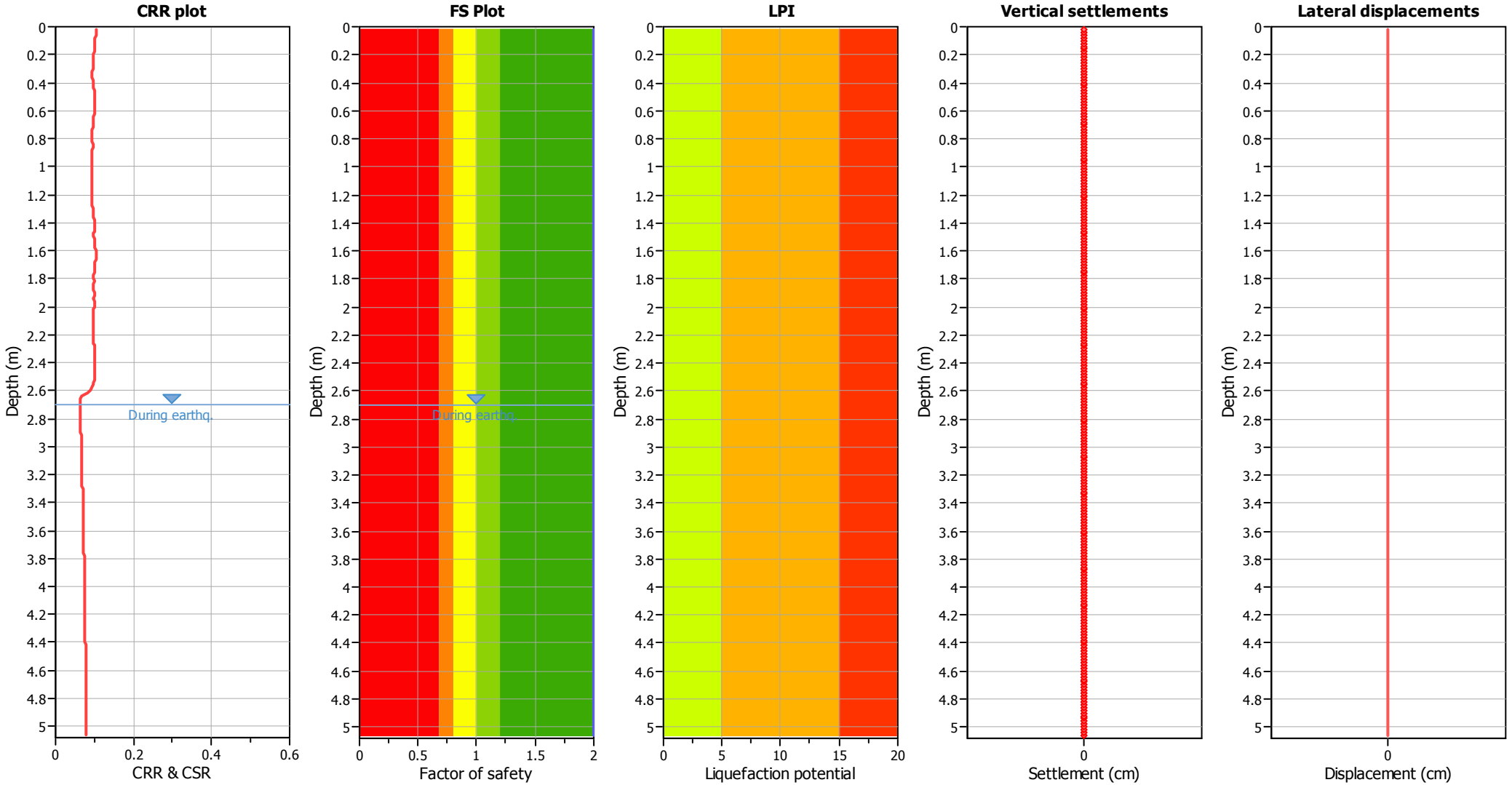






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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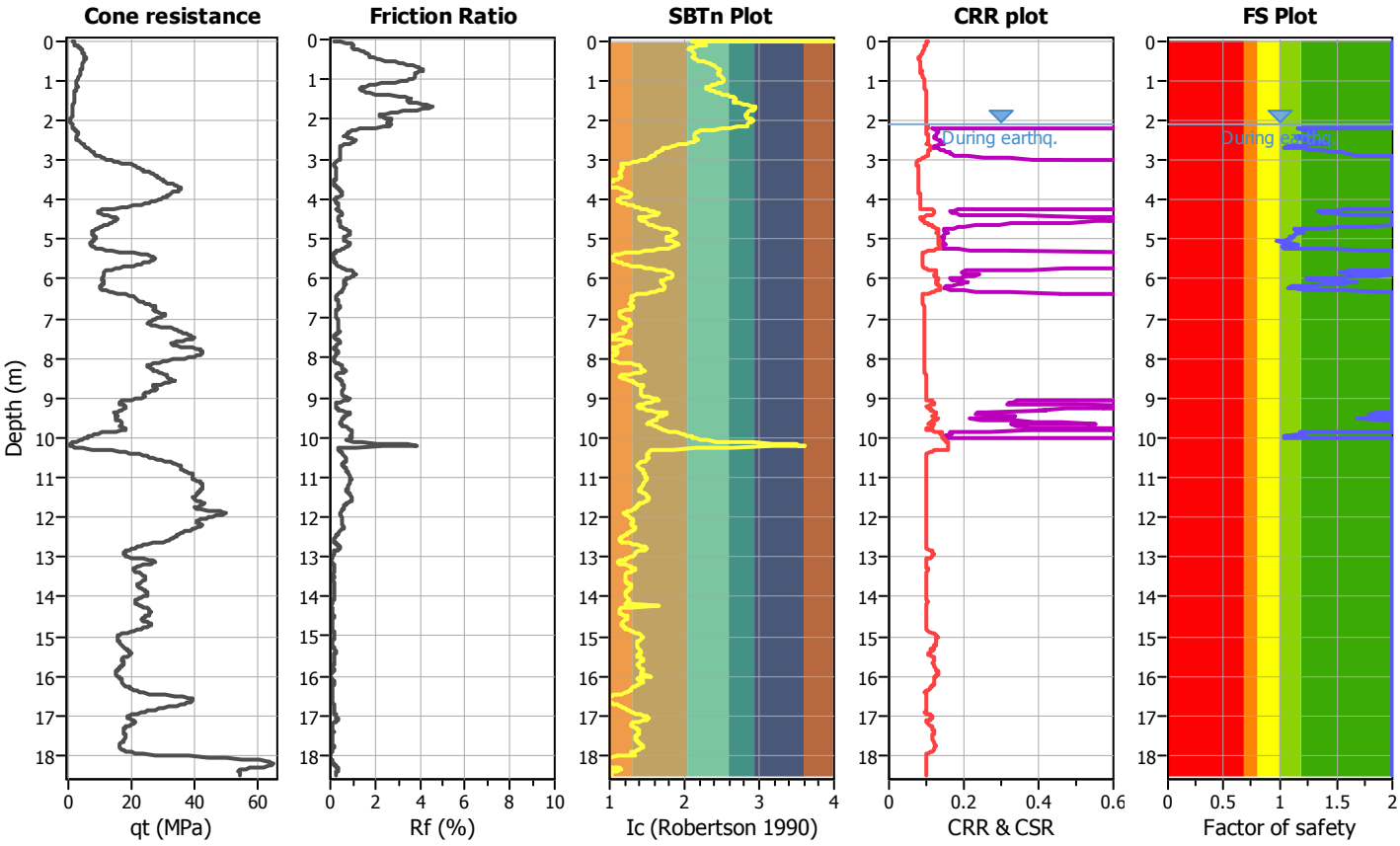
LIQUEFACTION ANALYSIS REPORT

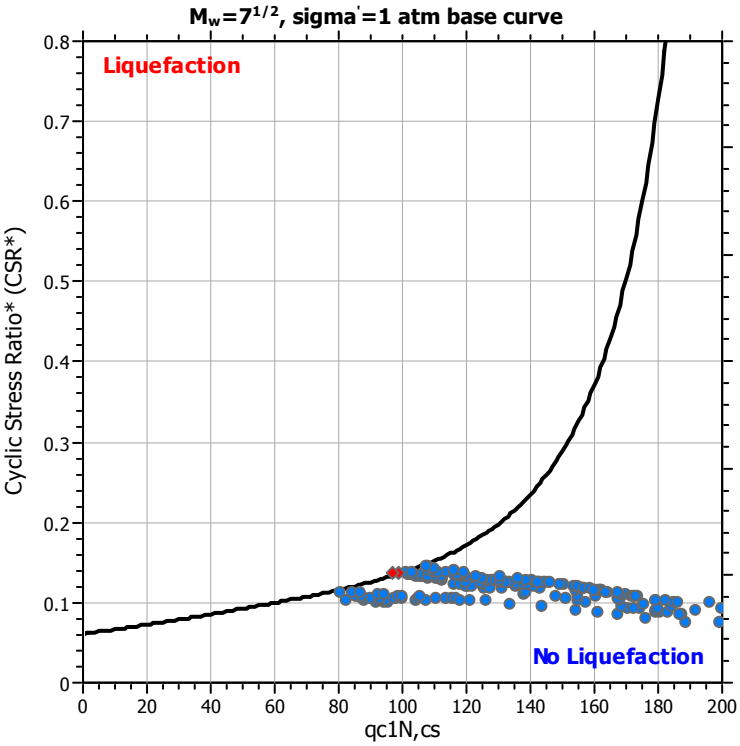
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

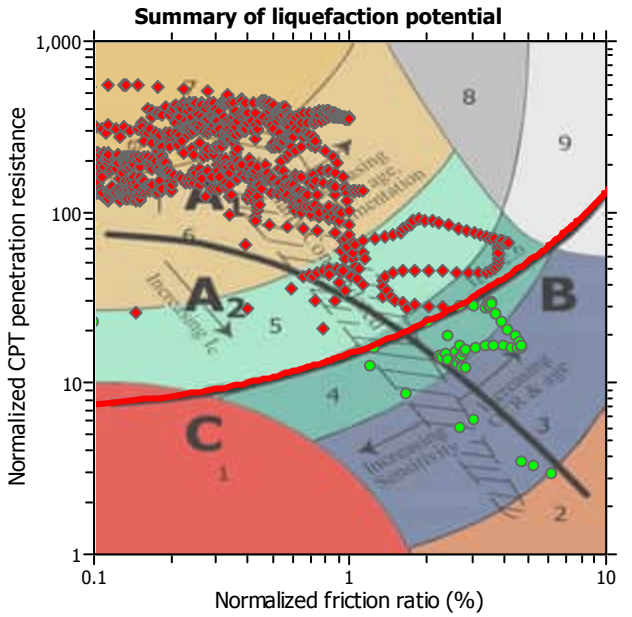
CPT file : CPT_18

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

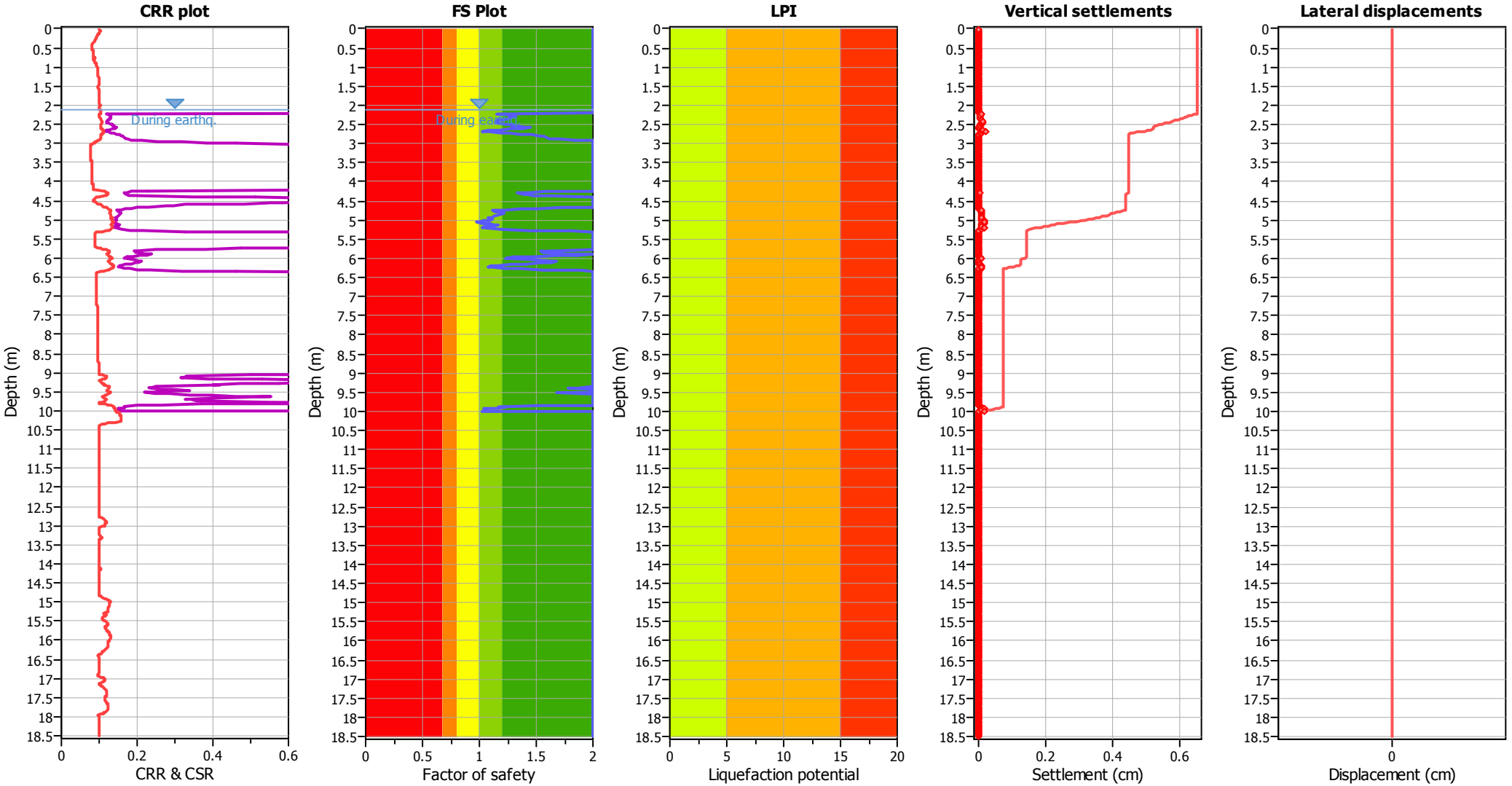






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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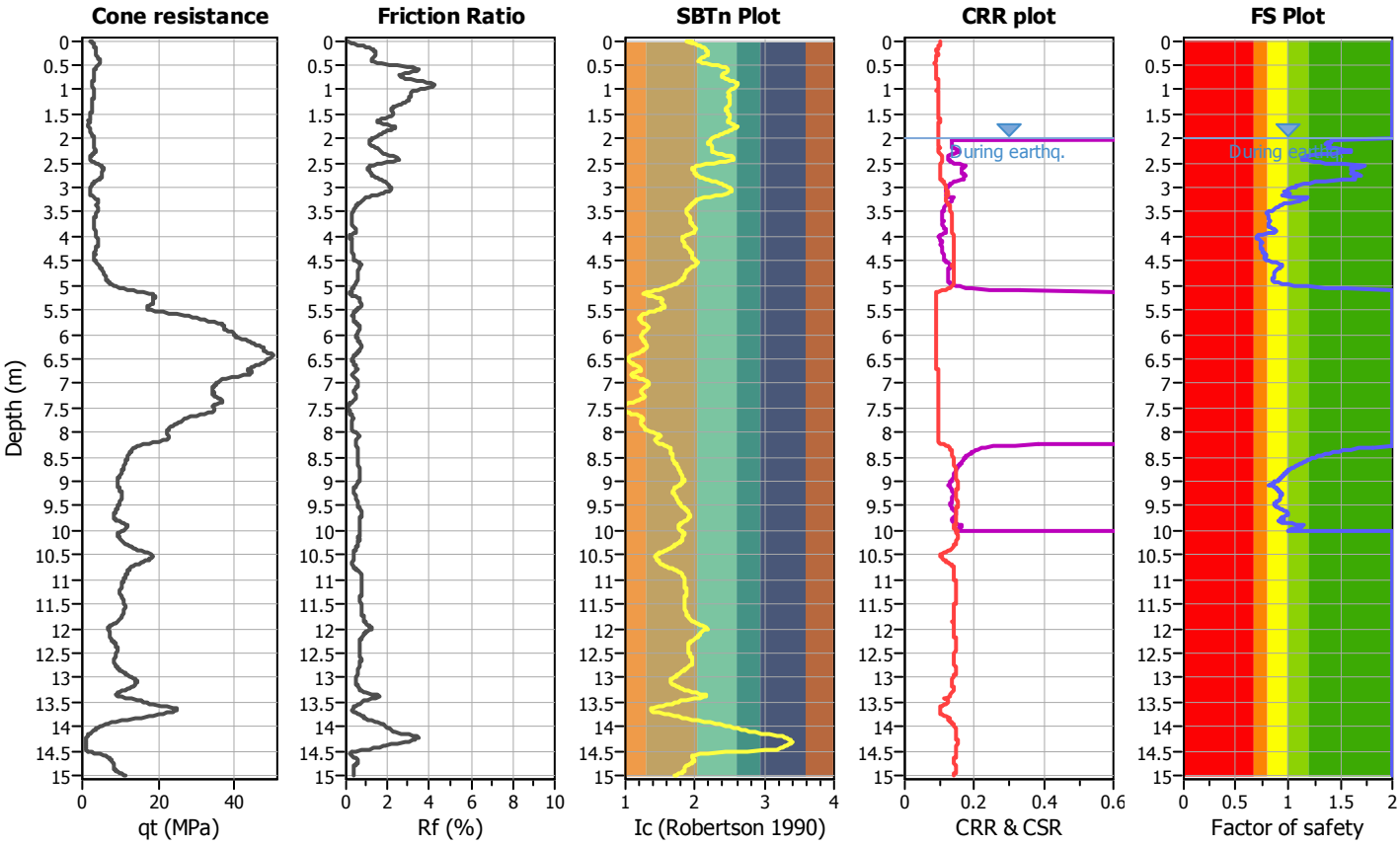
LIQUEFACTION ANALYSIS REPORT

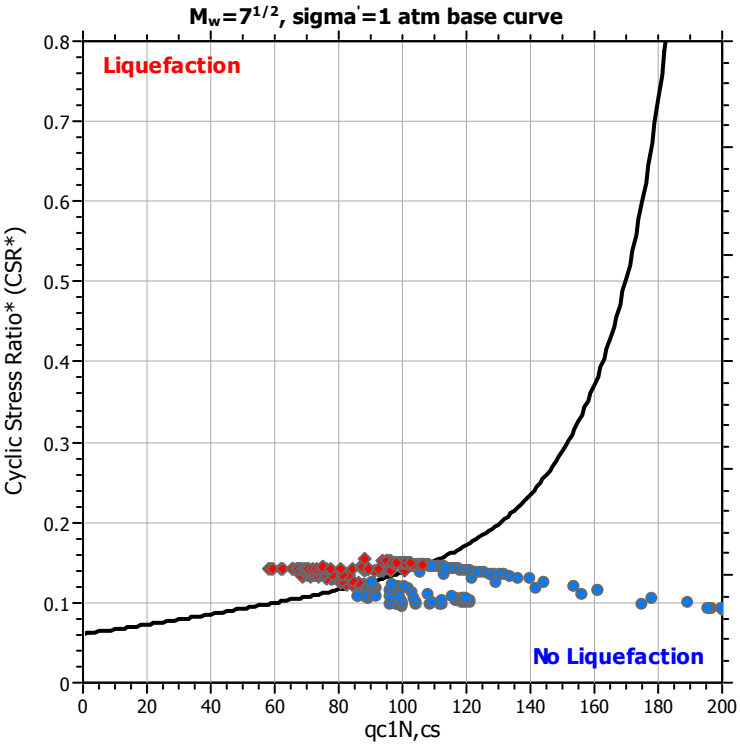
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

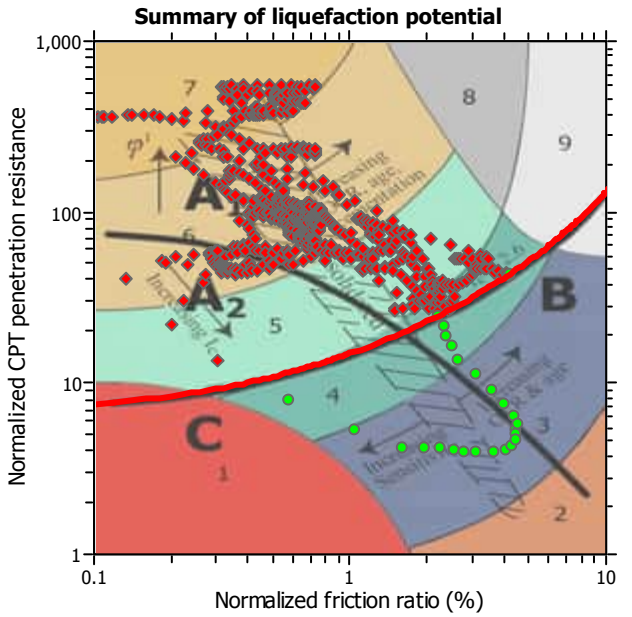
CPT file : CPT_19

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

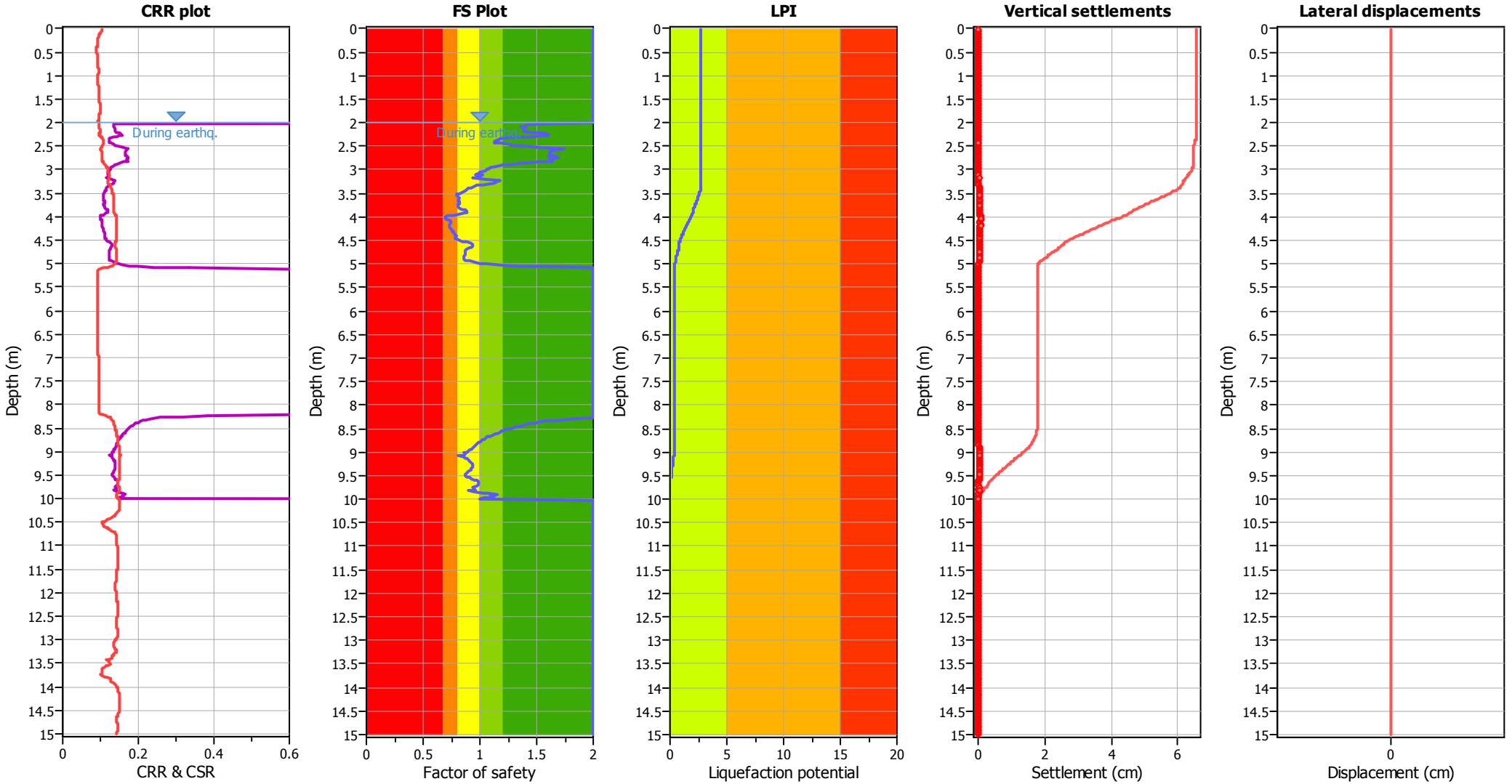






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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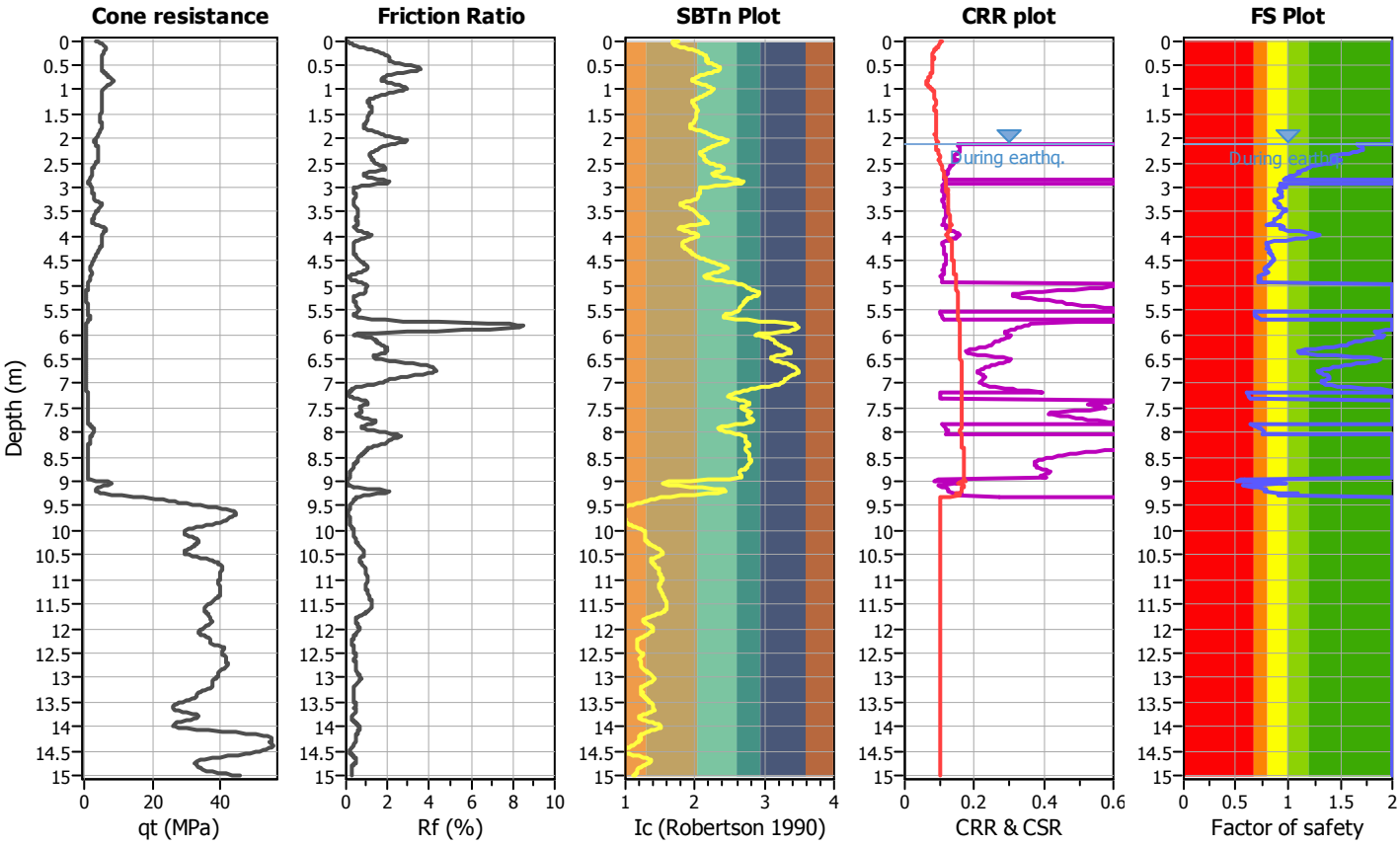
LIQUEFACTION ANALYSIS REPORT

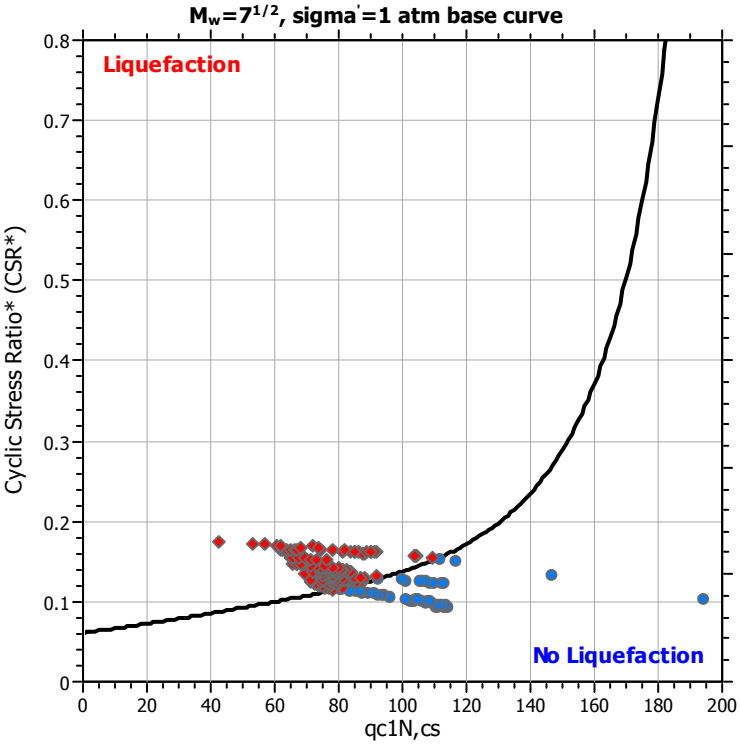
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

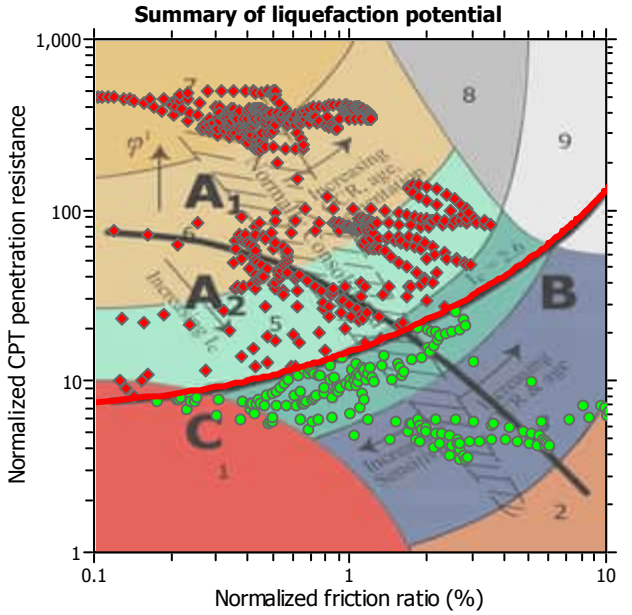
CPT file : CPT_20

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

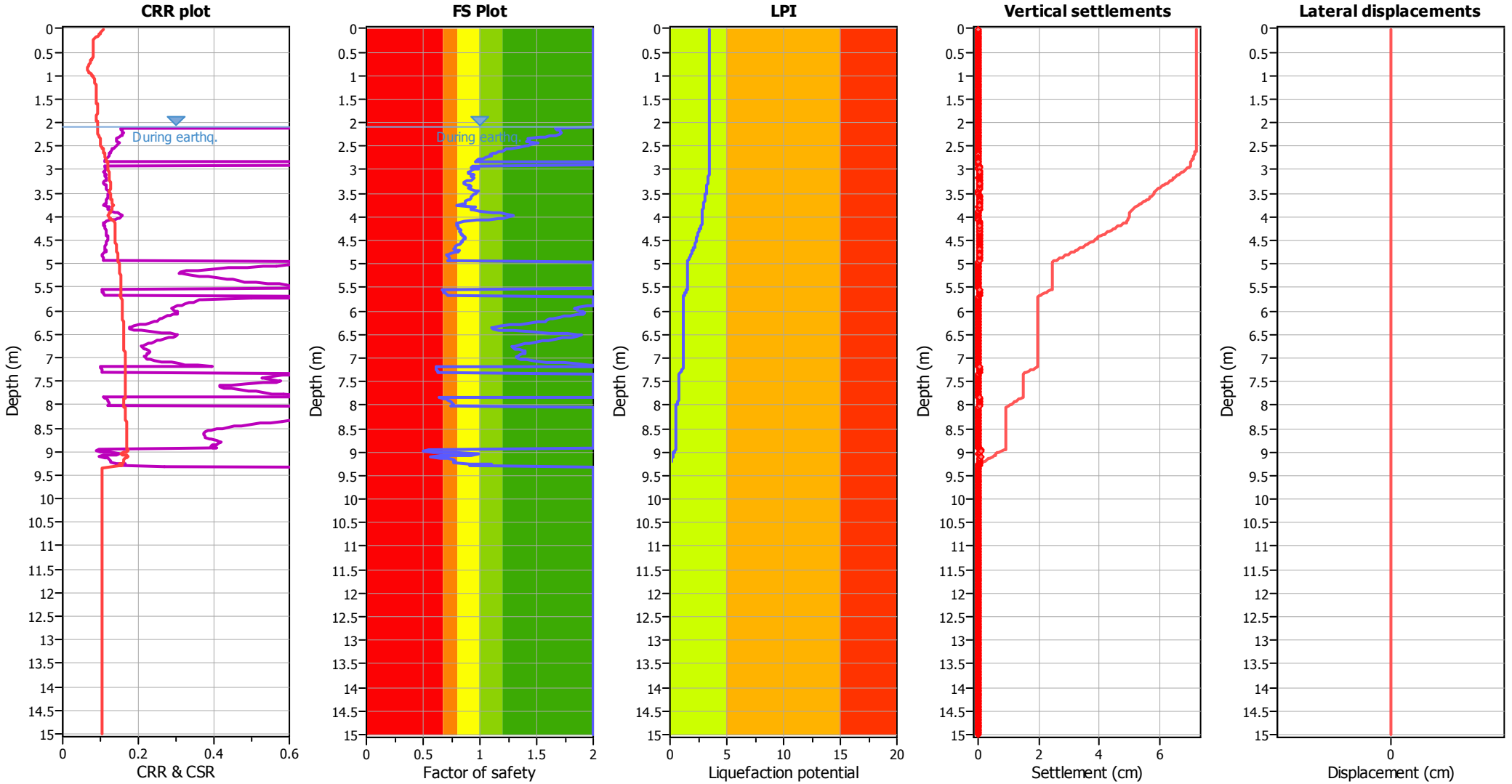






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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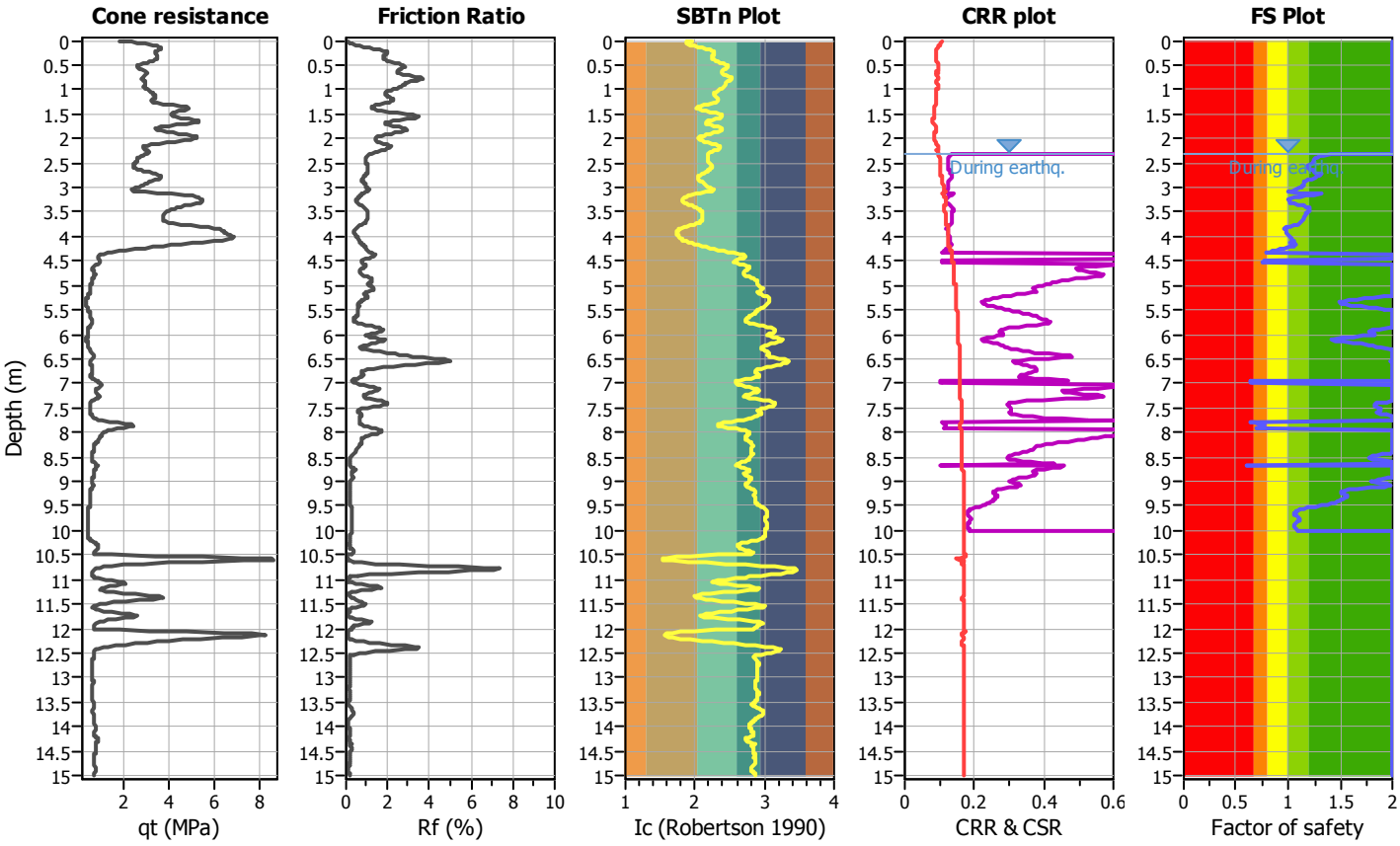
LIQUEFACTION ANALYSIS REPORT

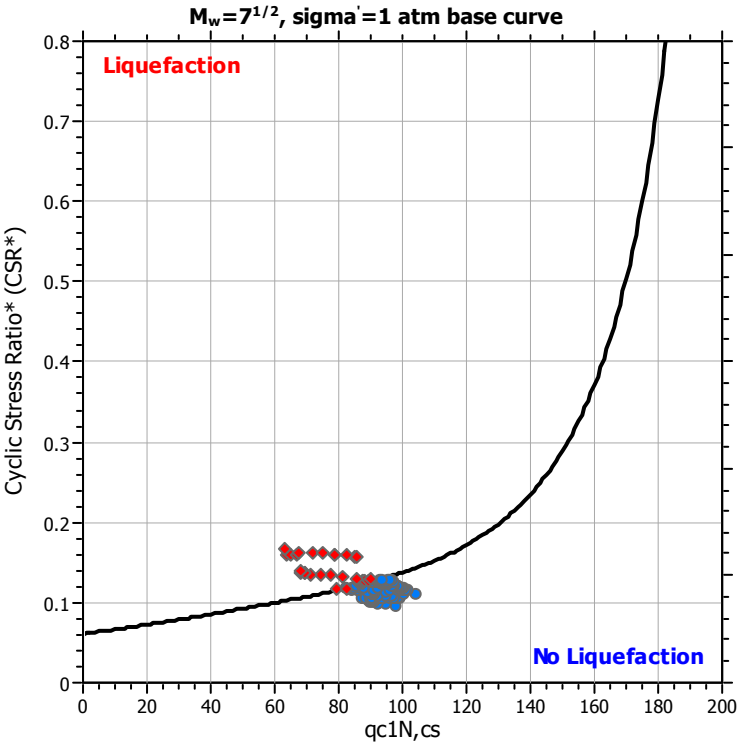
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

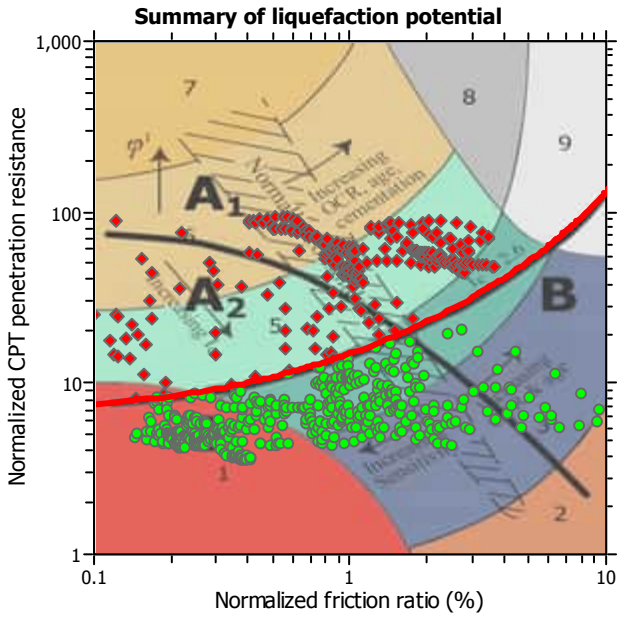
CPT file : CPT_21

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

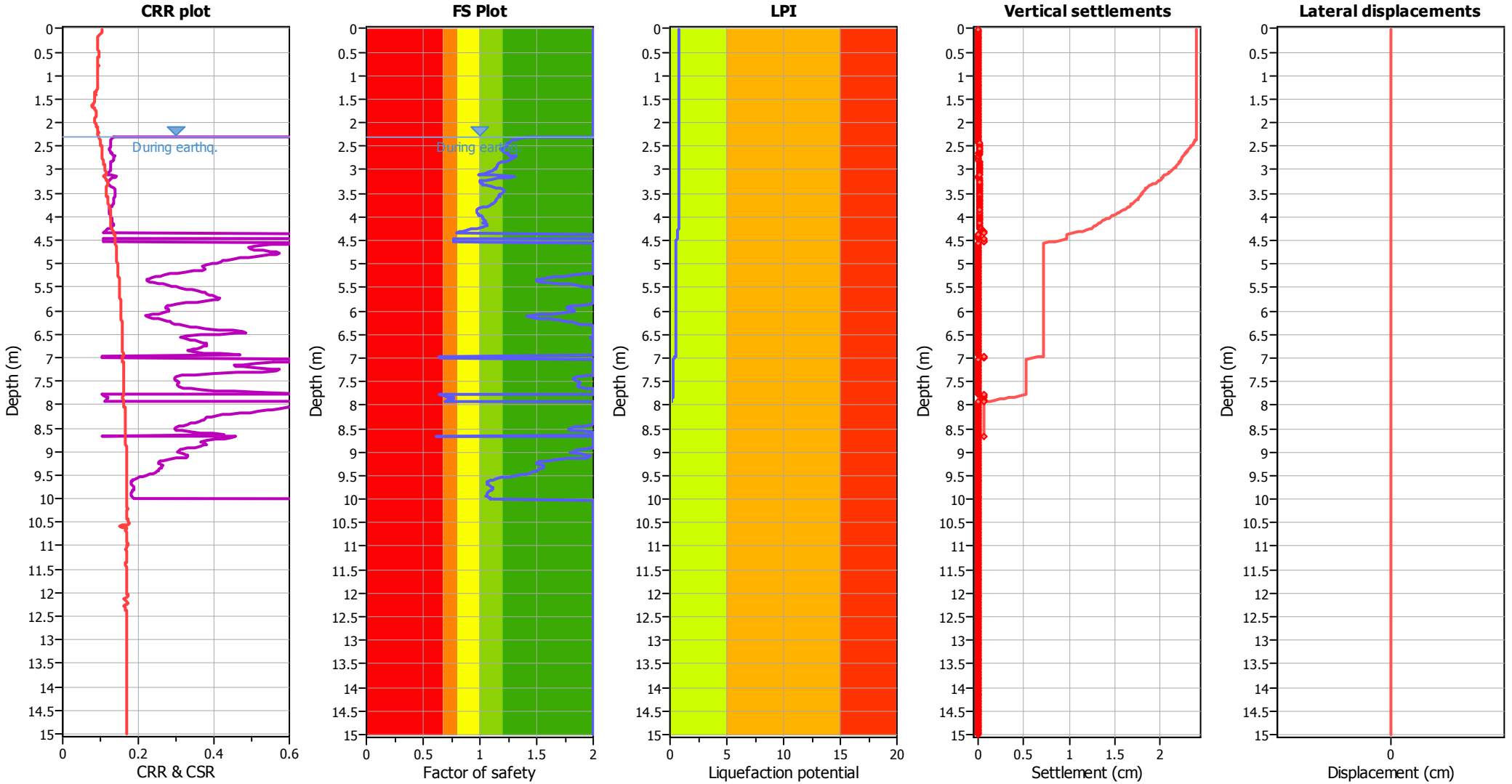






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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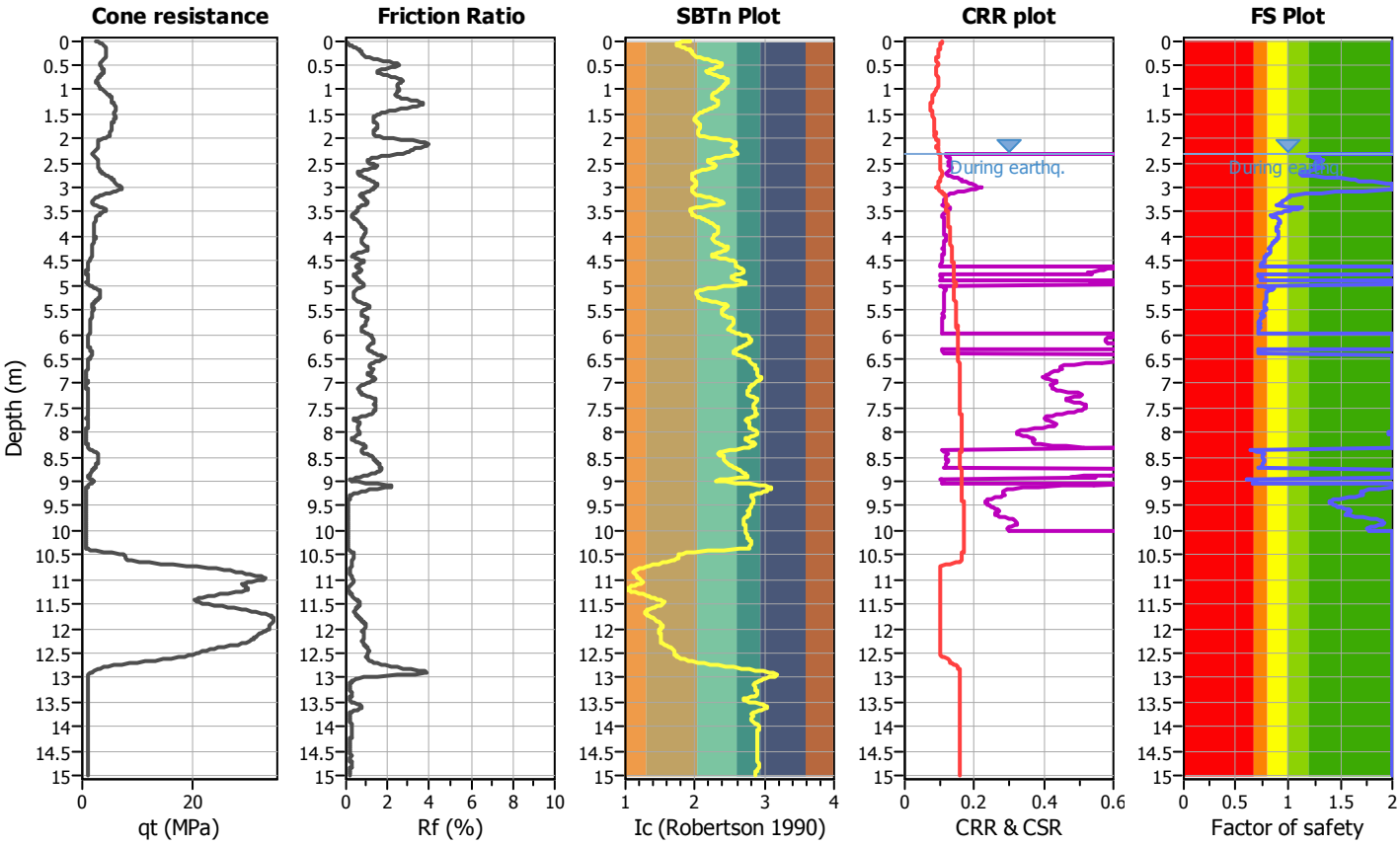
LIQUEFACTION ANALYSIS REPORT

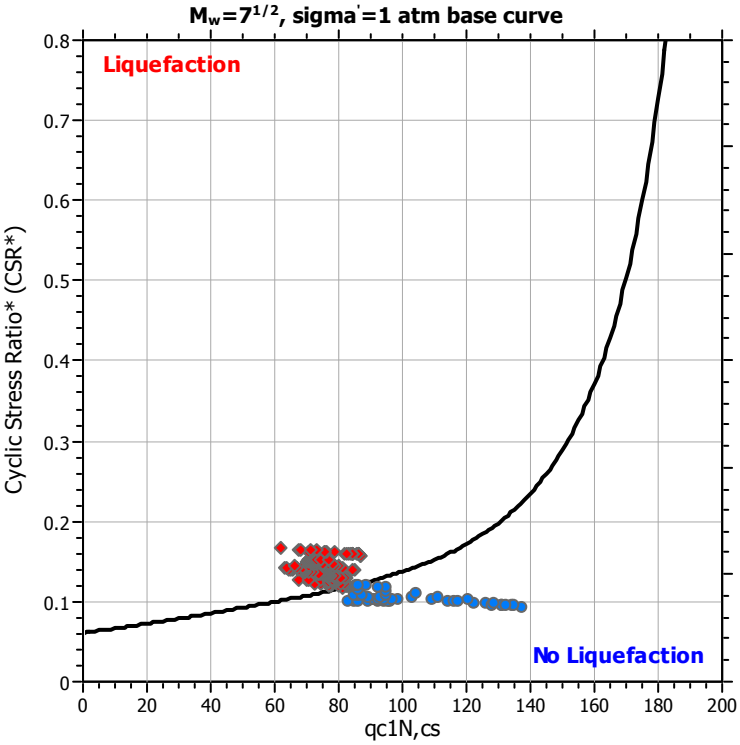
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

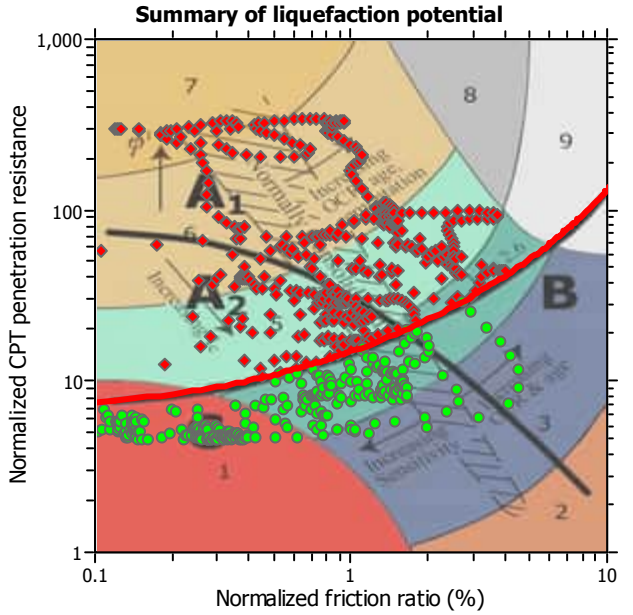
CPT file : CPT_22

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

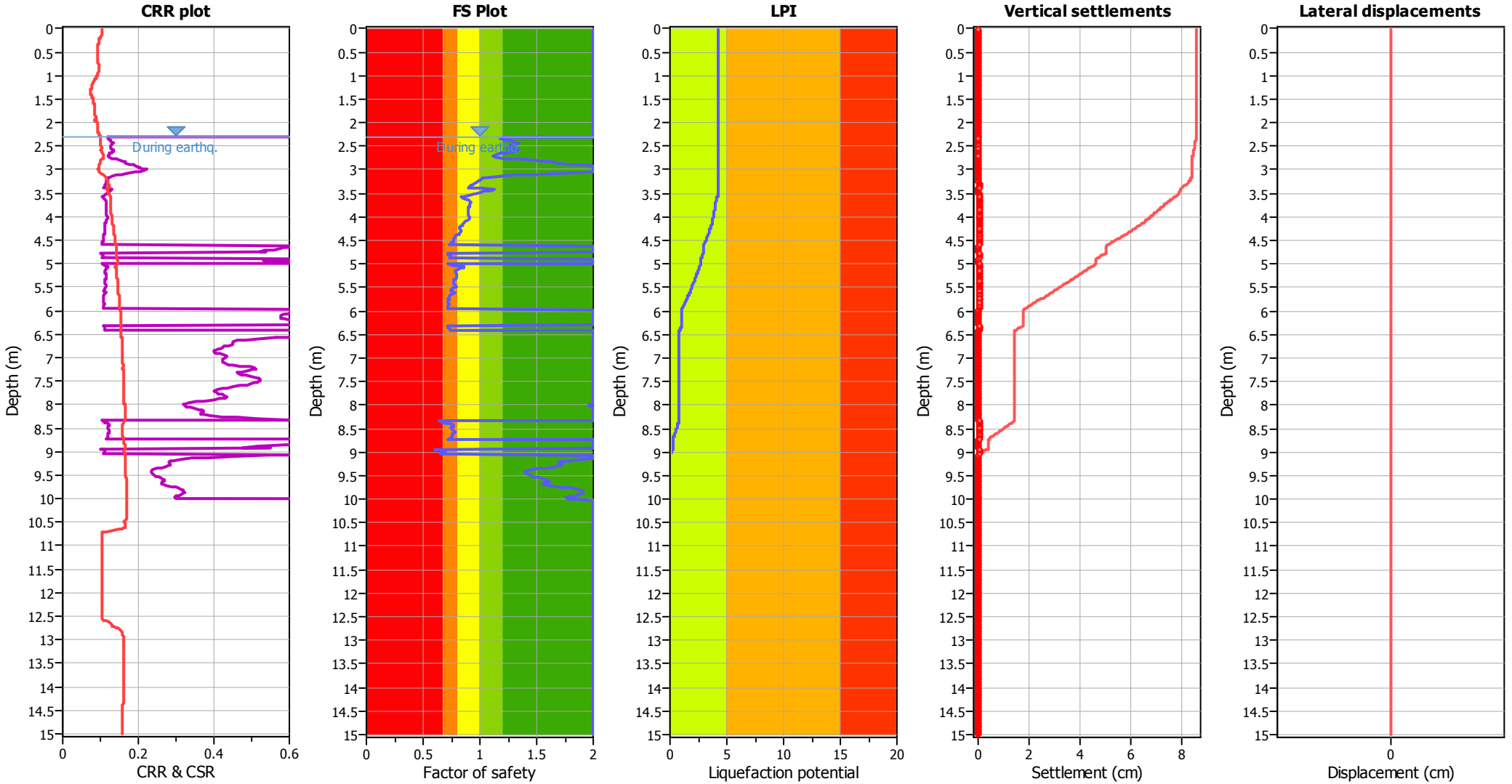






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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- Liquefaction and no liq. are equally likely
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LPI color scheme

- Very high risk
- High risk
- Low risk

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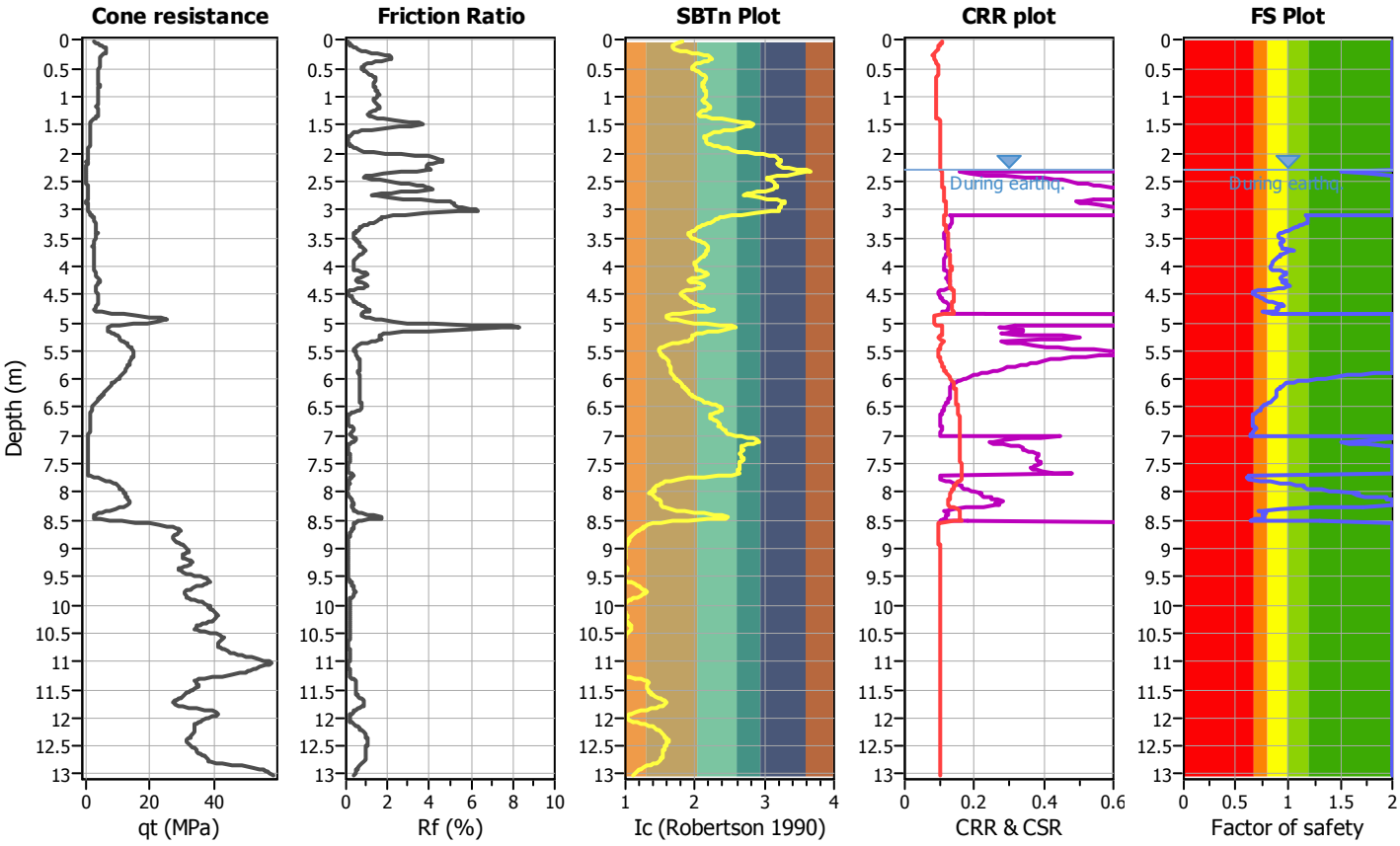
LIQUEFACTION ANALYSIS REPORT

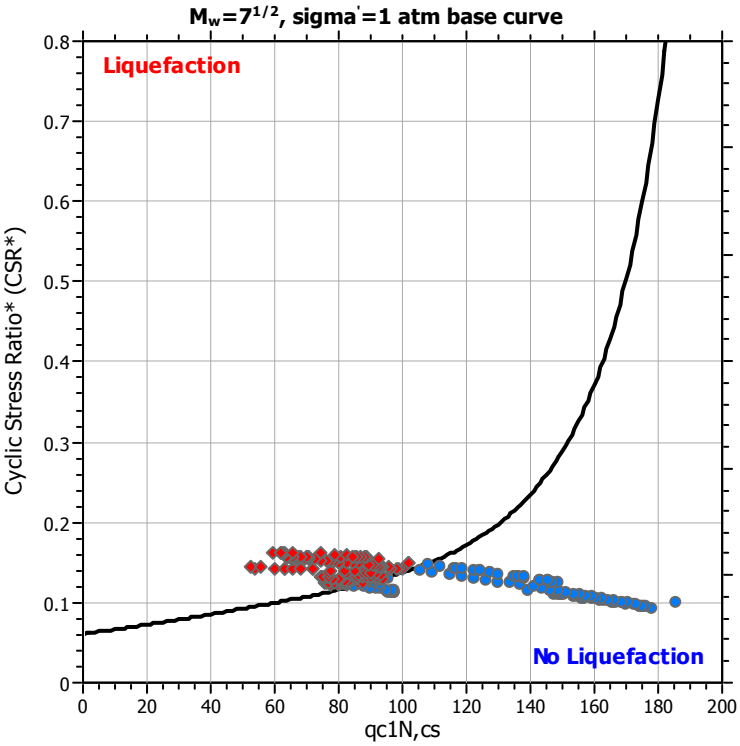
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

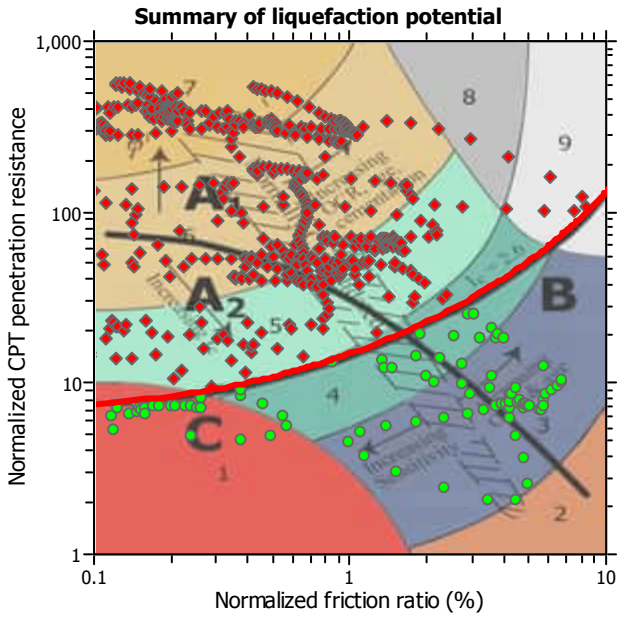
CPT file : CPT_23

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

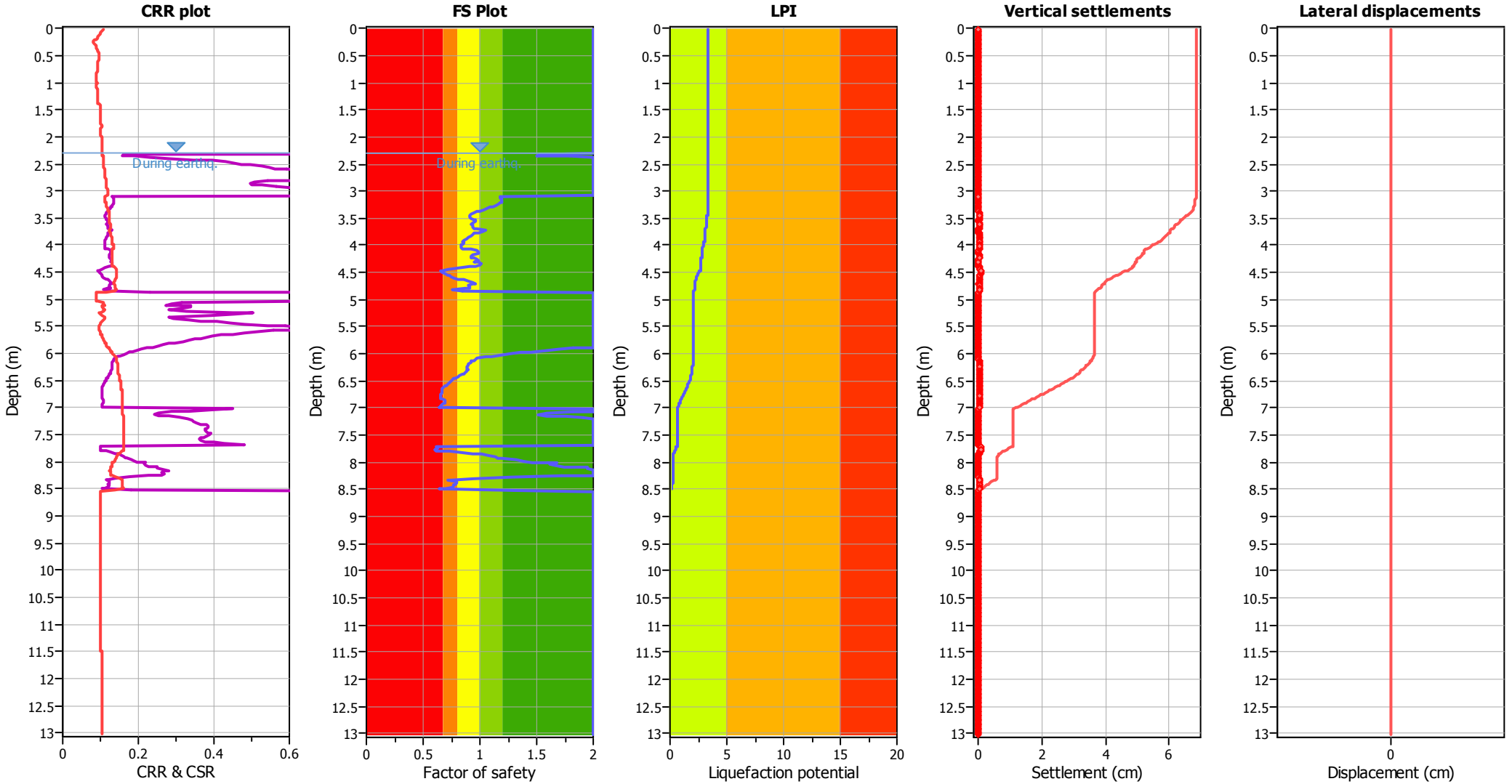






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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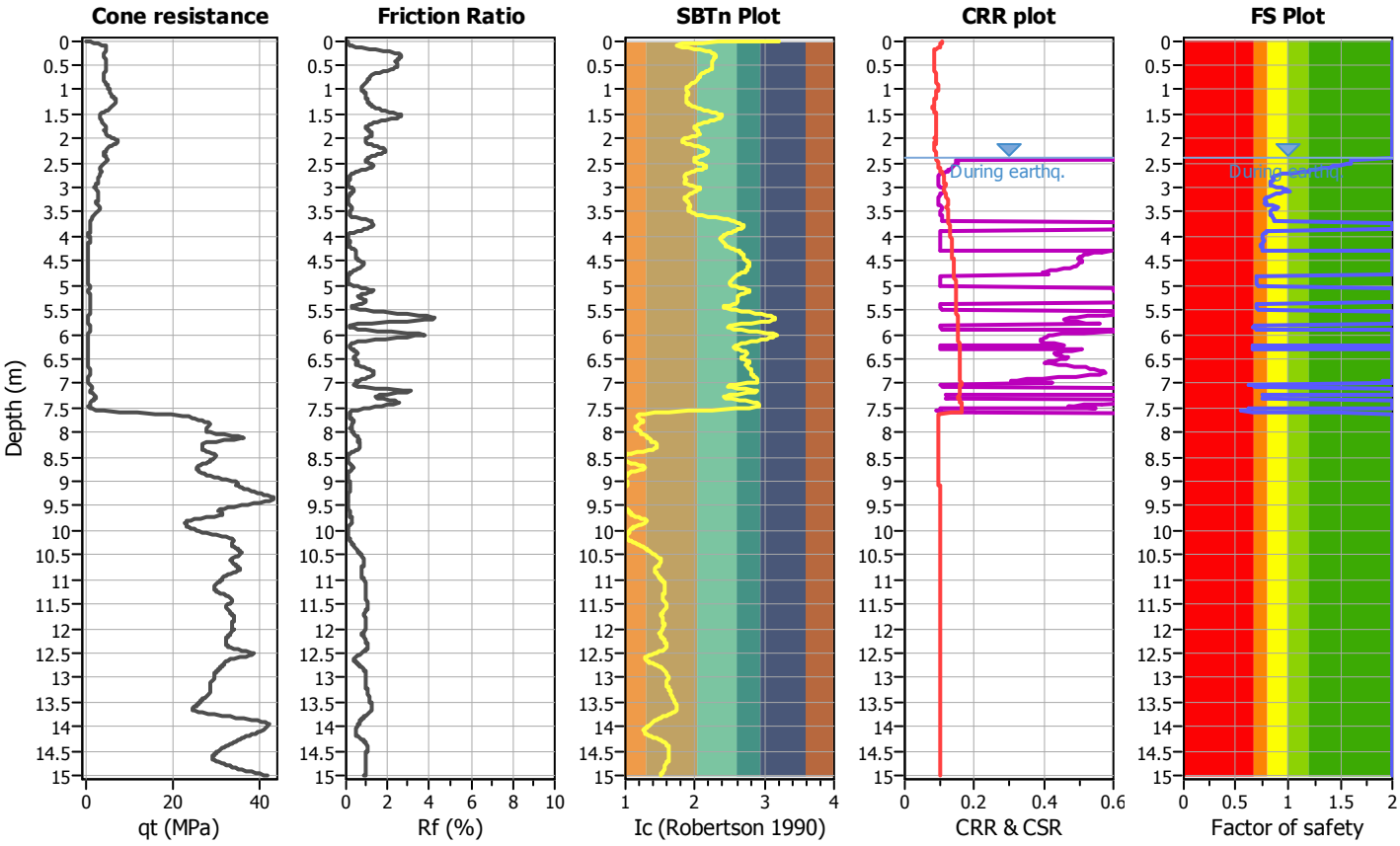
LIQUEFACTION ANALYSIS REPORT

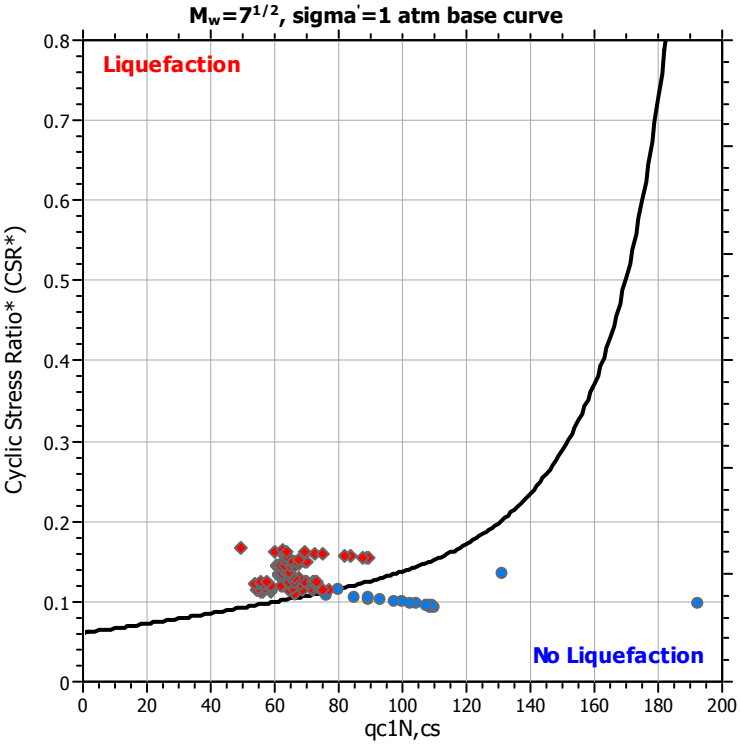
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

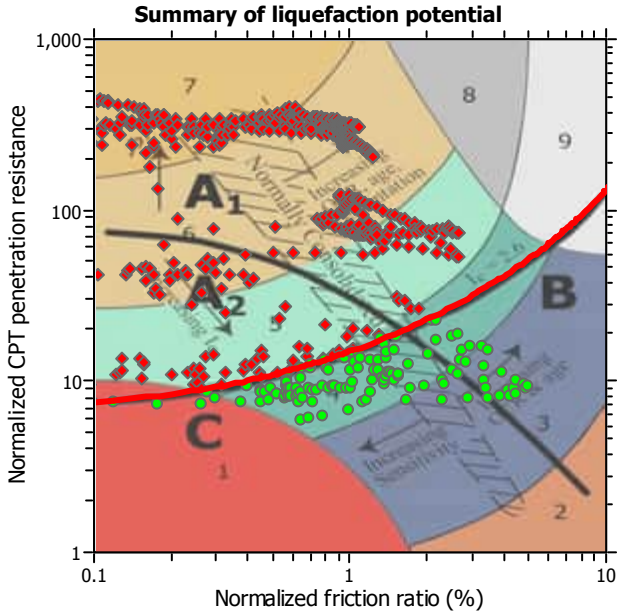
CPT file : CPT_24

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

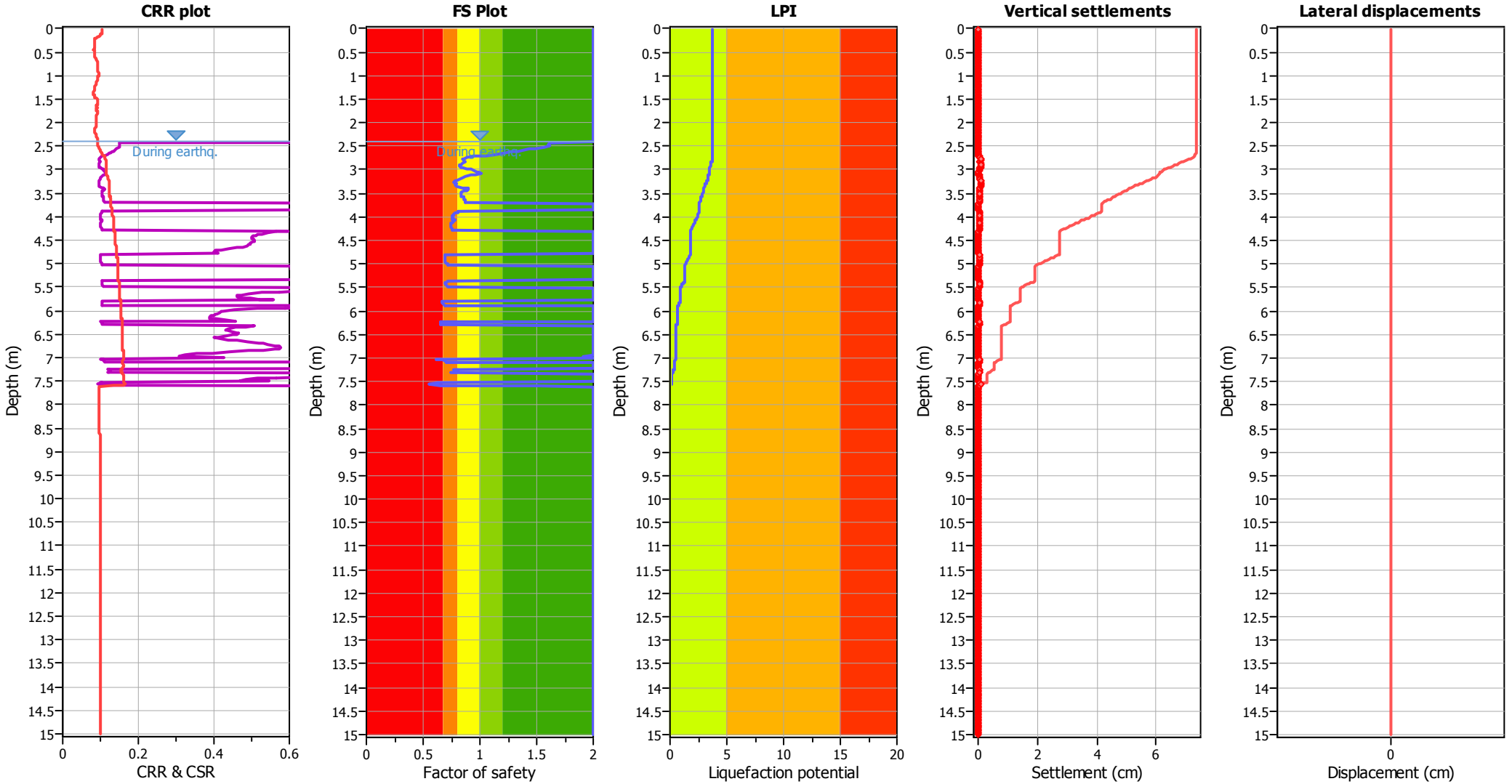






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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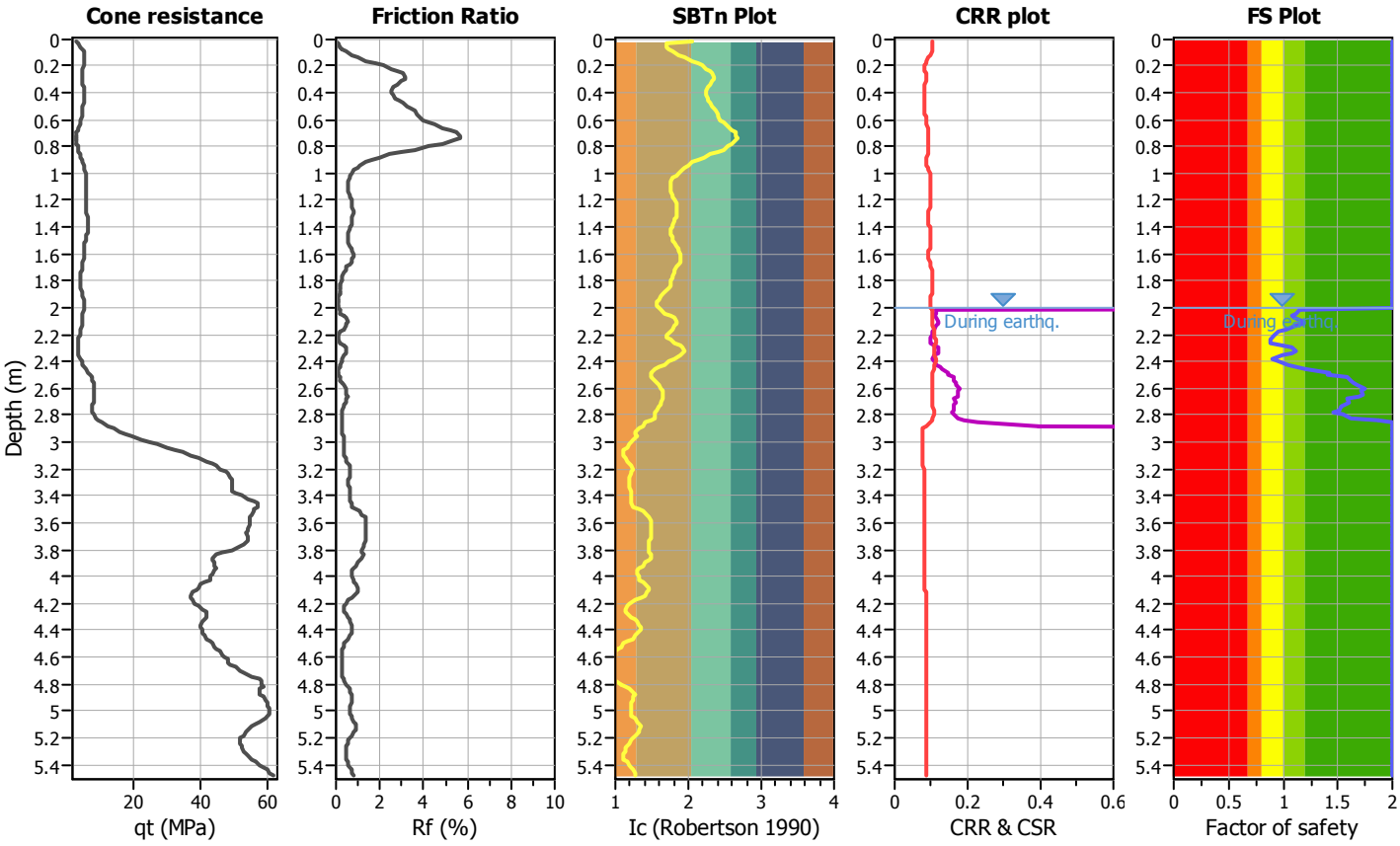
LIQUEFACTION ANALYSIS REPORT

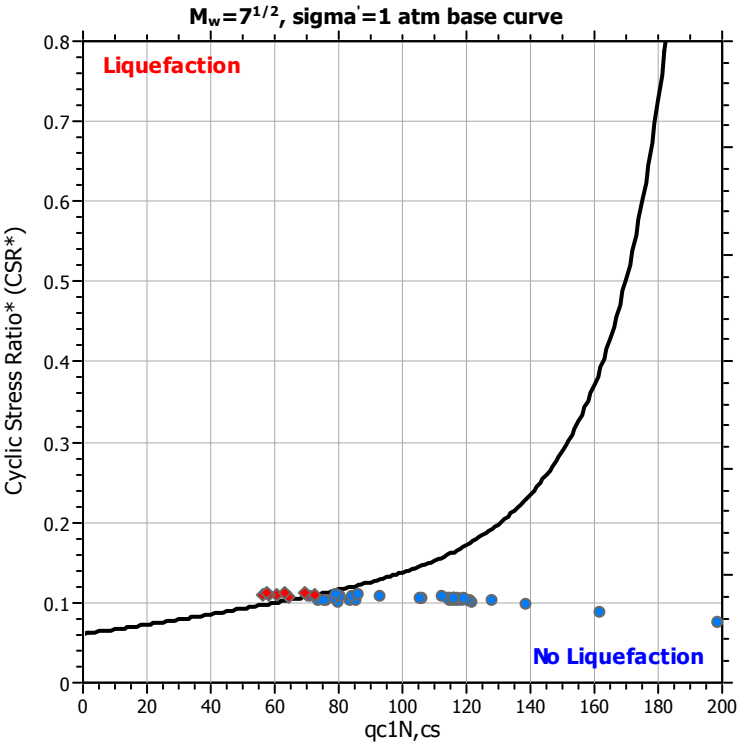
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

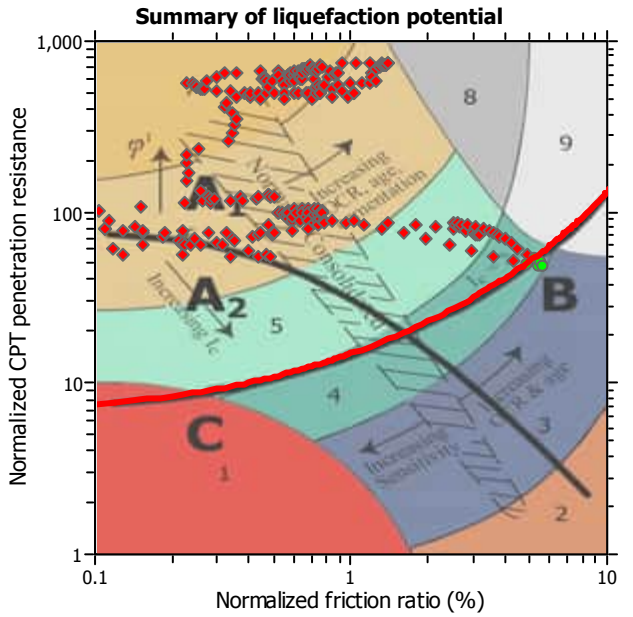
CPT file : CPT_25

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

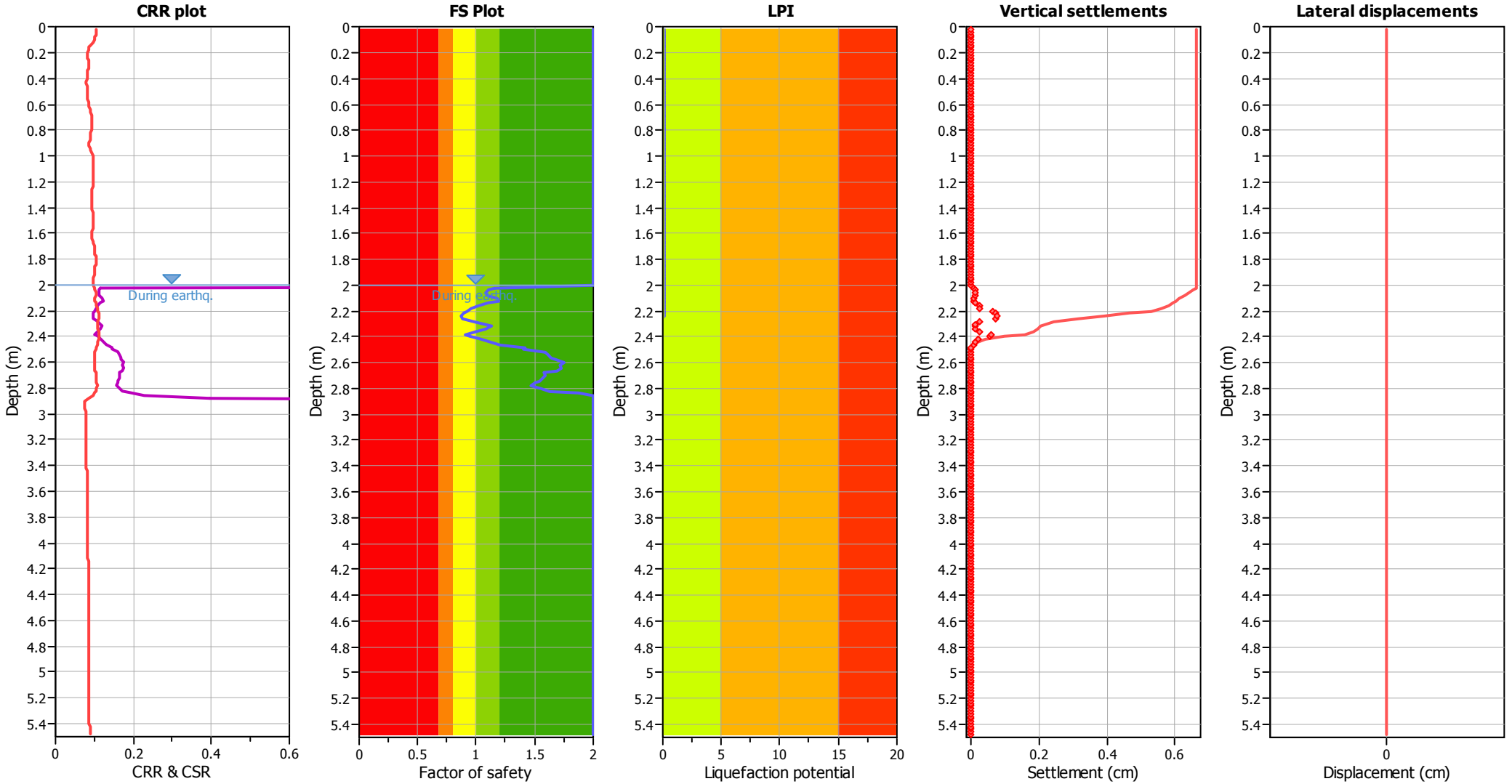






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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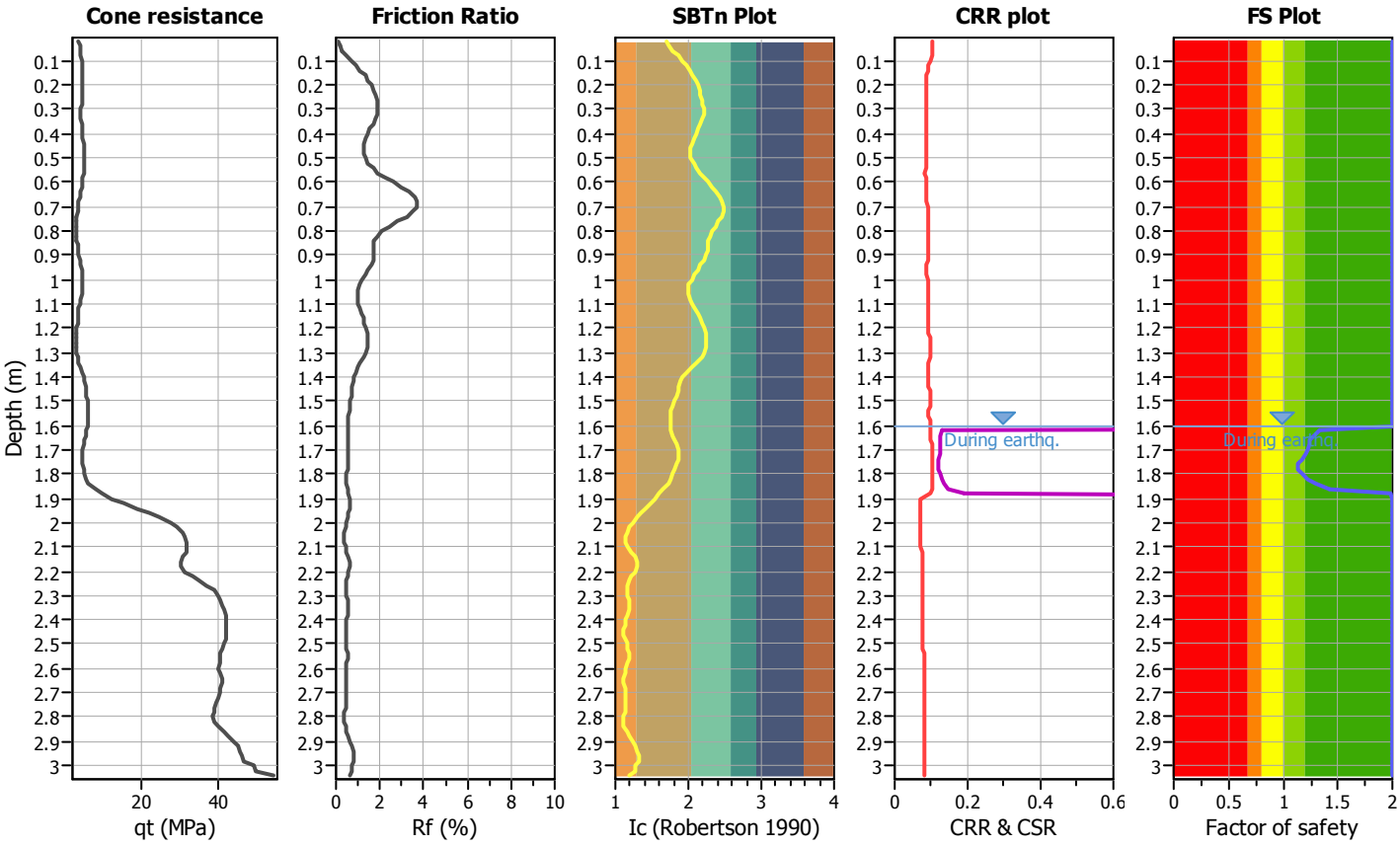
LIQUEFACTION ANALYSIS REPORT

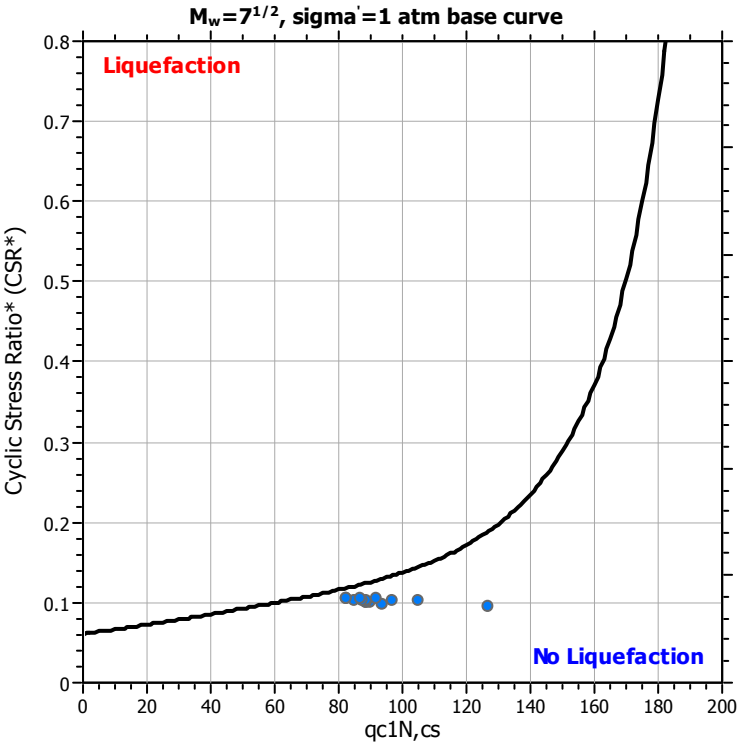
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

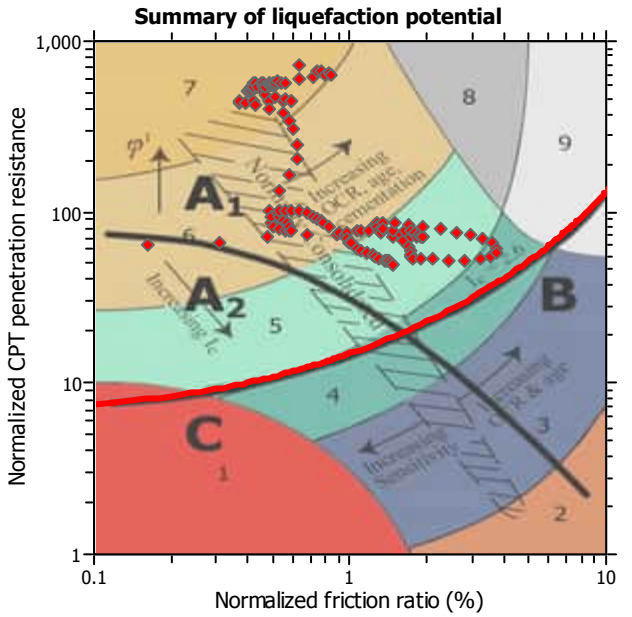
CPT file : CPT_26

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

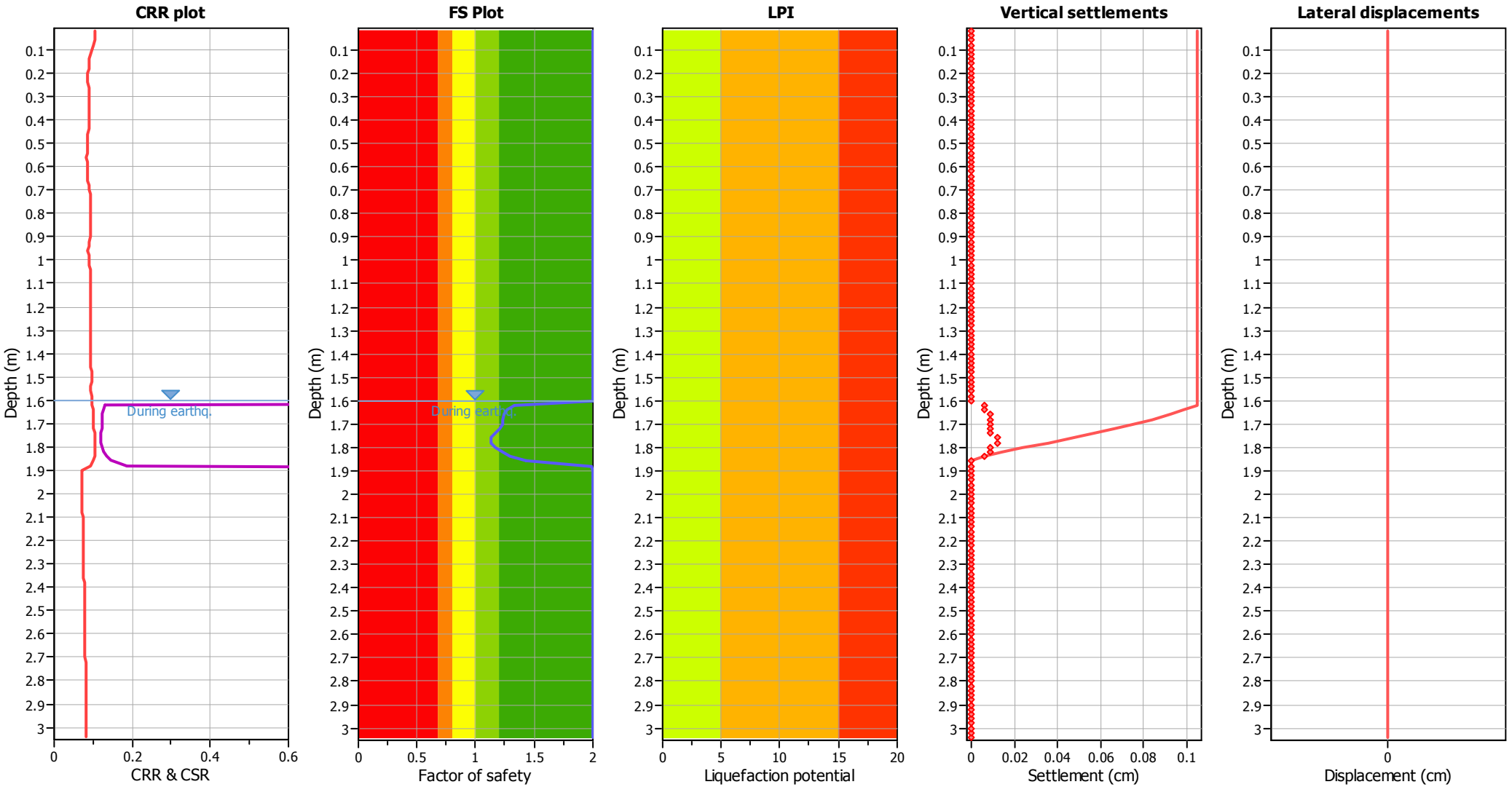






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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Christchurch 8140

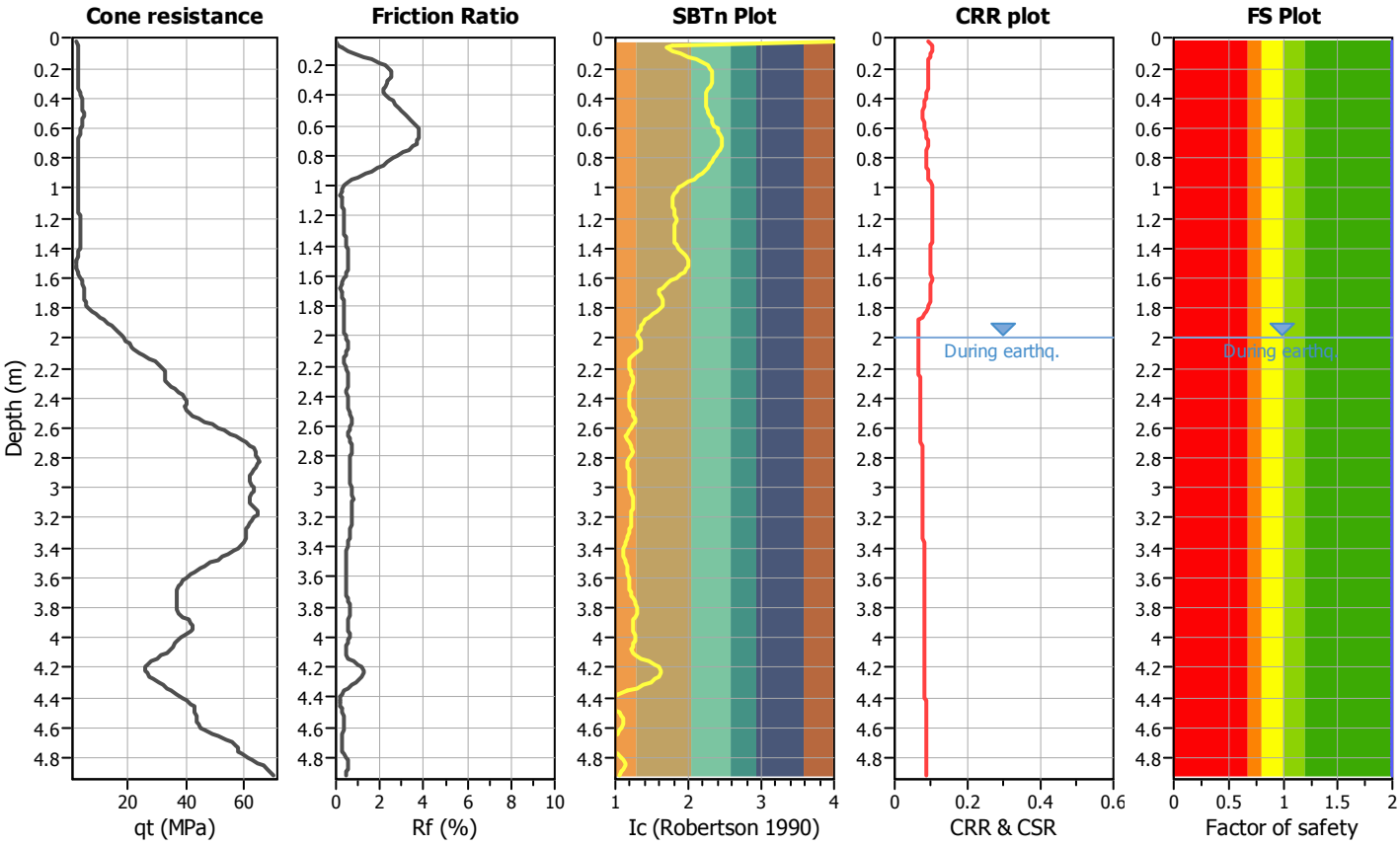
LIQUEFACTION ANALYSIS REPORT

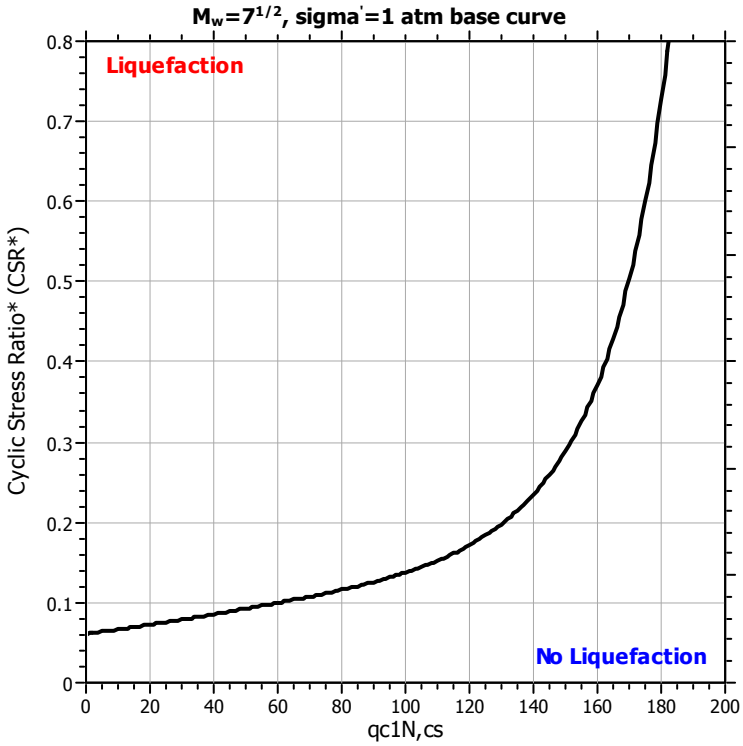
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

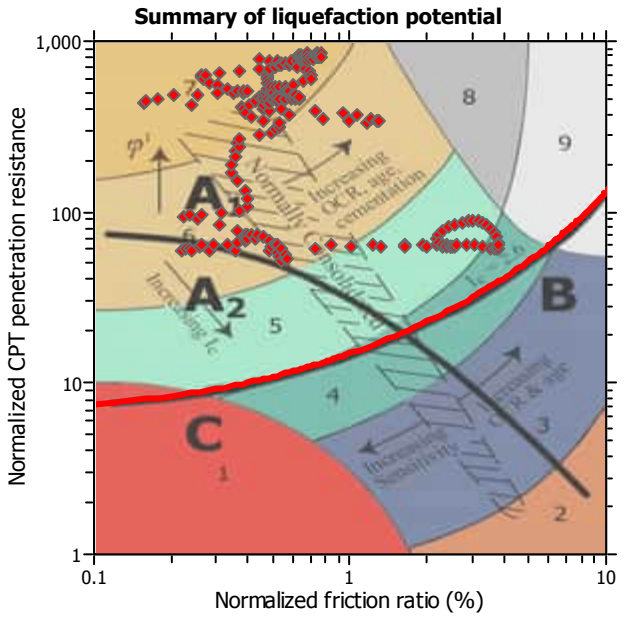
CPT file : CPT_27

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

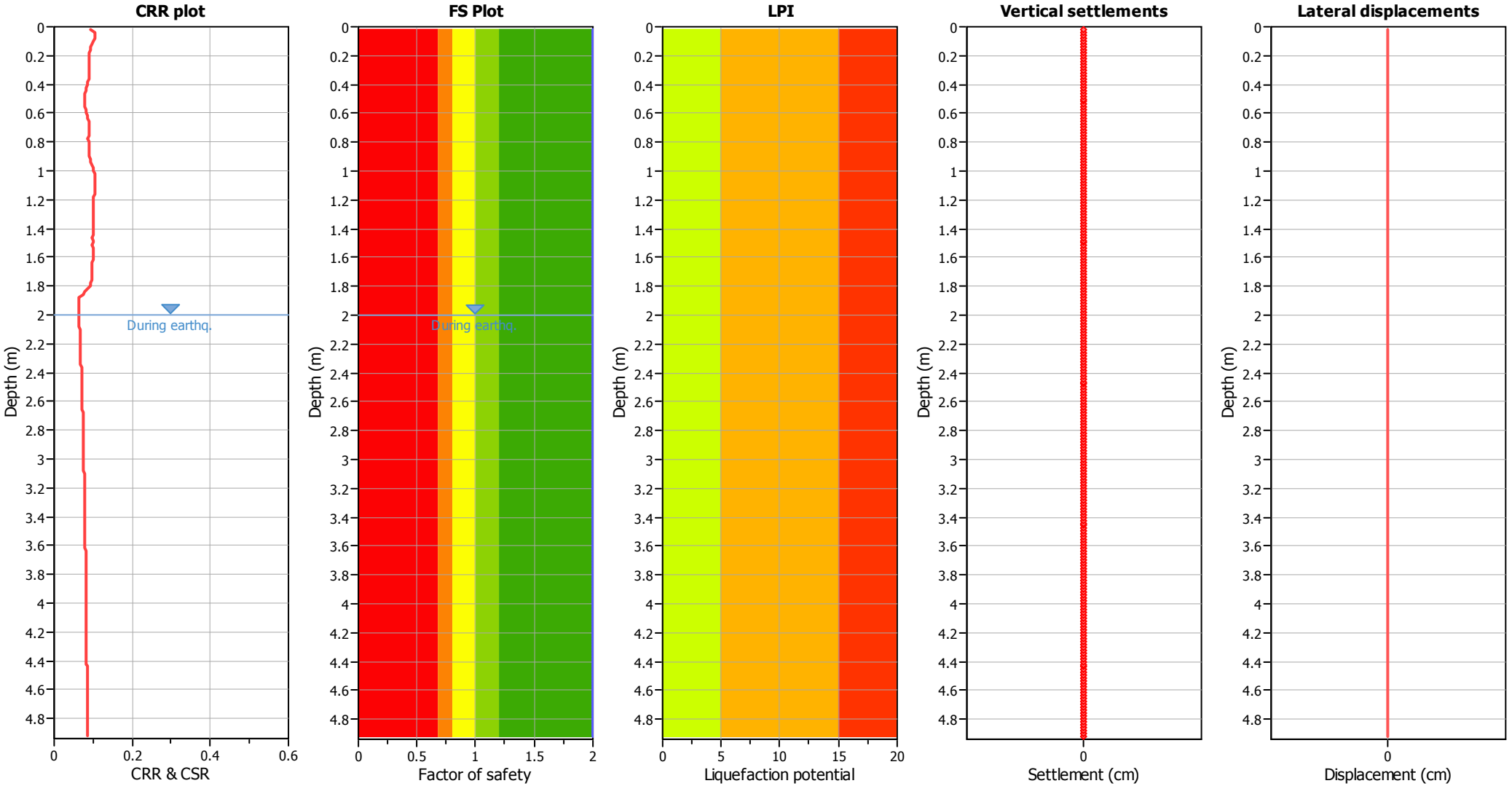






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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Christchurch 8140

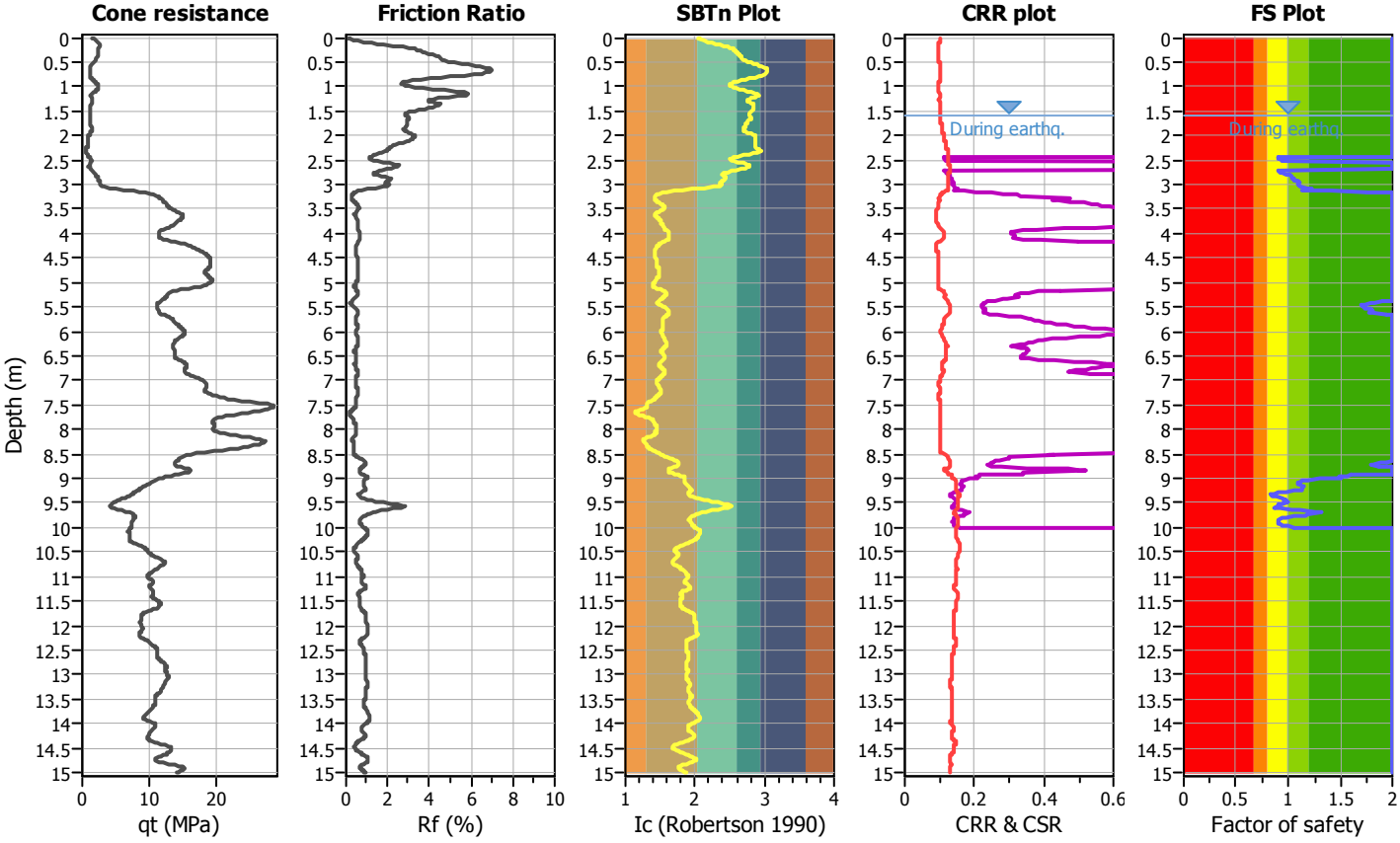
LIQUEFACTION ANALYSIS REPORT

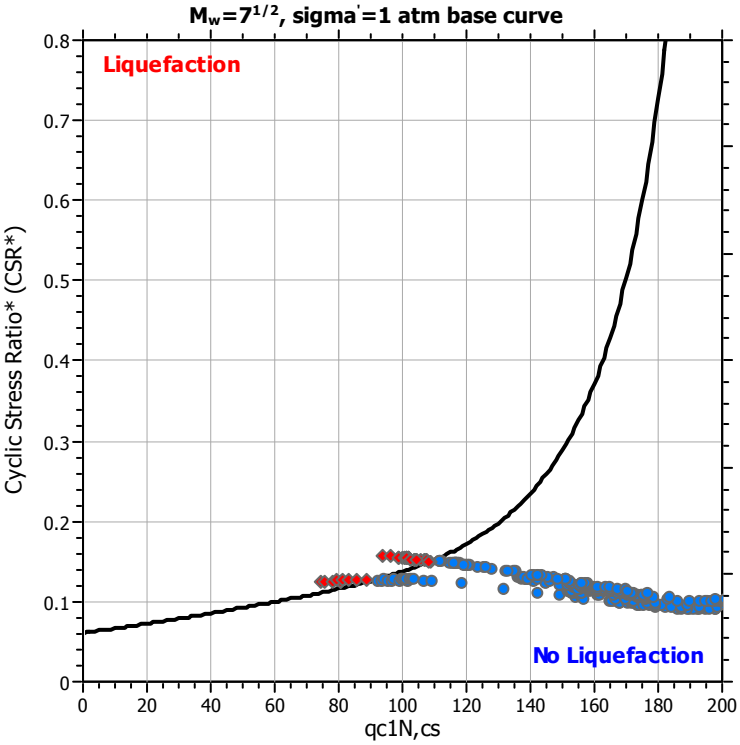
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

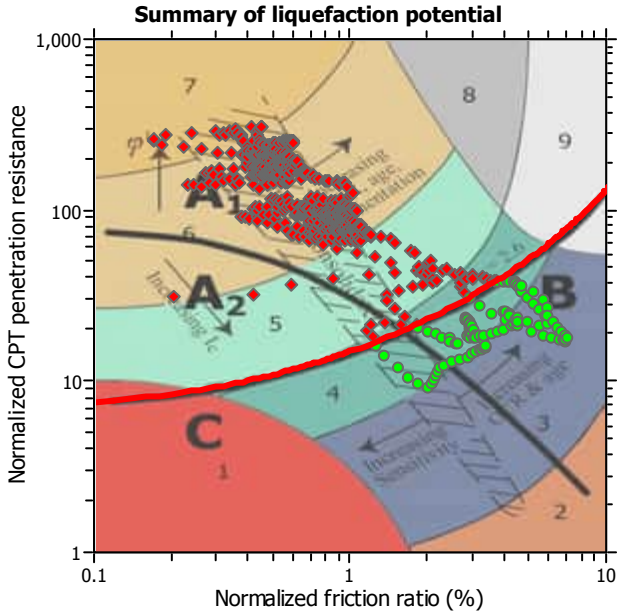
CPT file : CPT_28

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

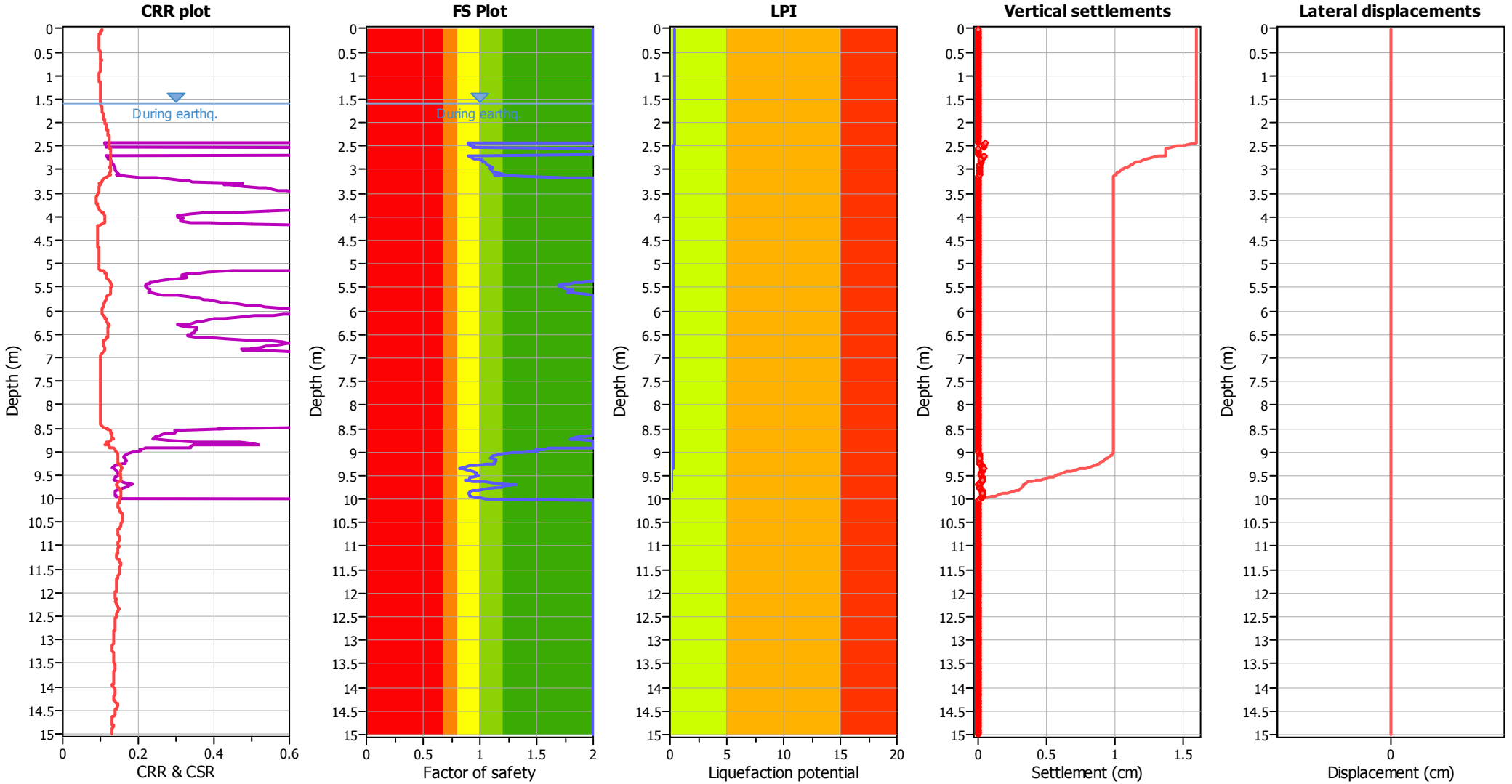






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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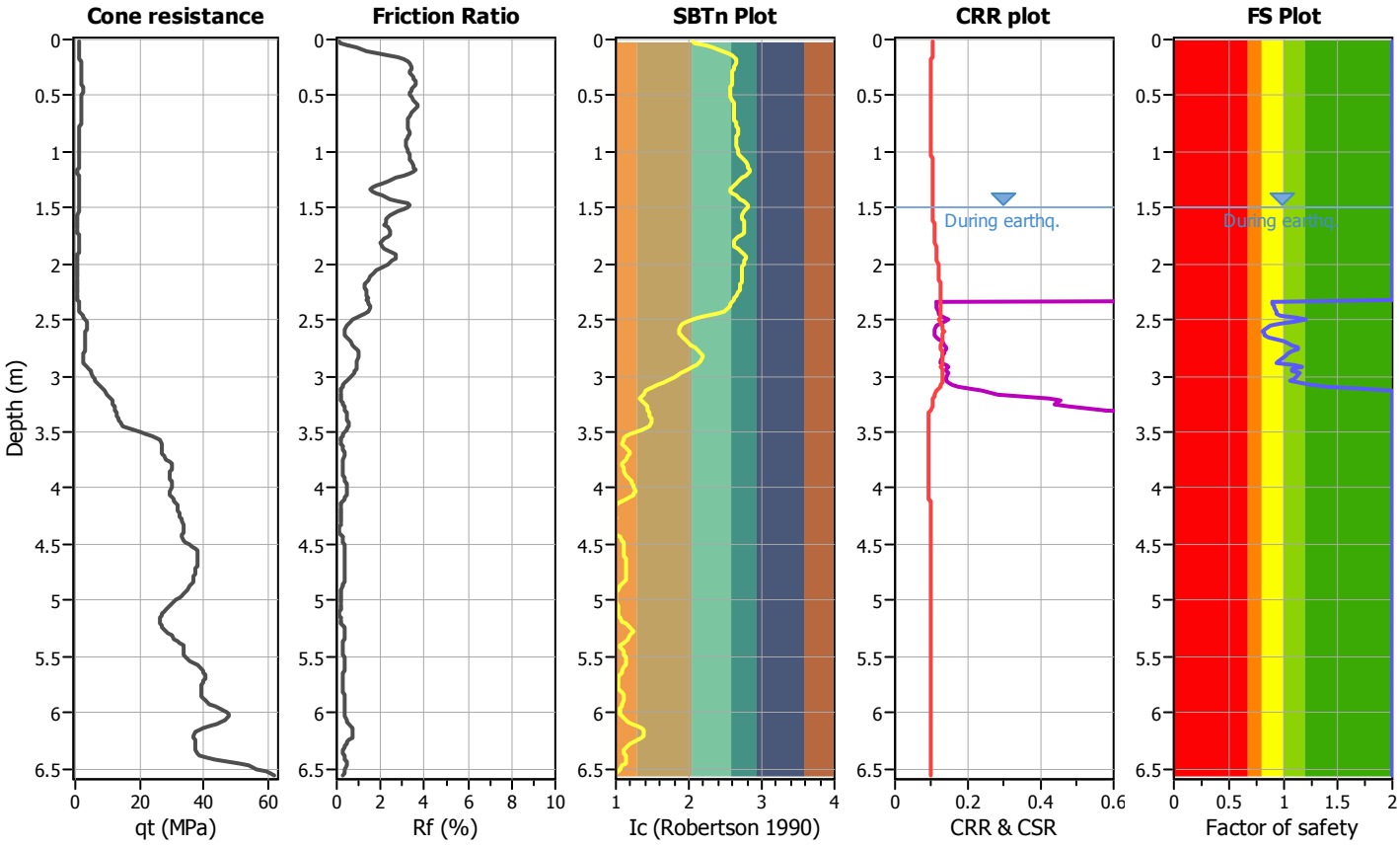
LIQUEFACTION ANALYSIS REPORT

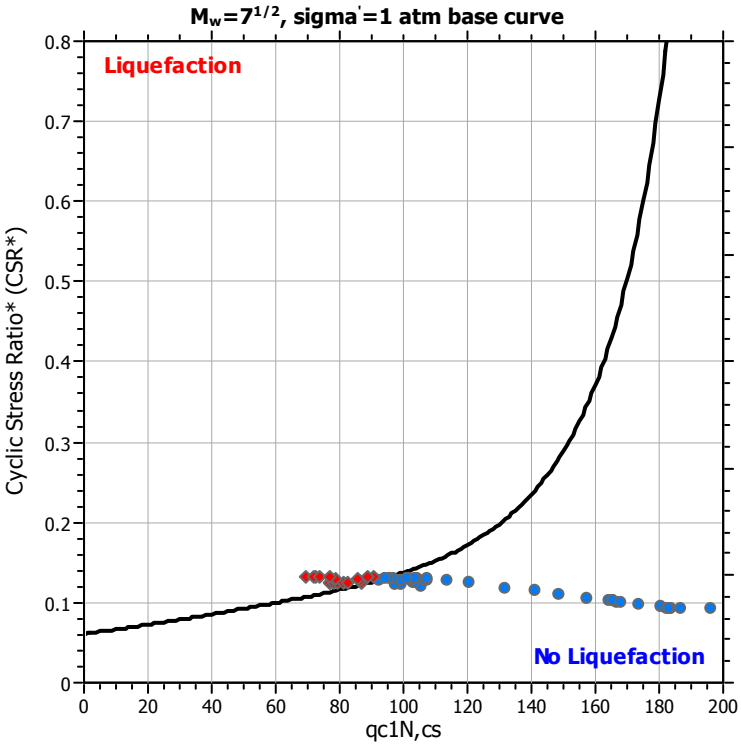
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

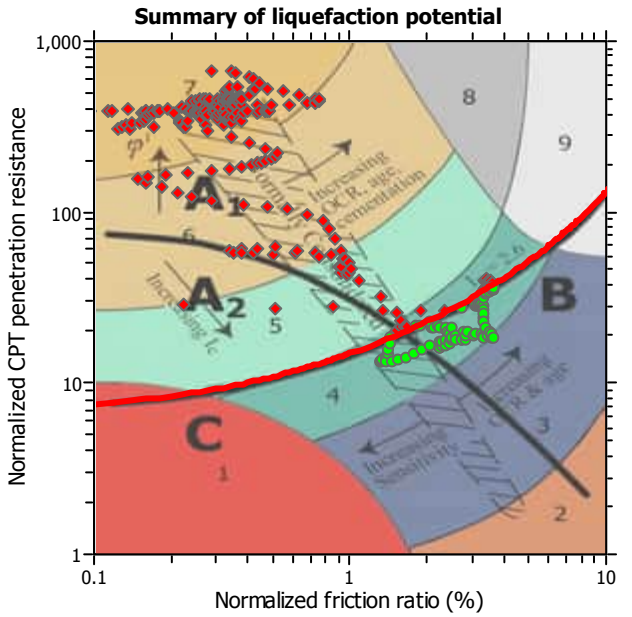
CPT file : CPT_29

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

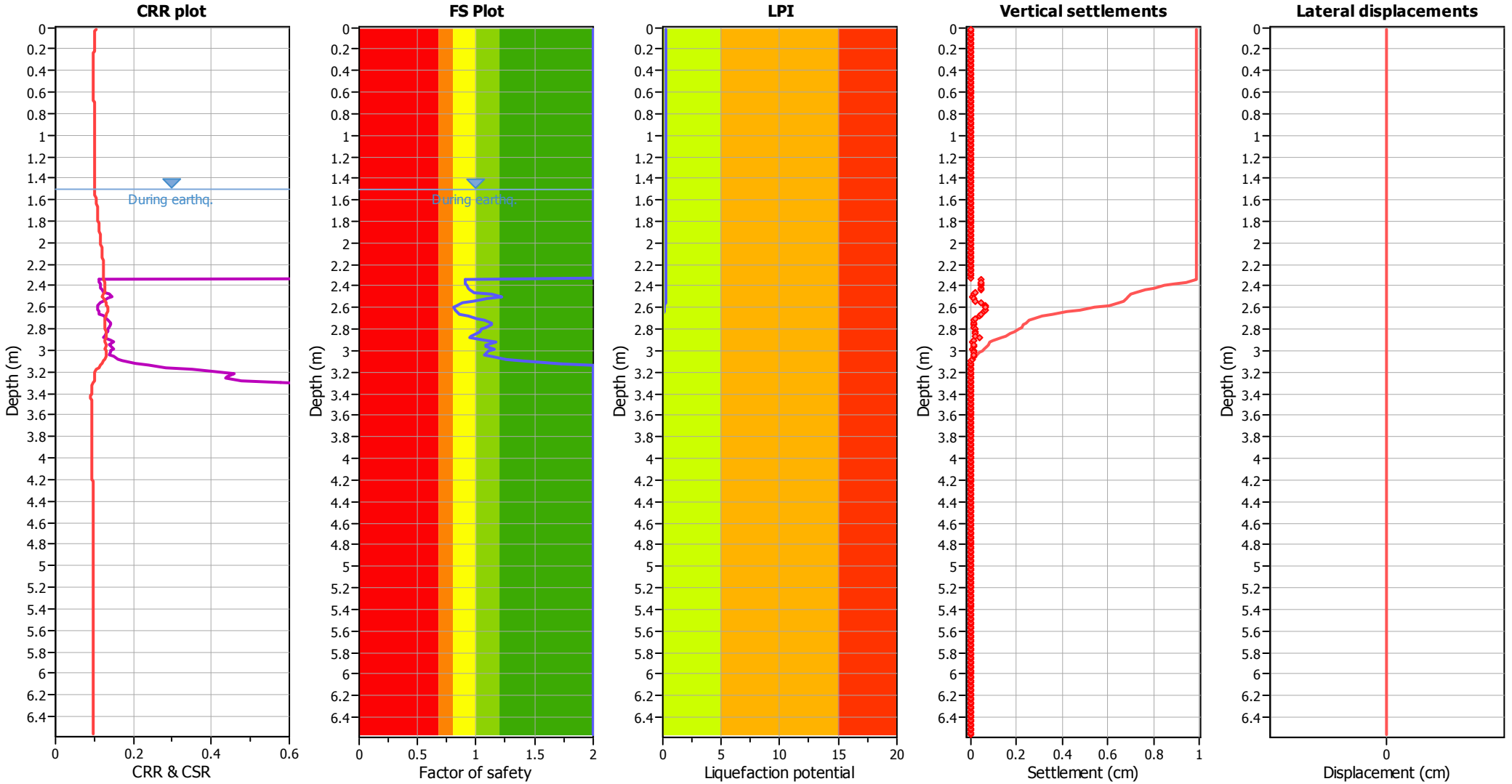






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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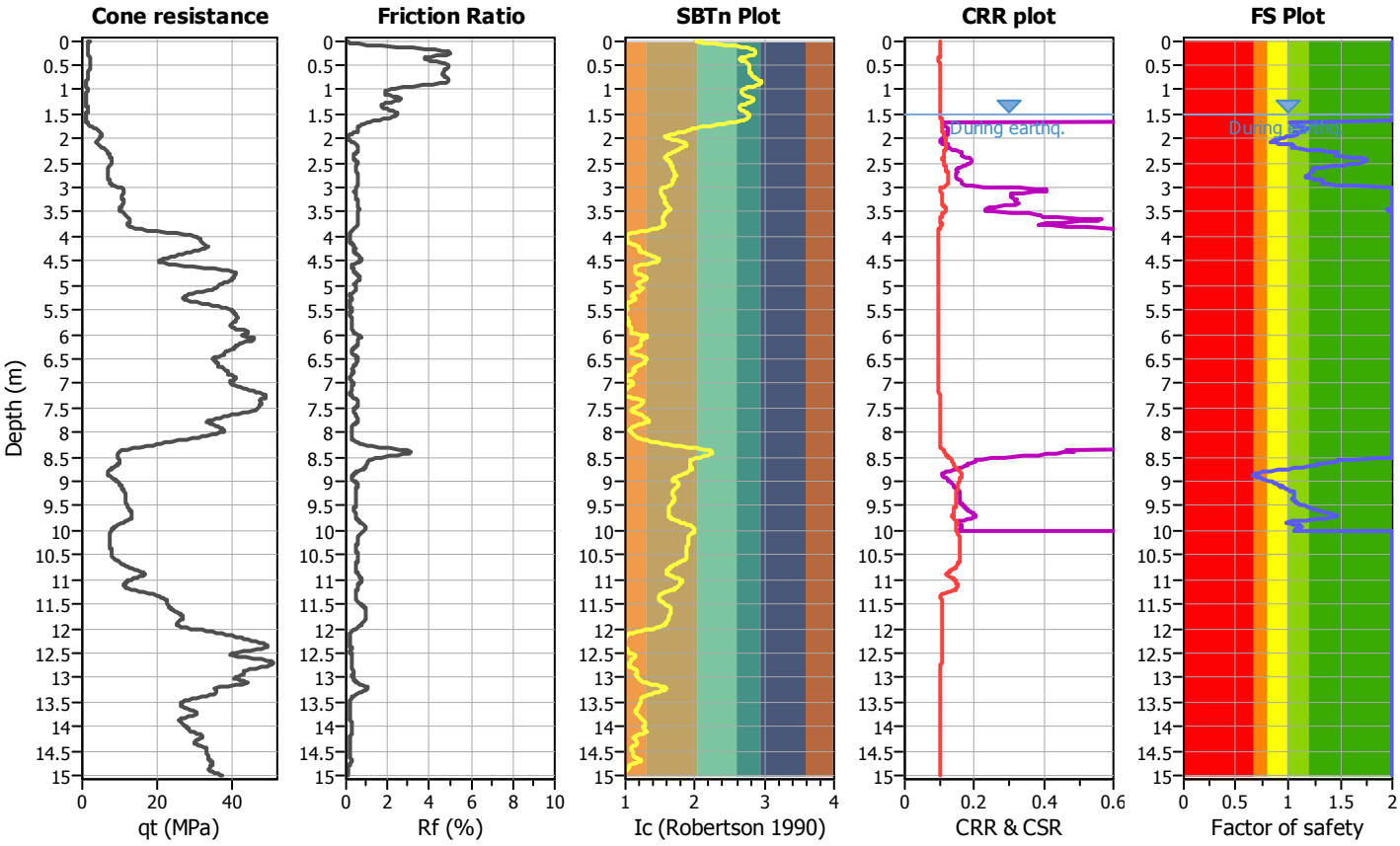
LIQUEFACTION ANALYSIS REPORT

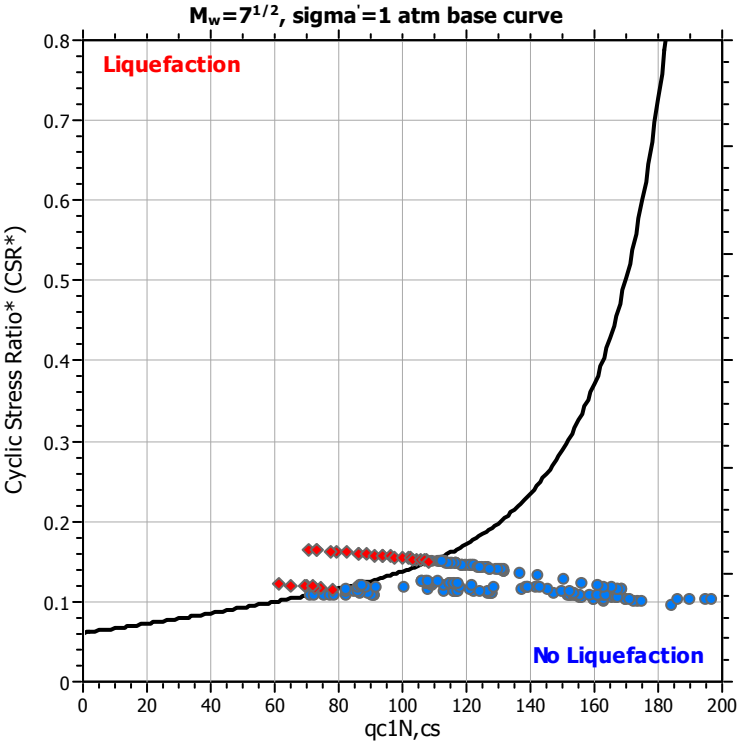
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

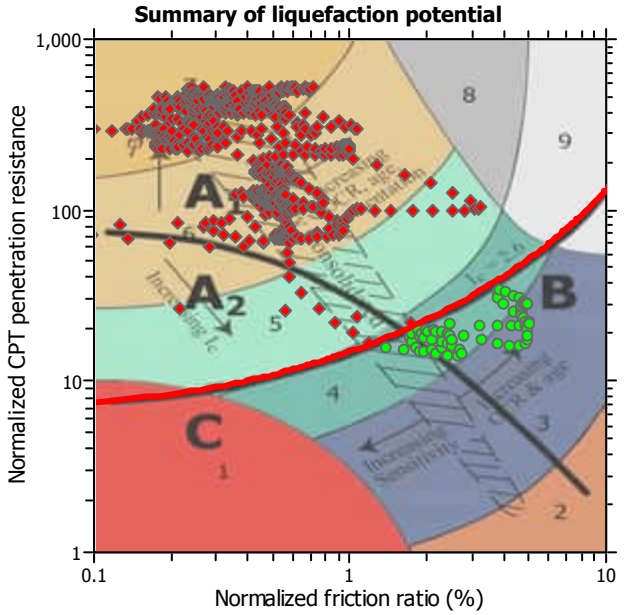
CPT file : CPT_30

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

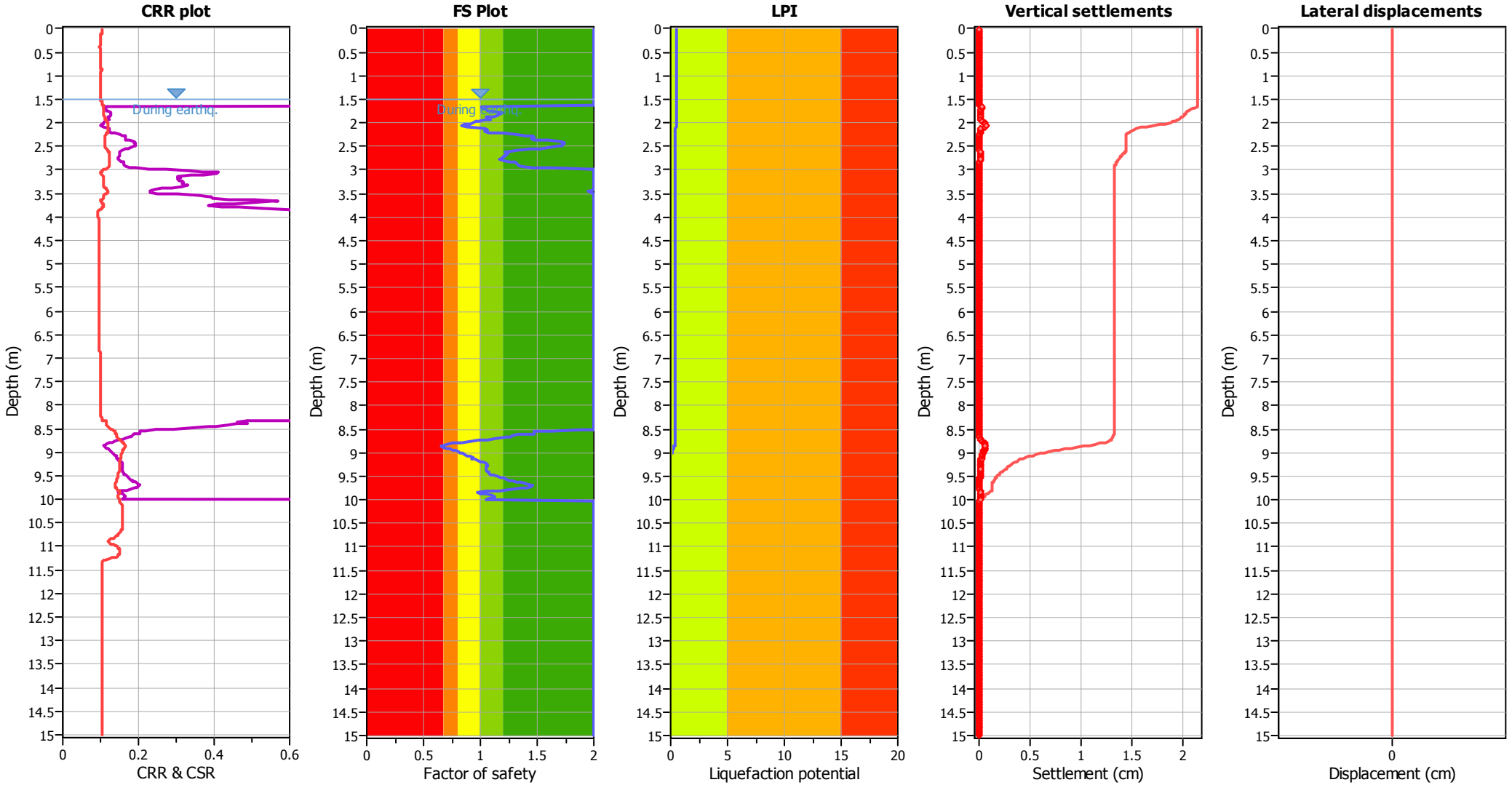






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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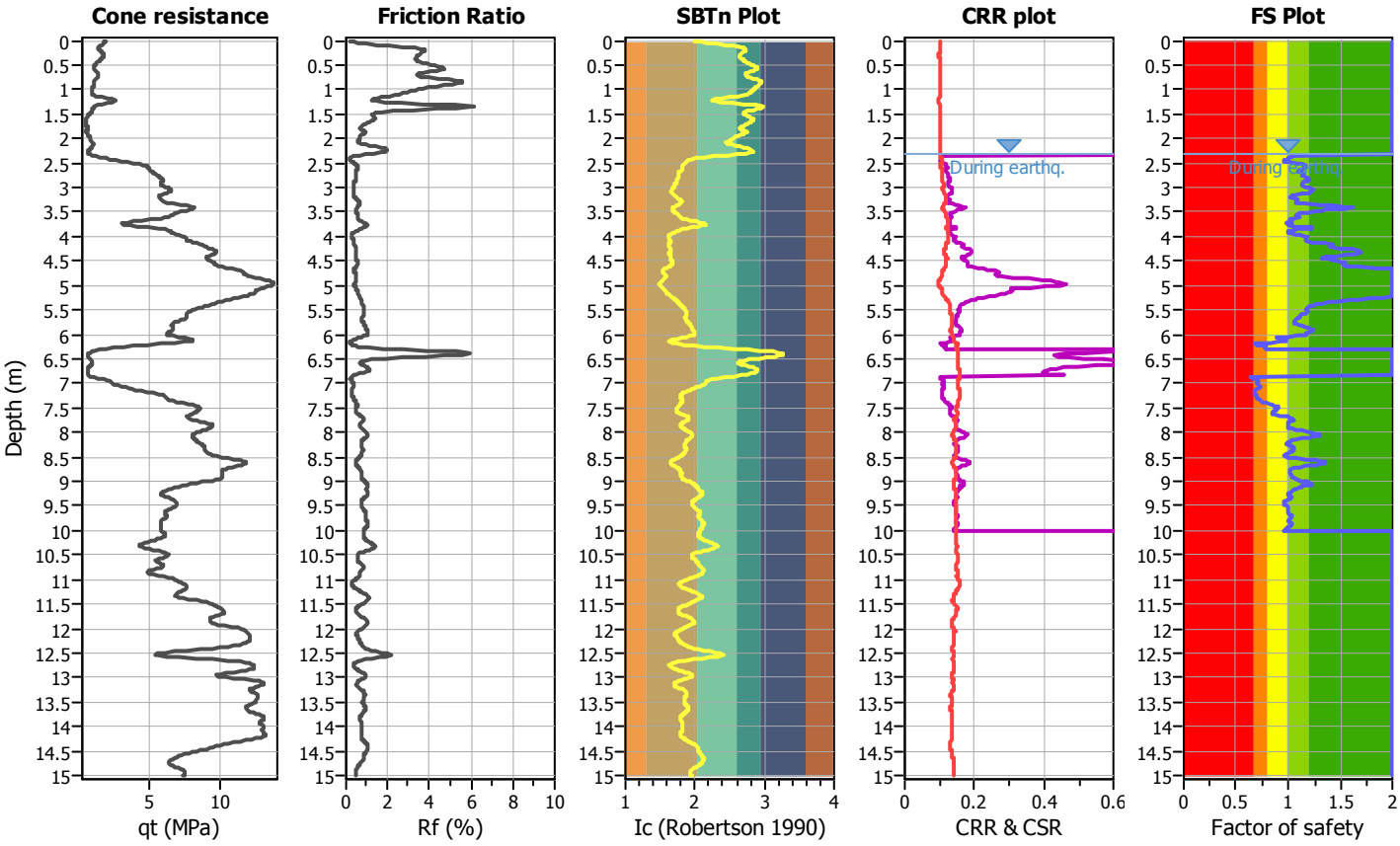
LIQUEFACTION ANALYSIS REPORT

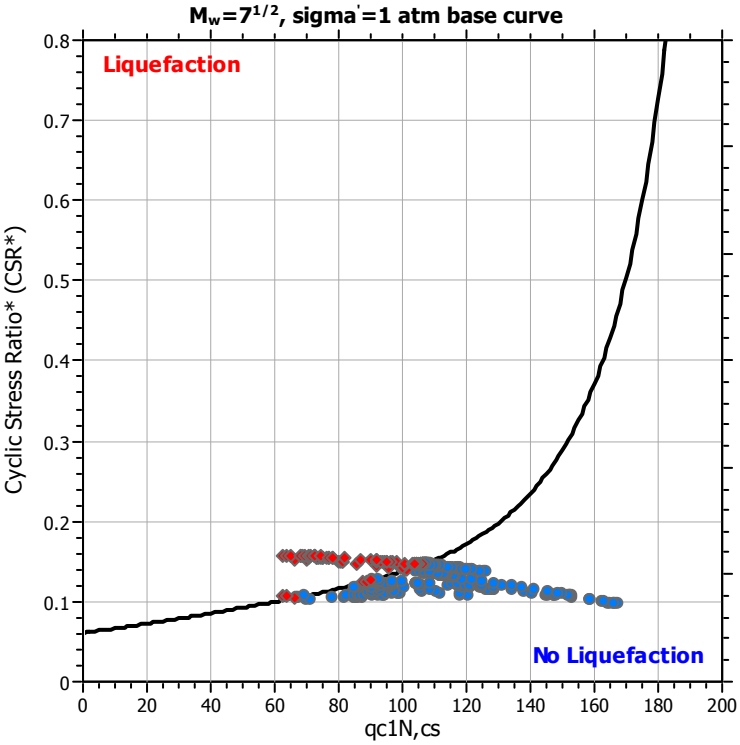
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

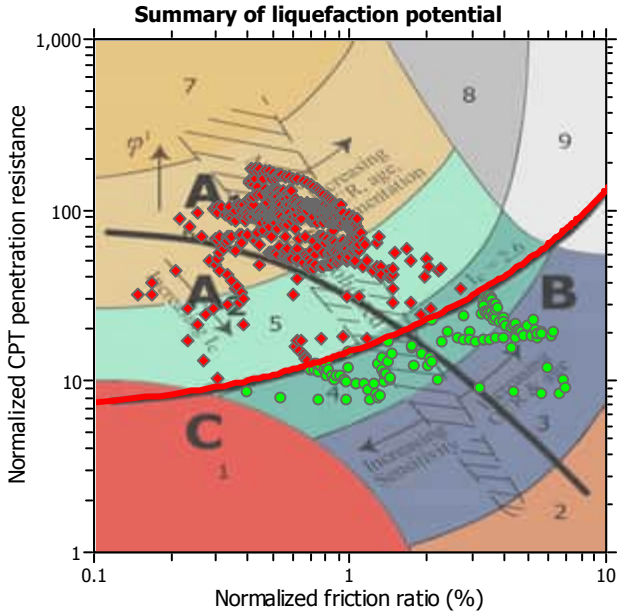
CPT file : CPT_31

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

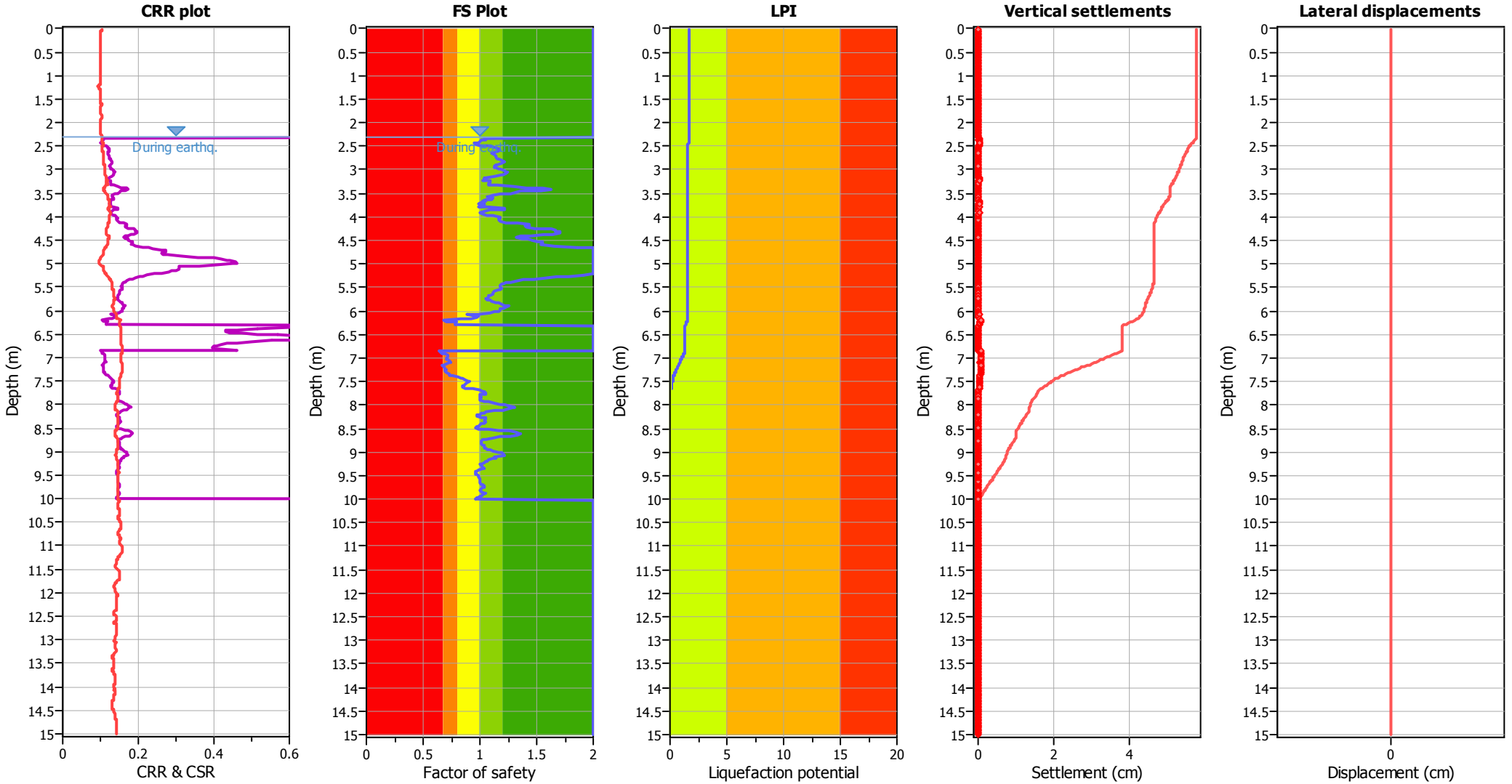






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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LPI color scheme

- Very high risk
- High risk
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Christchurch 8140

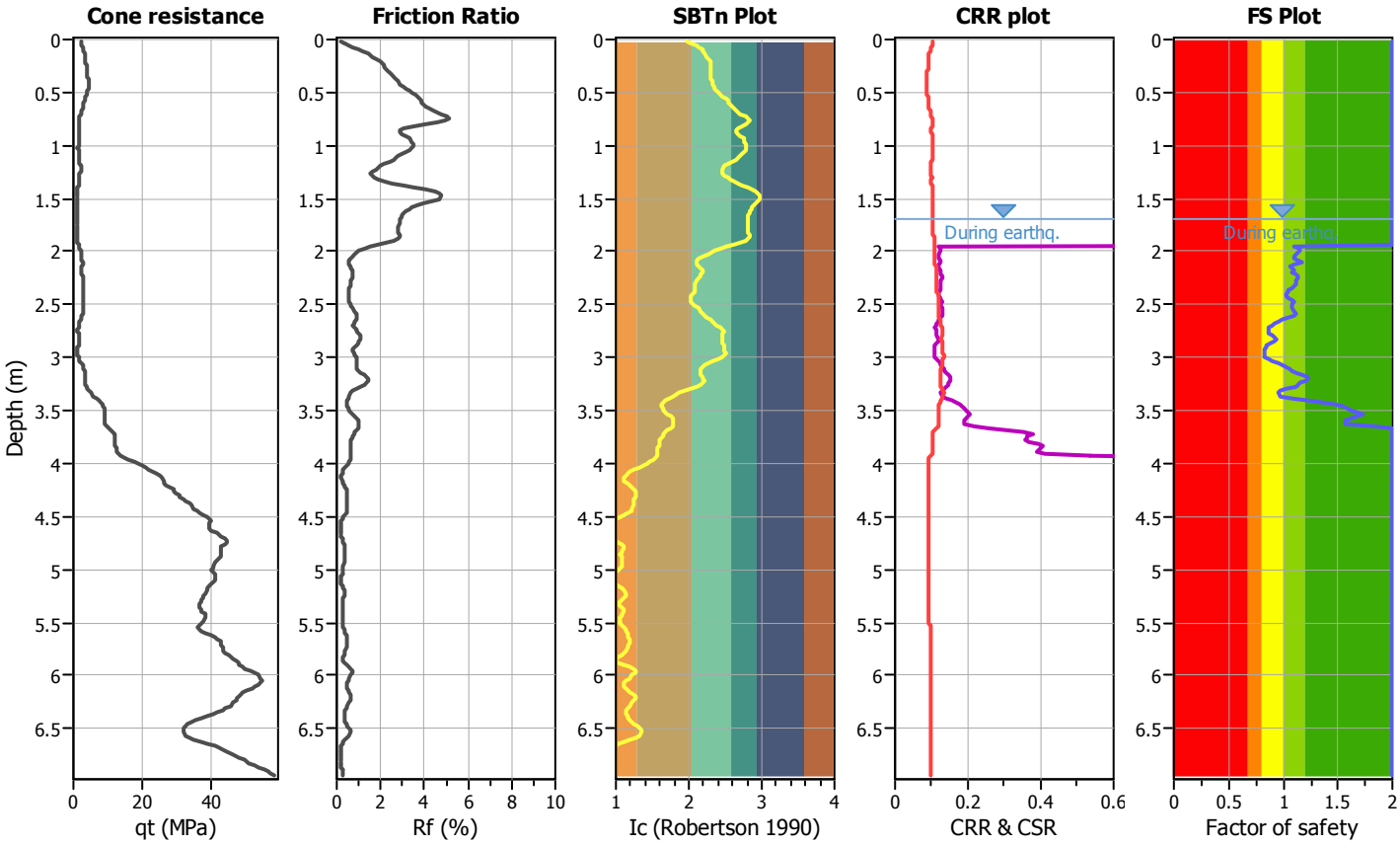
LIQUEFACTION ANALYSIS REPORT

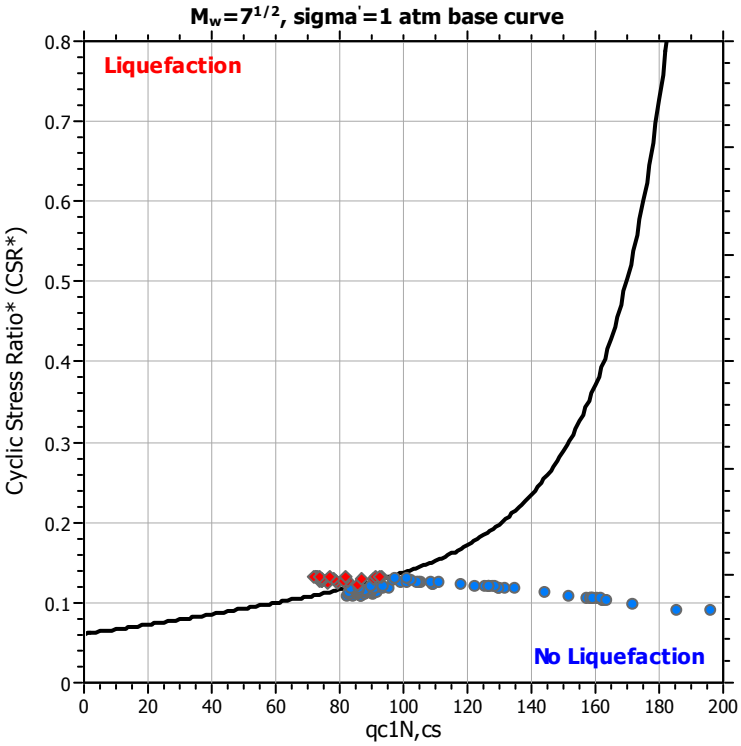
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

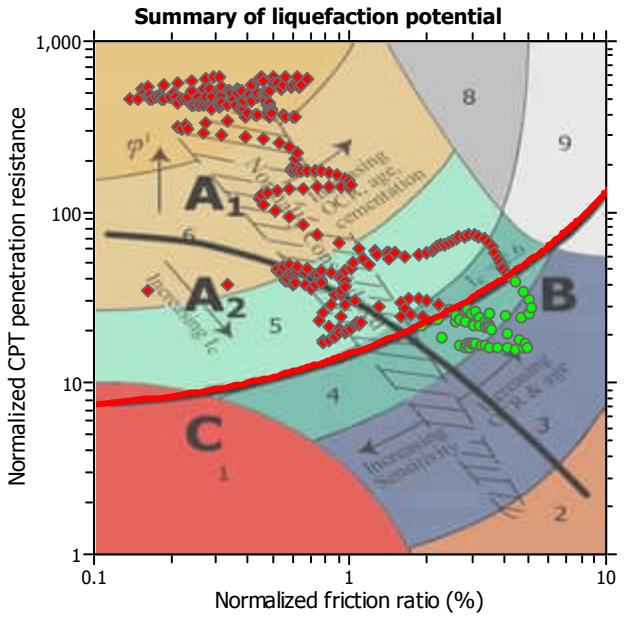
CPT file : CPT_32

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
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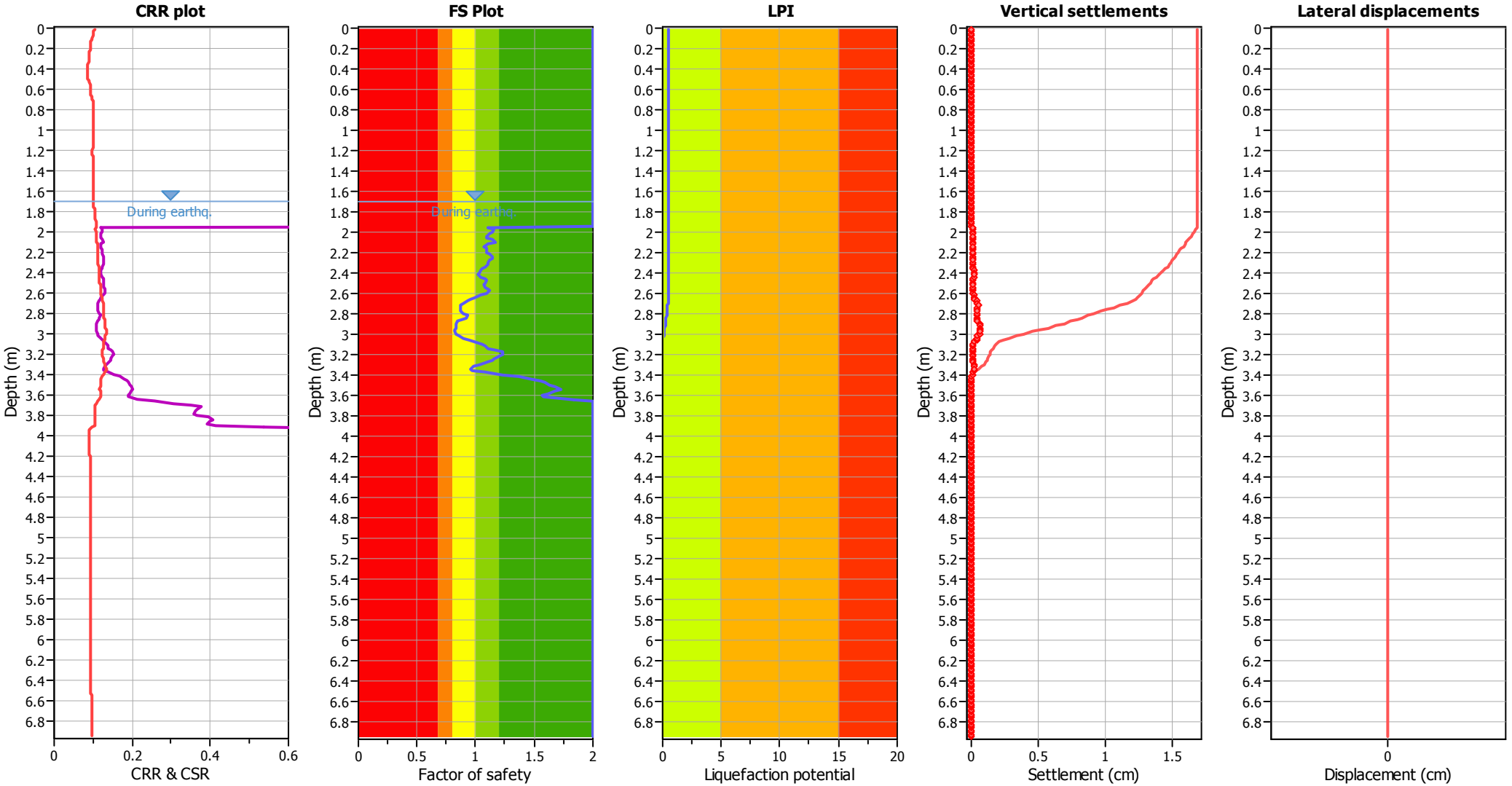
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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LPI color scheme

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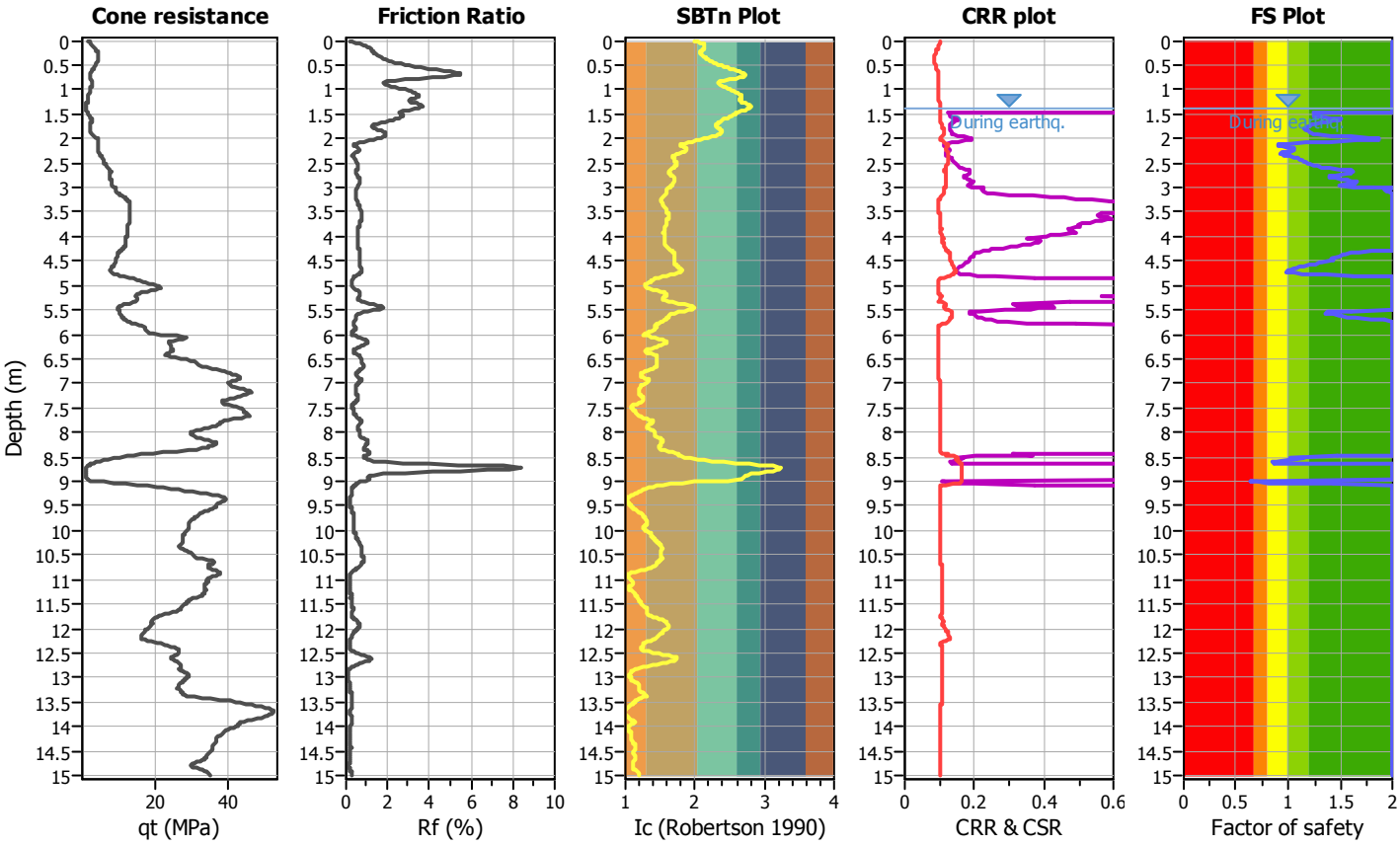
LIQUEFACTION ANALYSIS REPORT

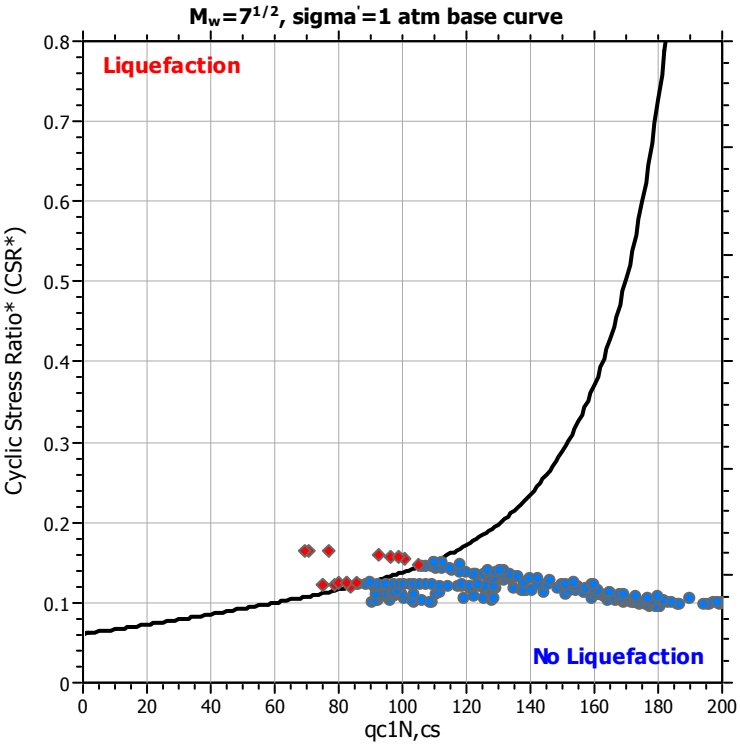
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

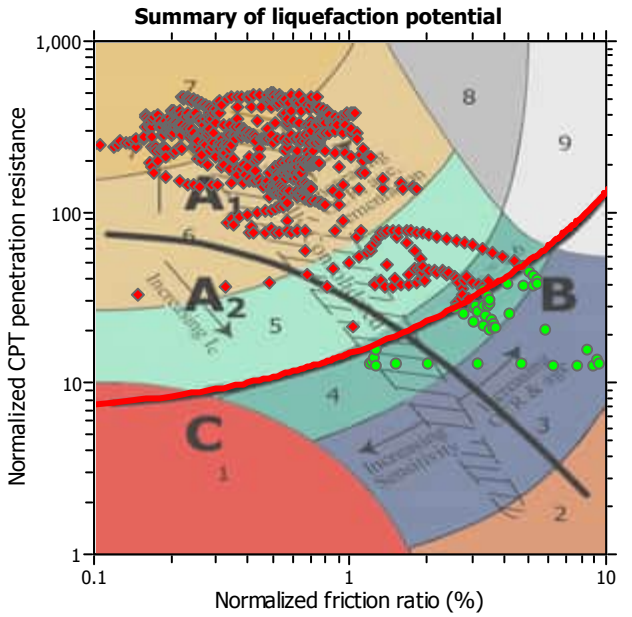
CPT file : CPT_33

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

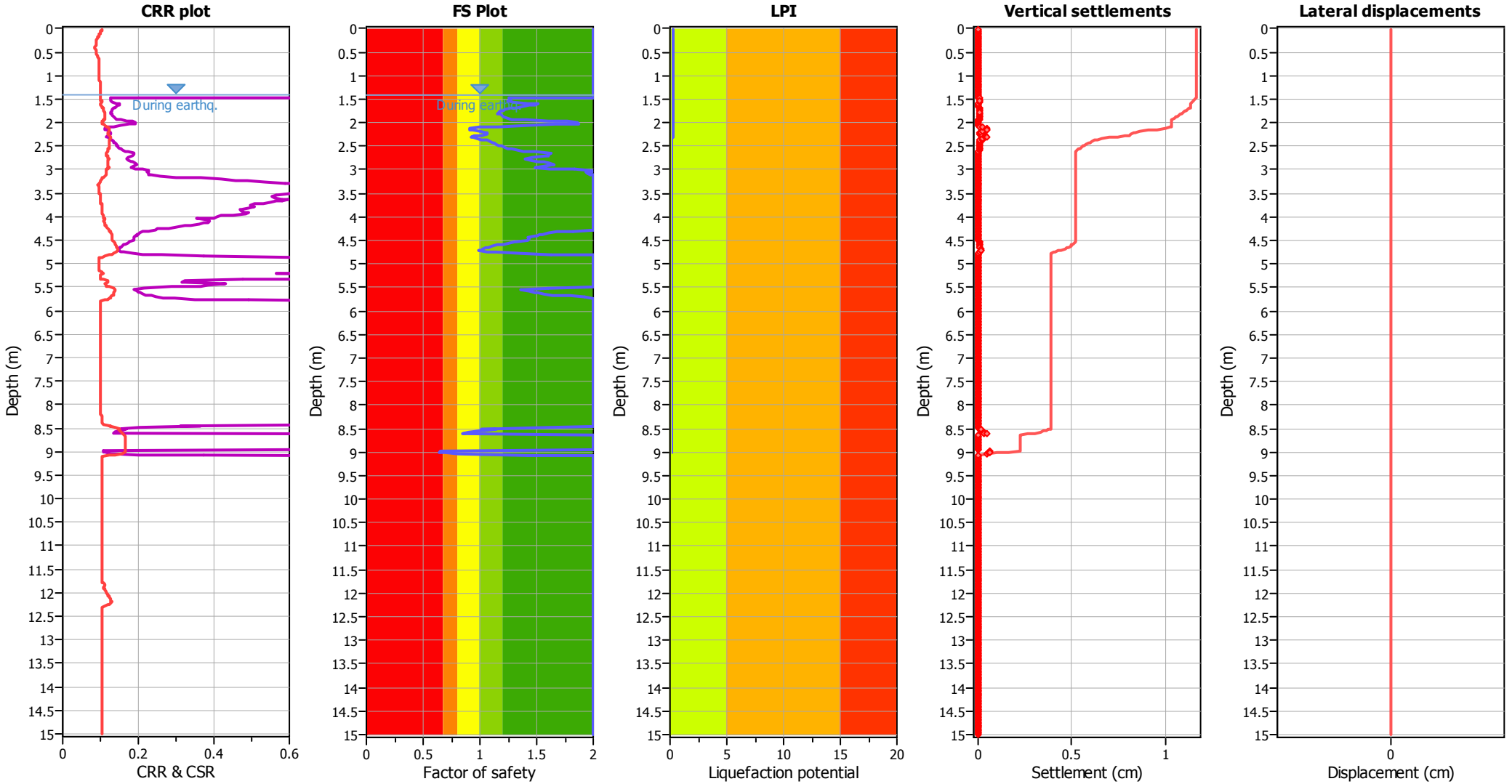






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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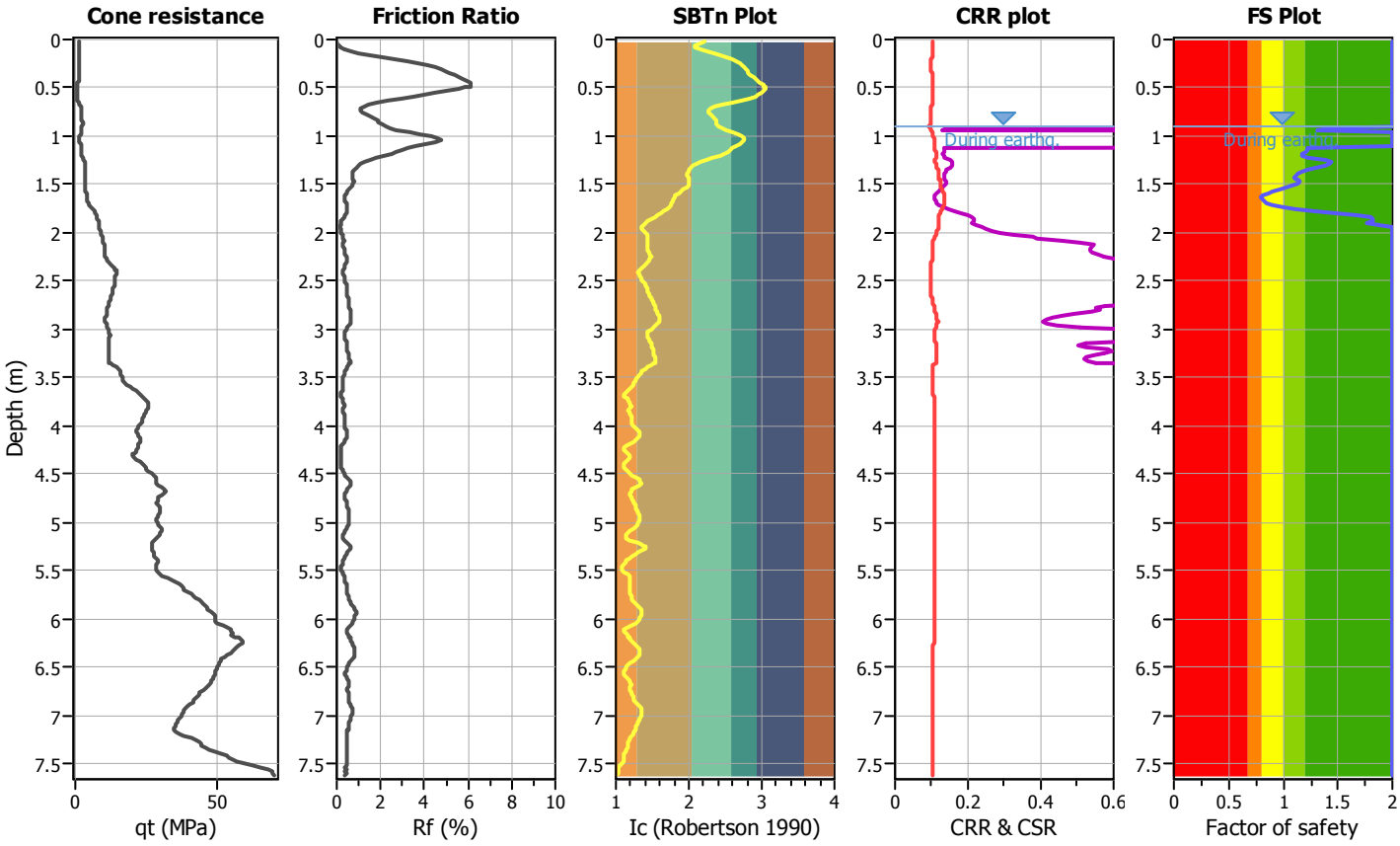
LIQUEFACTION ANALYSIS REPORT

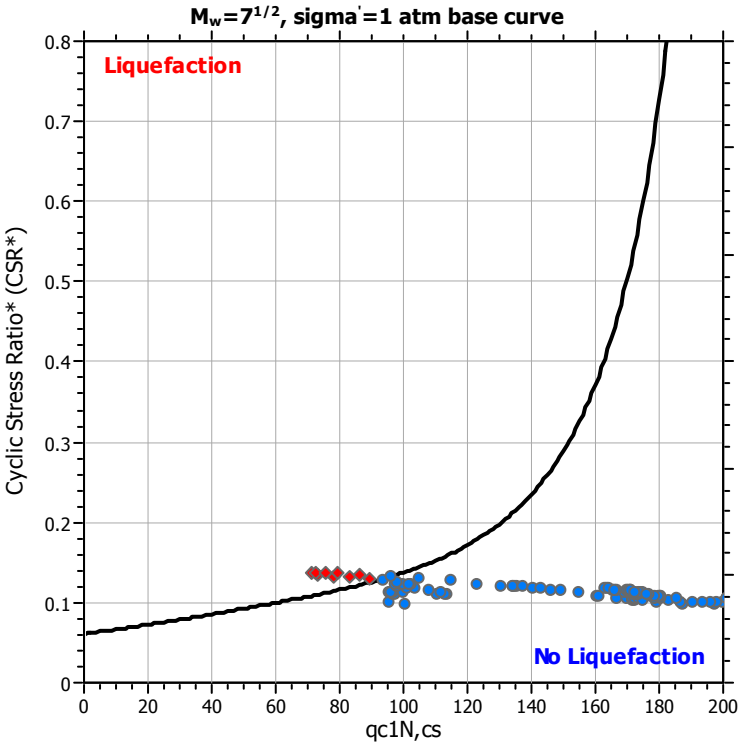
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

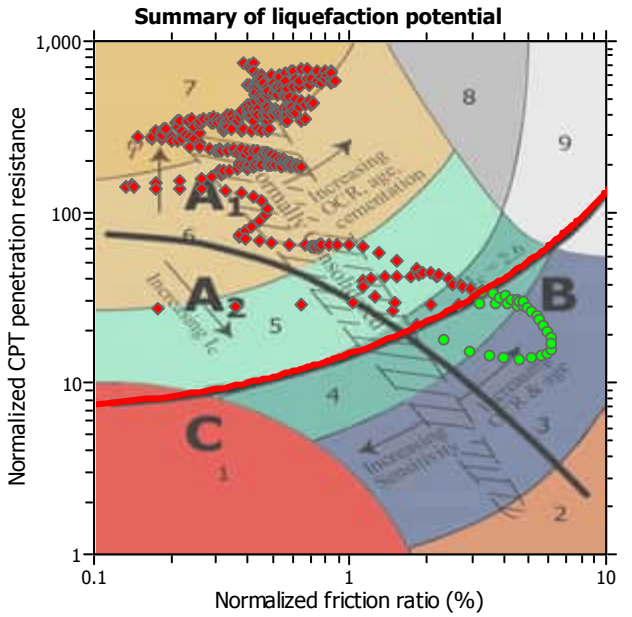
CPT file : CPT_34

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

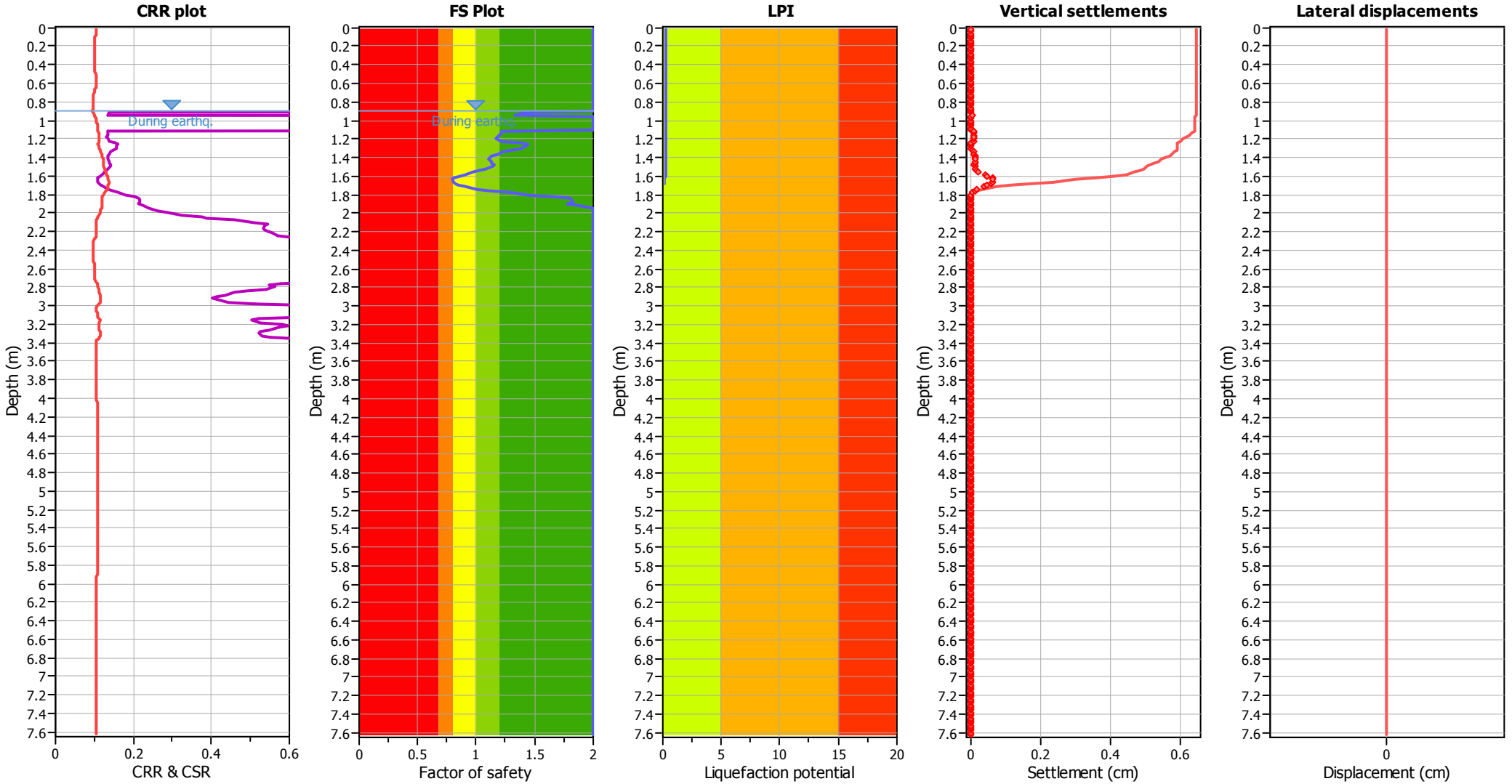






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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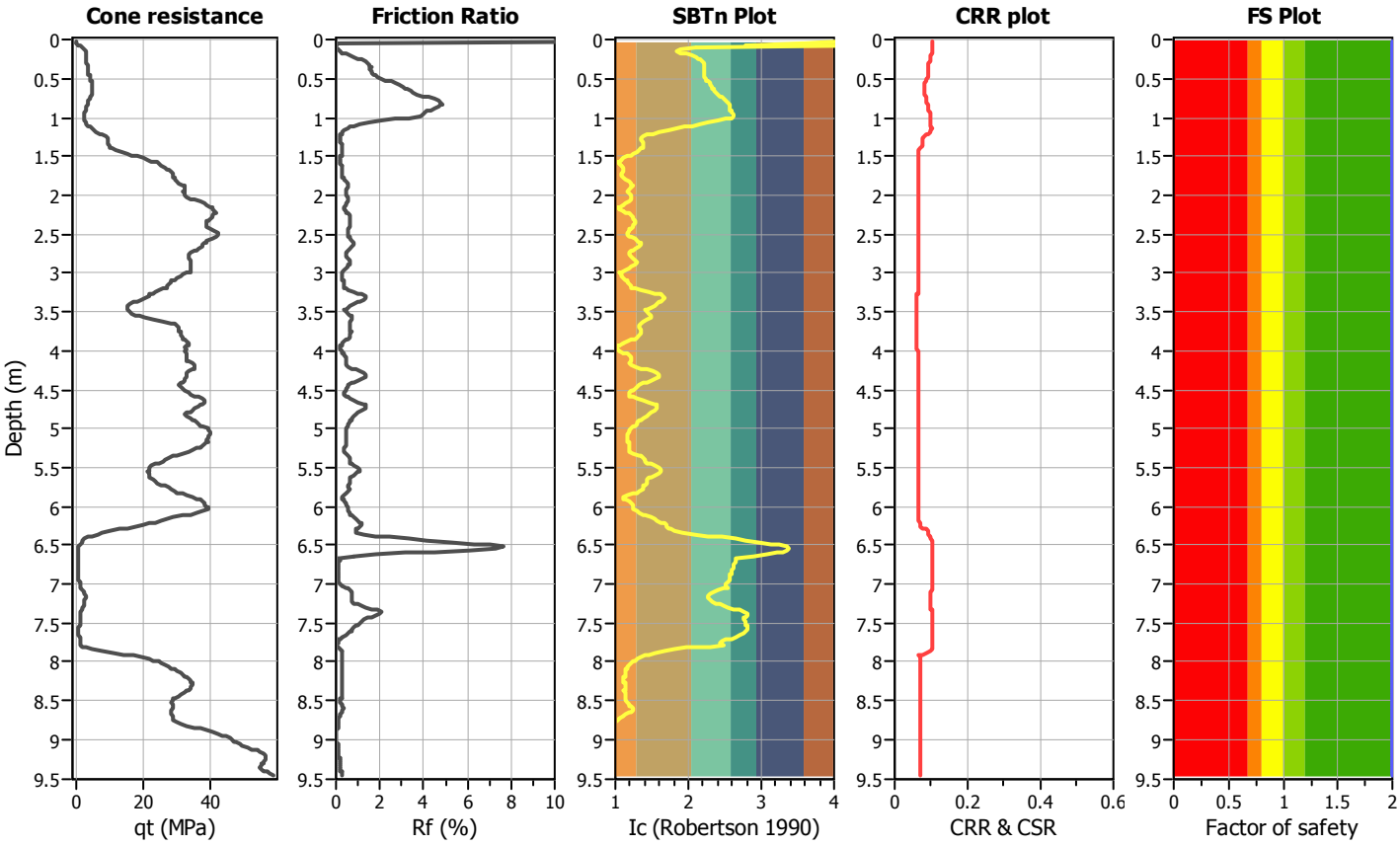
LIQUEFACTION ANALYSIS REPORT

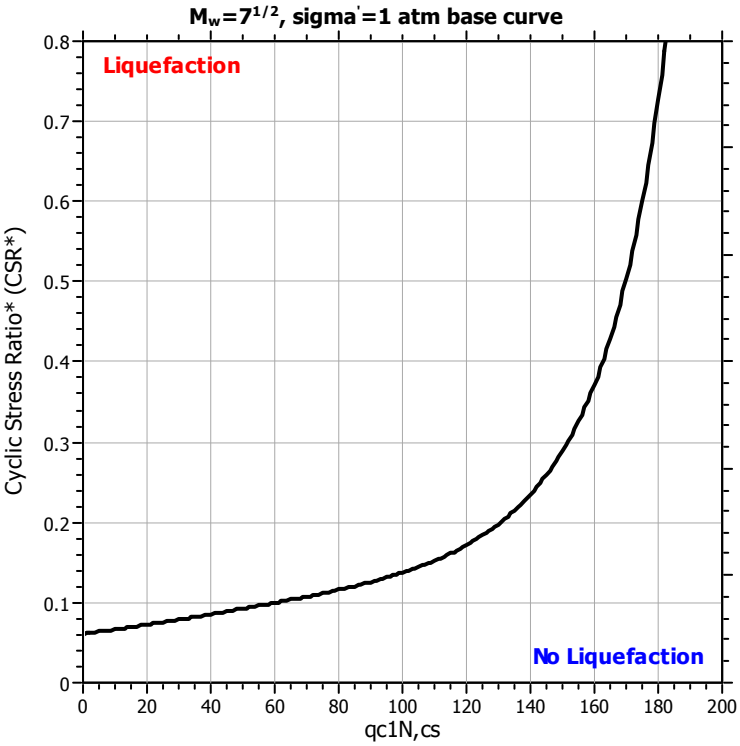
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

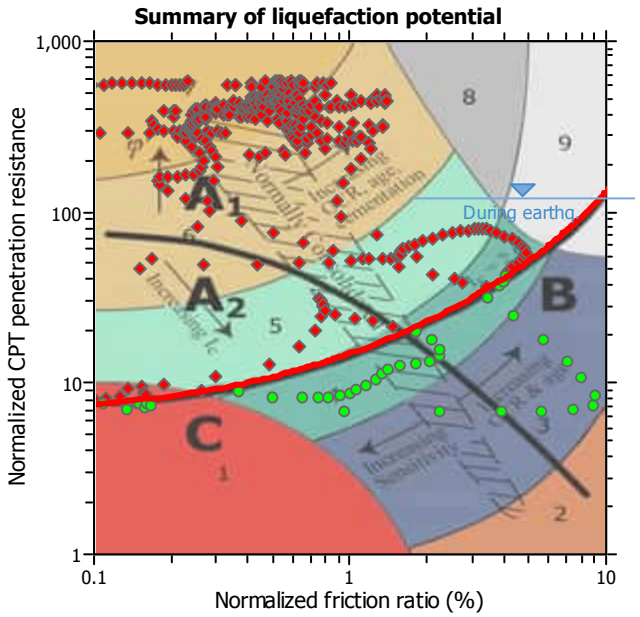
CPT file : CPT_35

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	13.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

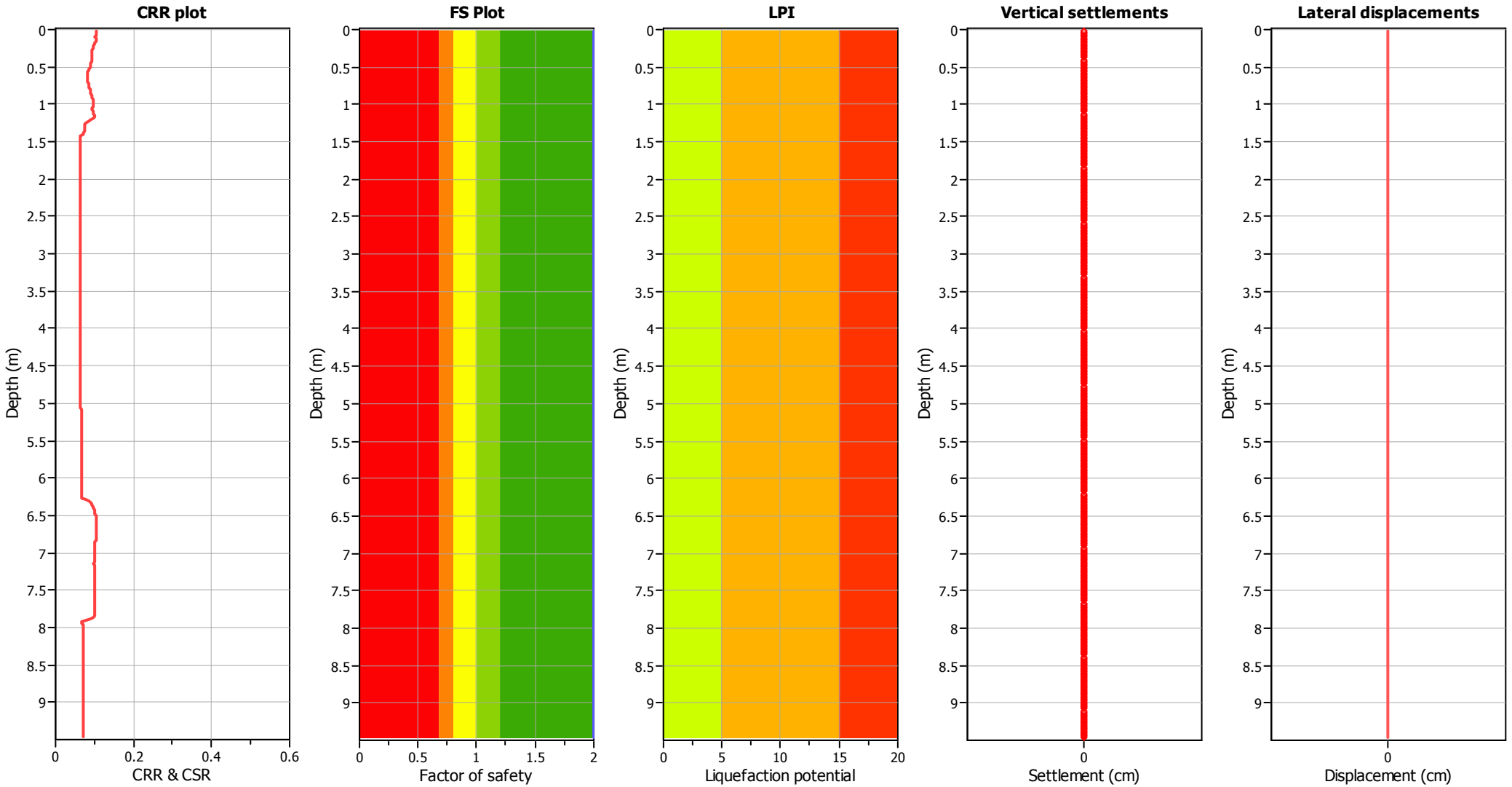






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	13.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

During earthq. During earthq.

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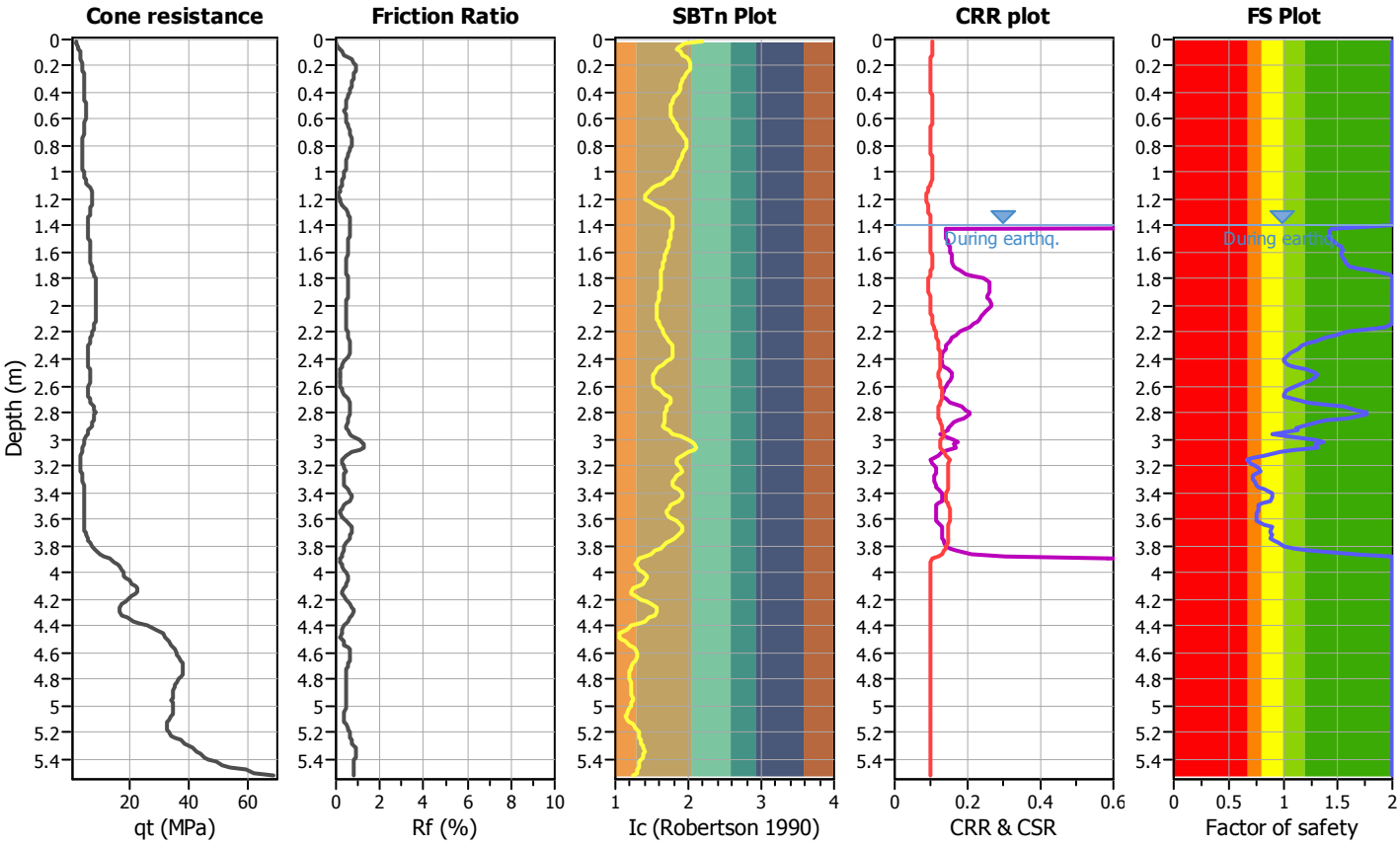
LIQUEFACTION ANALYSIS REPORT

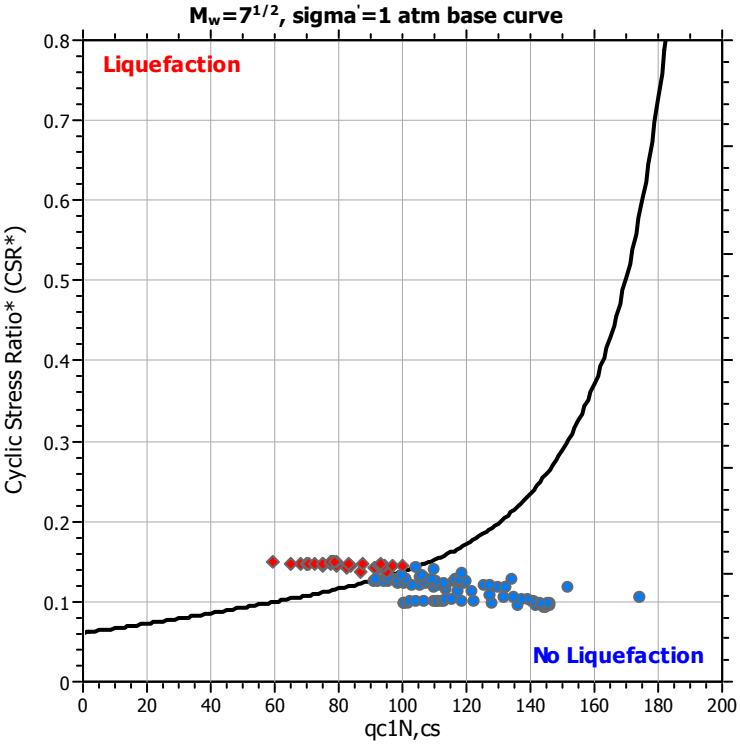
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

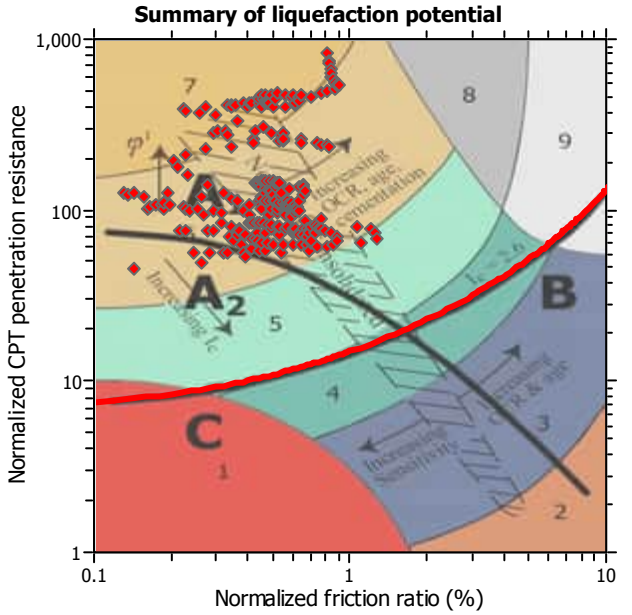
CPT file : CPT_36

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

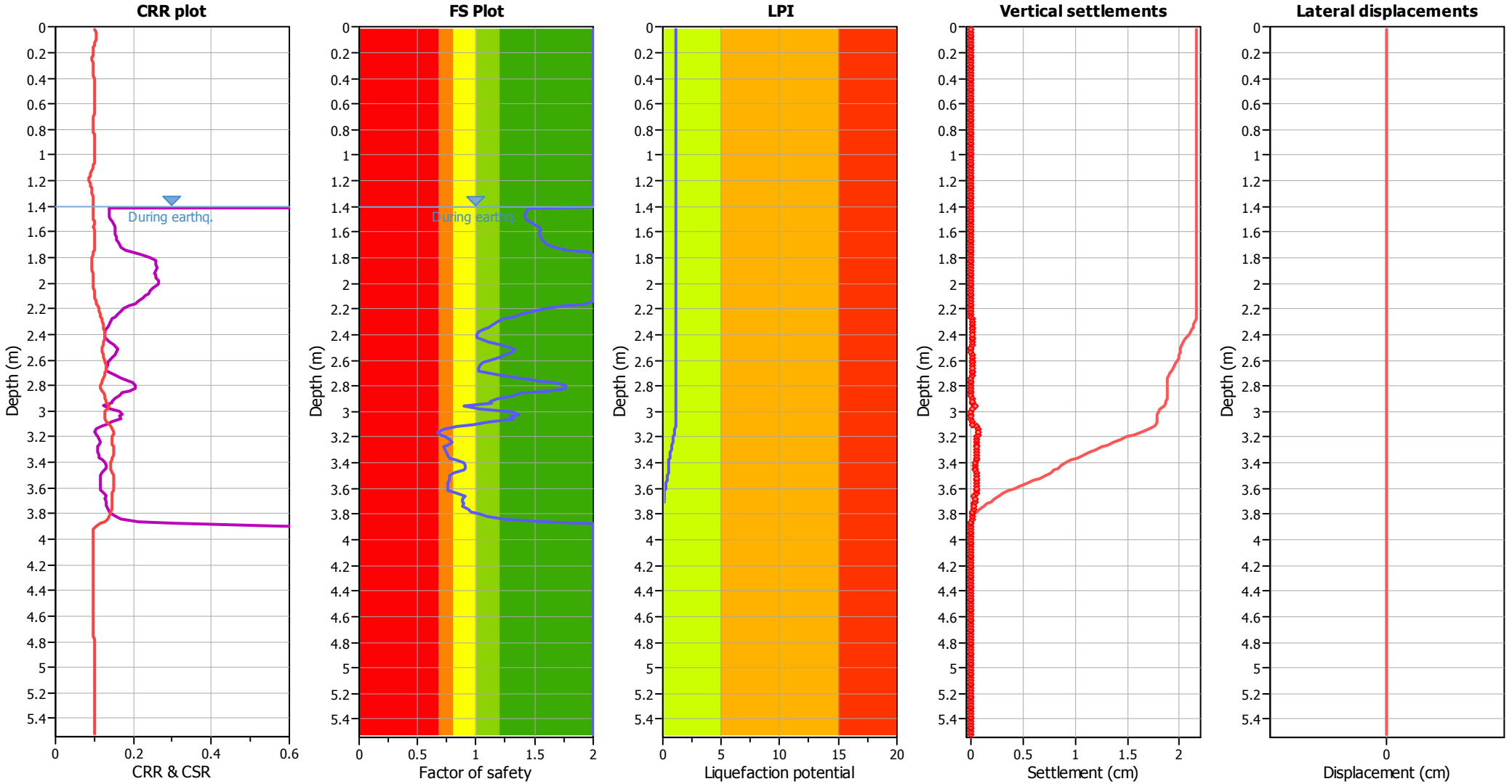






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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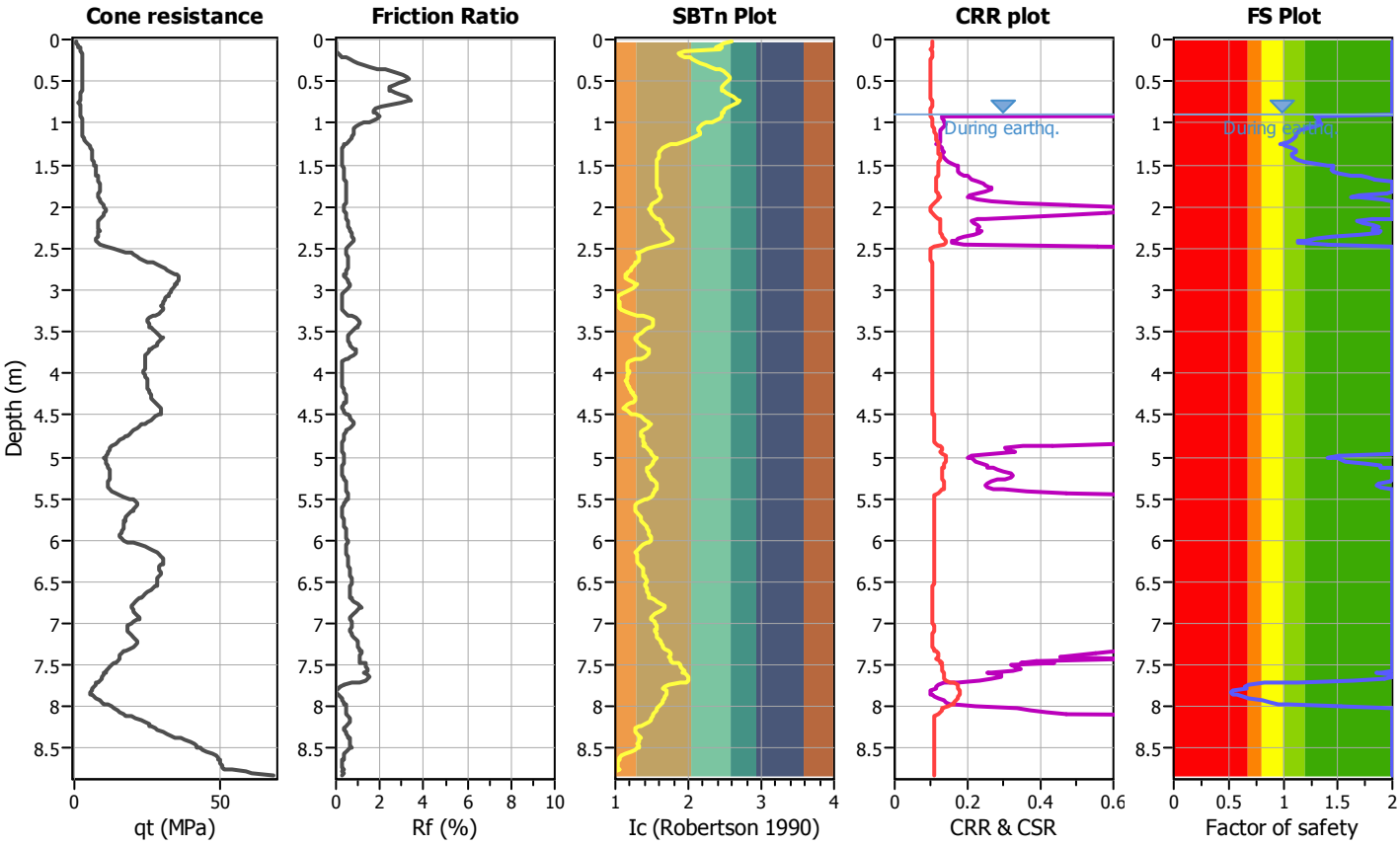
LIQUEFACTION ANALYSIS REPORT

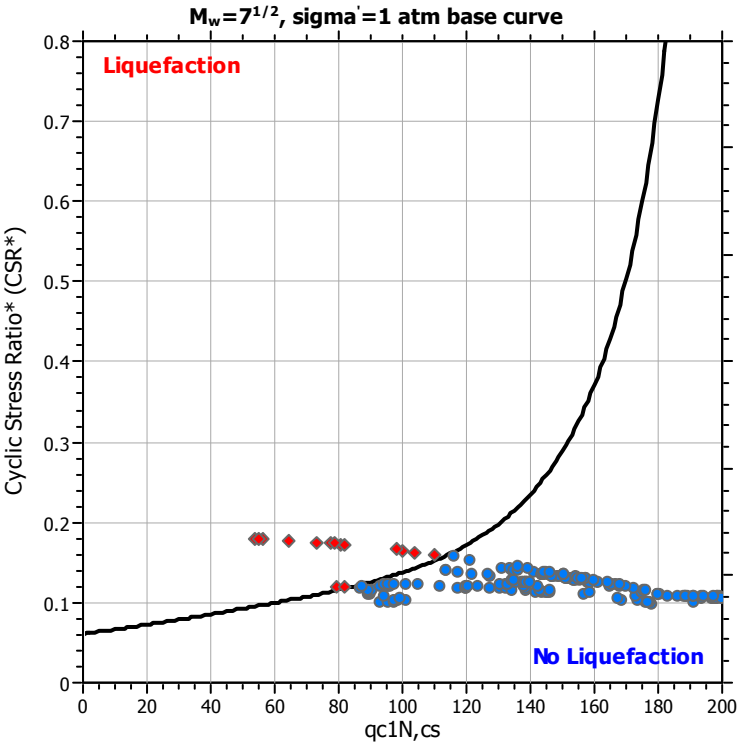
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

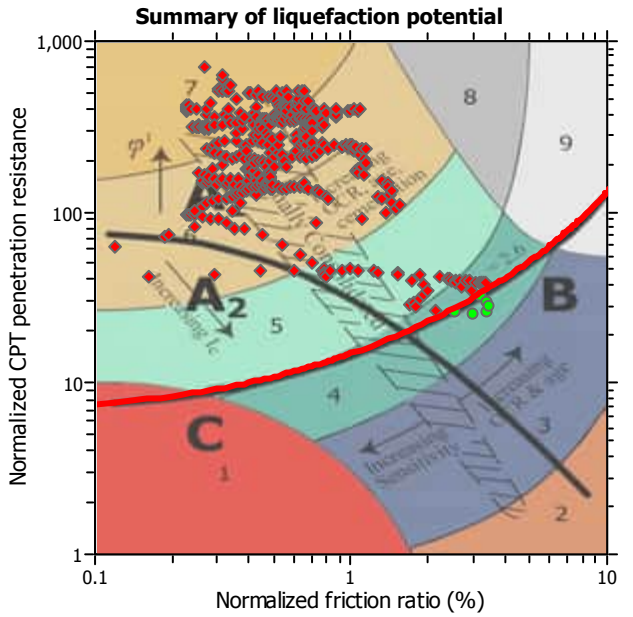
CPT file : CPT_37

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

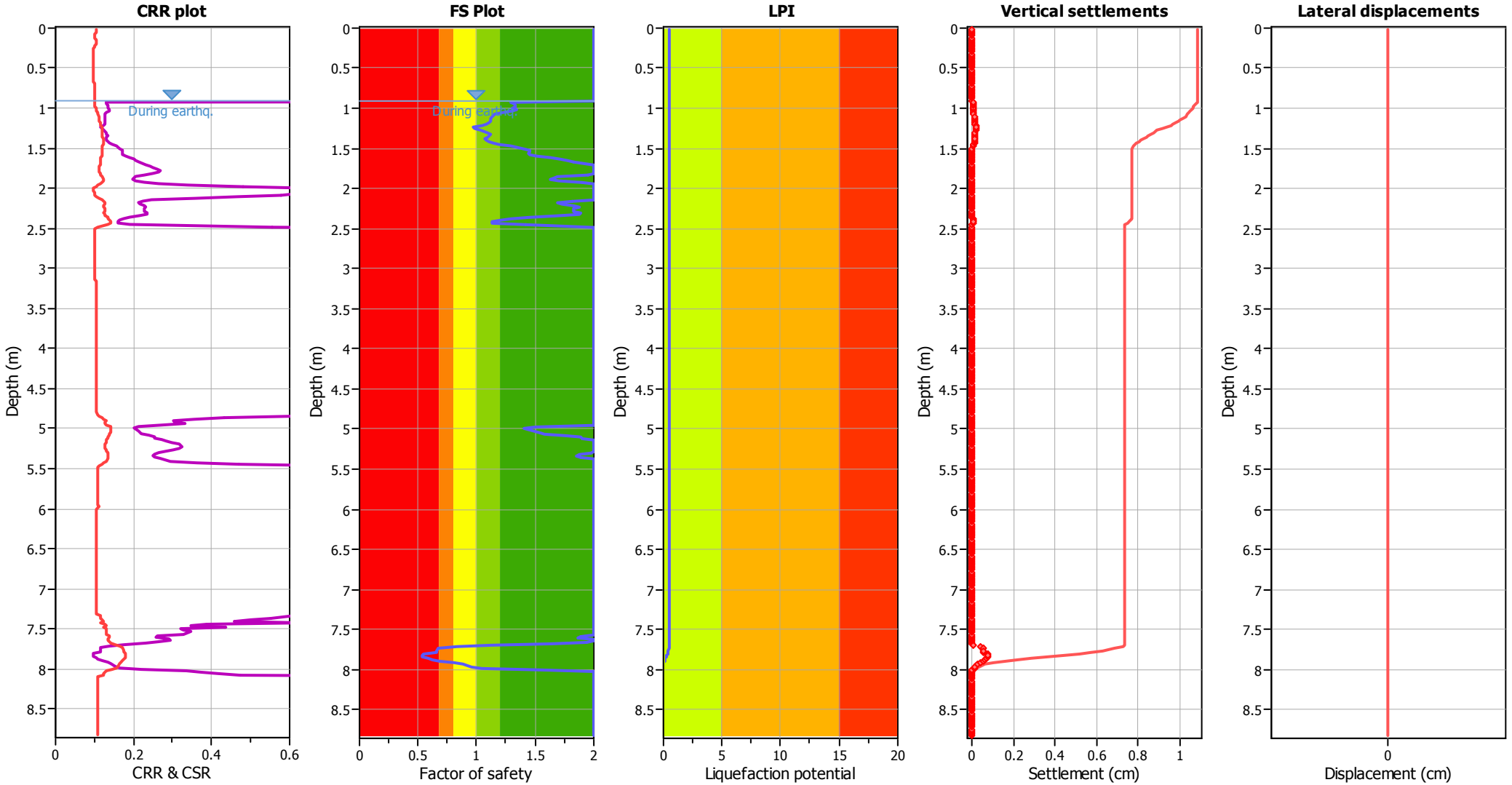






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
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LPI color scheme

- Very high risk
- High risk
- Low risk

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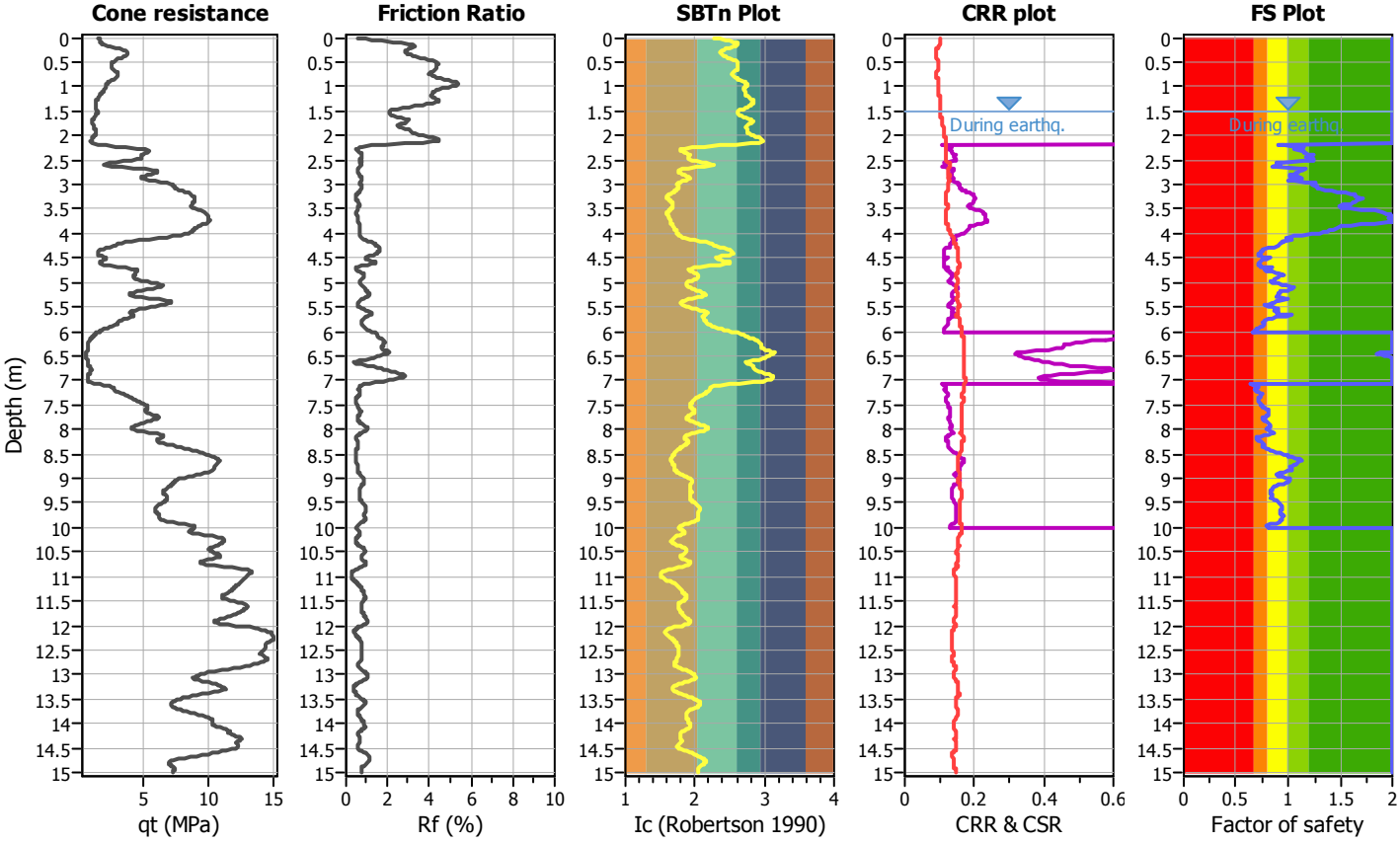
LIQUEFACTION ANALYSIS REPORT

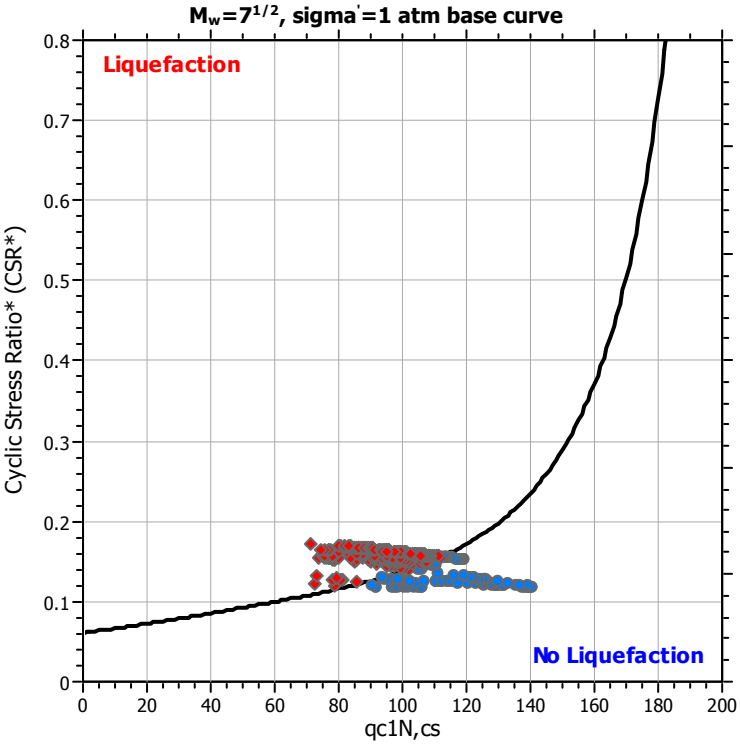
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

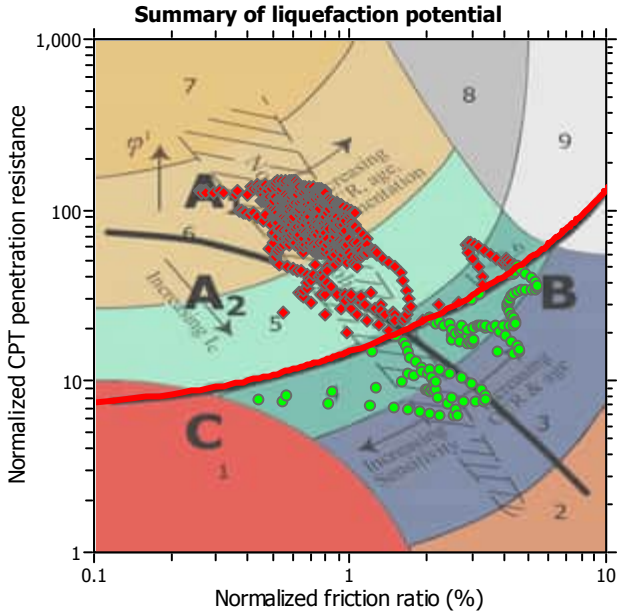
CPT file : CPT_38

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

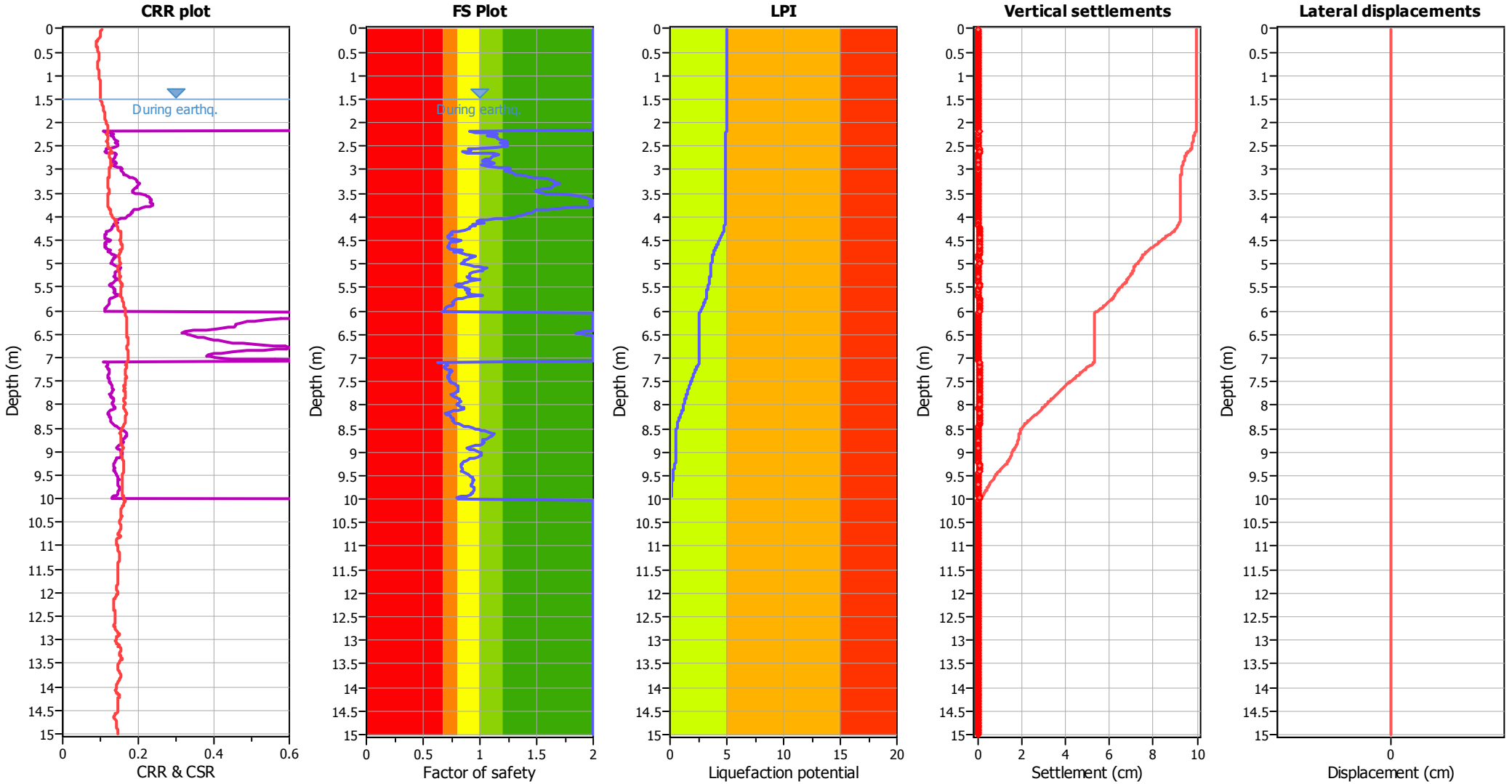






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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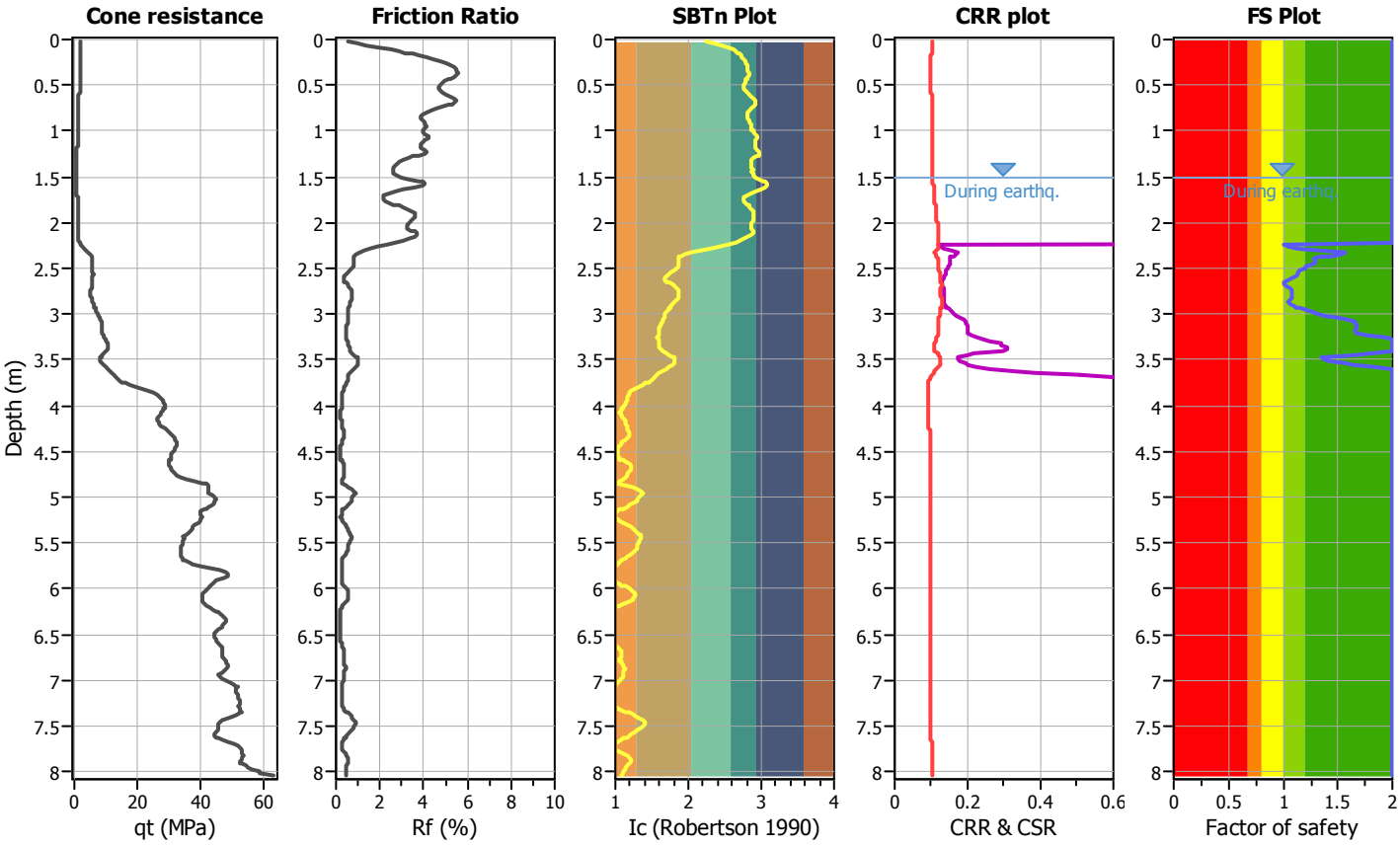
LIQUEFACTION ANALYSIS REPORT

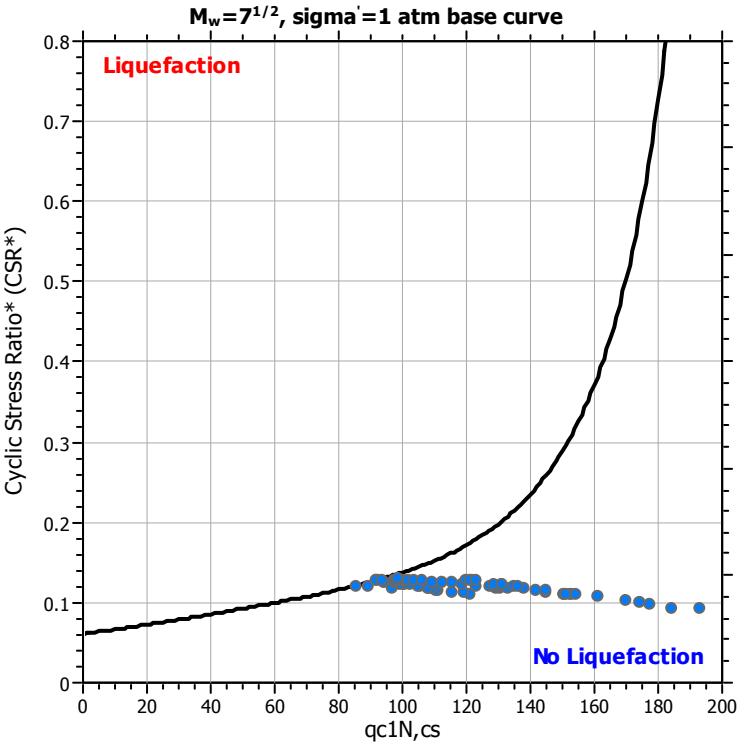
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

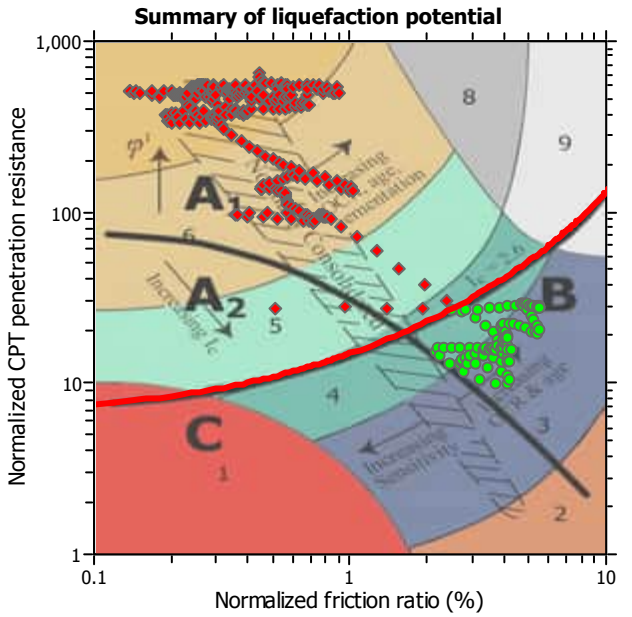
CPT file : CPT_39

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

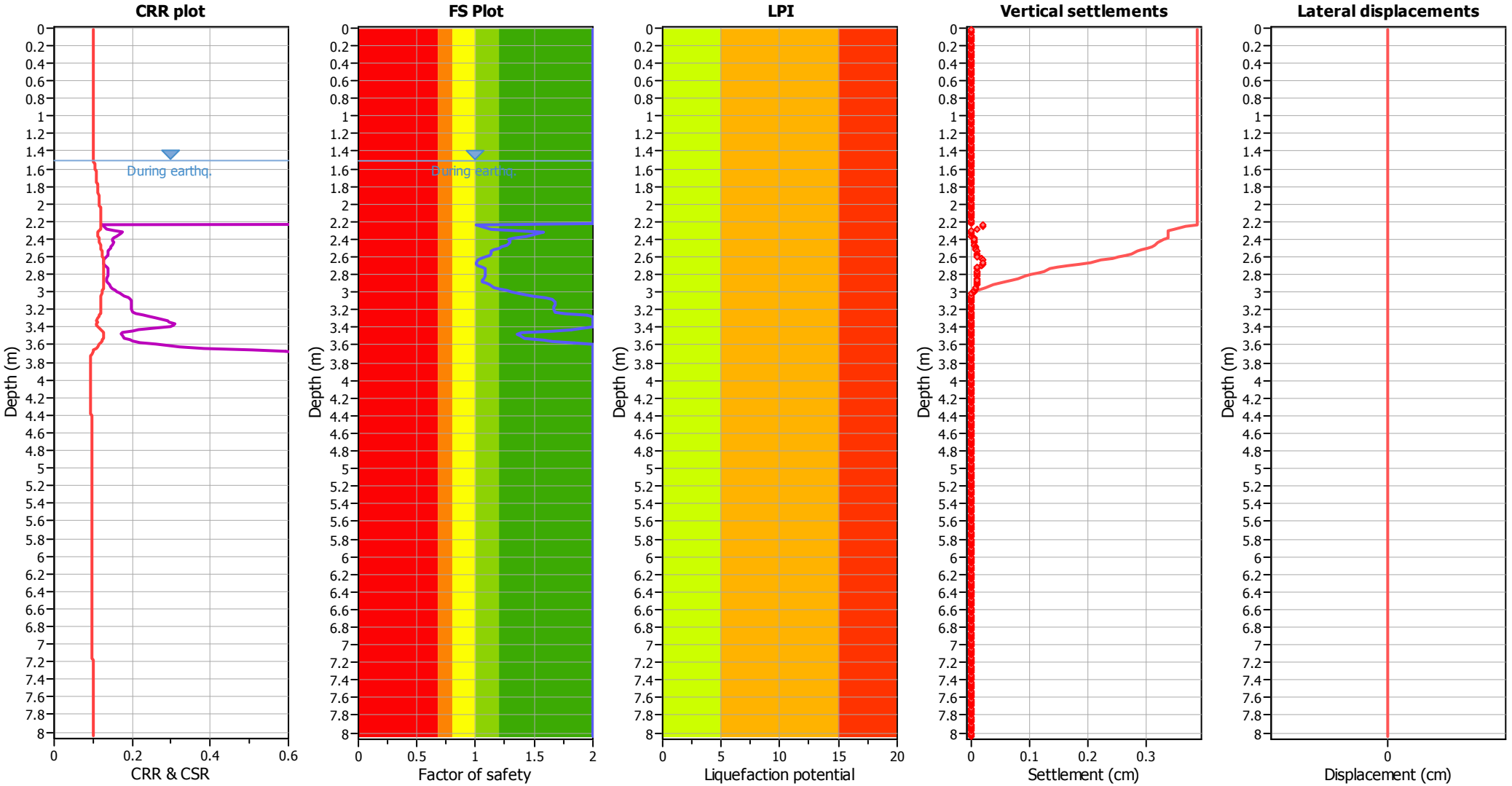






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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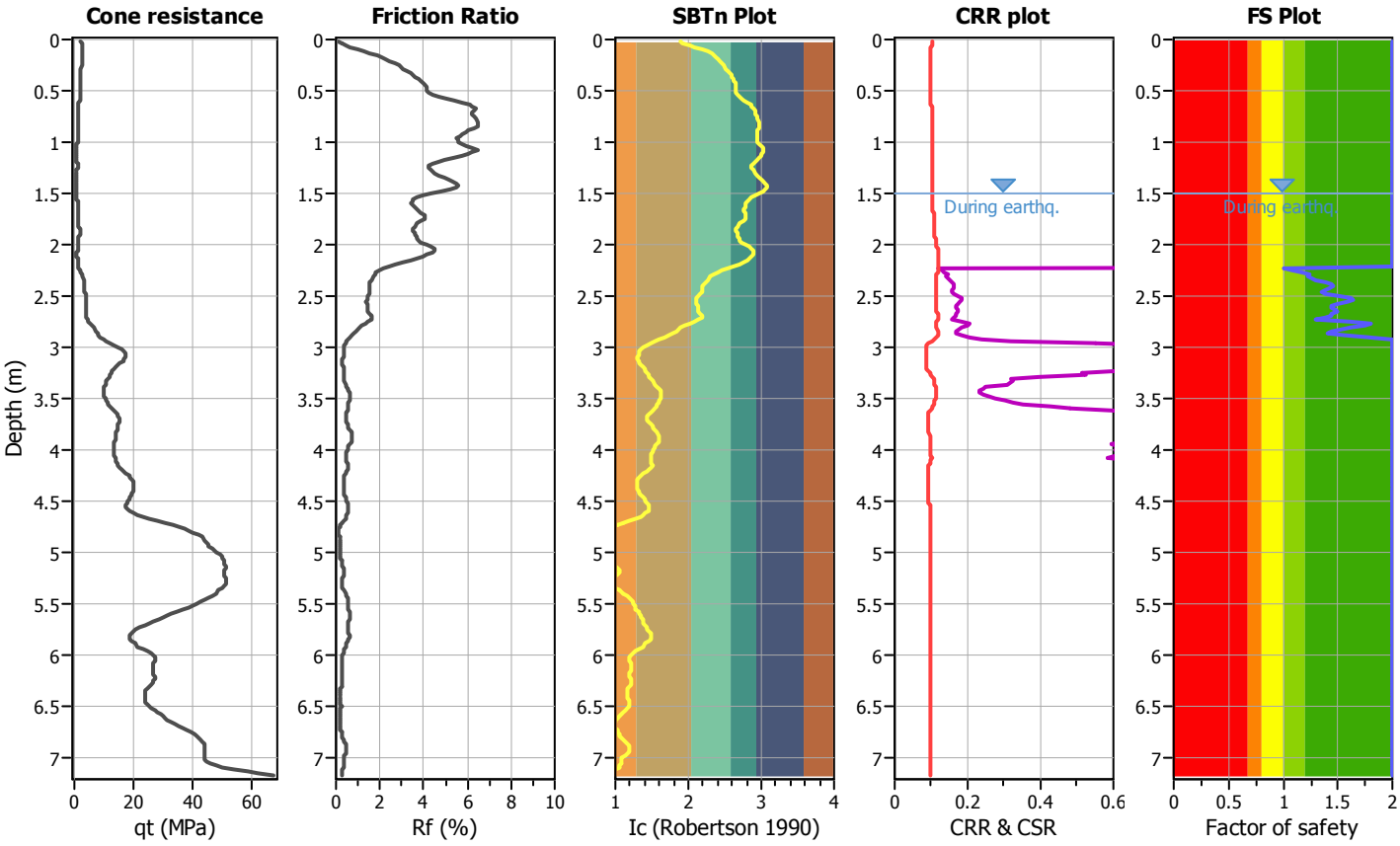
LIQUEFACTION ANALYSIS REPORT

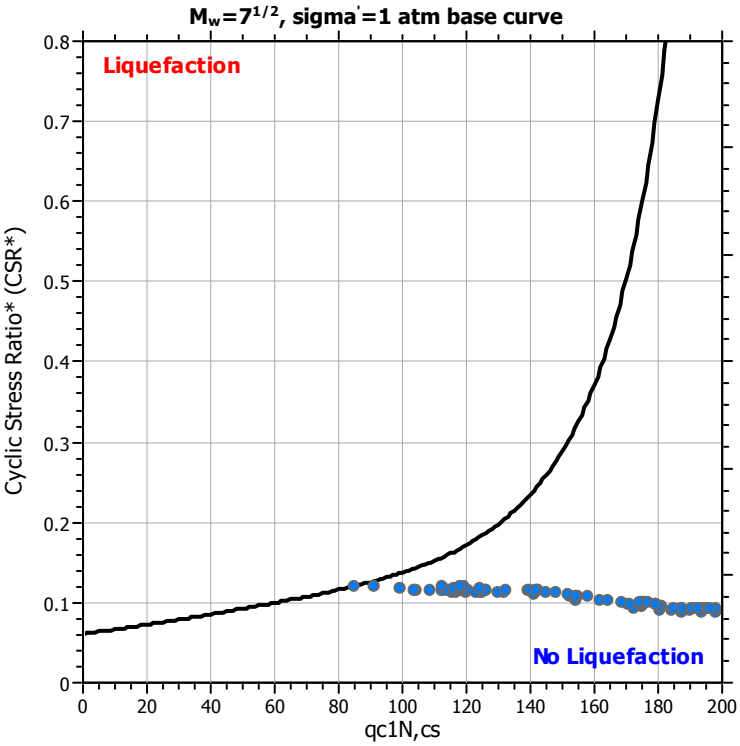
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

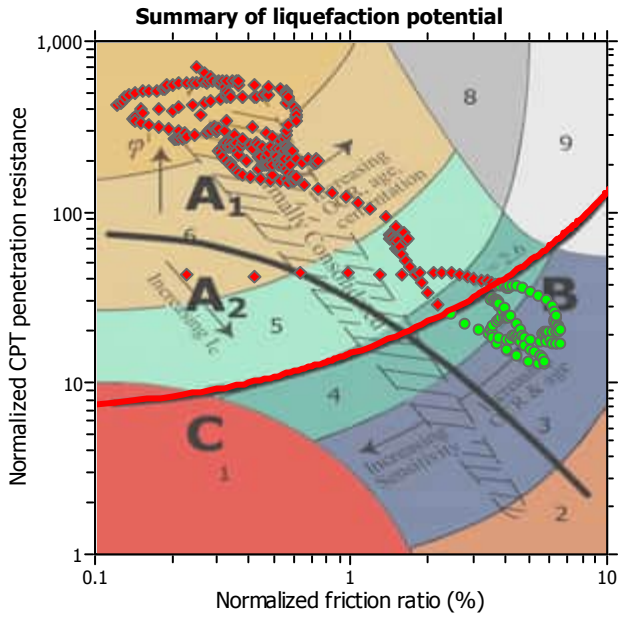
CPT file : CPT_40

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

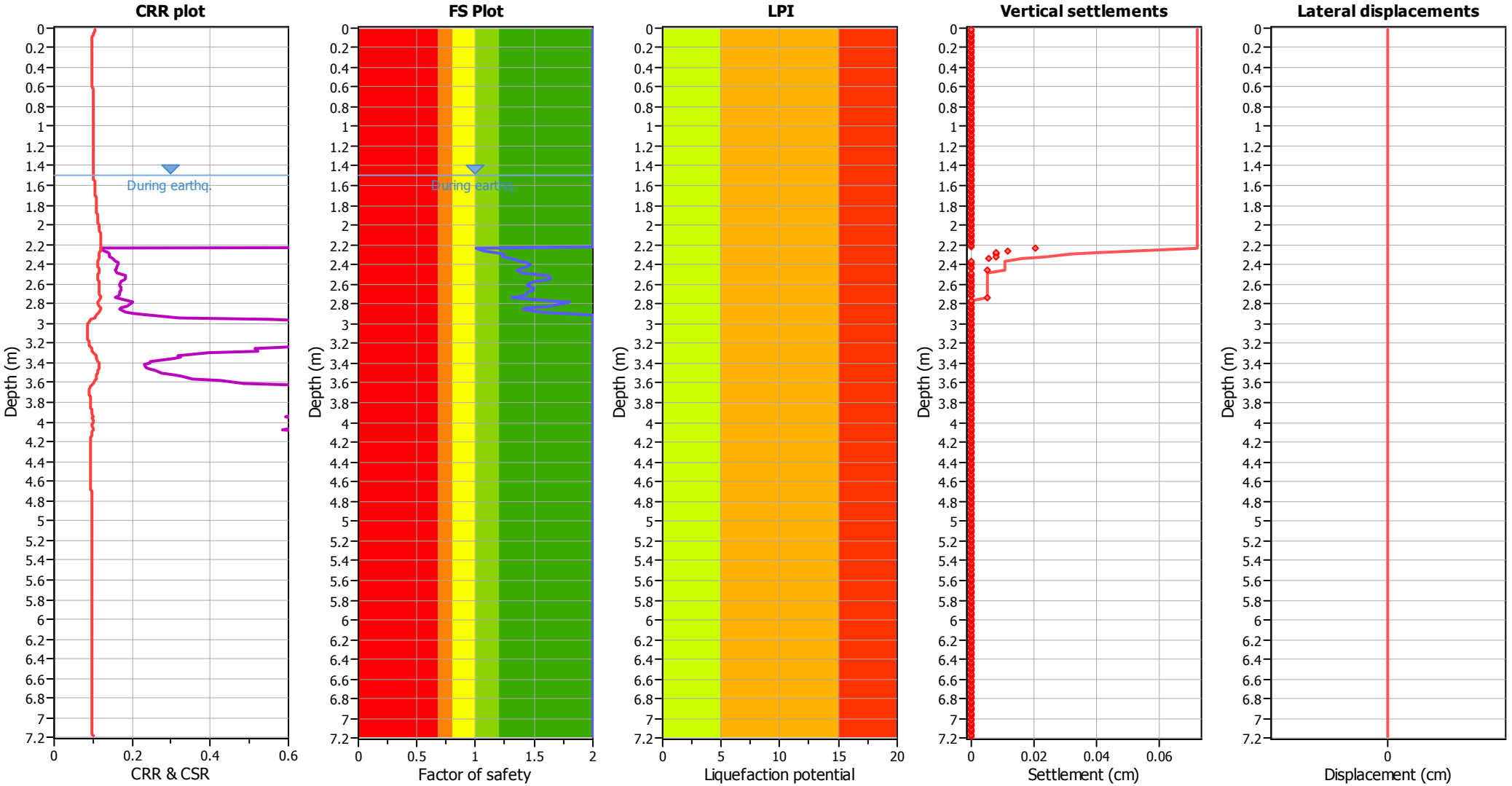






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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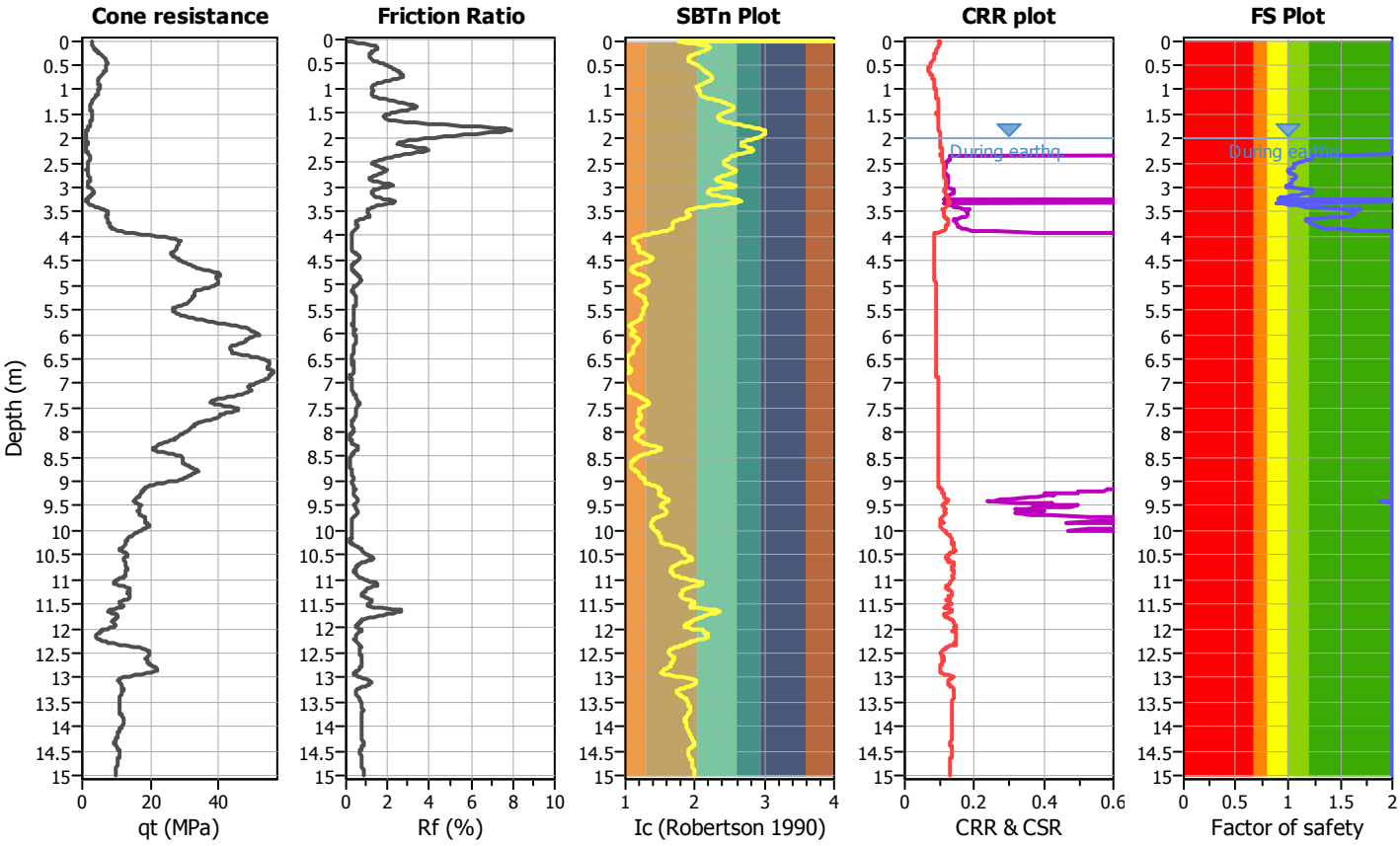
LIQUEFACTION ANALYSIS REPORT

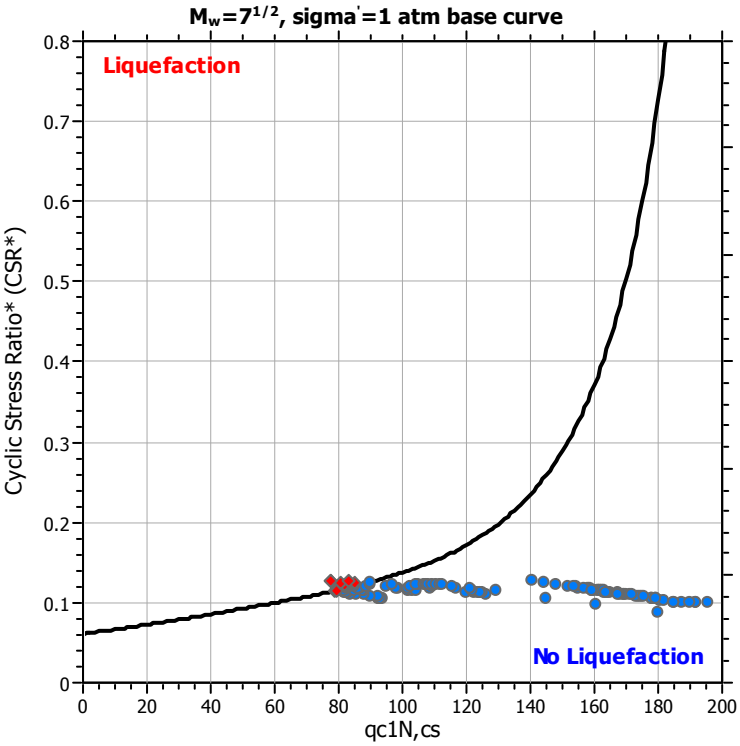
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

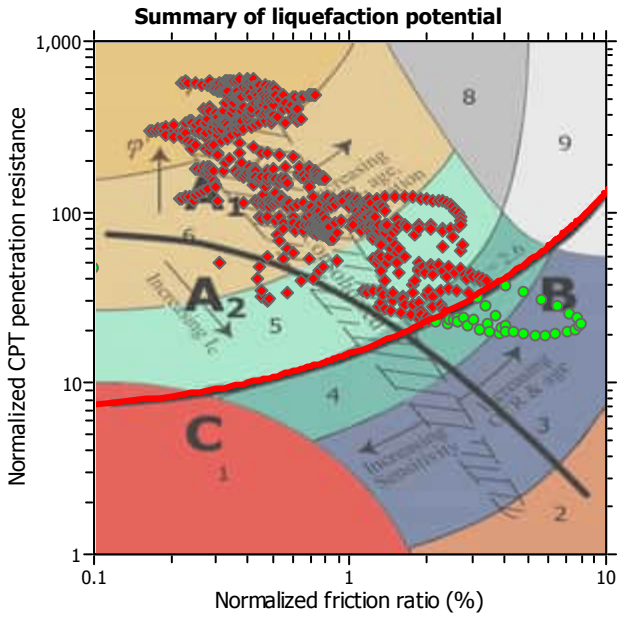
CPT file : CPT_41

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

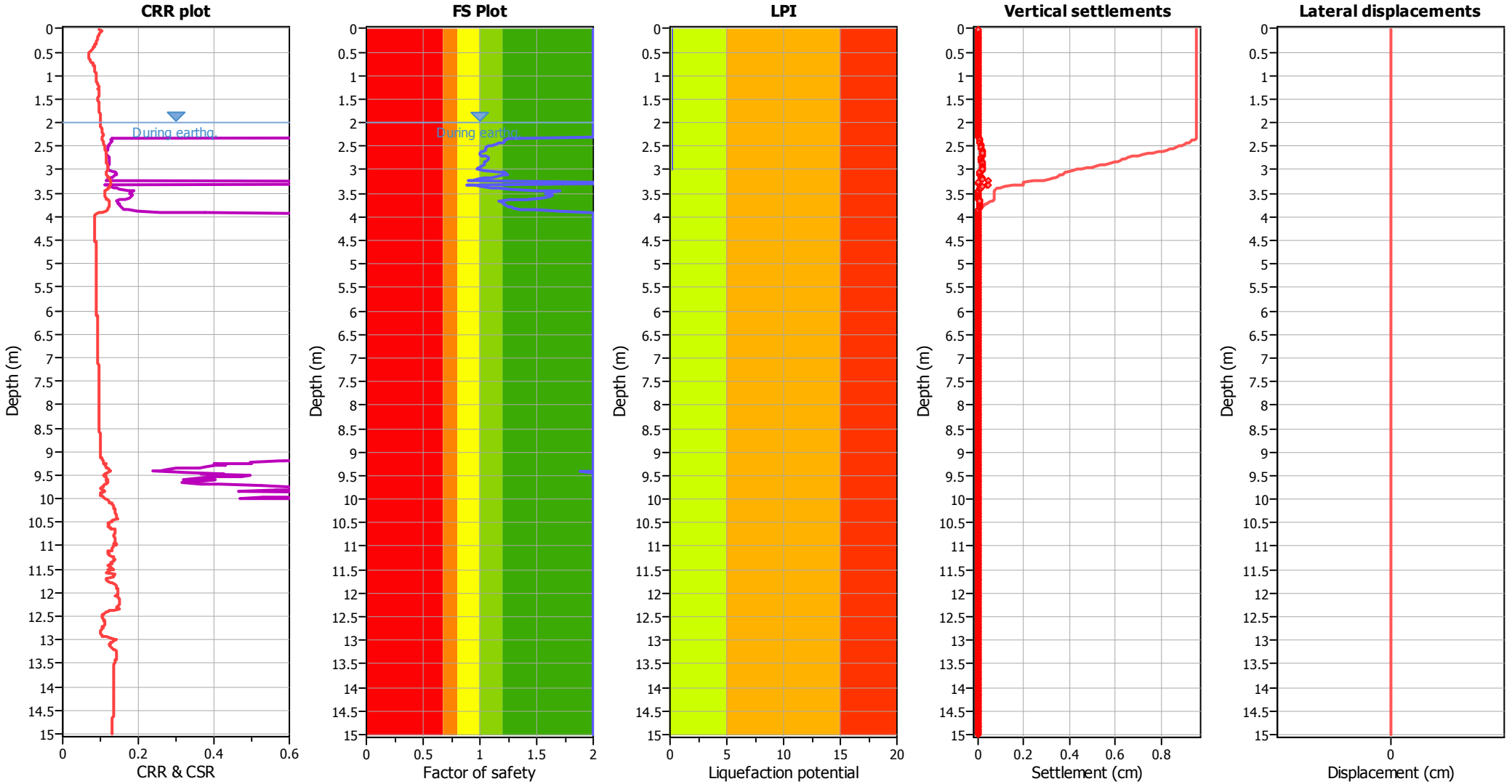






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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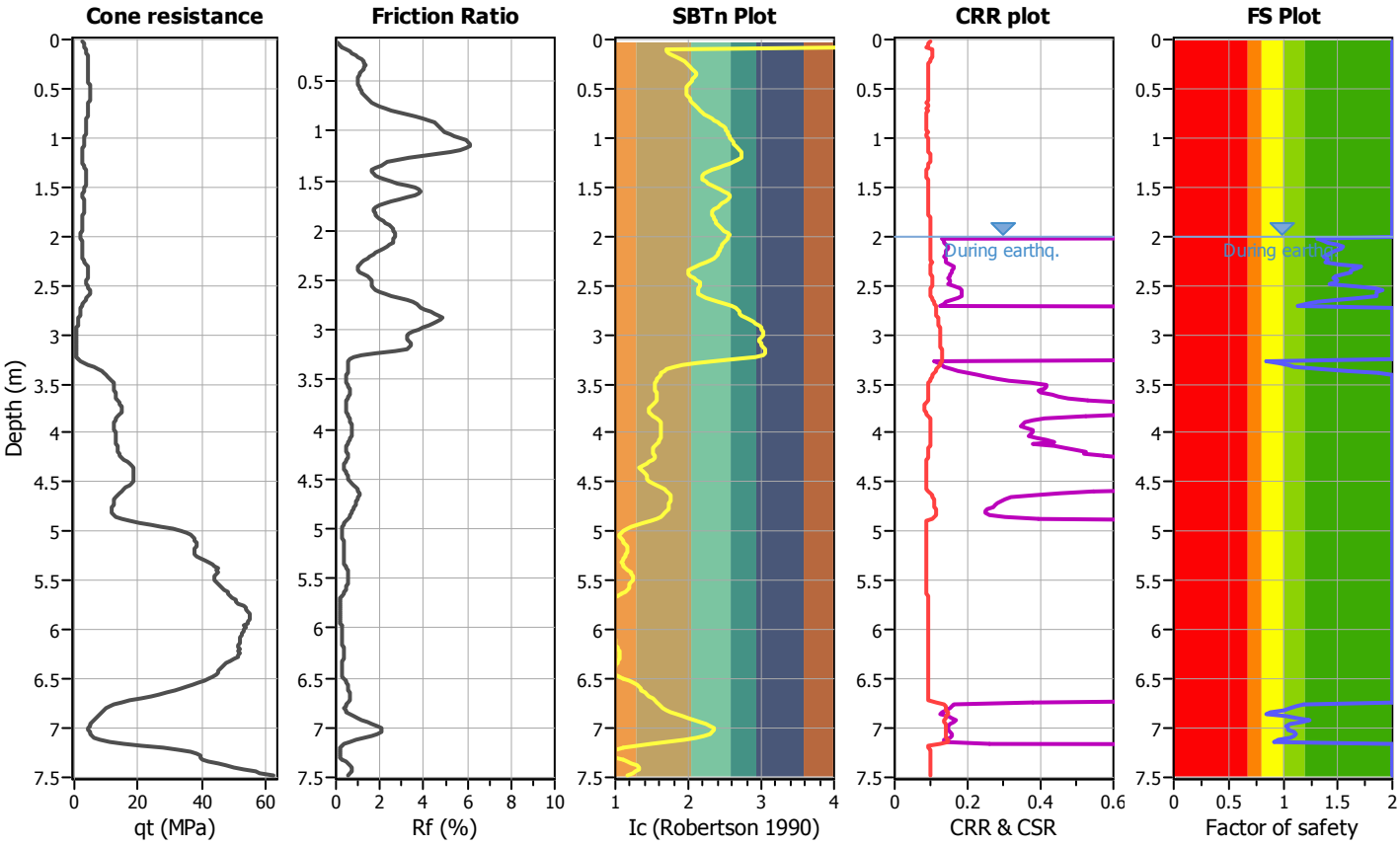
LIQUEFACTION ANALYSIS REPORT

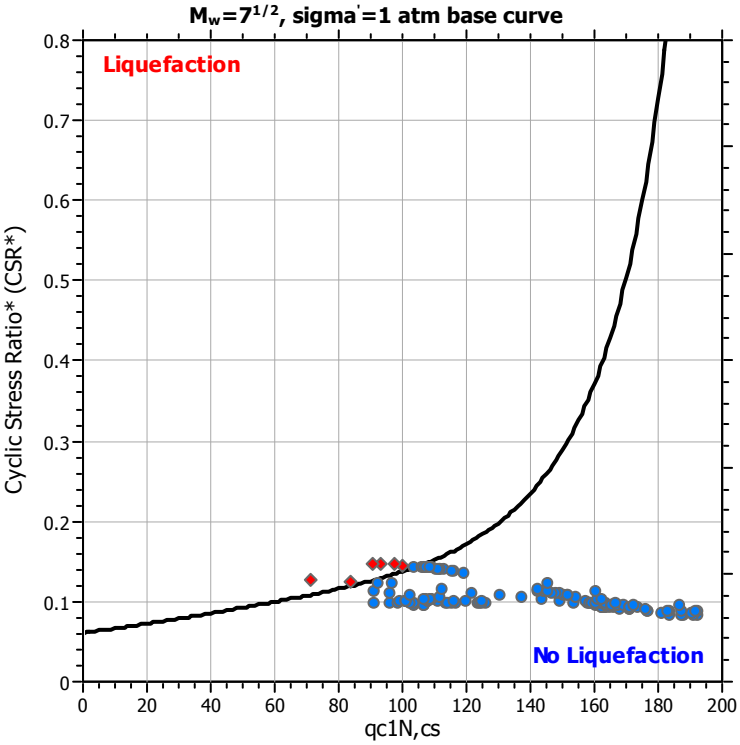
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

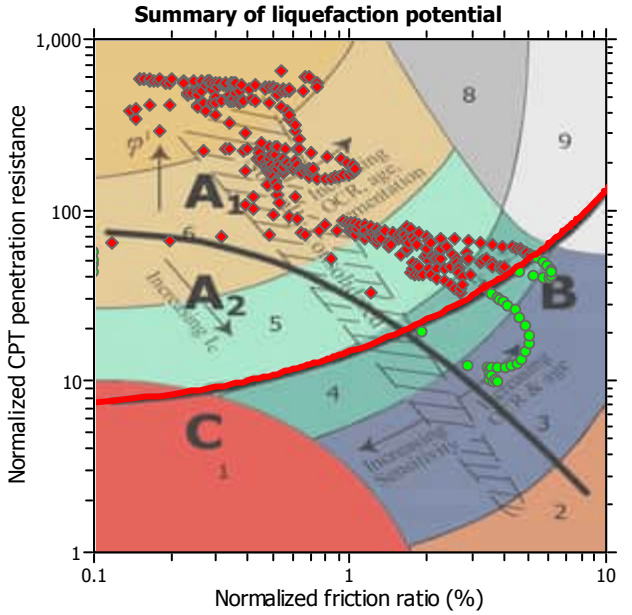
CPT file : CPT_42

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

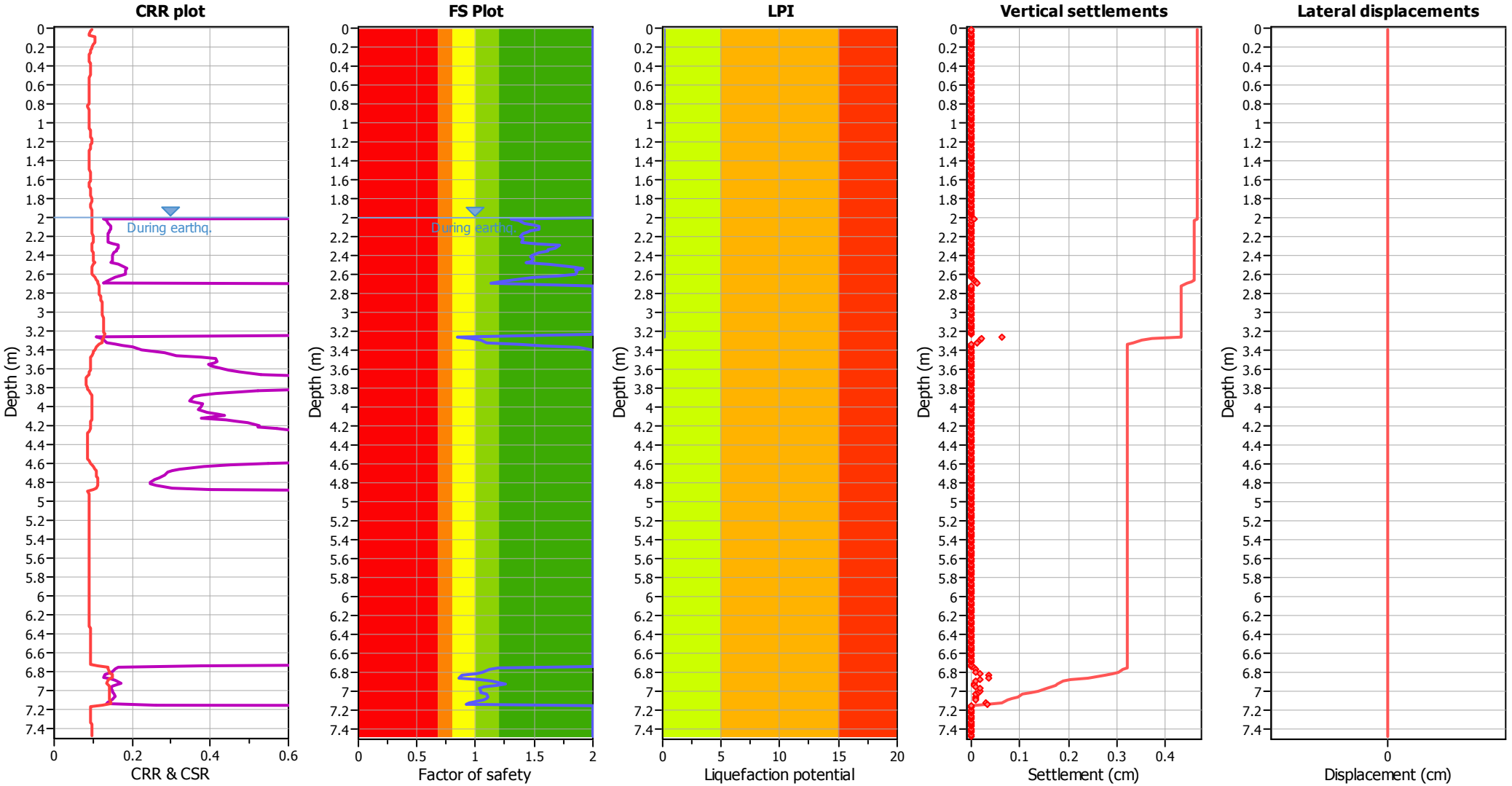






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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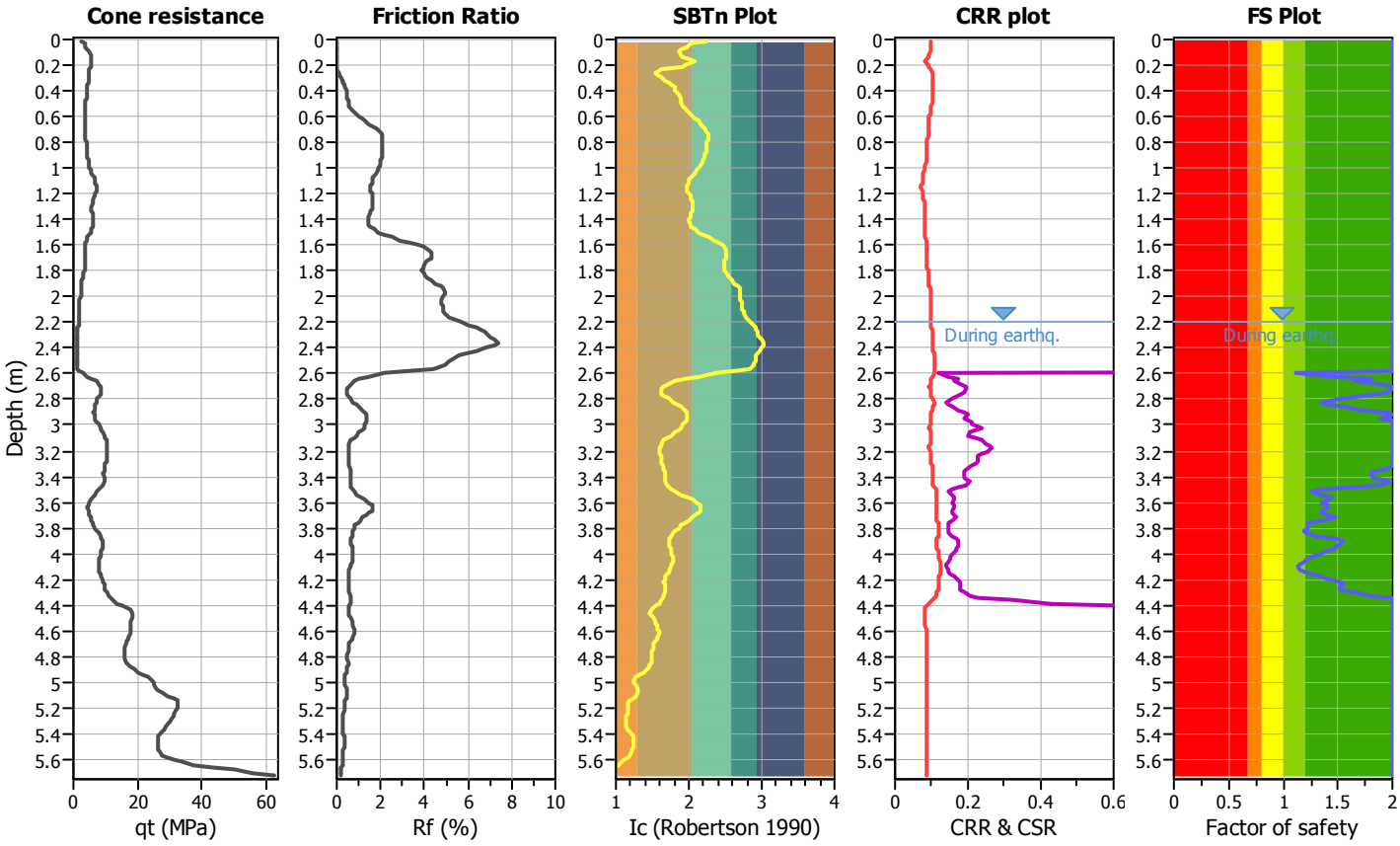
LIQUEFACTION ANALYSIS REPORT

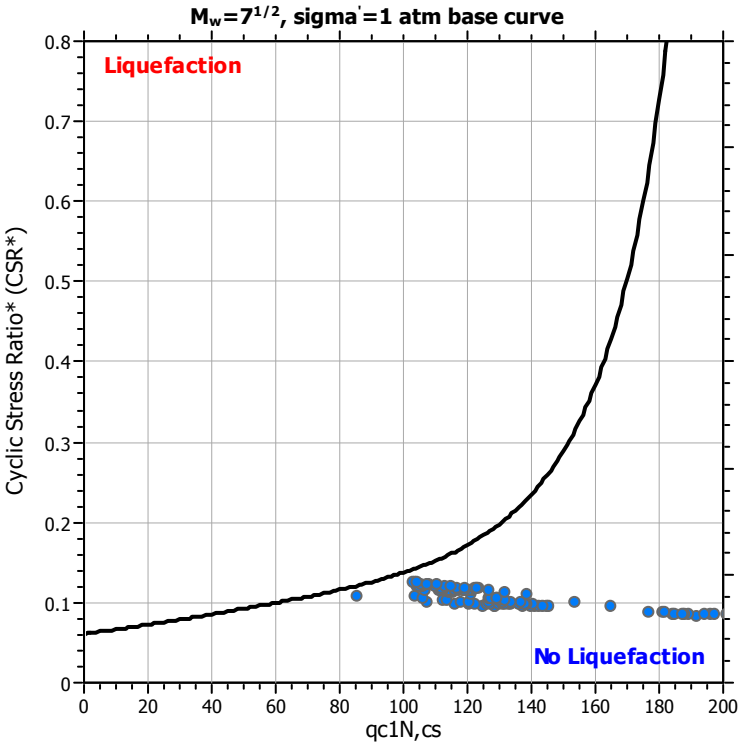
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

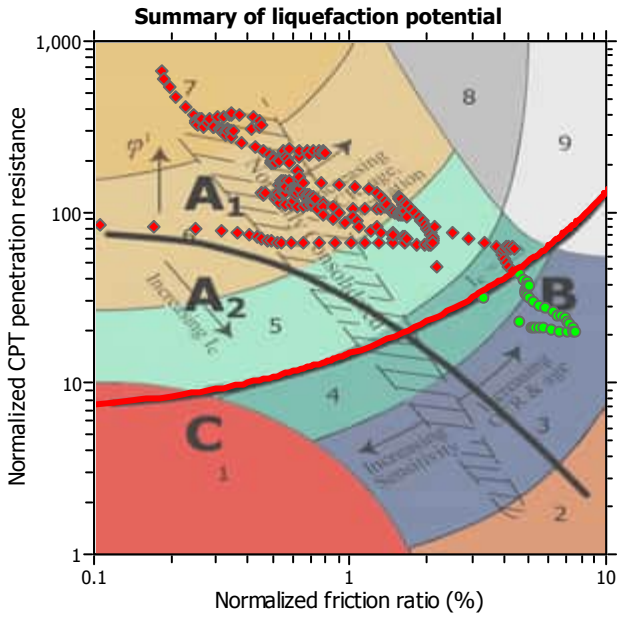
CPT file : CPT_43

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

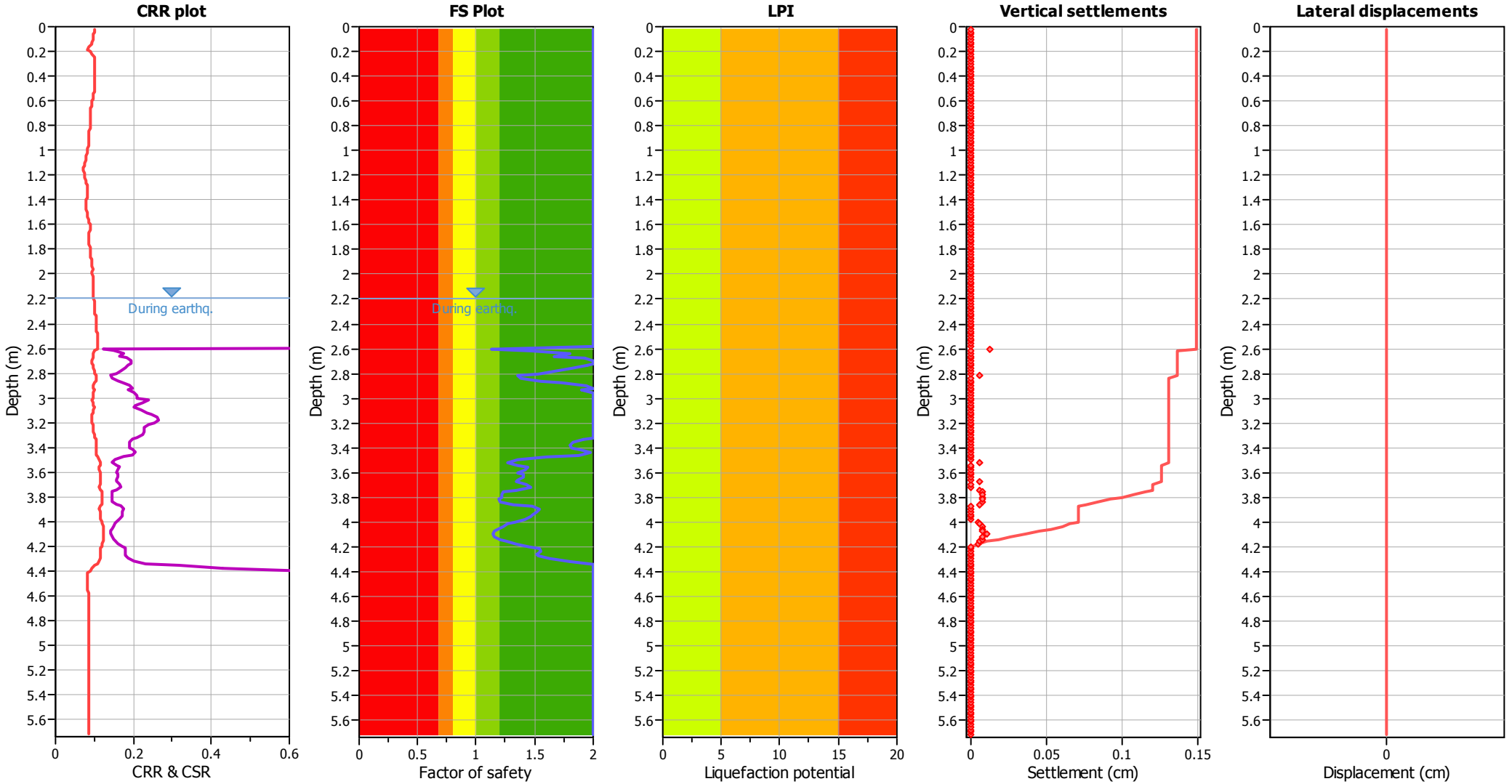






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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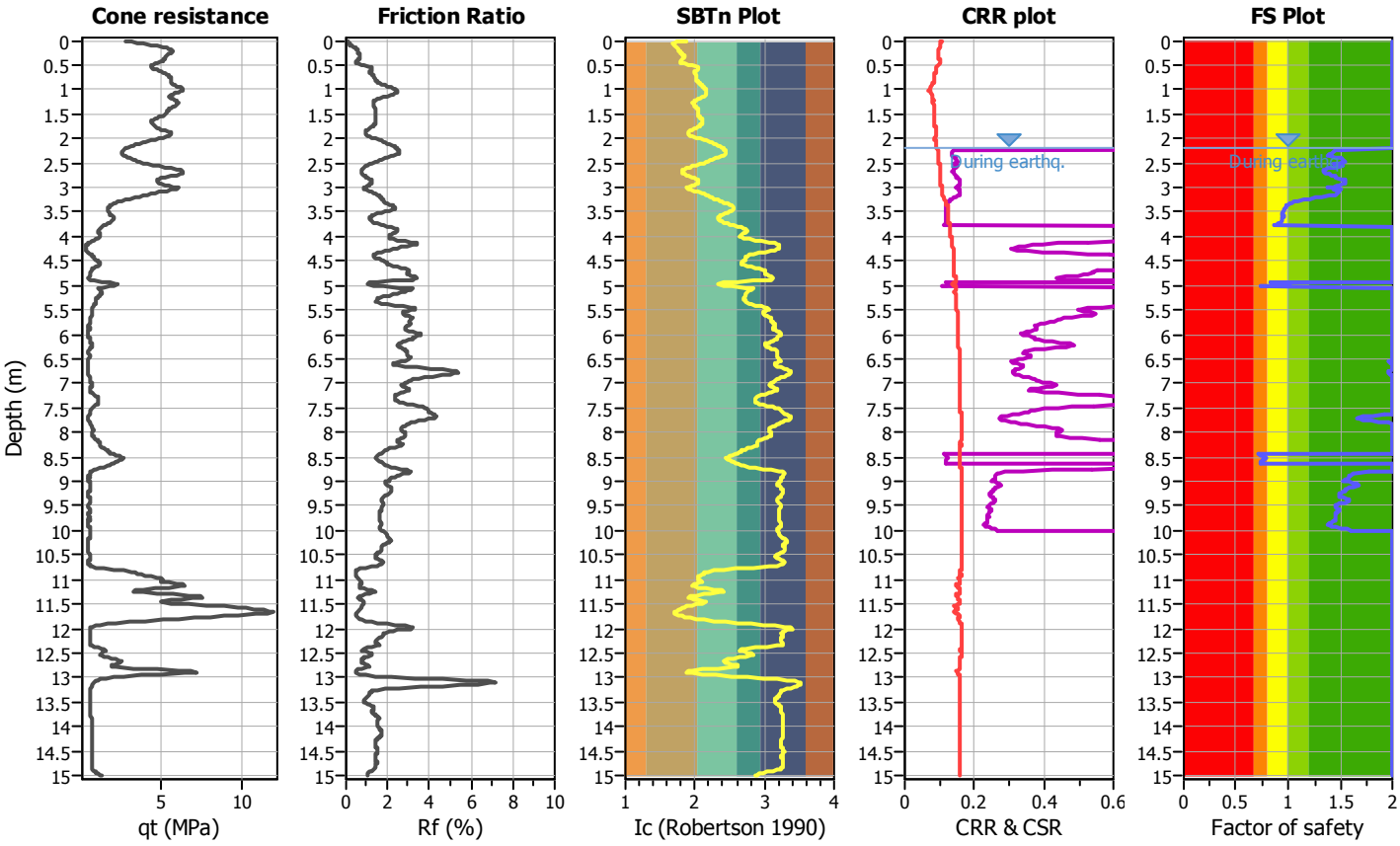
LIQUEFACTION ANALYSIS REPORT

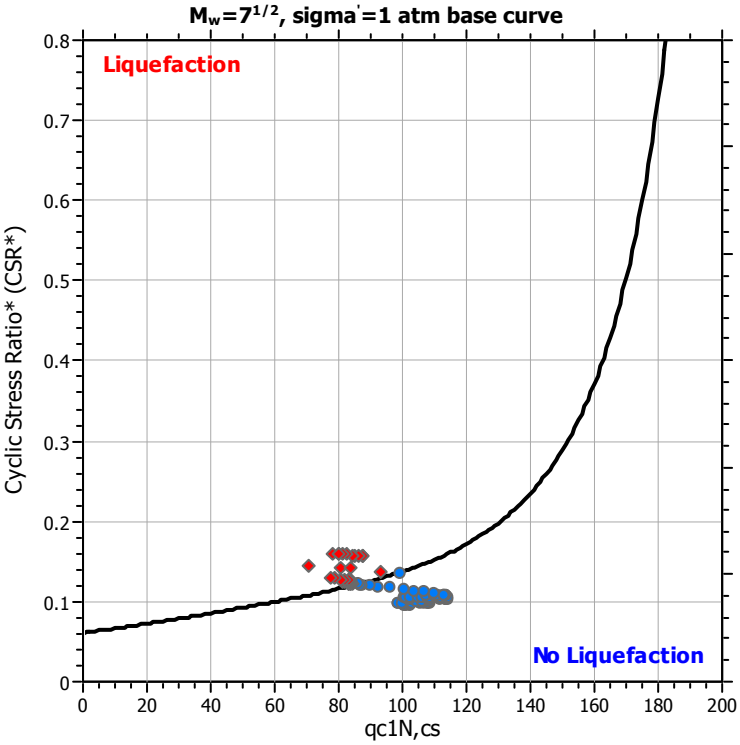
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

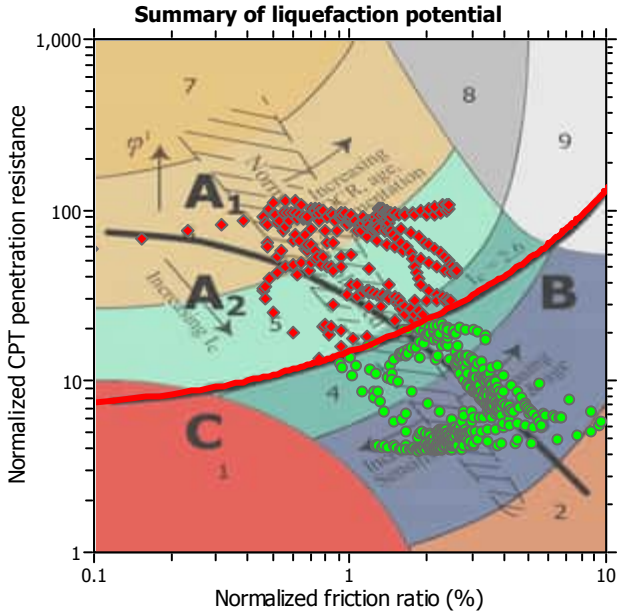
CPT file : CPT_44

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

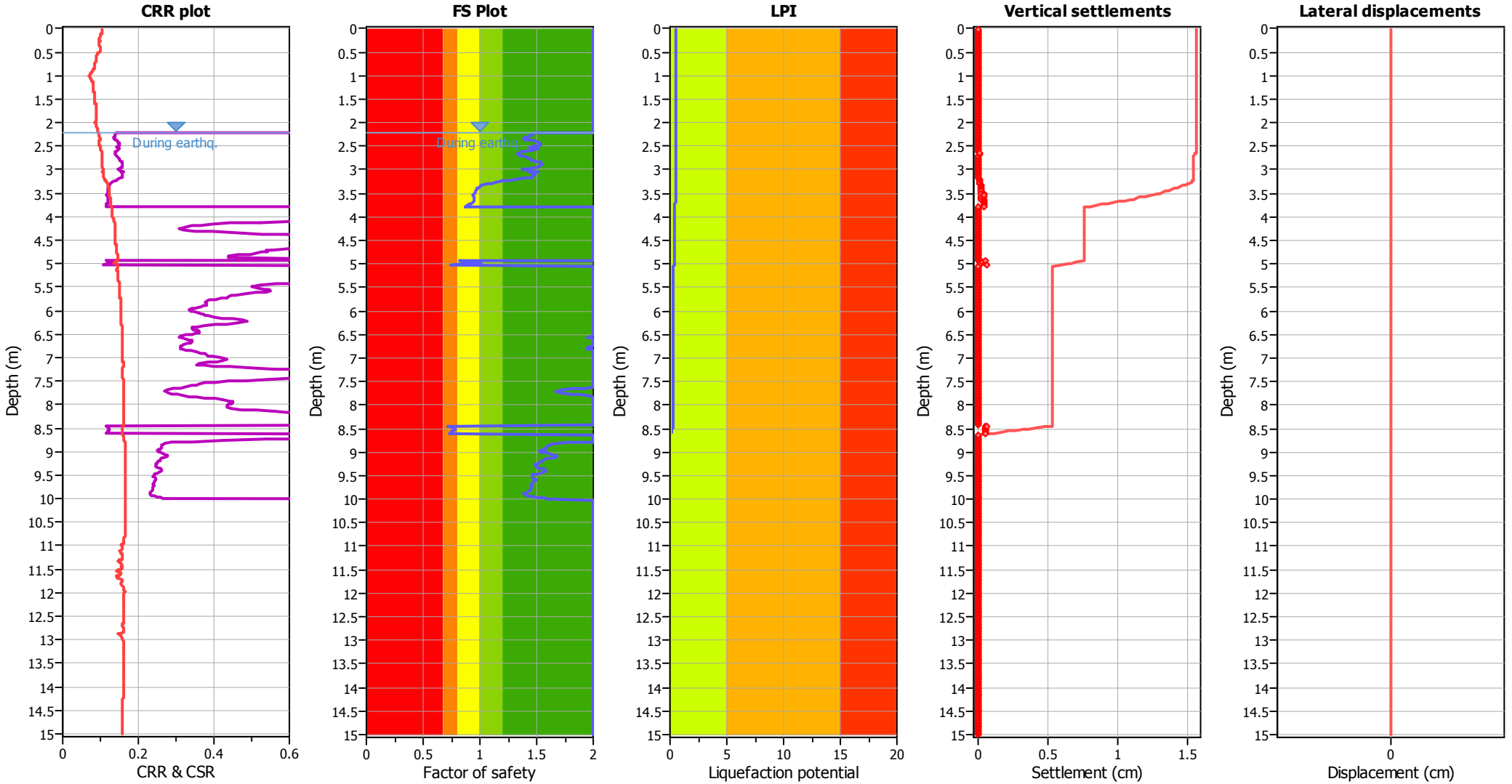






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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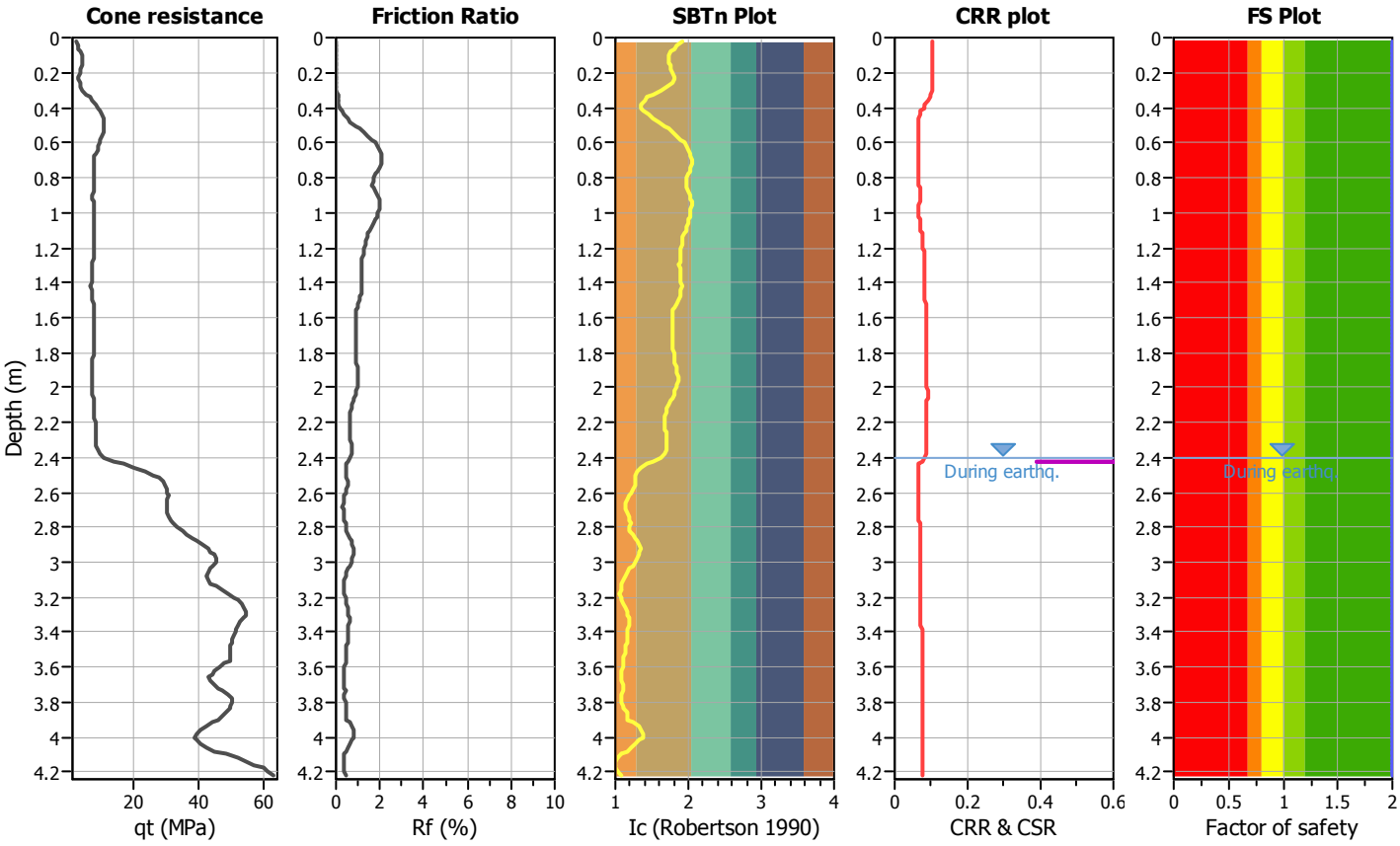
LIQUEFACTION ANALYSIS REPORT

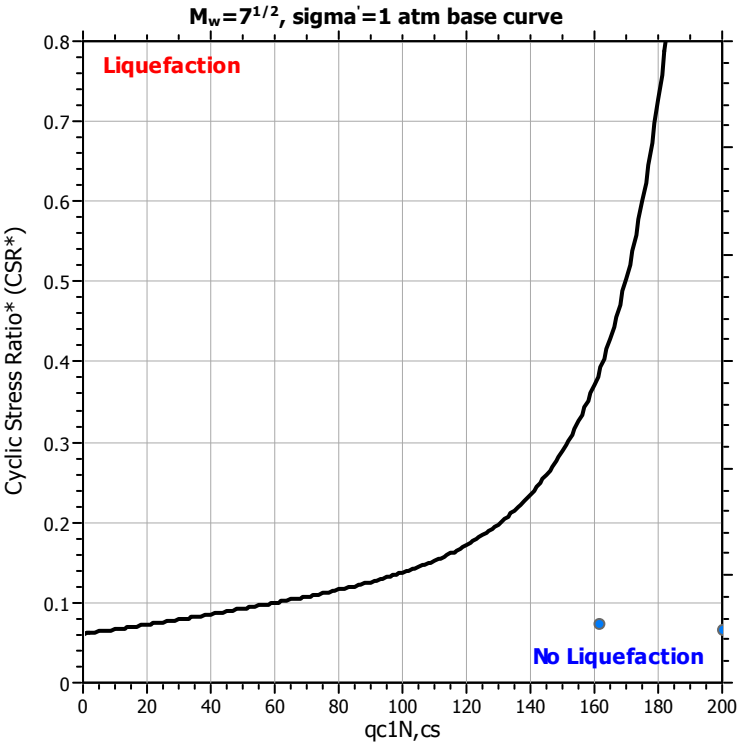
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

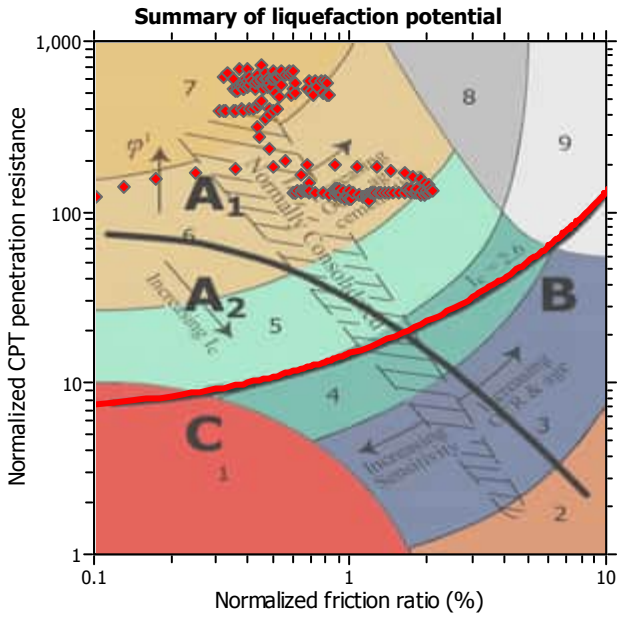
CPT file : CPT_45

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

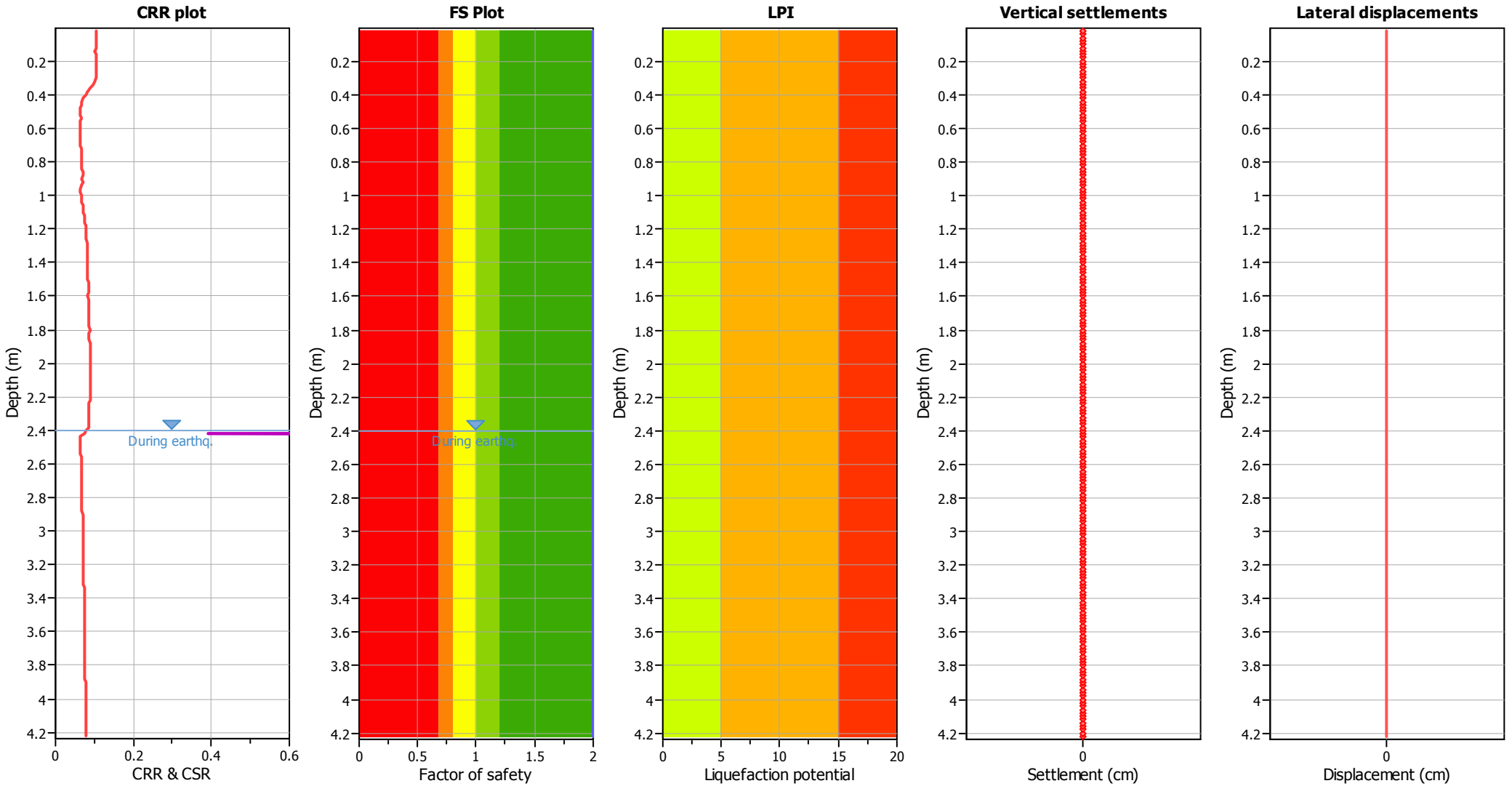






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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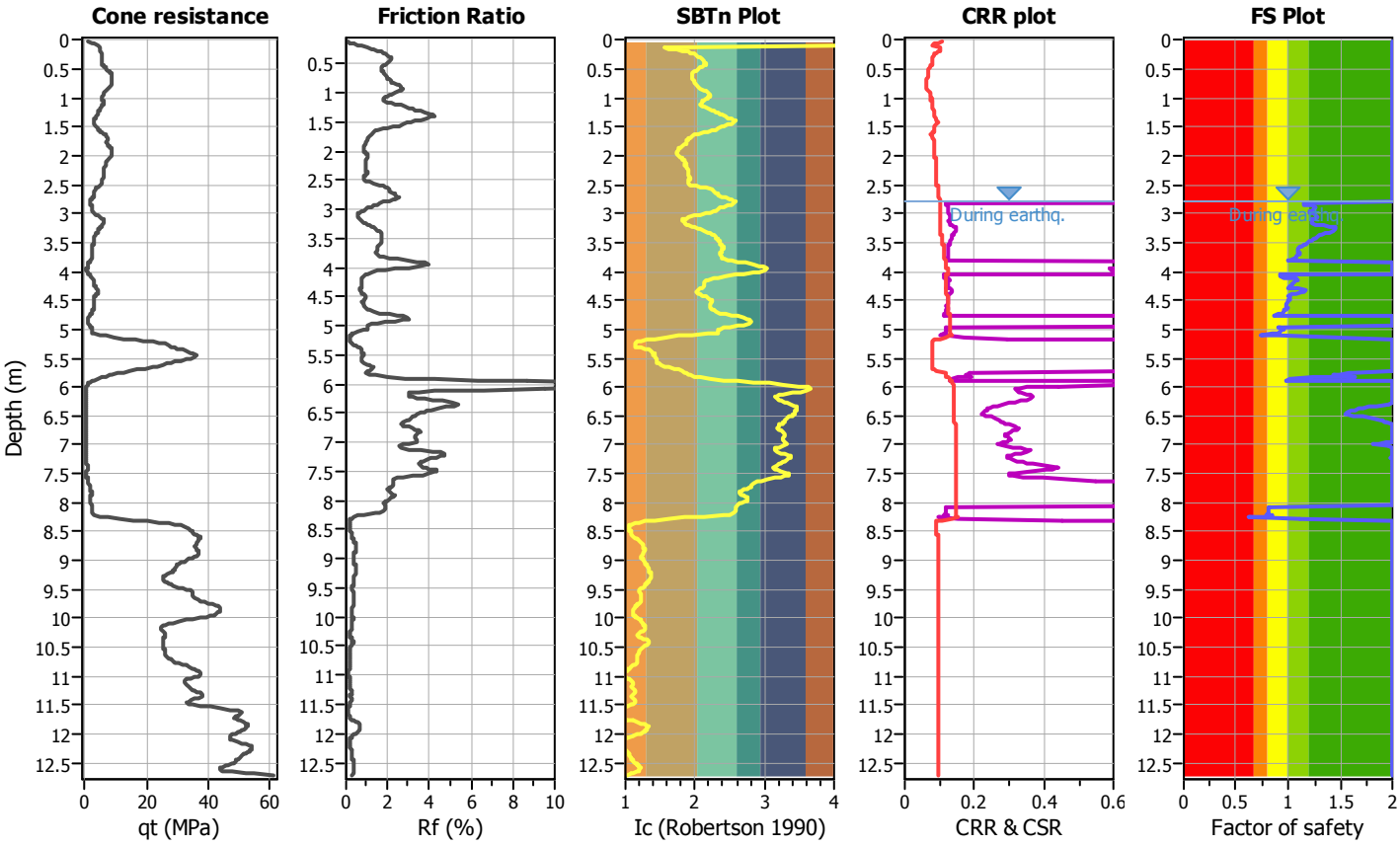
LIQUEFACTION ANALYSIS REPORT

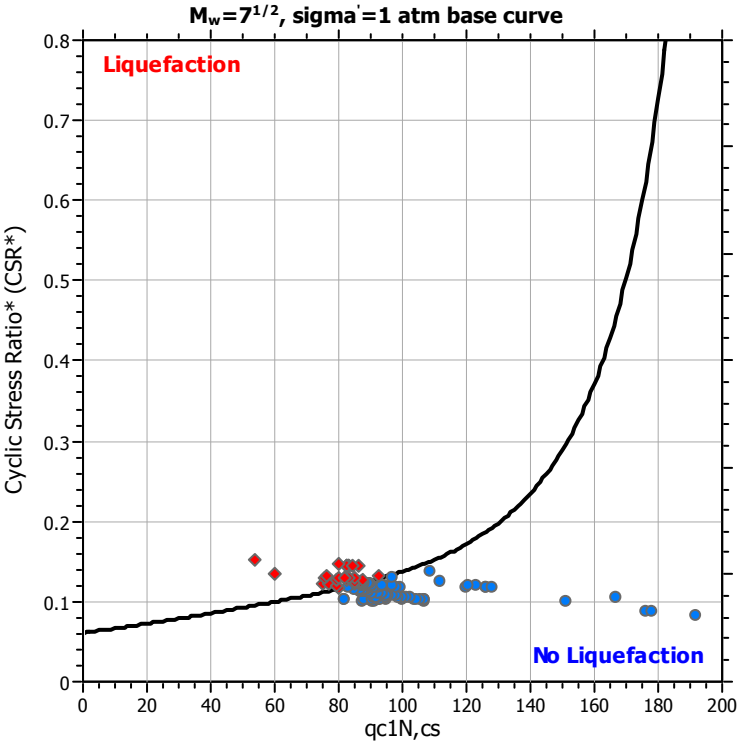
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

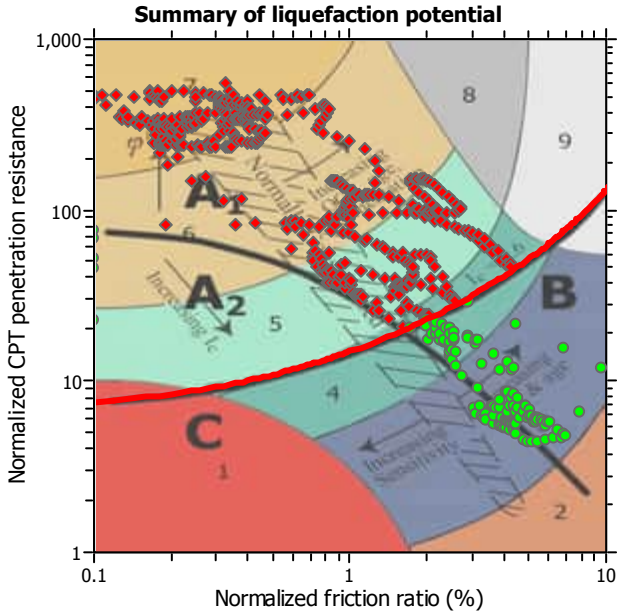
CPT file : CPT_46

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

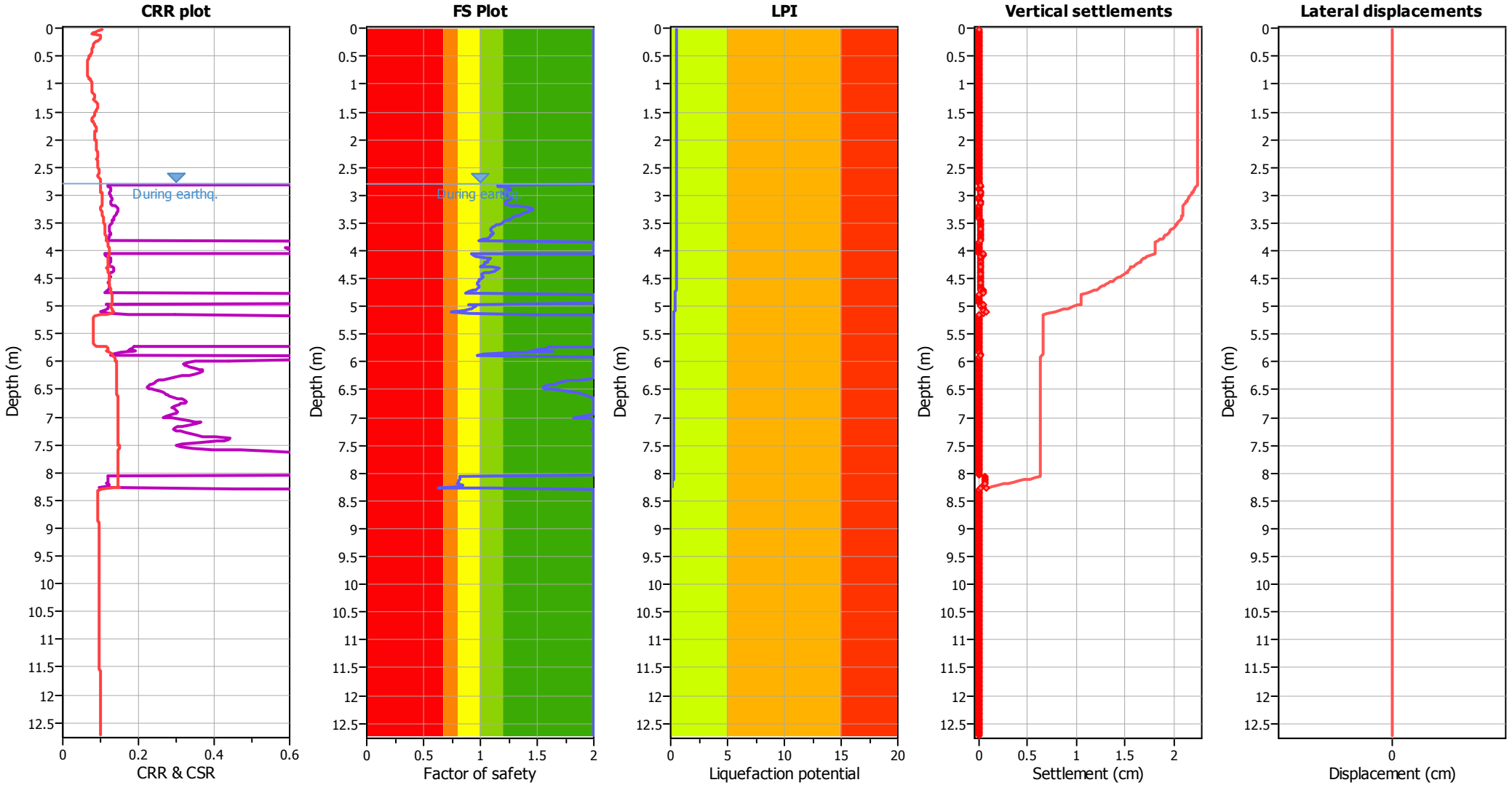






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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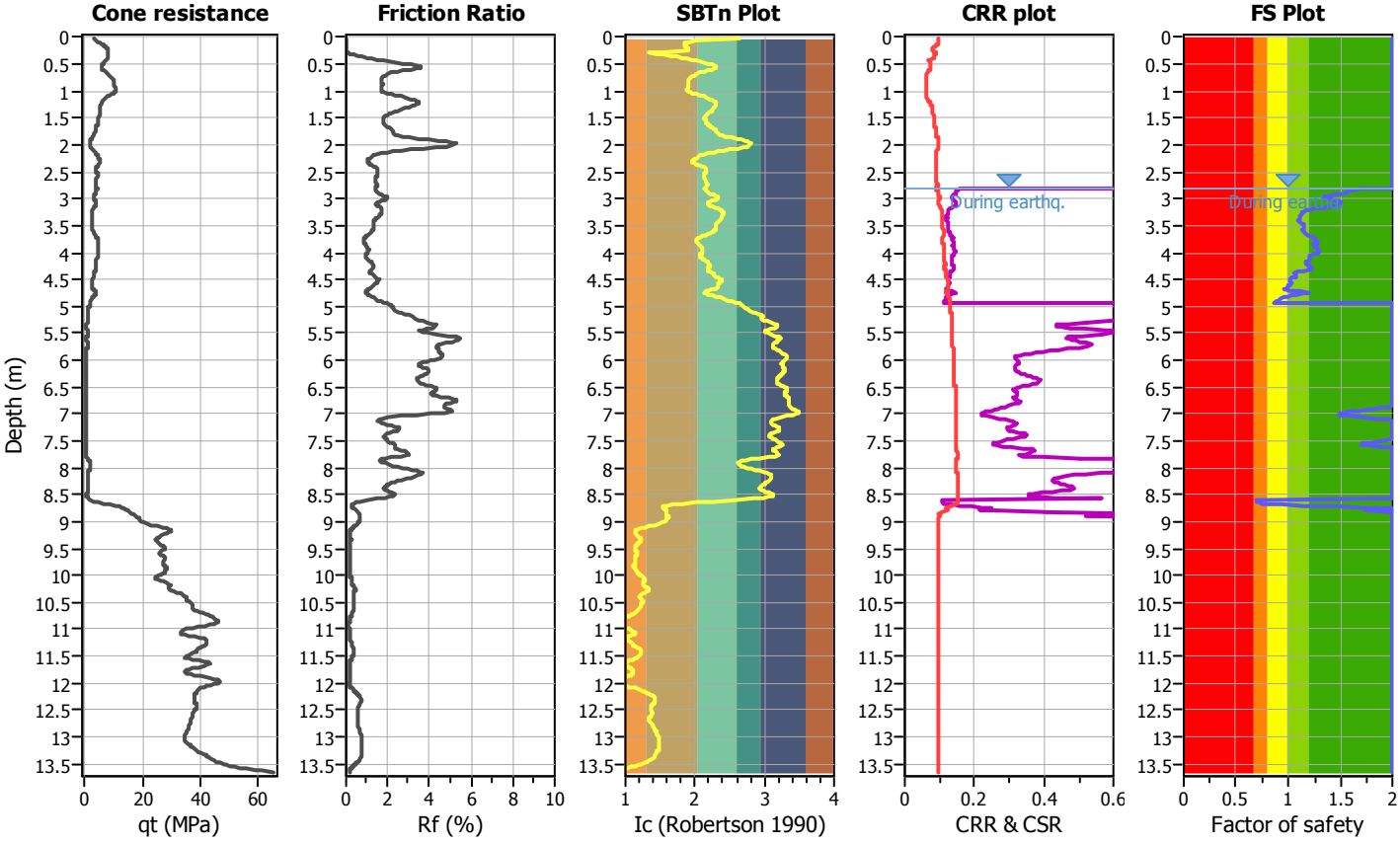
LIQUEFACTION ANALYSIS REPORT

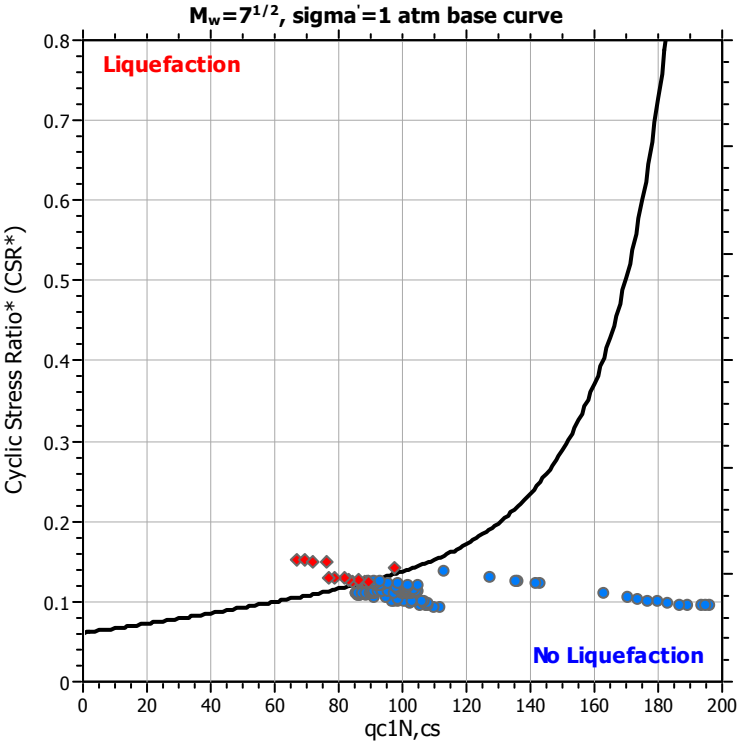
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

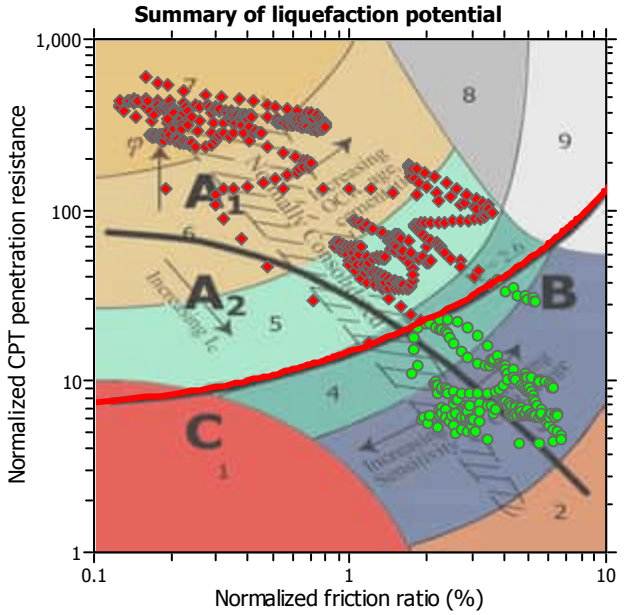
CPT file : CPT_47

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

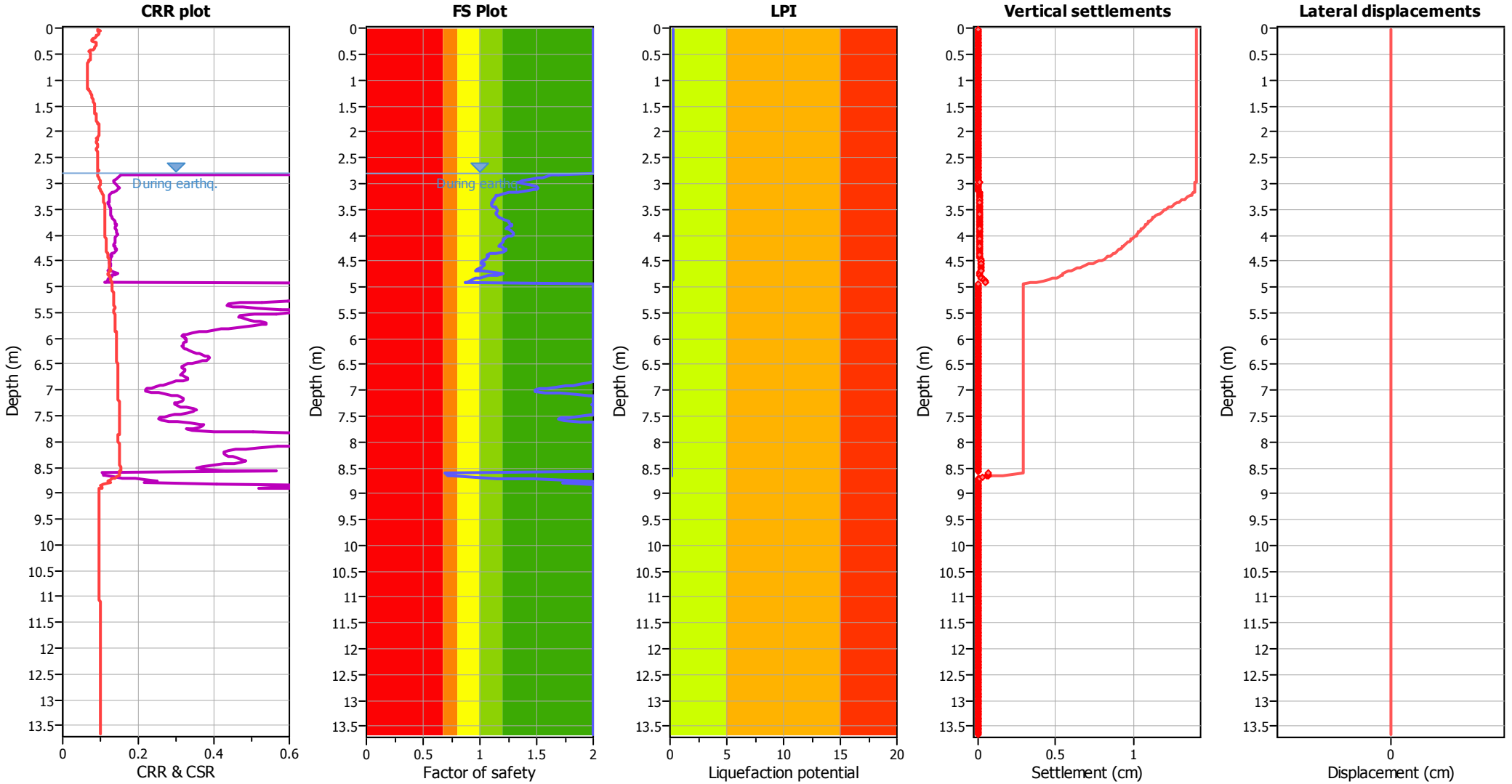






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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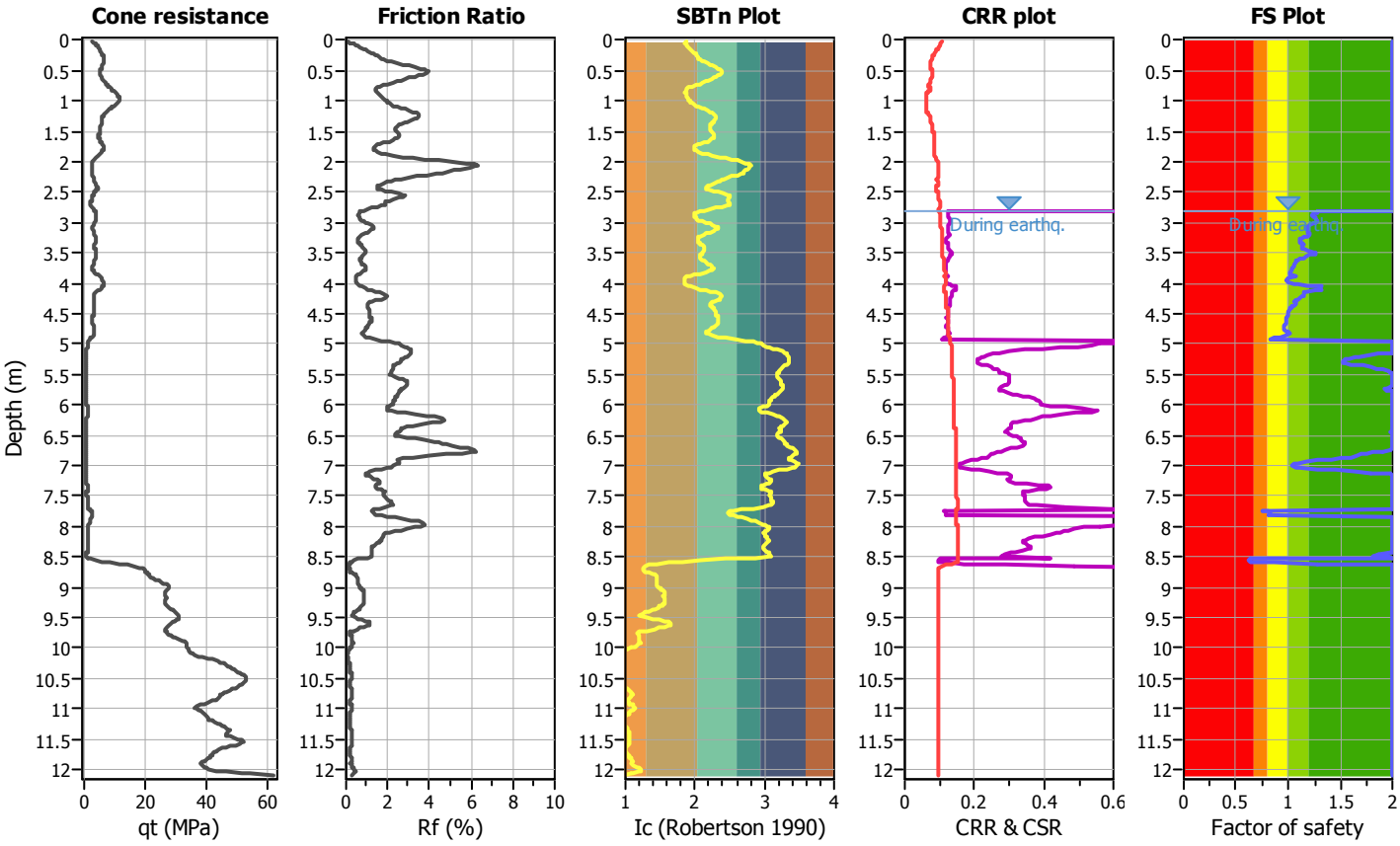
LIQUEFACTION ANALYSIS REPORT

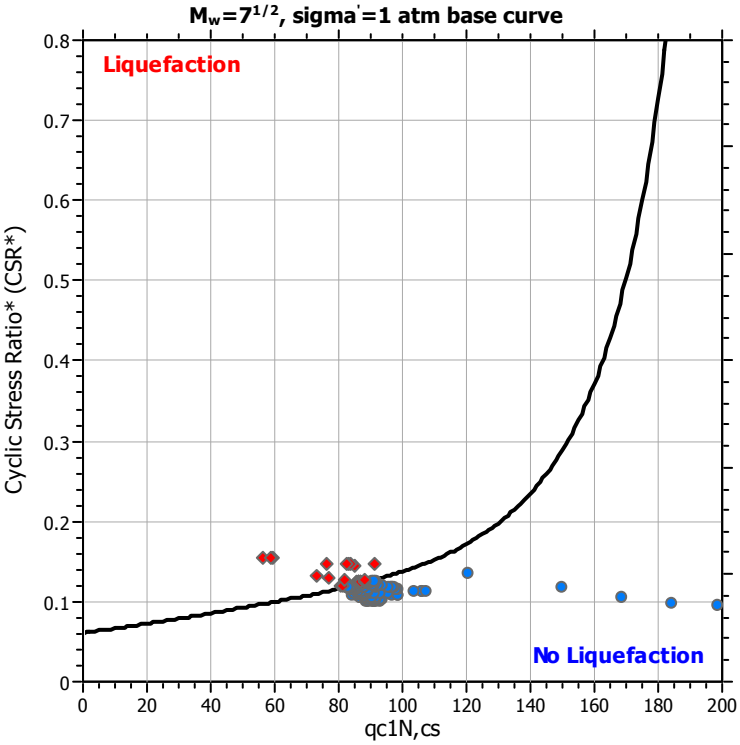
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

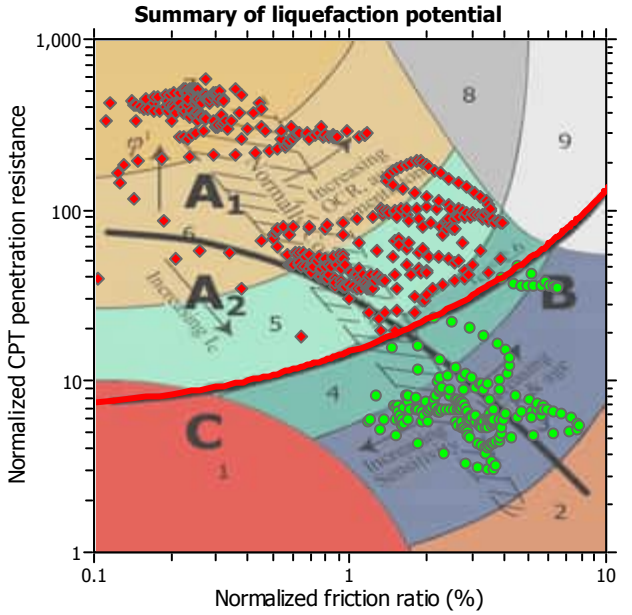
CPT file : CPT_48

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

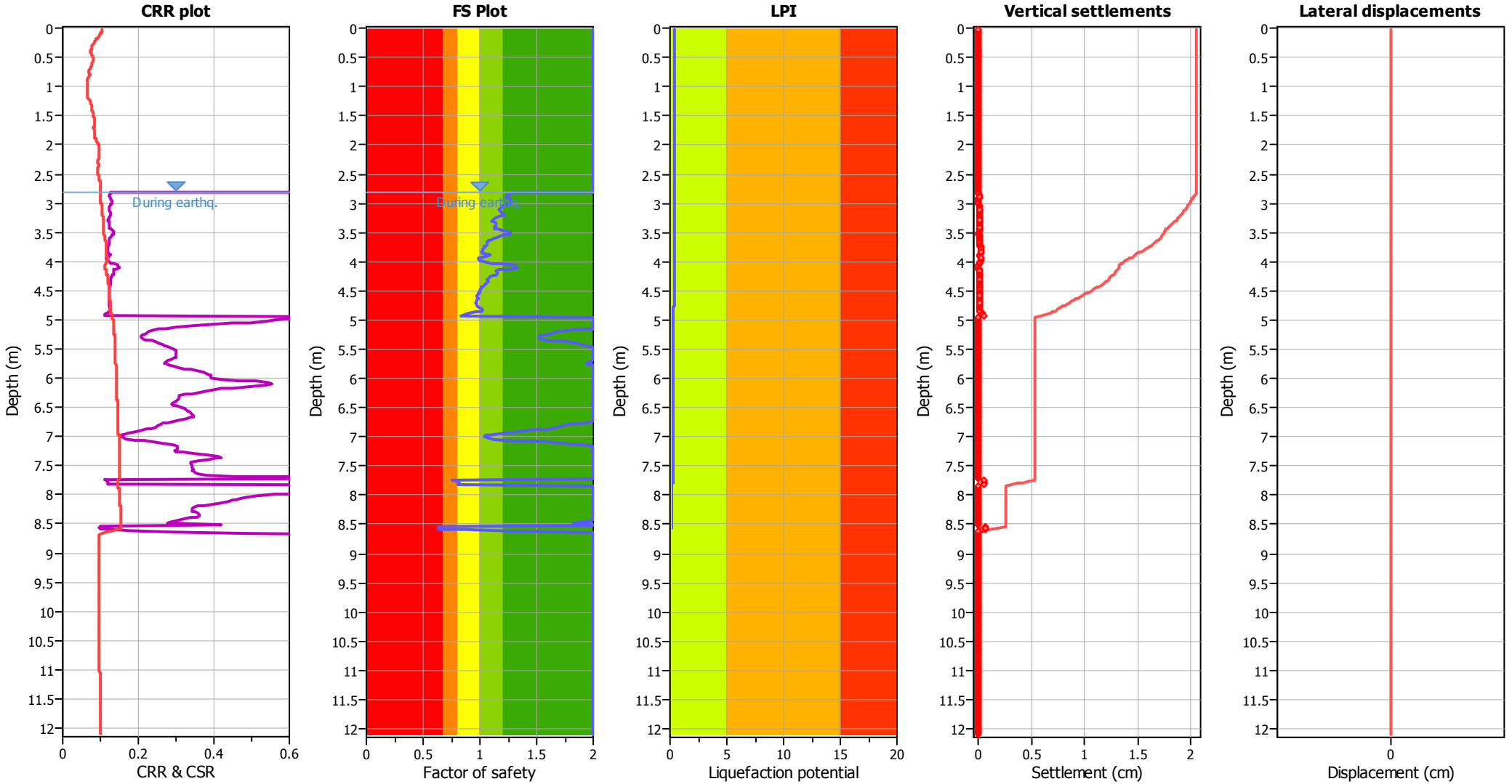






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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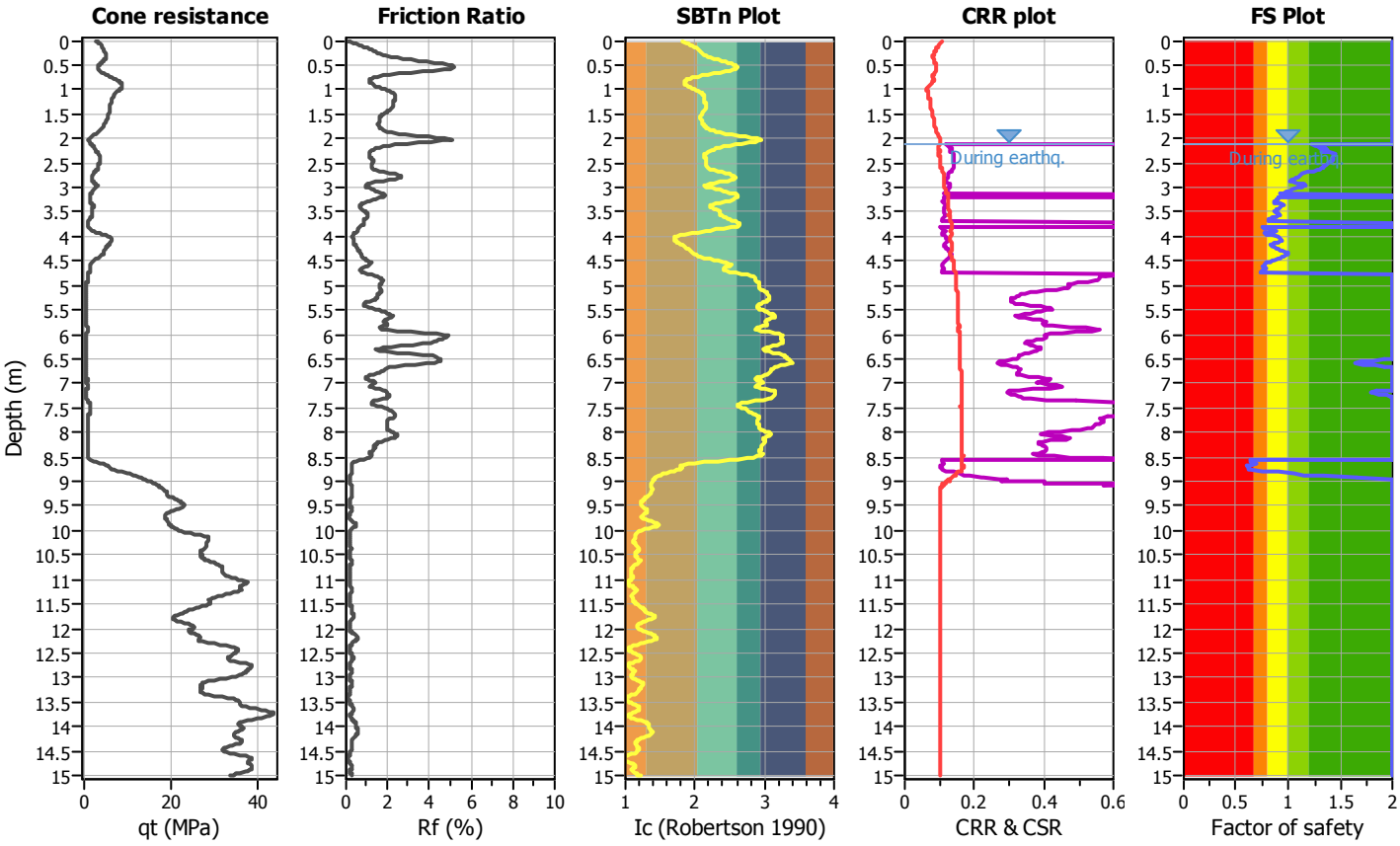
LIQUEFACTION ANALYSIS REPORT

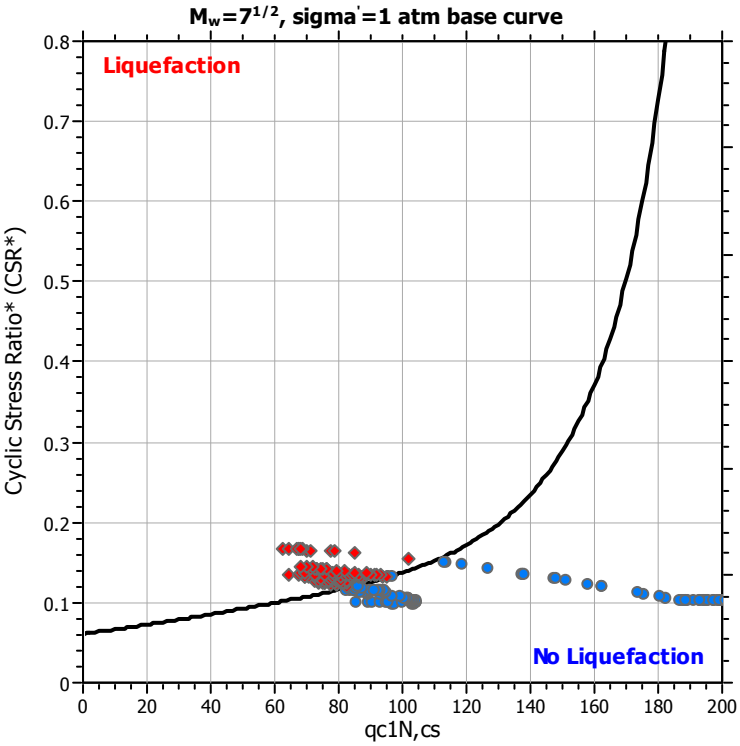
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

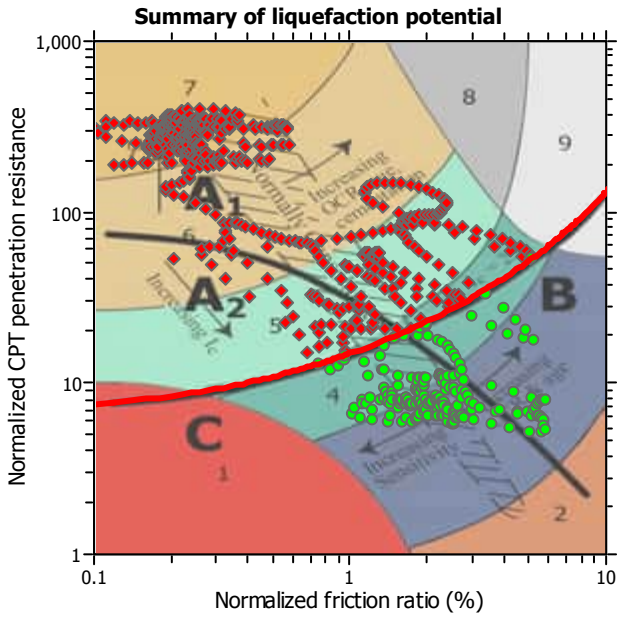
CPT file : CPT_49

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

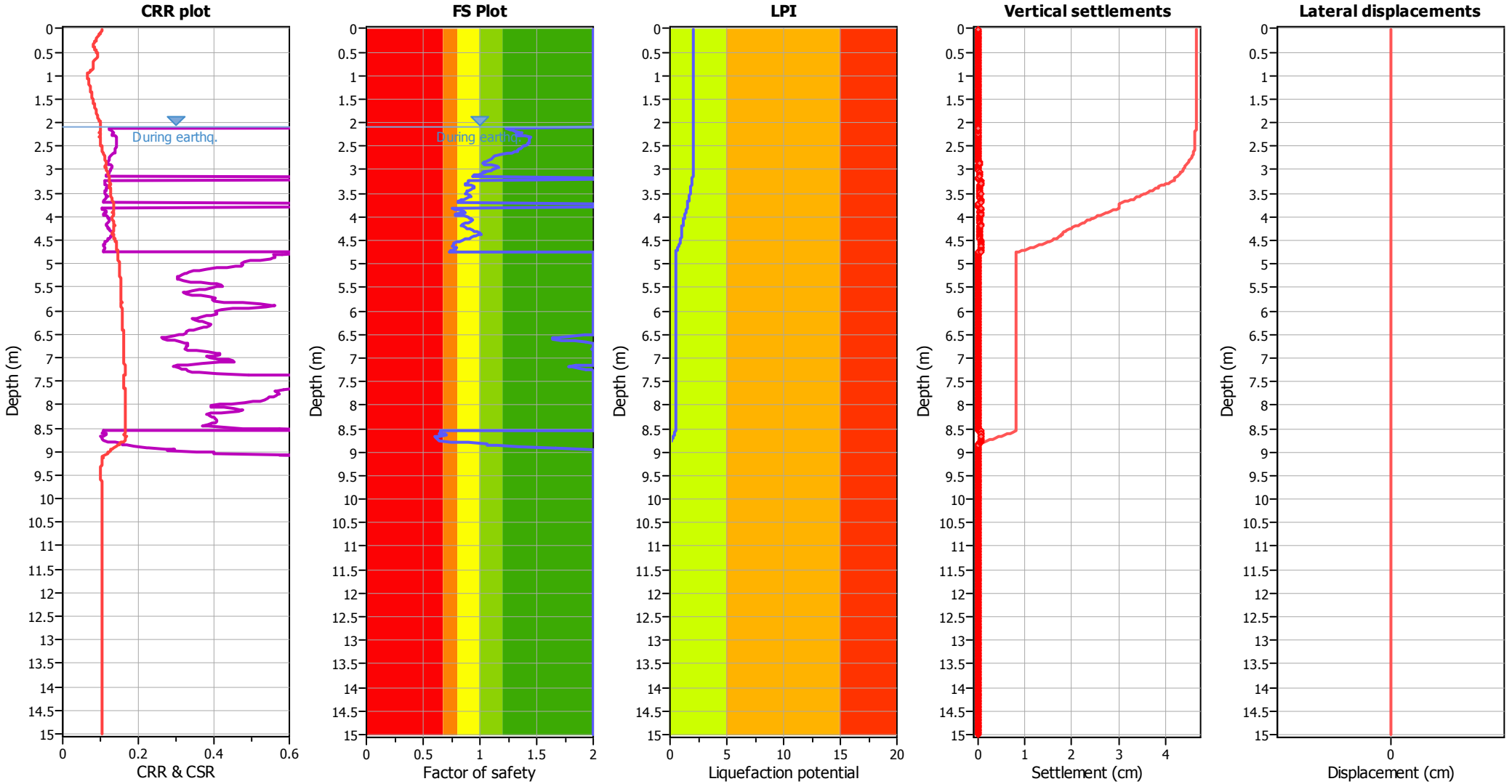






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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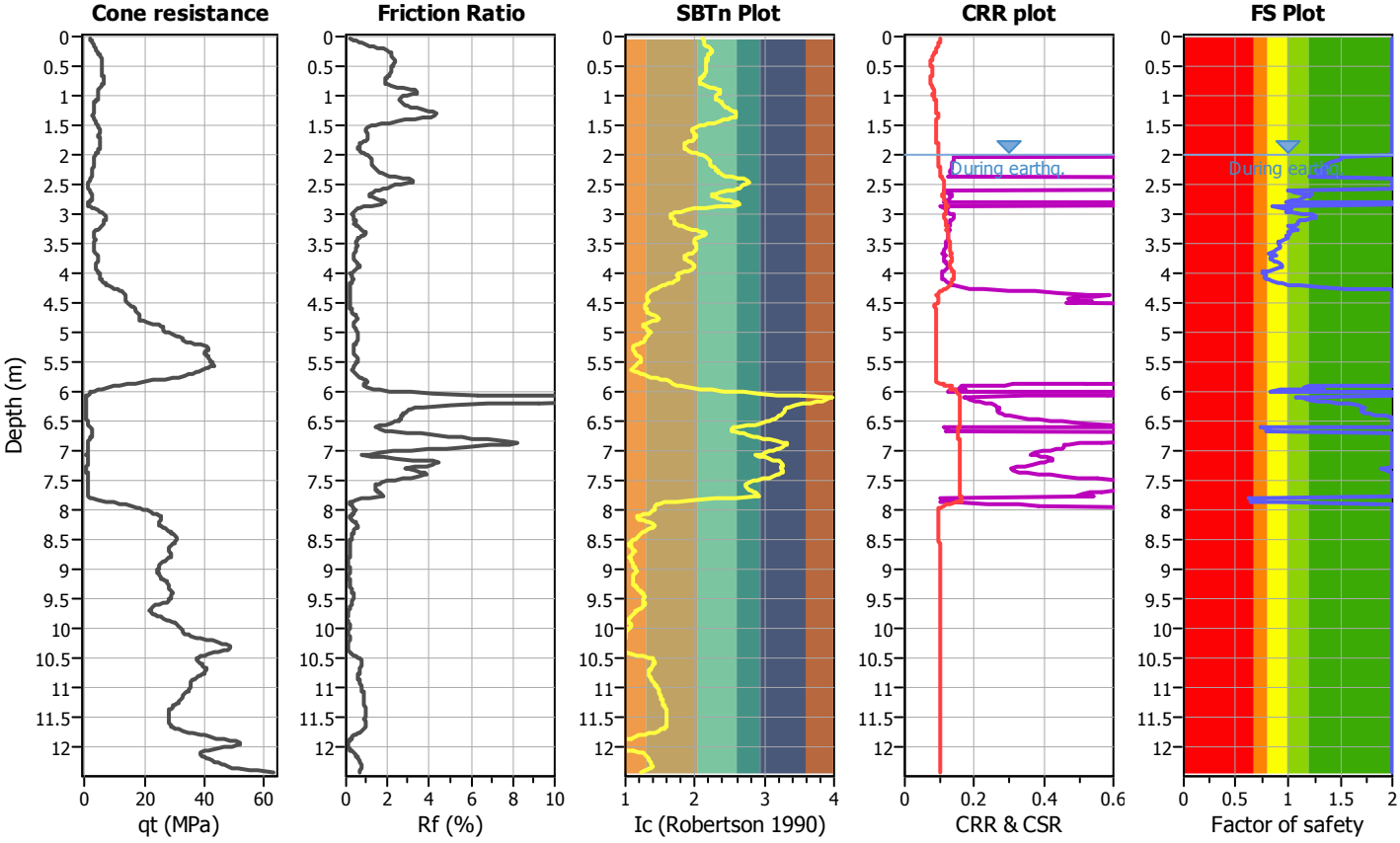
LIQUEFACTION ANALYSIS REPORT

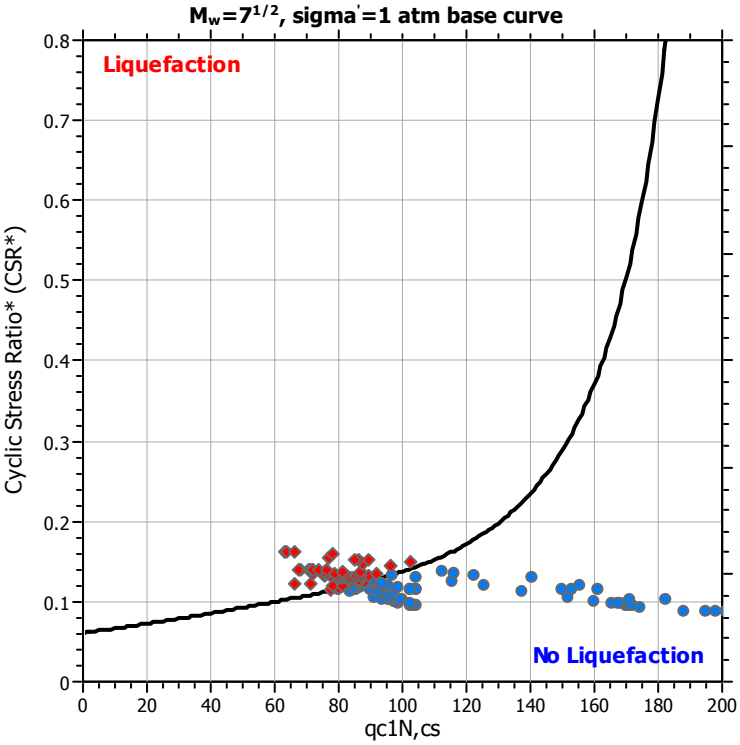
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

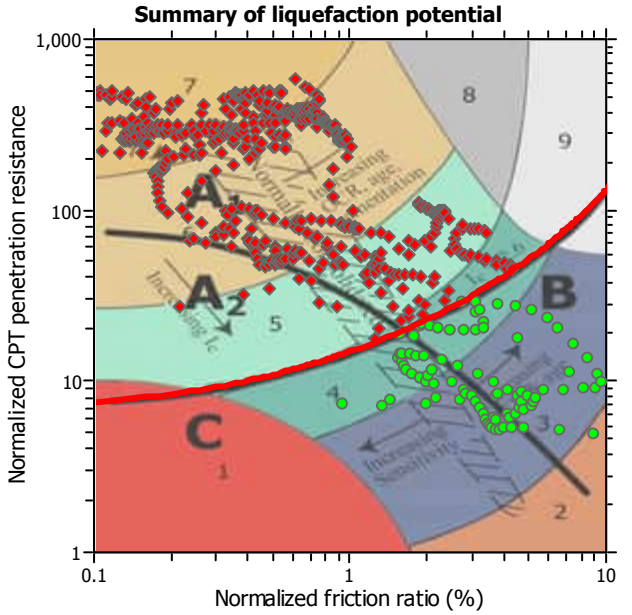
CPT file : CPT_50

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

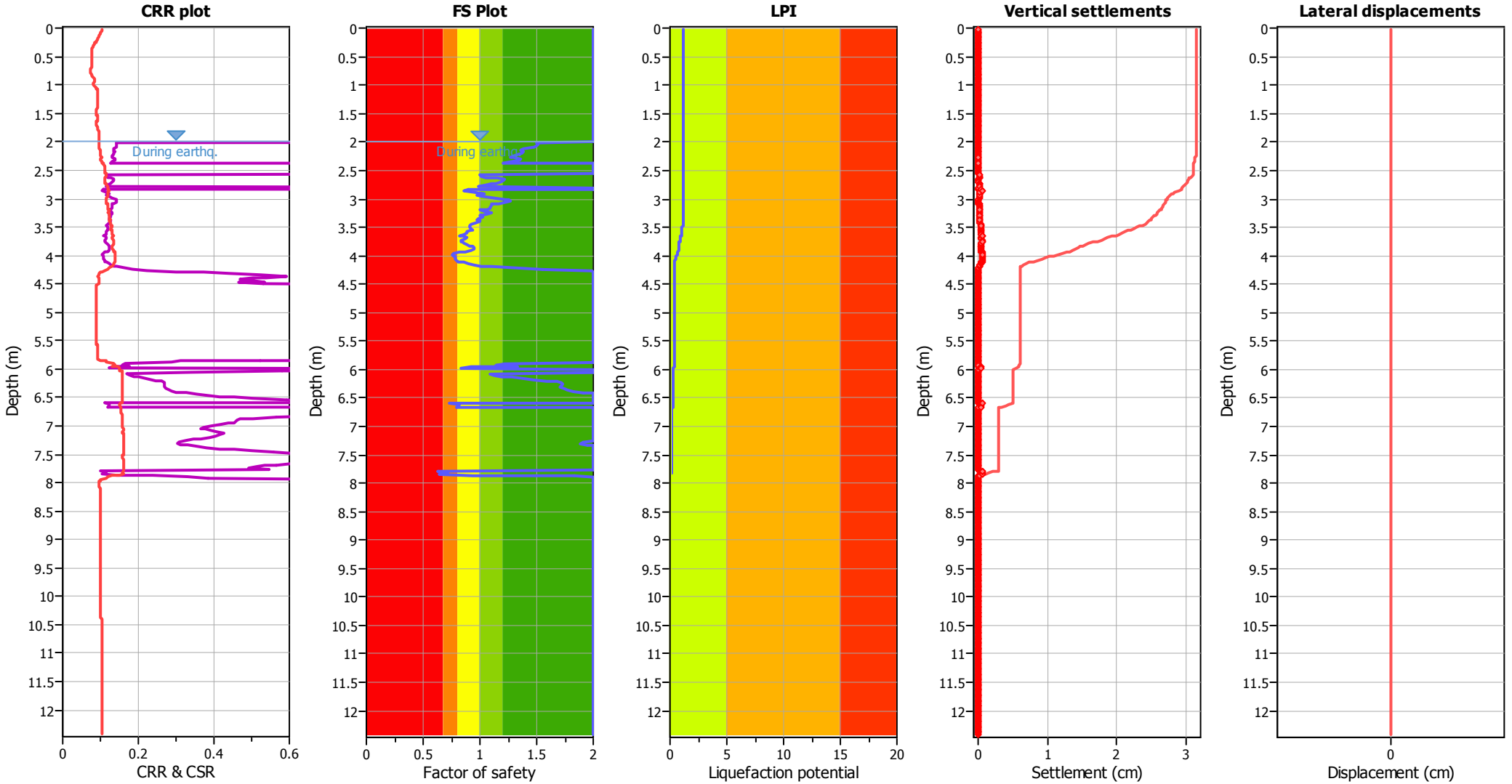






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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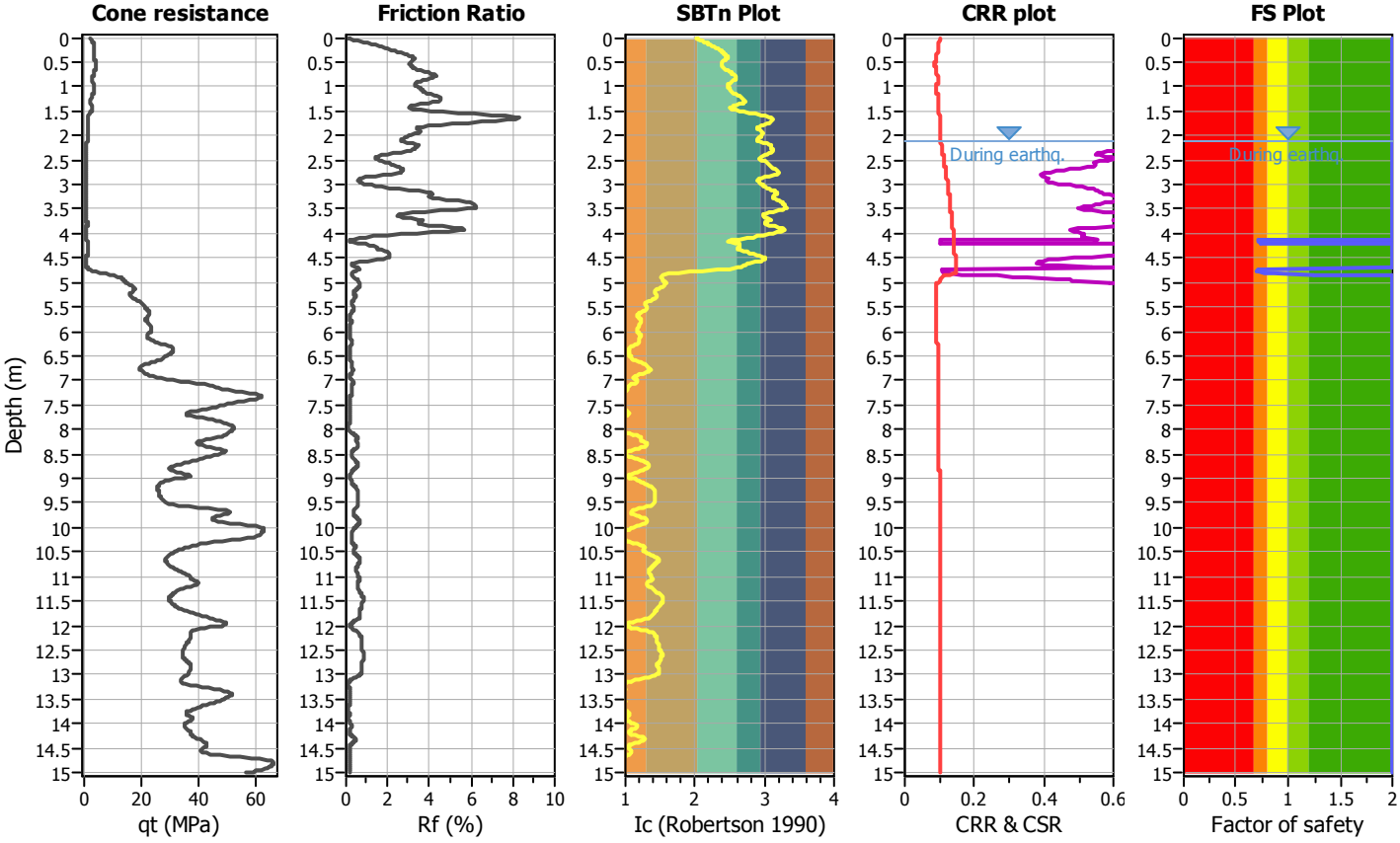
LIQUEFACTION ANALYSIS REPORT

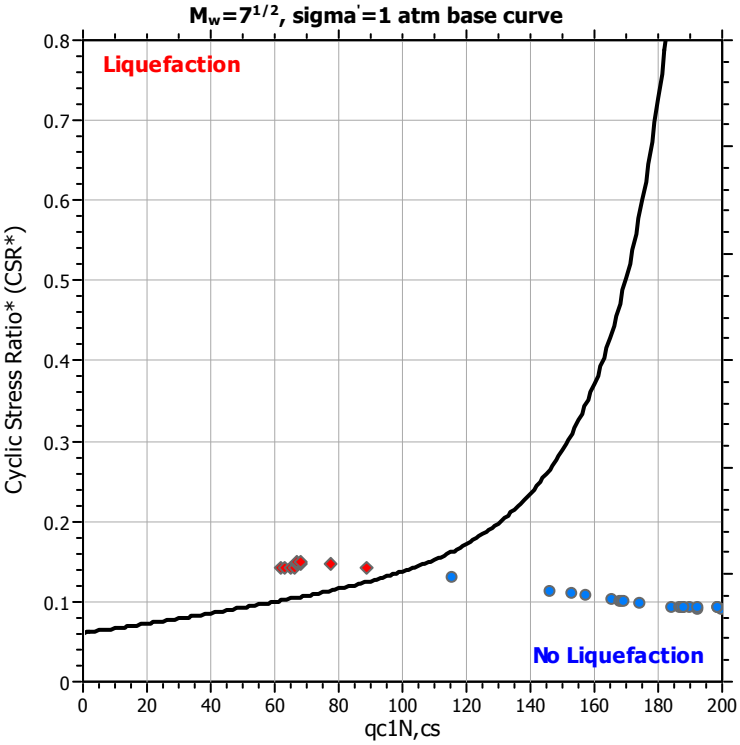
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

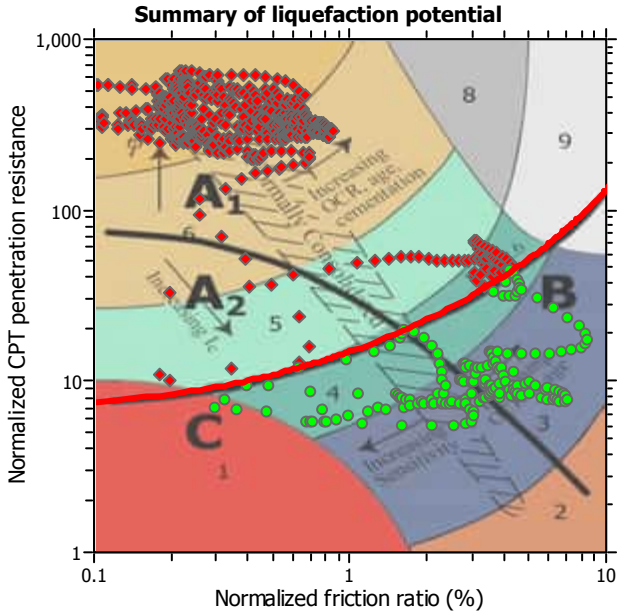
CPT file : CPT_51

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

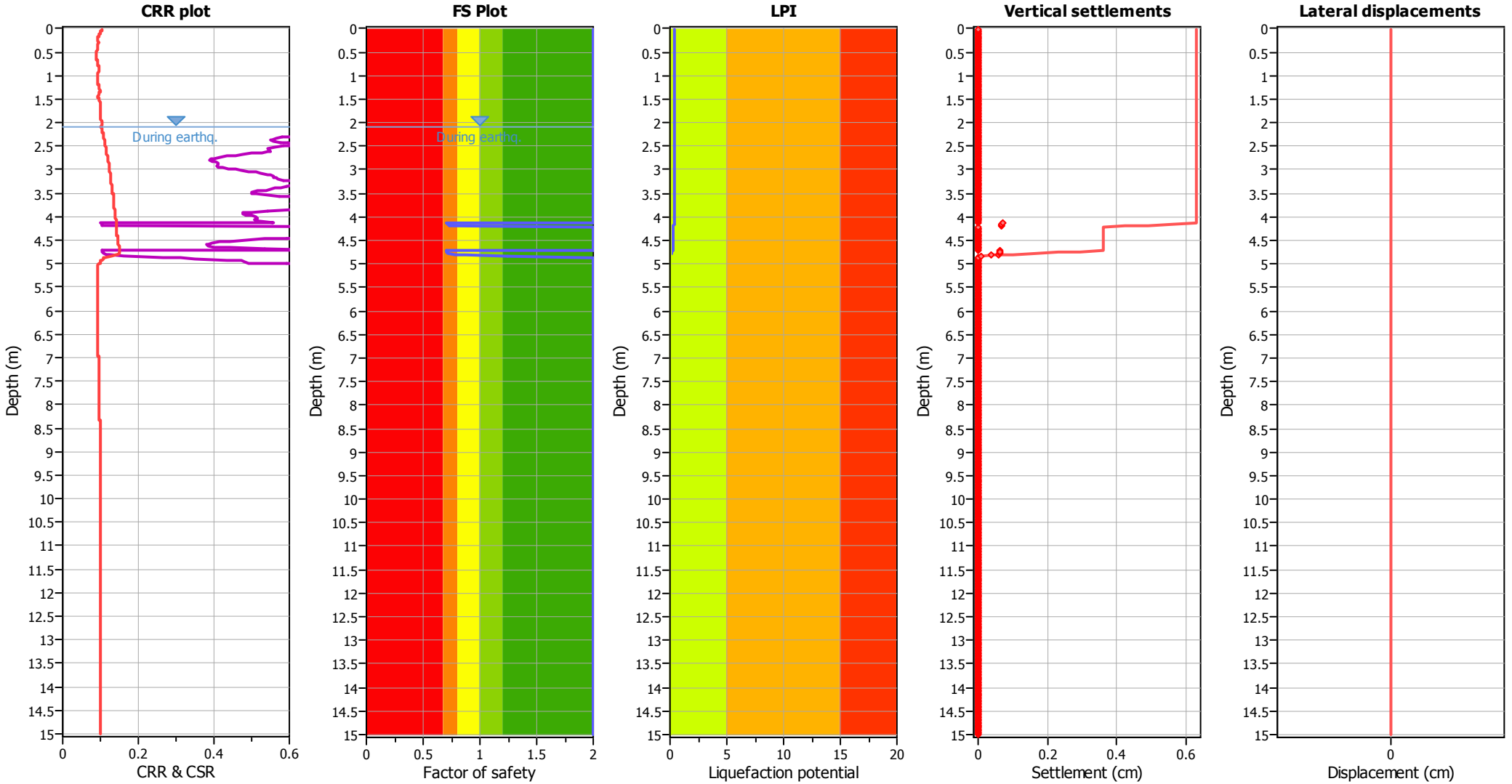






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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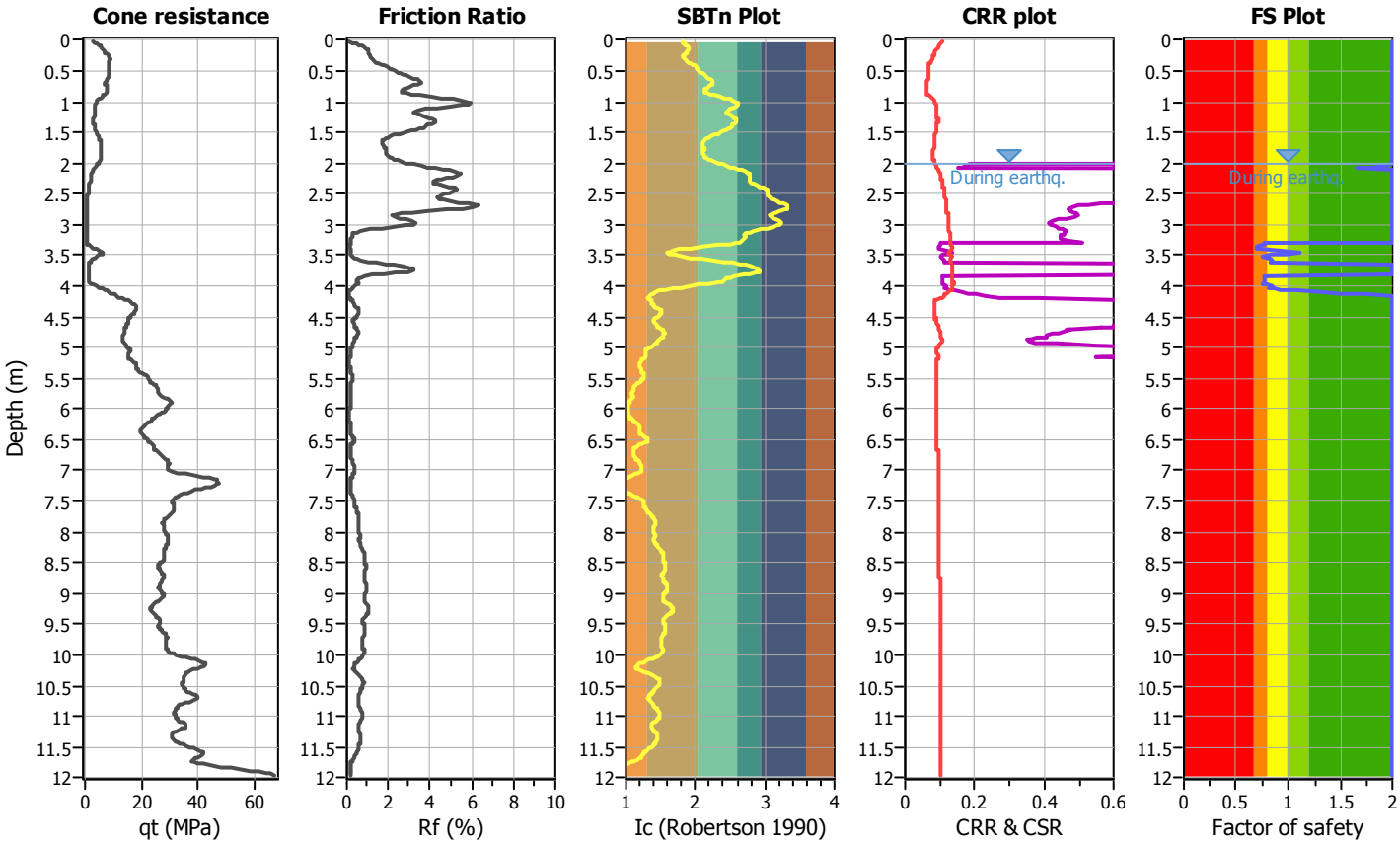
LIQUEFACTION ANALYSIS REPORT

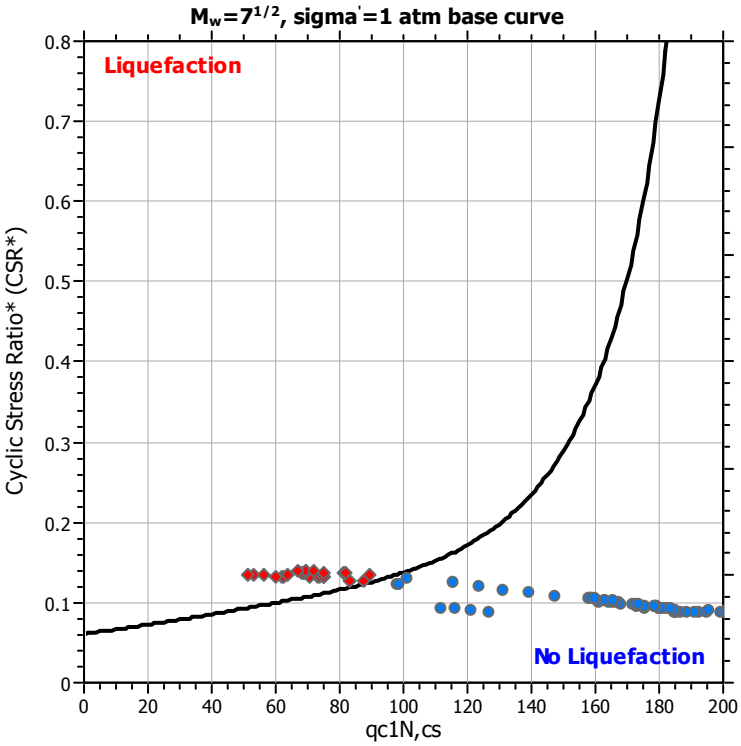
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

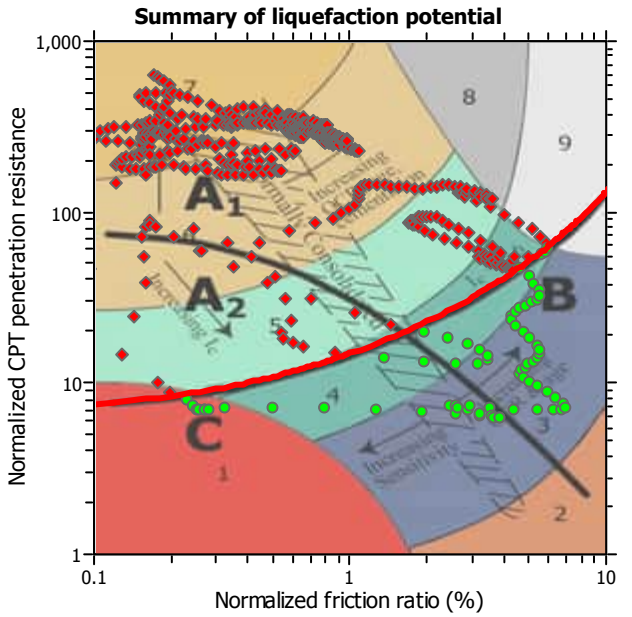
CPT file : CPT_52

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

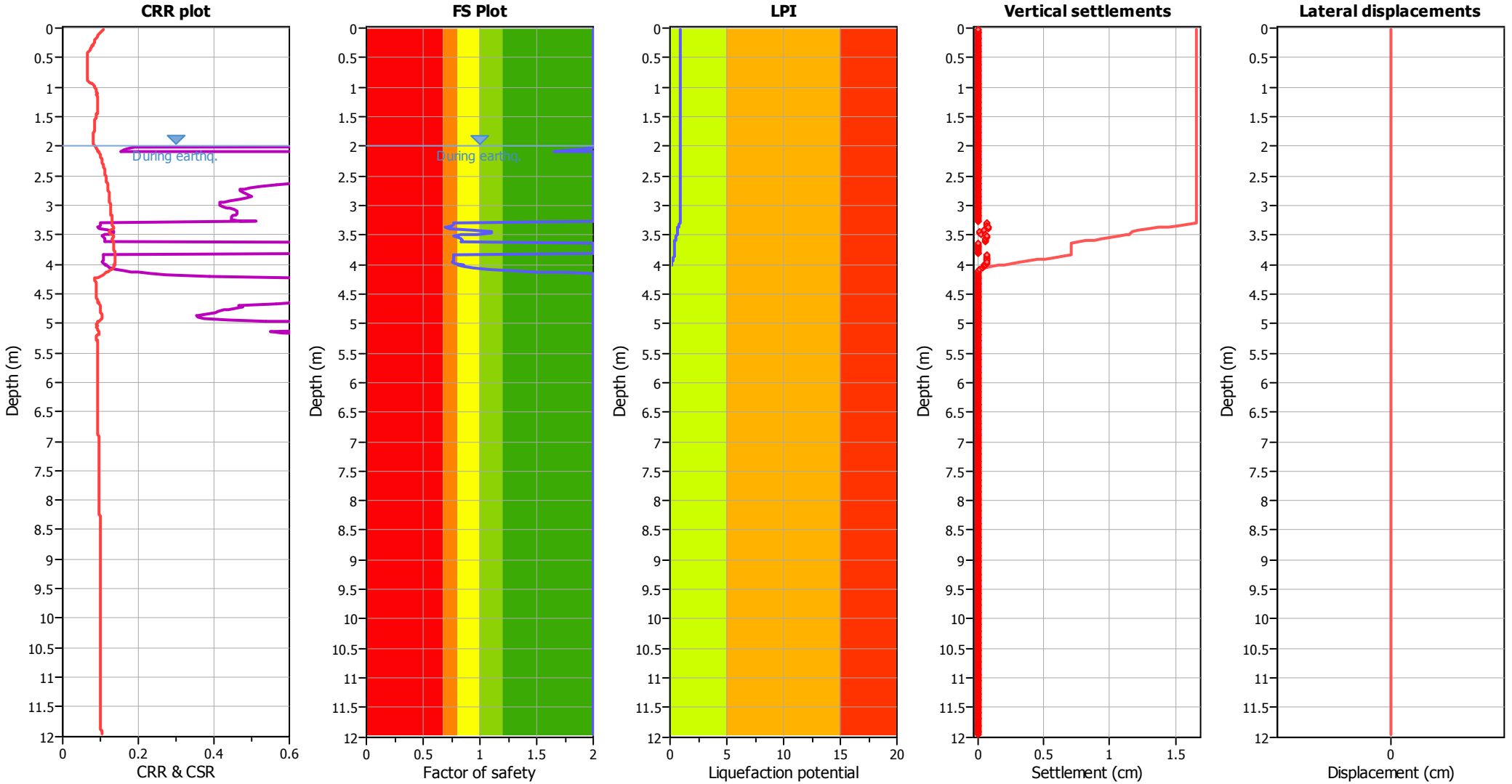






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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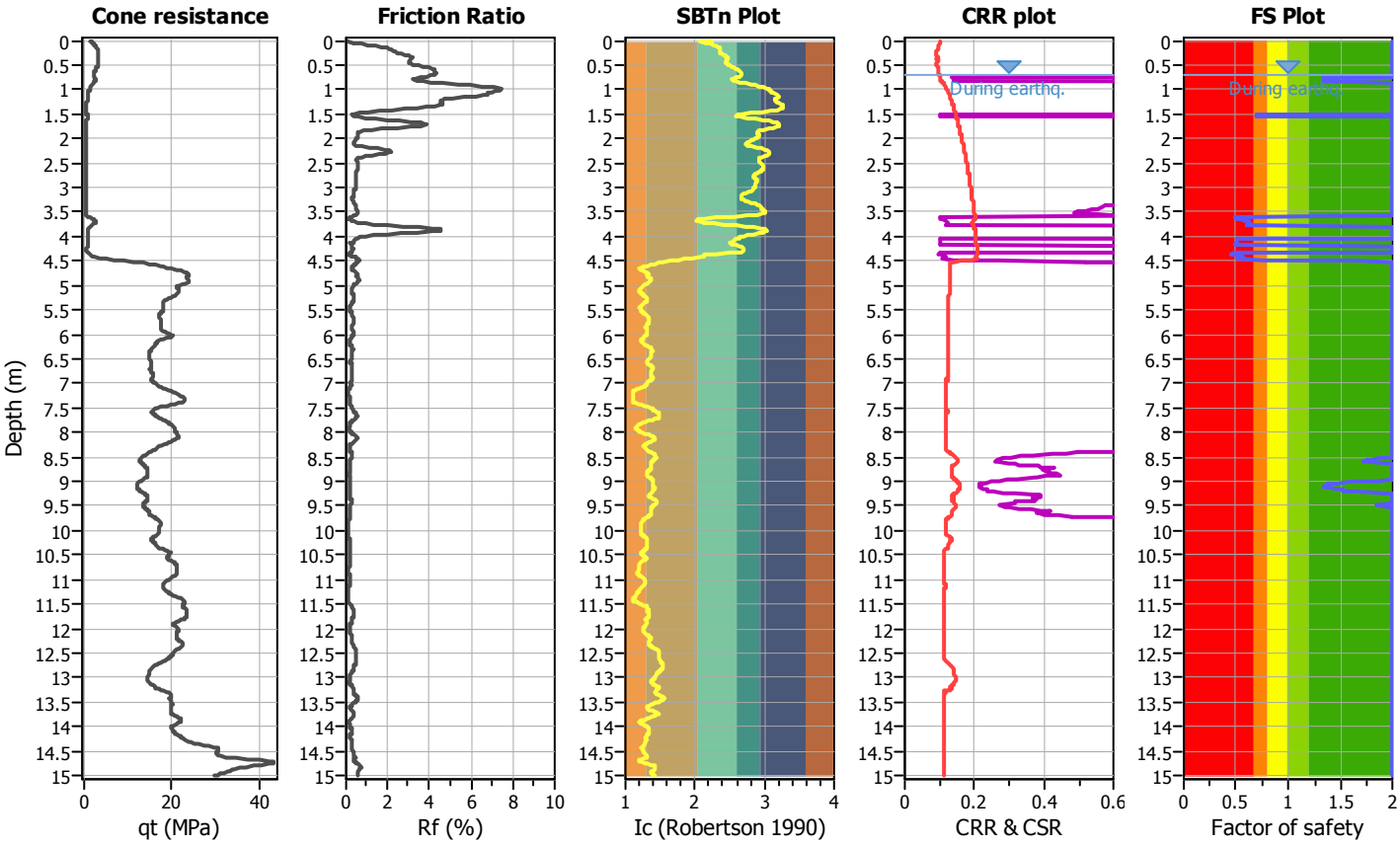
LIQUEFACTION ANALYSIS REPORT

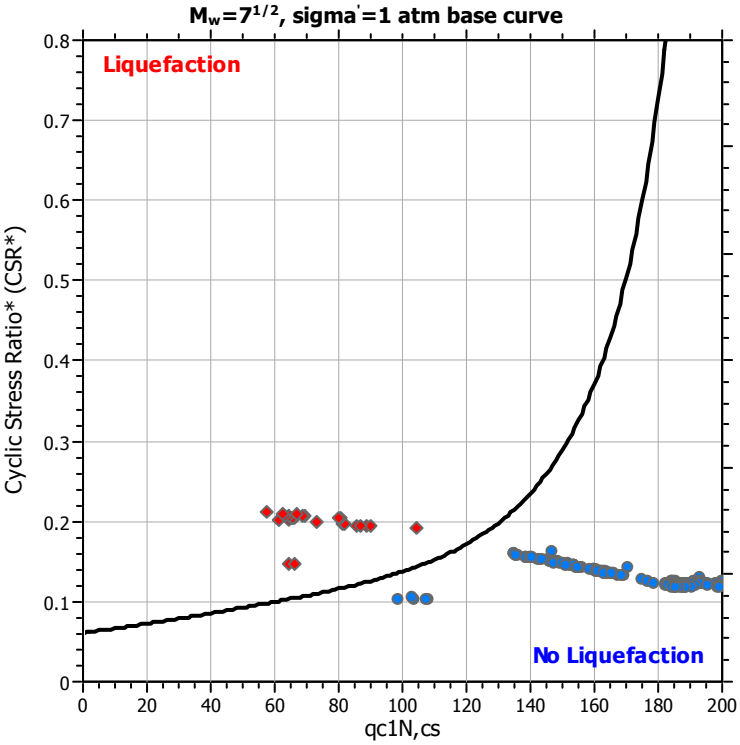
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

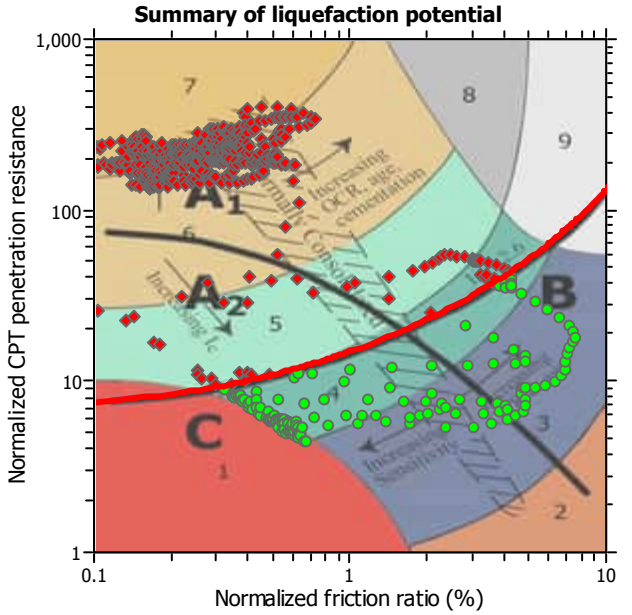
CPT file : CPT_53

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

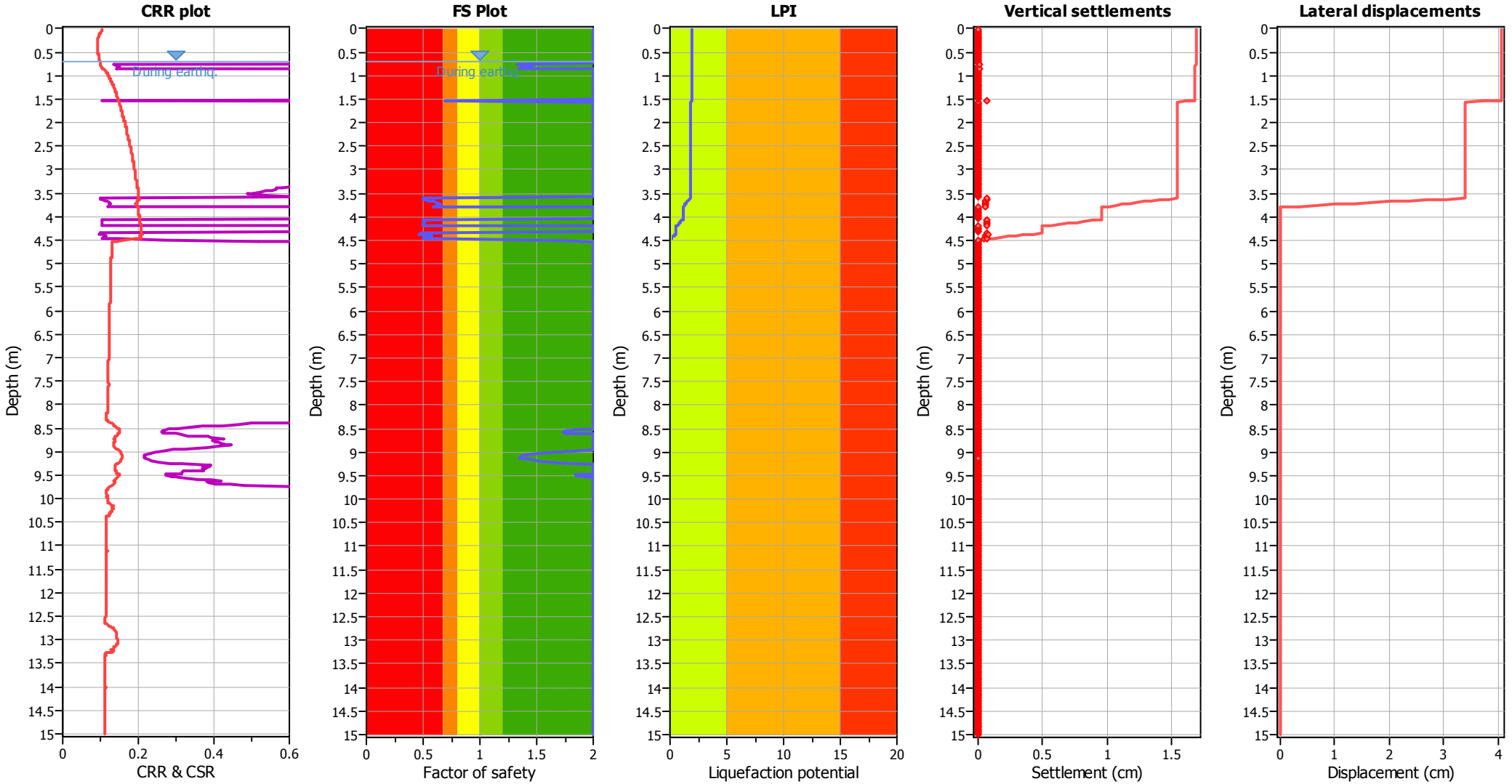






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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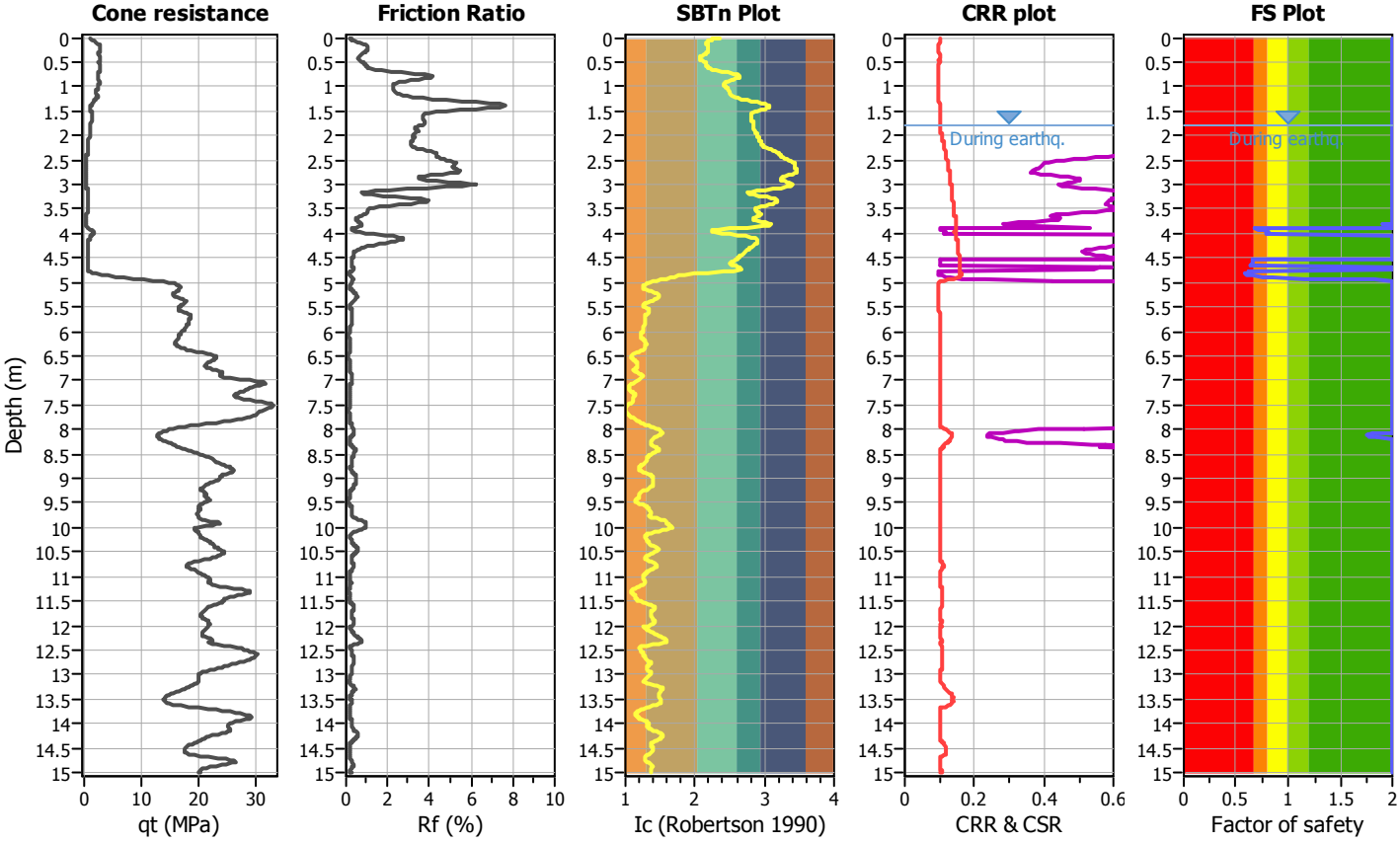
LIQUEFACTION ANALYSIS REPORT

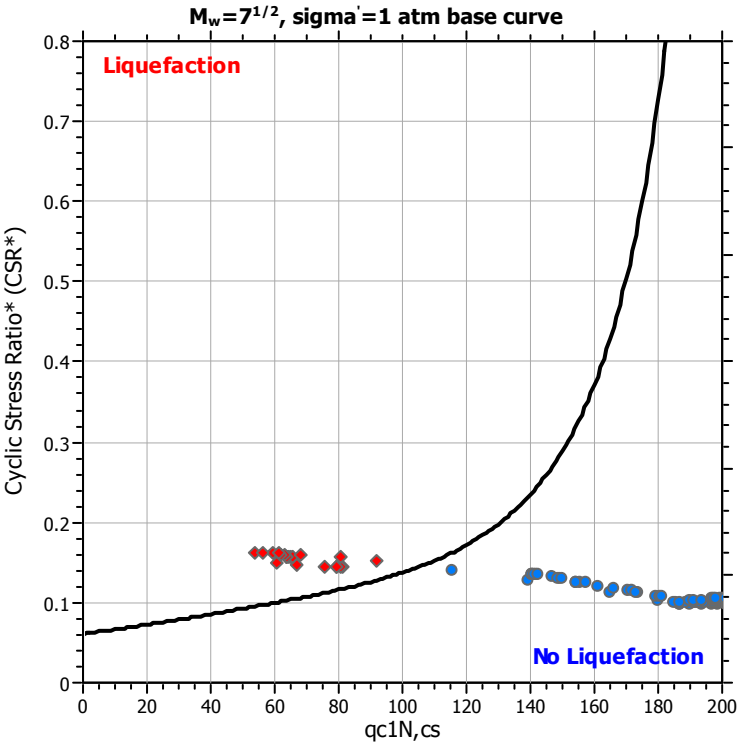
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

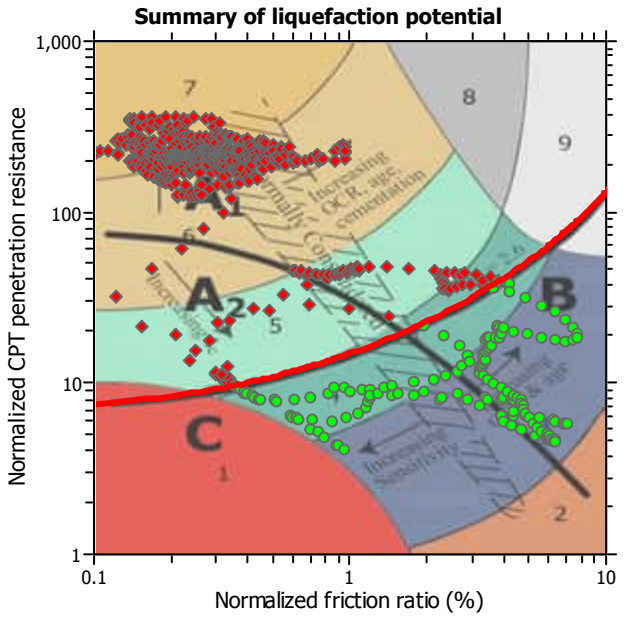
CPT file : CPT_54

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

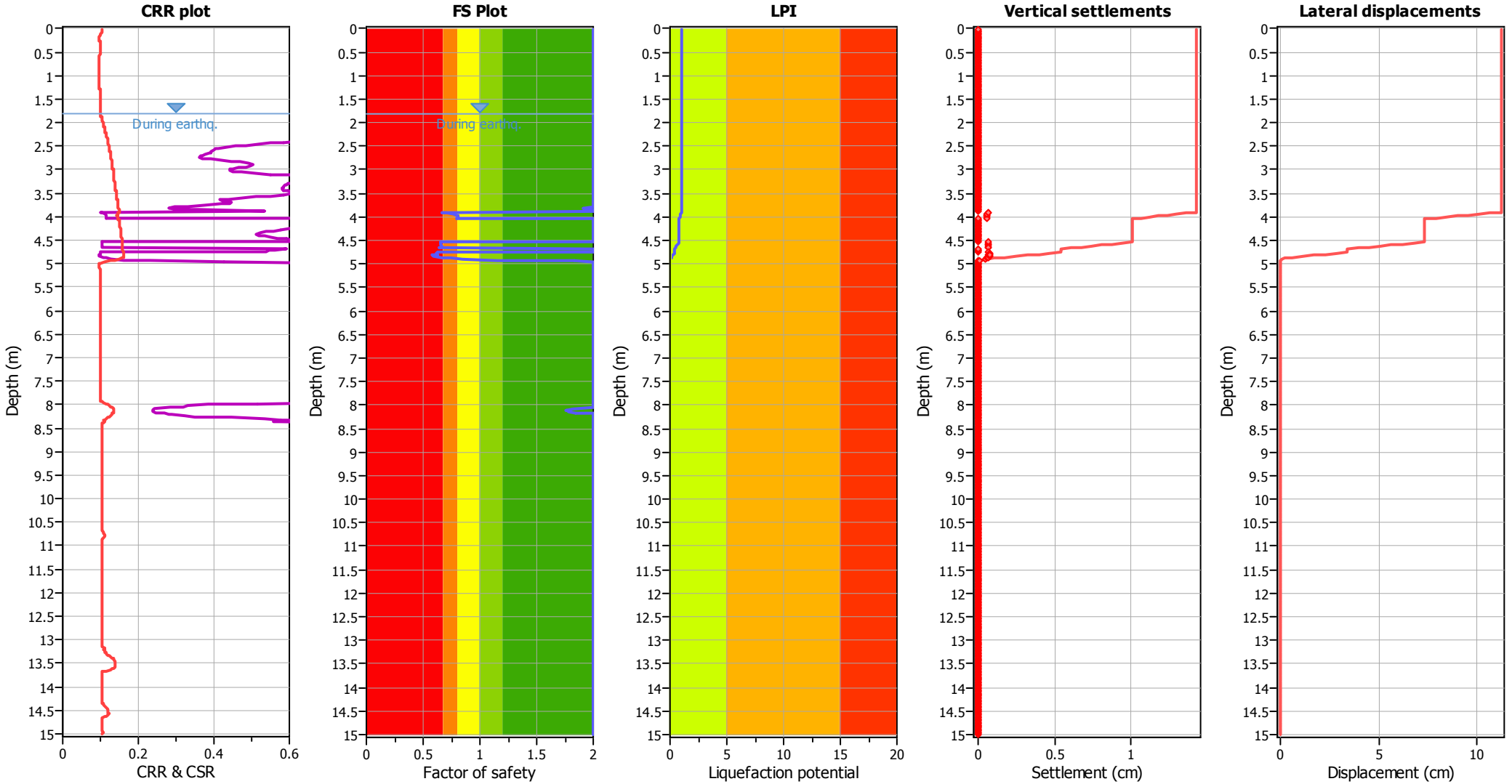






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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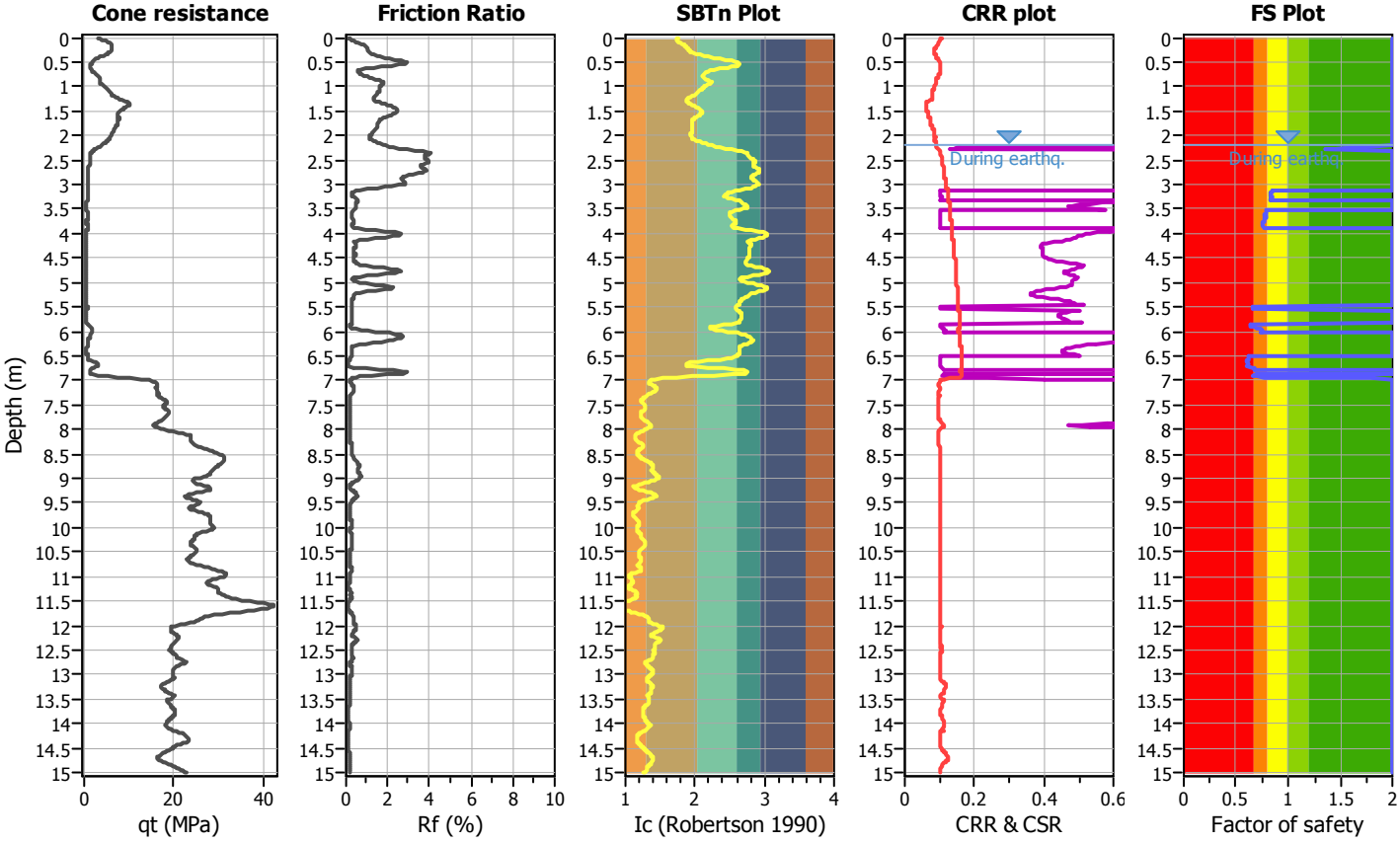
LIQUEFACTION ANALYSIS REPORT

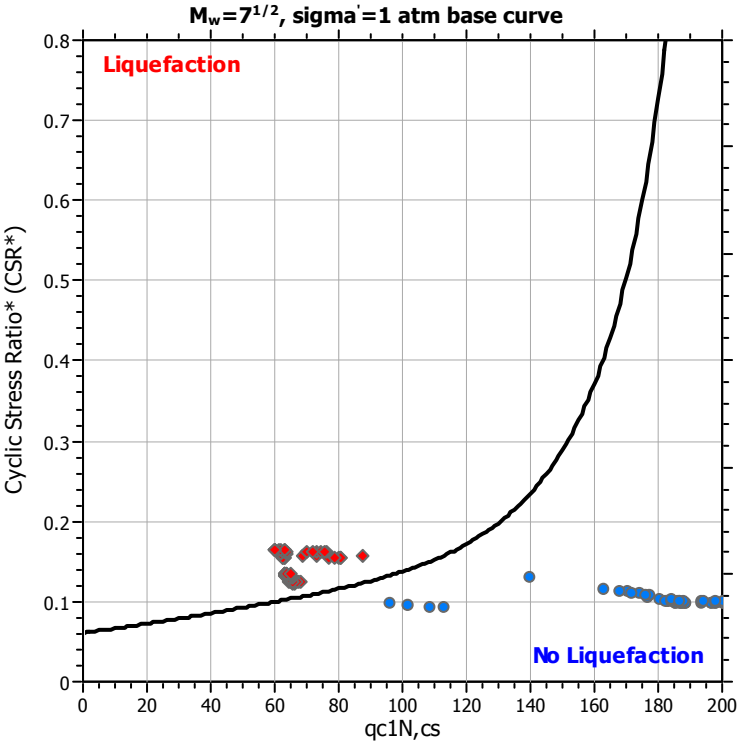
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

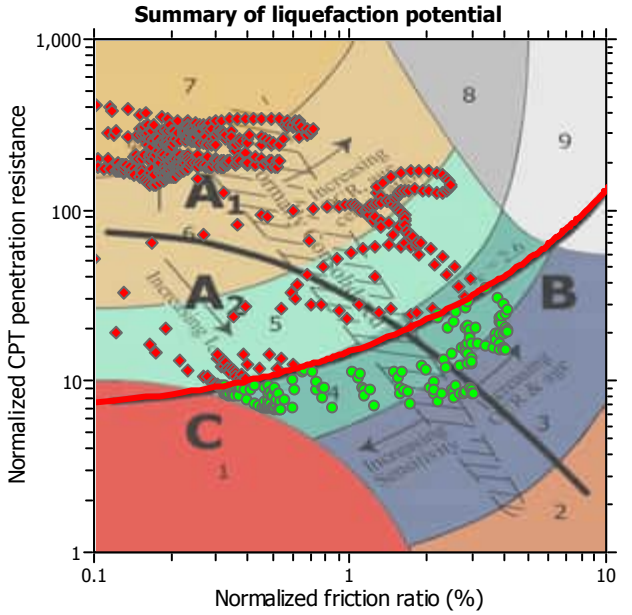
CPT file : CPT_55

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

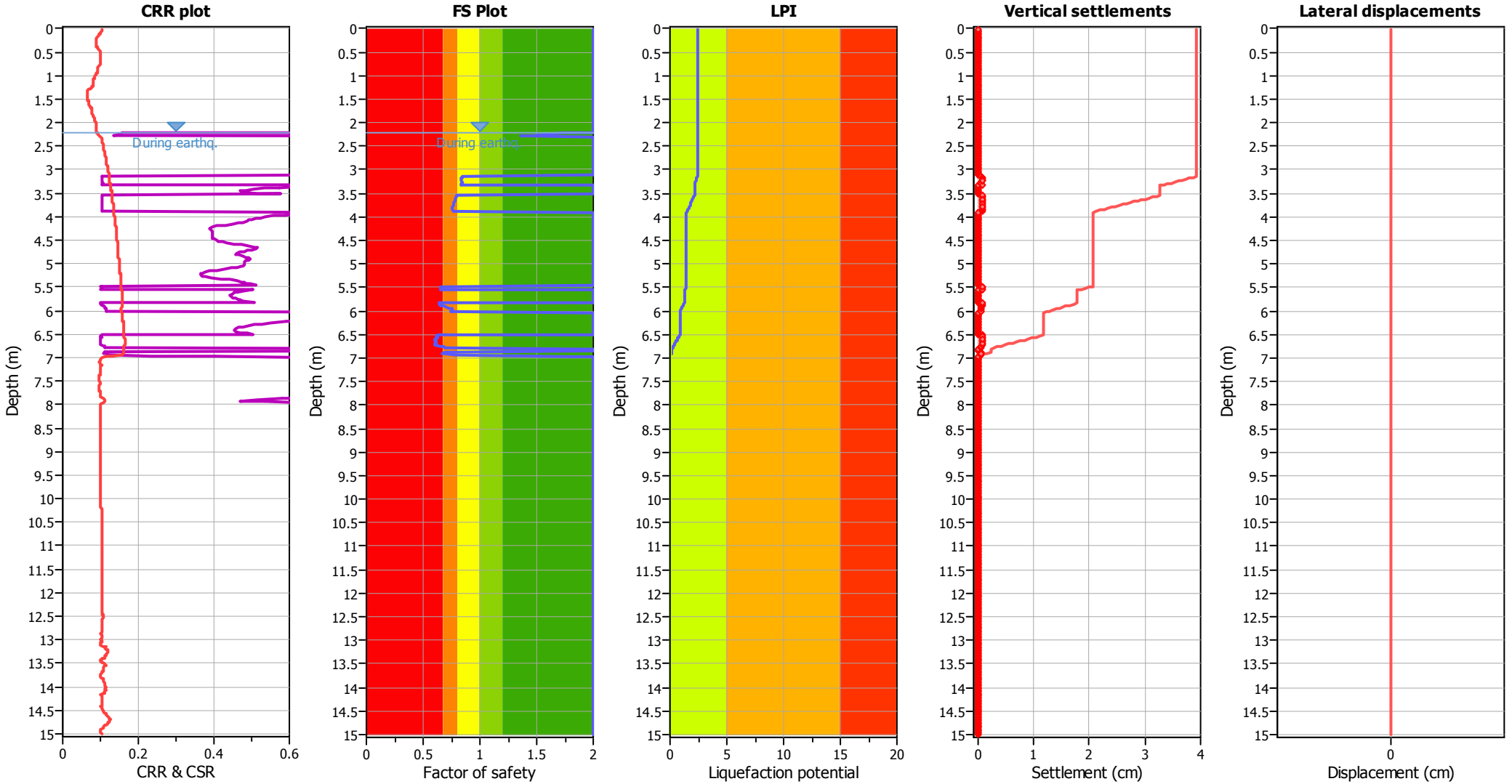






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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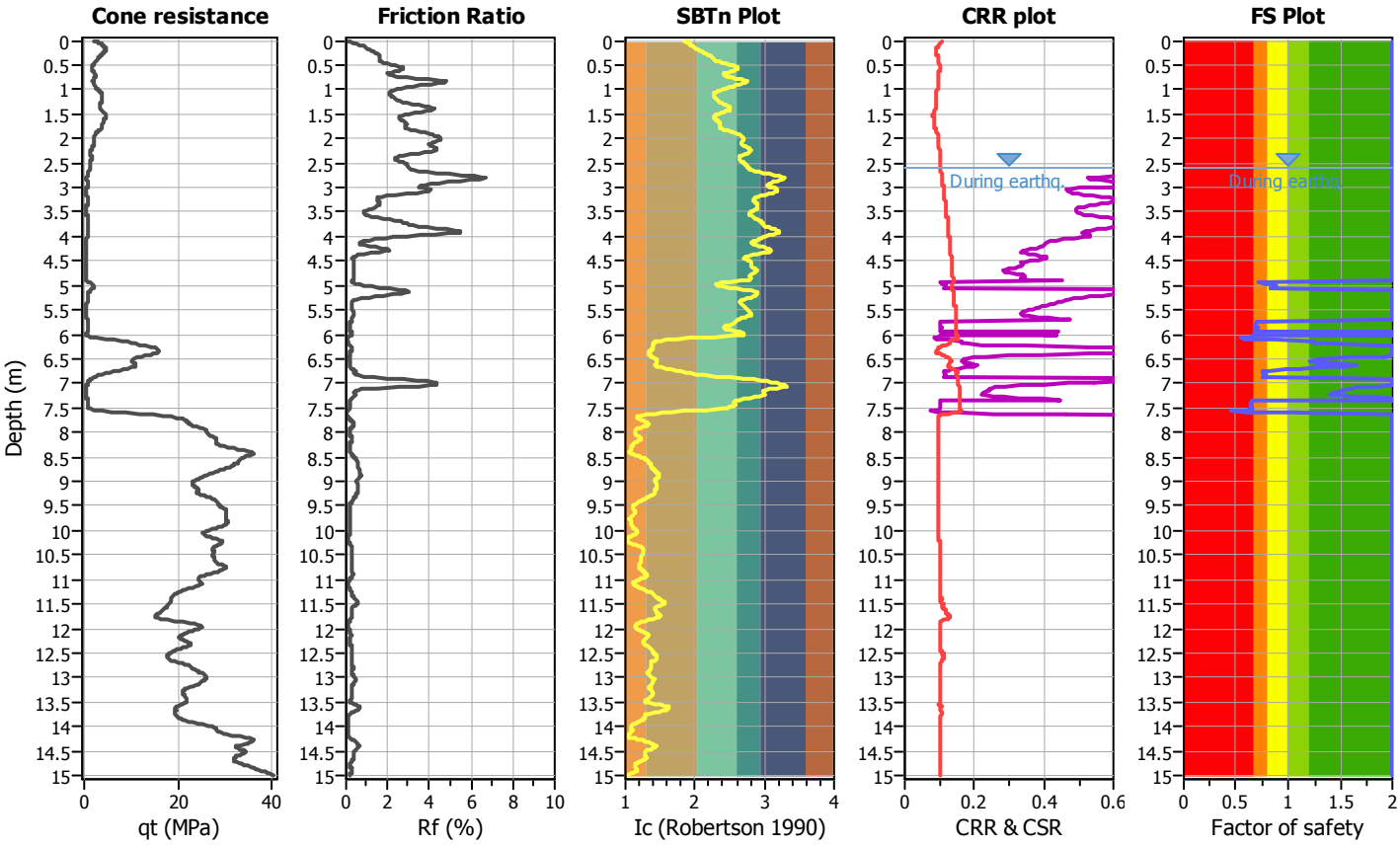
LIQUEFACTION ANALYSIS REPORT

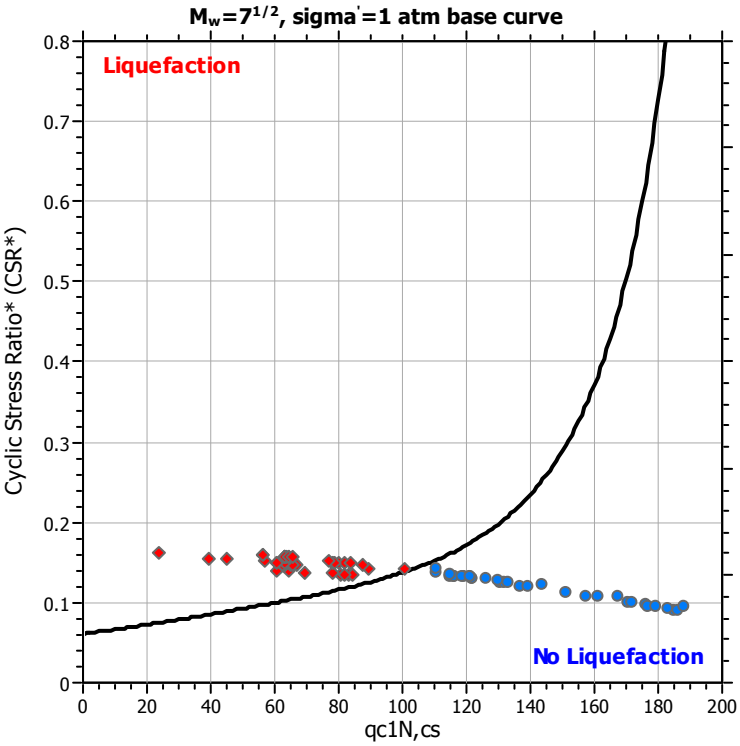
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

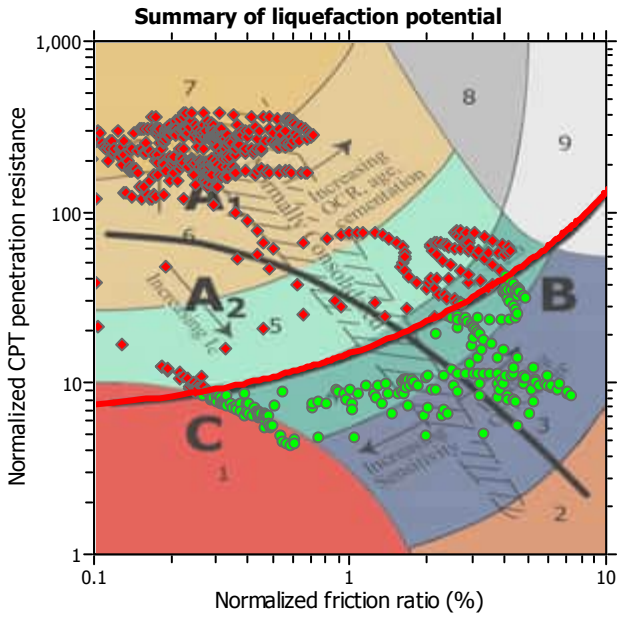
CPT file : CPT_56

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

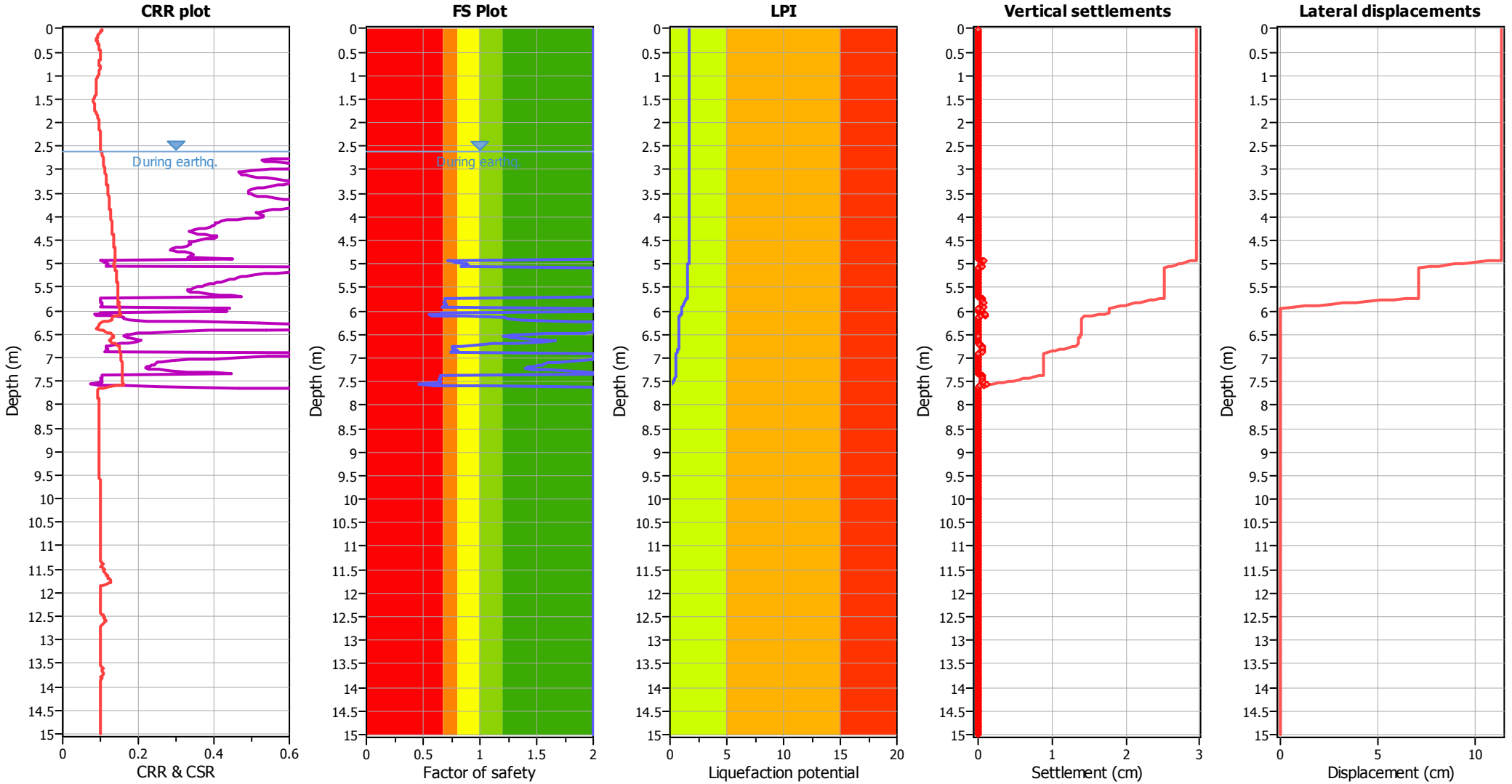






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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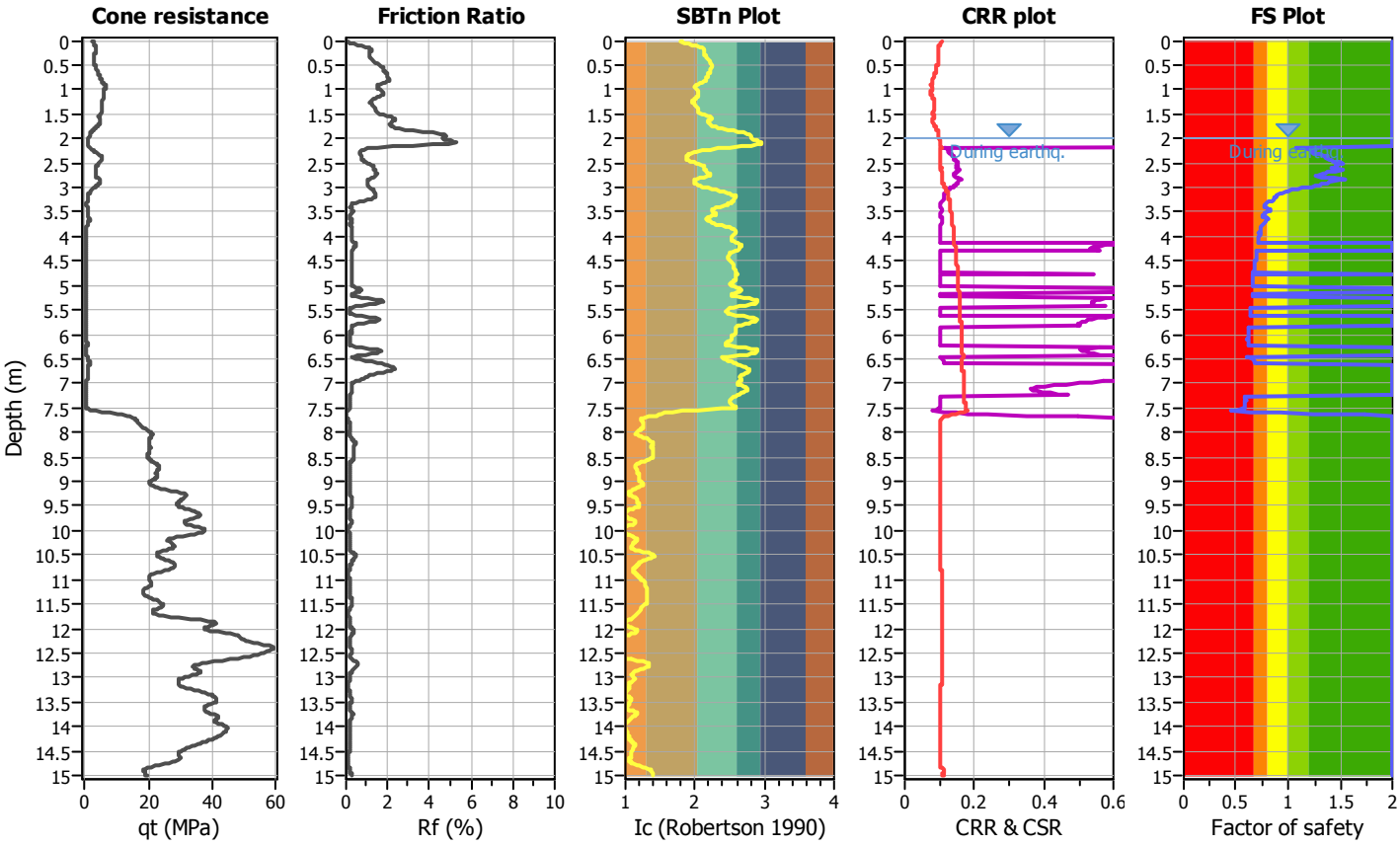
LIQUEFACTION ANALYSIS REPORT

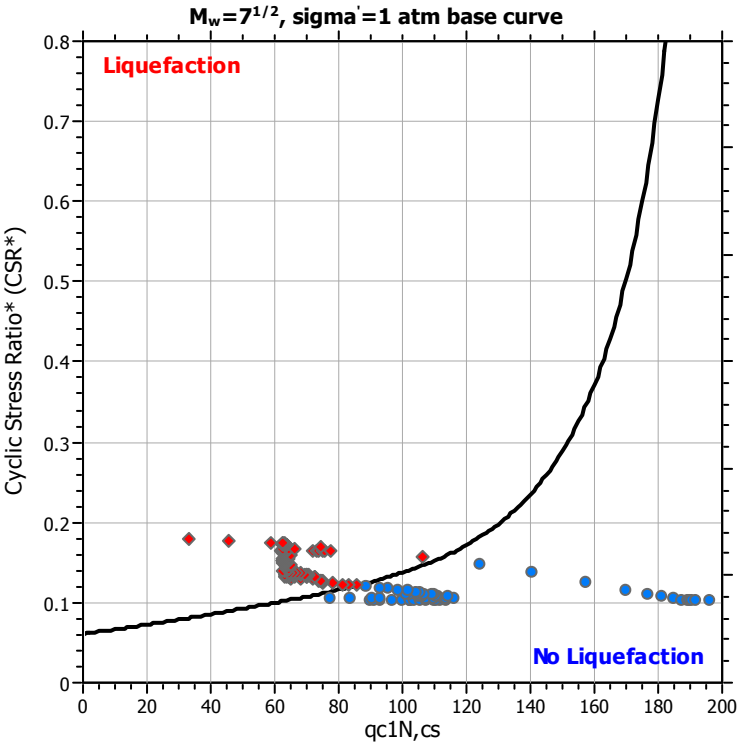
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

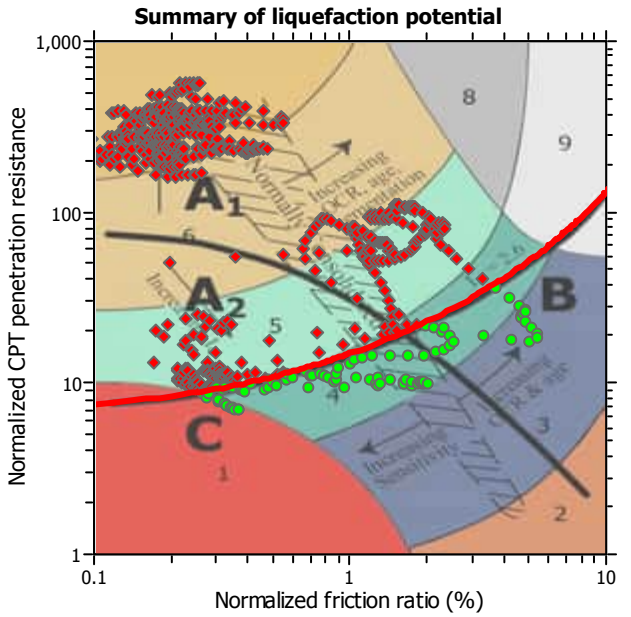
CPT file : CPT_57

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

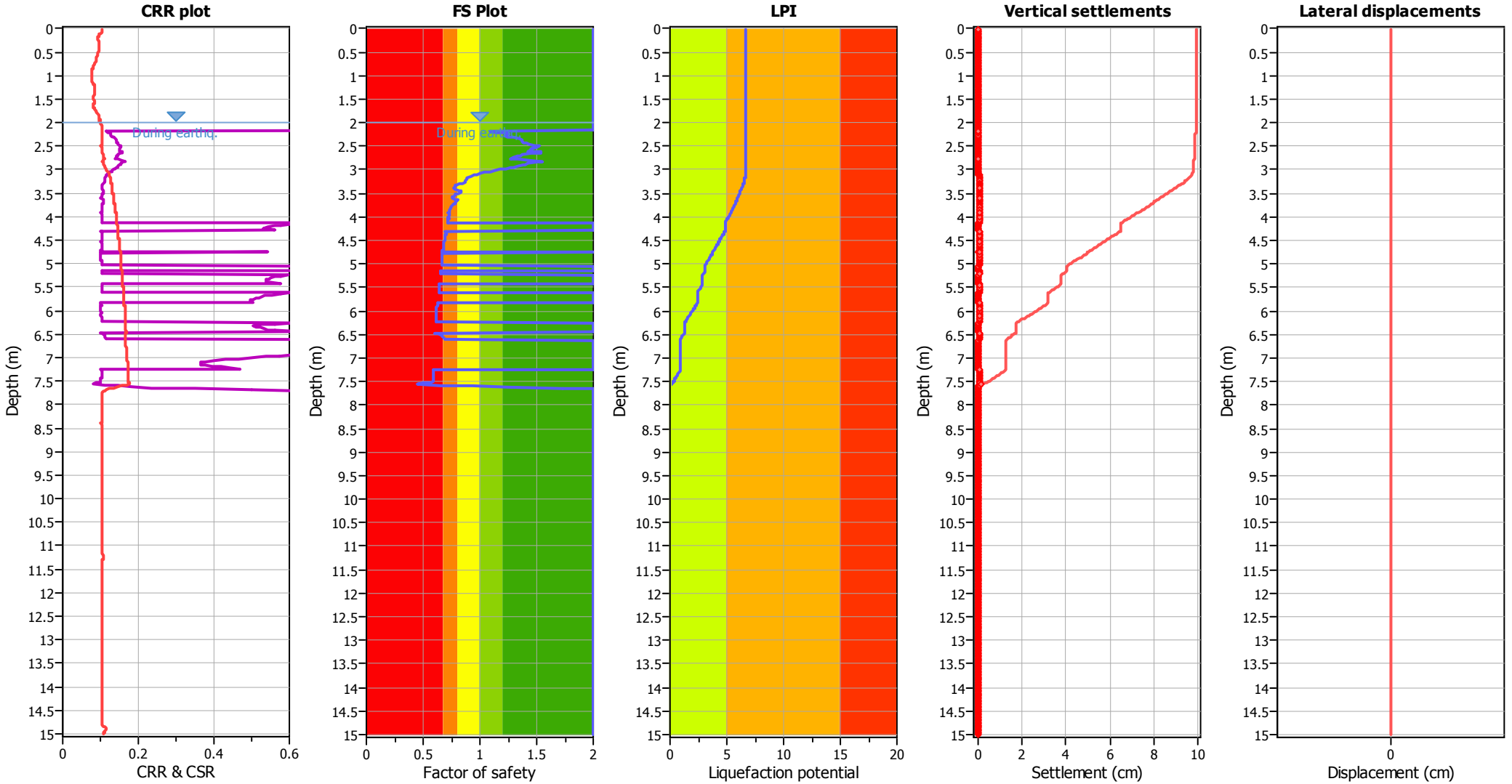






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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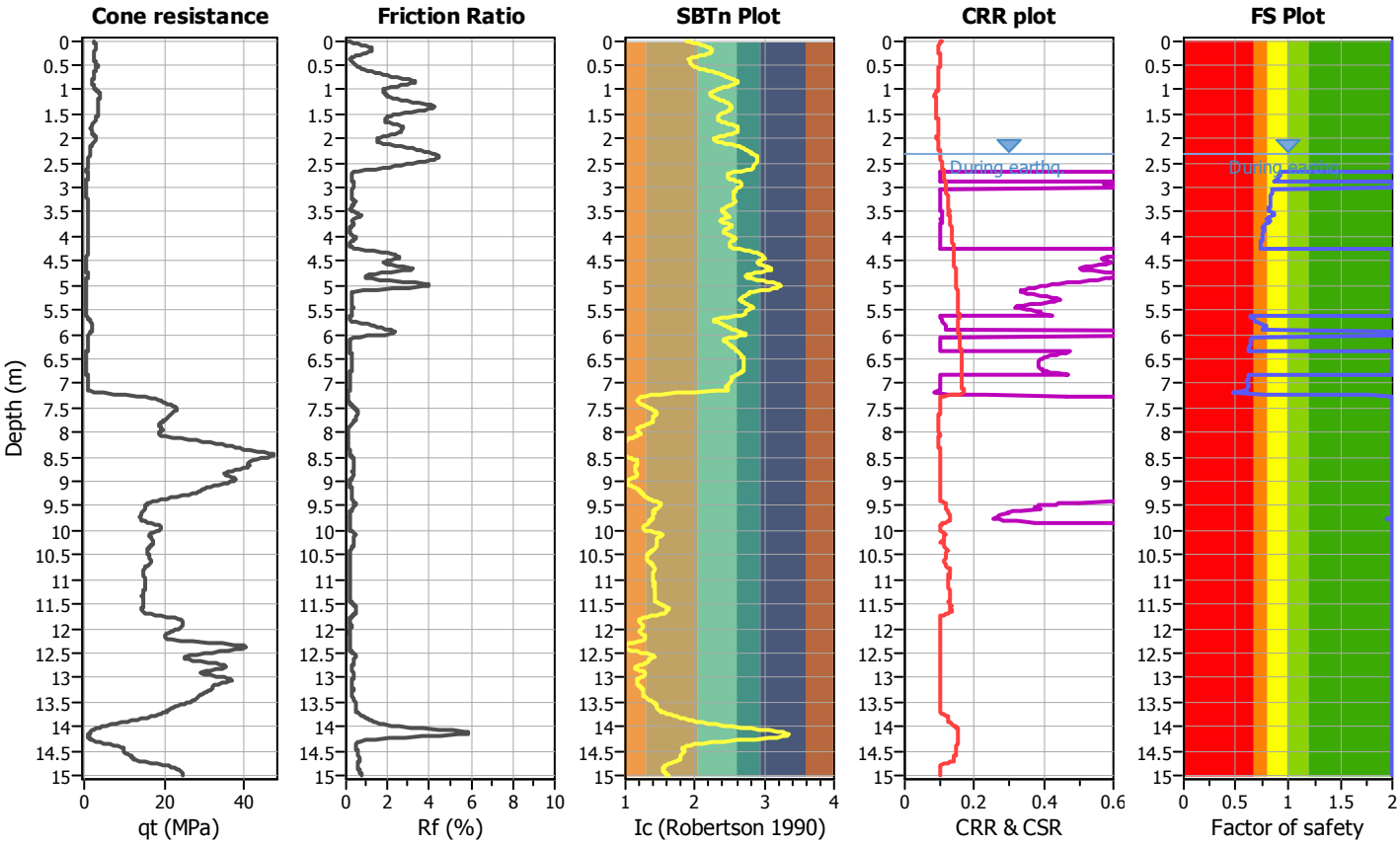
LIQUEFACTION ANALYSIS REPORT

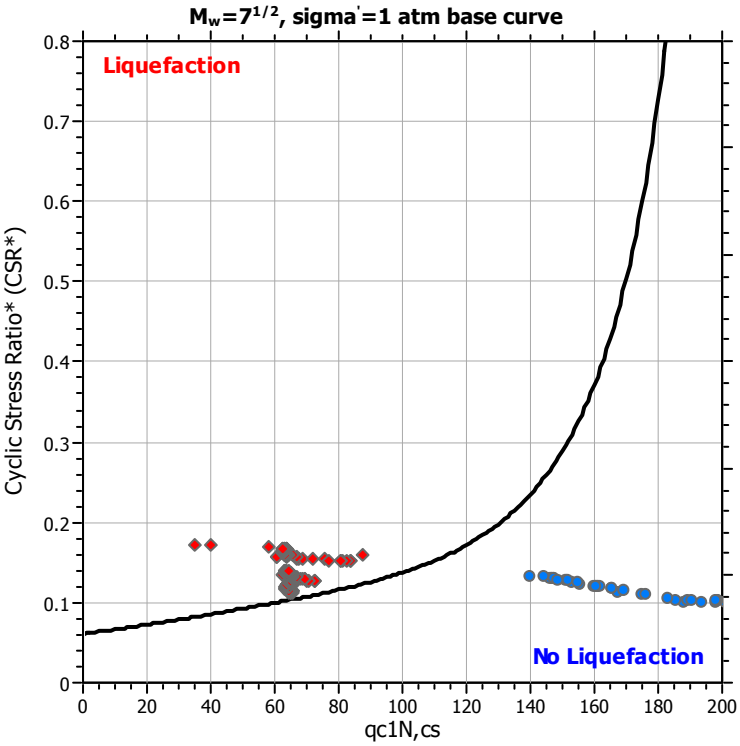
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

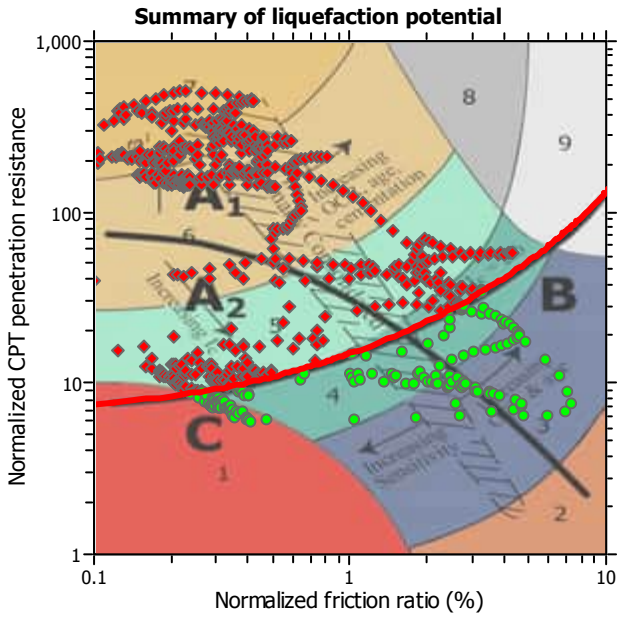
CPT file : CPT_58

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

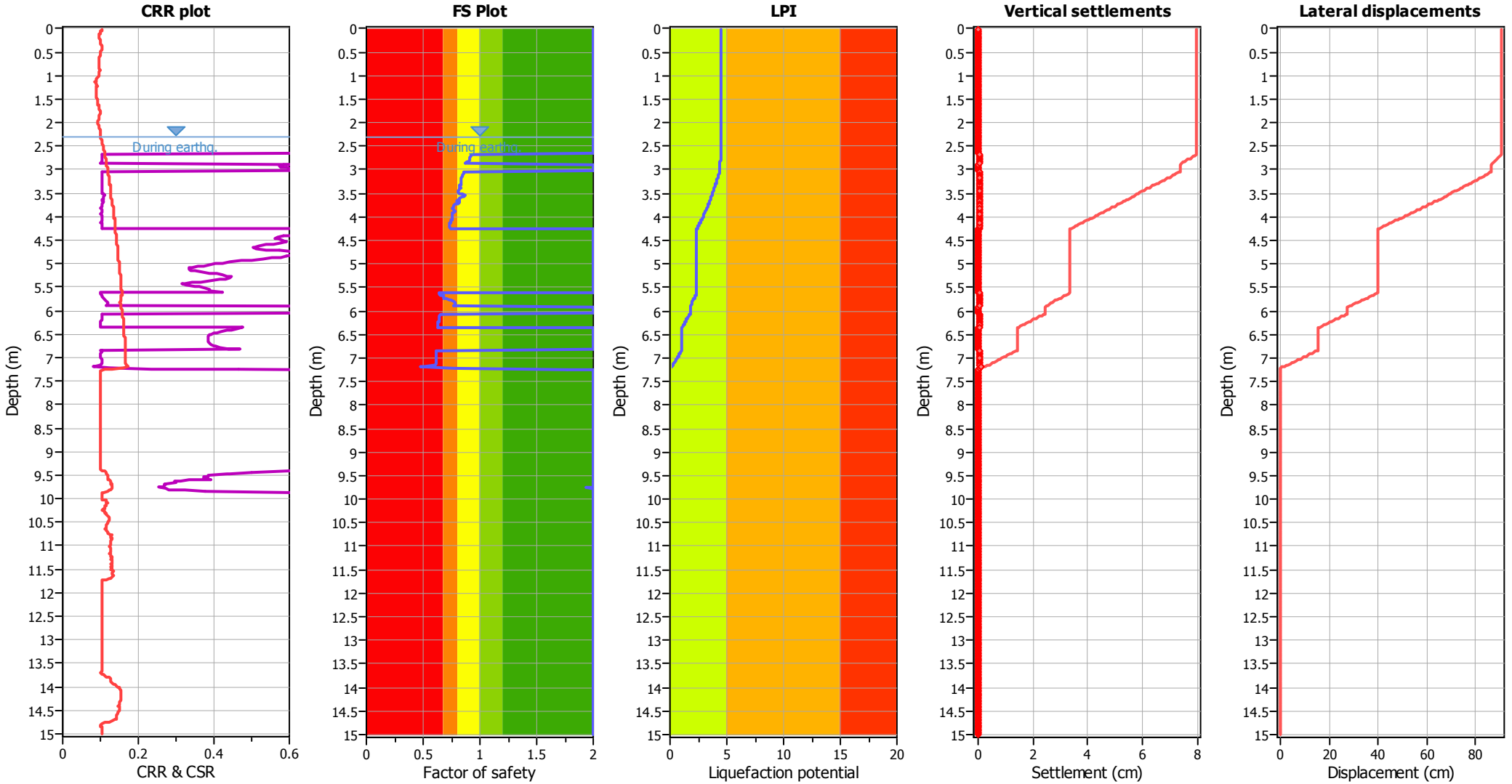






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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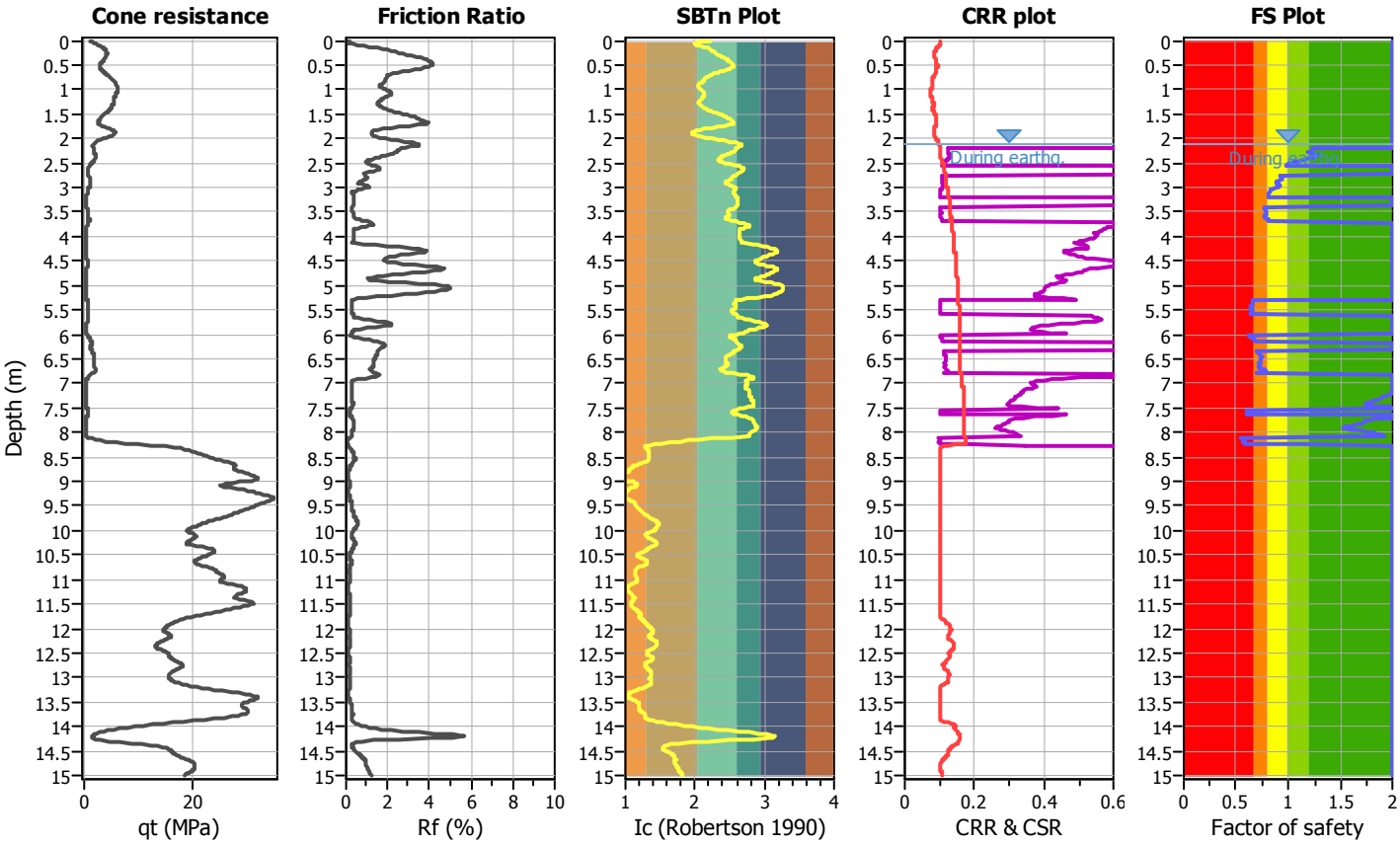
LIQUEFACTION ANALYSIS REPORT

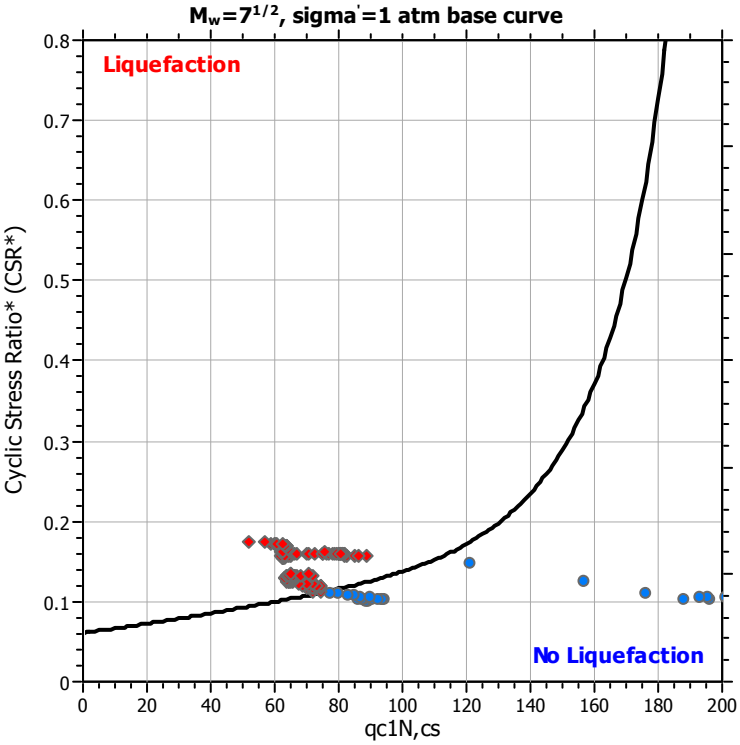
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

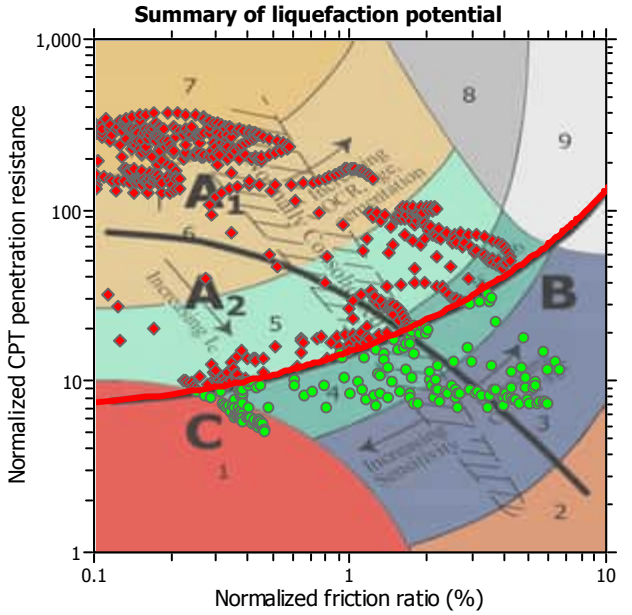
CPT file : CPT_59

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

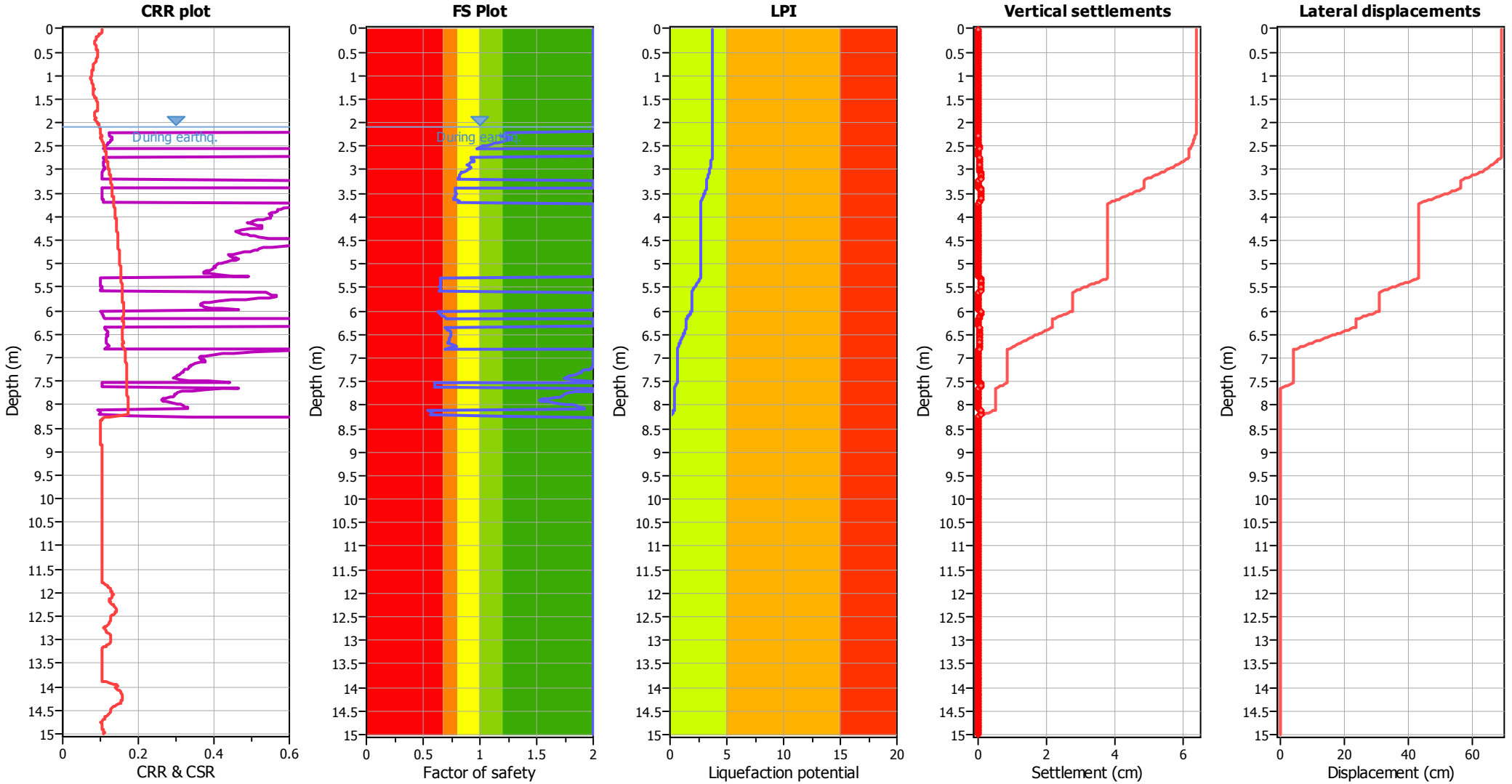






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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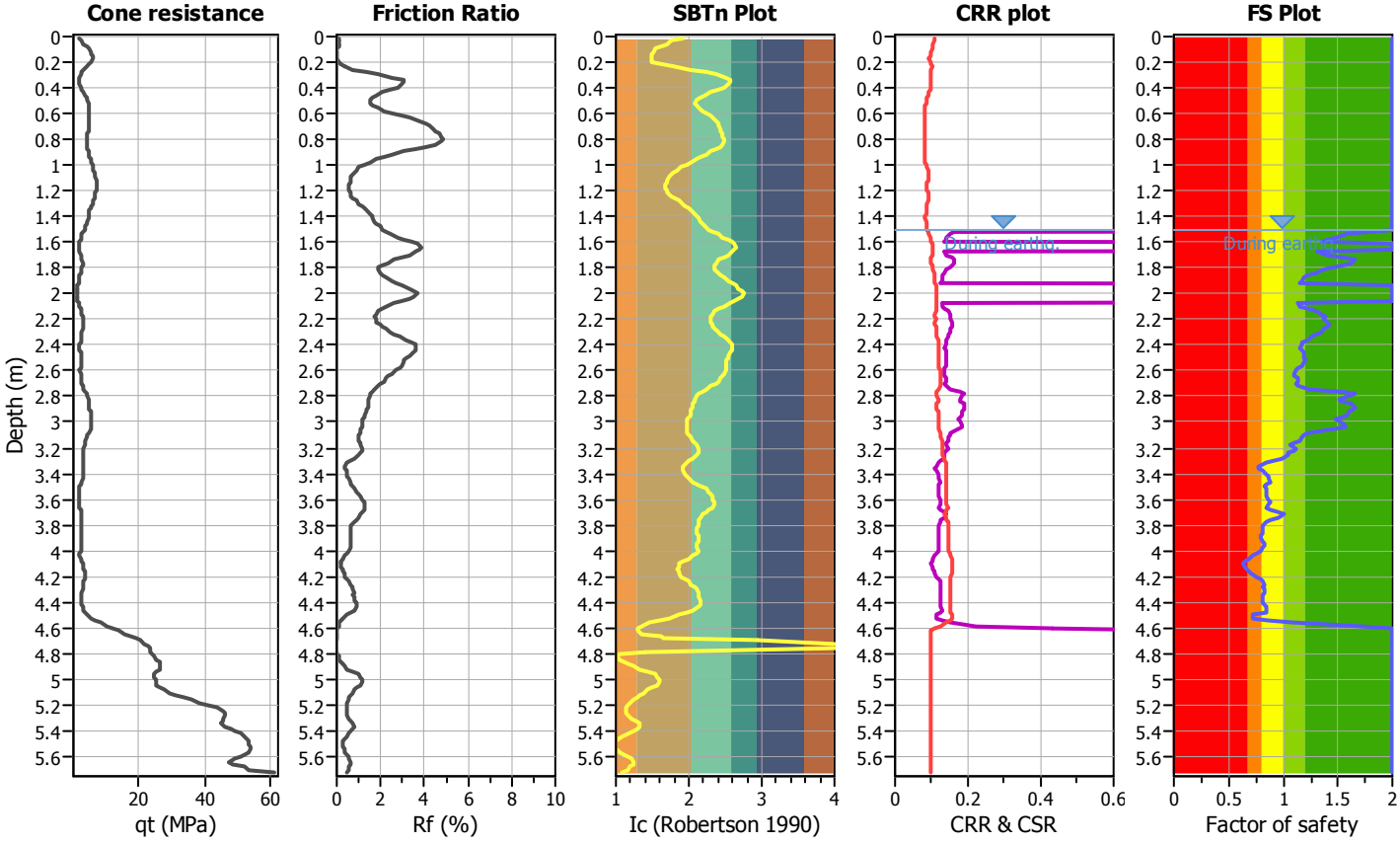
LIQUEFACTION ANALYSIS REPORT

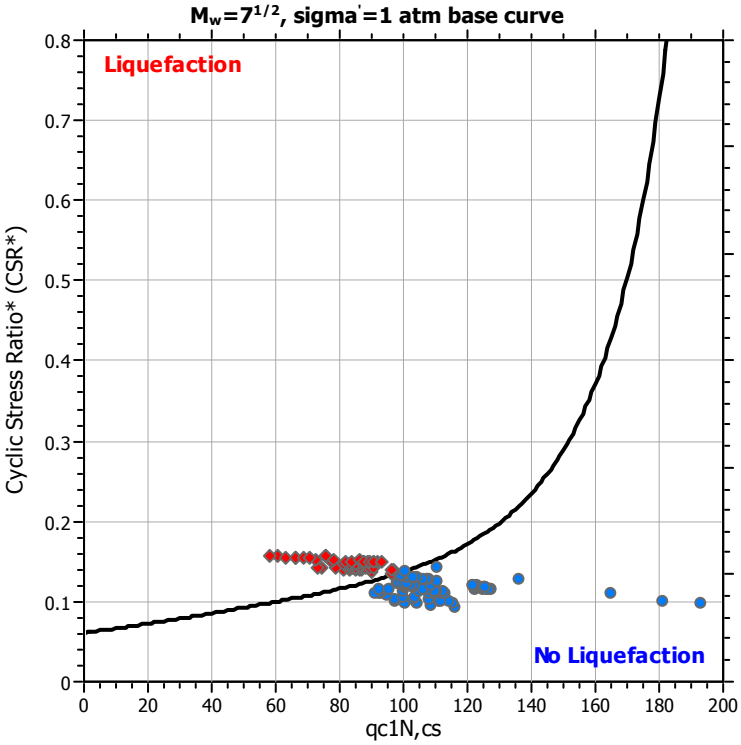
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

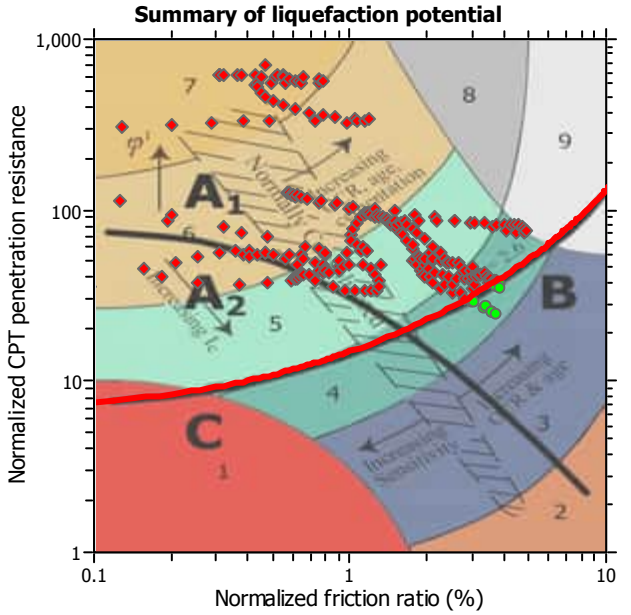
CPT file : CPT_60

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

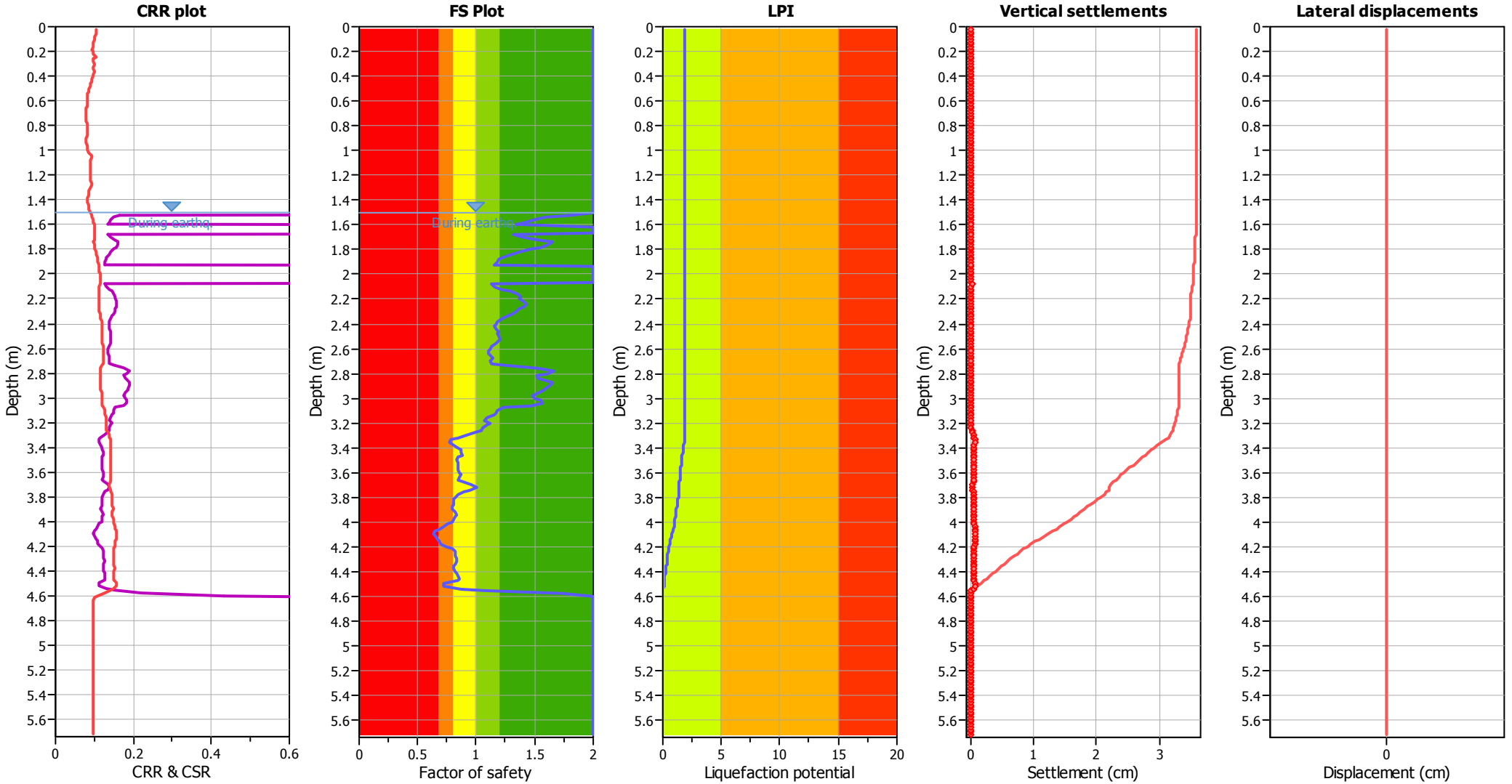






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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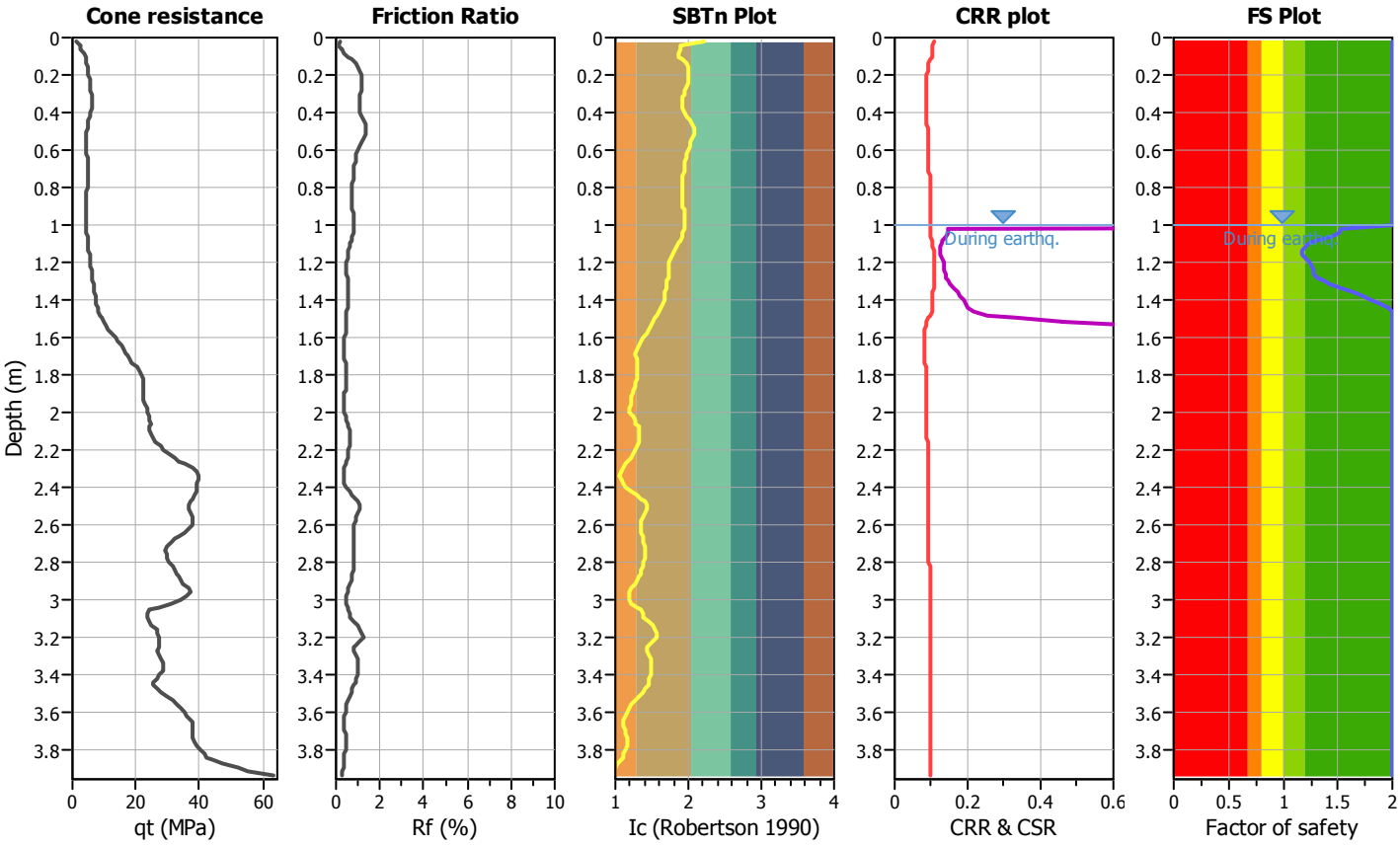
LIQUEFACTION ANALYSIS REPORT

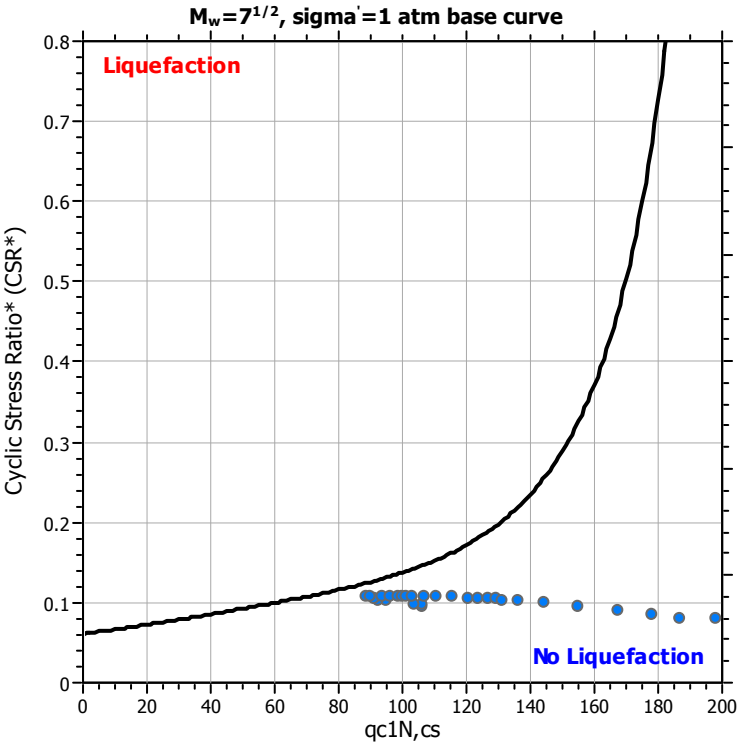
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

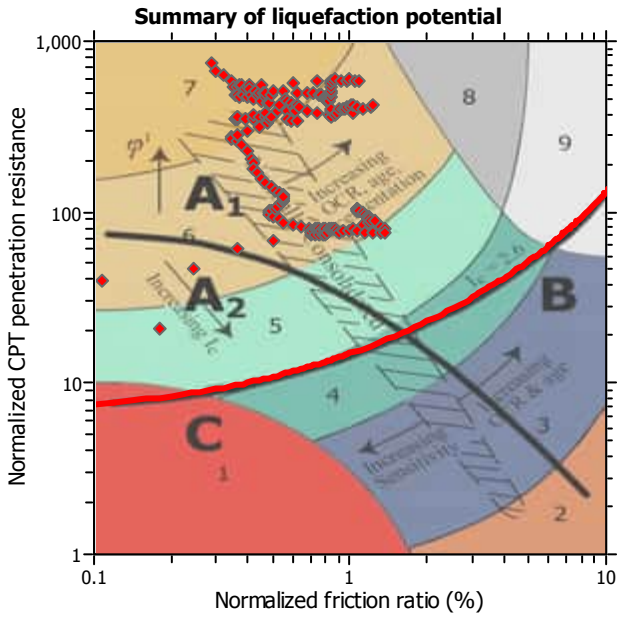
CPT file : CPT_61

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

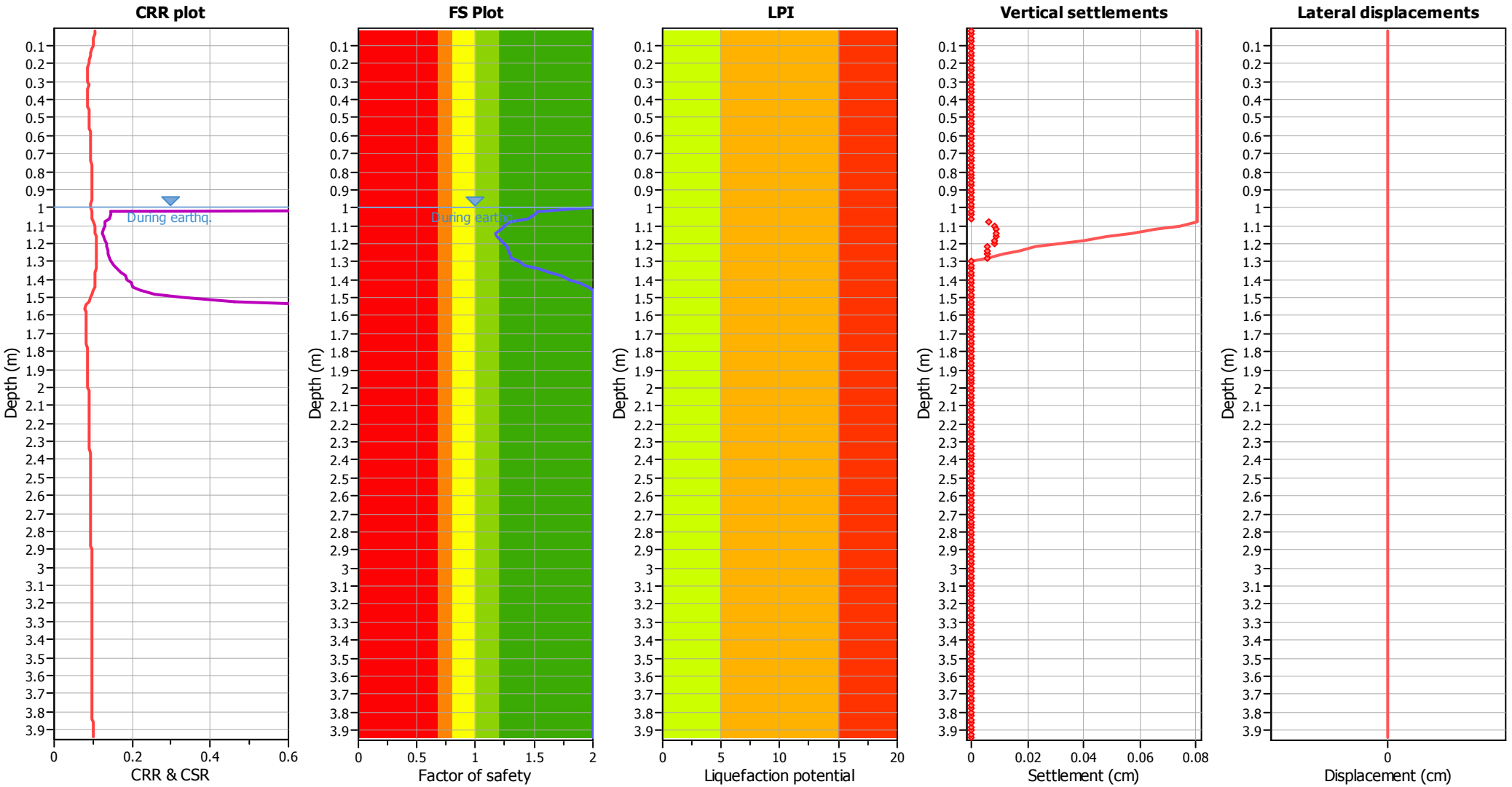






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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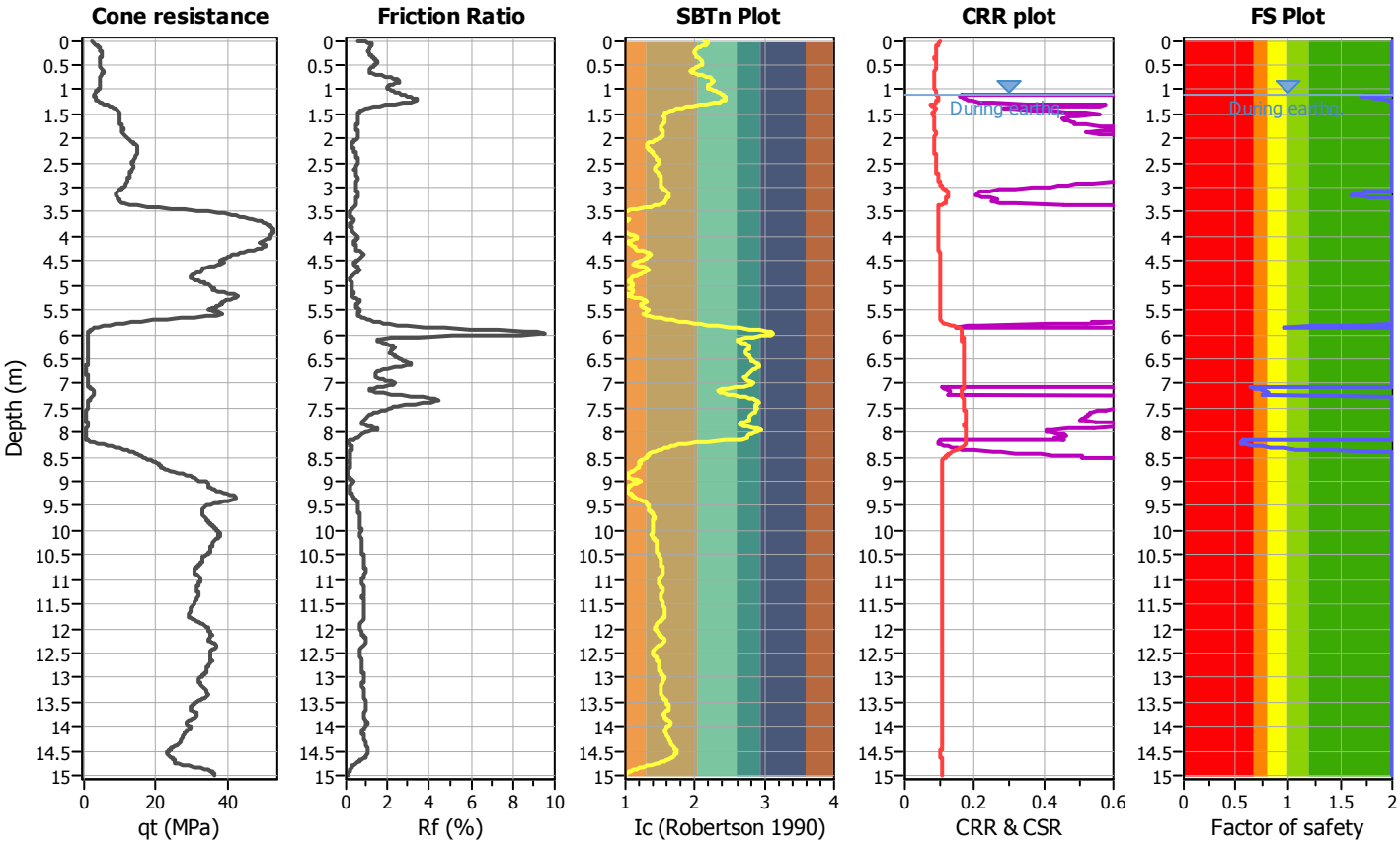
LIQUEFACTION ANALYSIS REPORT

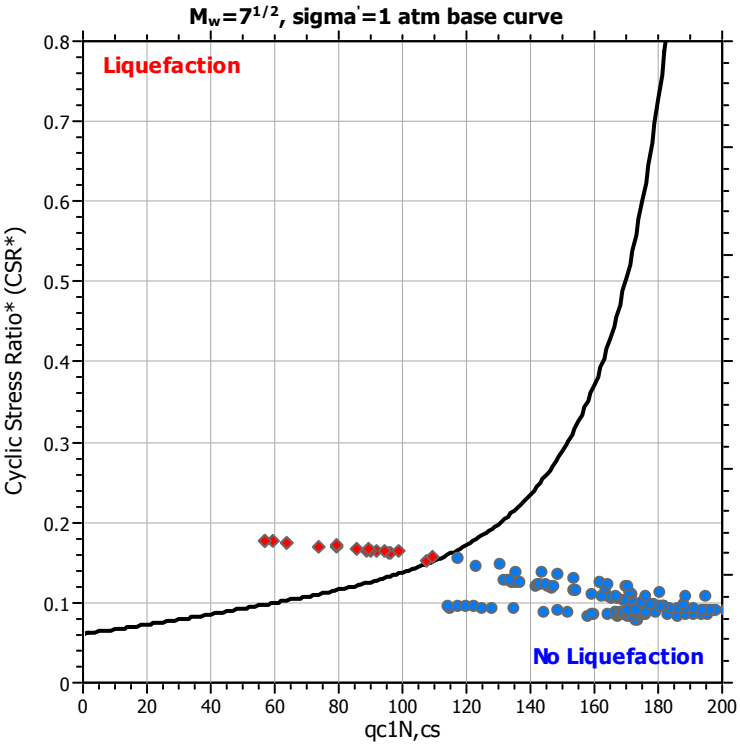
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

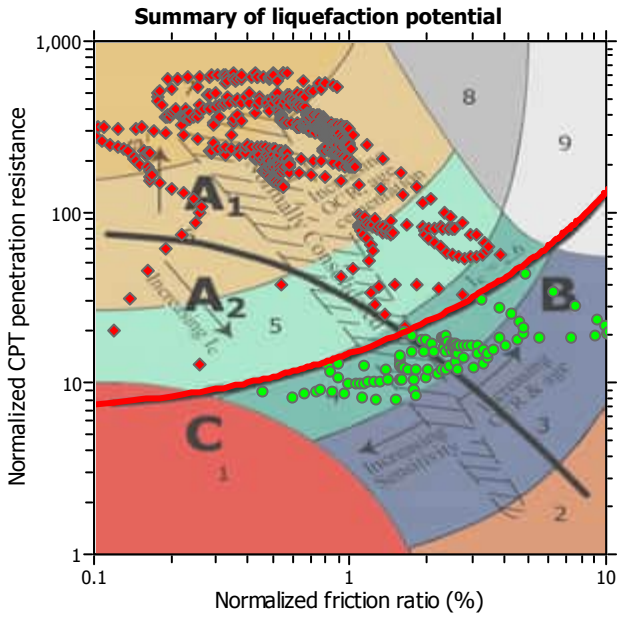
CPT file : CPT_62

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

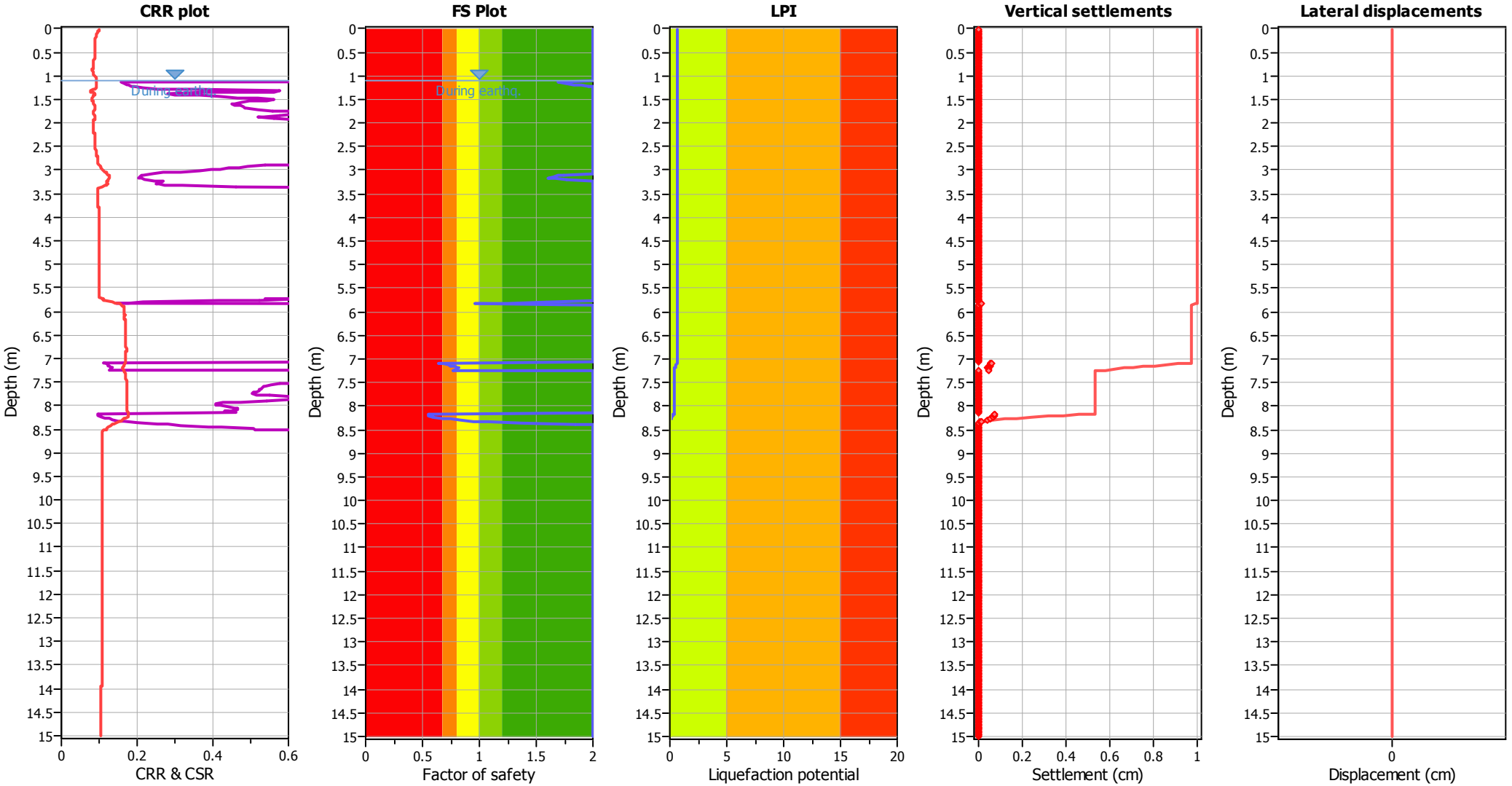






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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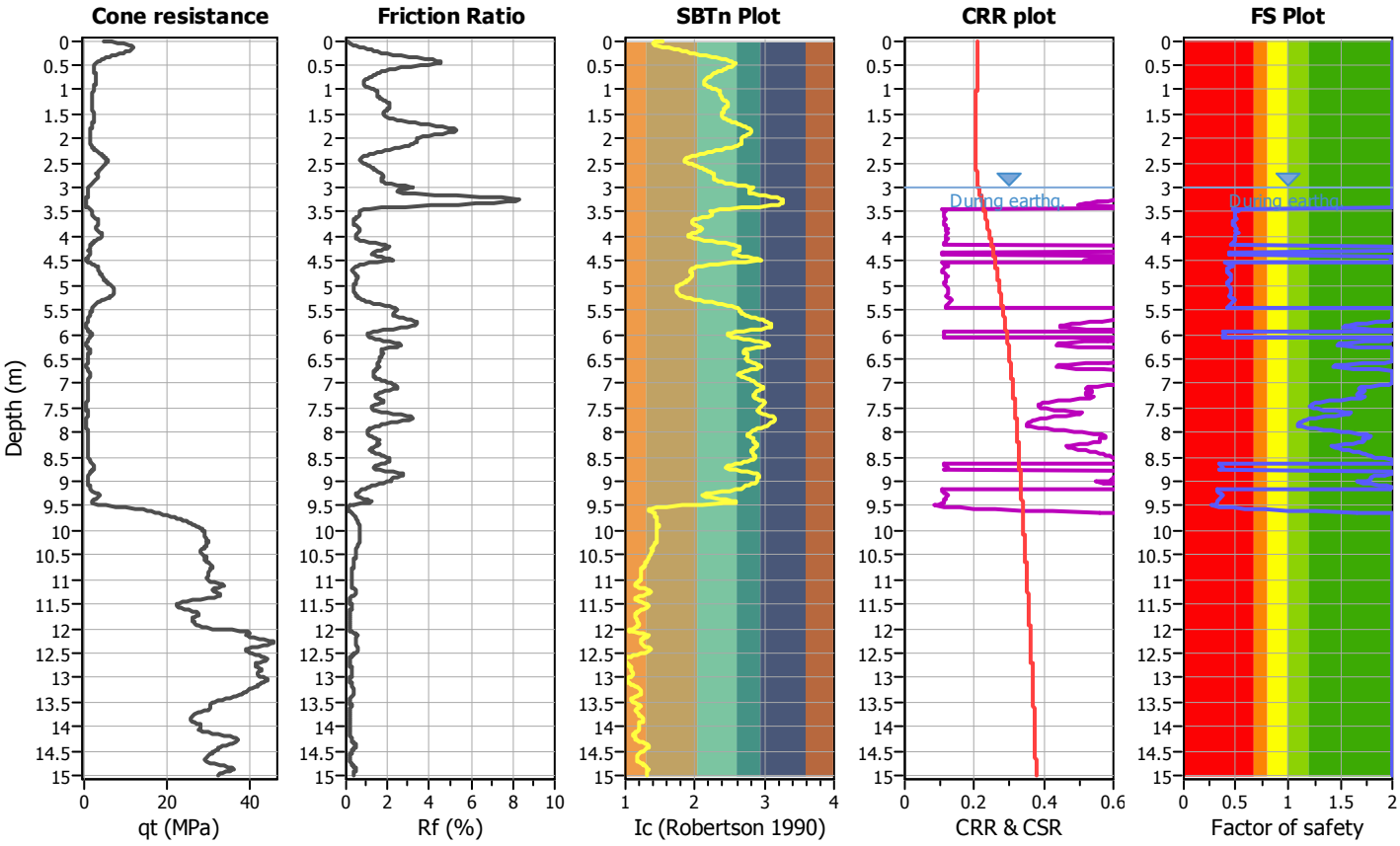
LIQUEFACTION ANALYSIS REPORT

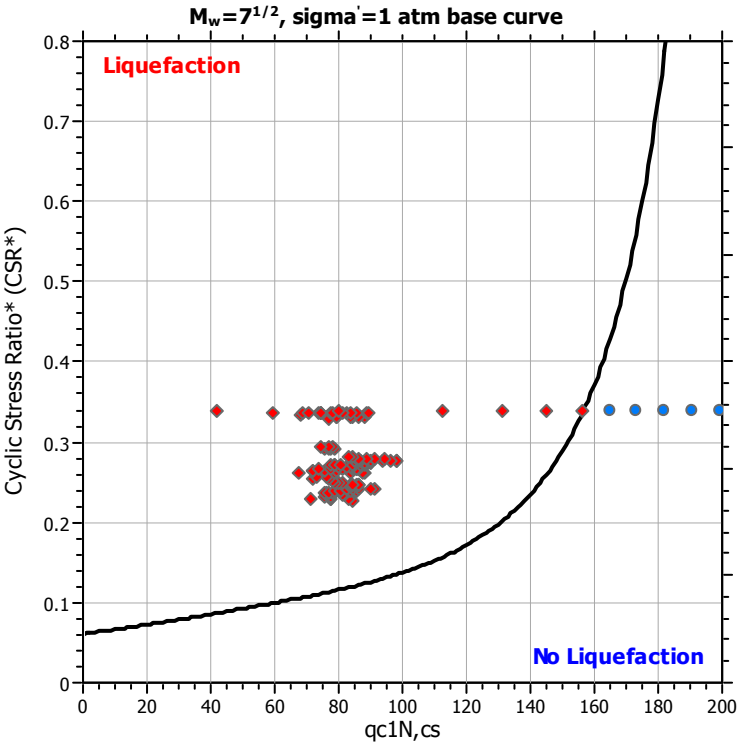
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

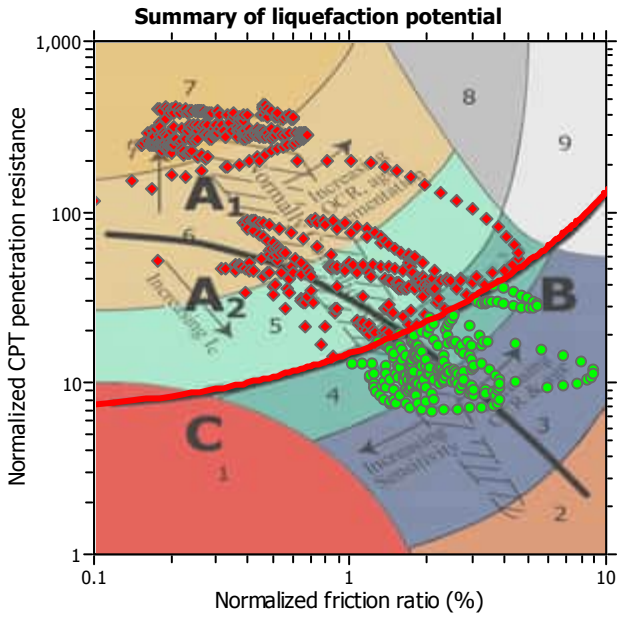
CPT file : CPT_01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

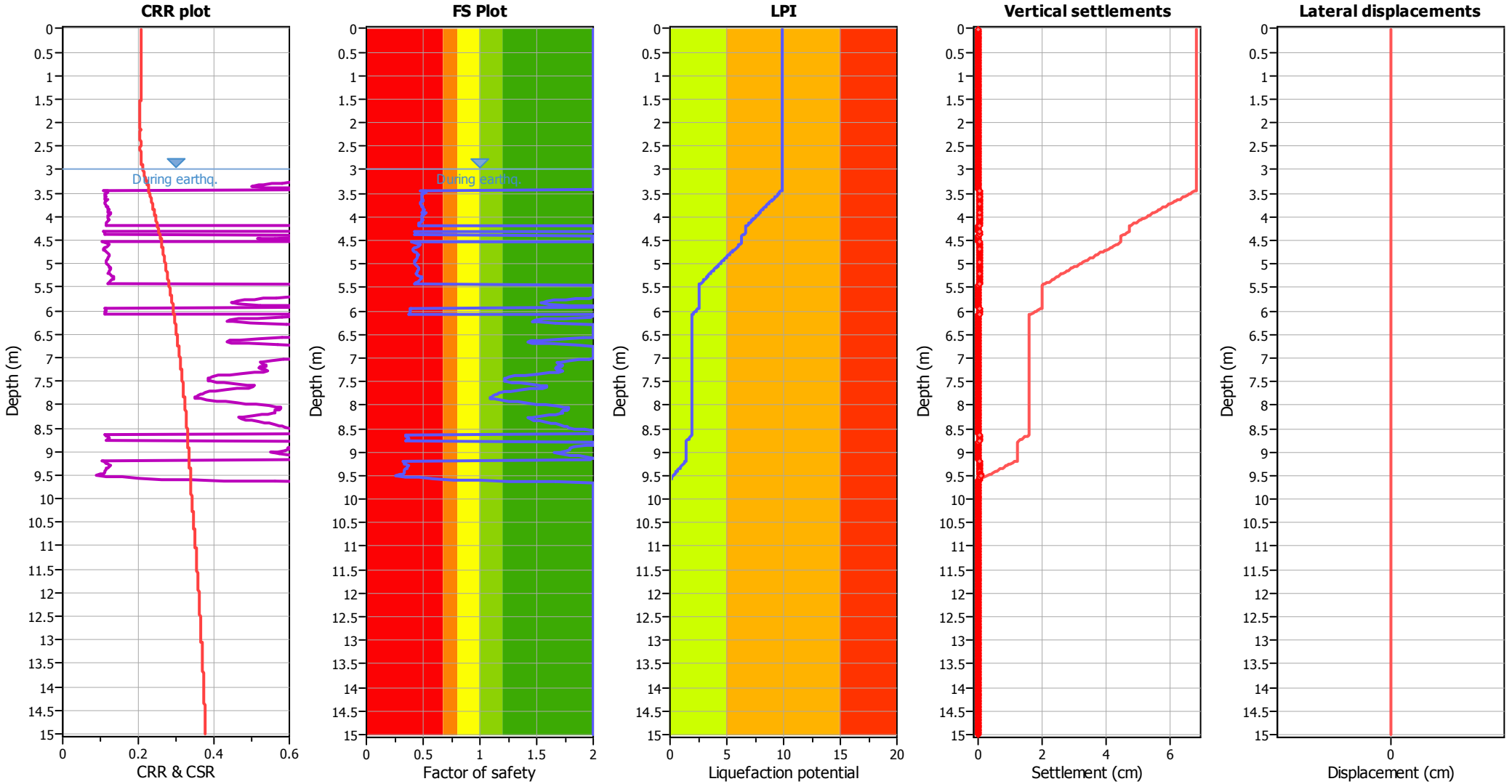






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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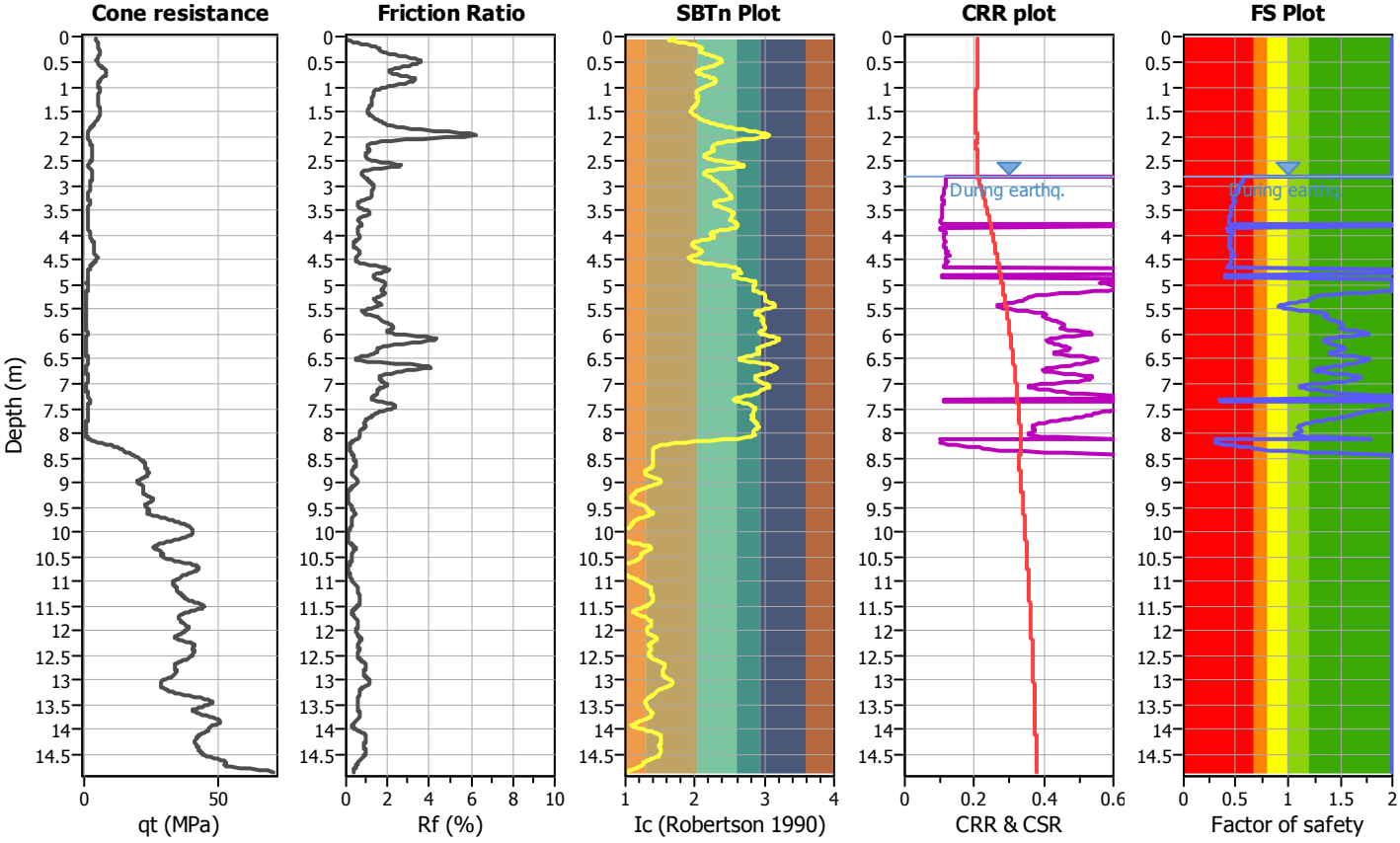
LIQUEFACTION ANALYSIS REPORT

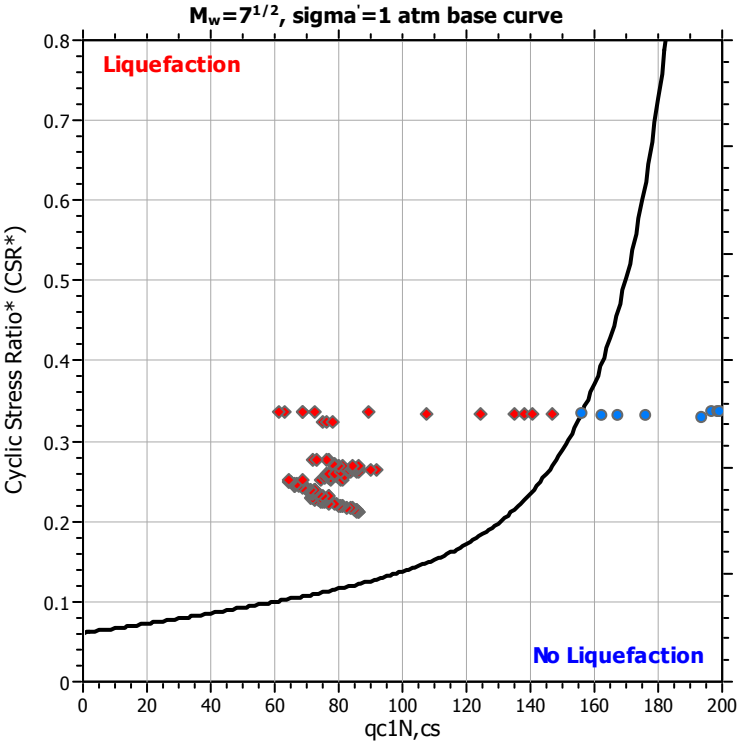
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

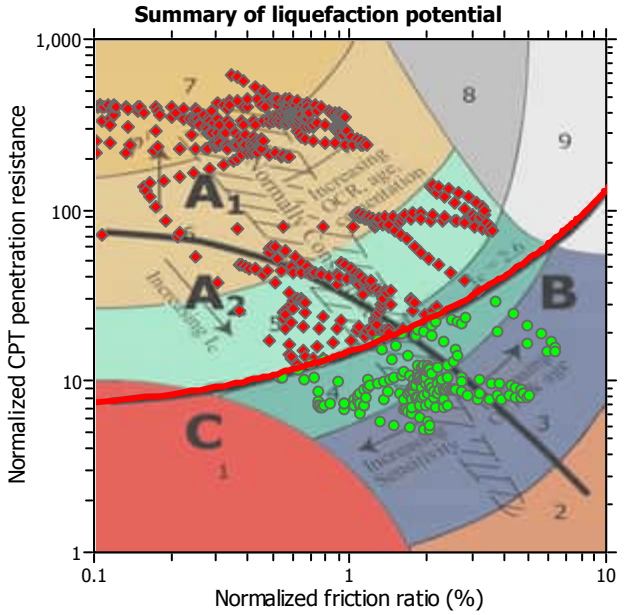
CPT file : CPT_02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

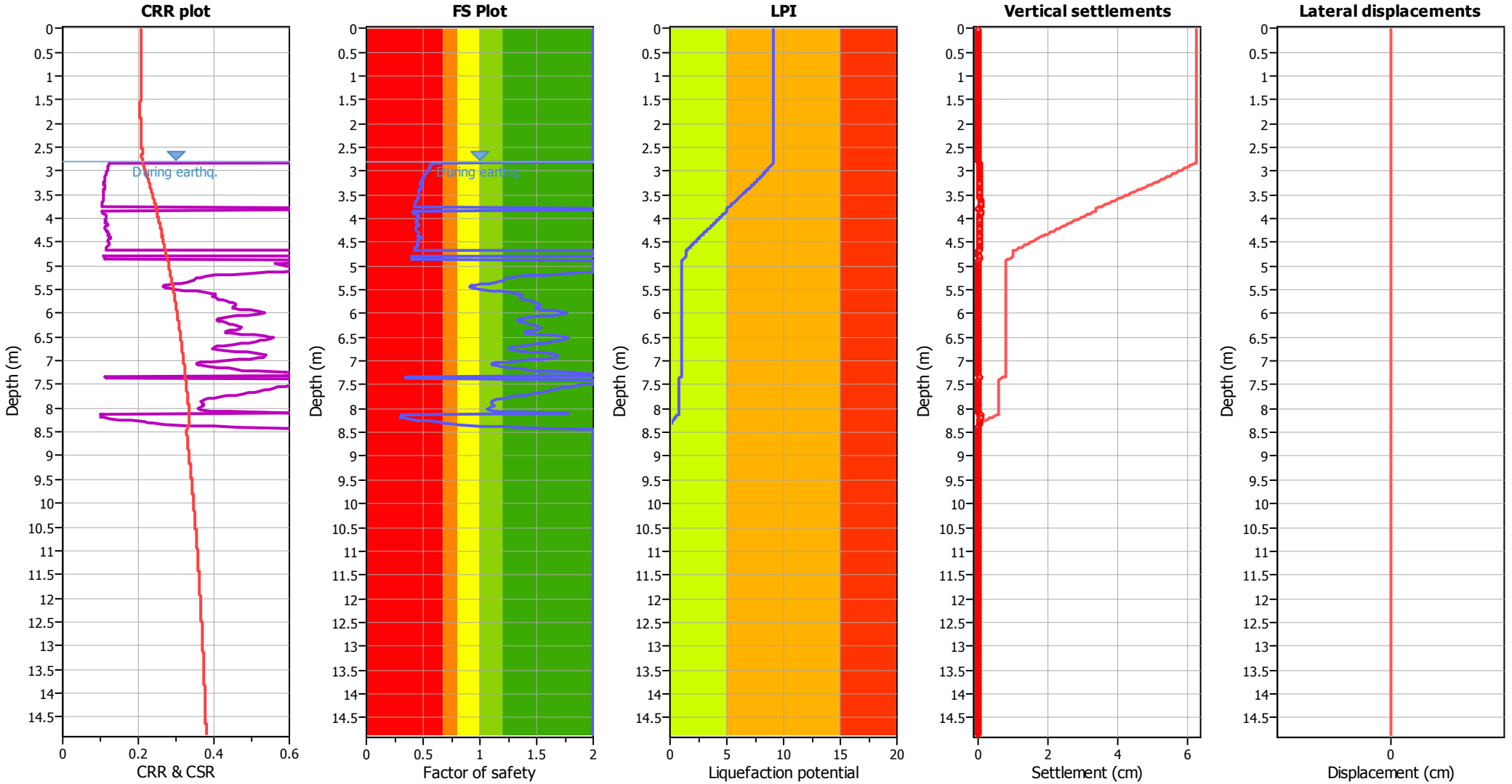






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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Christchurch 8140

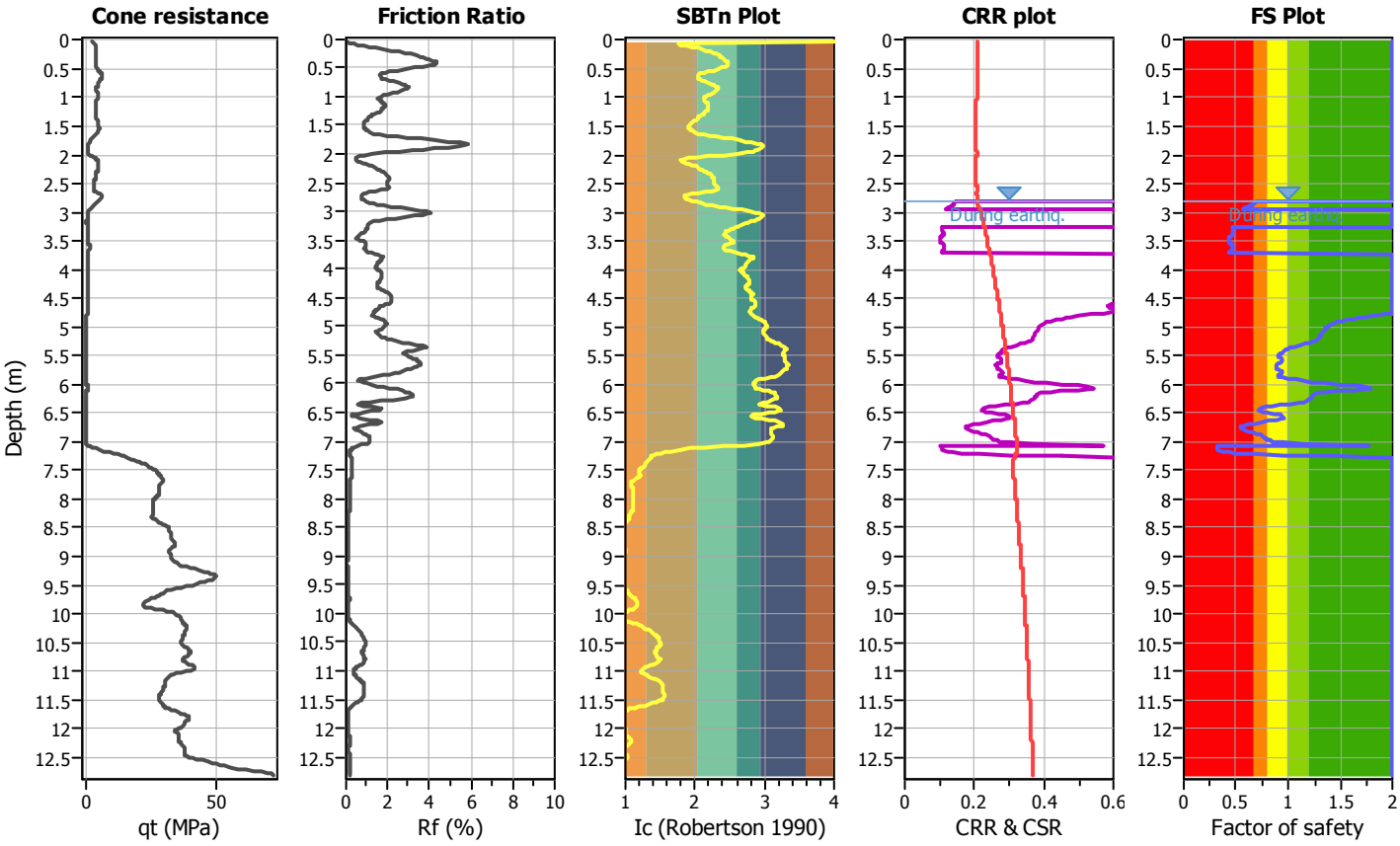
LIQUEFACTION ANALYSIS REPORT

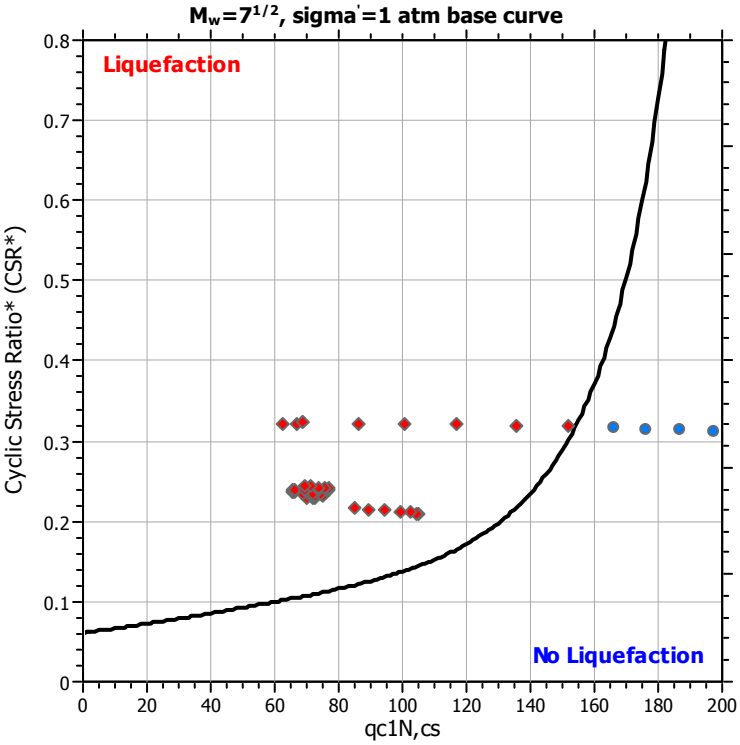
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

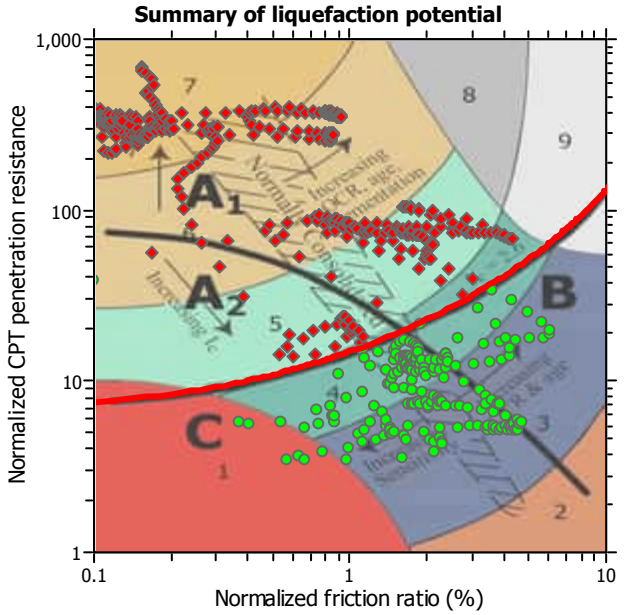
CPT file : CPT_03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

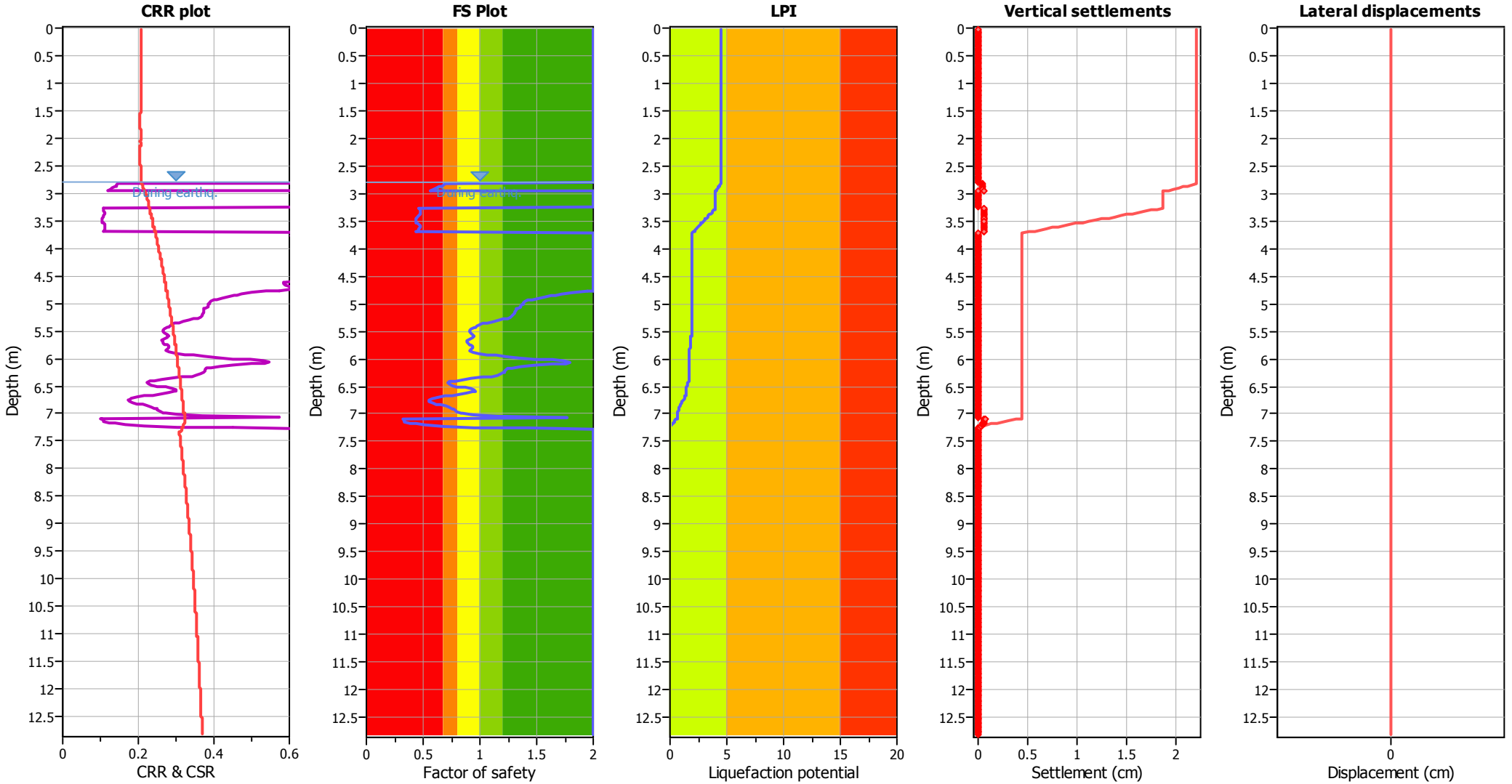






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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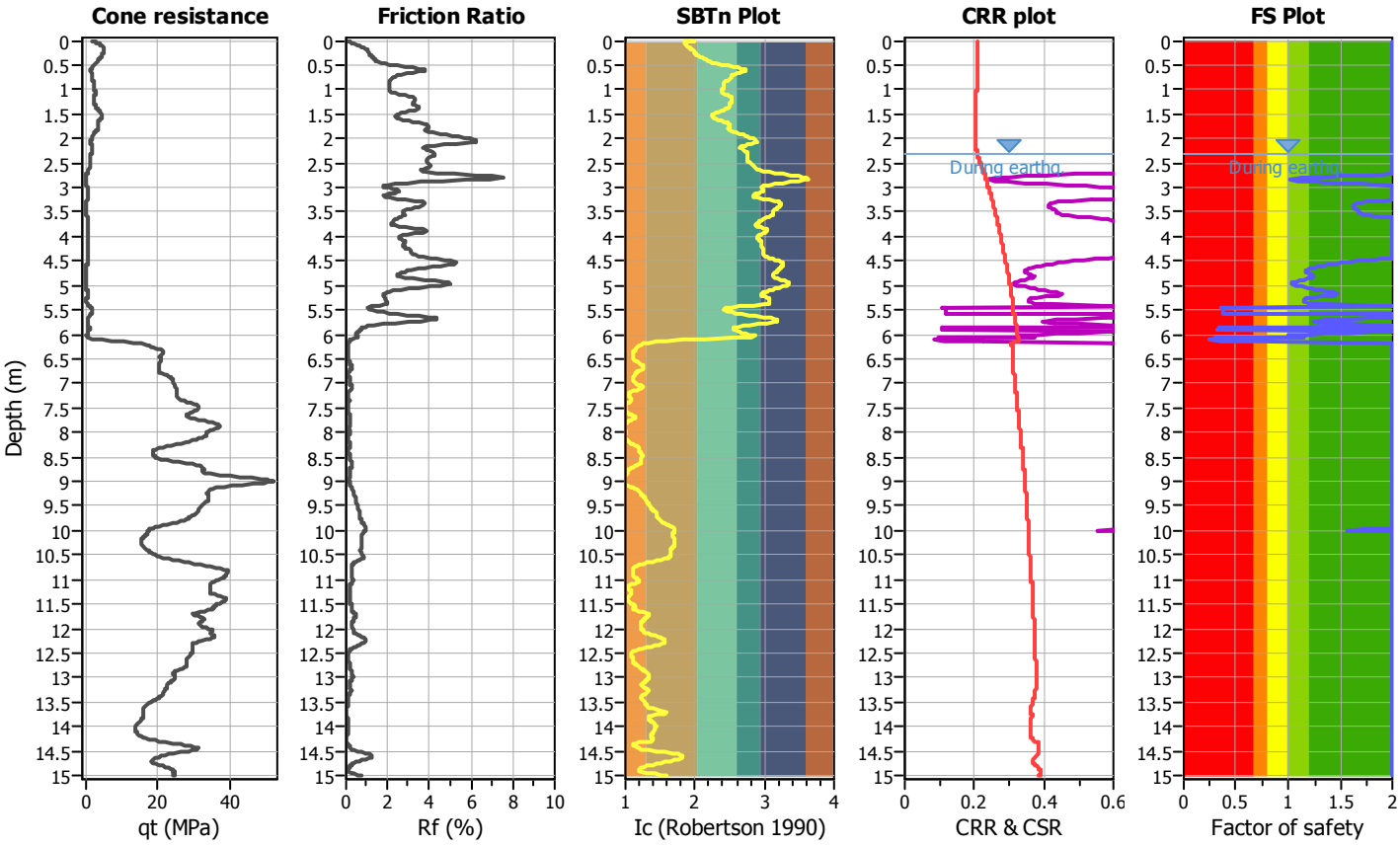
LIQUEFACTION ANALYSIS REPORT

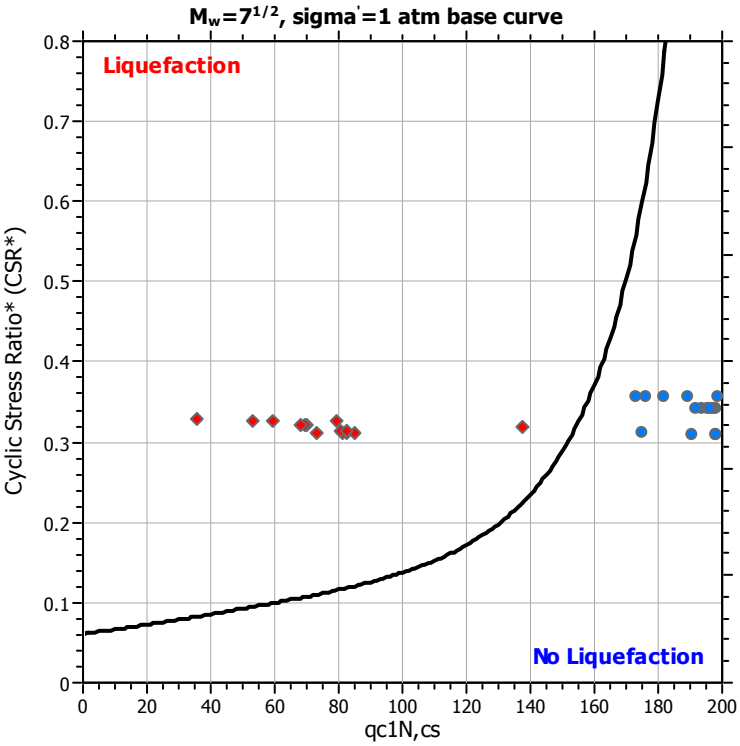
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

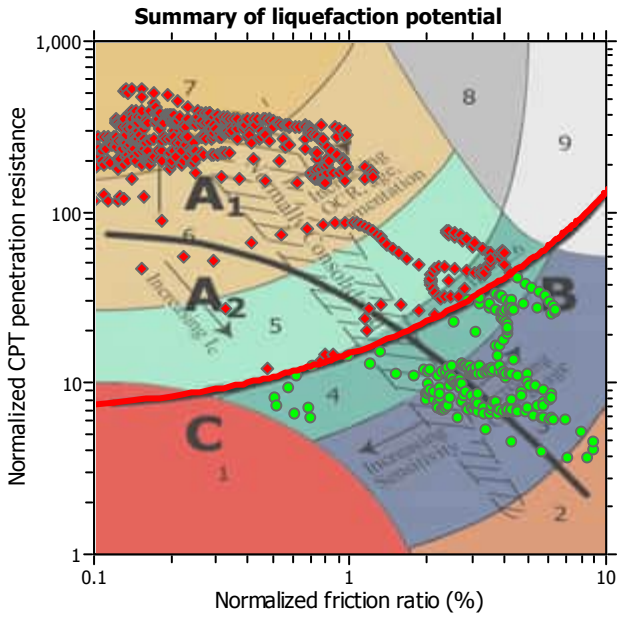
CPT file : CPT_04

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

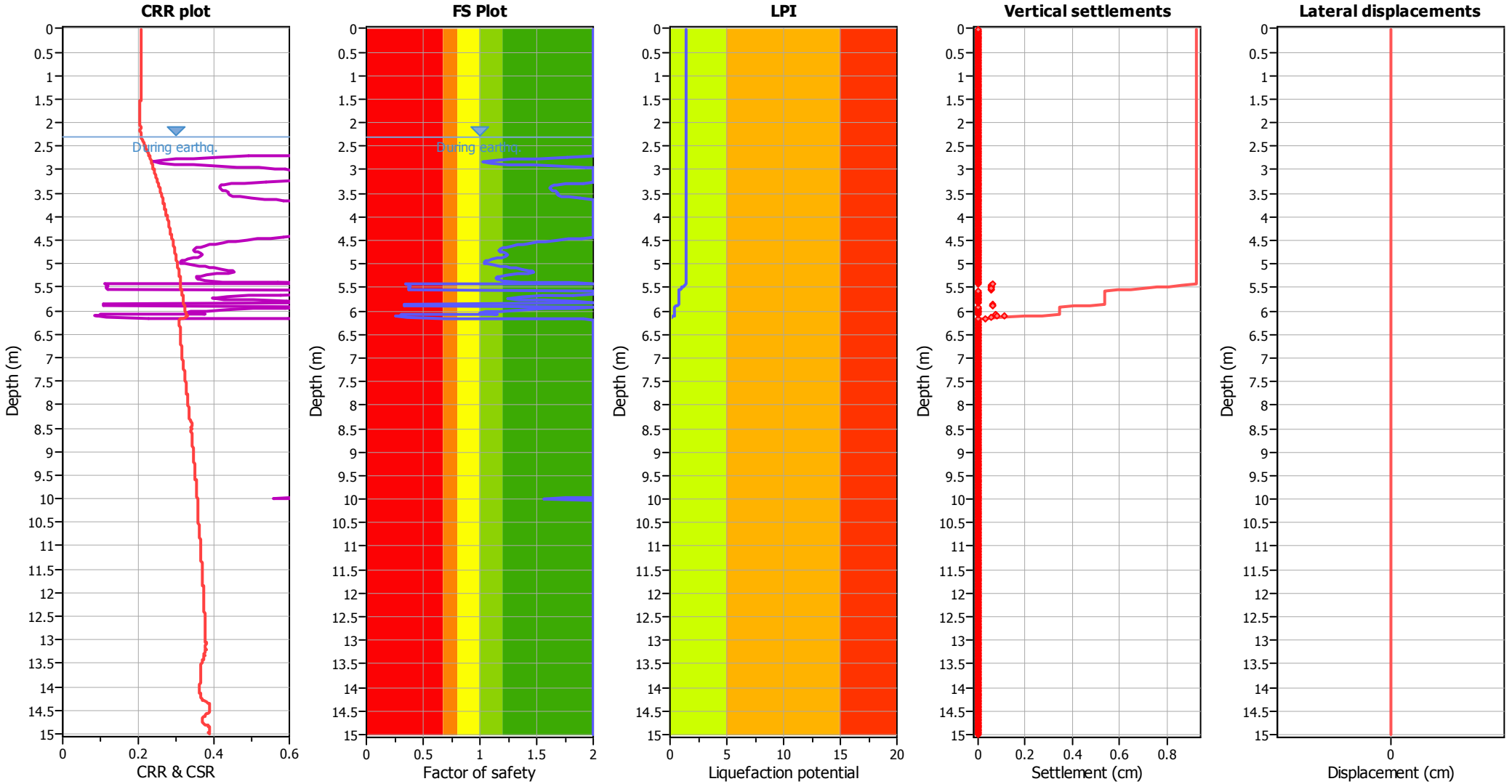






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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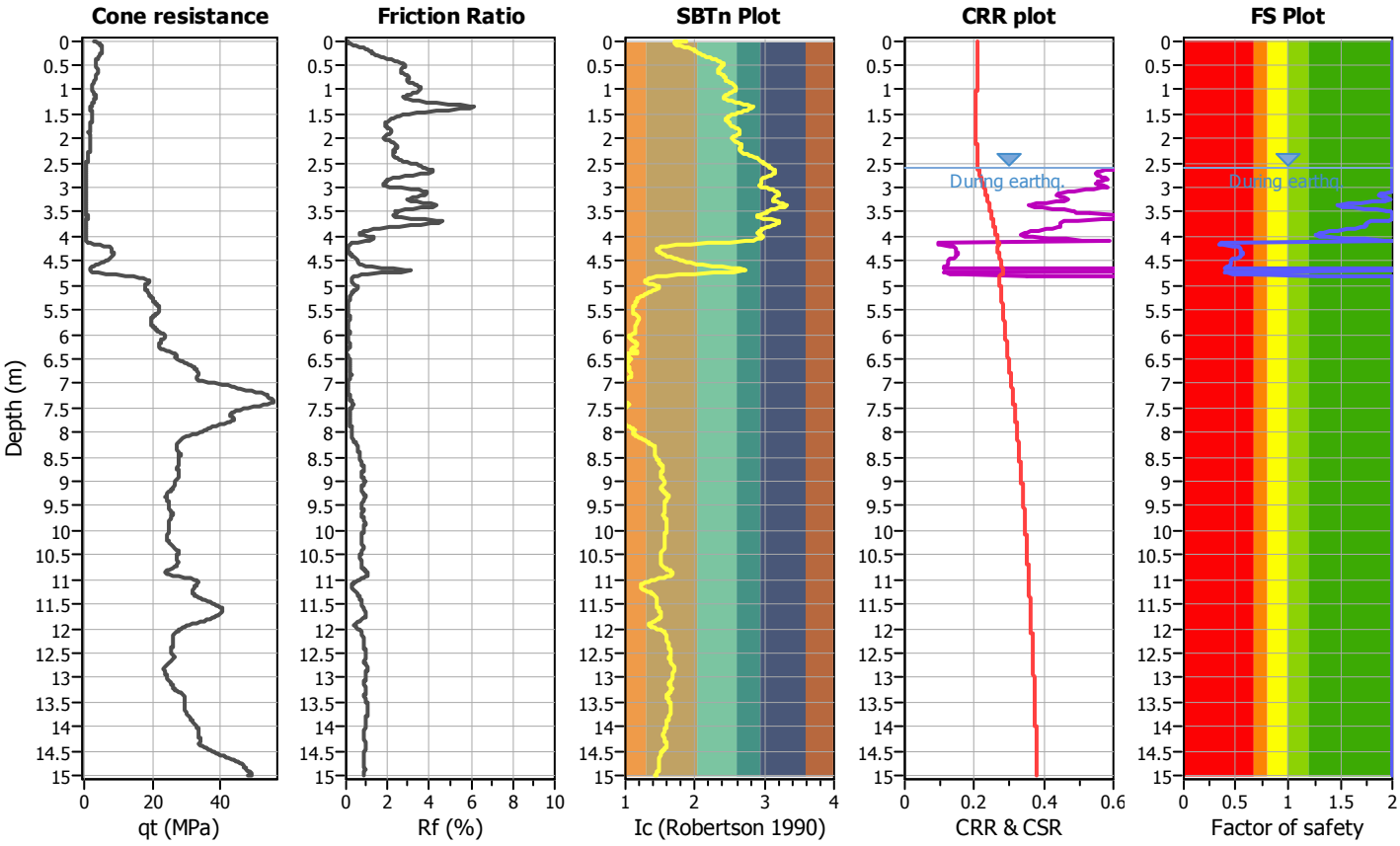
LIQUEFACTION ANALYSIS REPORT

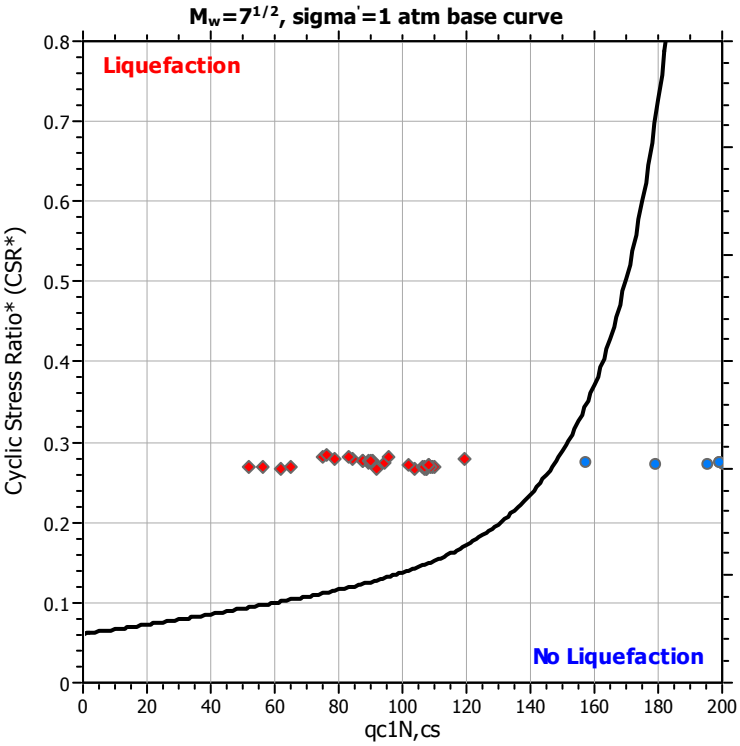
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

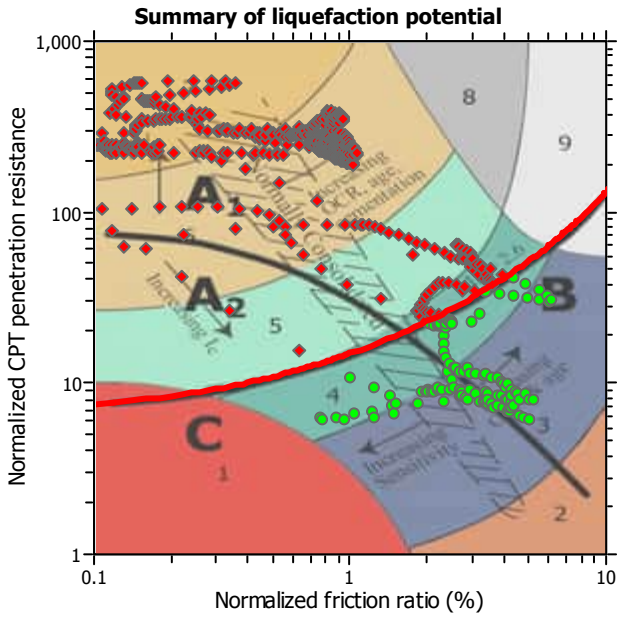
CPT file : CPT_05

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

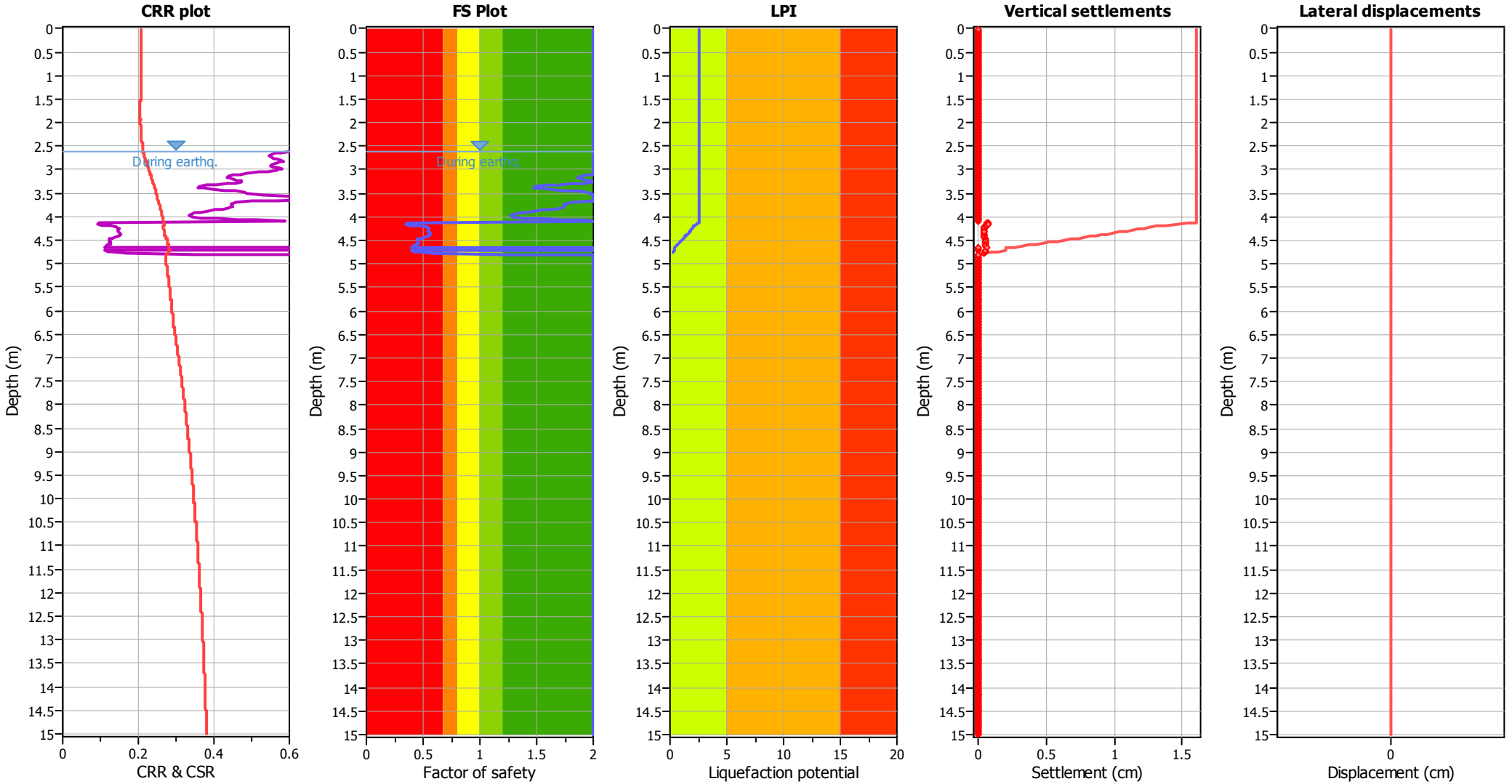






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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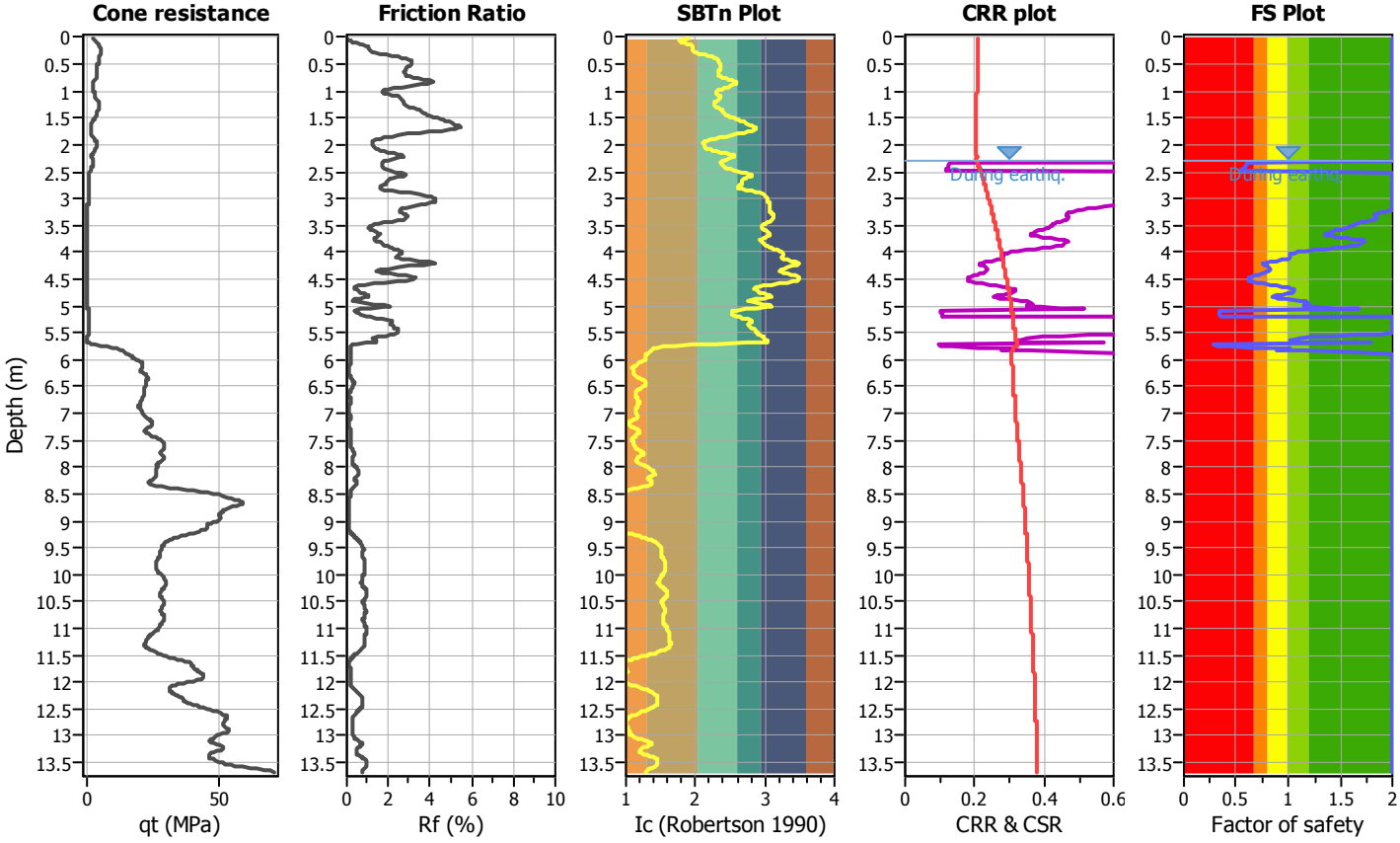
LIQUEFACTION ANALYSIS REPORT

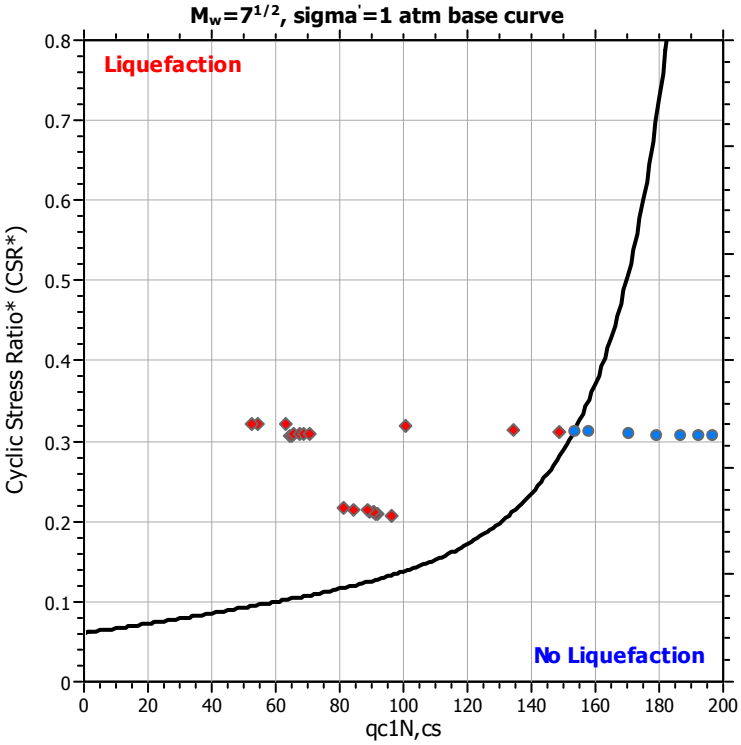
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

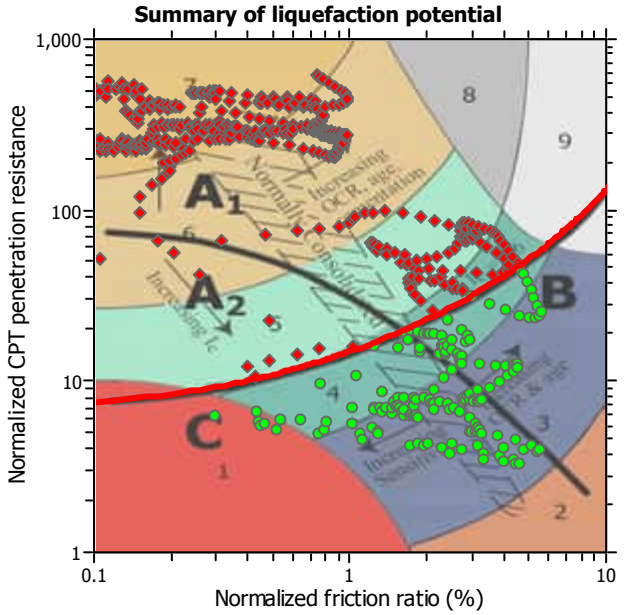
CPT file : CPT_06

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

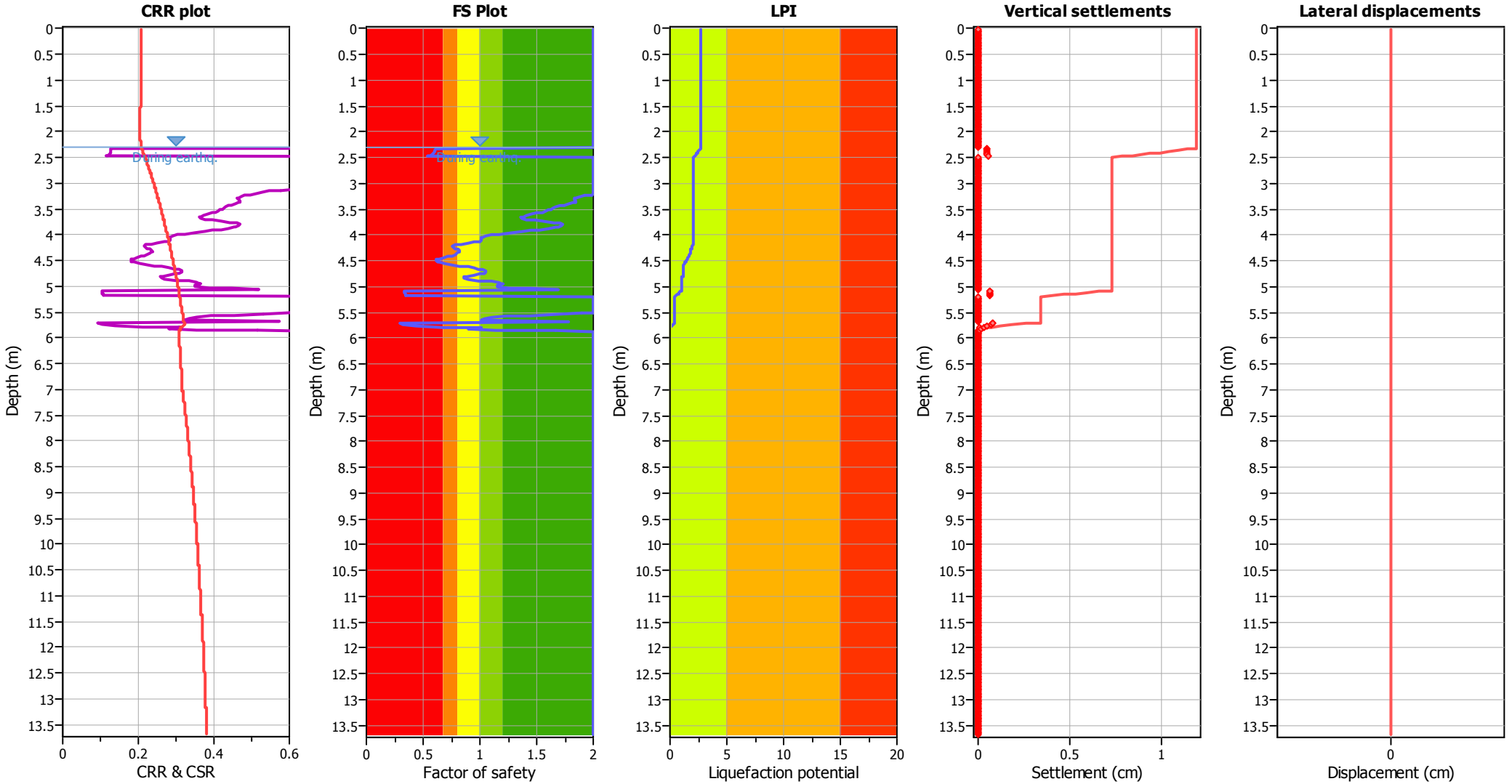






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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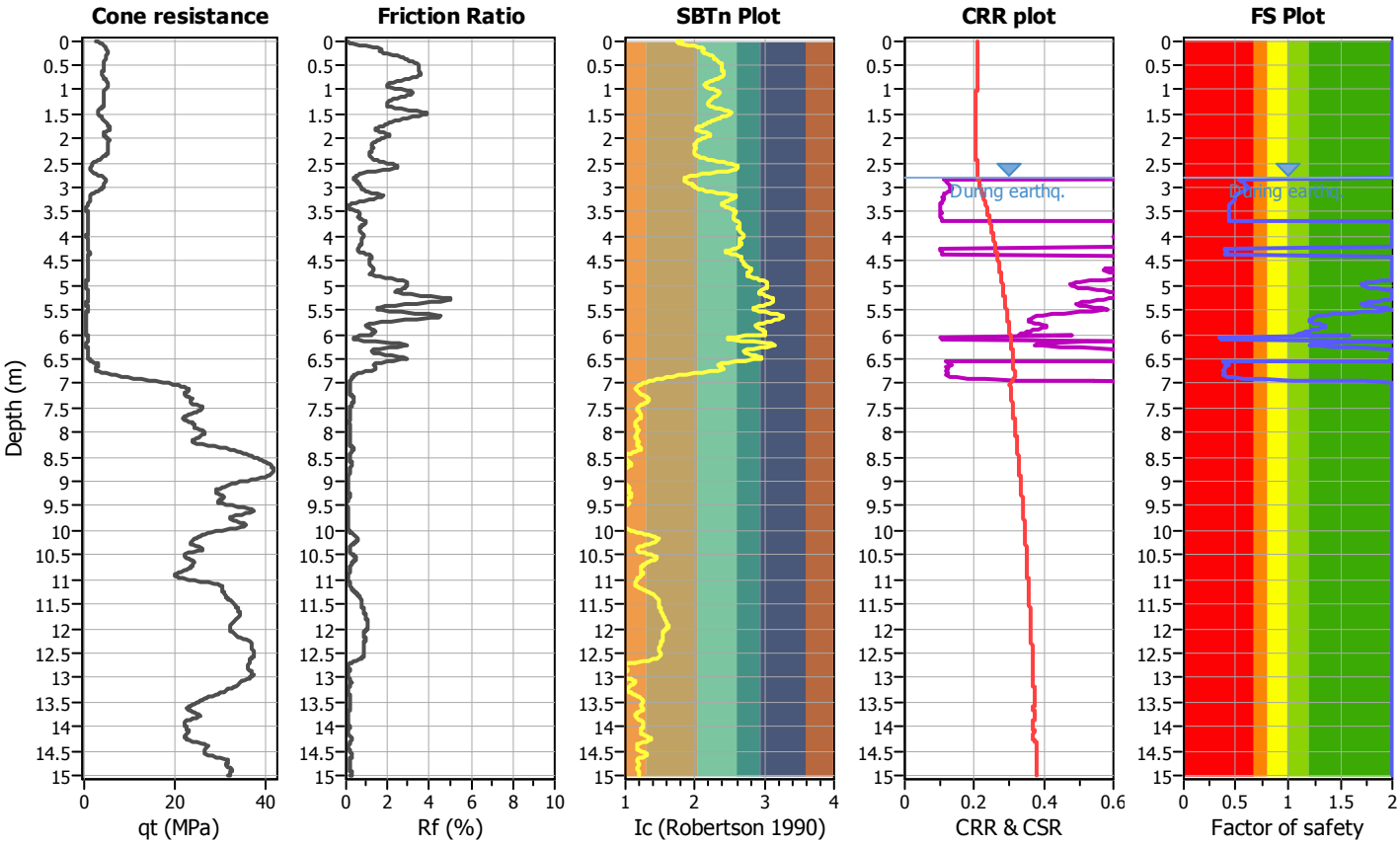
LIQUEFACTION ANALYSIS REPORT

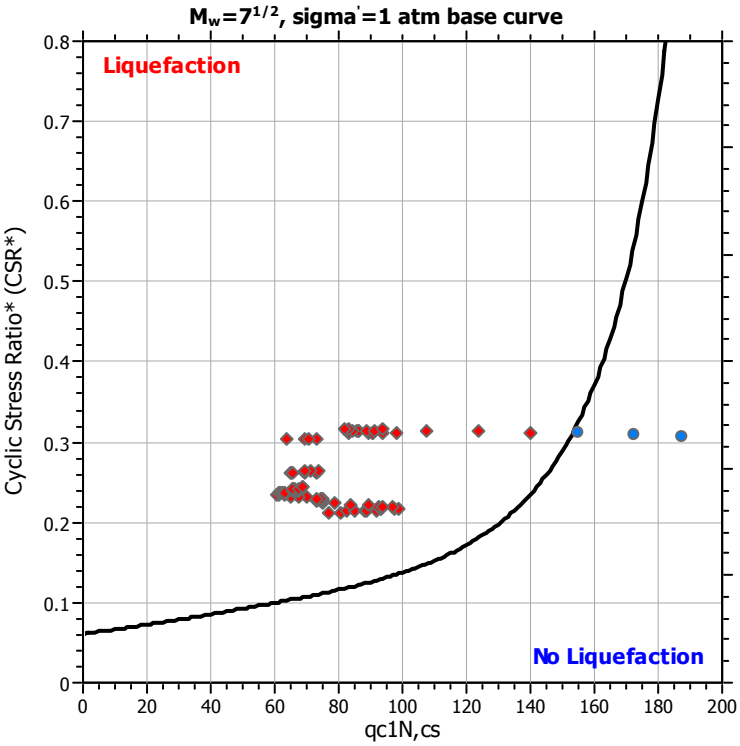
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

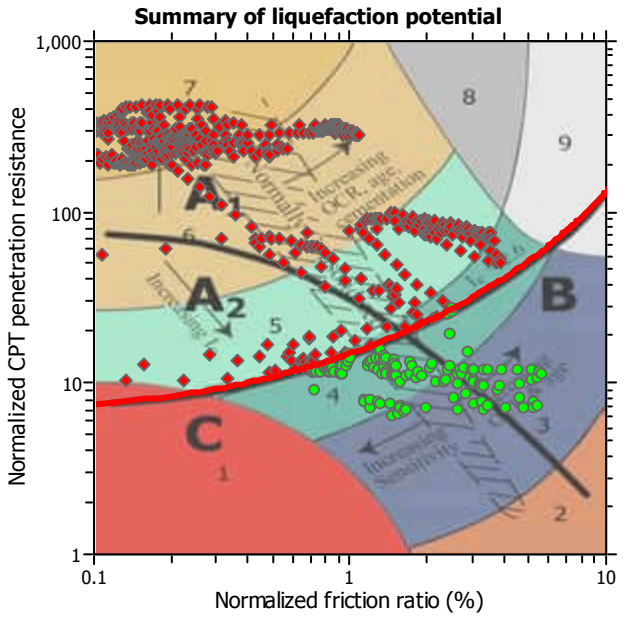
CPT file : CPT_07

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

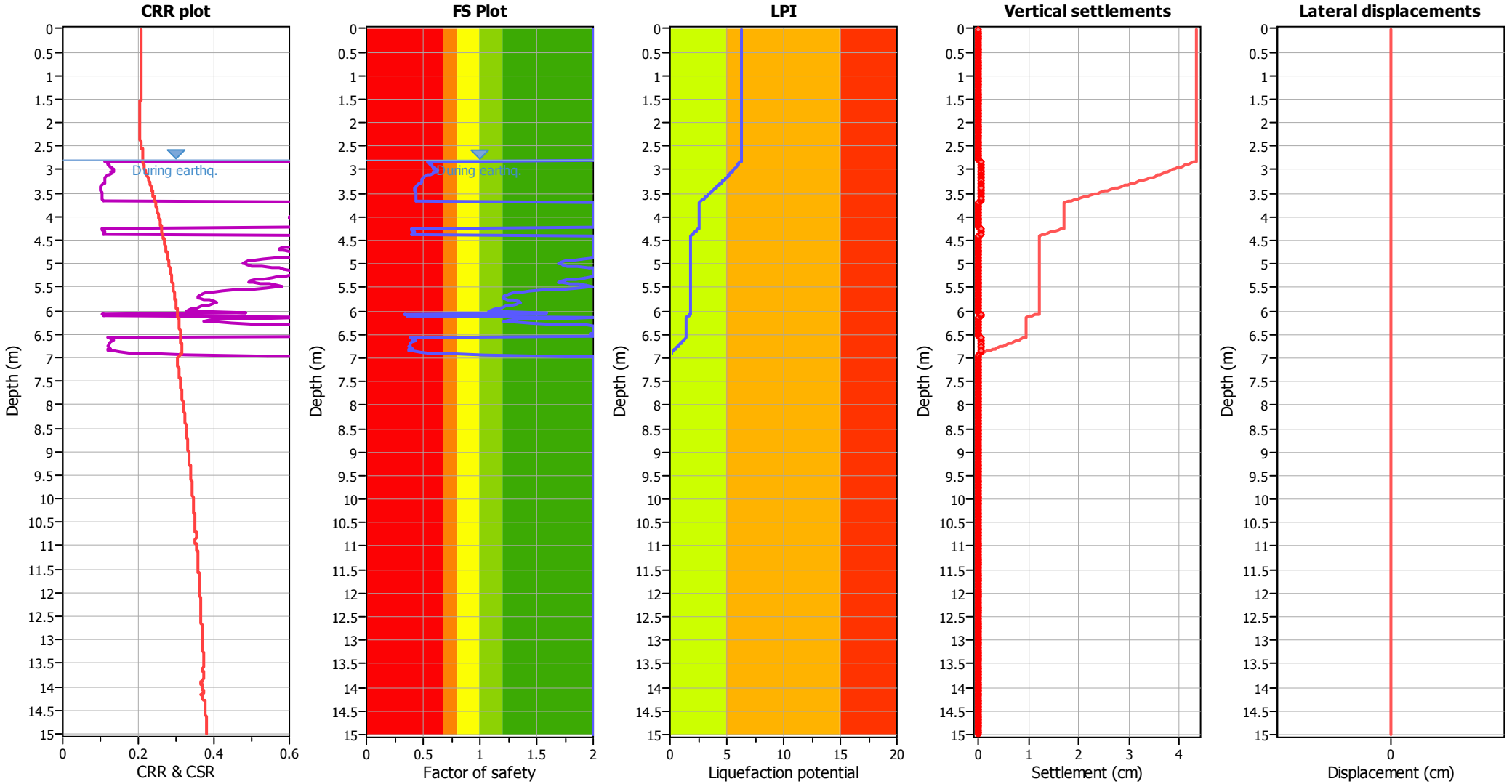






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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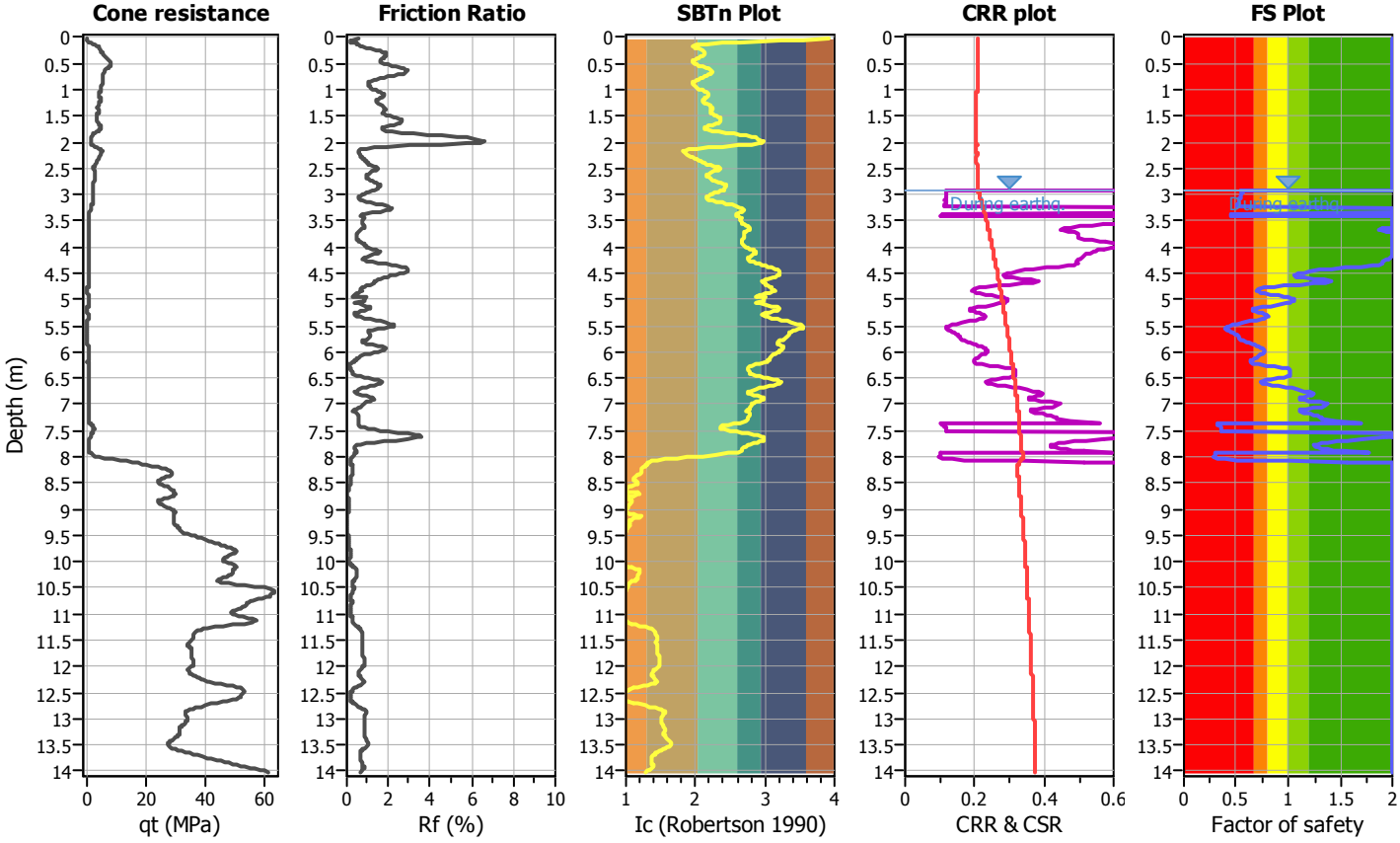
LIQUEFACTION ANALYSIS REPORT

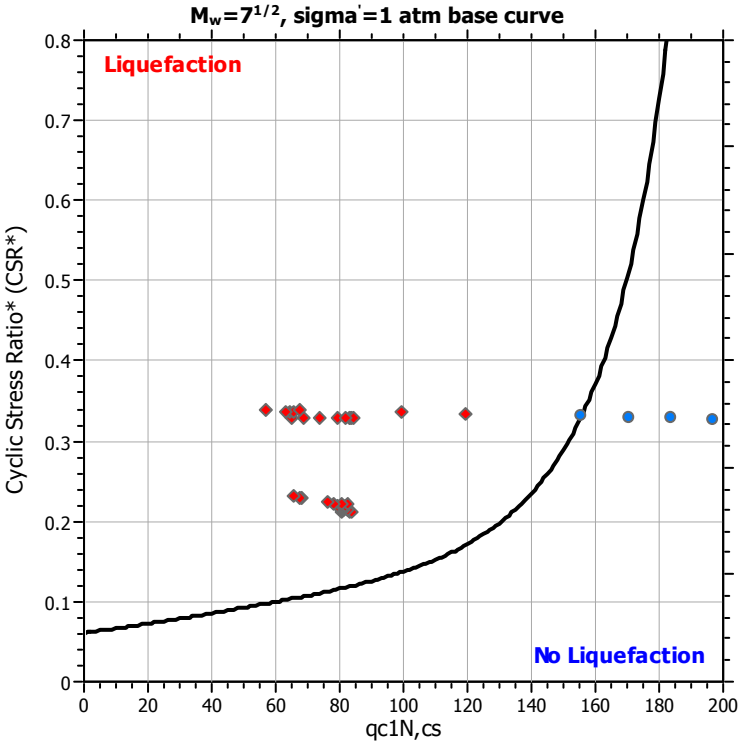
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

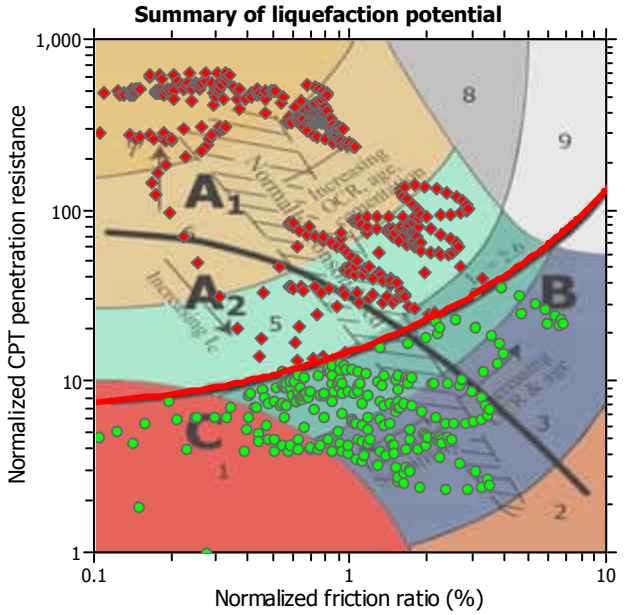
CPT file : CPT_08

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

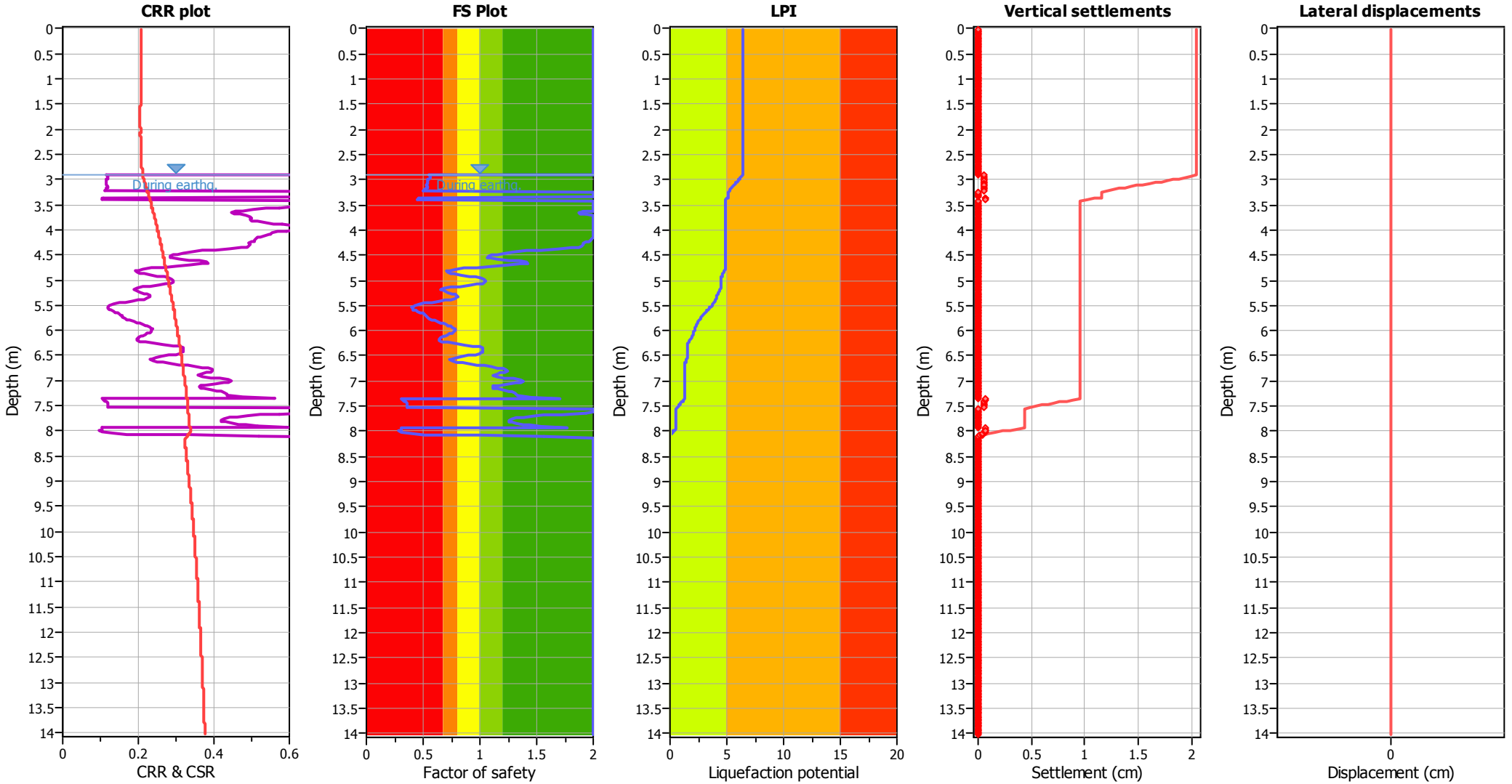






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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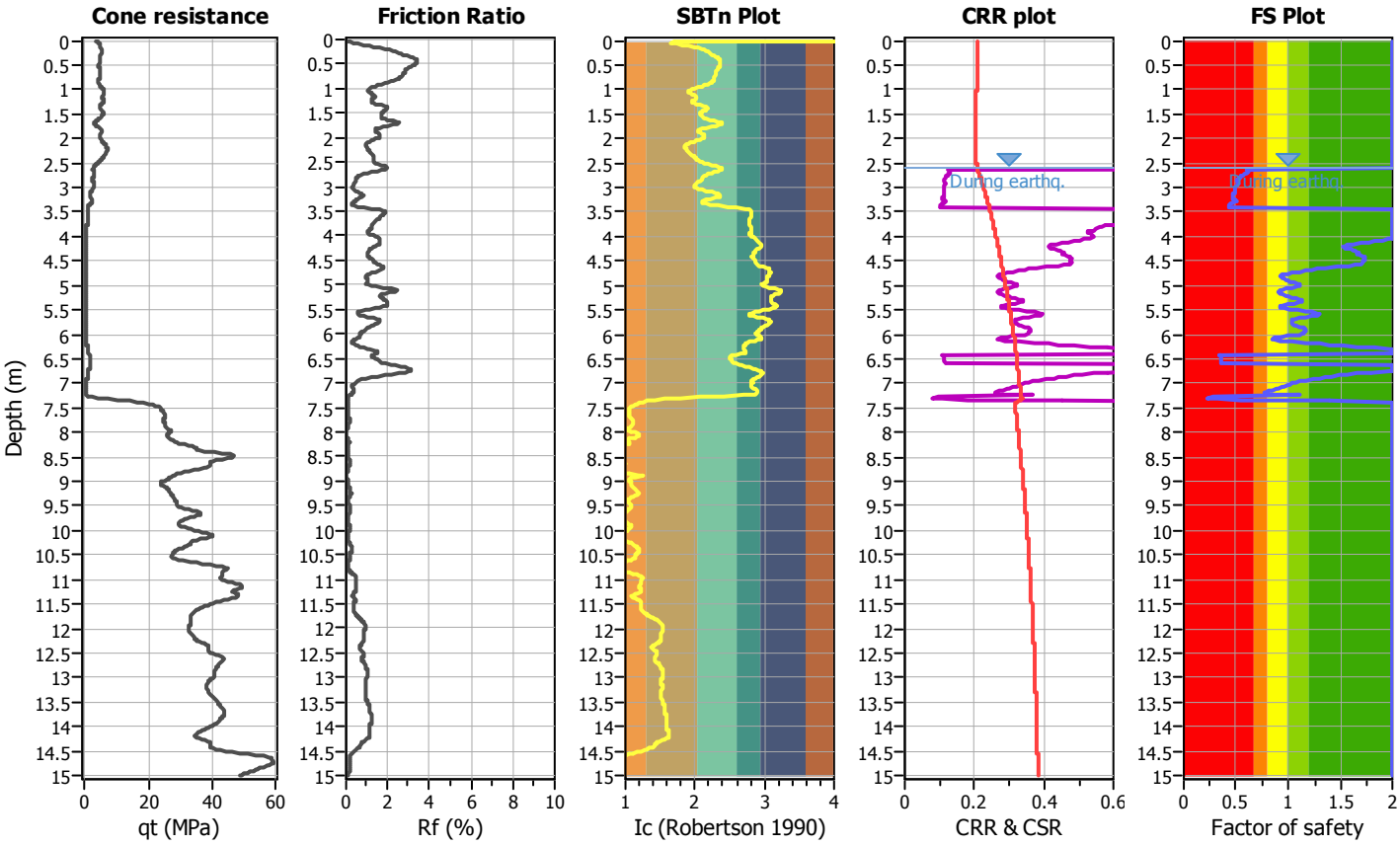
LIQUEFACTION ANALYSIS REPORT

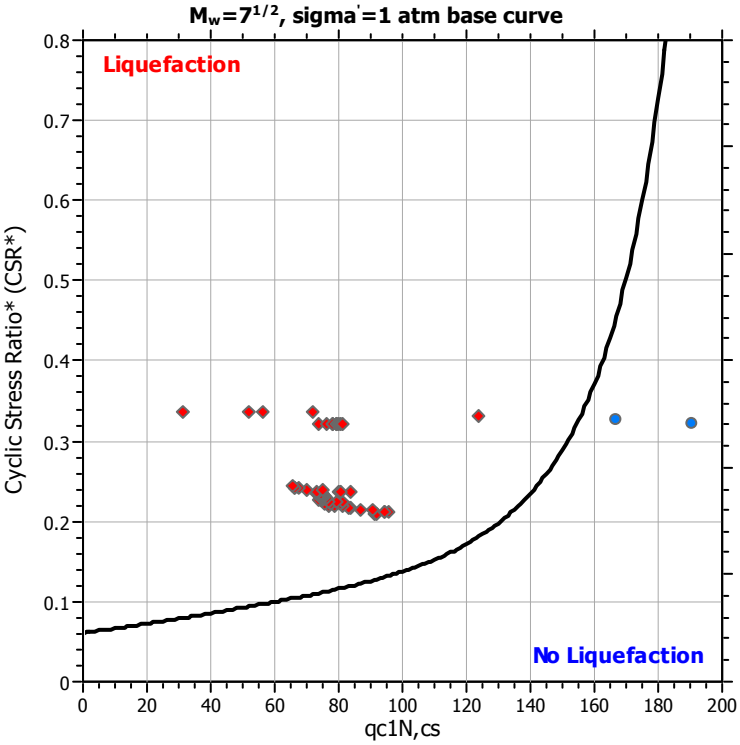
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

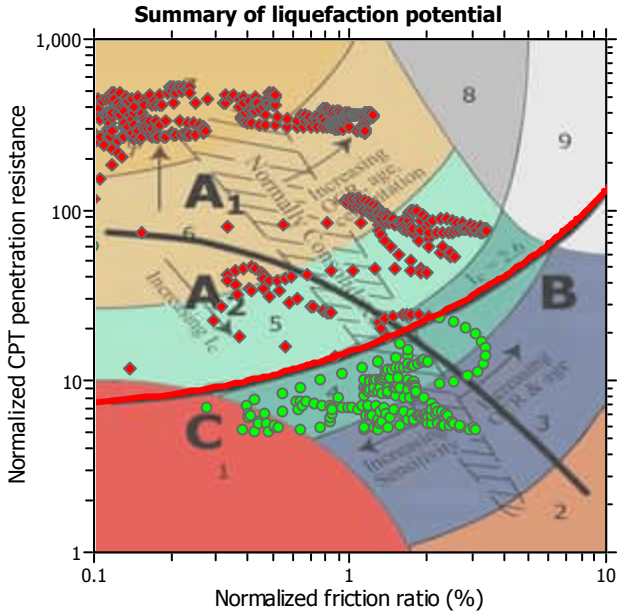
CPT file : CPT_09

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

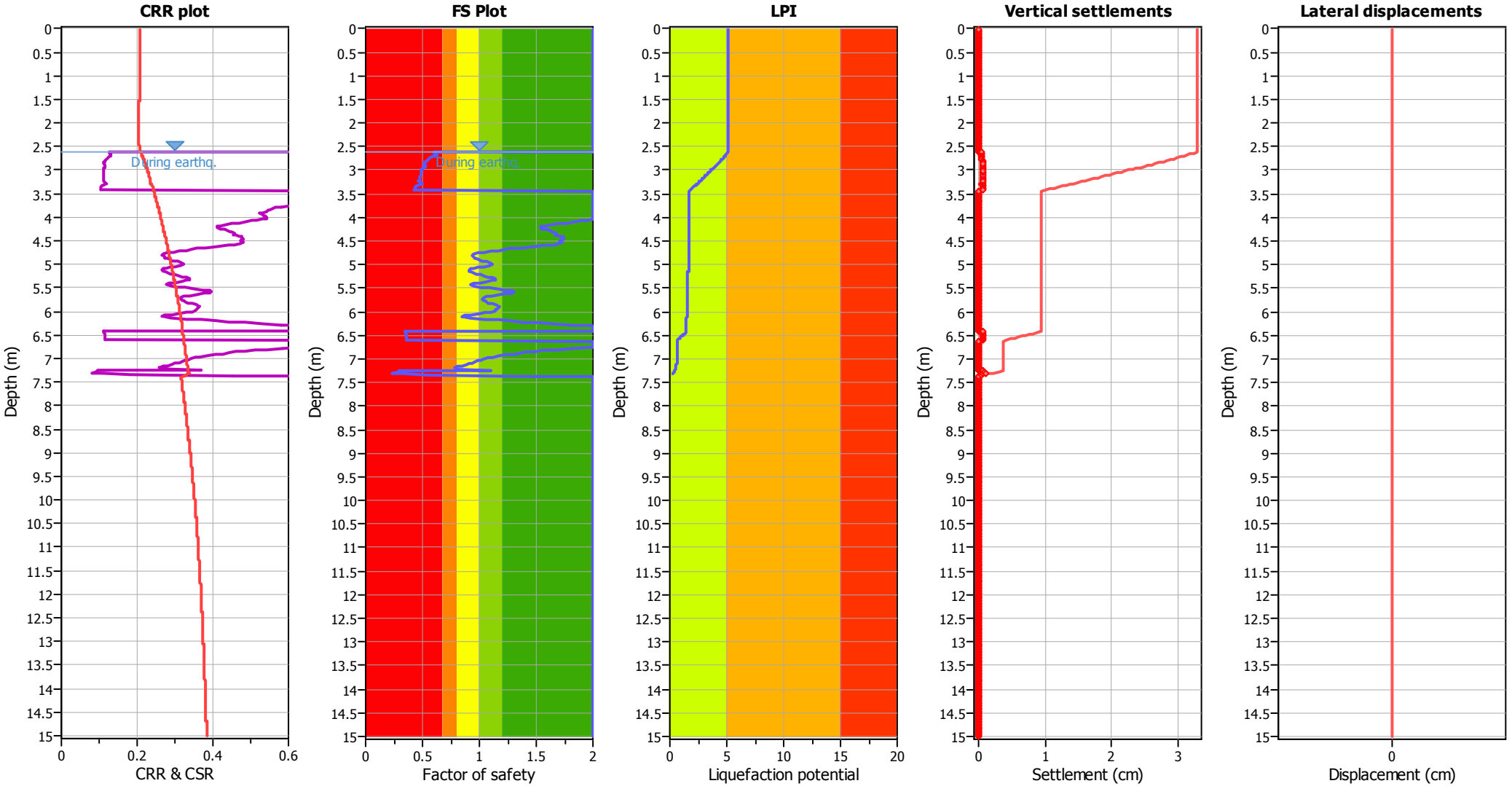






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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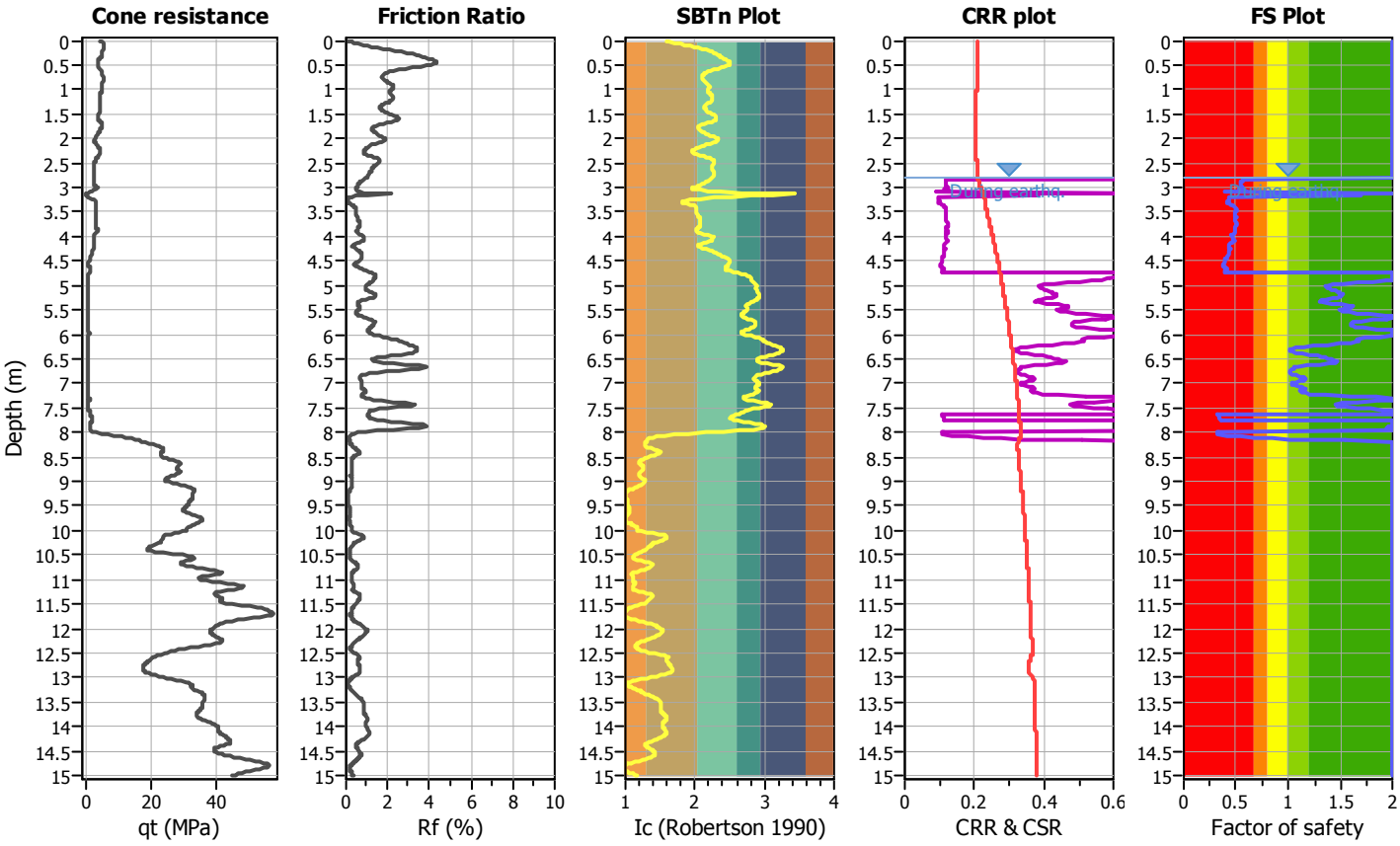
LIQUEFACTION ANALYSIS REPORT

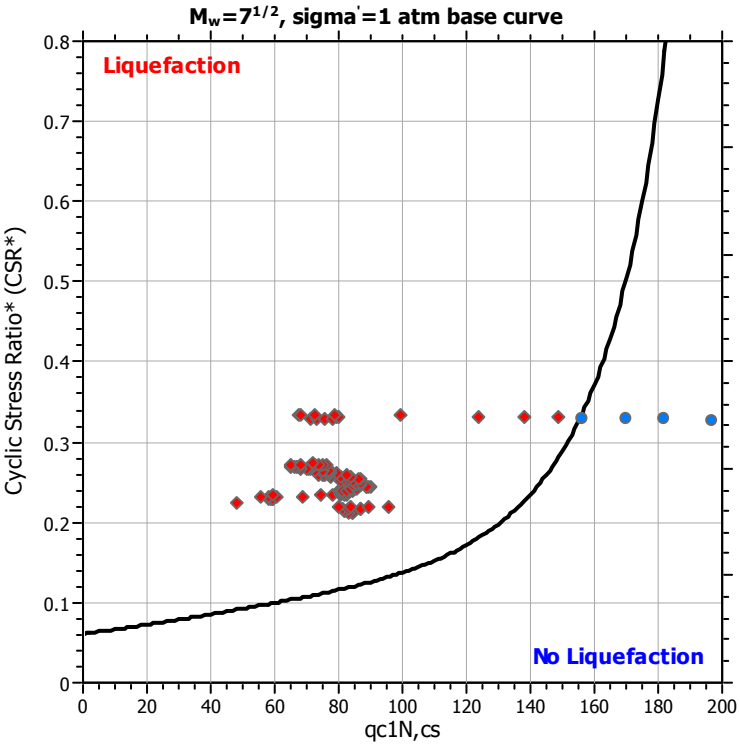
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

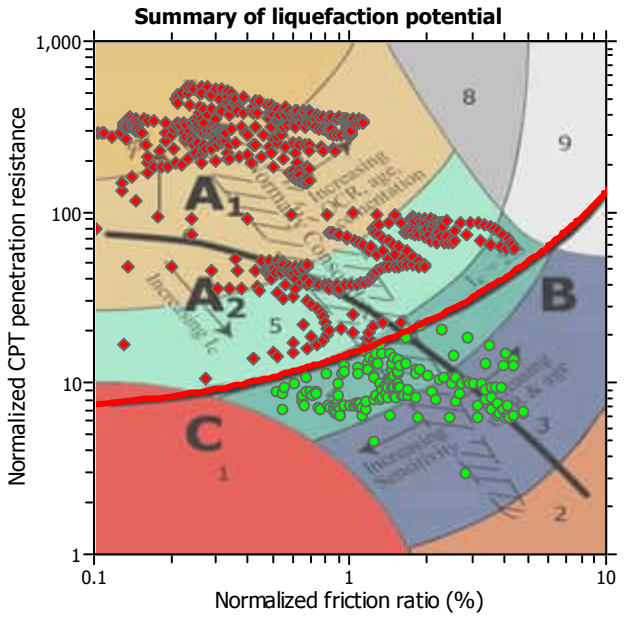
CPT file : CPT_10

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

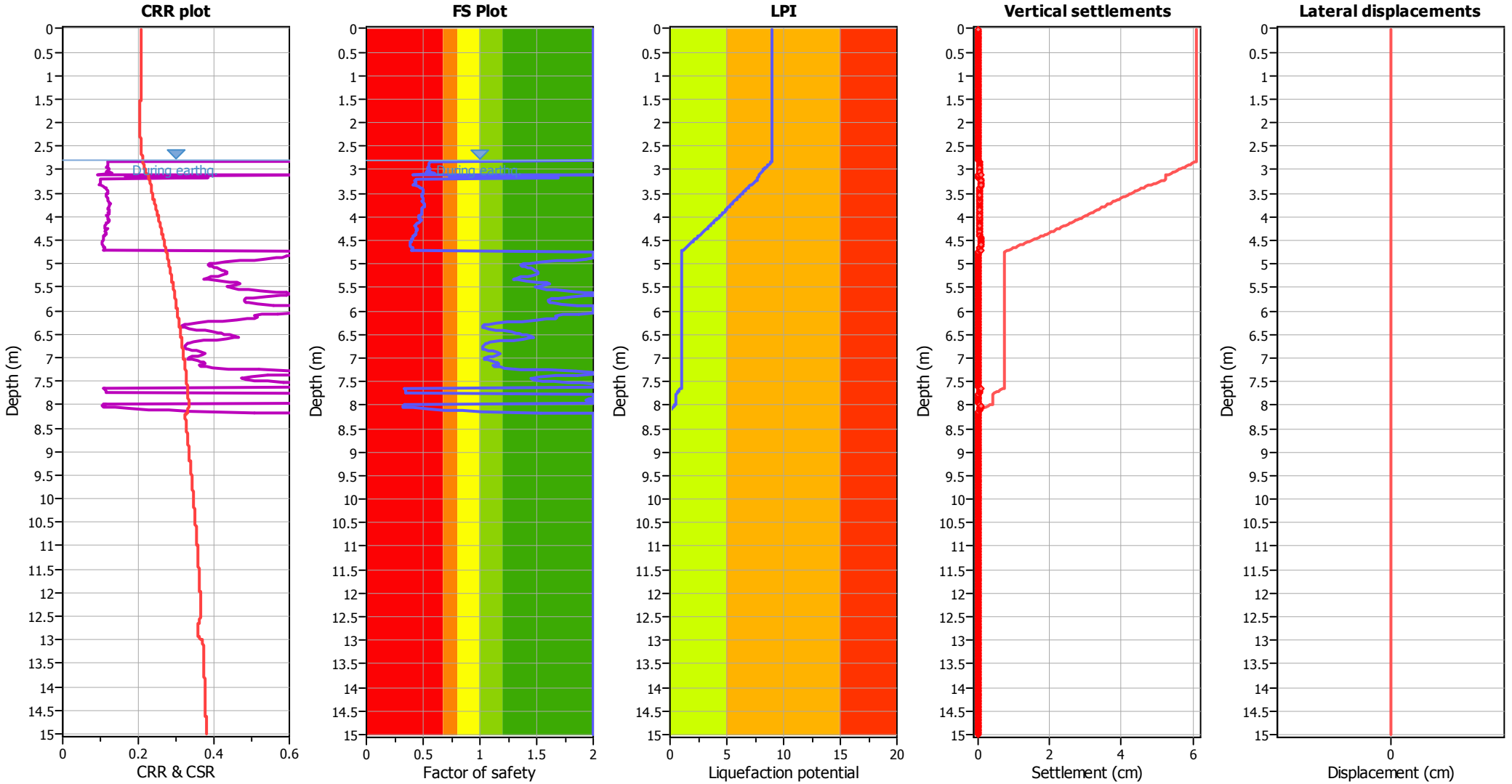






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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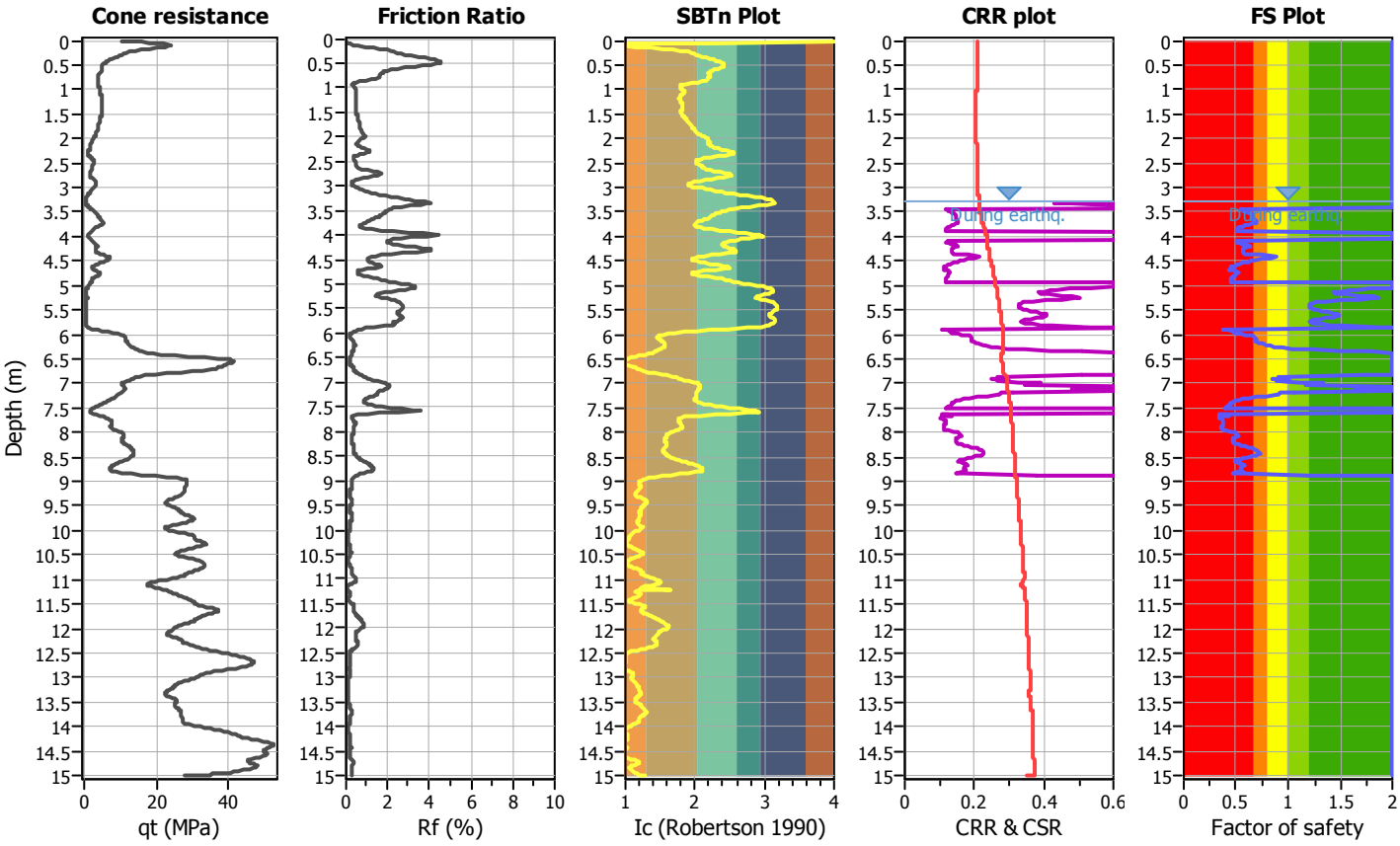
LIQUEFACTION ANALYSIS REPORT

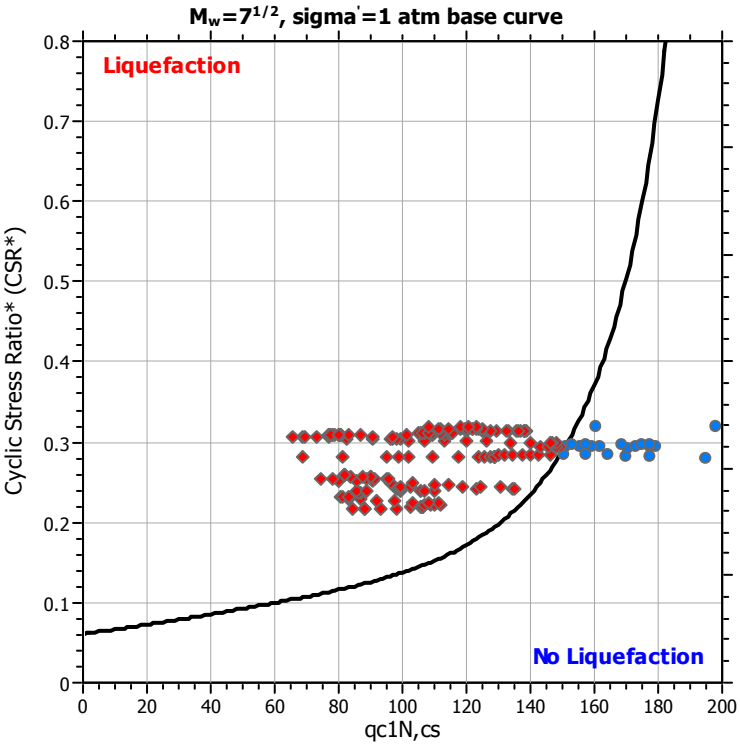
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

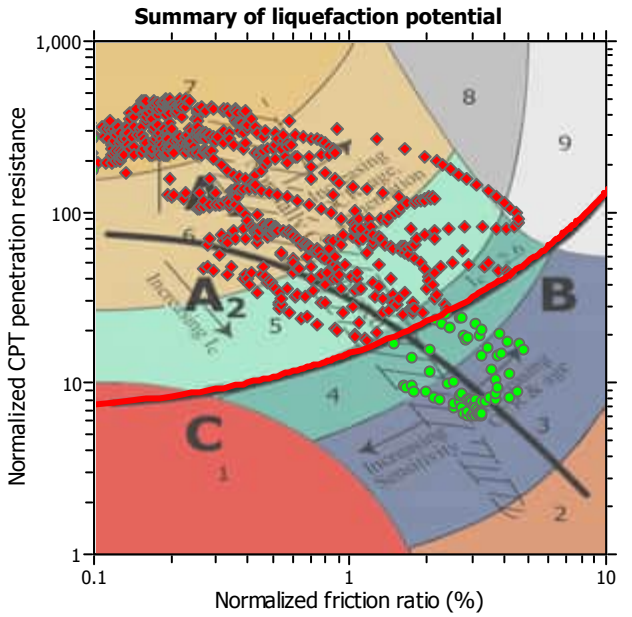
CPT file : CPT_11

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

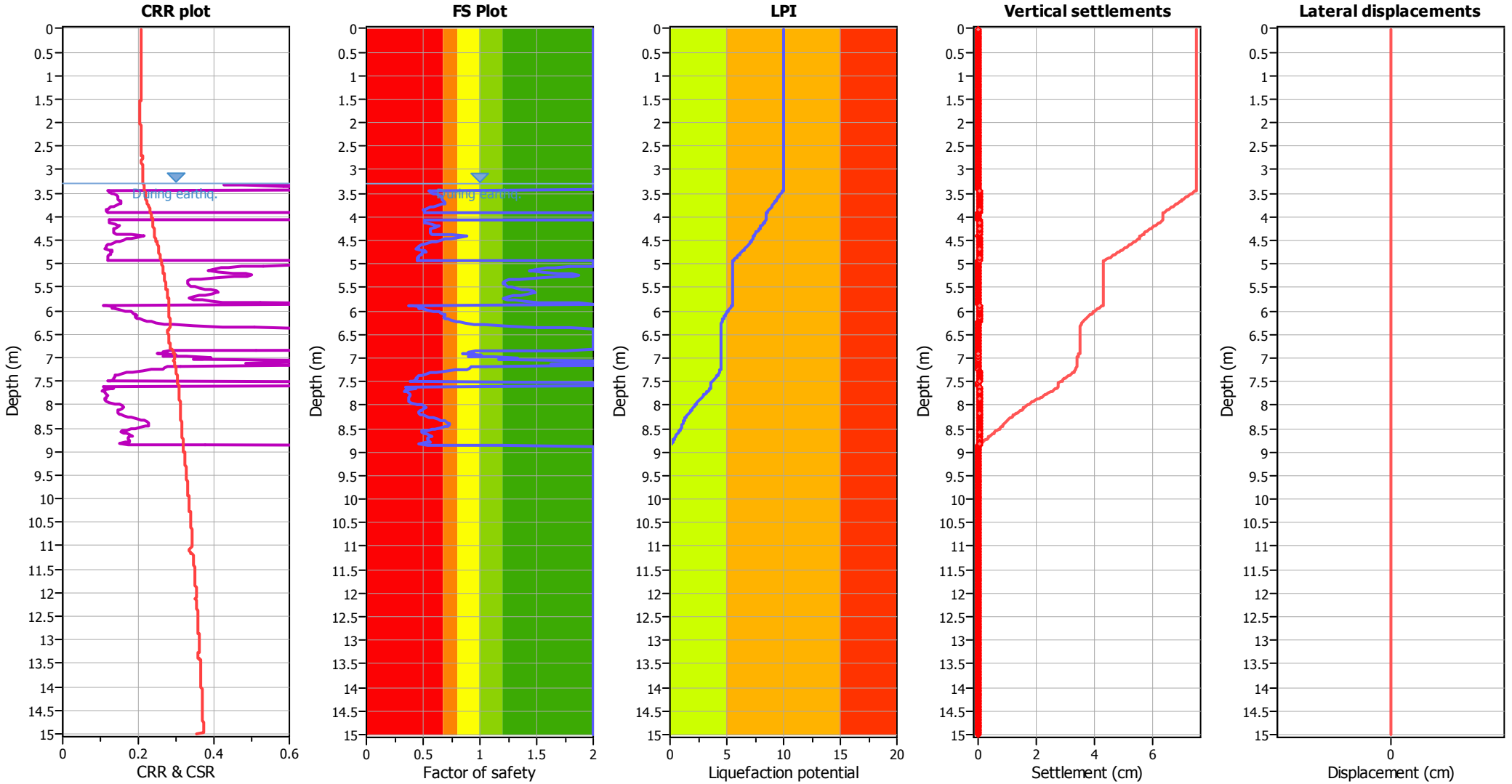






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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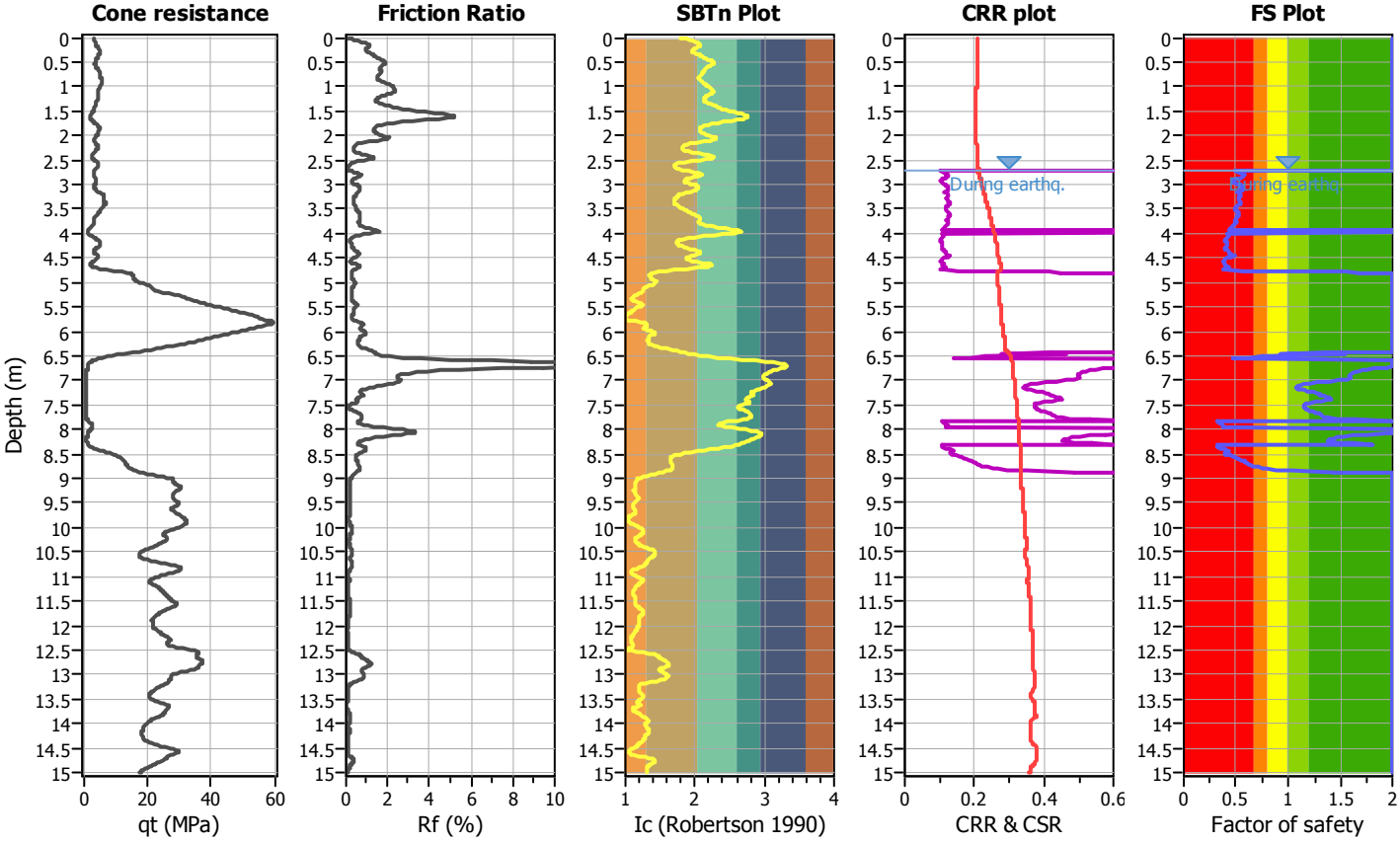
LIQUEFACTION ANALYSIS REPORT

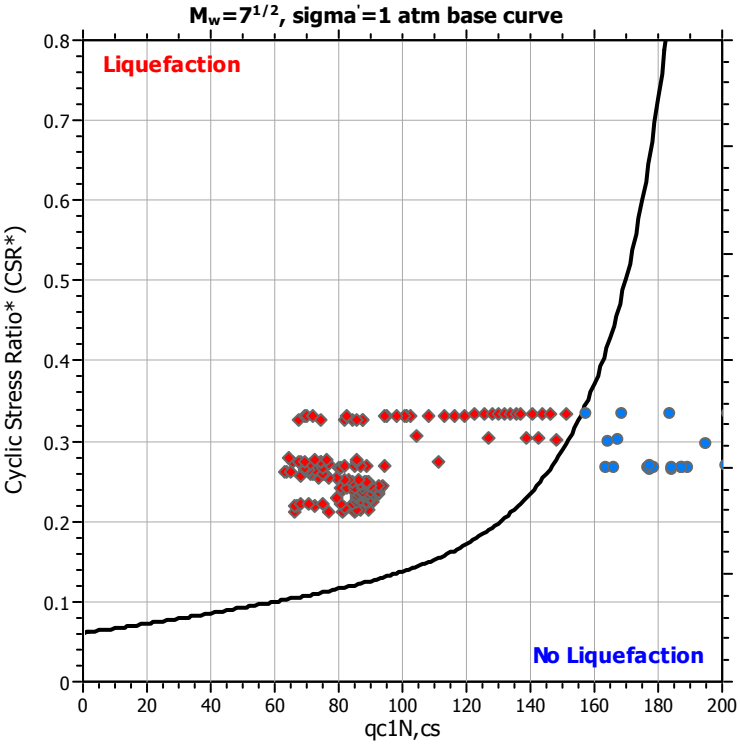
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

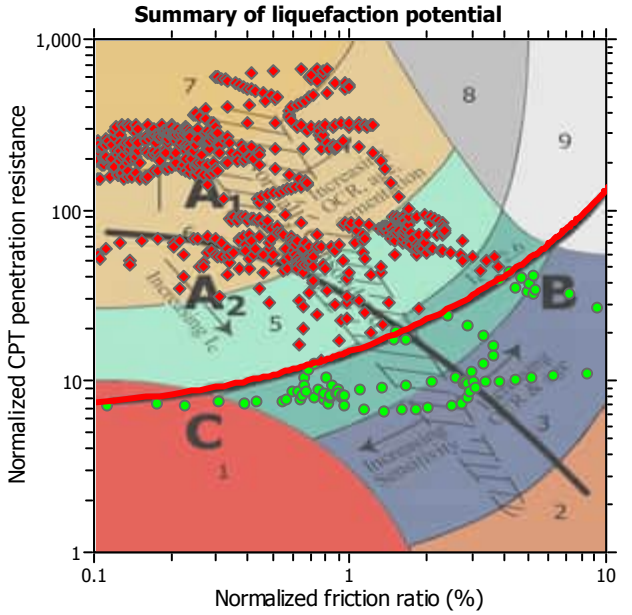
CPT file : CPT_12

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

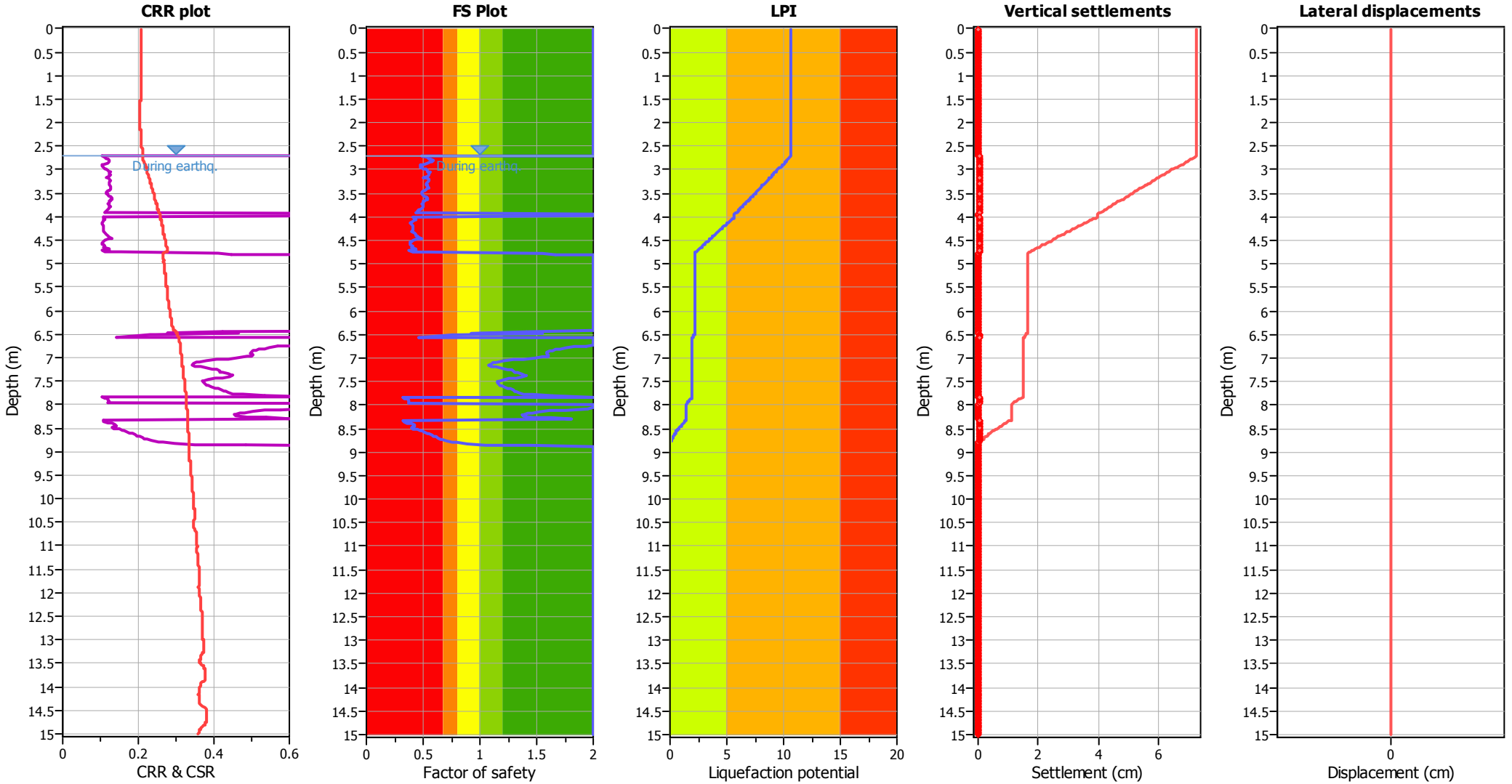






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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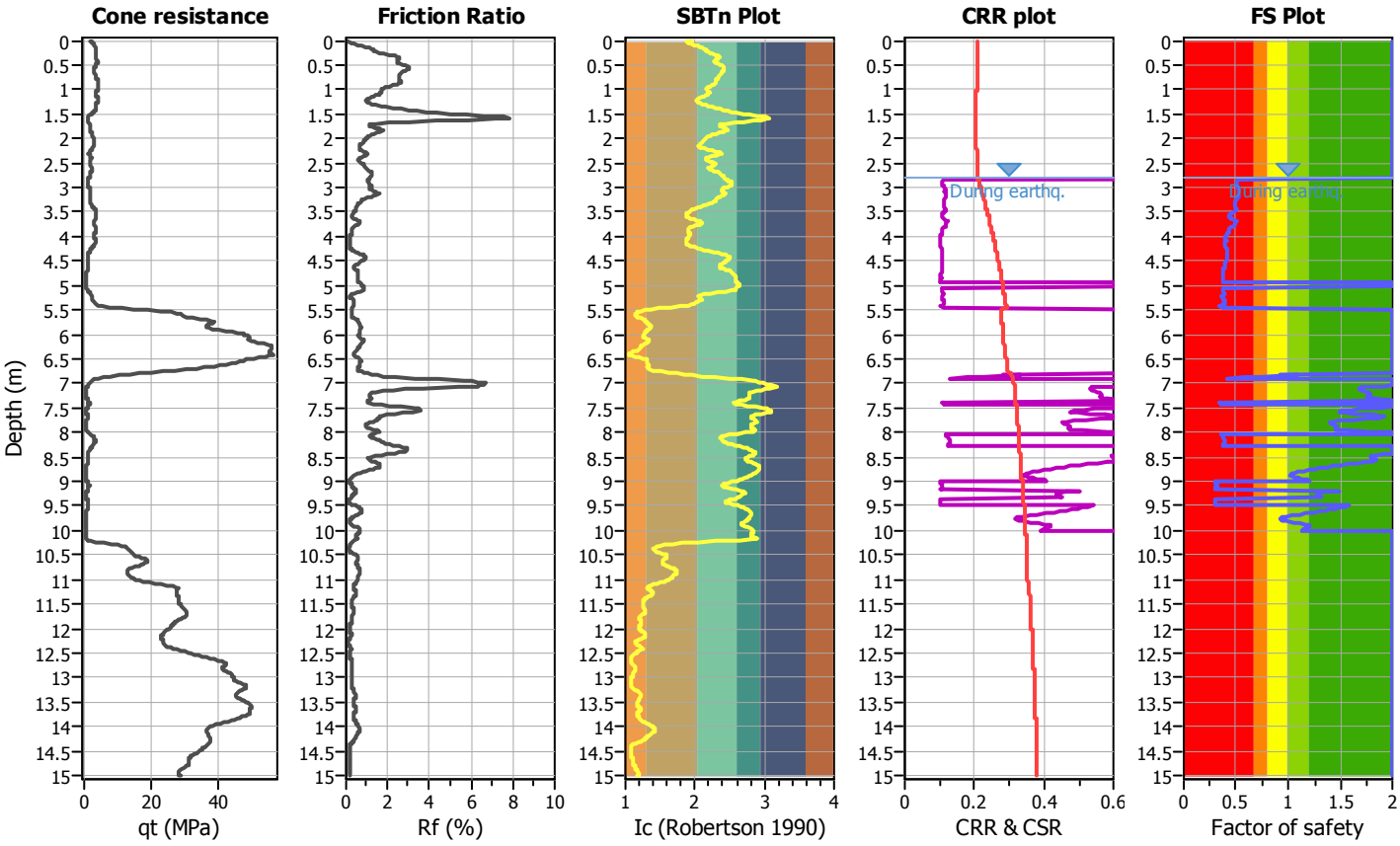
LIQUEFACTION ANALYSIS REPORT

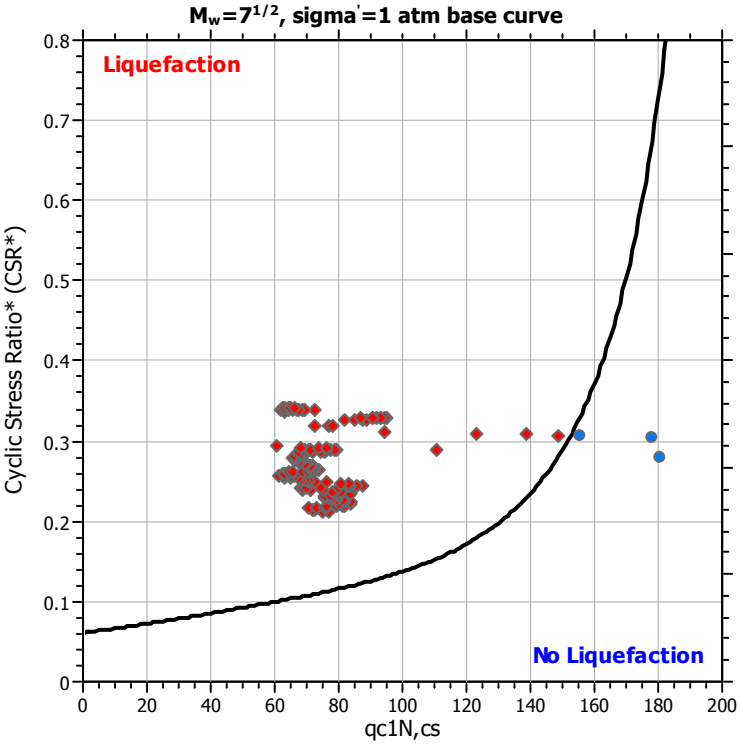
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

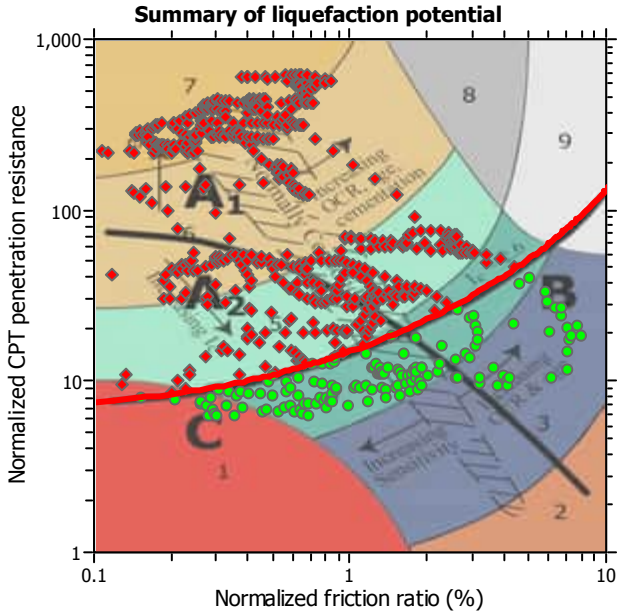
CPT file : CPT_13

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

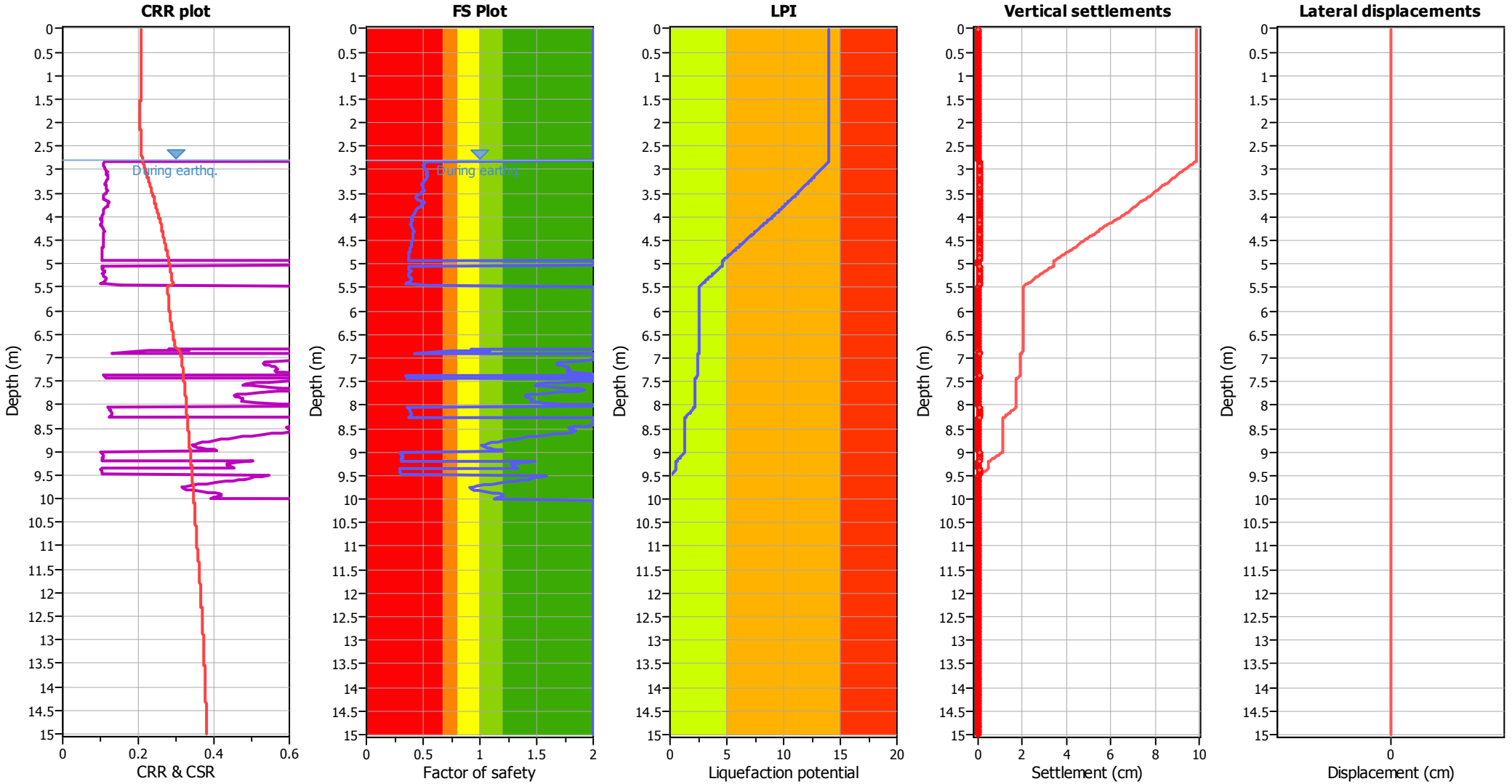






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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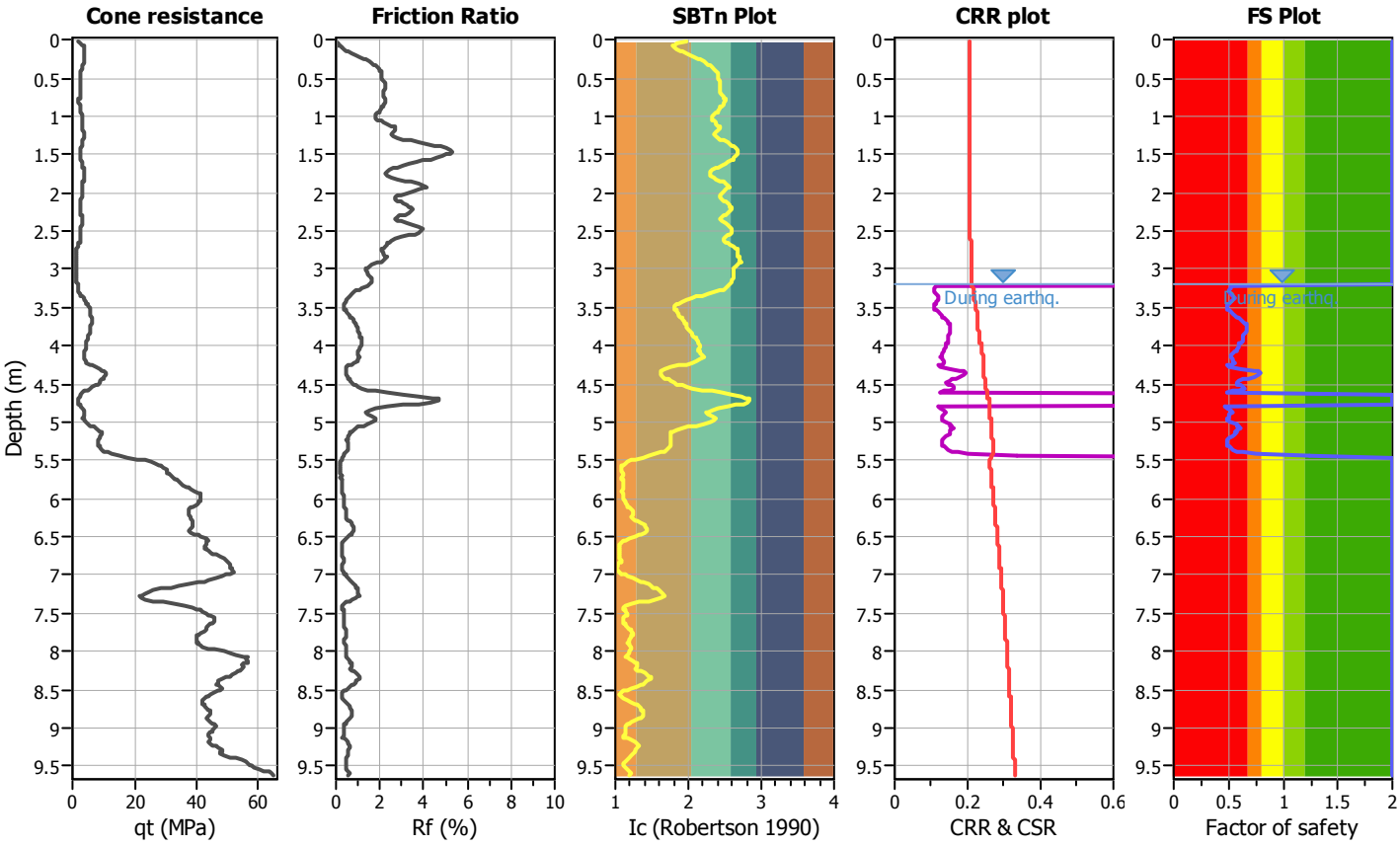
LIQUEFACTION ANALYSIS REPORT

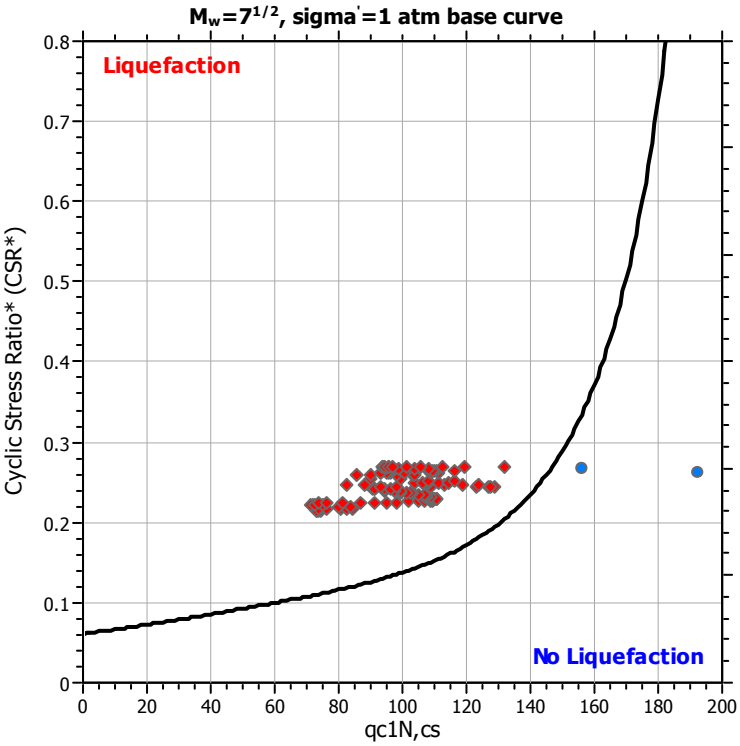
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

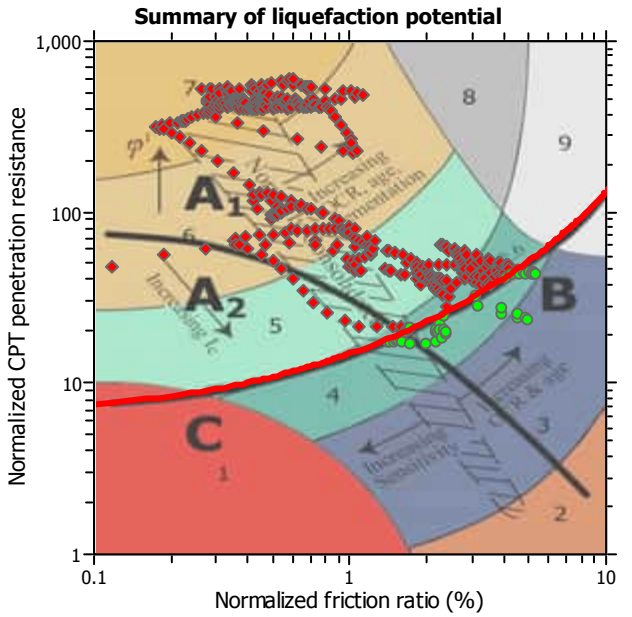
CPT file : CPT_14

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

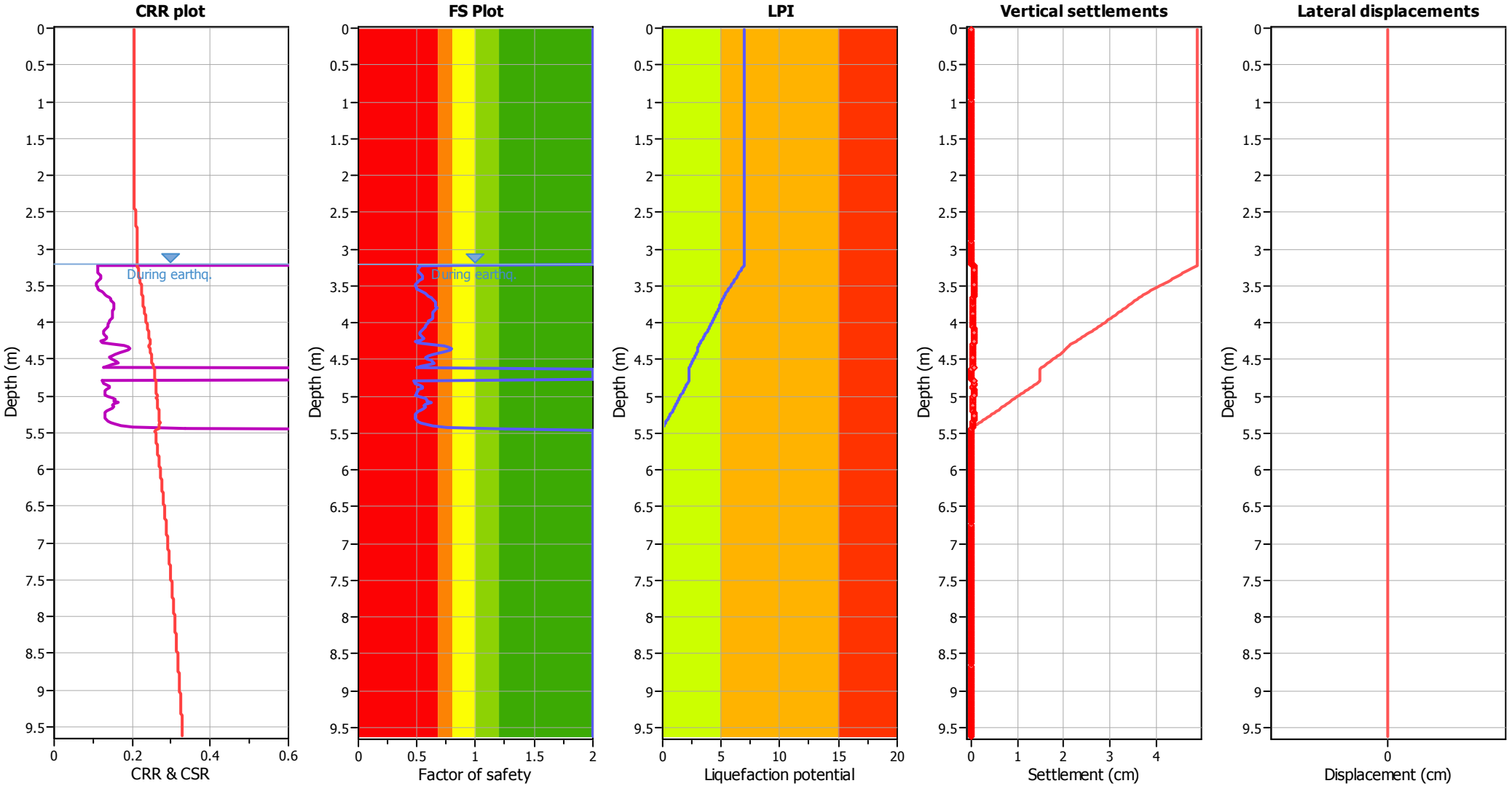






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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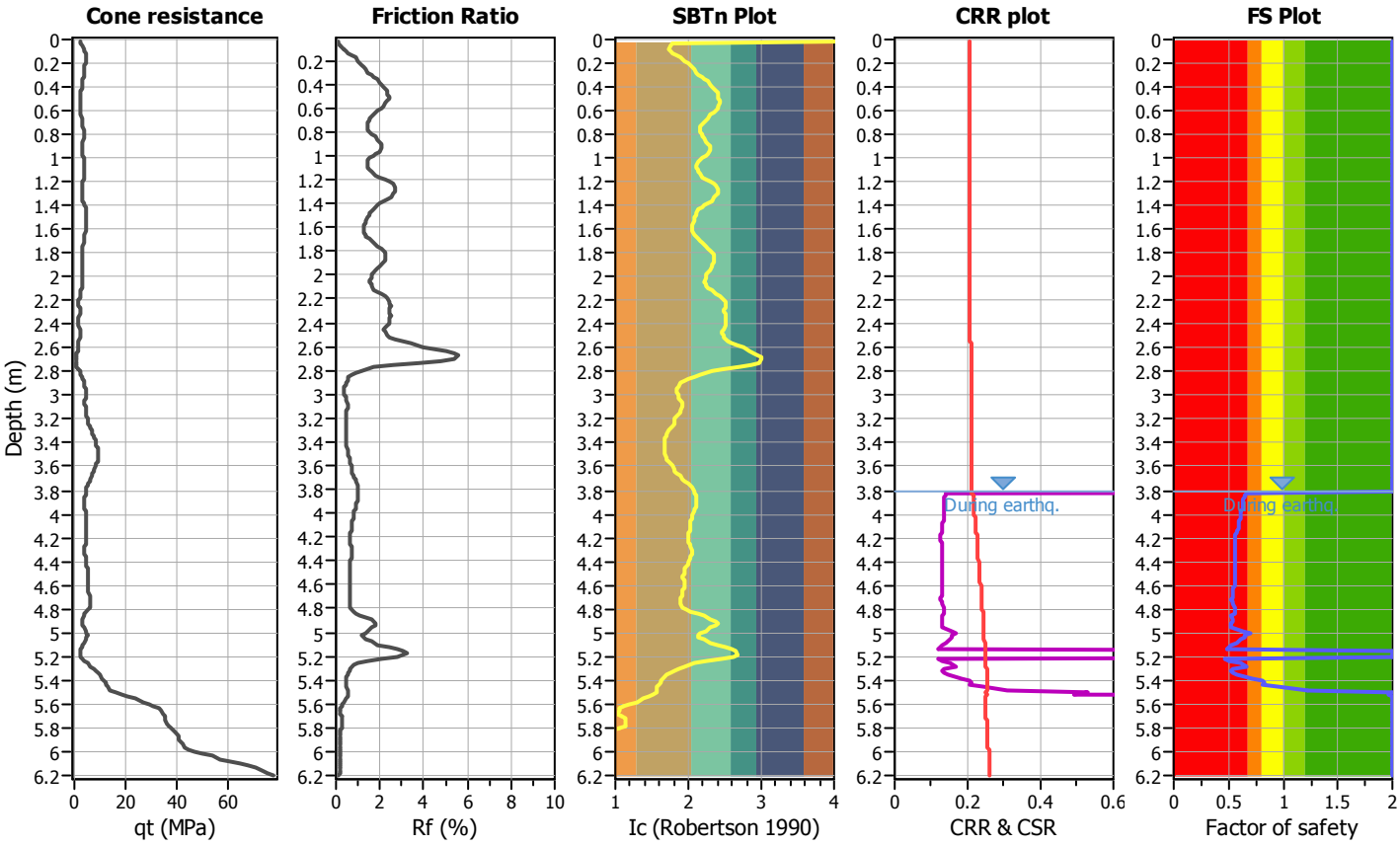
LIQUEFACTION ANALYSIS REPORT

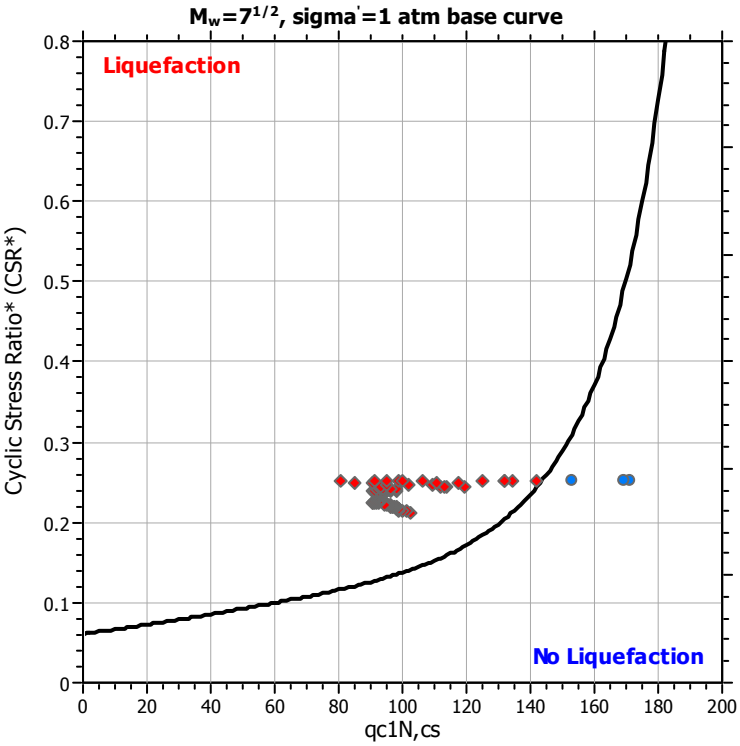
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

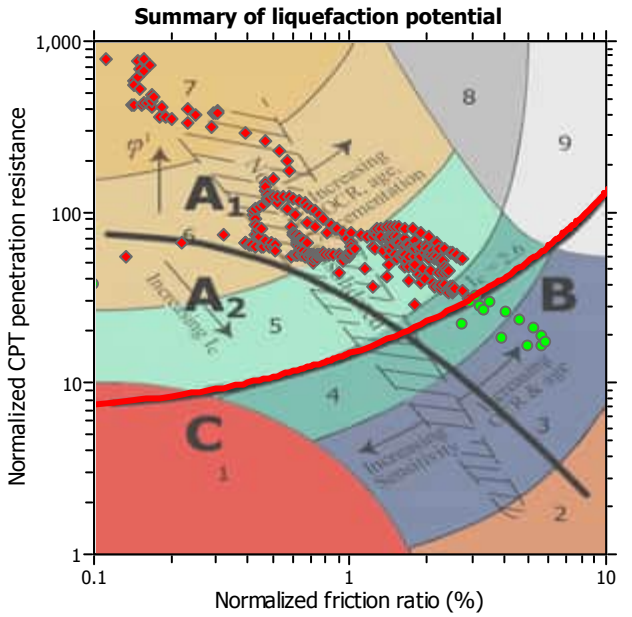
CPT file : CPT_15

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

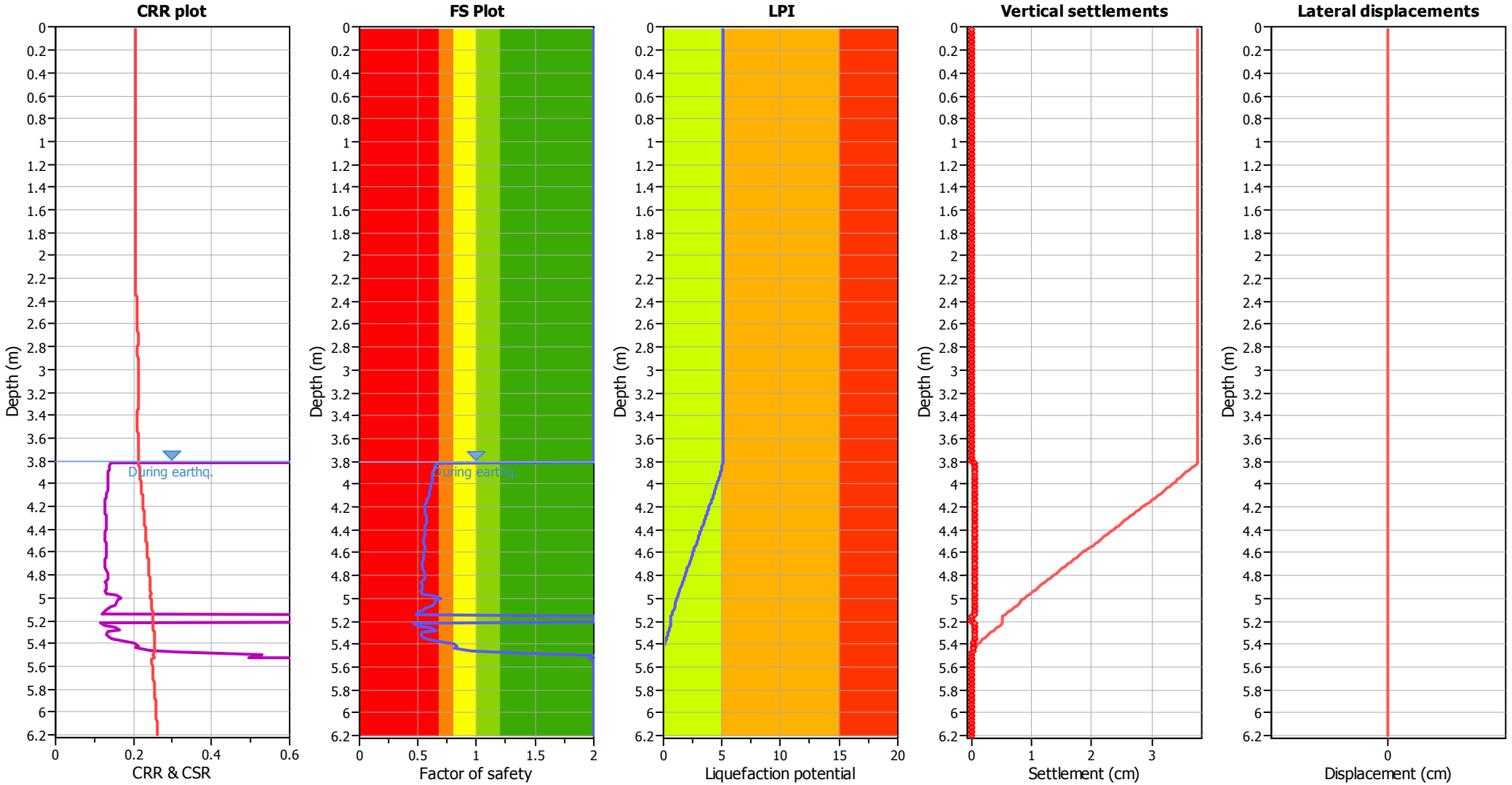






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
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- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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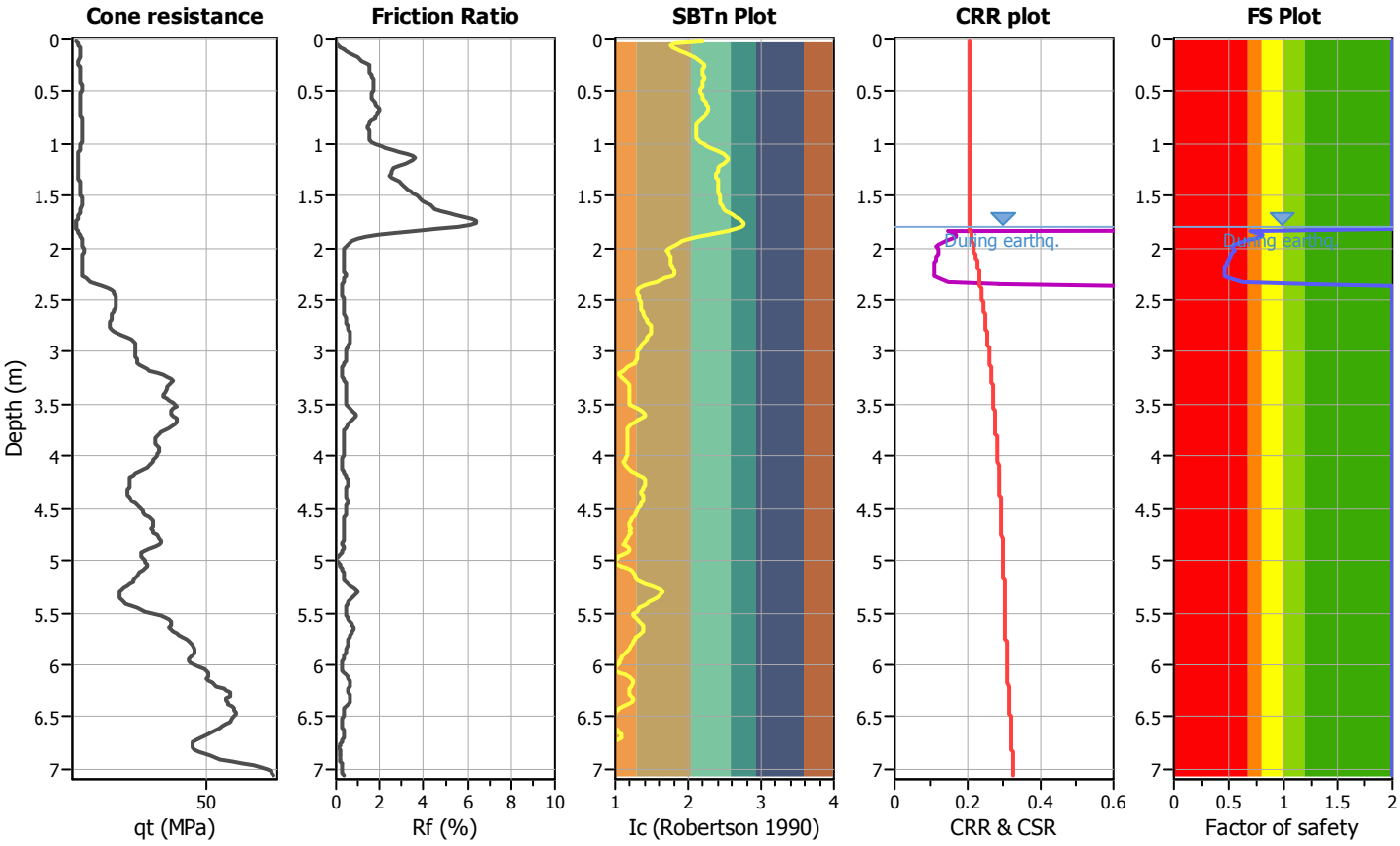
LIQUEFACTION ANALYSIS REPORT

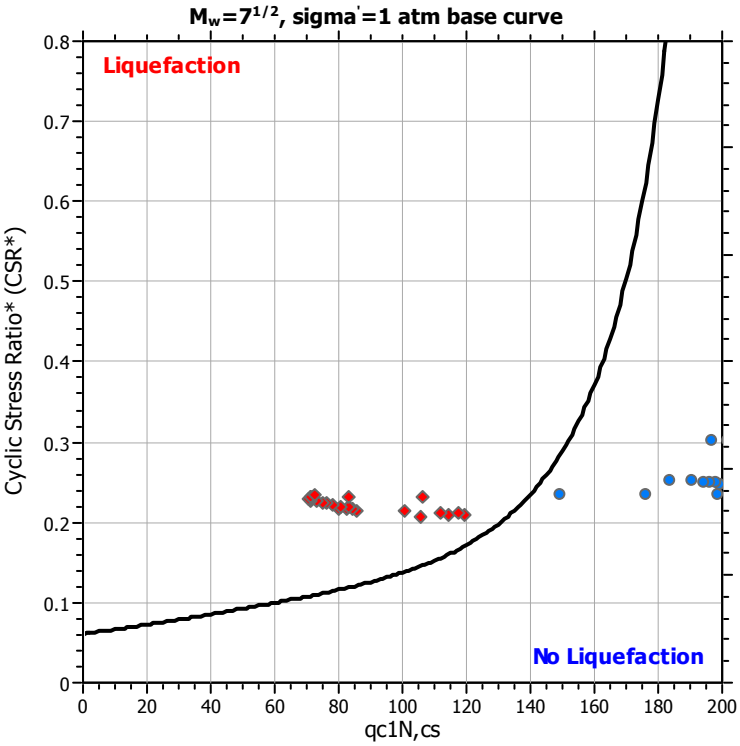
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

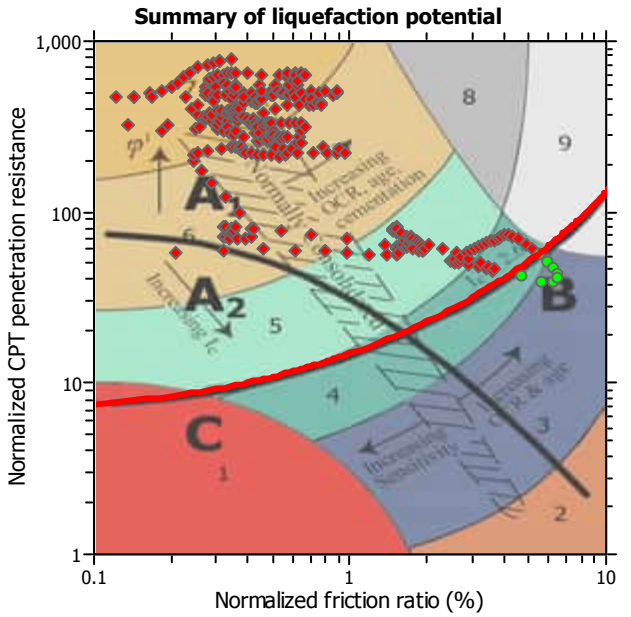
CPT file : CPT_16

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

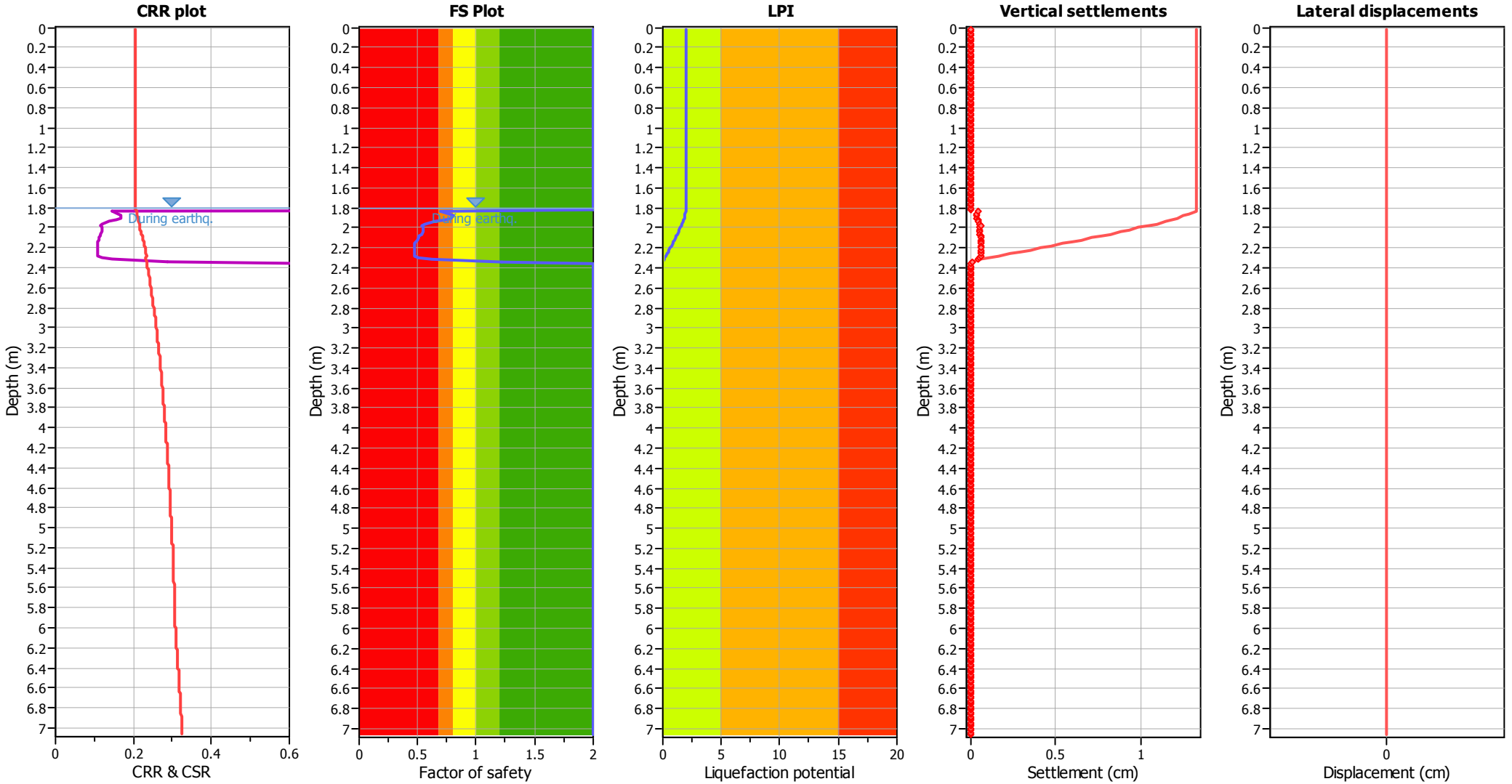






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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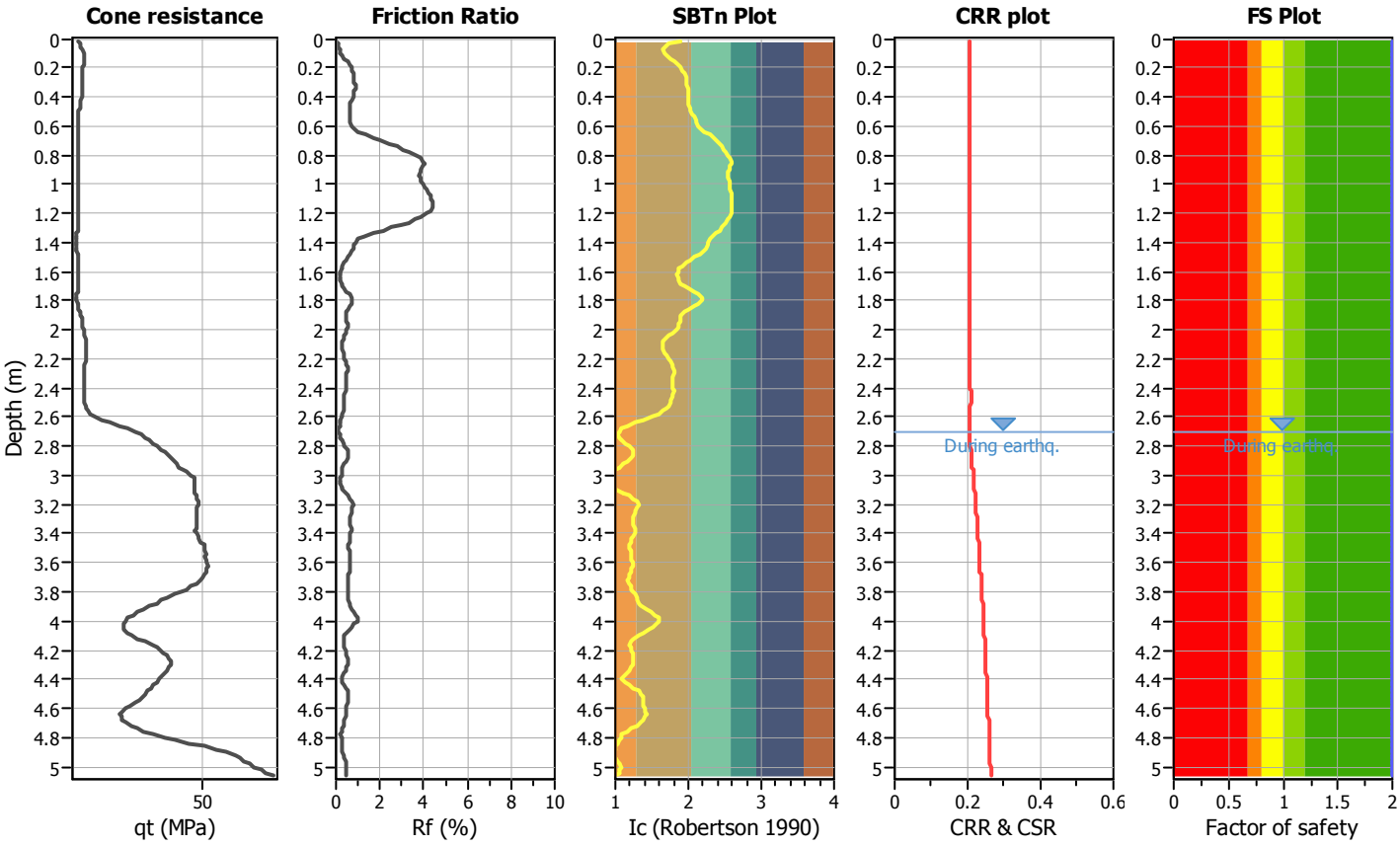
LIQUEFACTION ANALYSIS REPORT

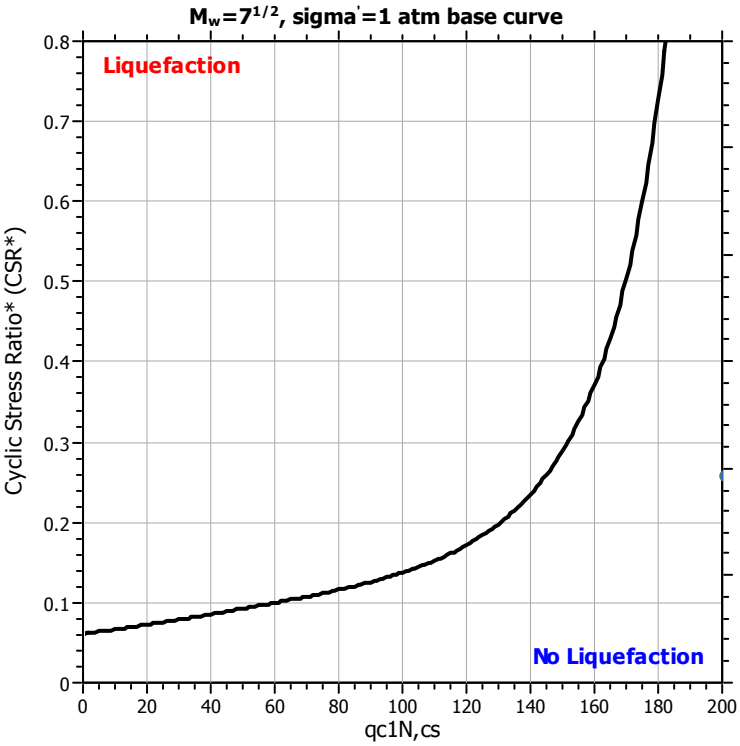
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

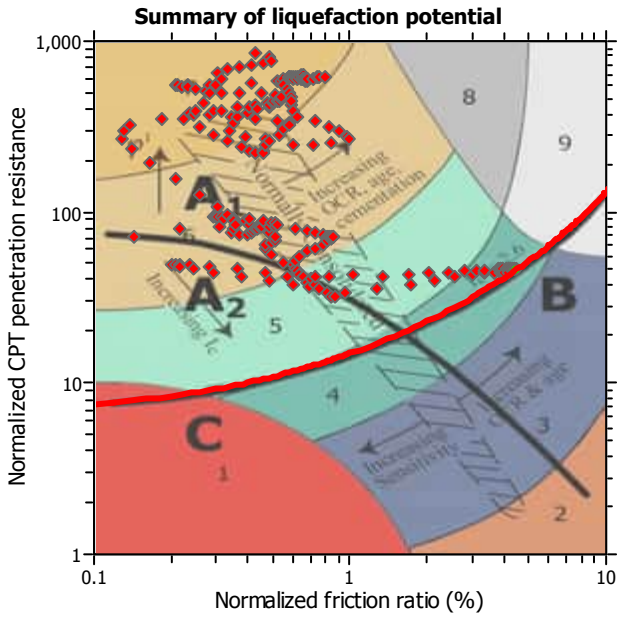
CPT file : CPT_17

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

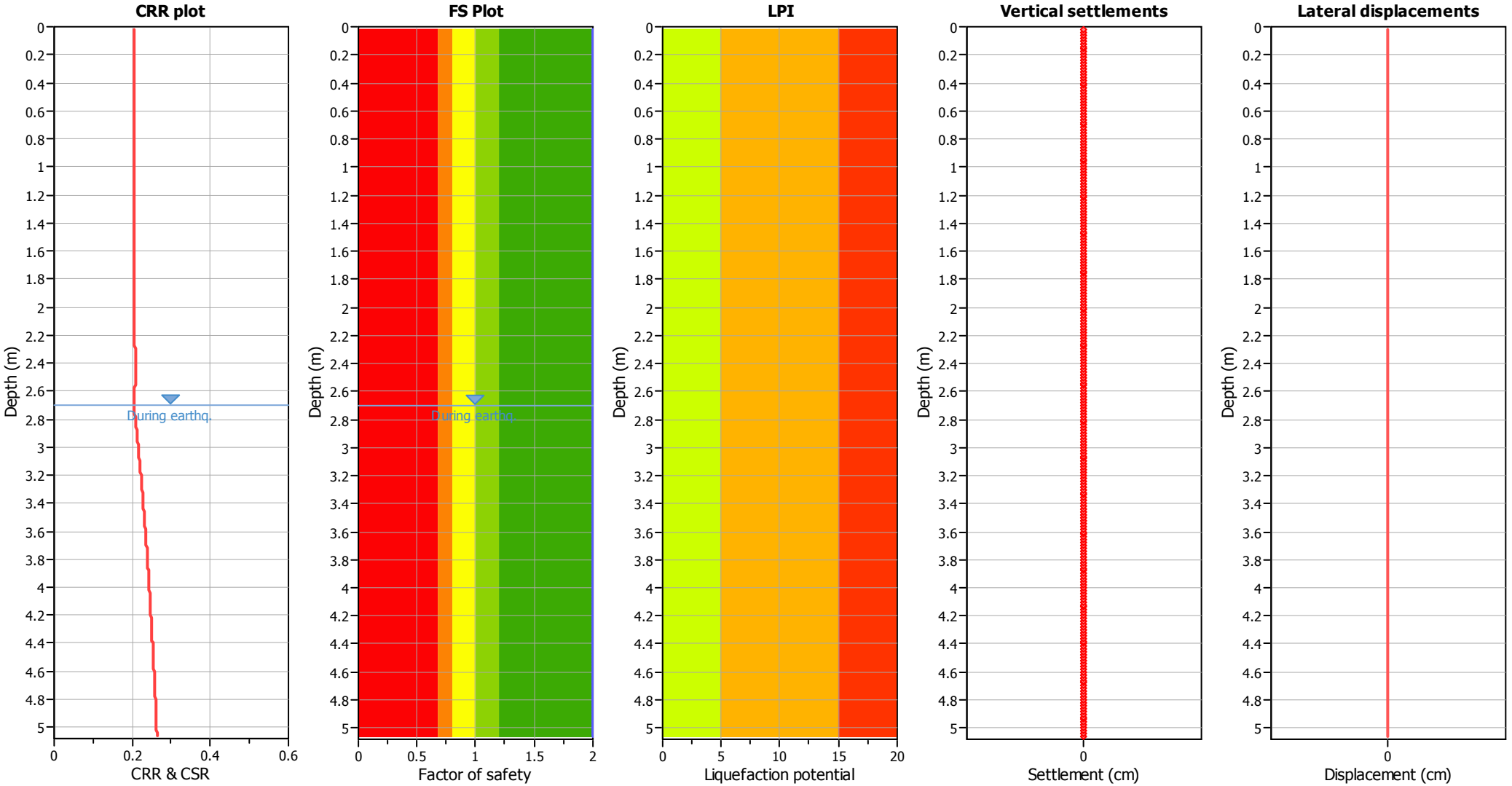






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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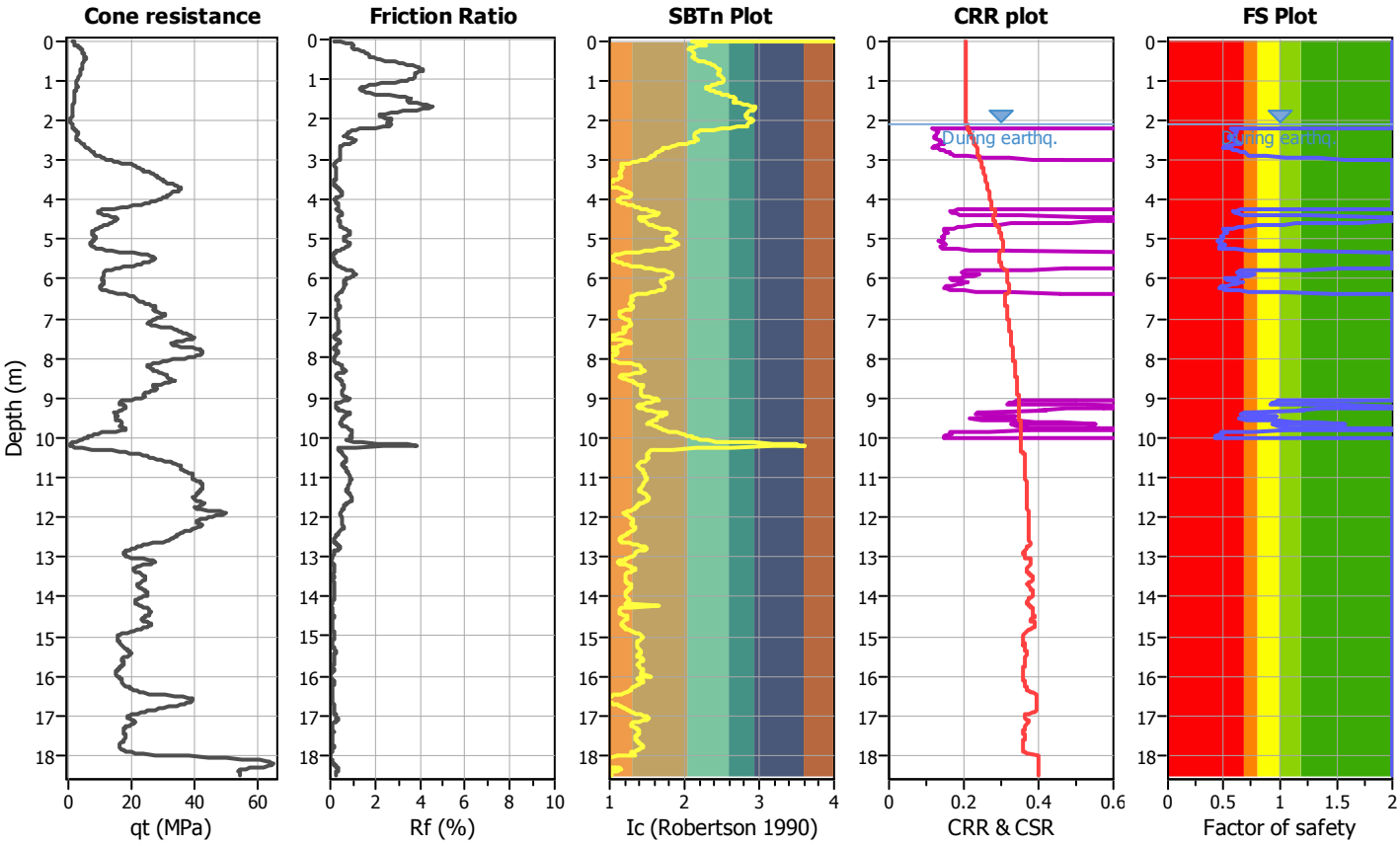
LIQUEFACTION ANALYSIS REPORT

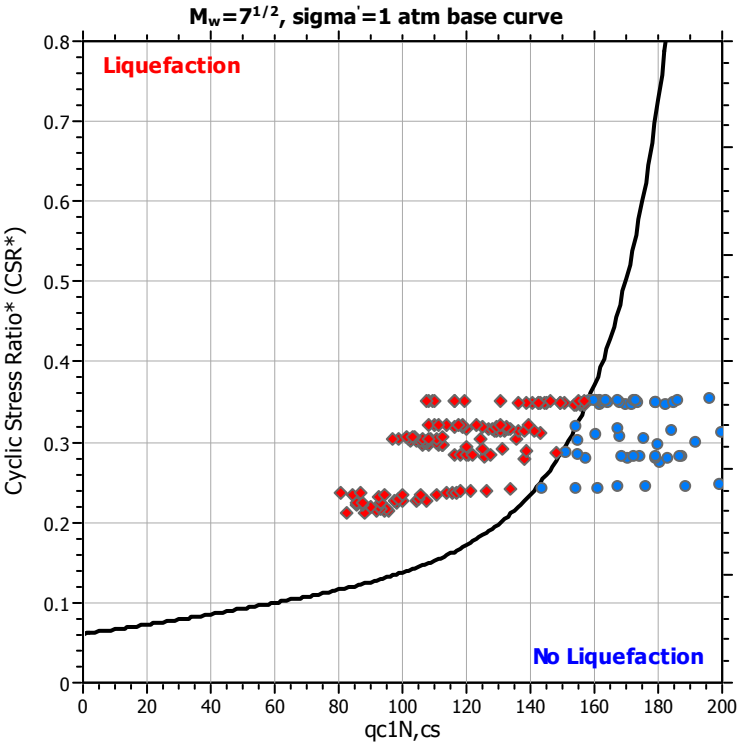
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

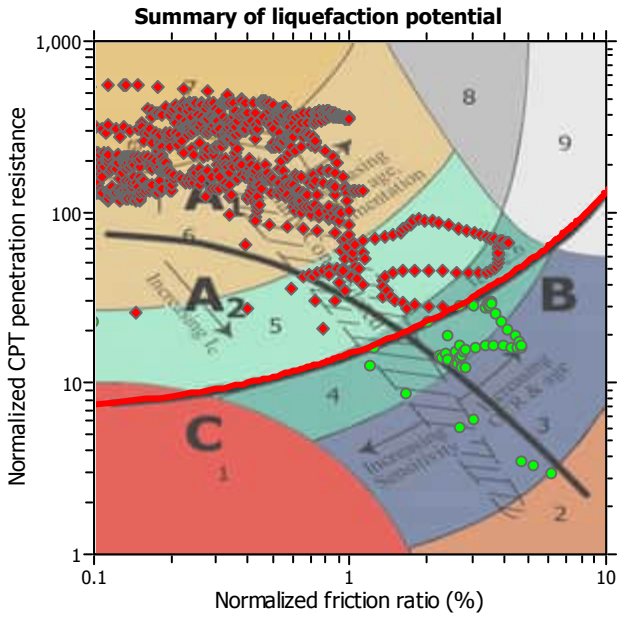
CPT file : CPT_18

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

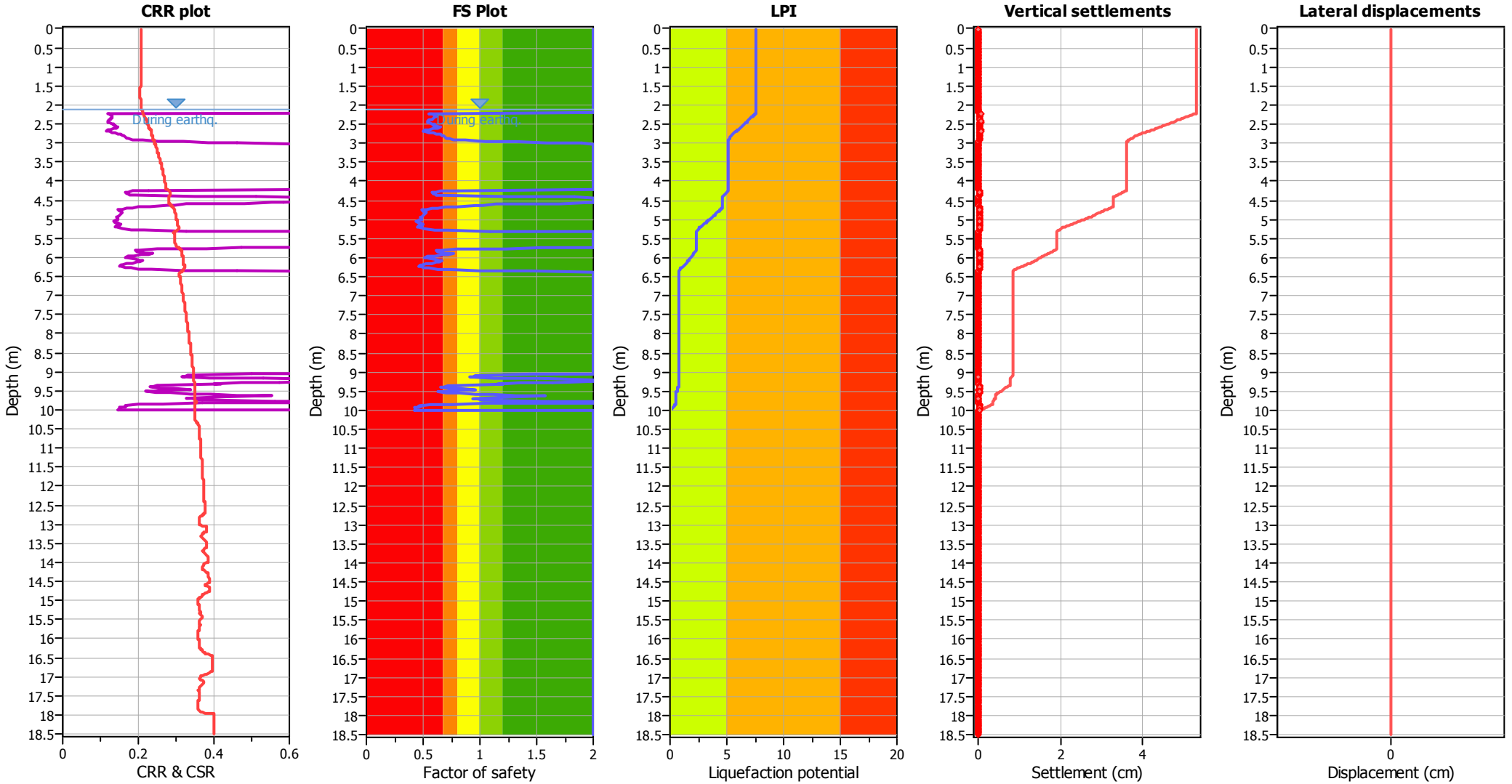






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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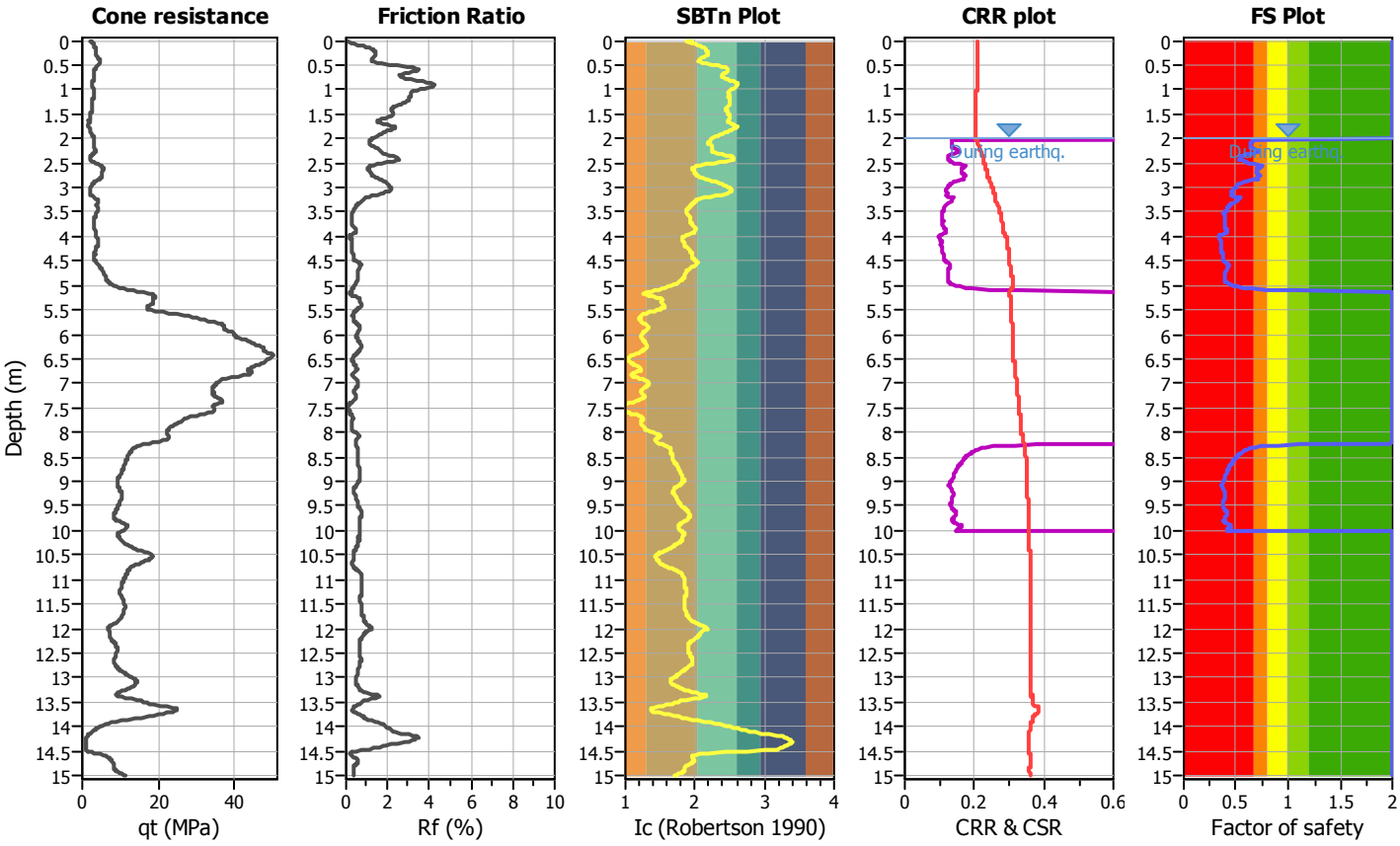
LIQUEFACTION ANALYSIS REPORT

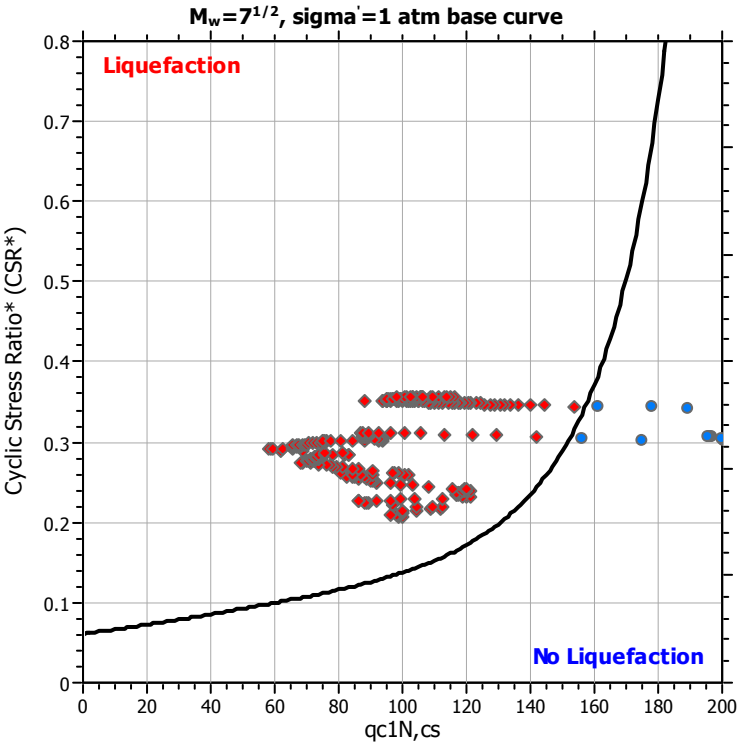
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

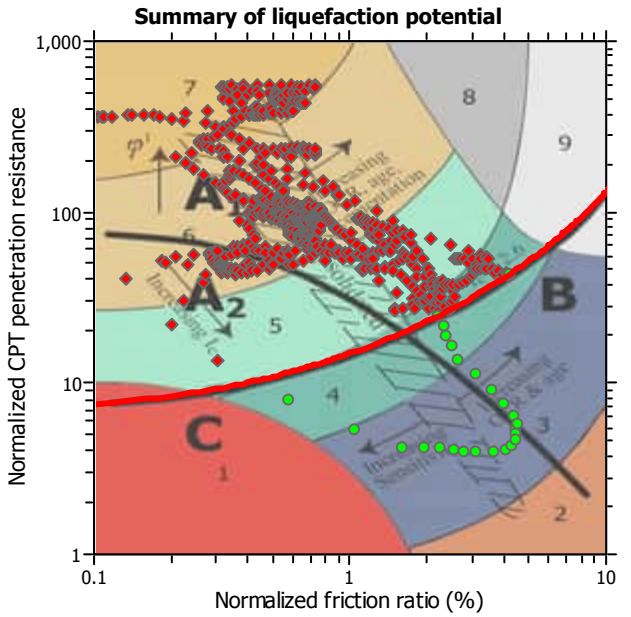
CPT file : CPT_19

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

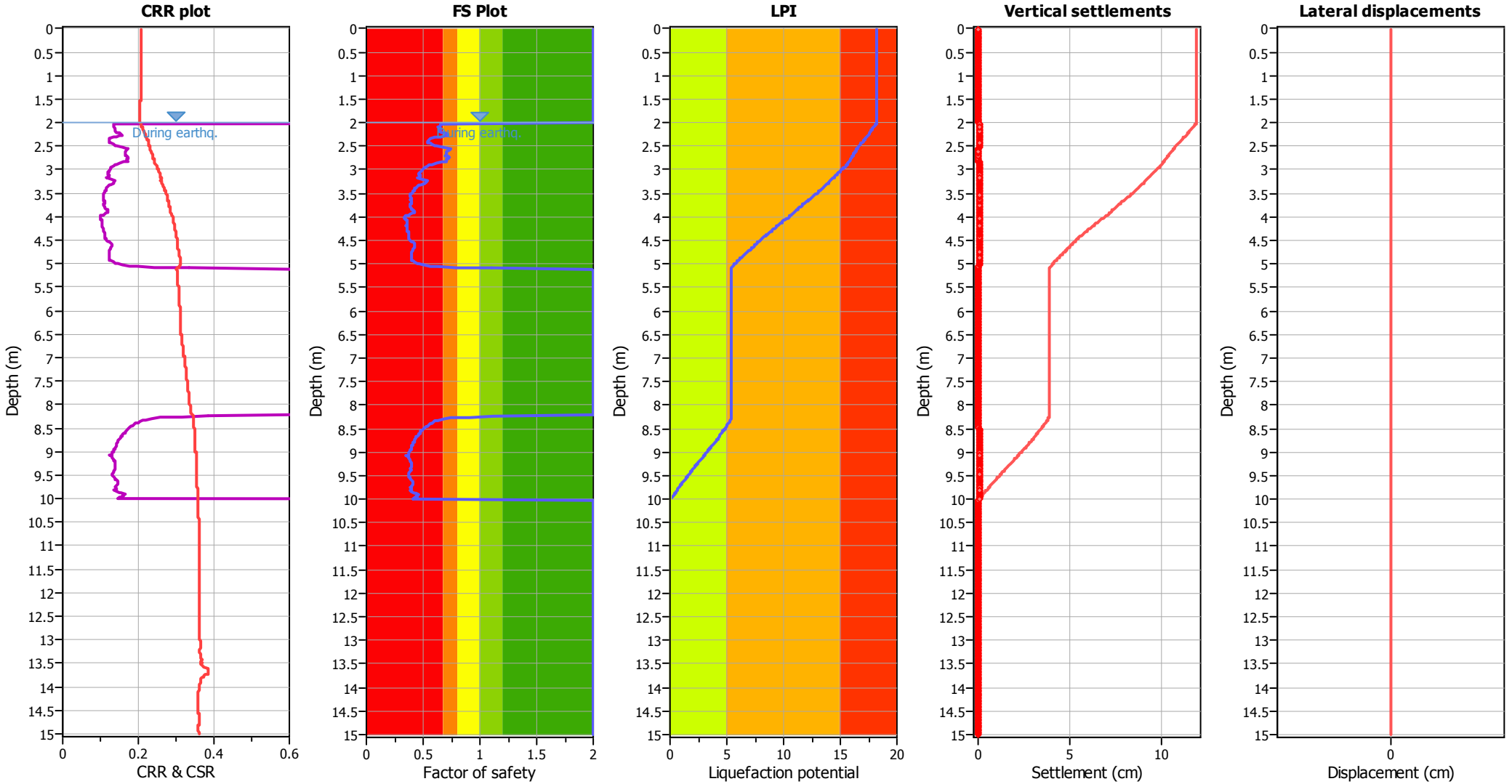






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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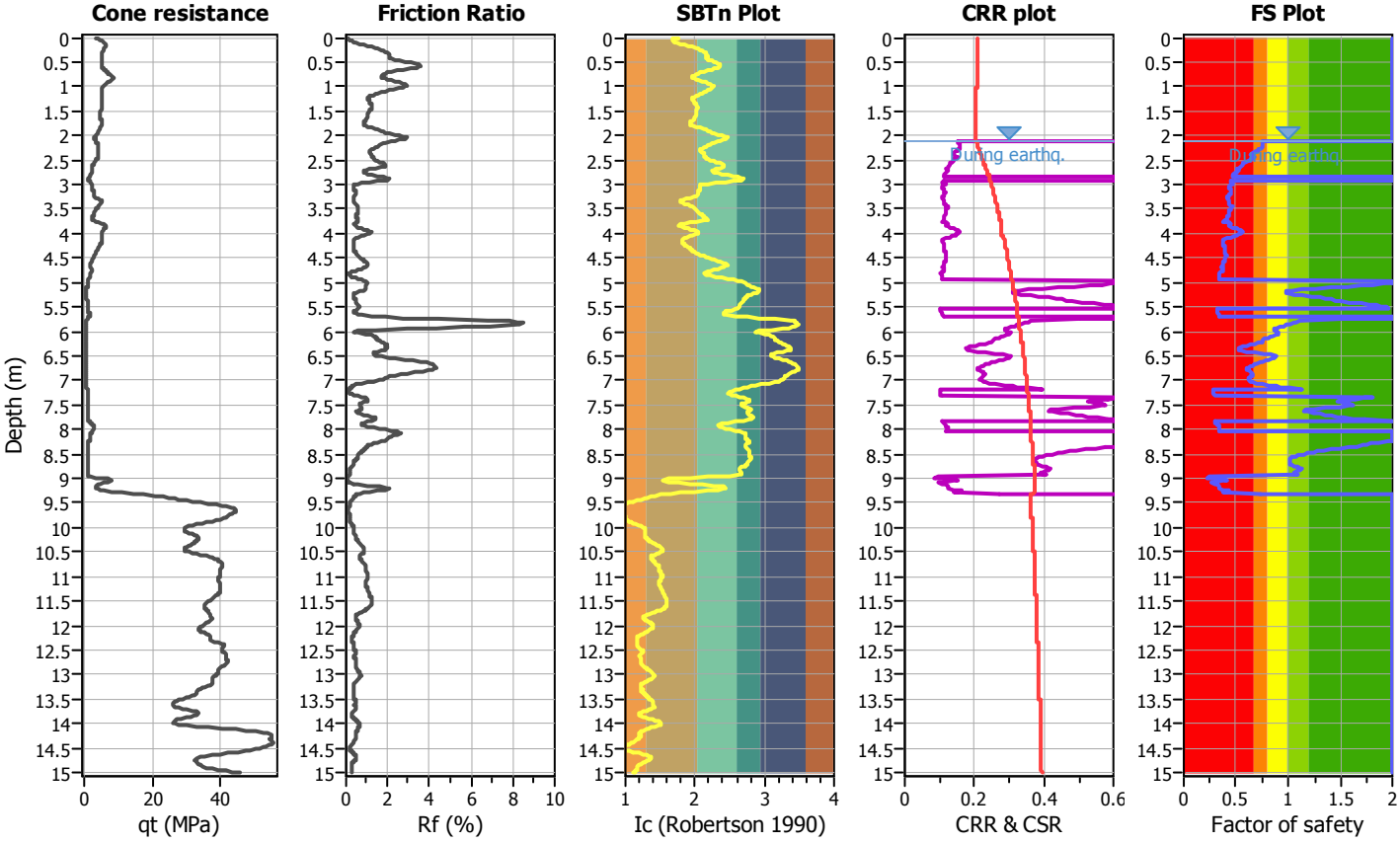
LIQUEFACTION ANALYSIS REPORT

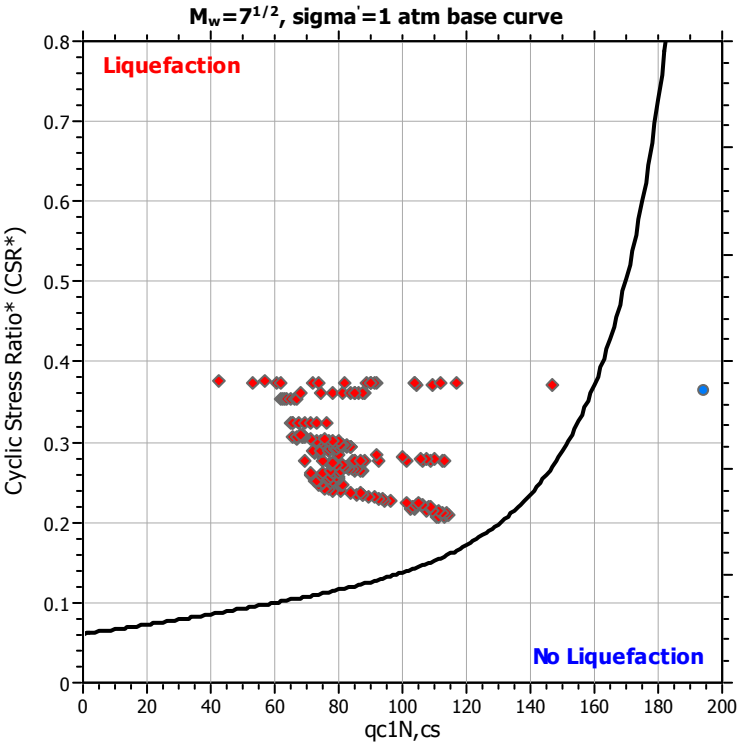
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

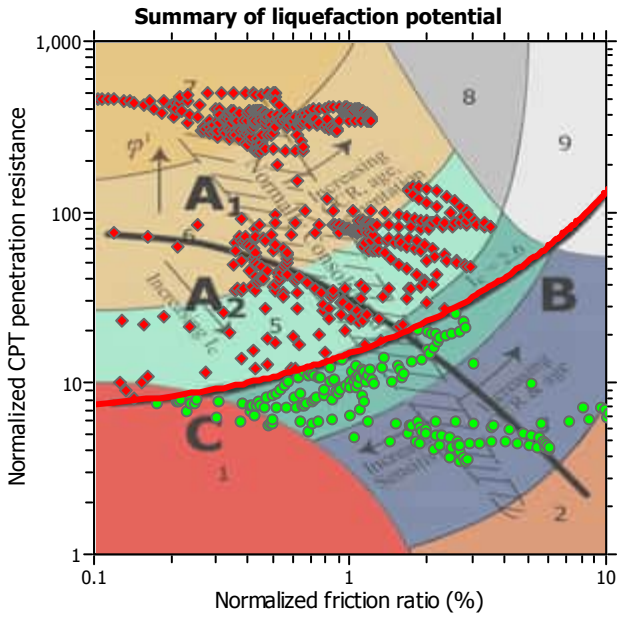
CPT file : CPT_20

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

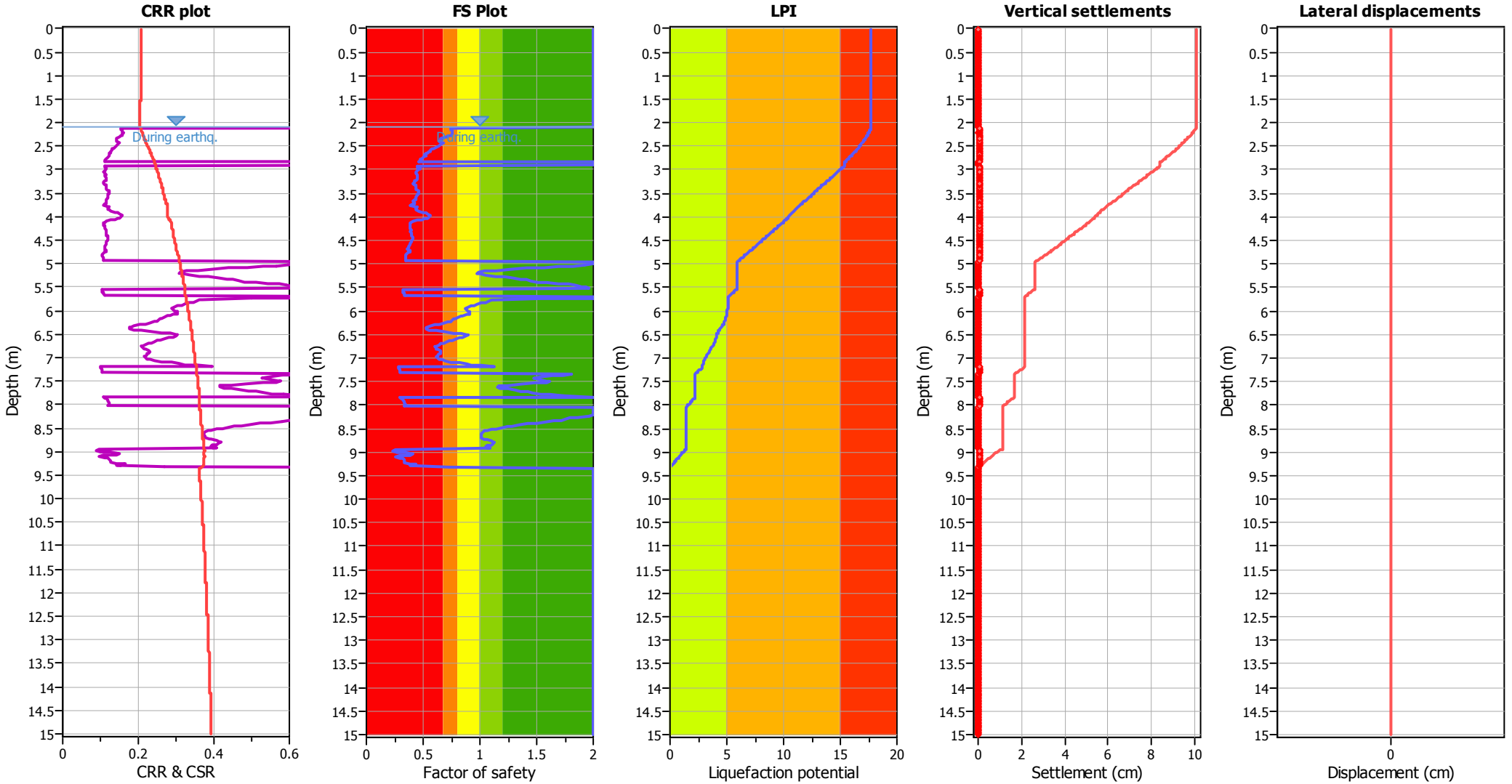






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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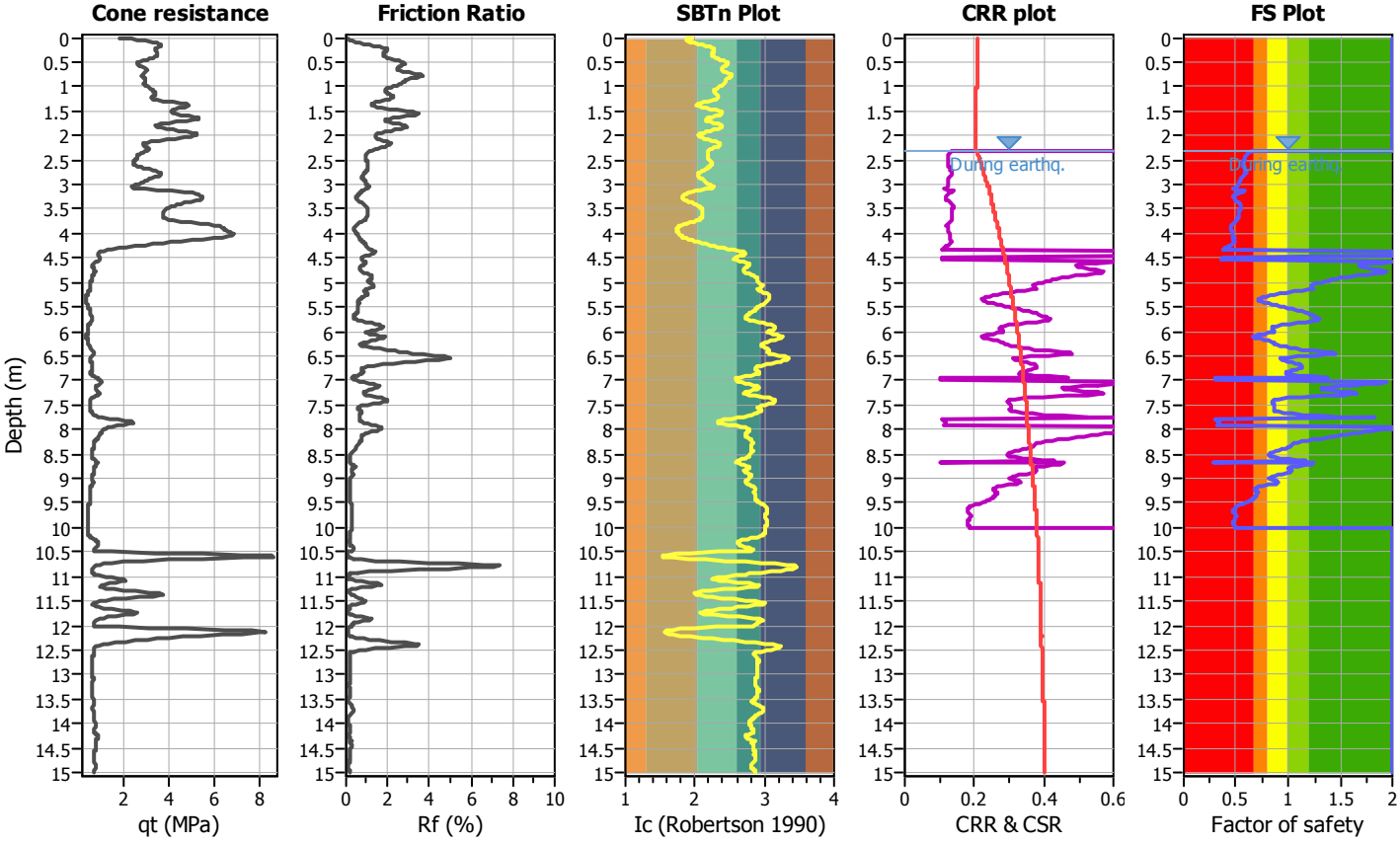
LIQUEFACTION ANALYSIS REPORT

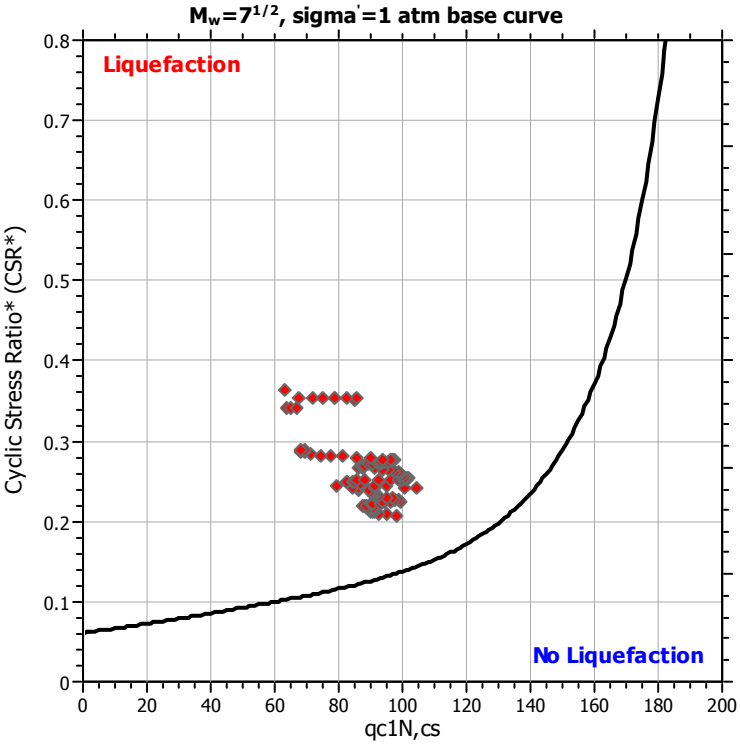
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

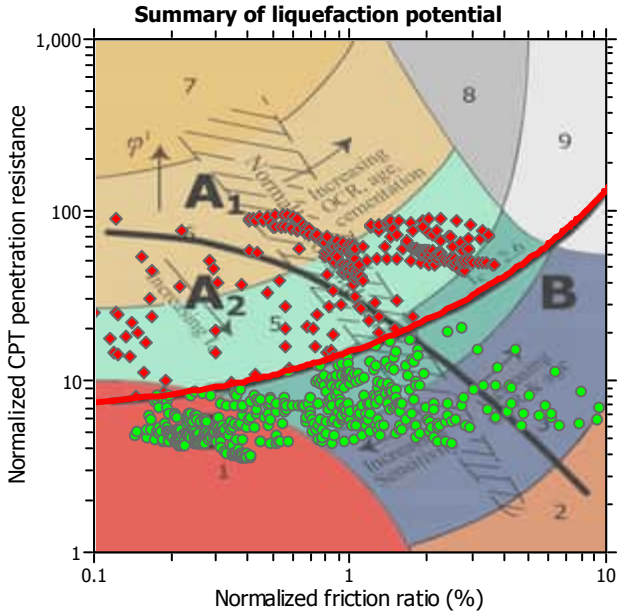
CPT file : CPT_21

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

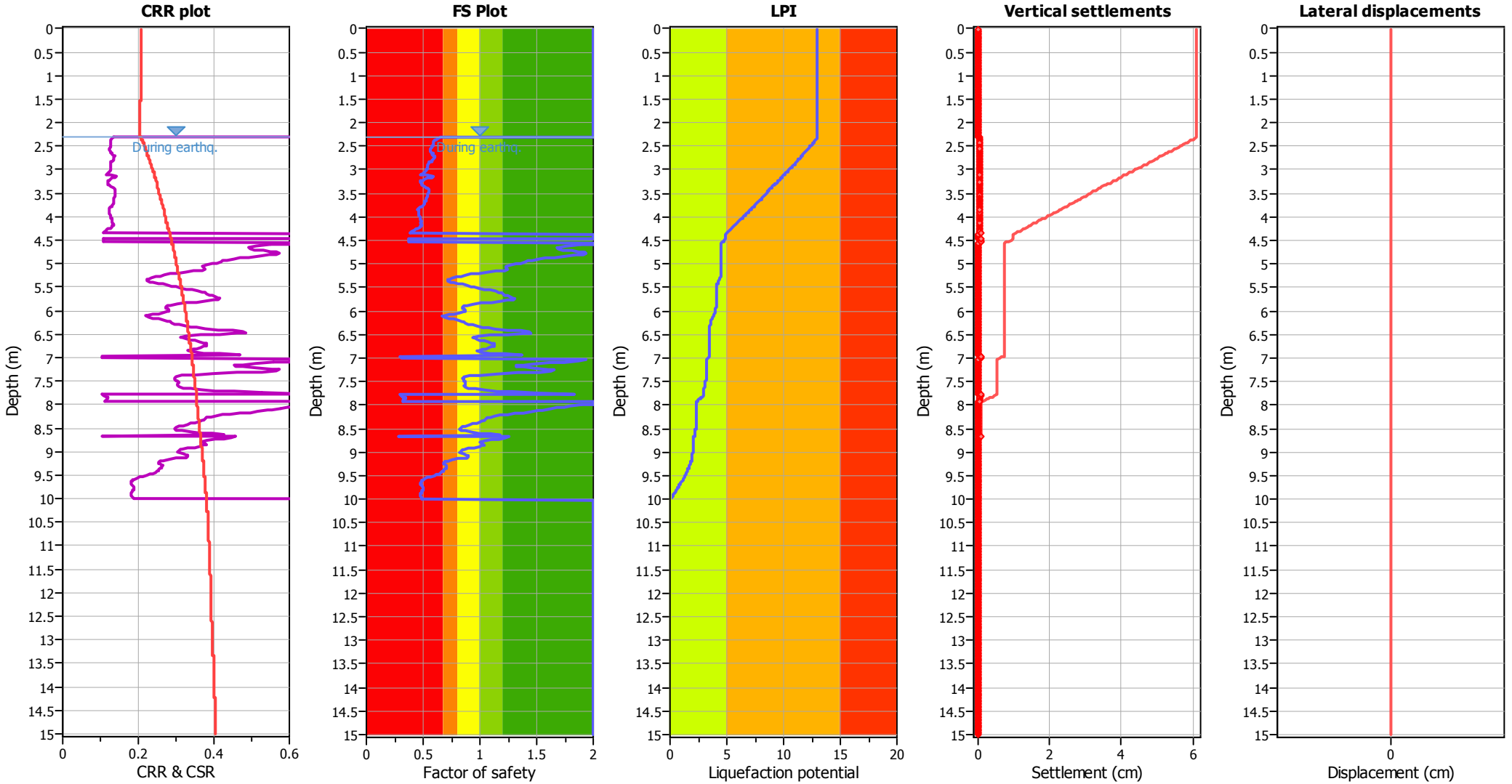






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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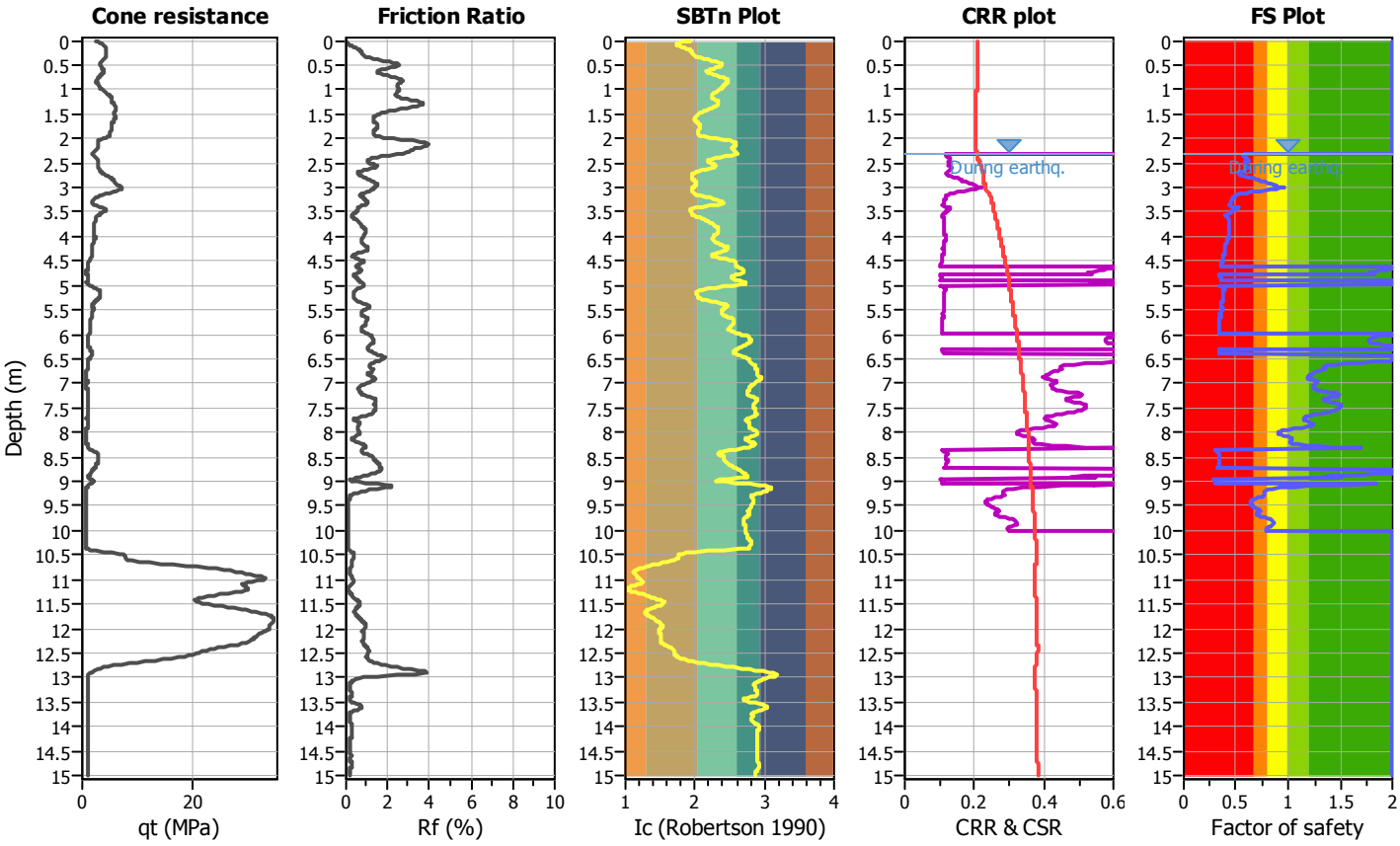
LIQUEFACTION ANALYSIS REPORT

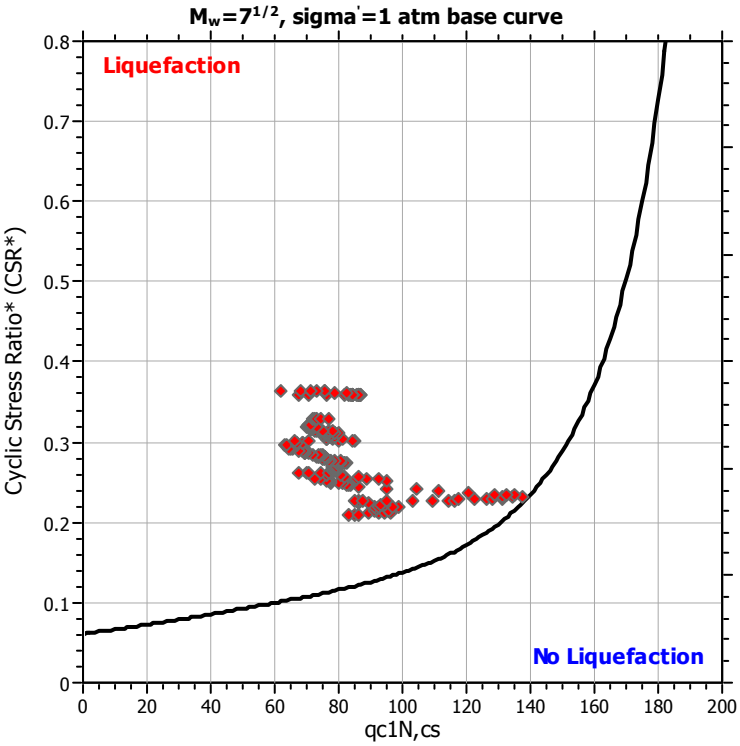
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

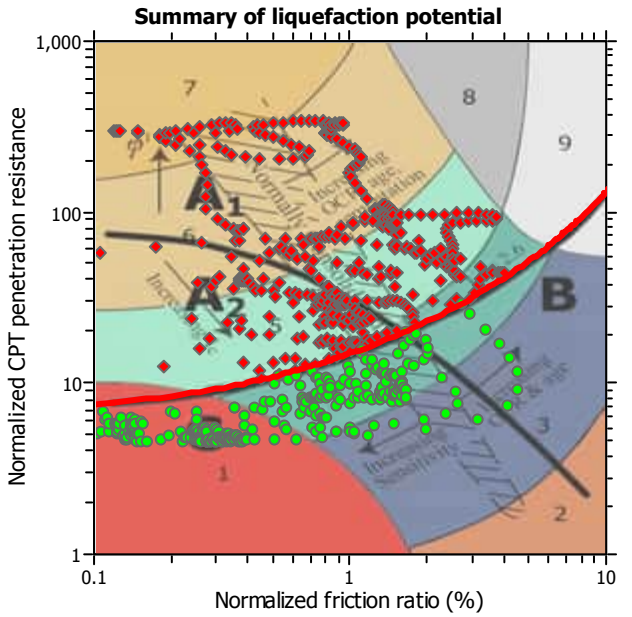
CPT file : CPT_22

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

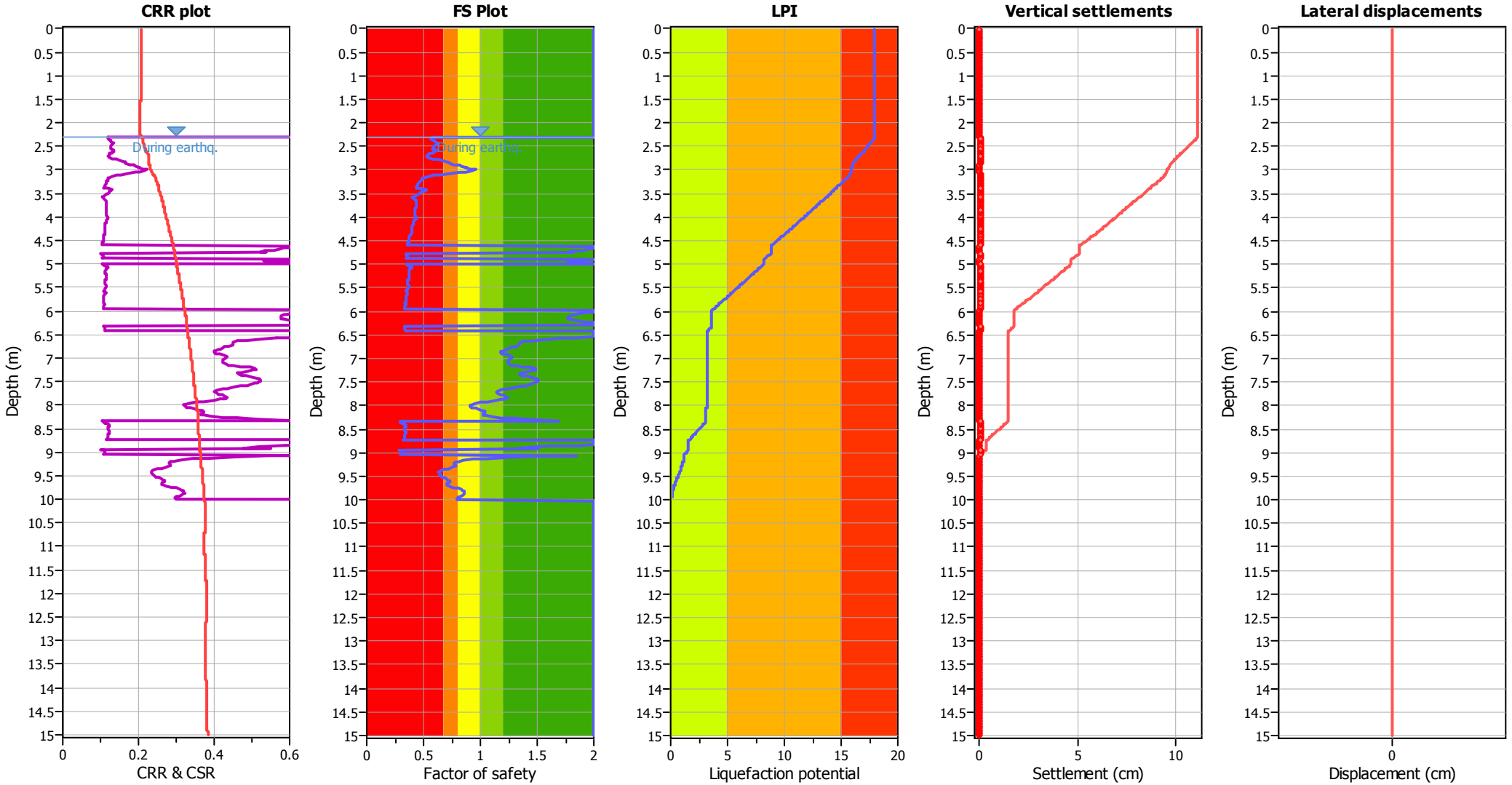






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
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LPI color scheme

- Very high risk
- High risk
- Low risk

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Christchurch 8140

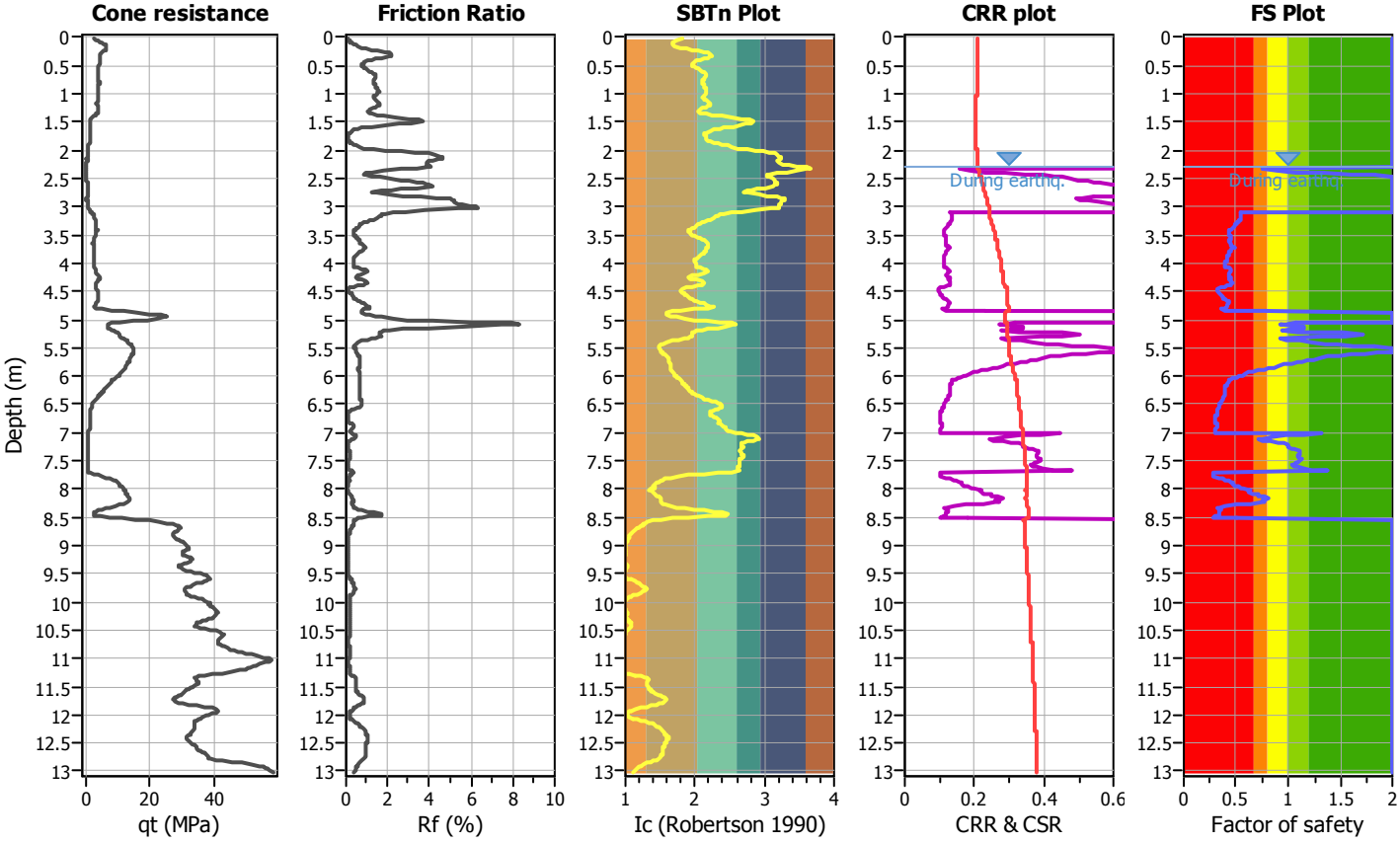
LIQUEFACTION ANALYSIS REPORT

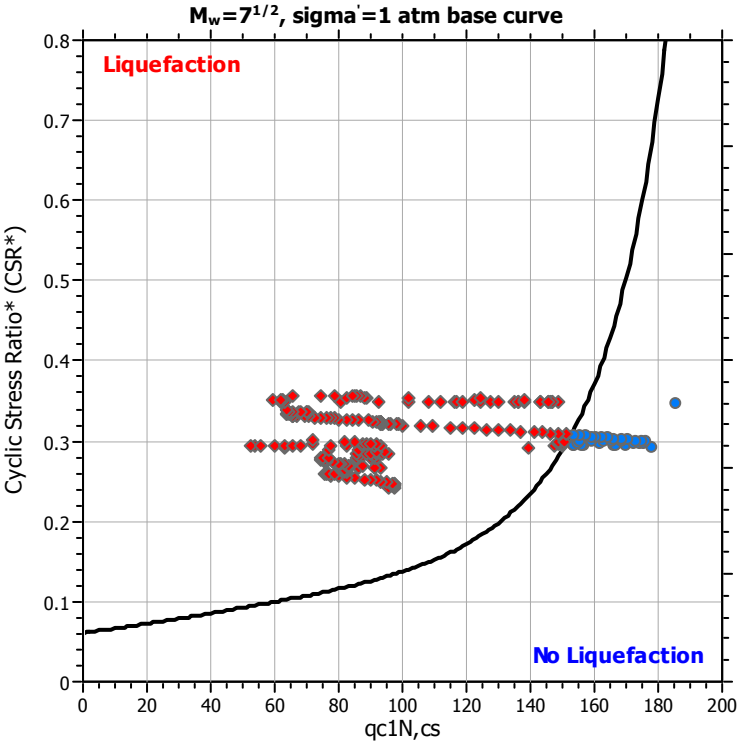
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

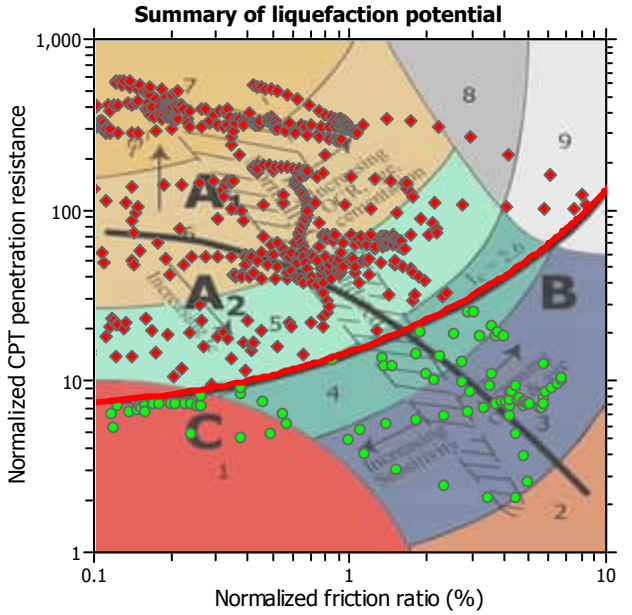
CPT file : CPT_23

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

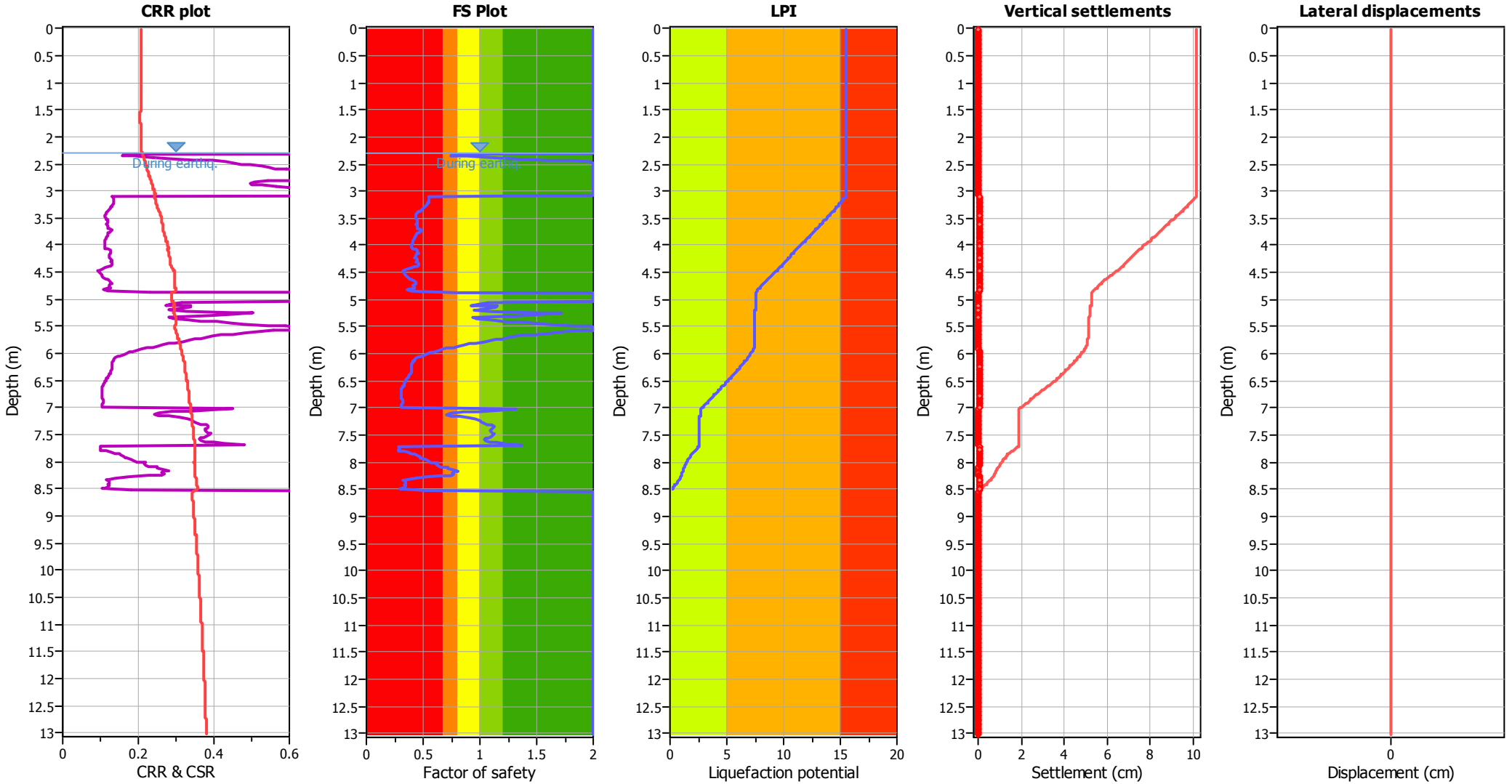






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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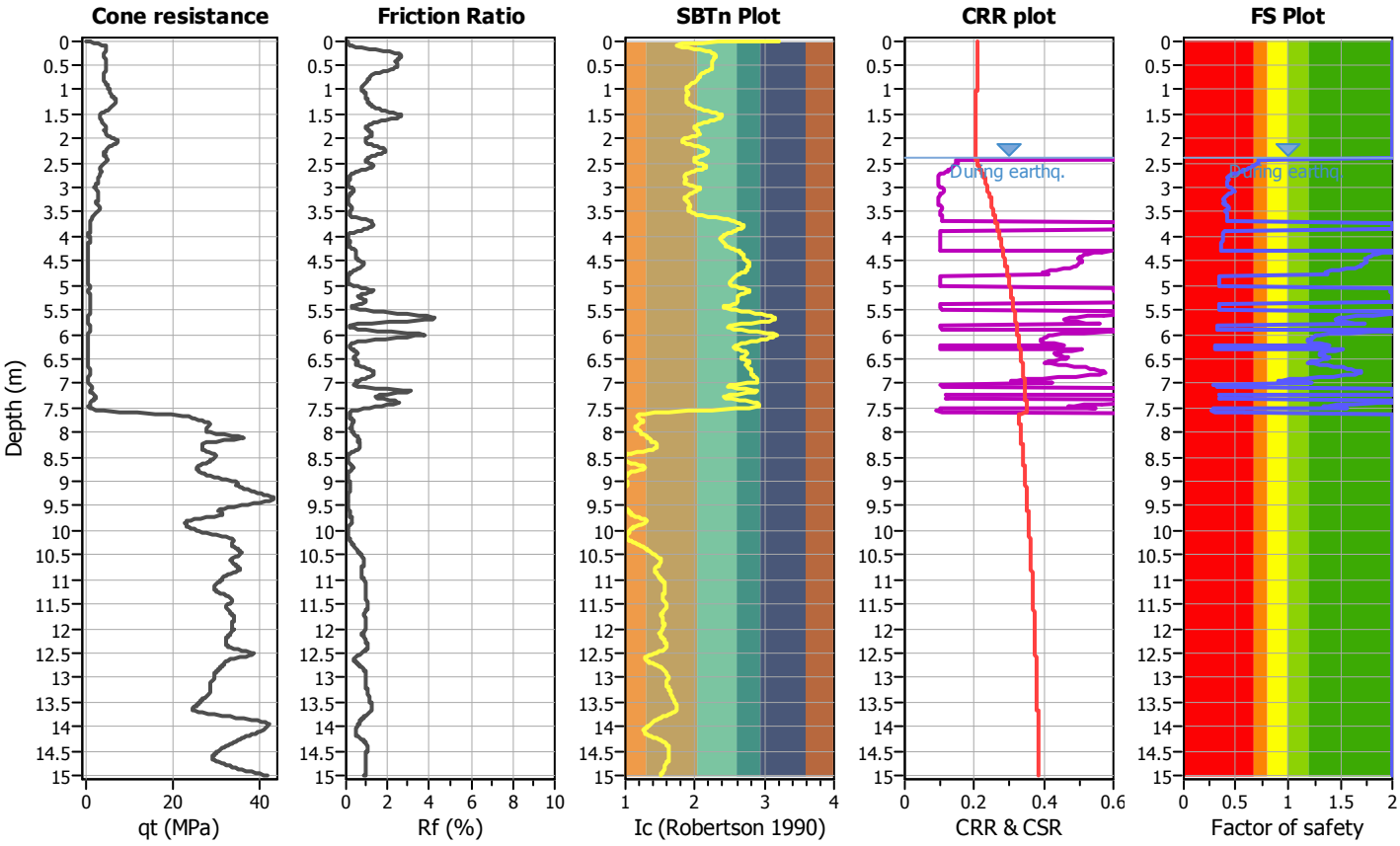
LIQUEFACTION ANALYSIS REPORT

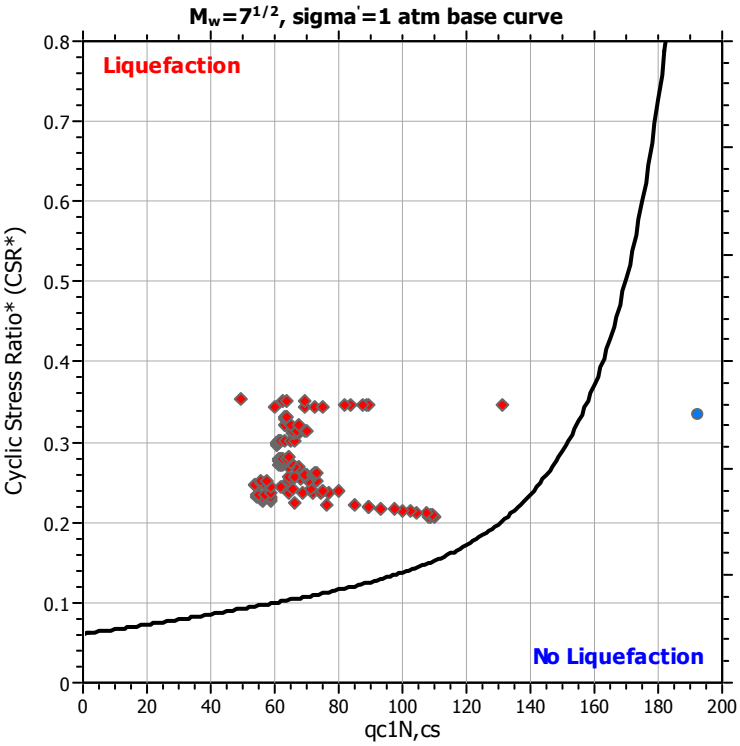
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

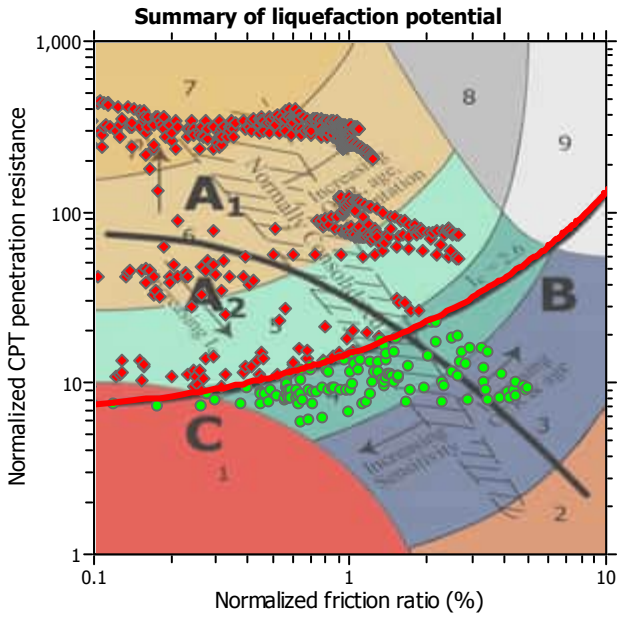
CPT file : CPT_24

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

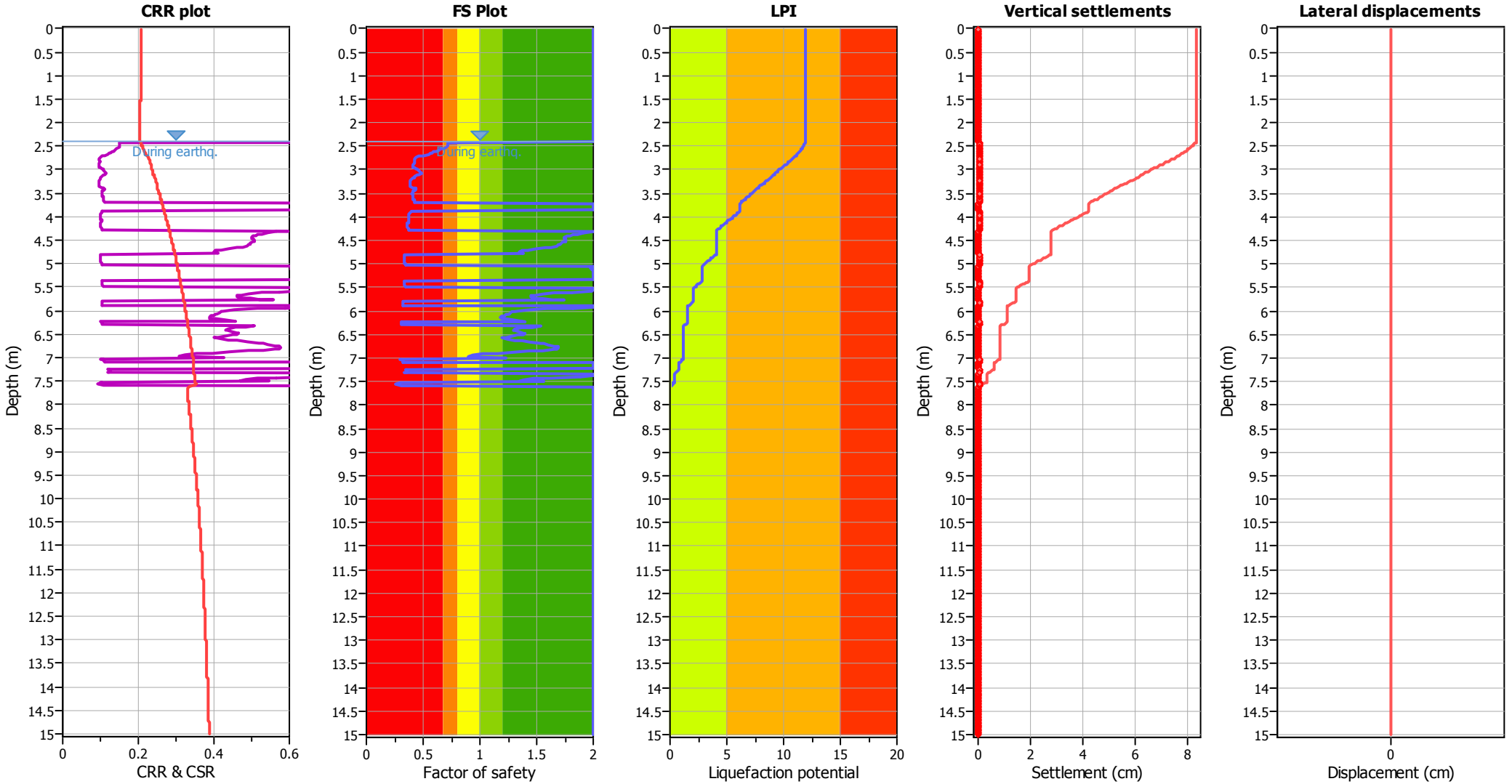






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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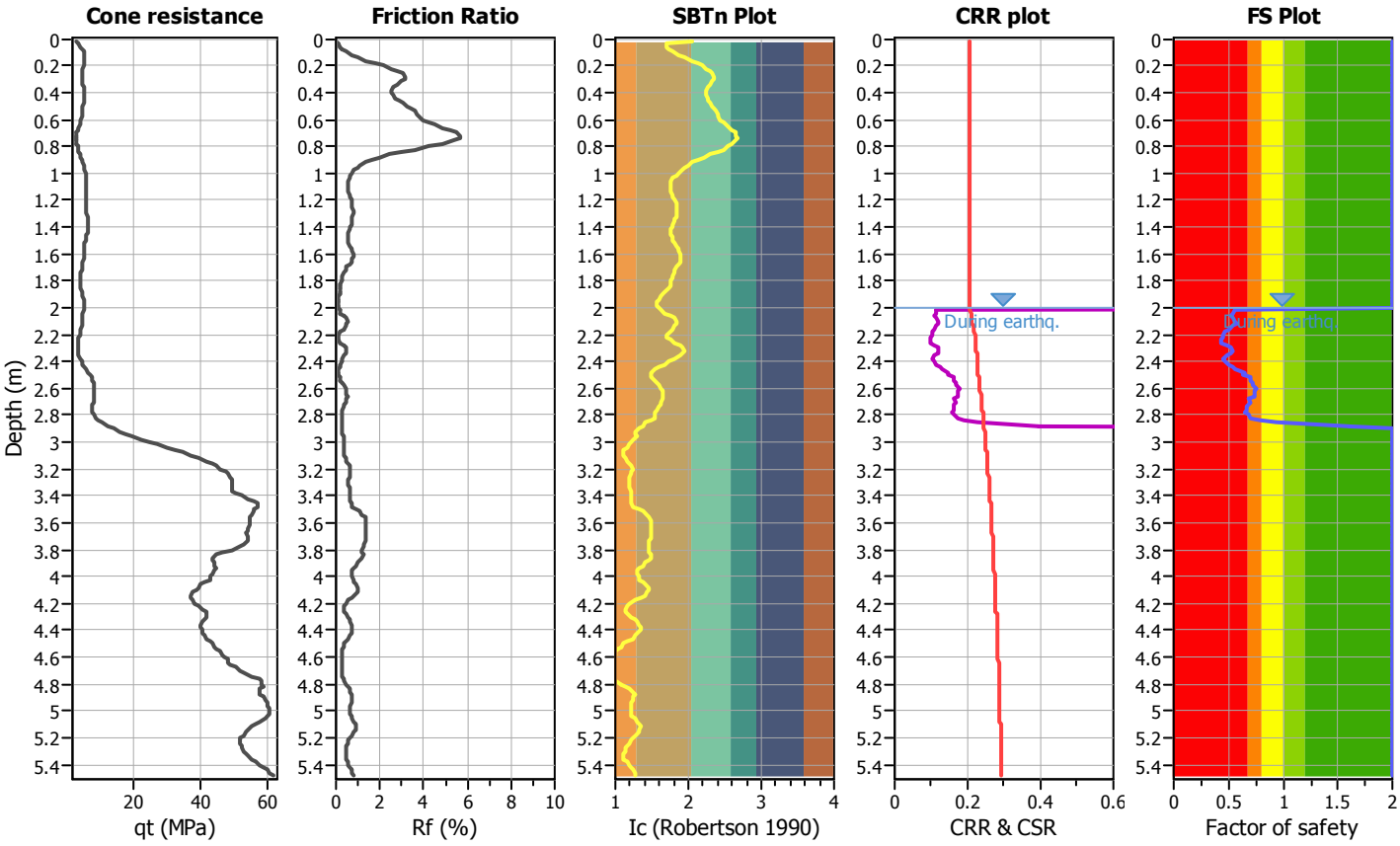
LIQUEFACTION ANALYSIS REPORT

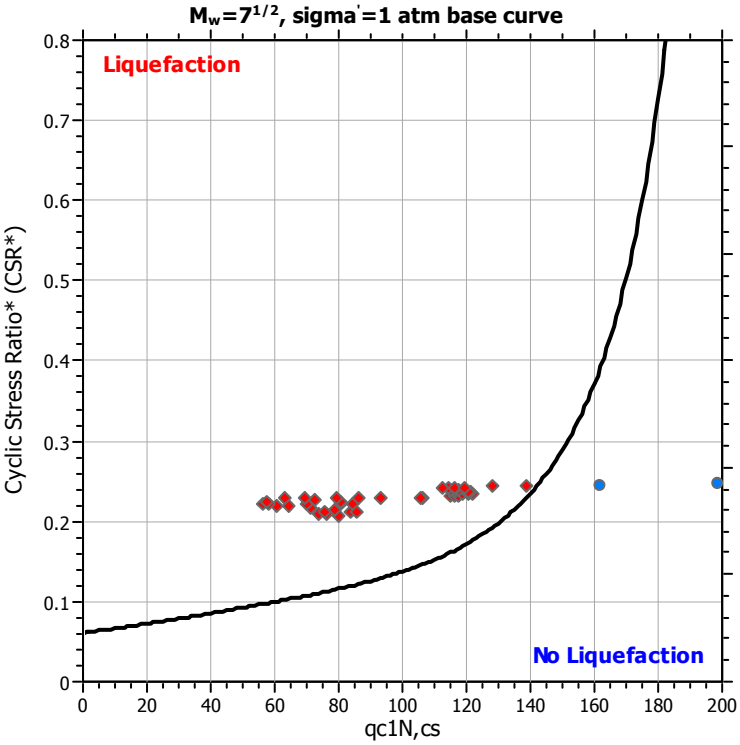
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

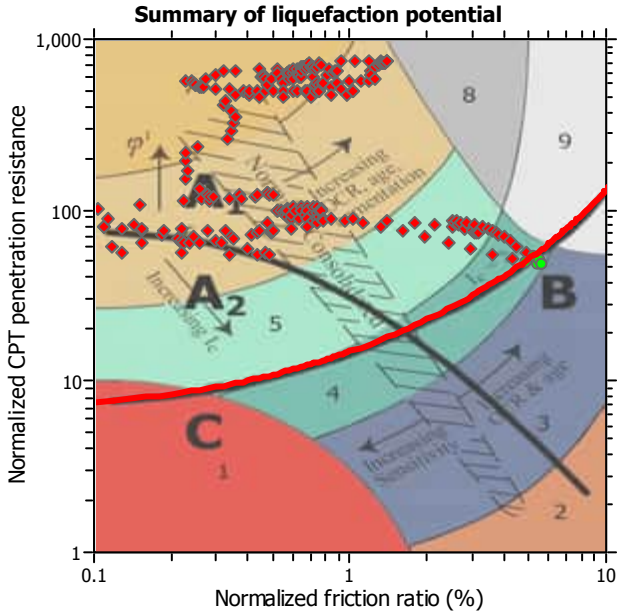
CPT file : CPT_25

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

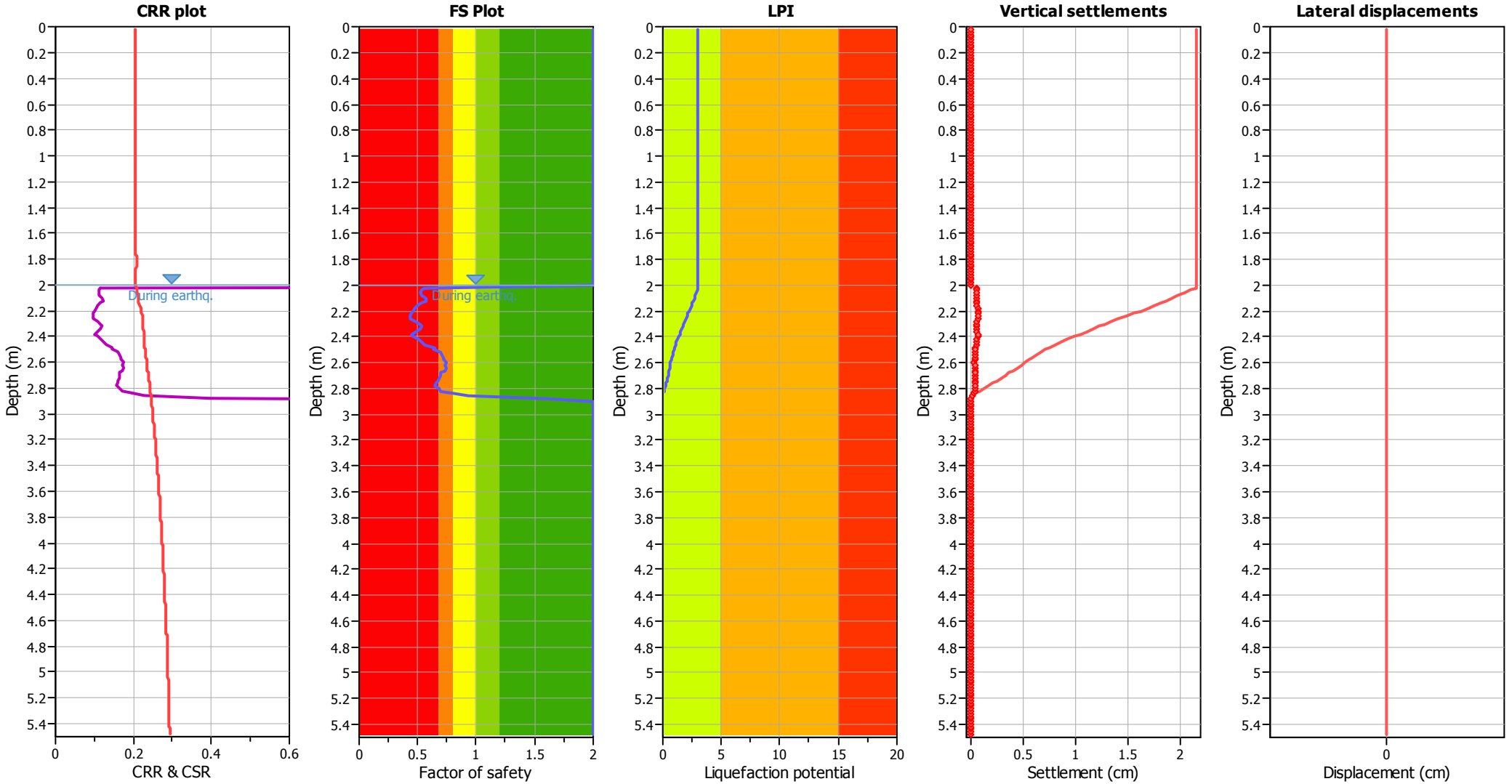






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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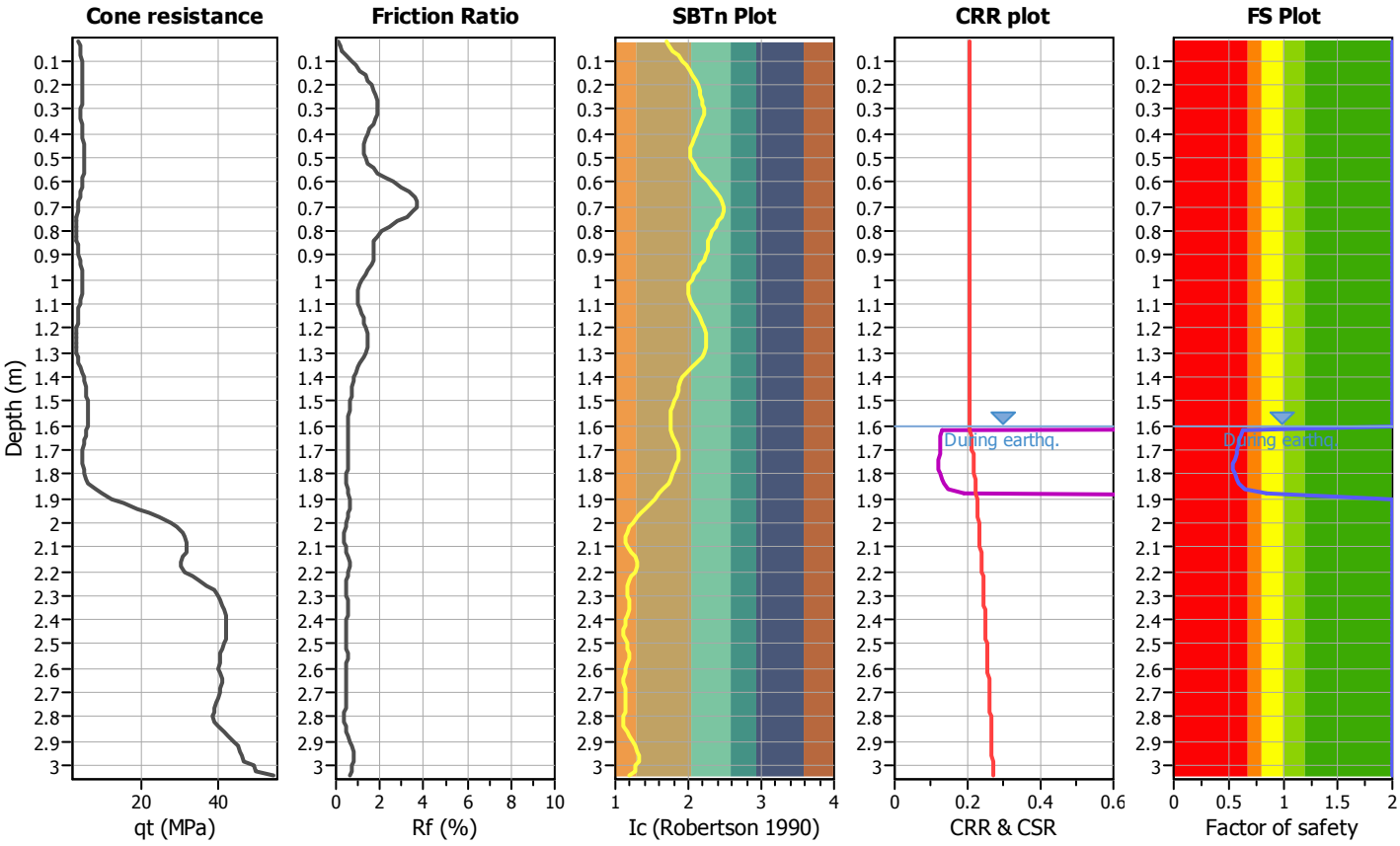
LIQUEFACTION ANALYSIS REPORT

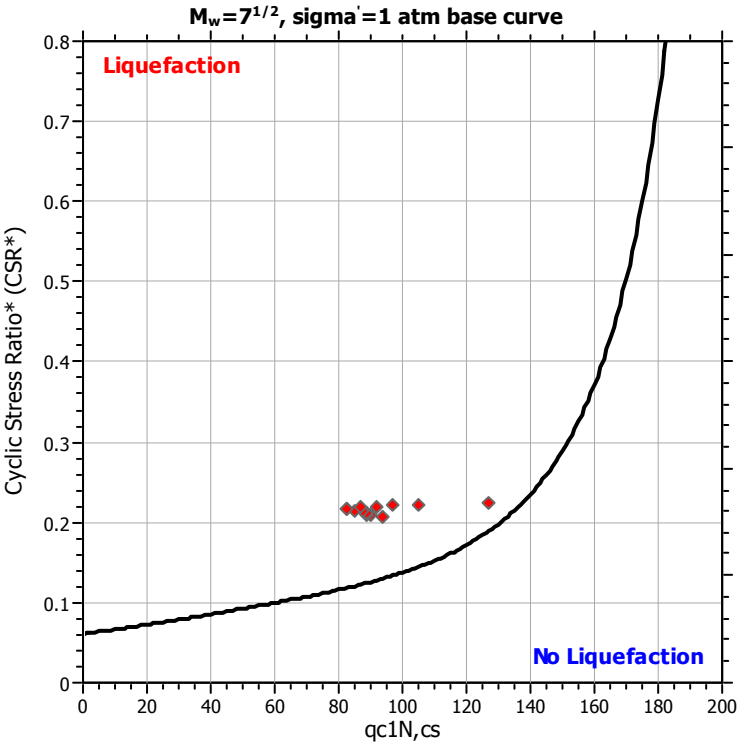
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

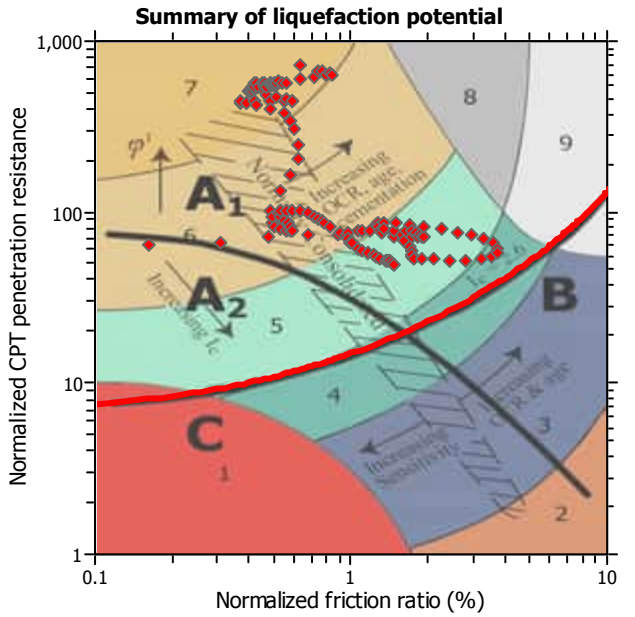
CPT file : CPT_26

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

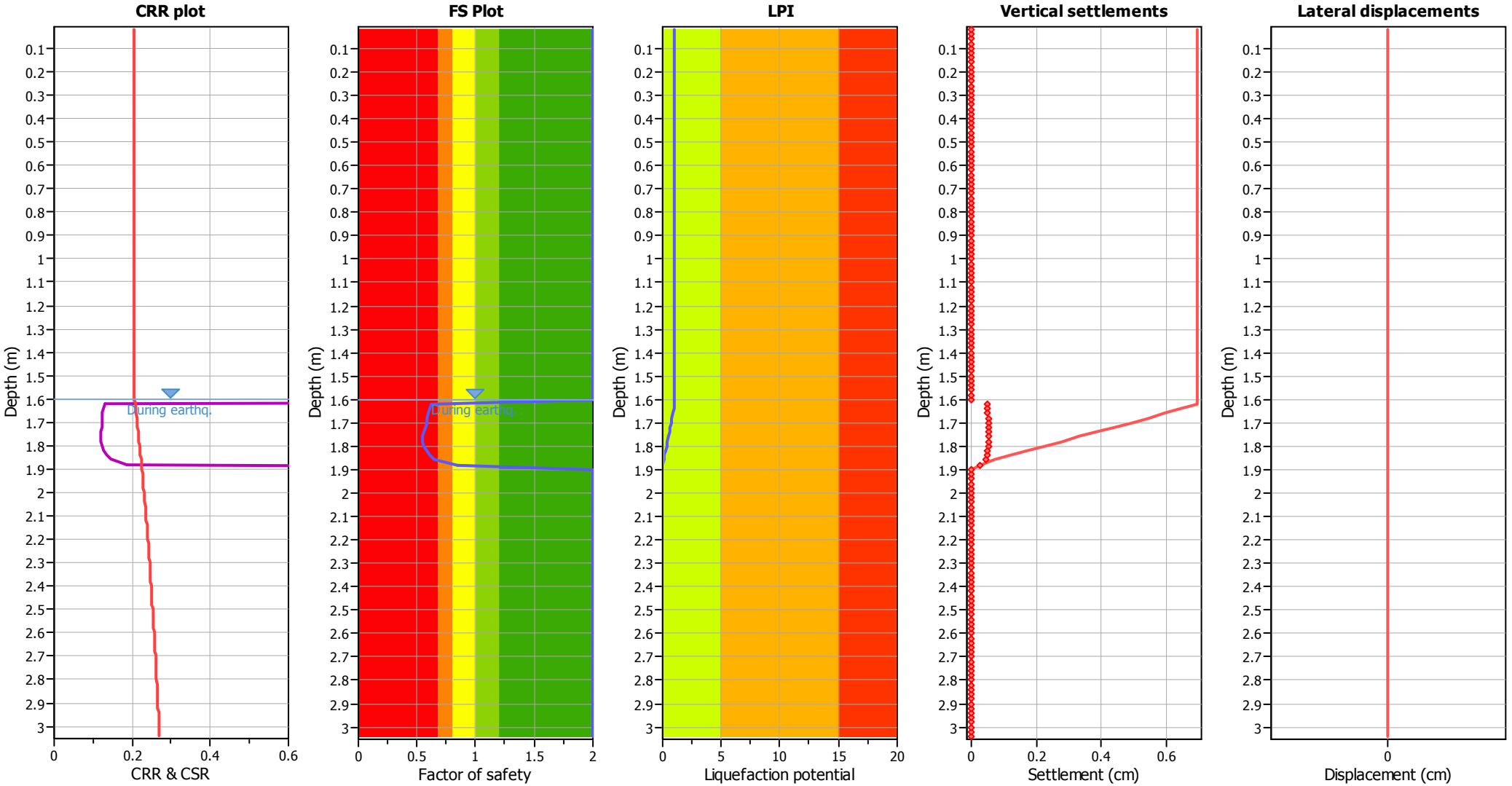






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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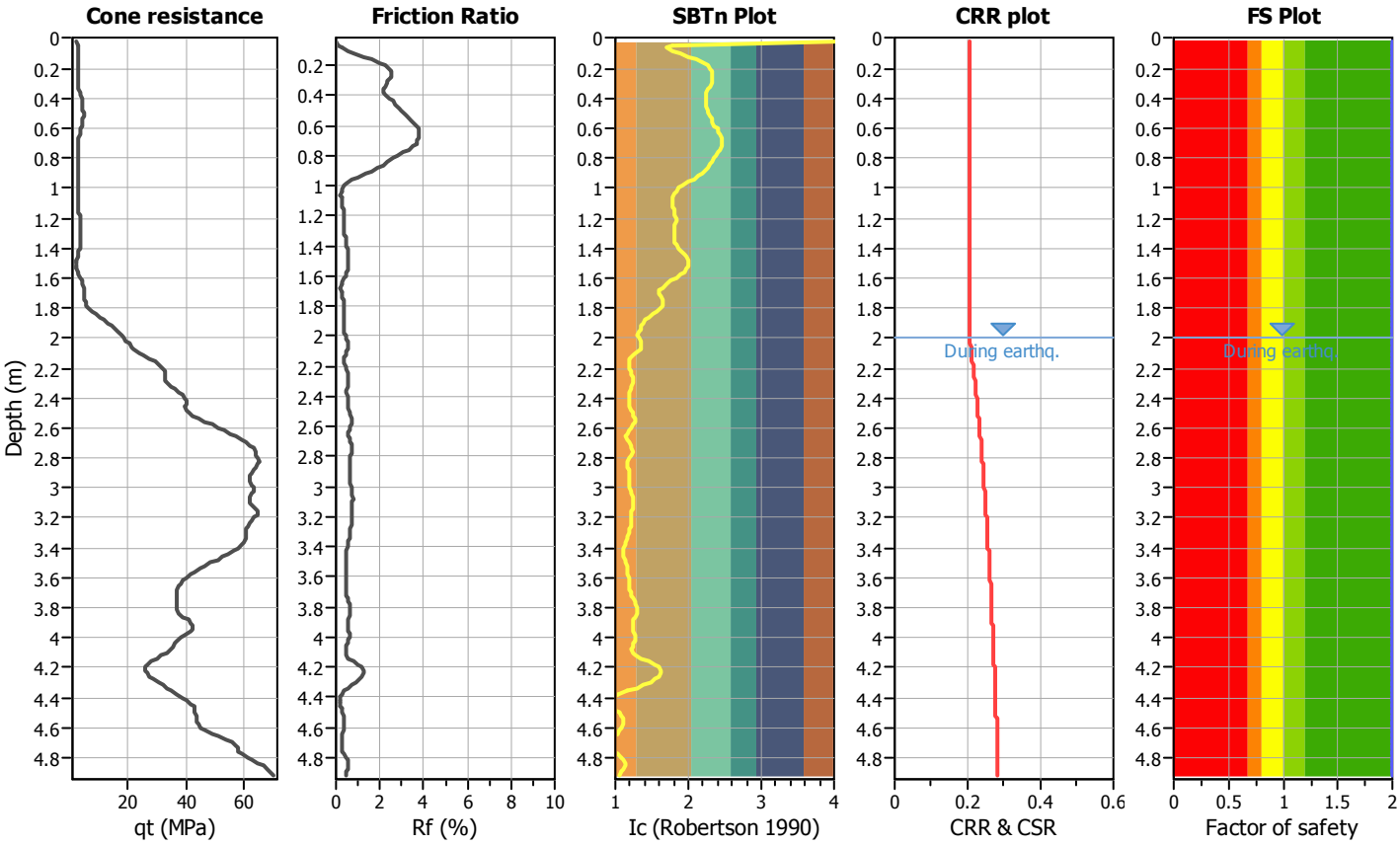
LIQUEFACTION ANALYSIS REPORT

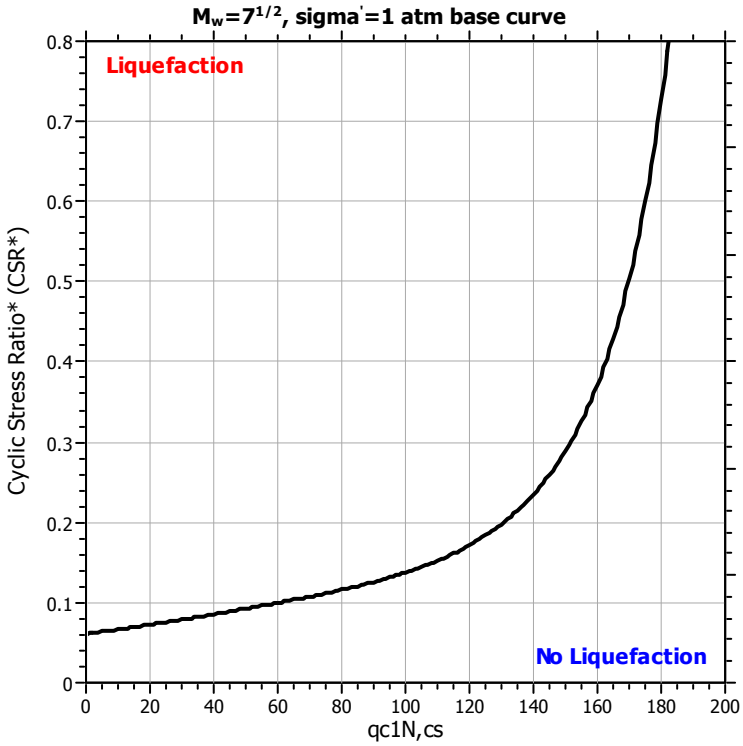
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

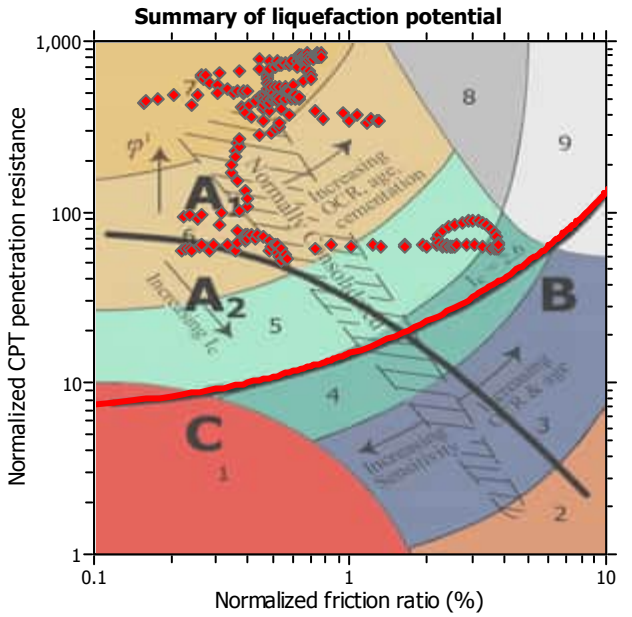
CPT file : CPT_27

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

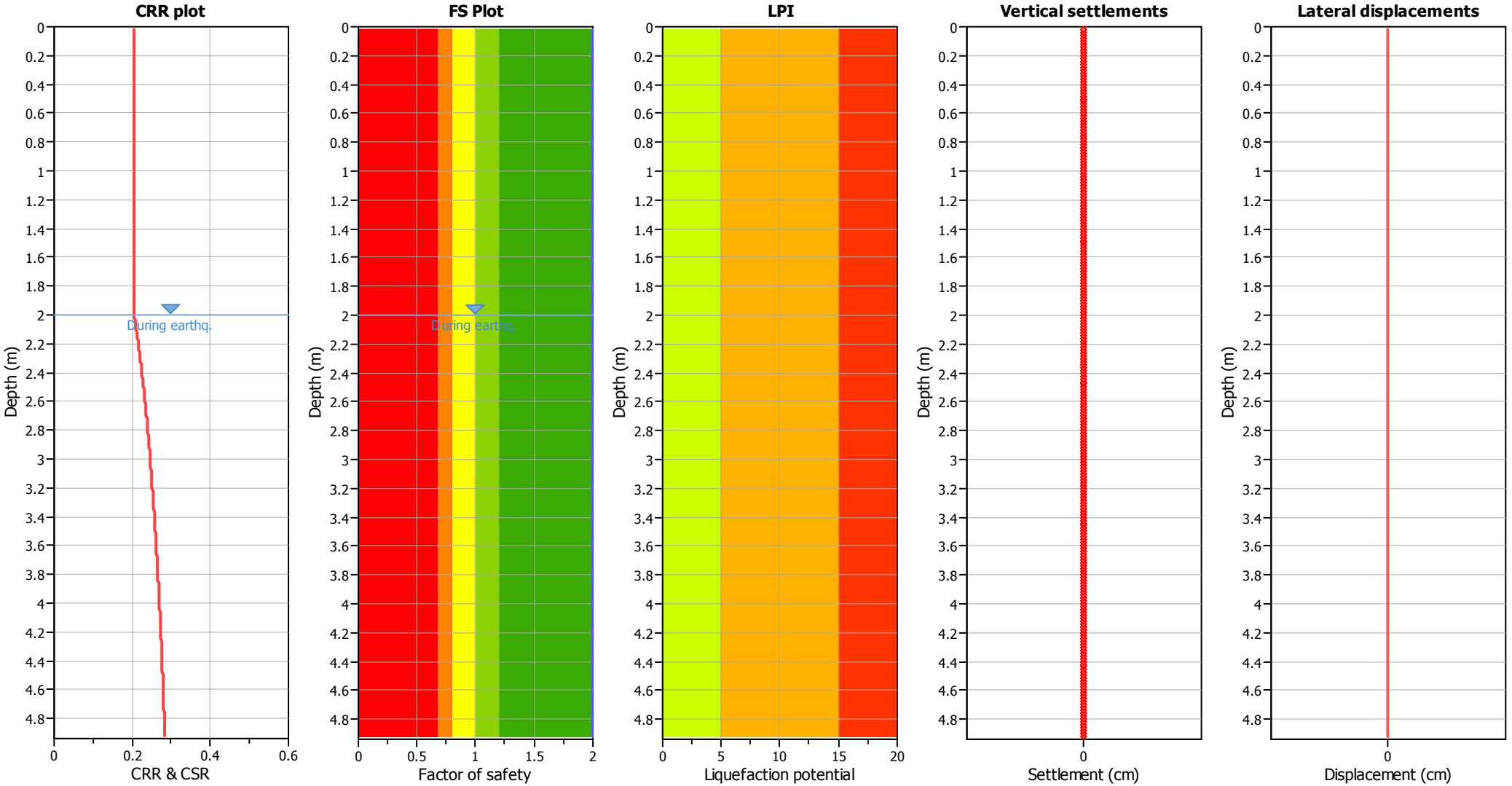






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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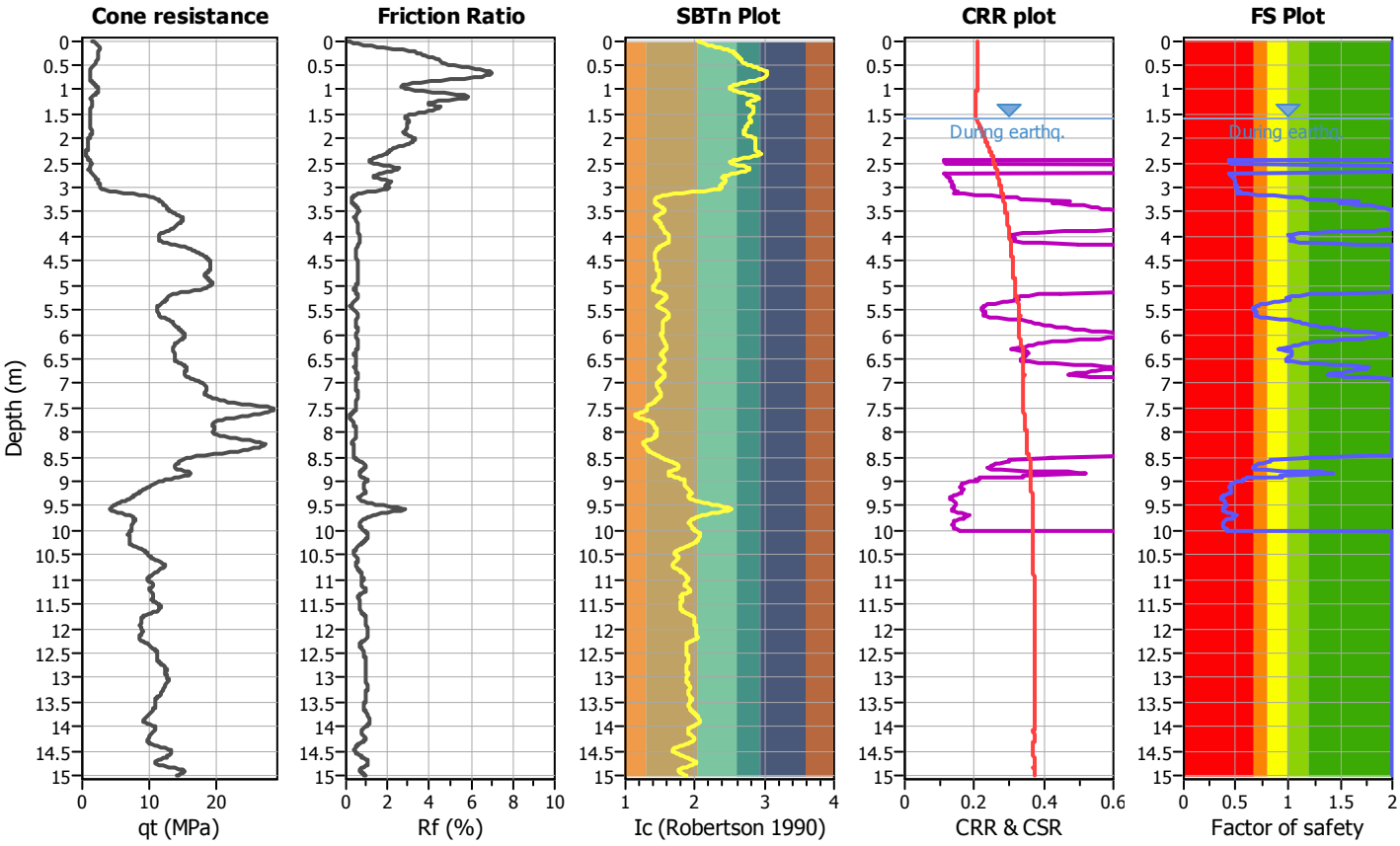
LIQUEFACTION ANALYSIS REPORT

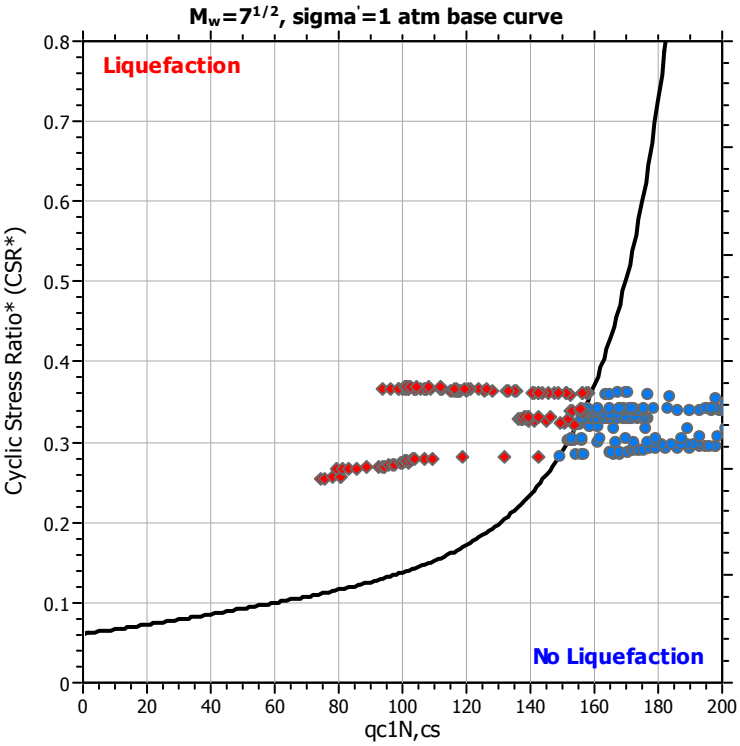
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

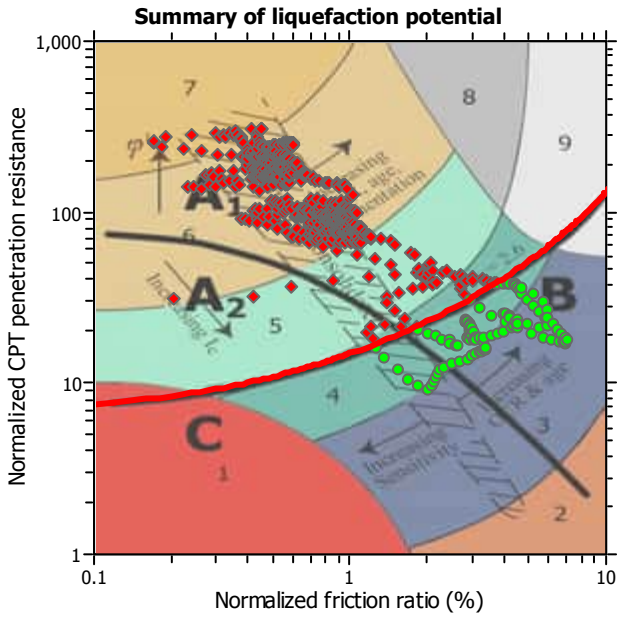
CPT file : CPT_28

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

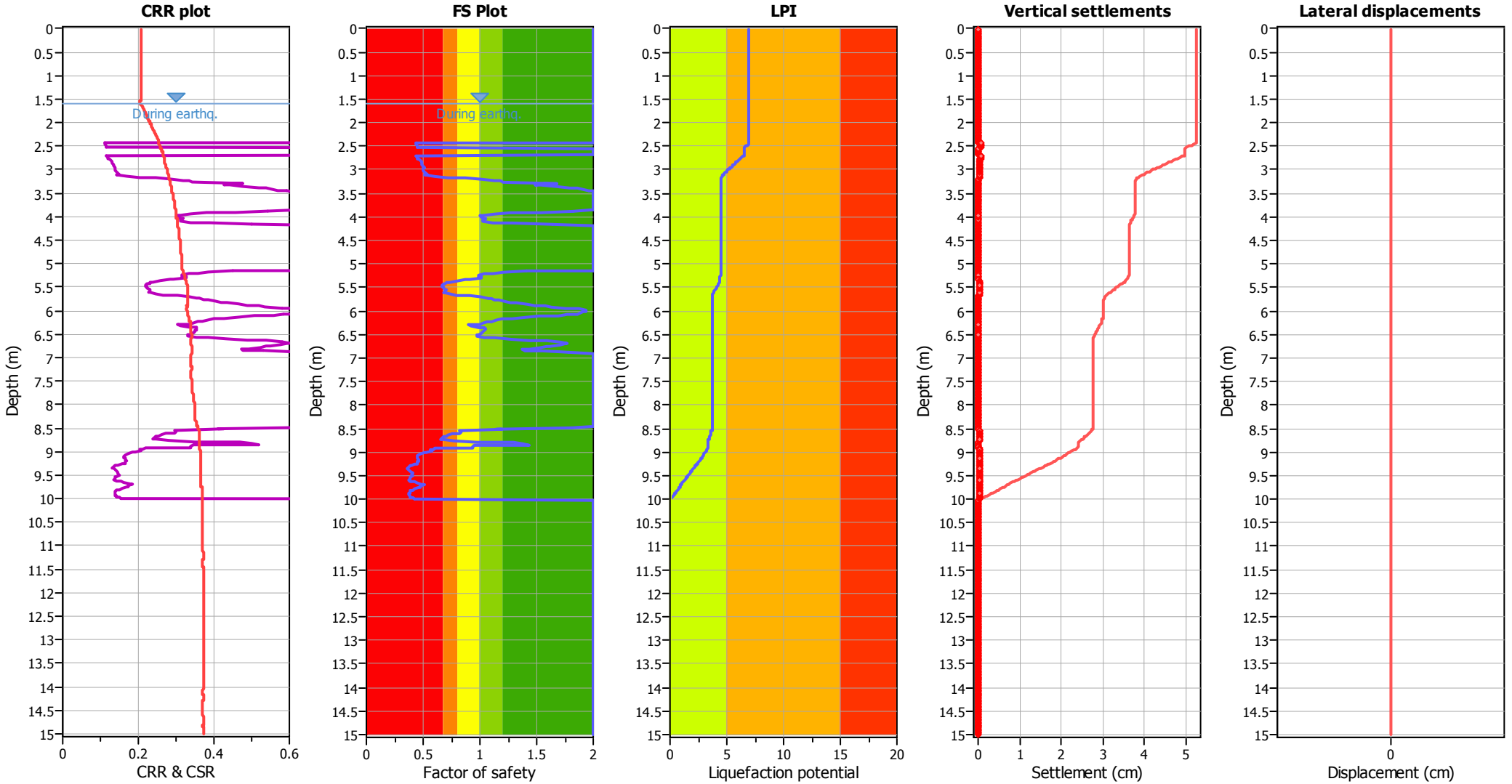






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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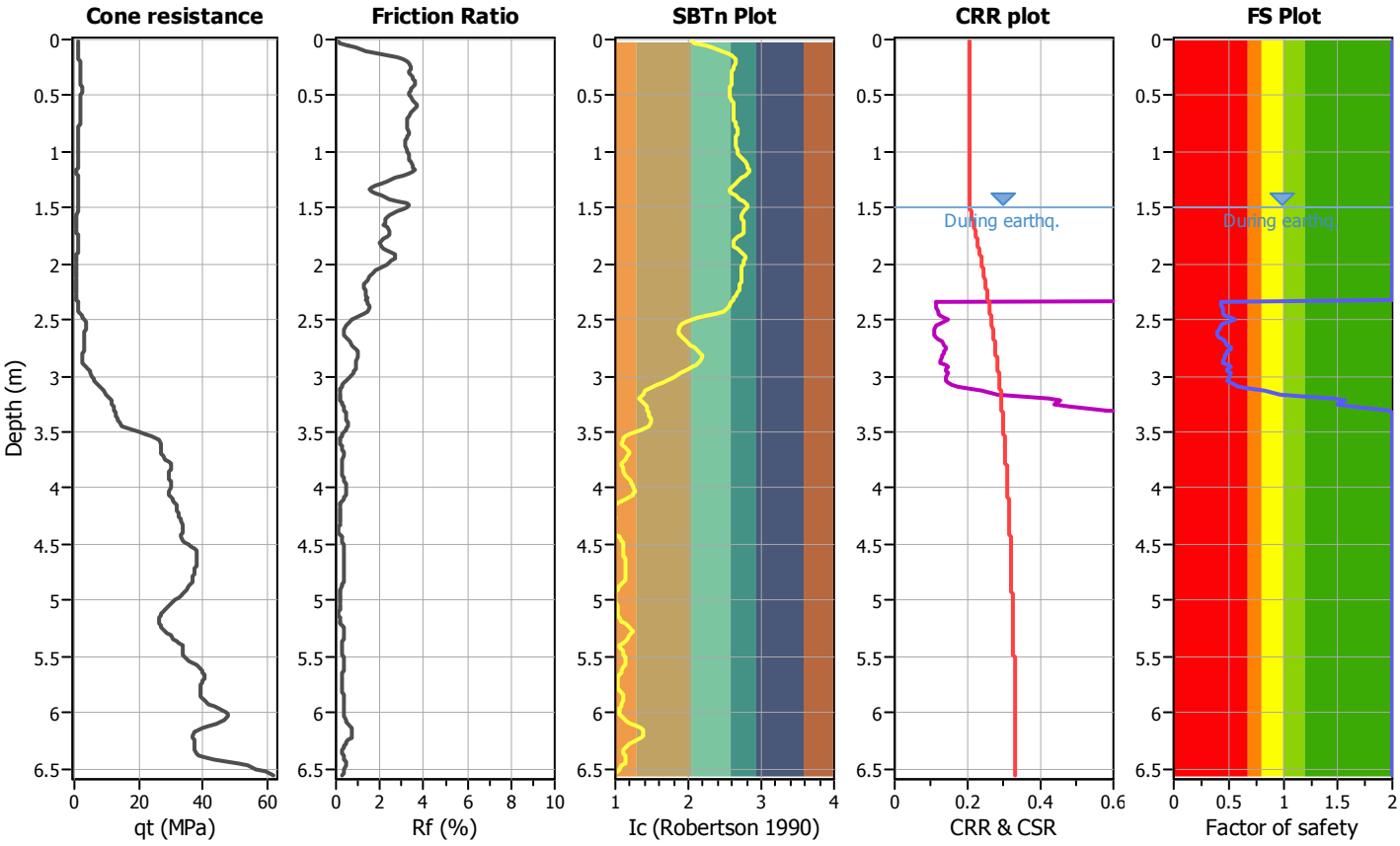
LIQUEFACTION ANALYSIS REPORT

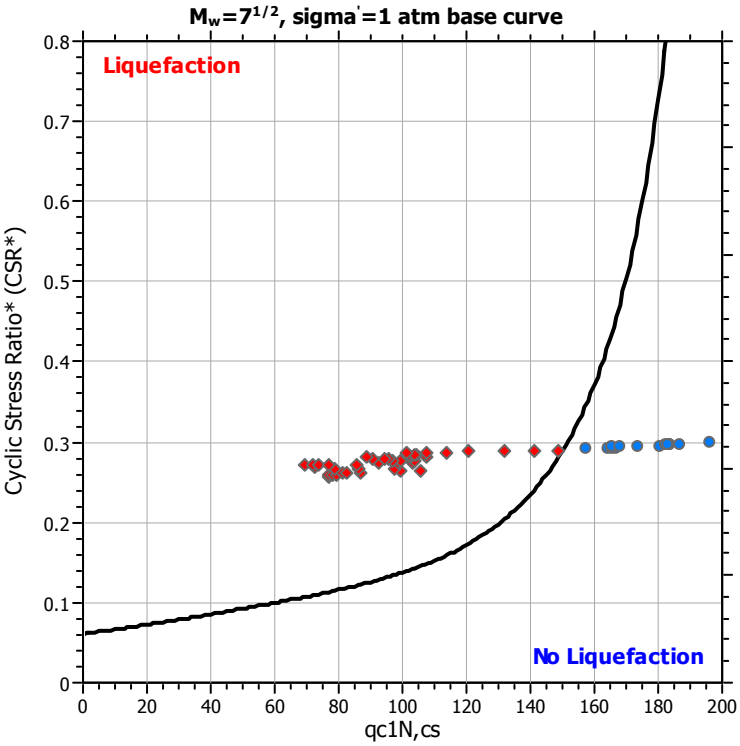
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

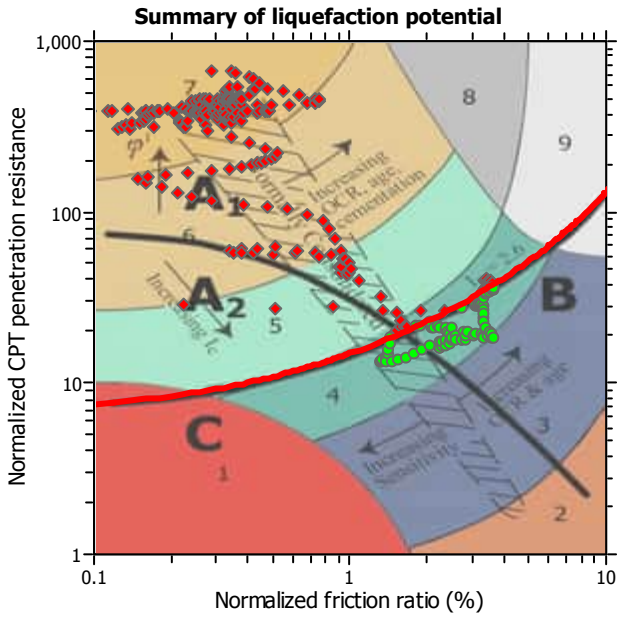
CPT file : CPT_29

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

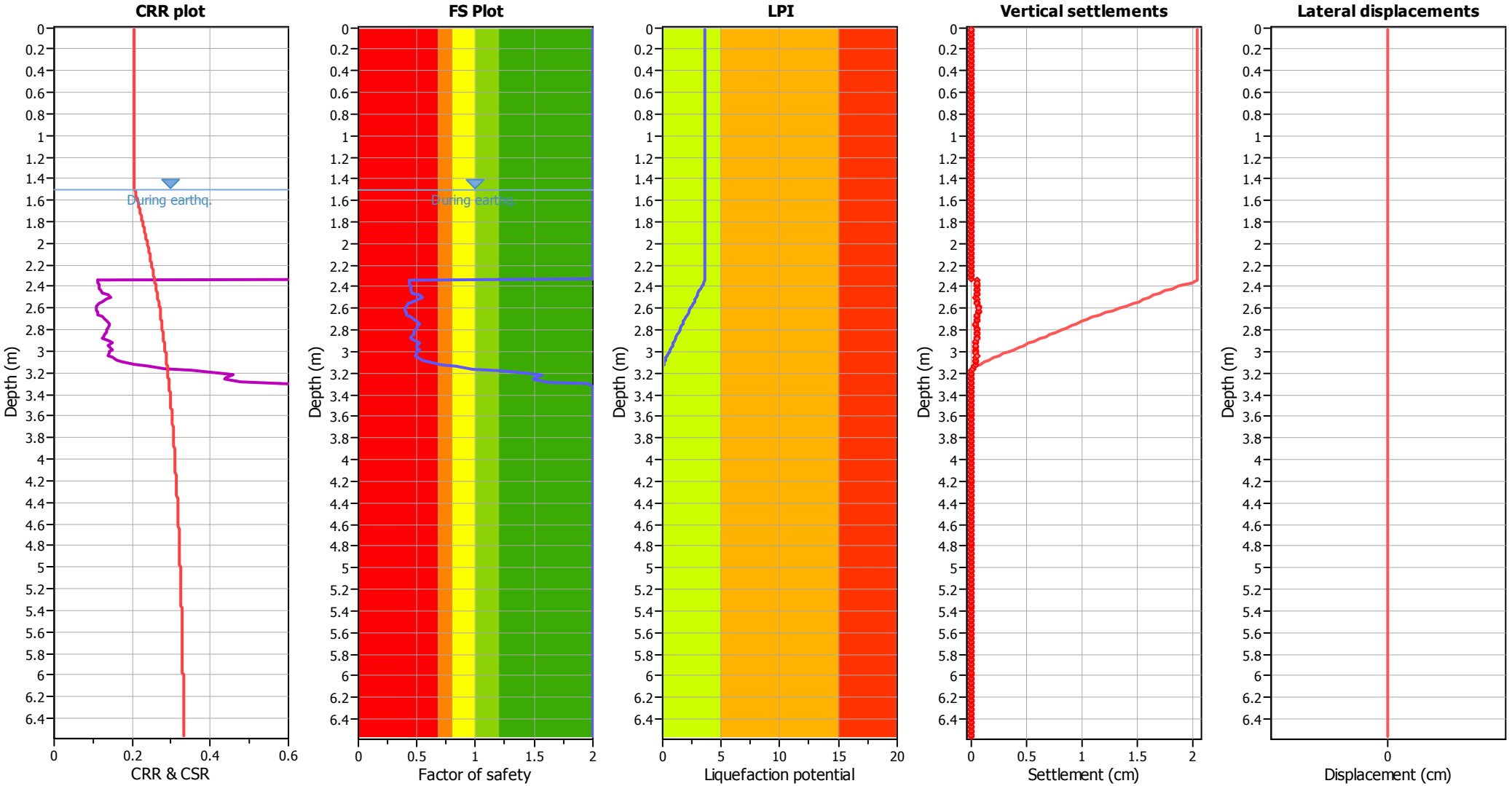






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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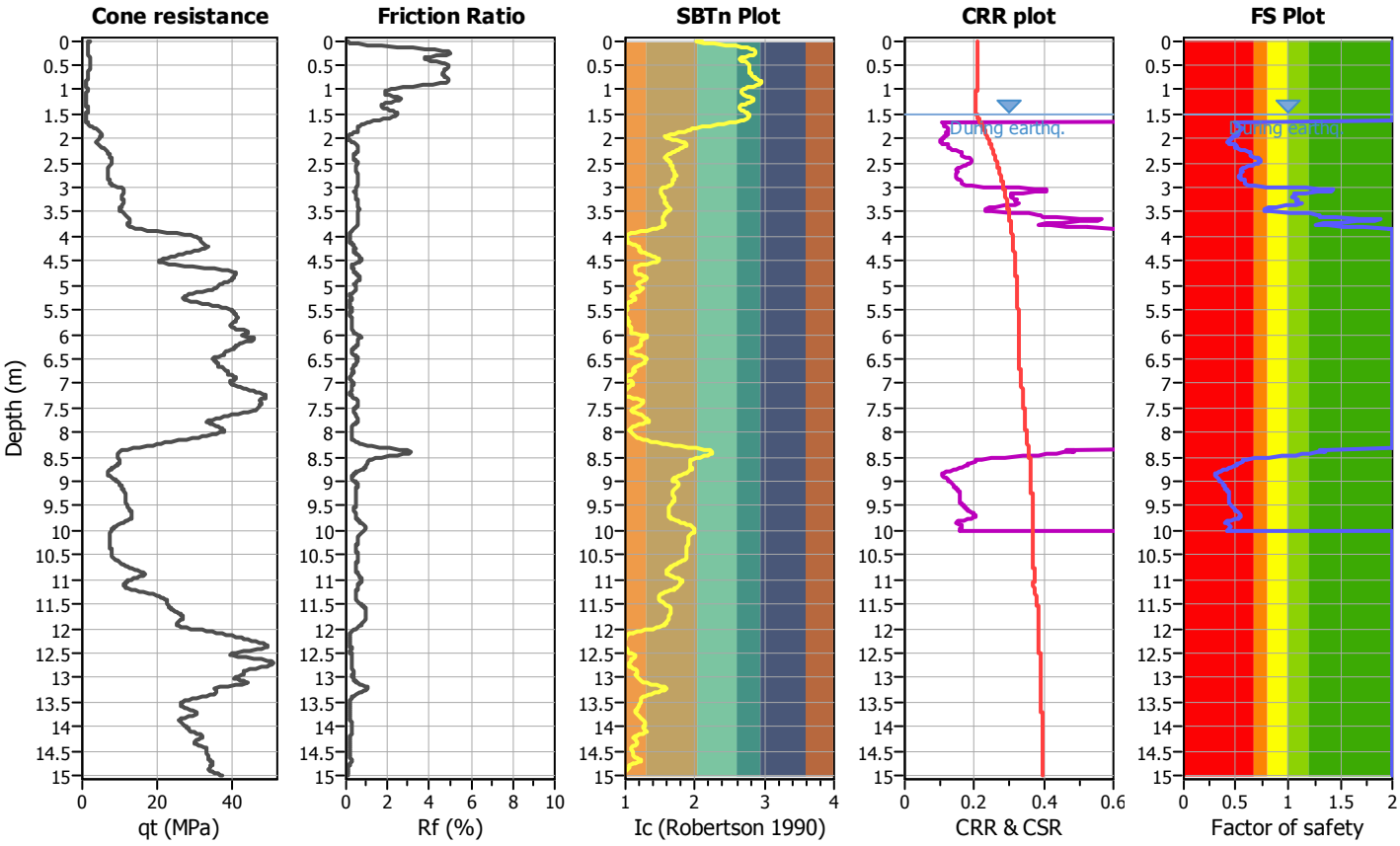
LIQUEFACTION ANALYSIS REPORT

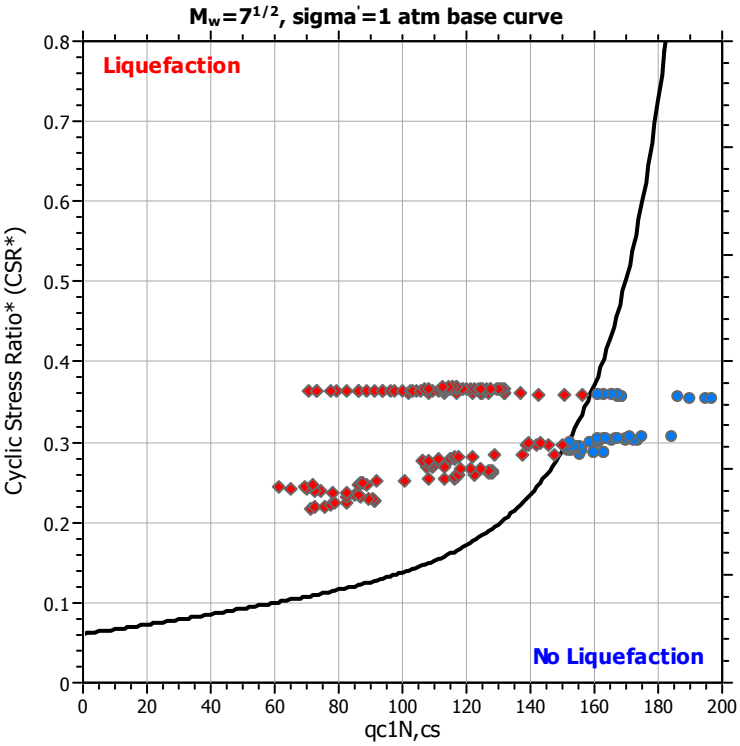
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

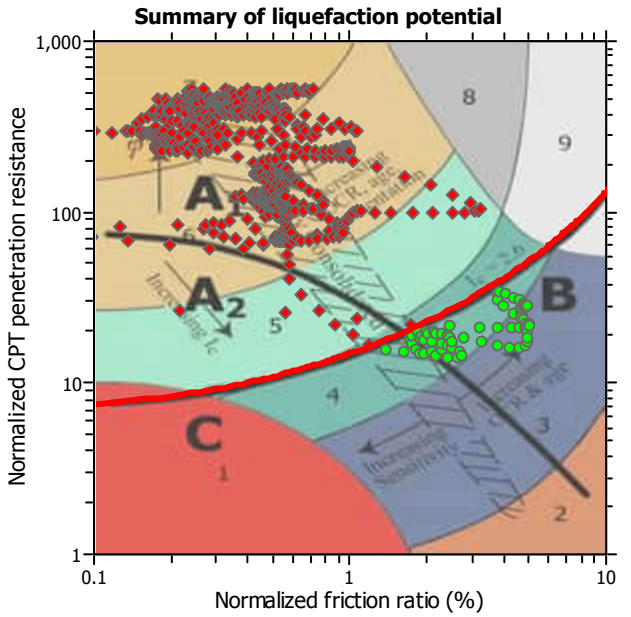
CPT file : CPT_30

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

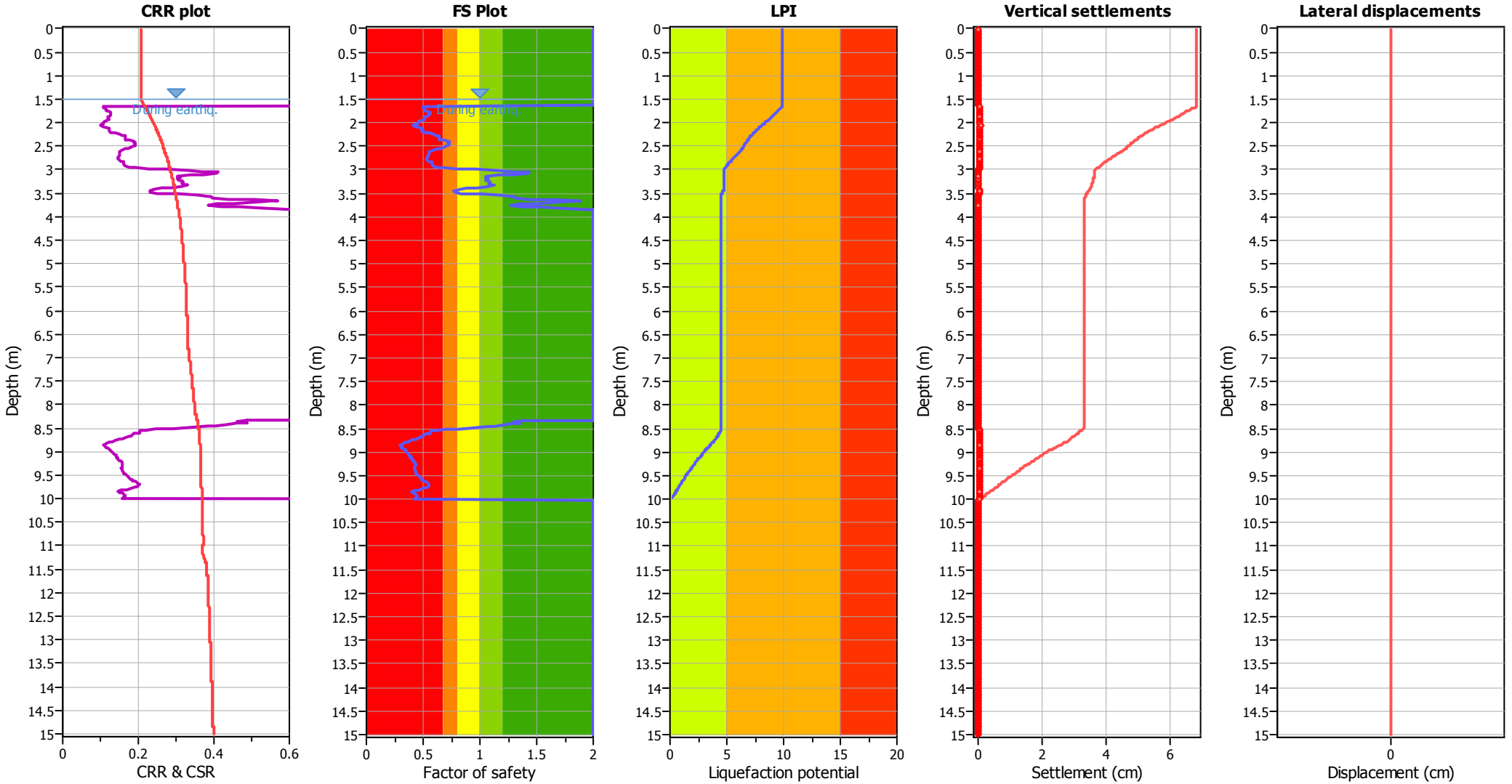






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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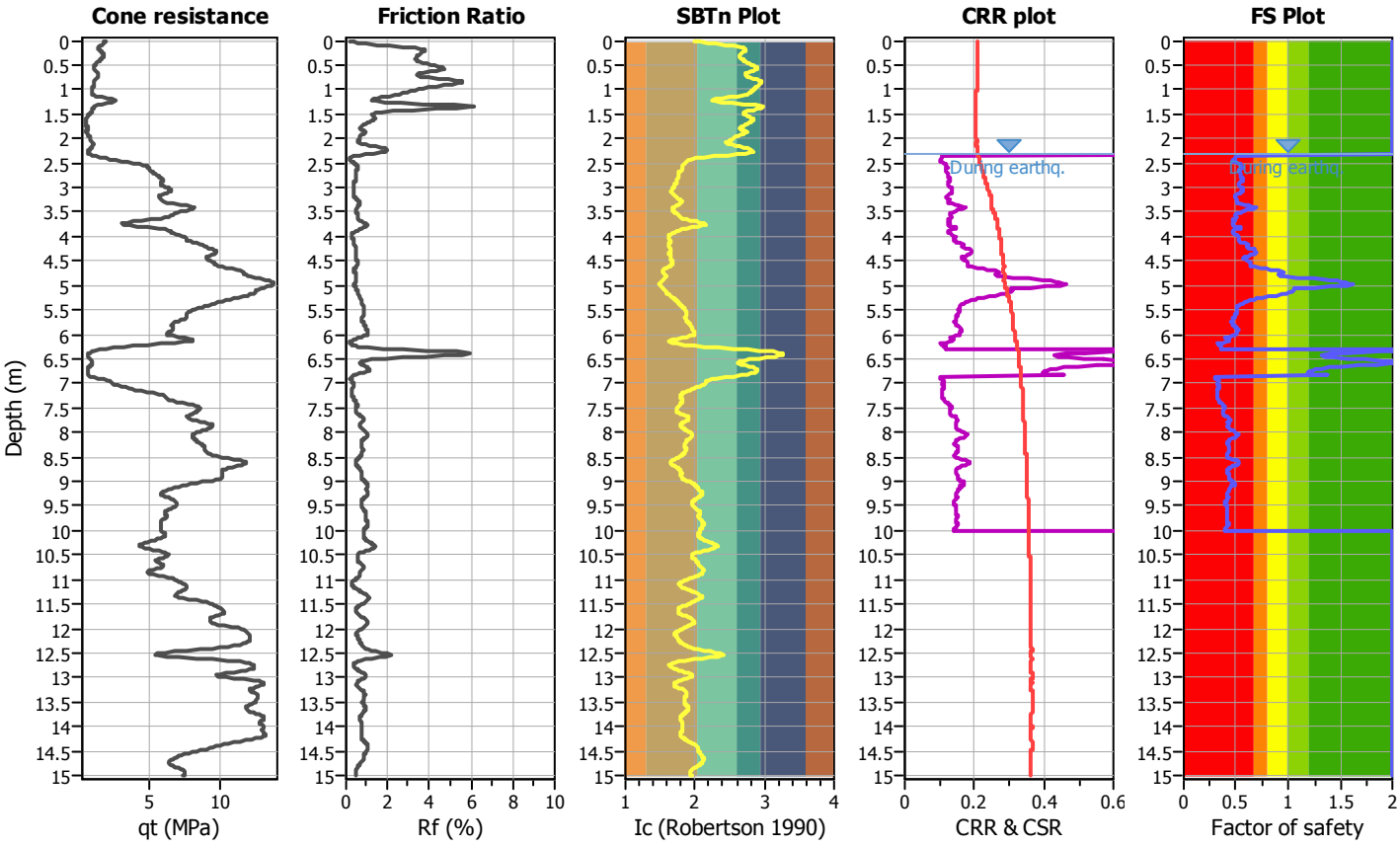
LIQUEFACTION ANALYSIS REPORT

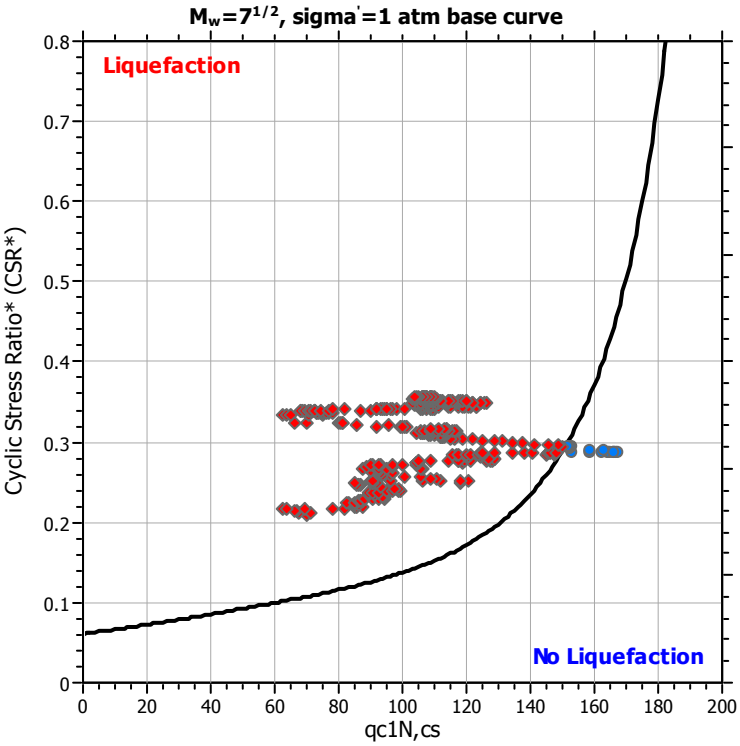
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

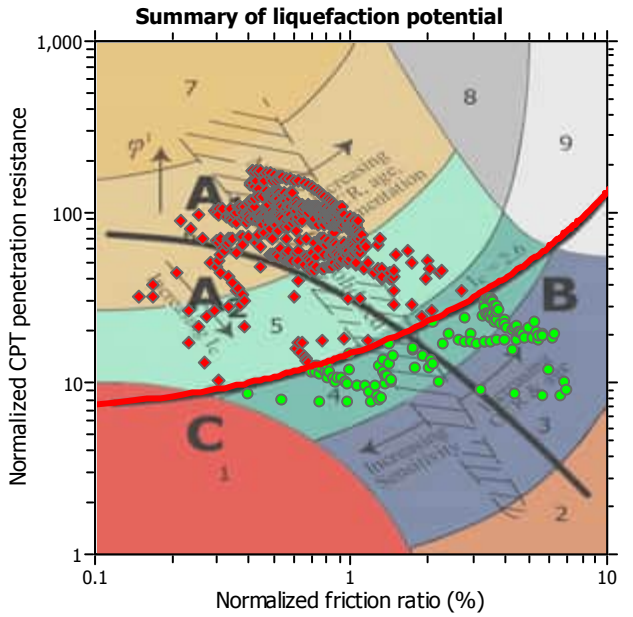
CPT file : CPT_31

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

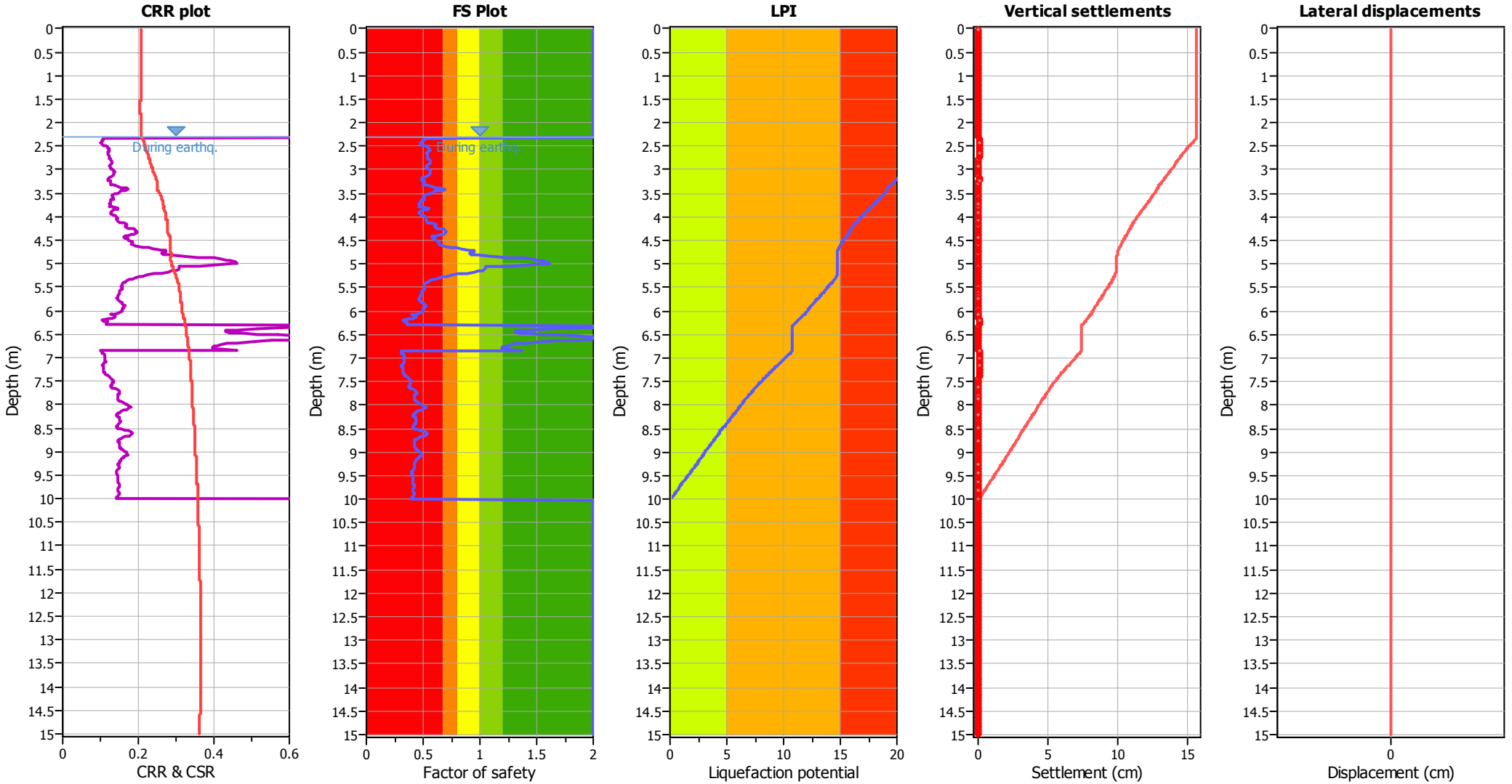






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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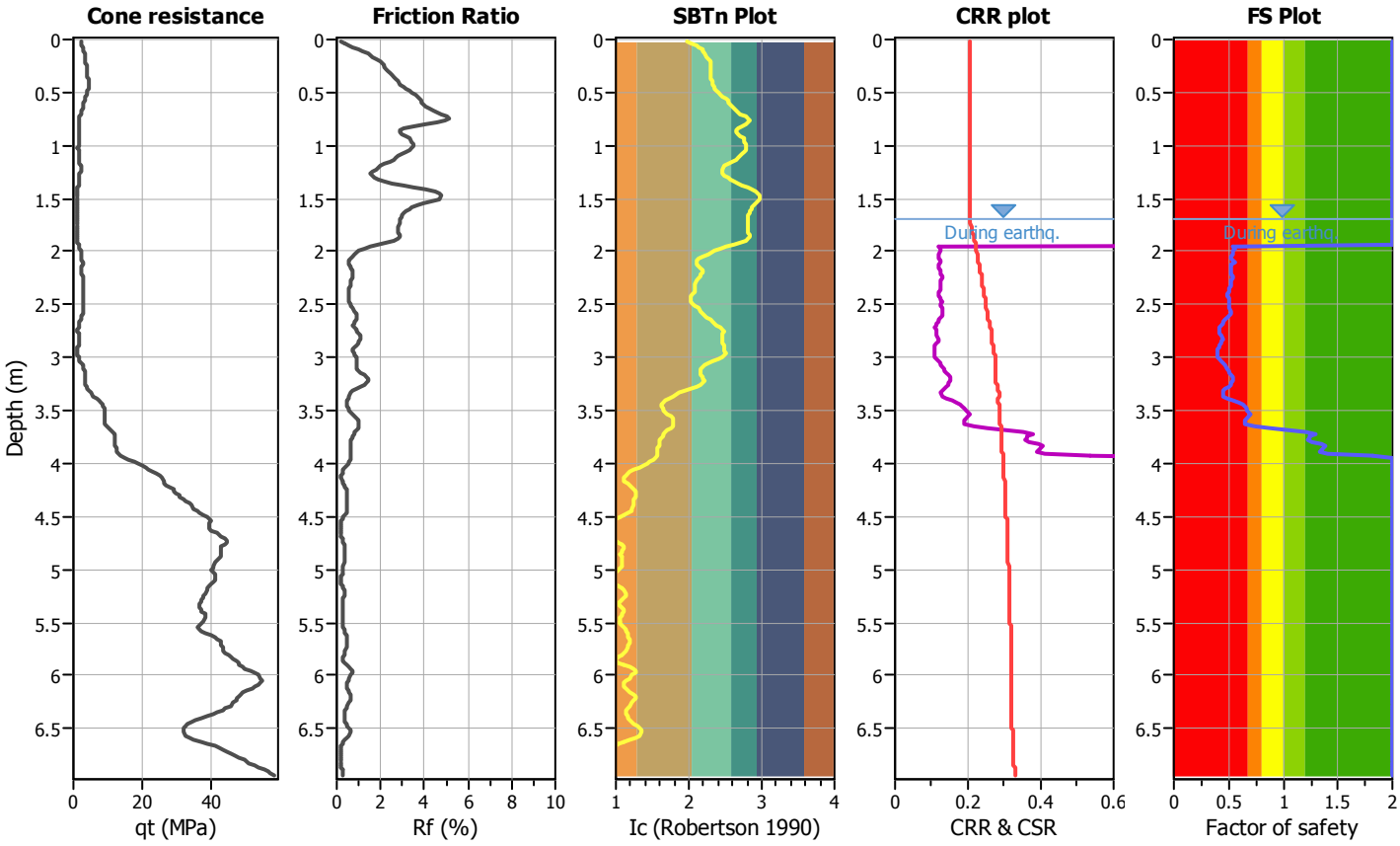
LIQUEFACTION ANALYSIS REPORT

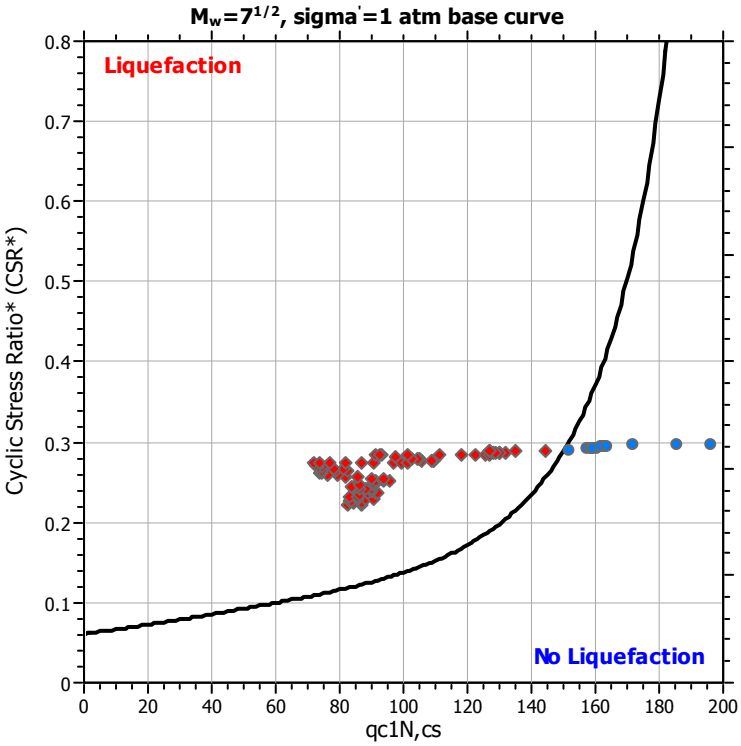
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

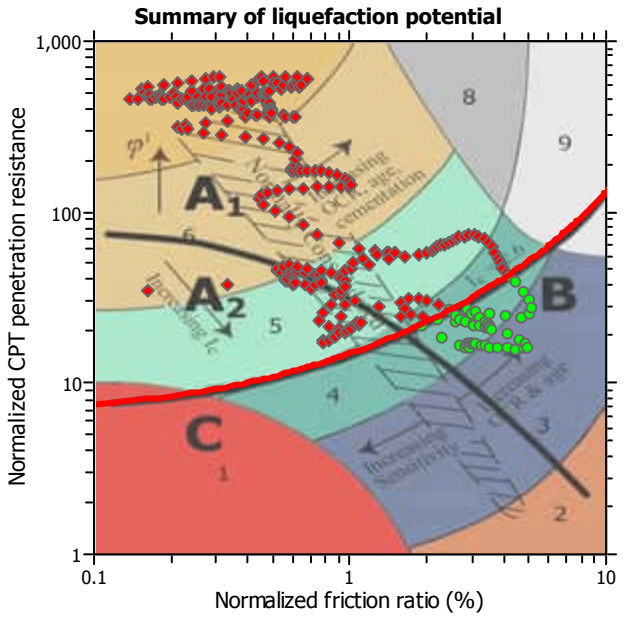
CPT file : CPT_32

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

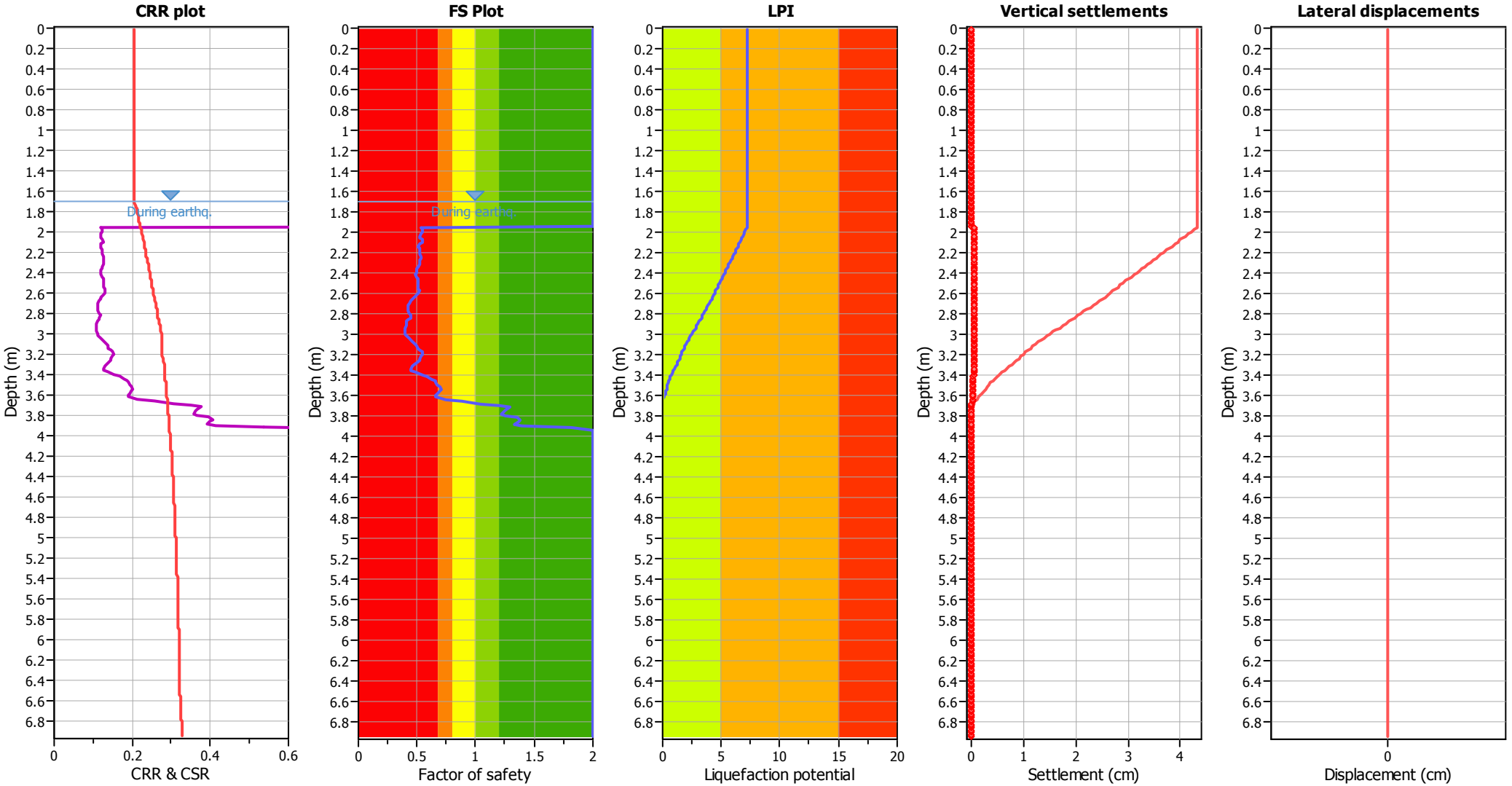






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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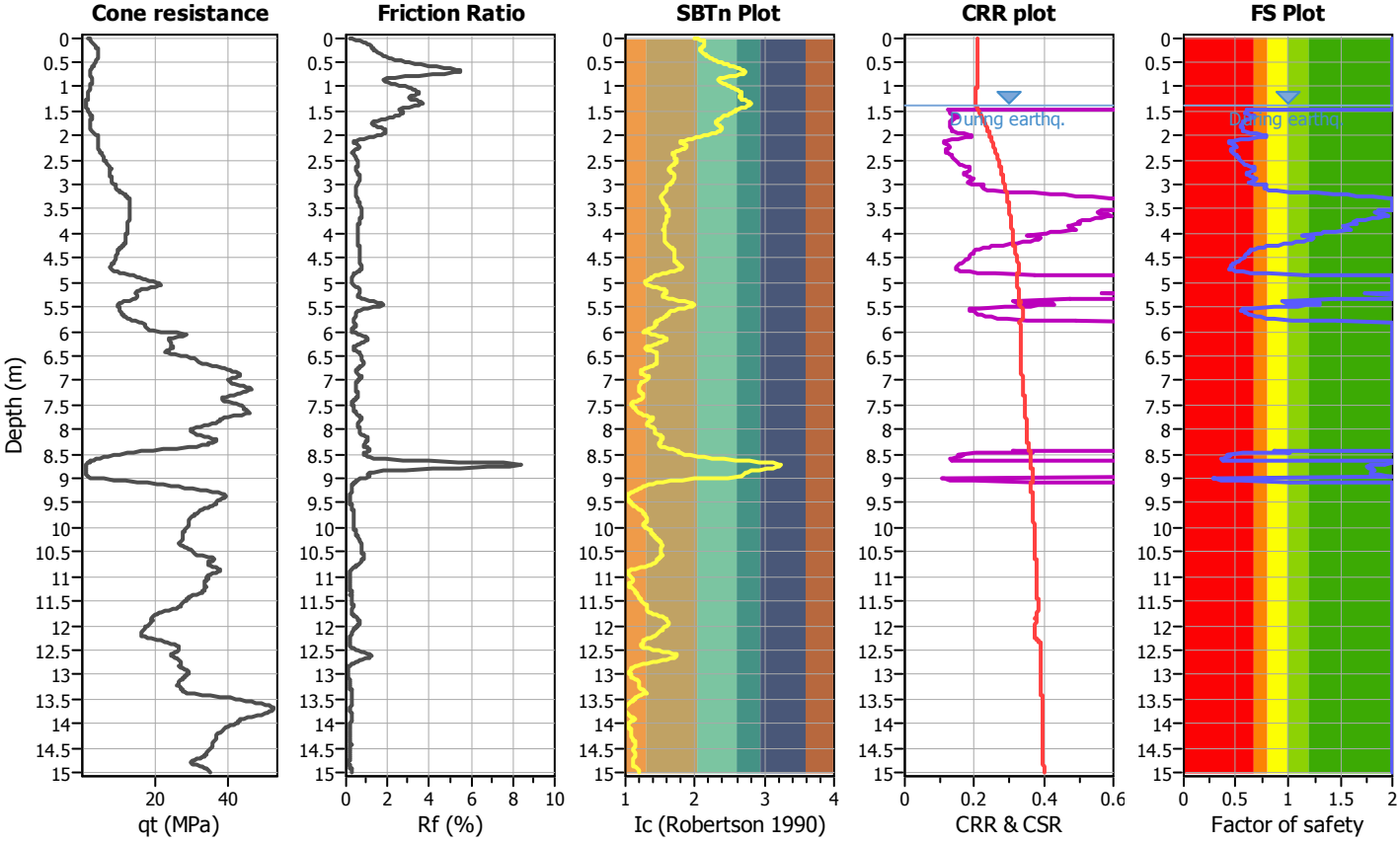
LIQUEFACTION ANALYSIS REPORT

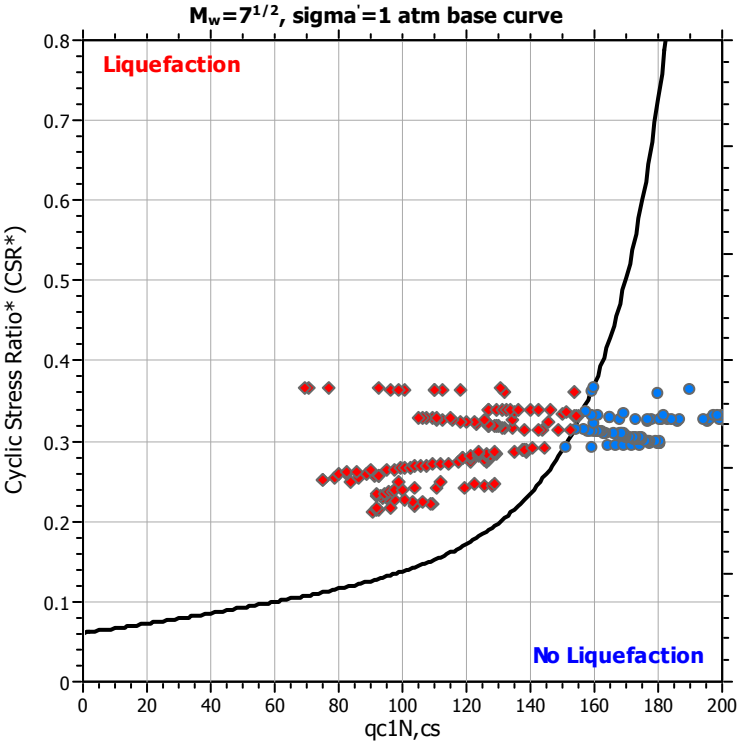
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

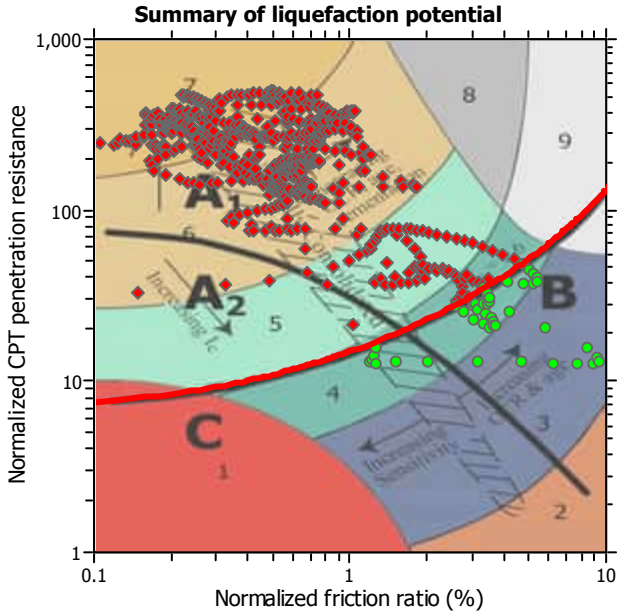
CPT file : CPT_33

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

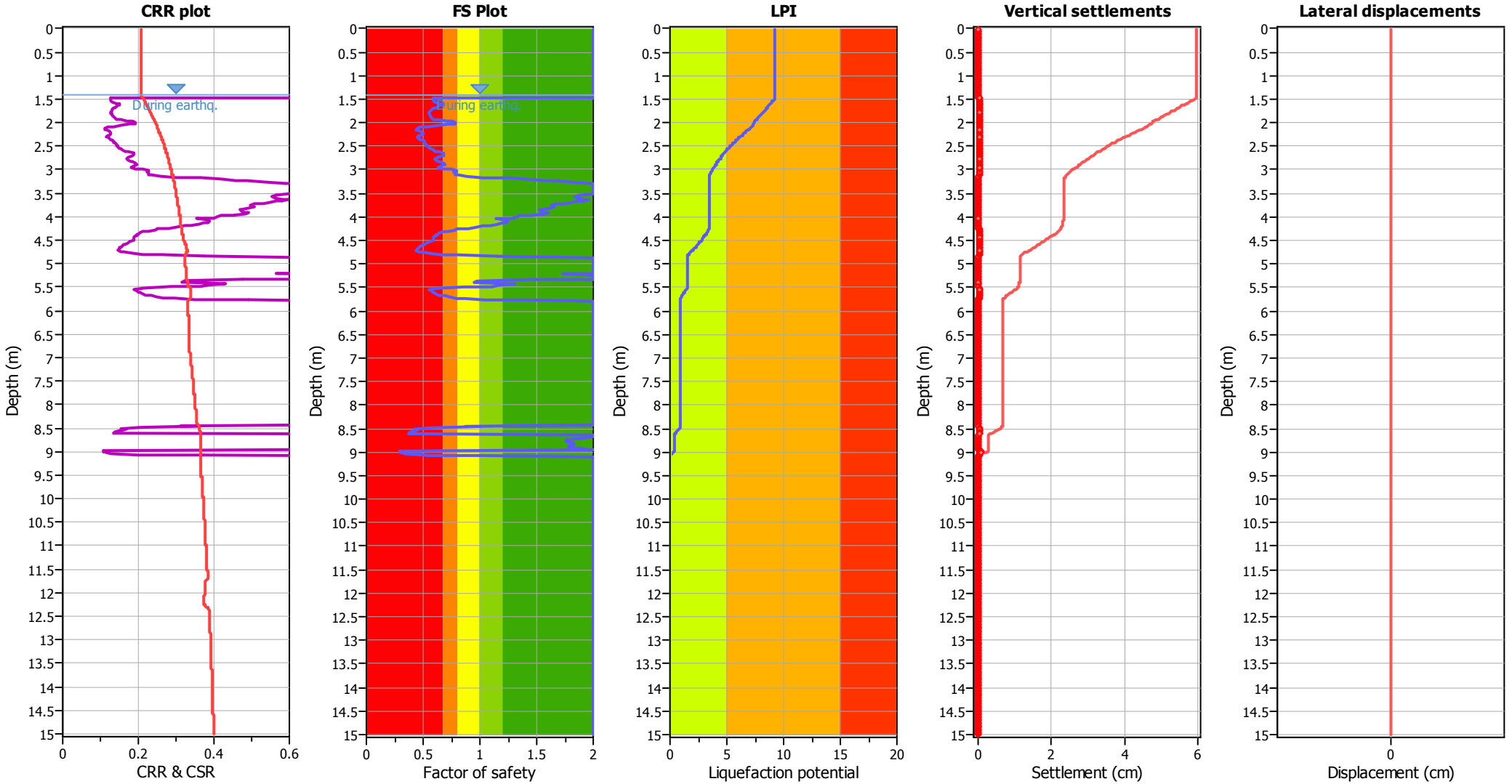






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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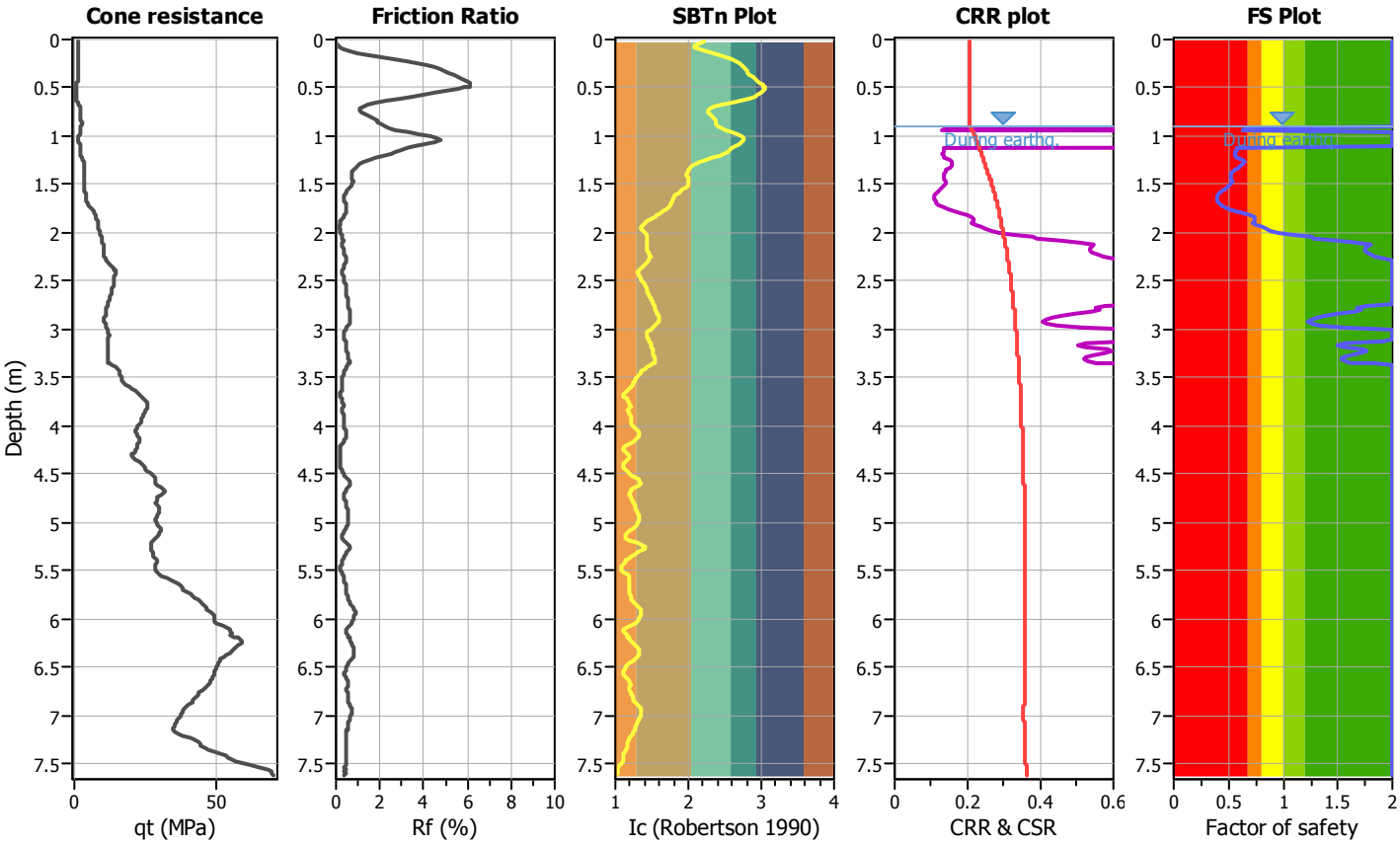
LIQUEFACTION ANALYSIS REPORT

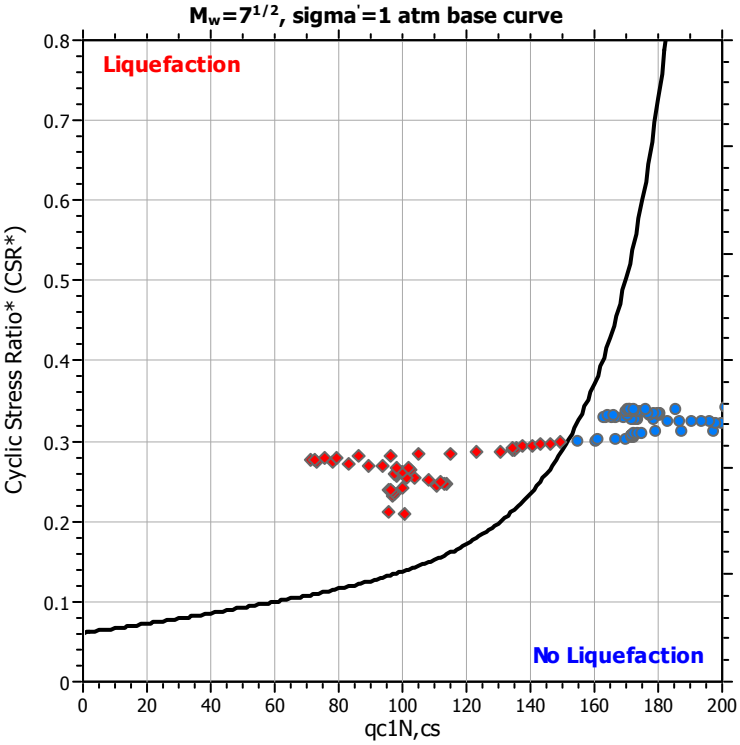
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

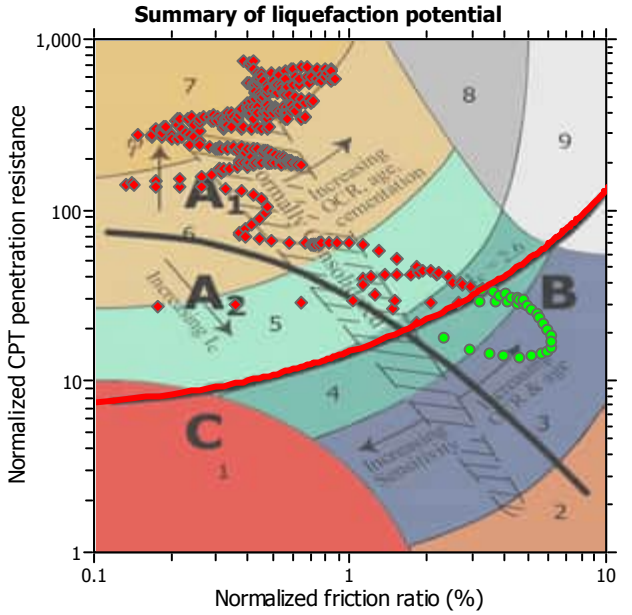
CPT file : CPT_34

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

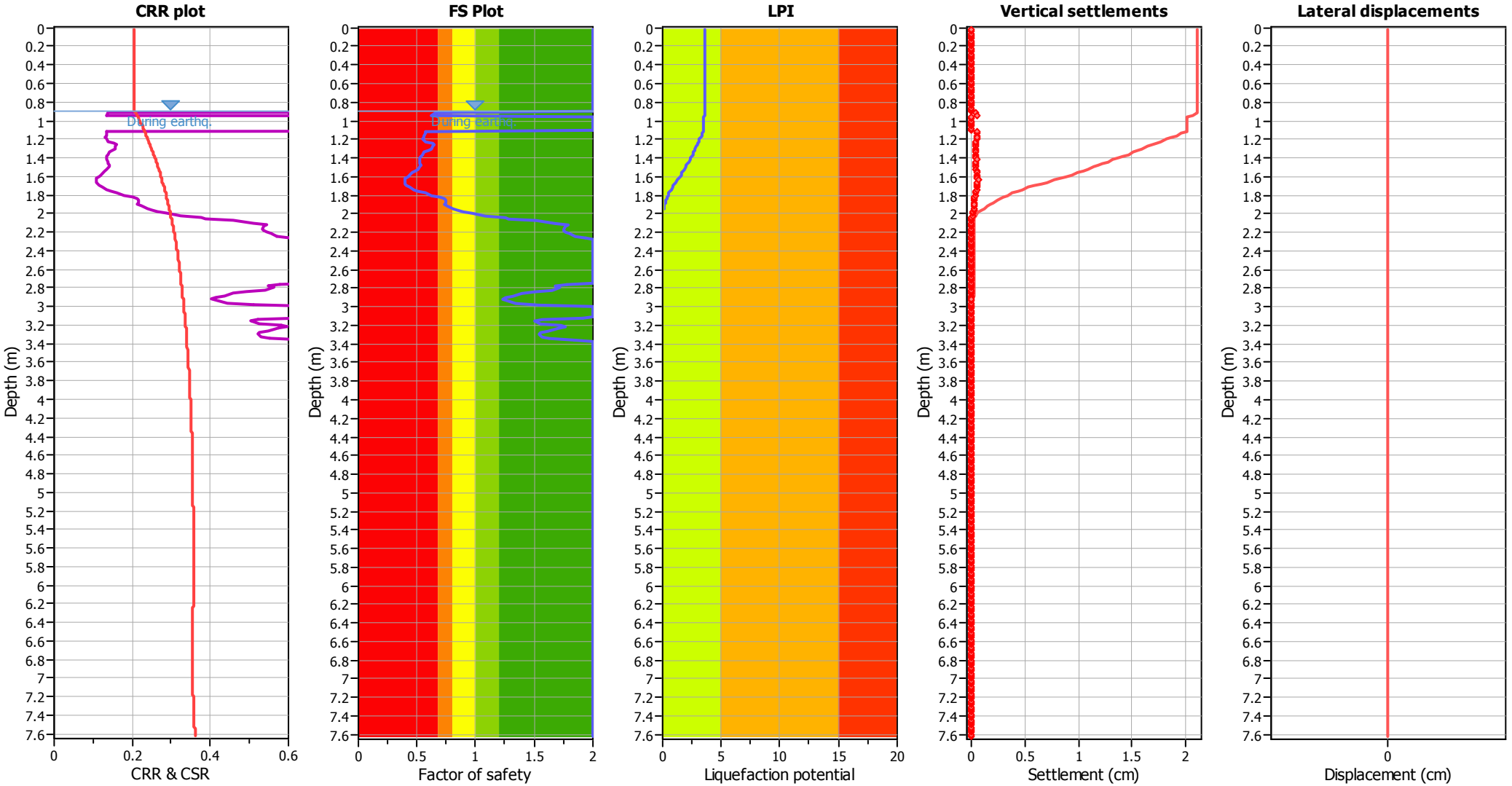






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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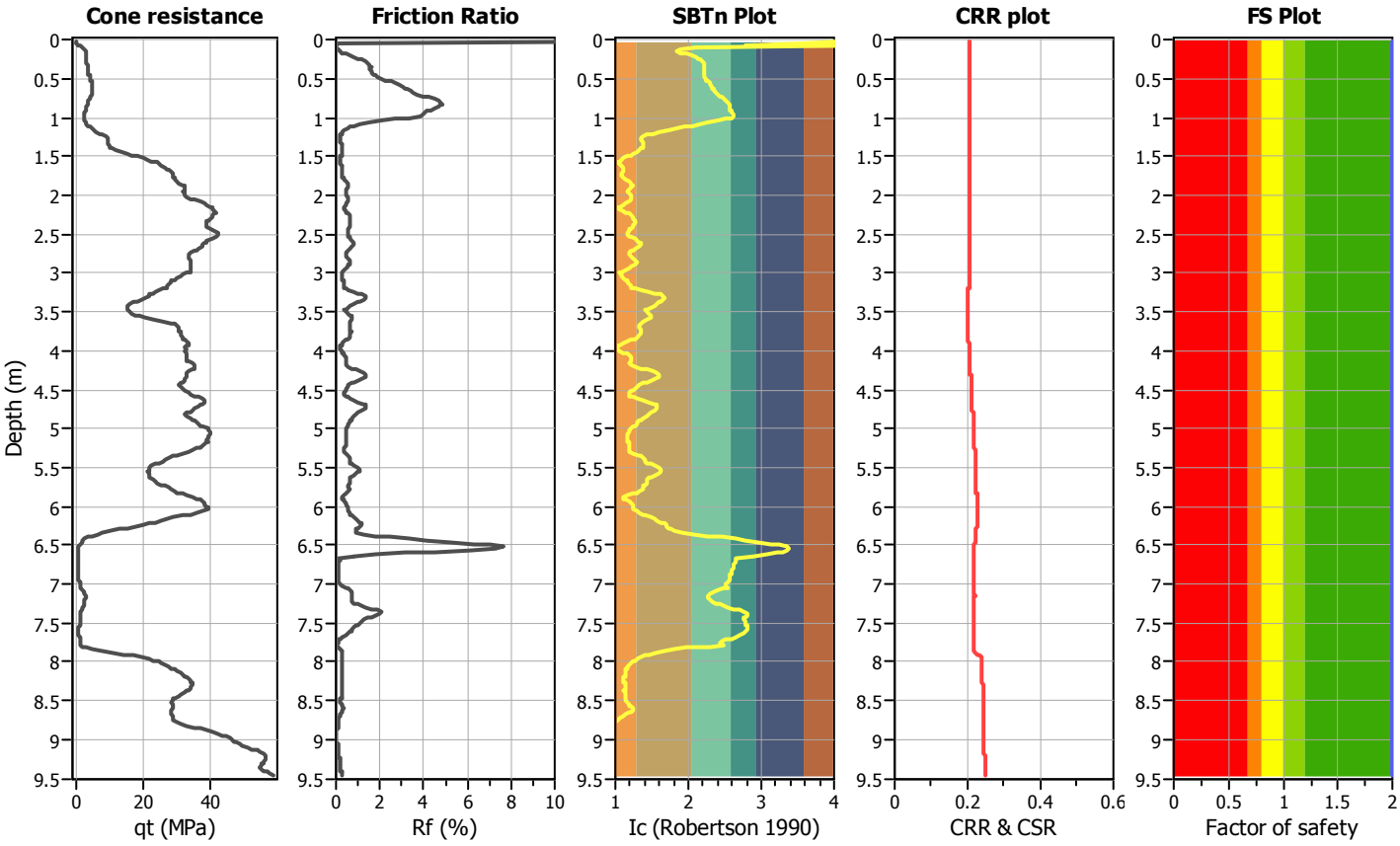
LIQUEFACTION ANALYSIS REPORT

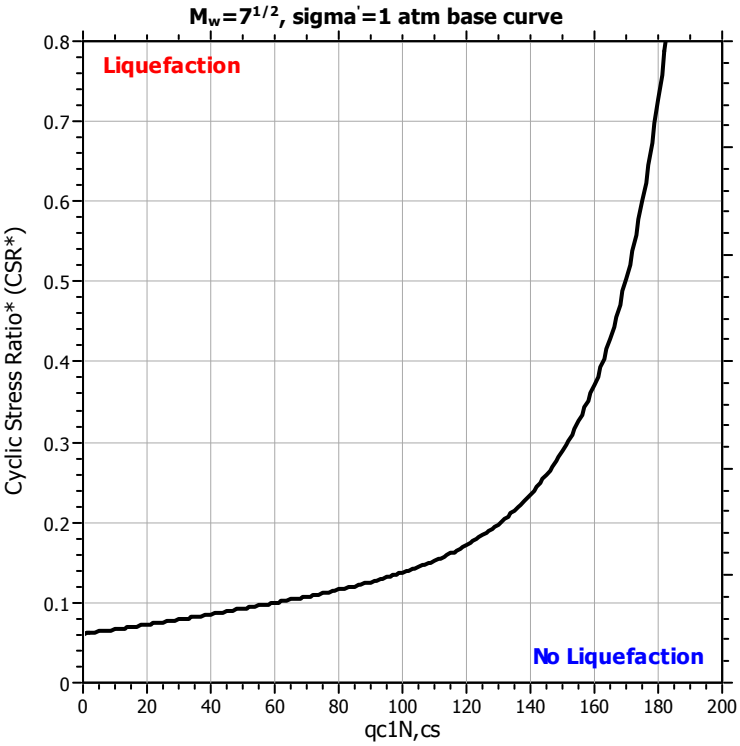
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

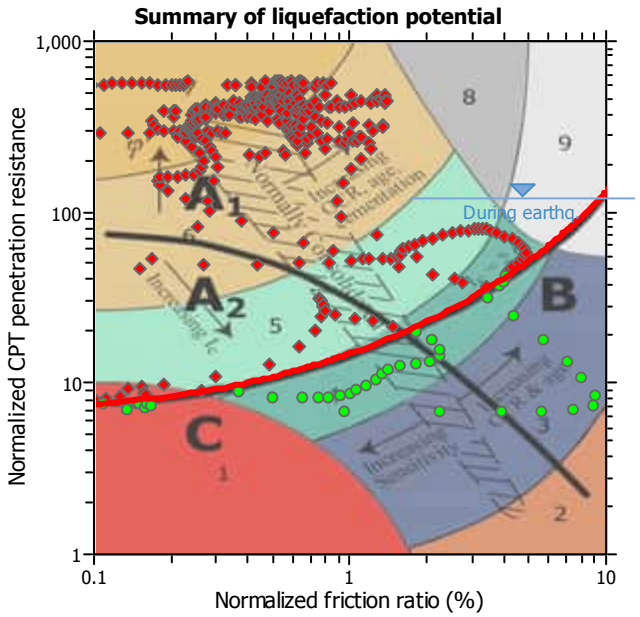
CPT file : CPT_35

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	13.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

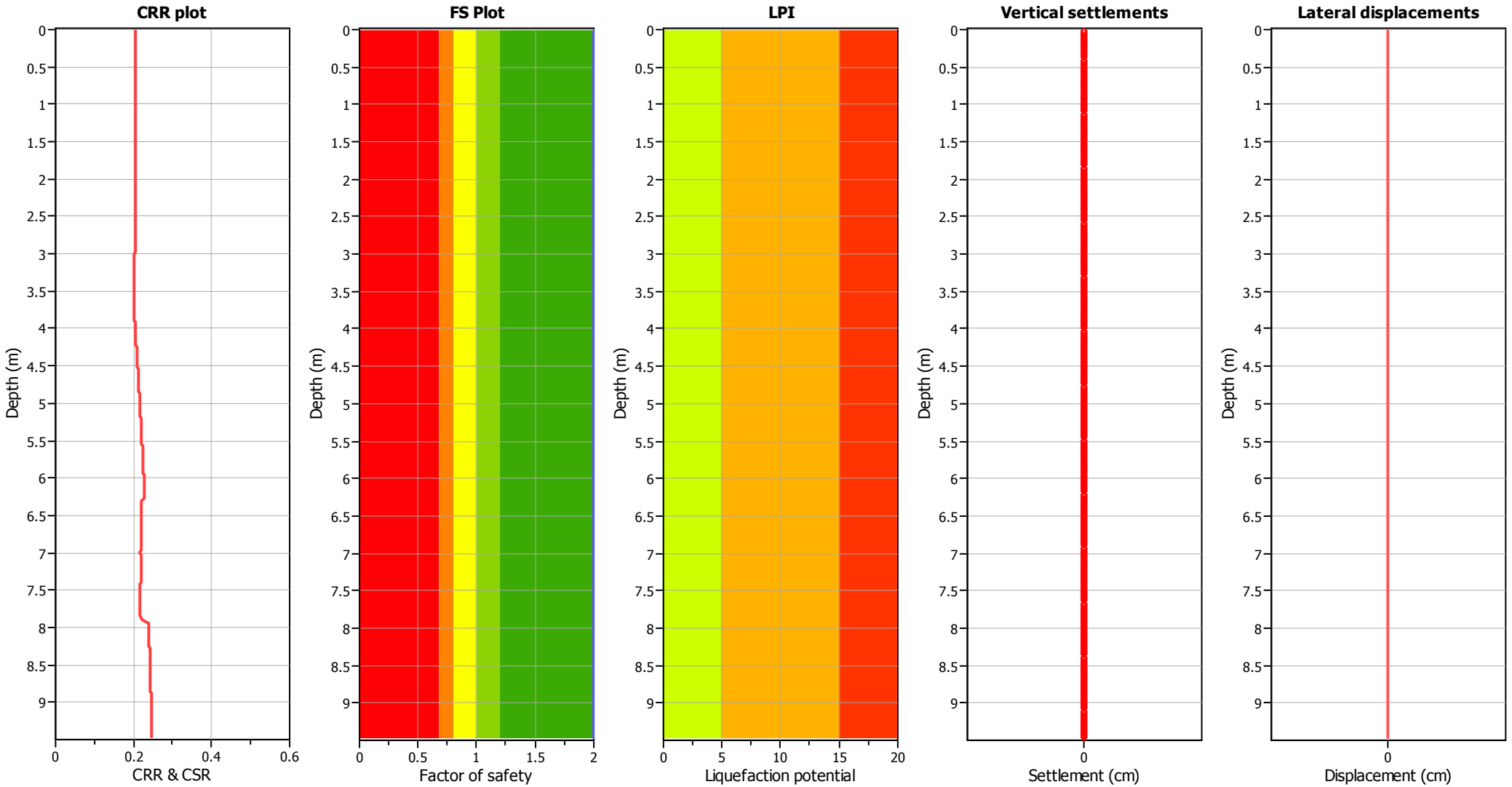






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	13.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

During earthq. During earthq.

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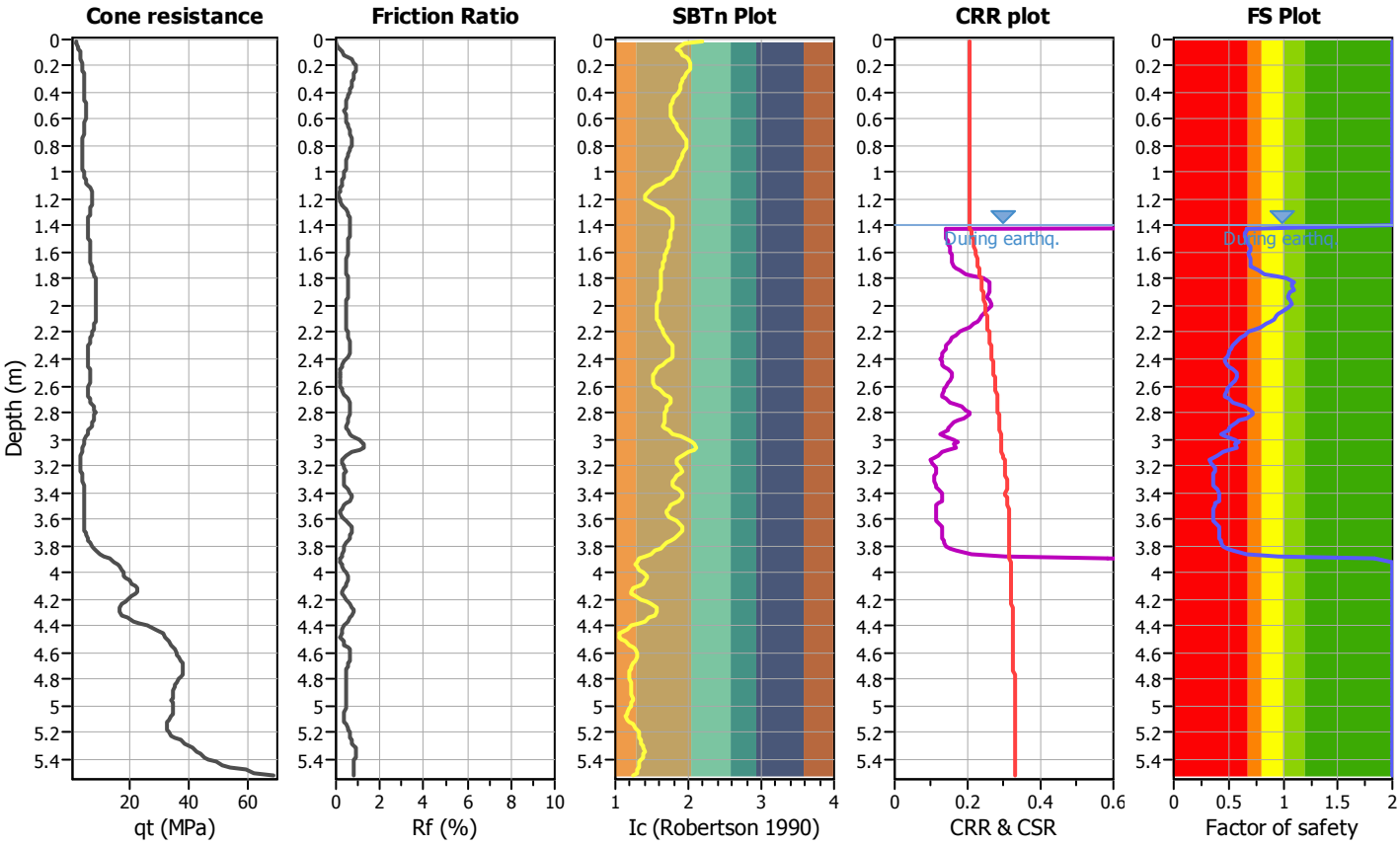
LIQUEFACTION ANALYSIS REPORT

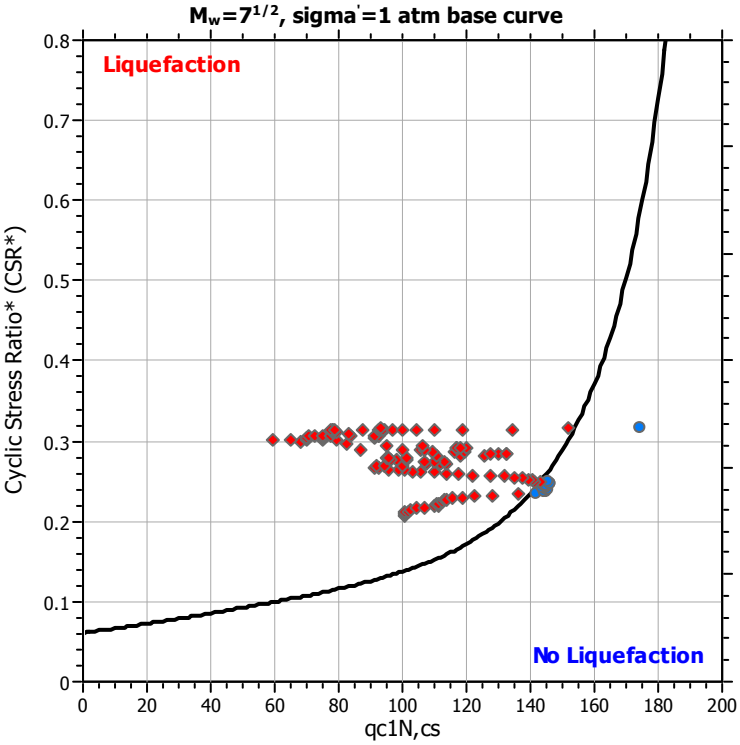
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

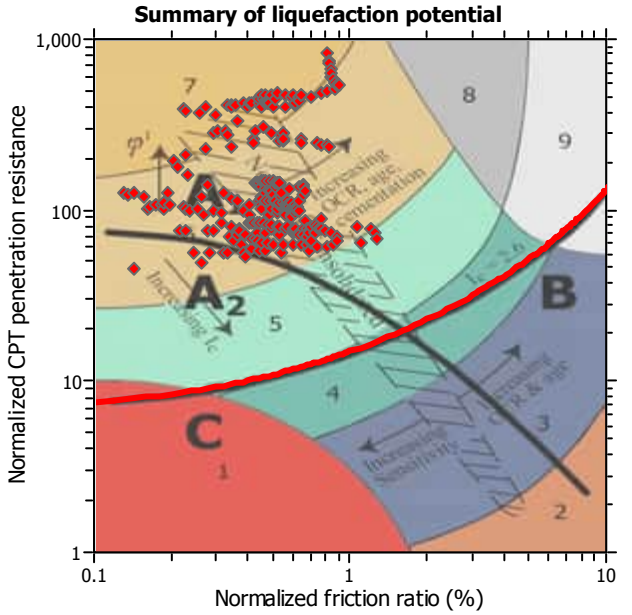
CPT file : CPT_36

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

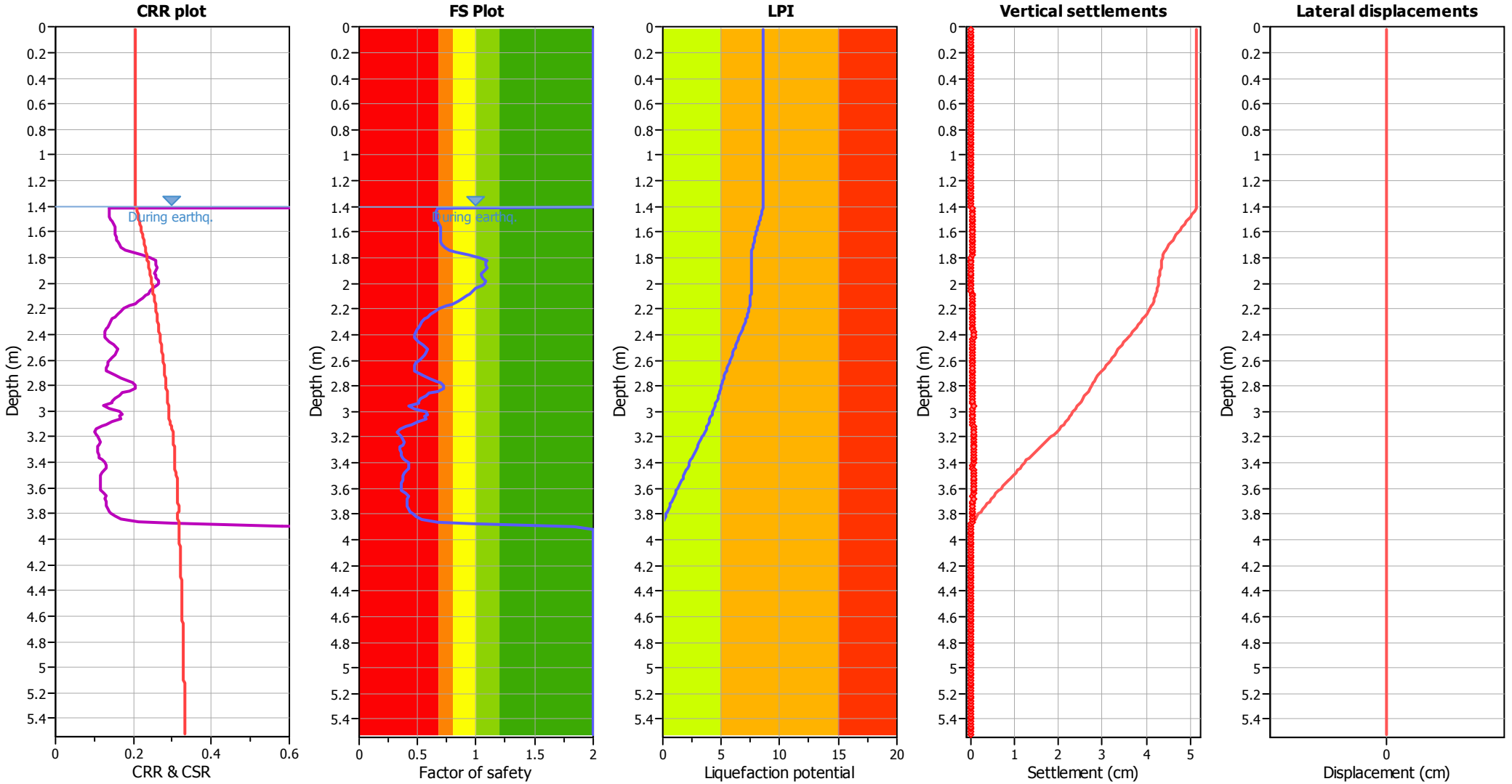






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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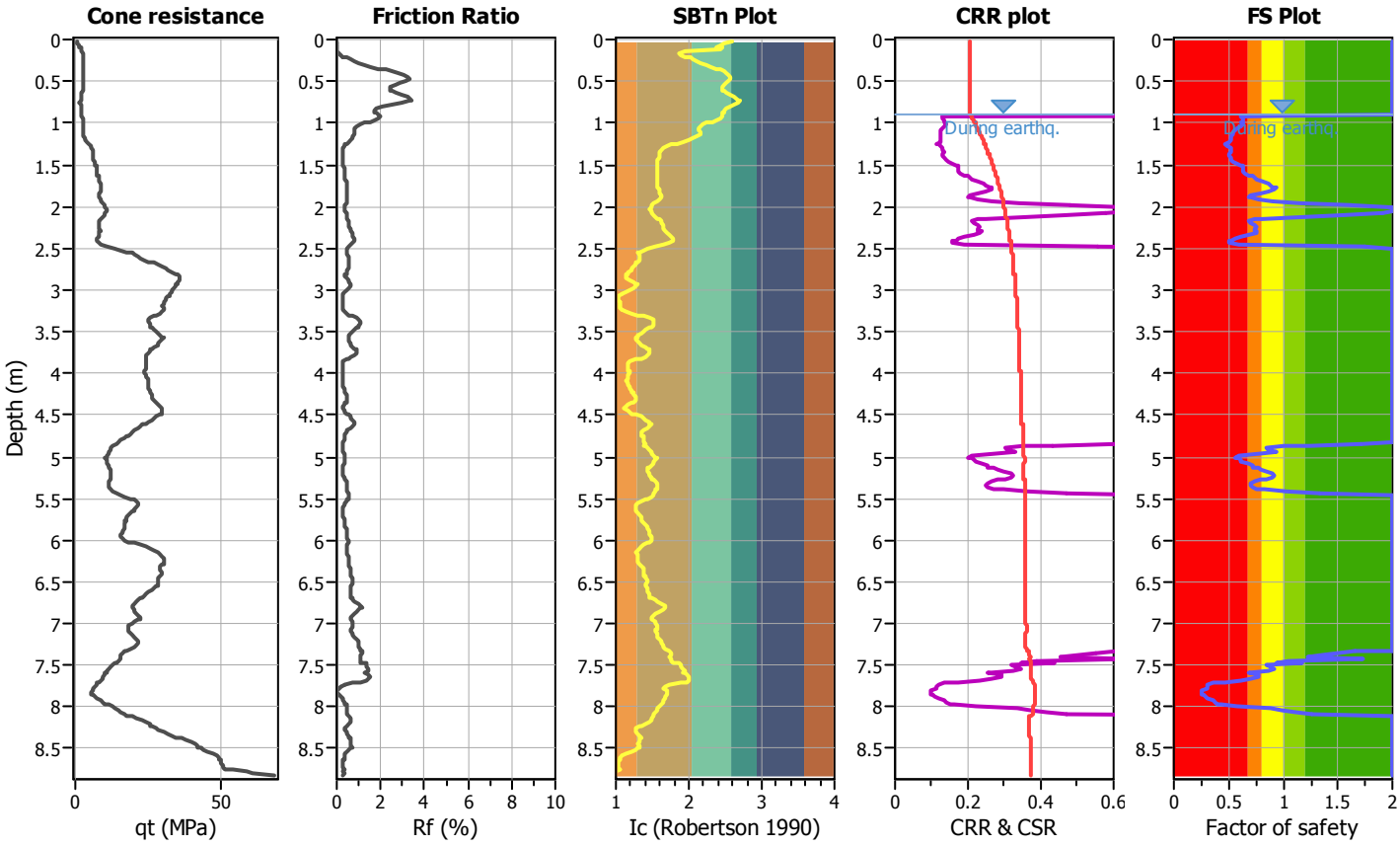
LIQUEFACTION ANALYSIS REPORT

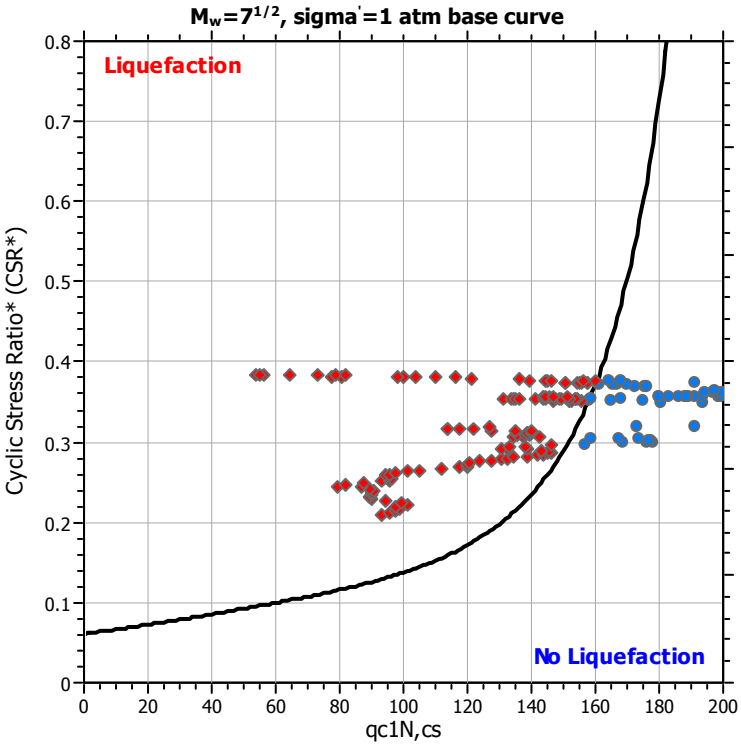
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

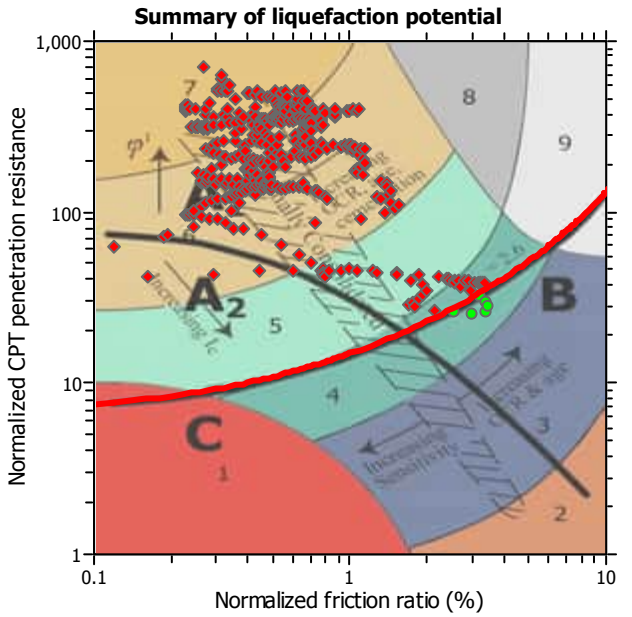
CPT file : CPT_37

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.90 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.90 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

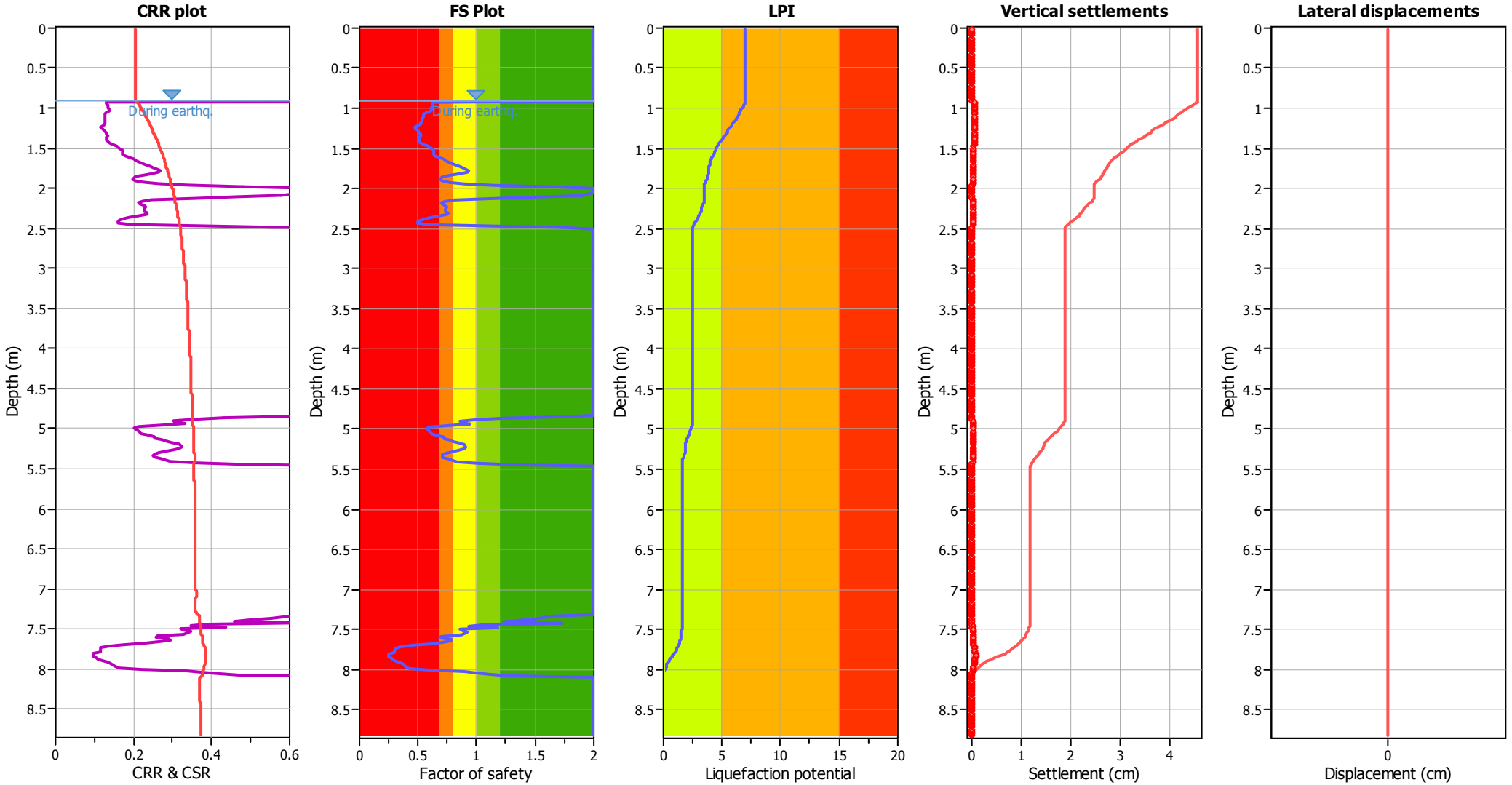






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.90 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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Christchurch 8140

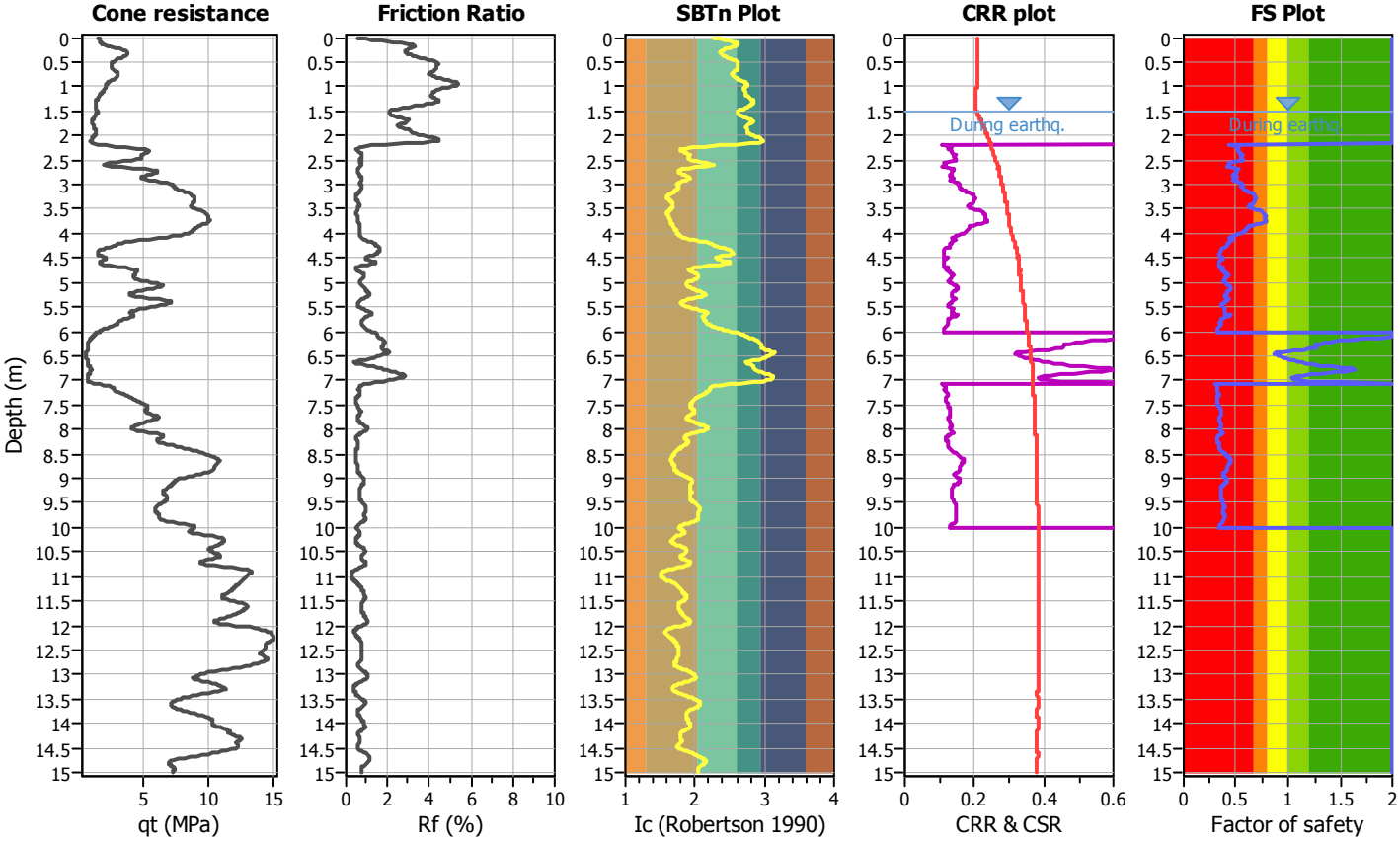
LIQUEFACTION ANALYSIS REPORT

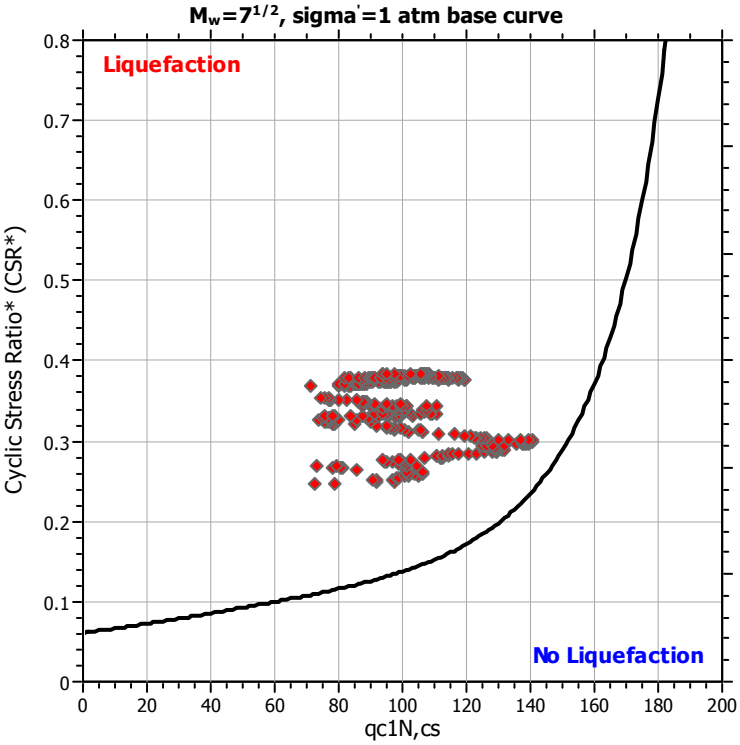
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

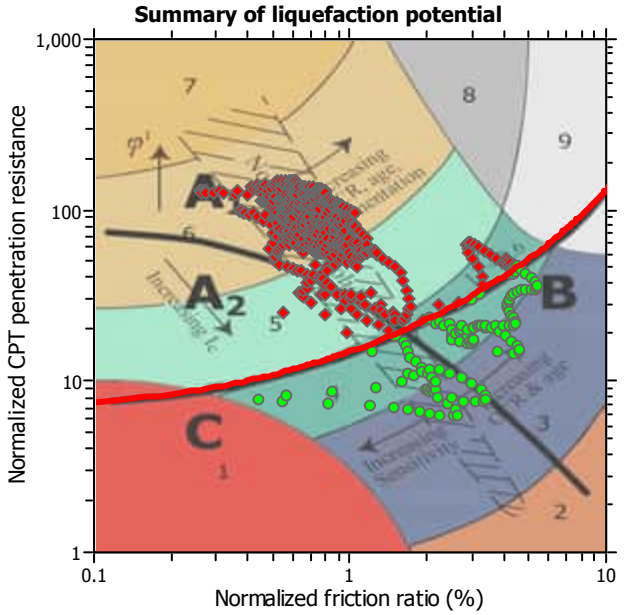
CPT file : CPT_38

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

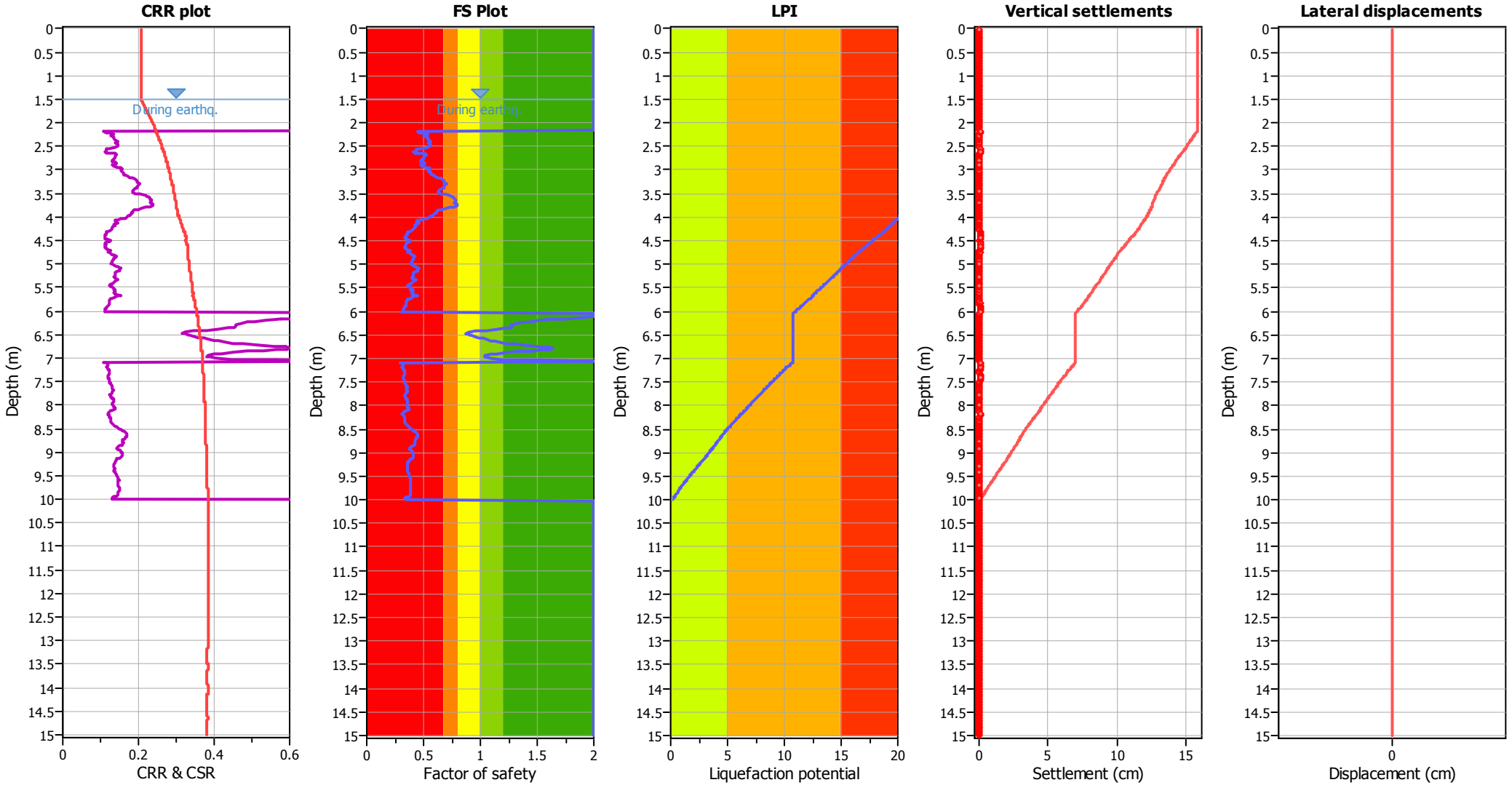






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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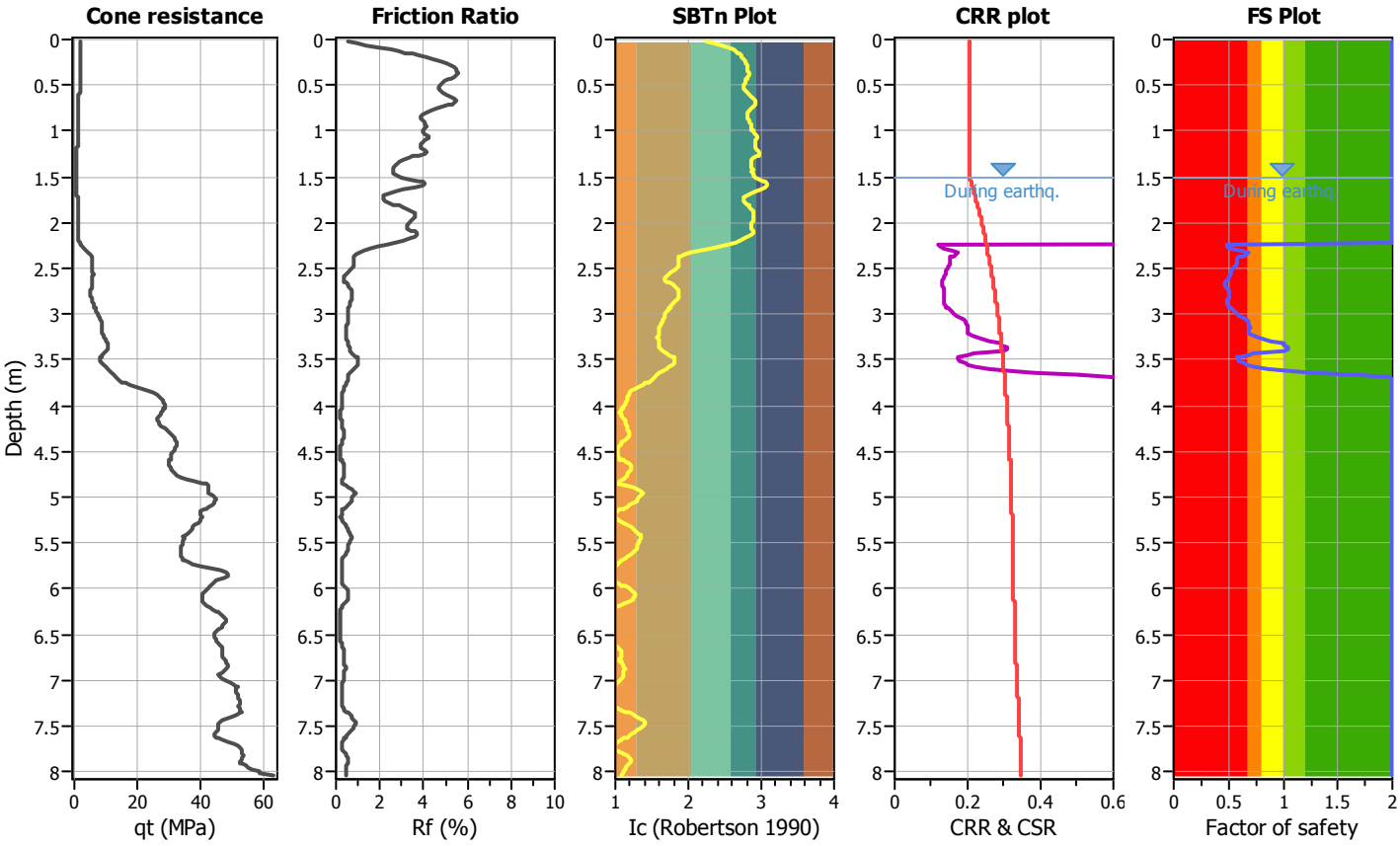
LIQUEFACTION ANALYSIS REPORT

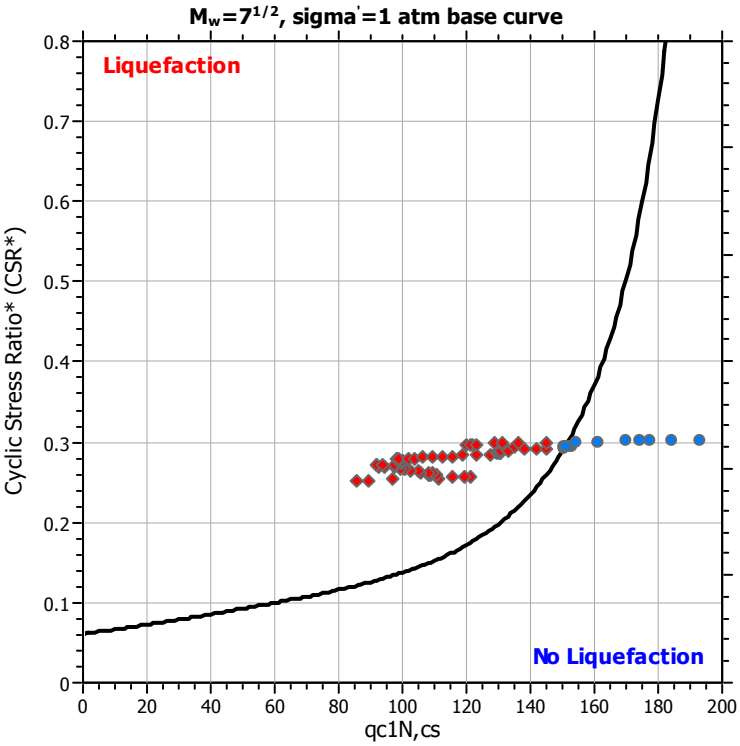
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

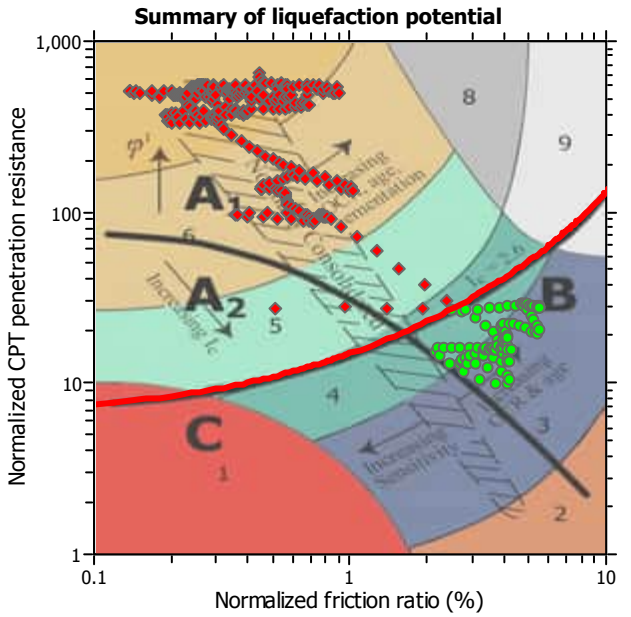
CPT file : CPT_39

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

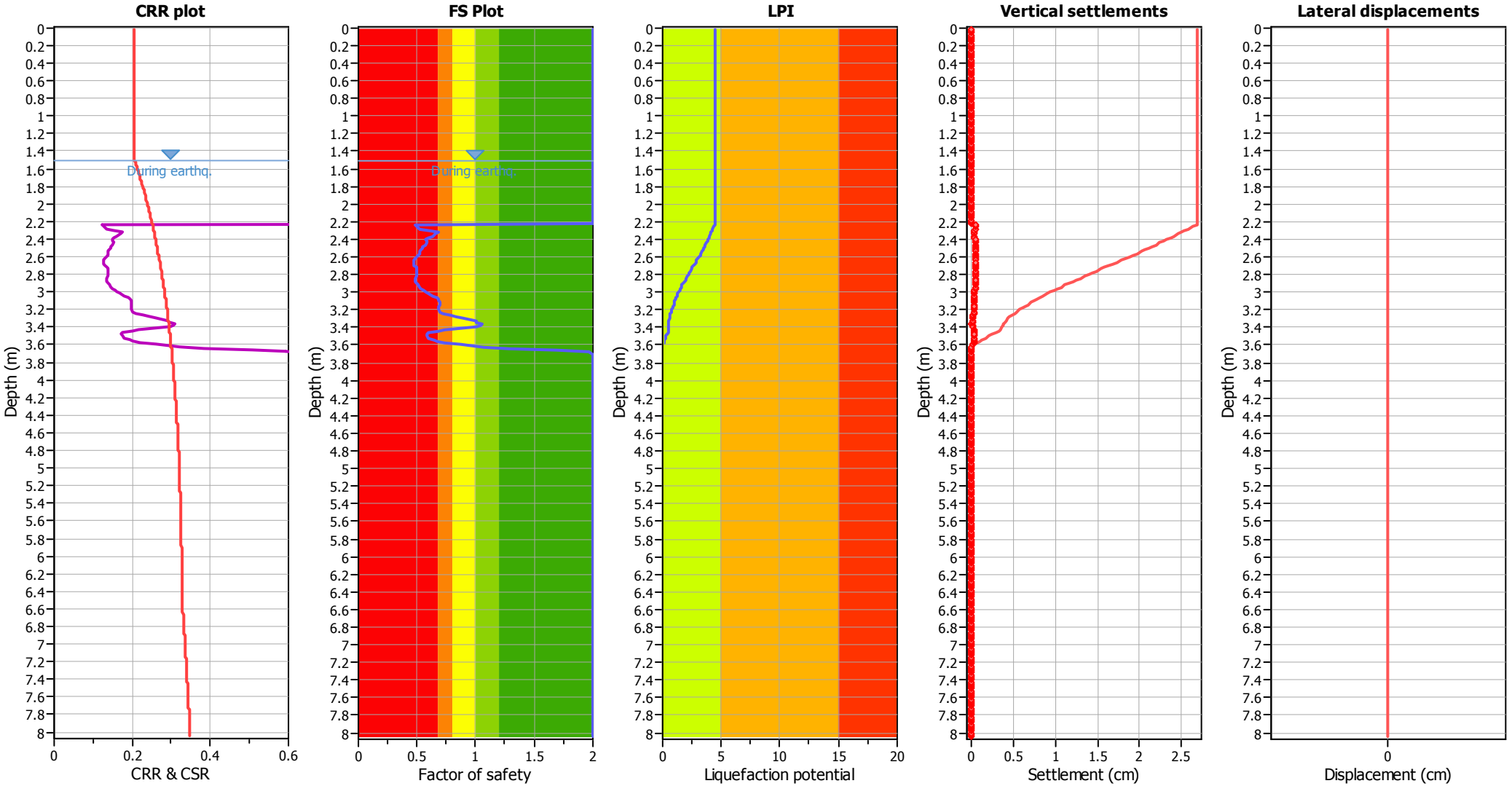






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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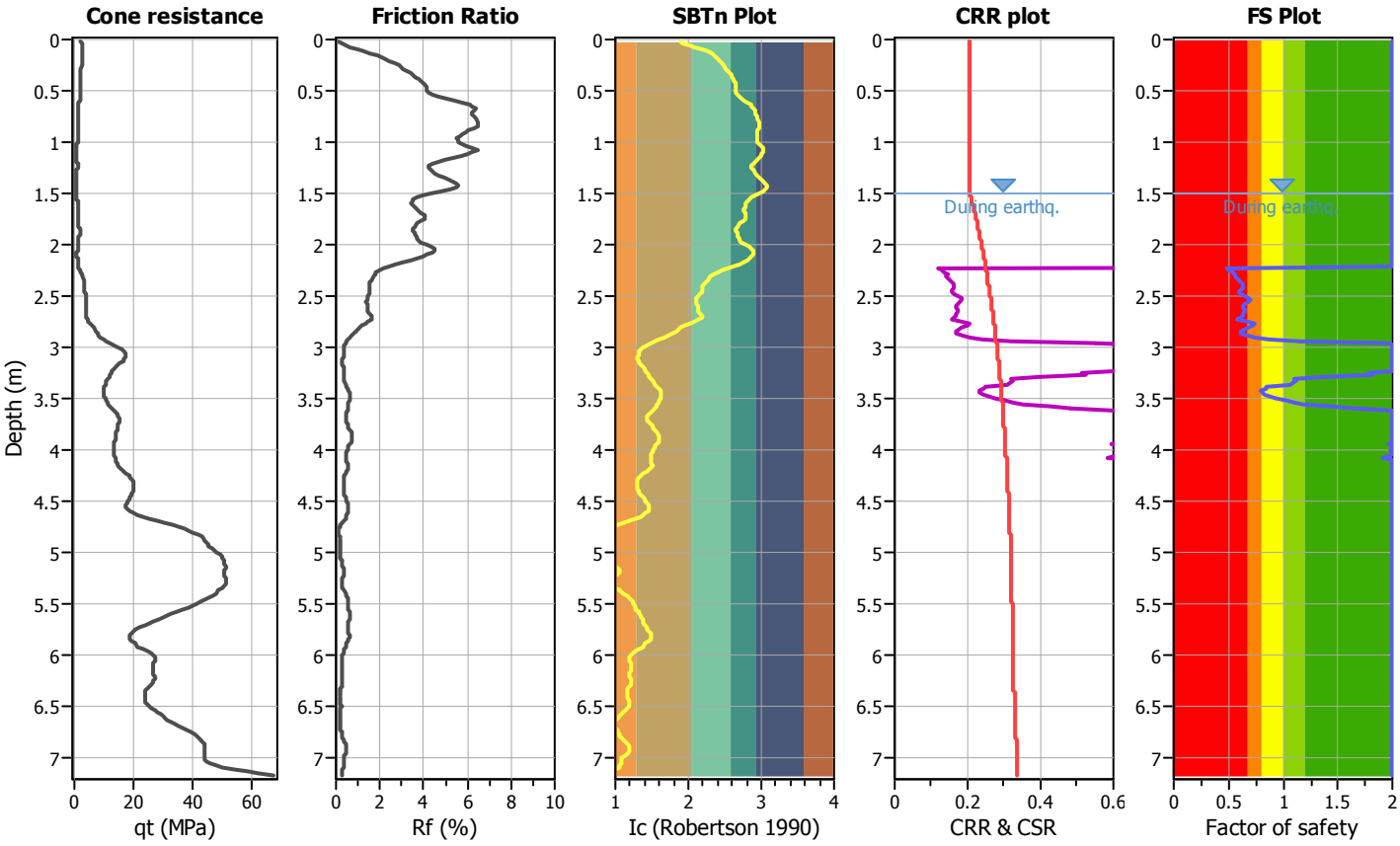
LIQUEFACTION ANALYSIS REPORT

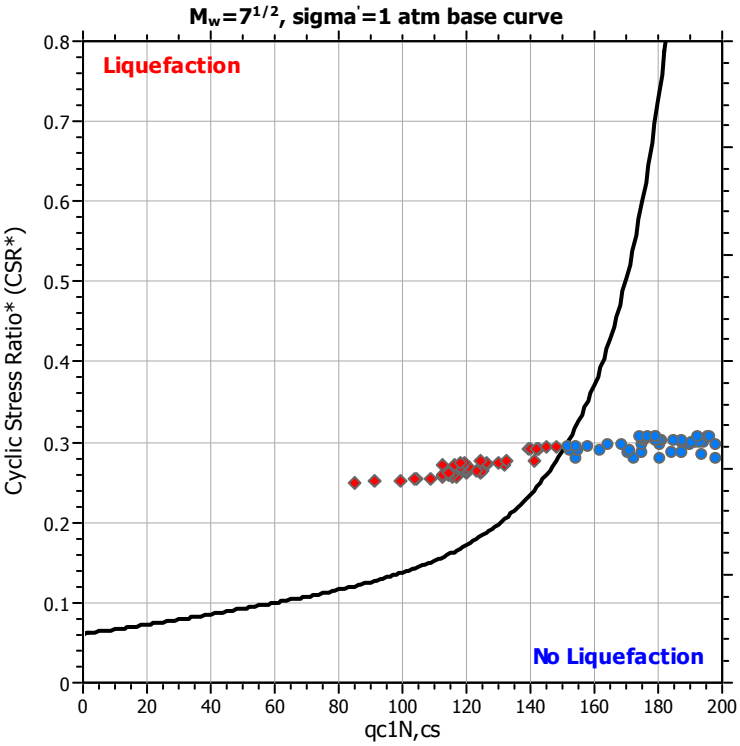
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

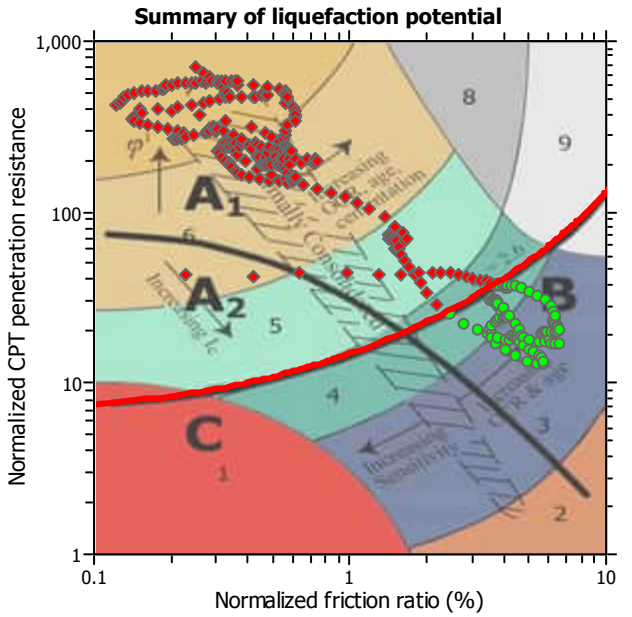
CPT file : CPT_40

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

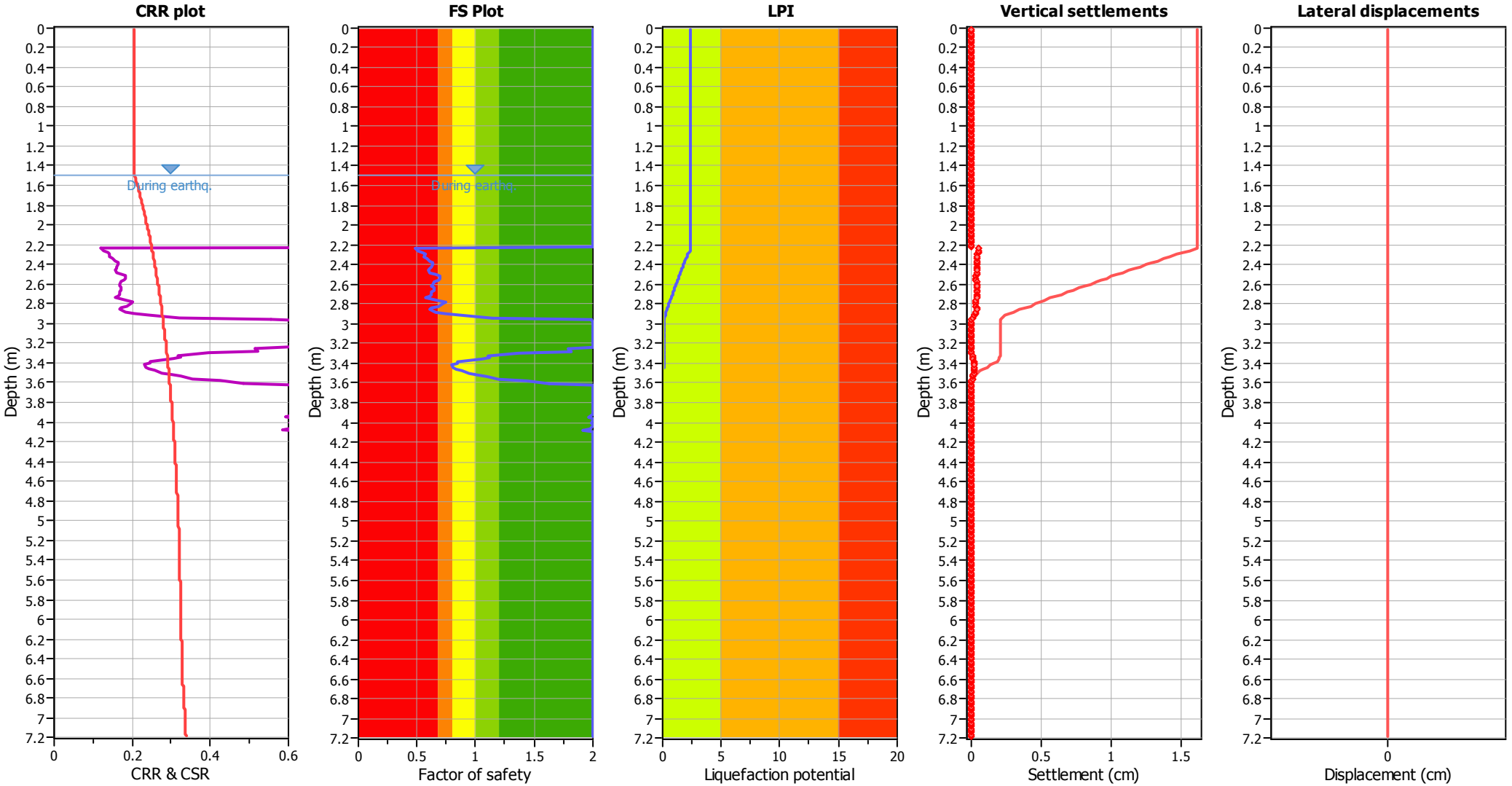






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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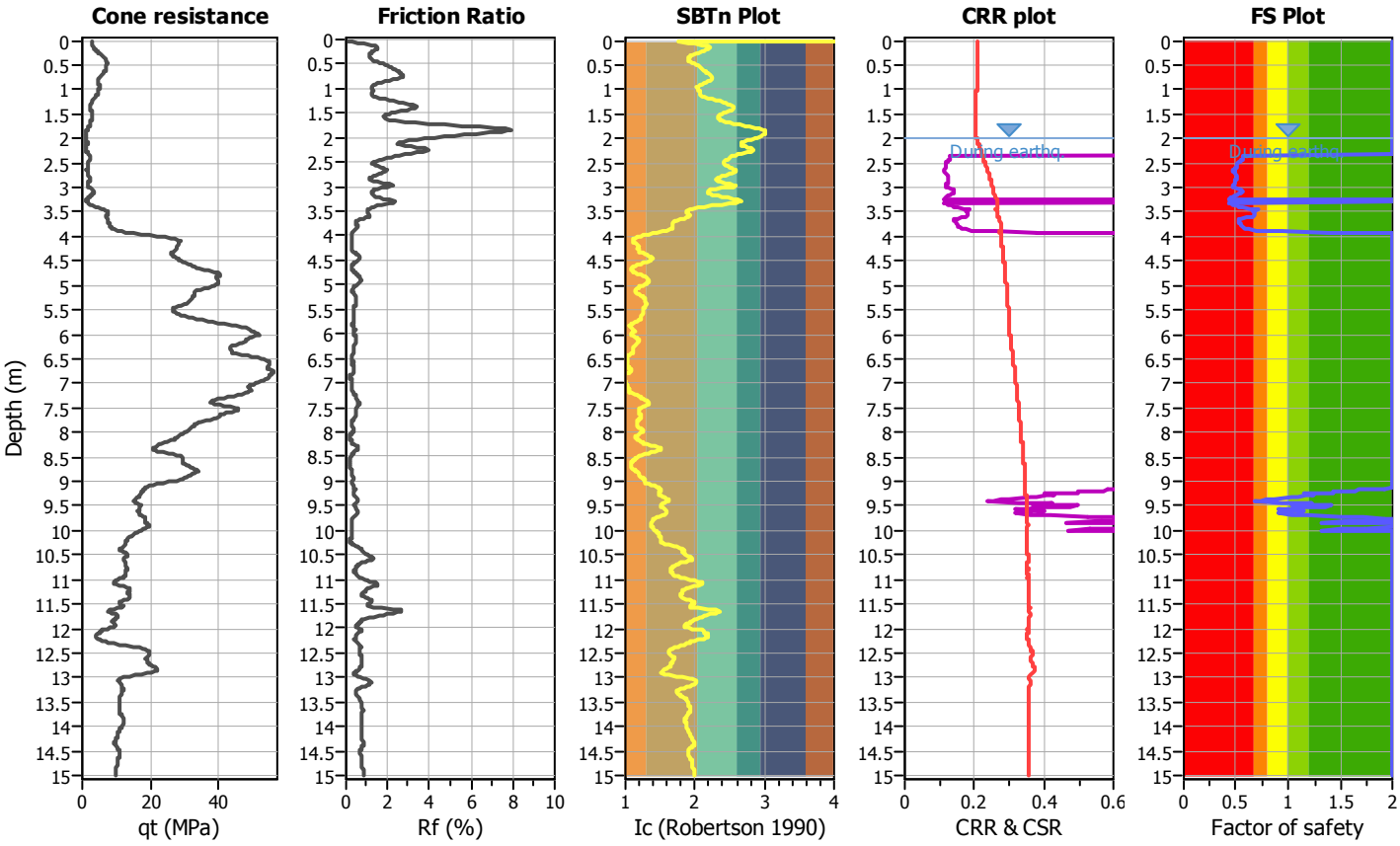
LIQUEFACTION ANALYSIS REPORT

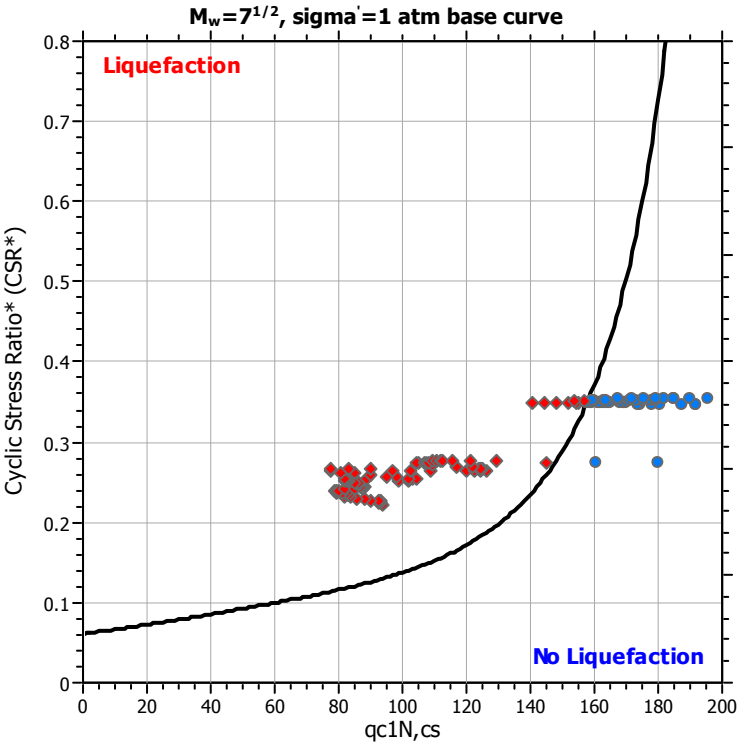
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

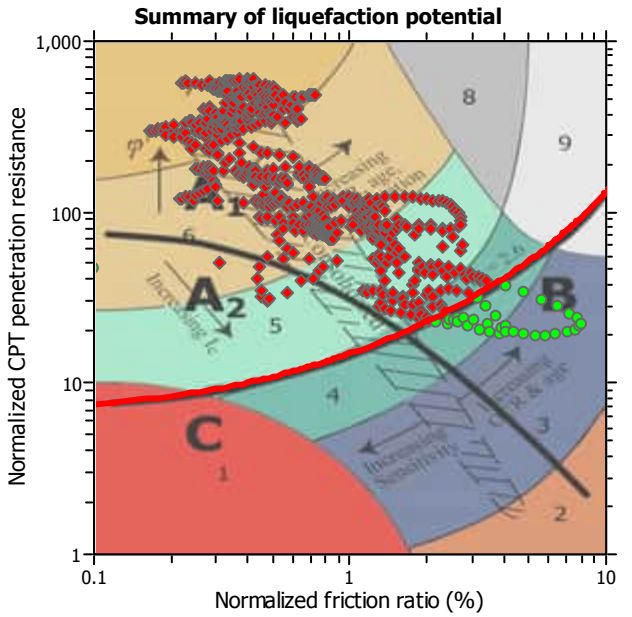
CPT file : CPT_41

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

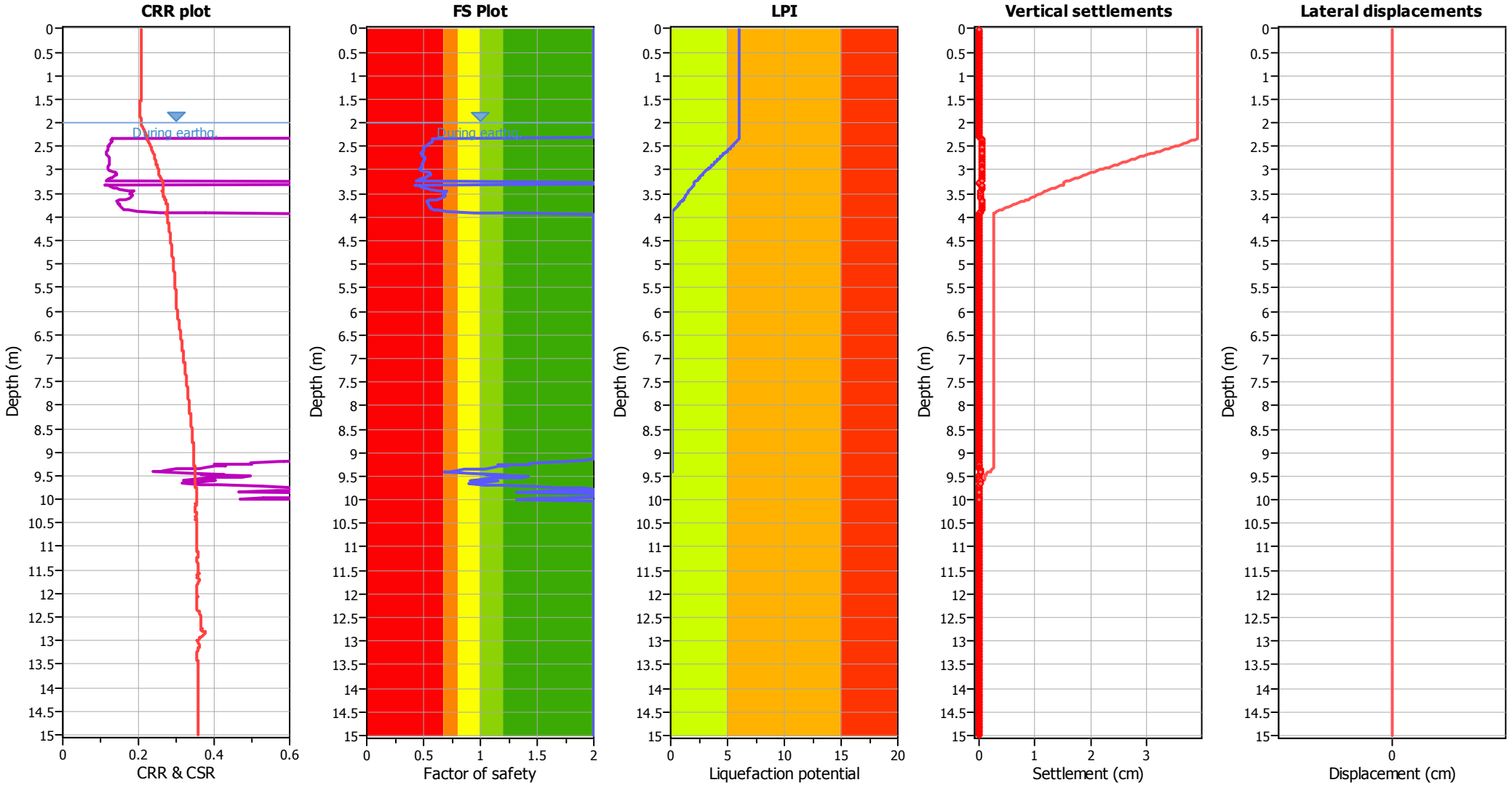






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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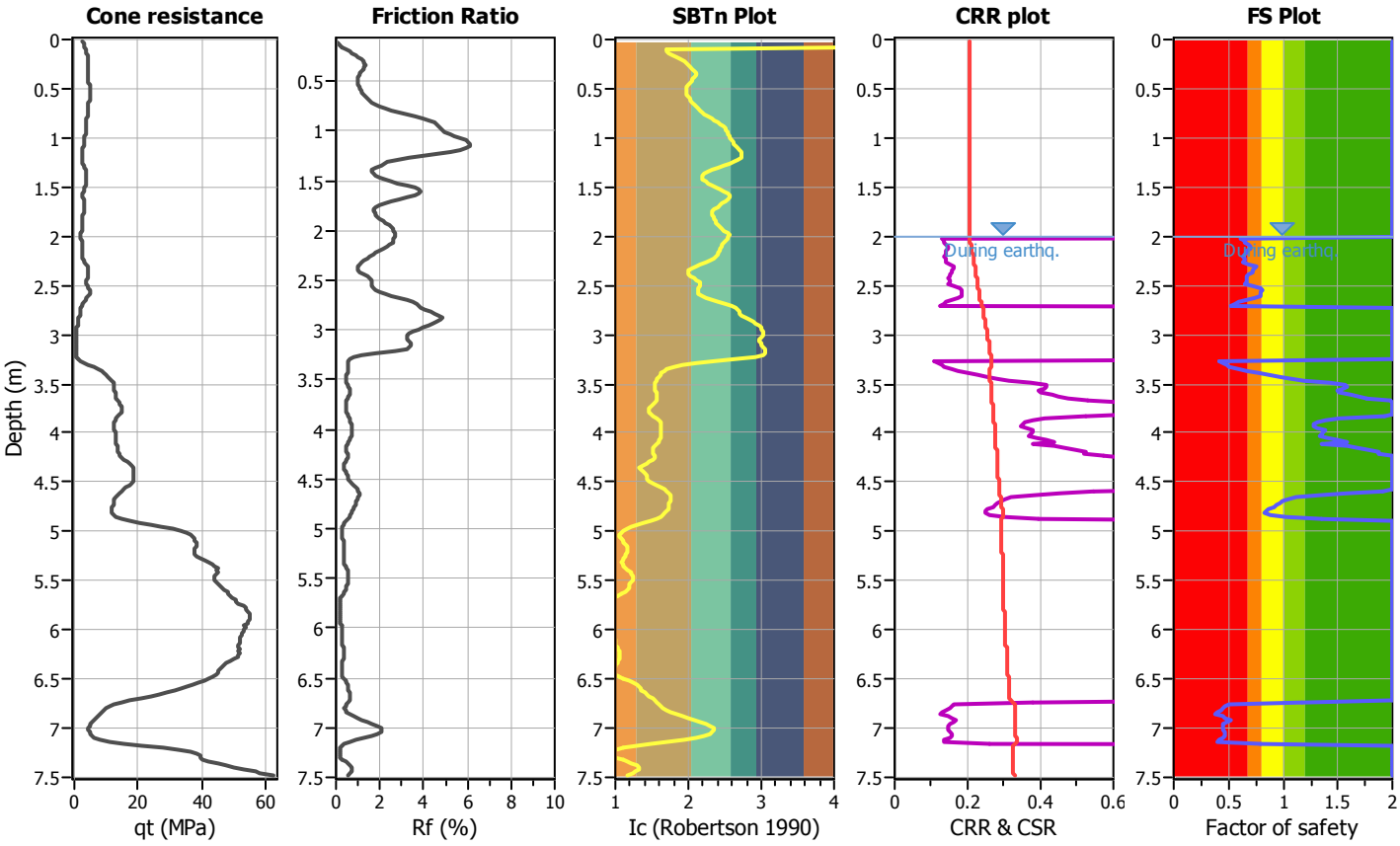
LIQUEFACTION ANALYSIS REPORT

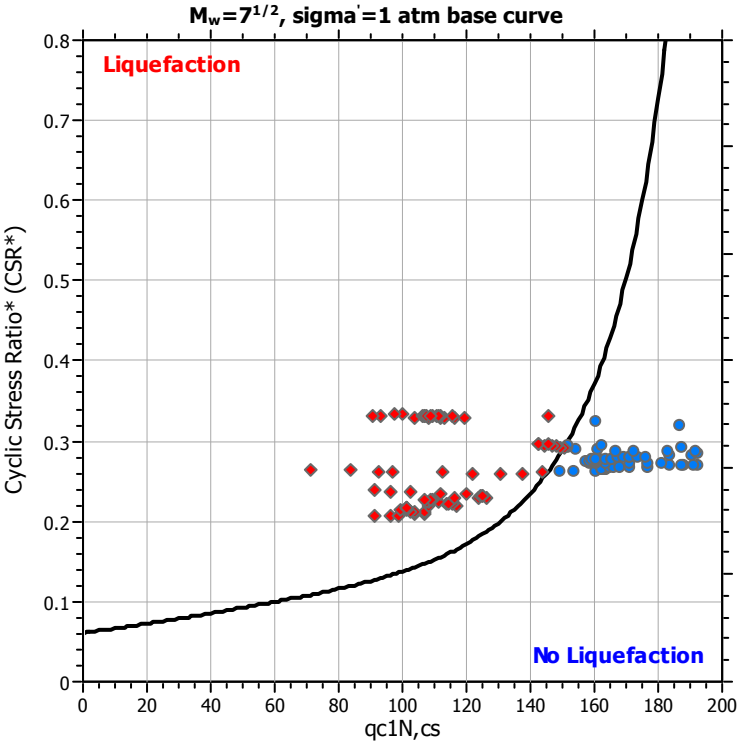
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

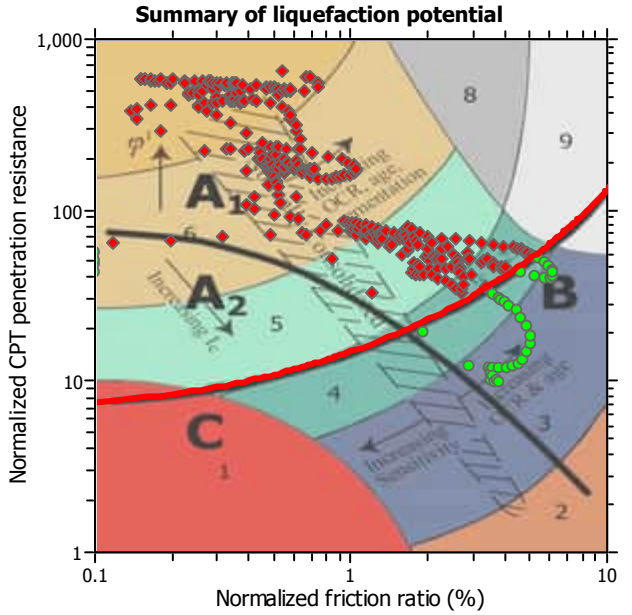
CPT file : CPT_42

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

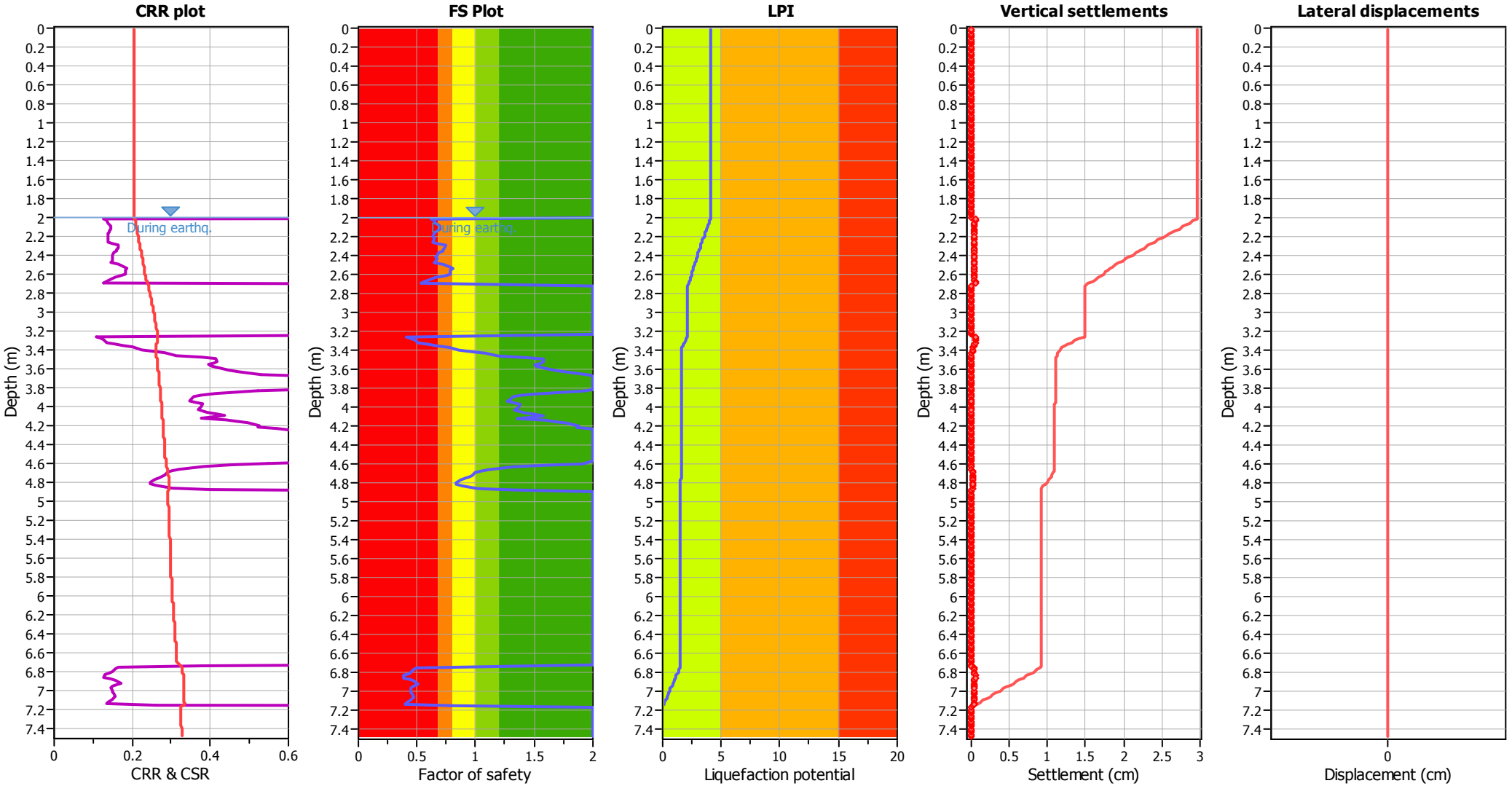






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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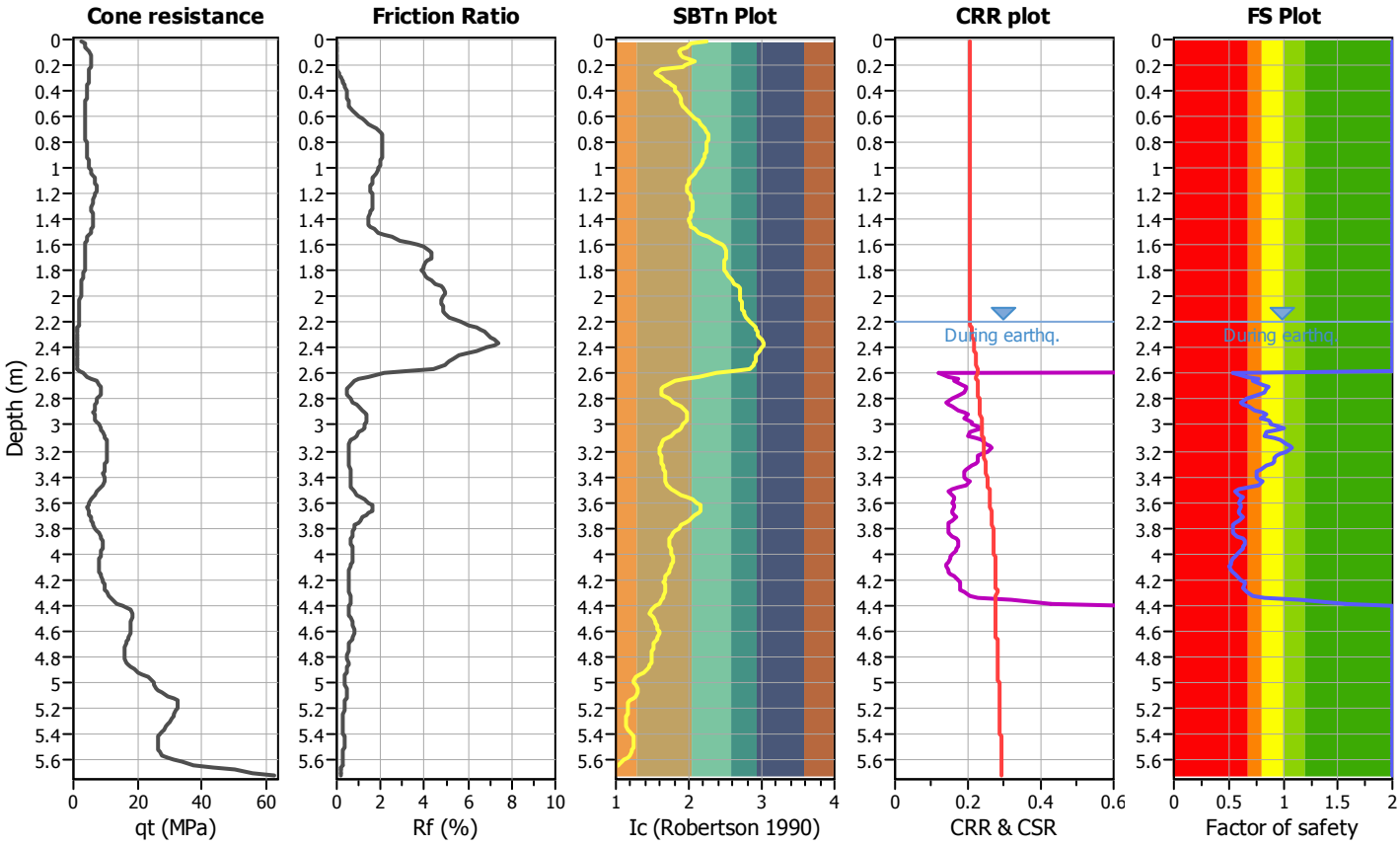
LIQUEFACTION ANALYSIS REPORT

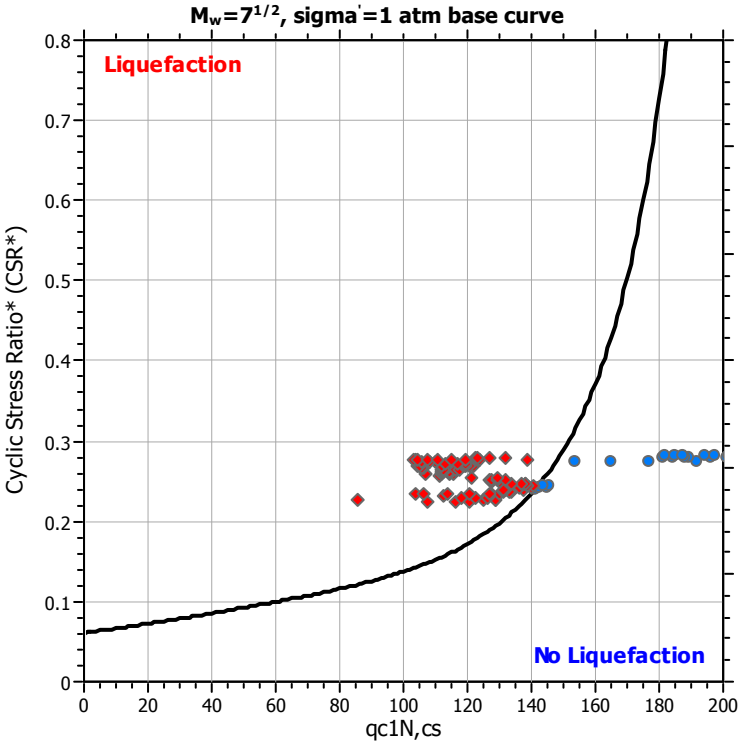
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

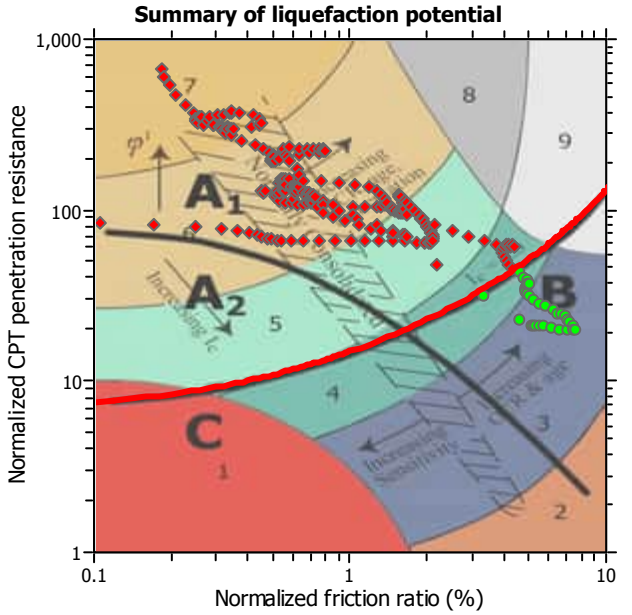
CPT file : CPT_43

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

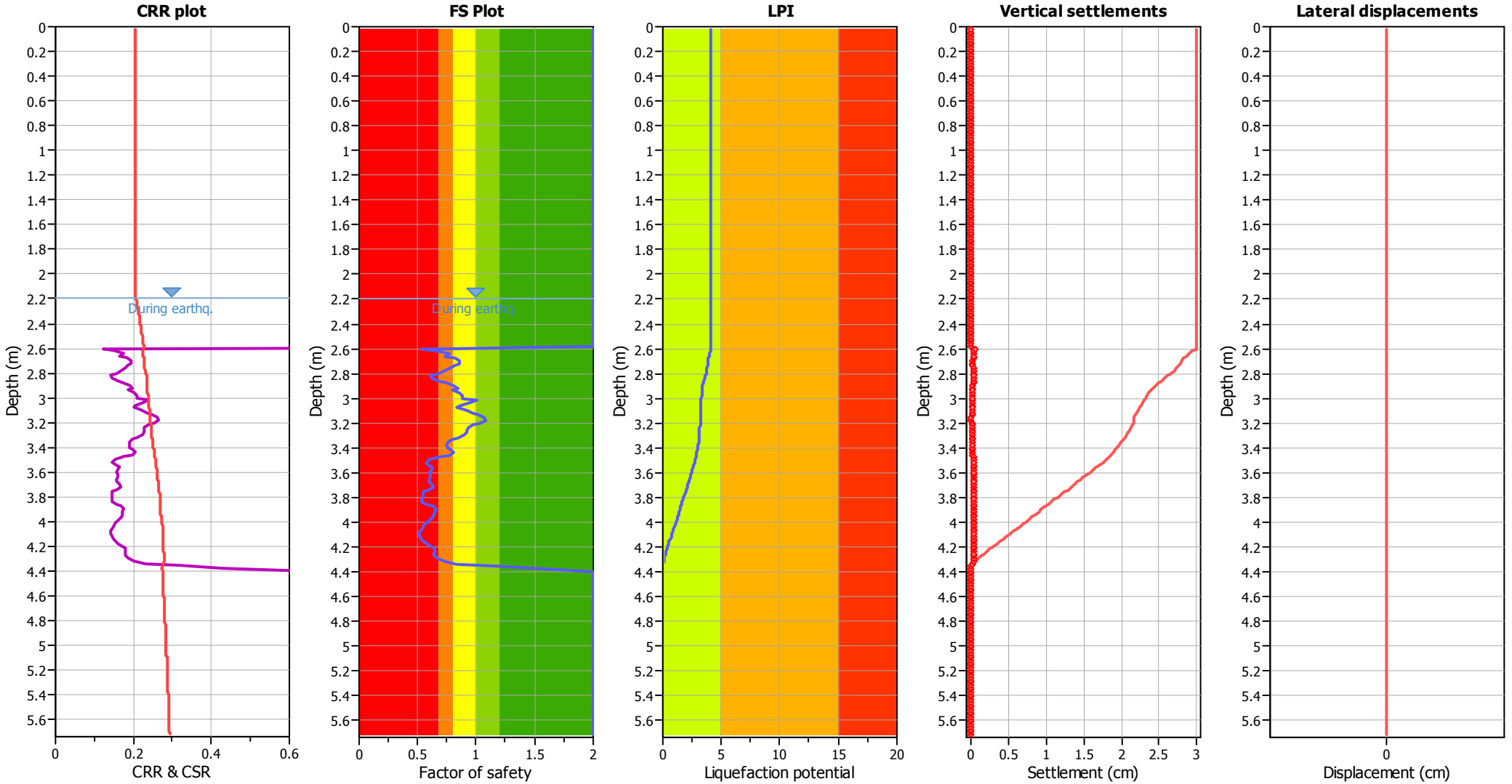






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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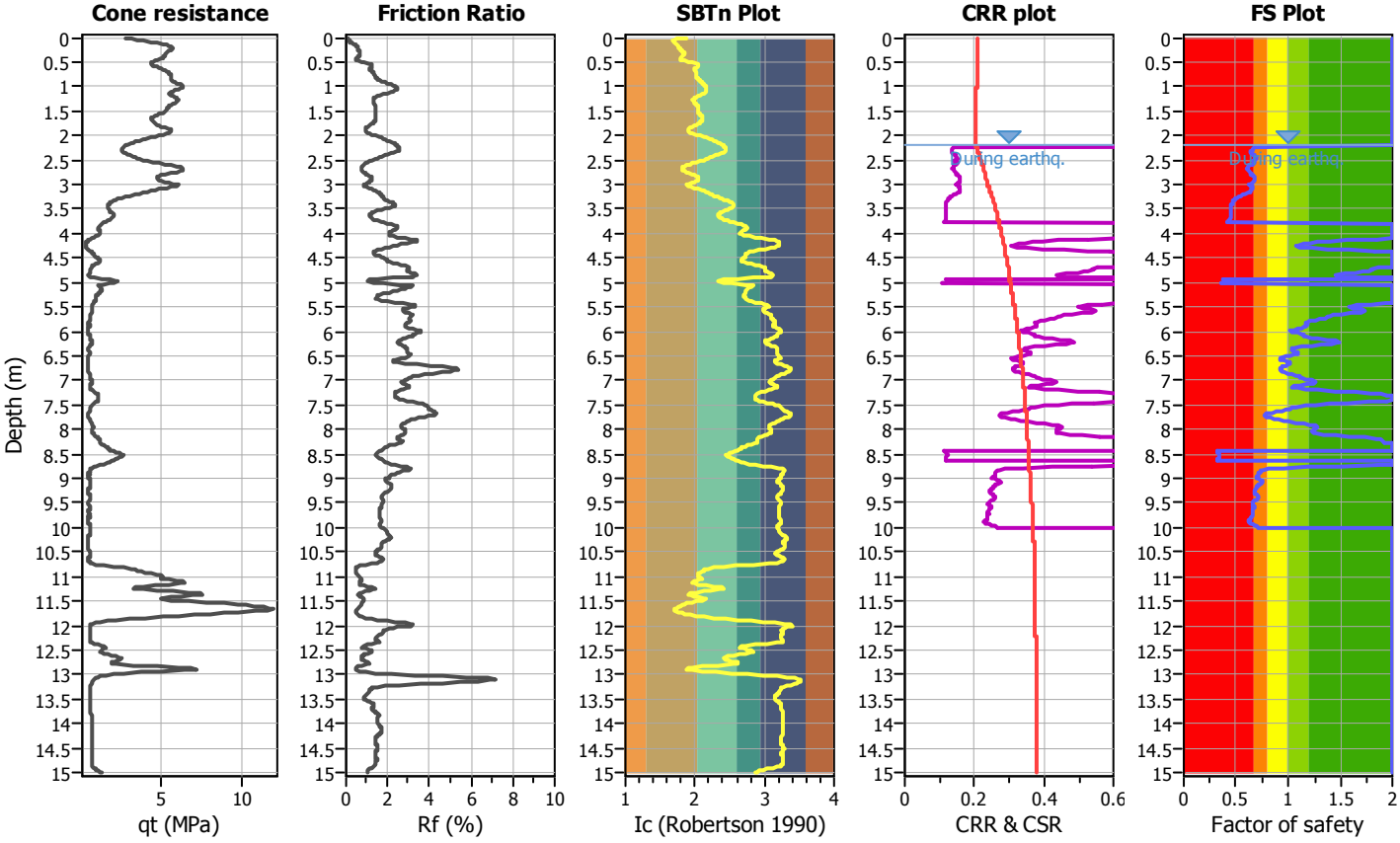
LIQUEFACTION ANALYSIS REPORT

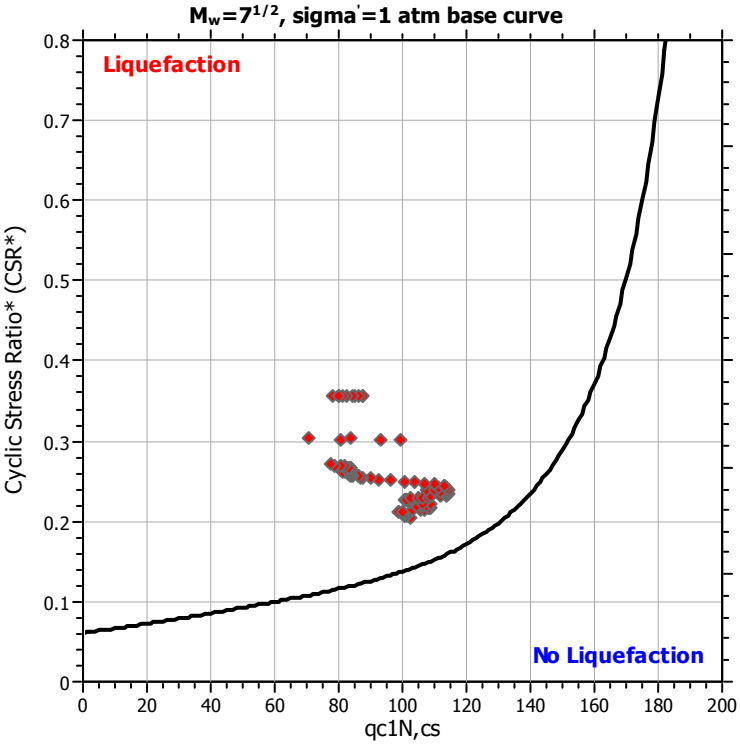
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

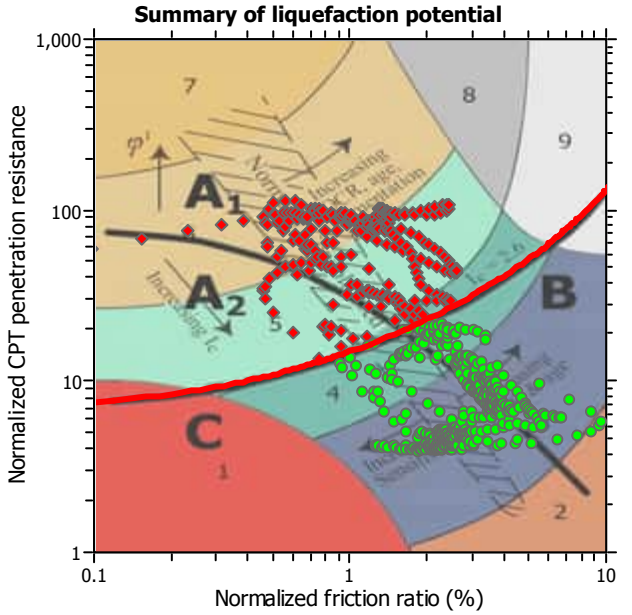
CPT file : CPT_44

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

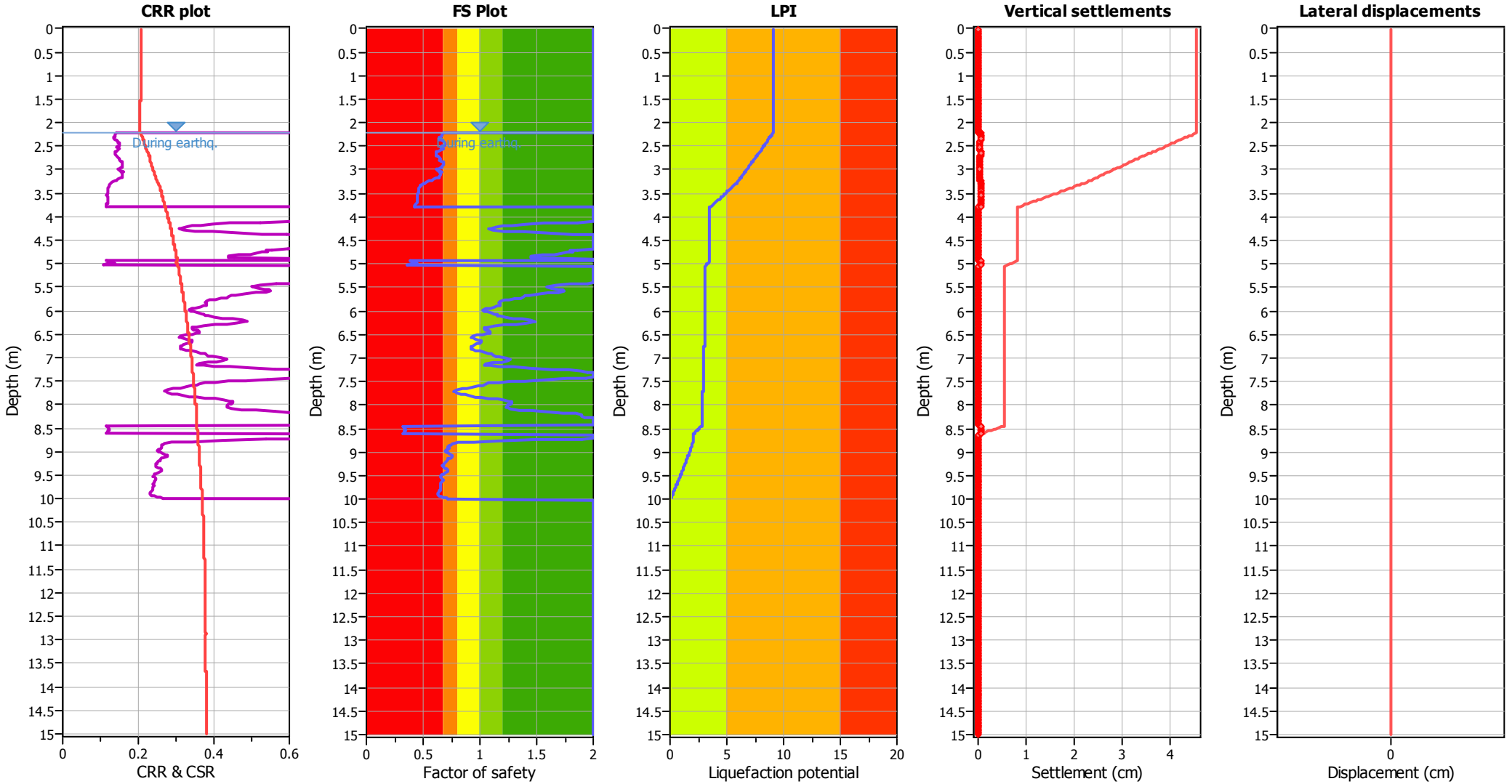






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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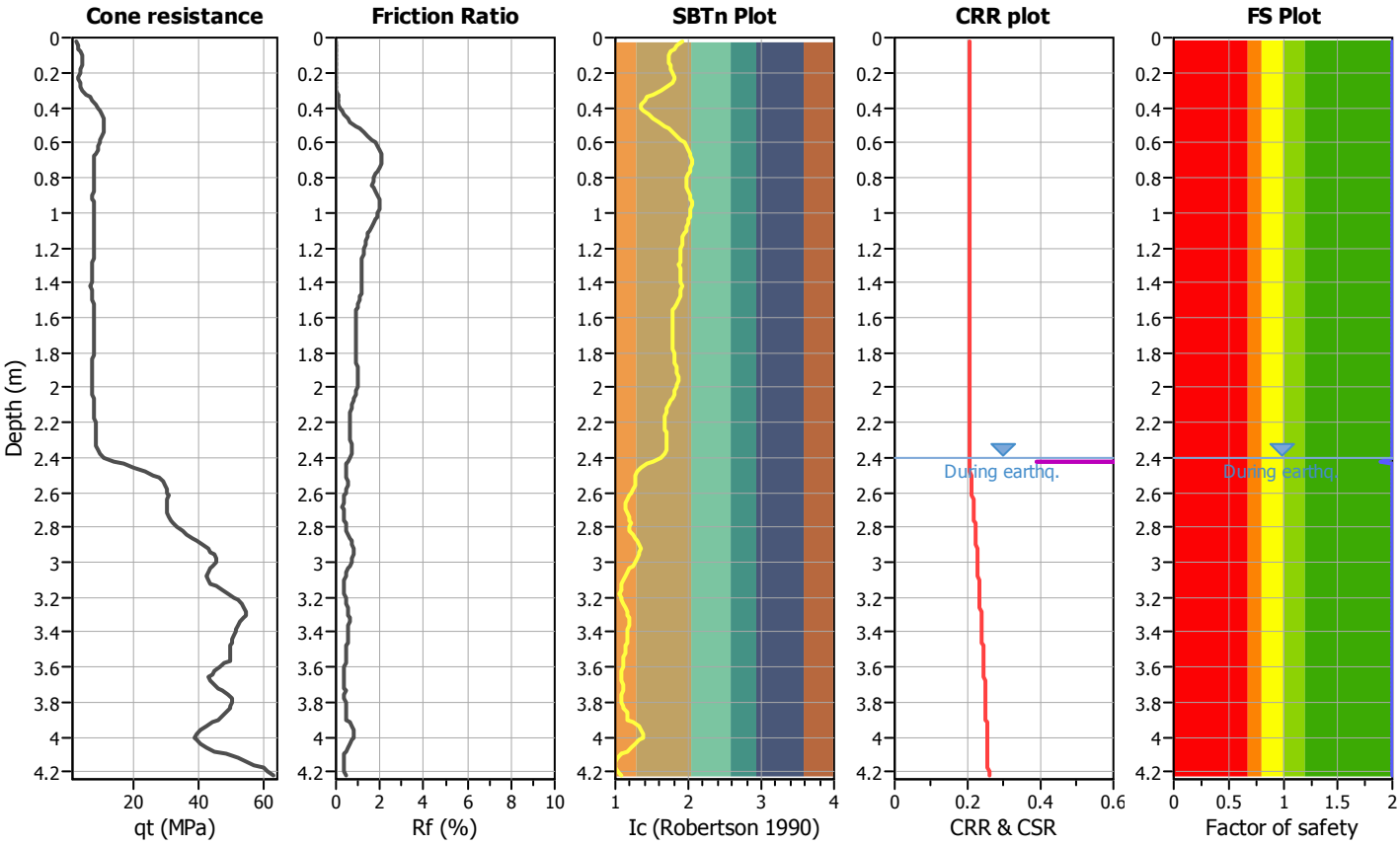
LIQUEFACTION ANALYSIS REPORT

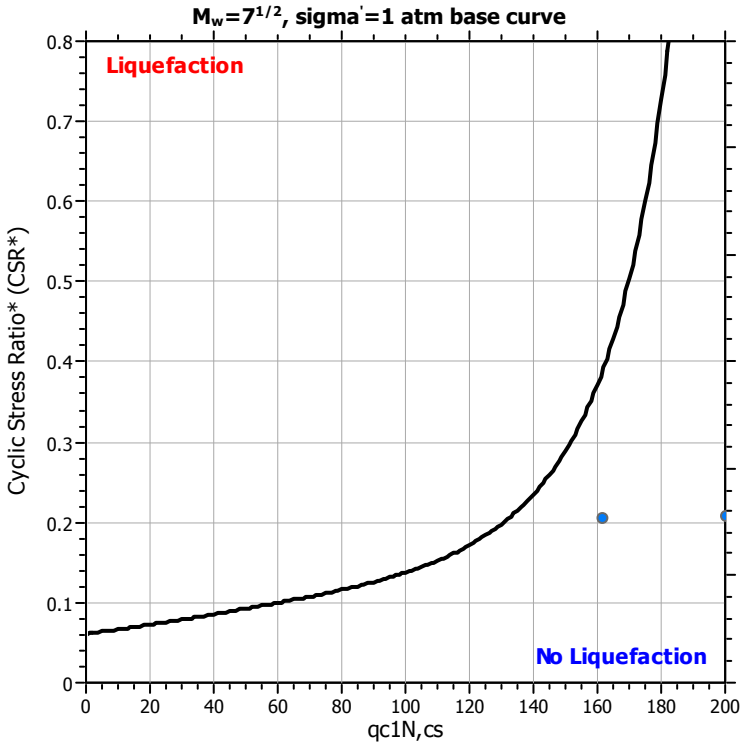
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

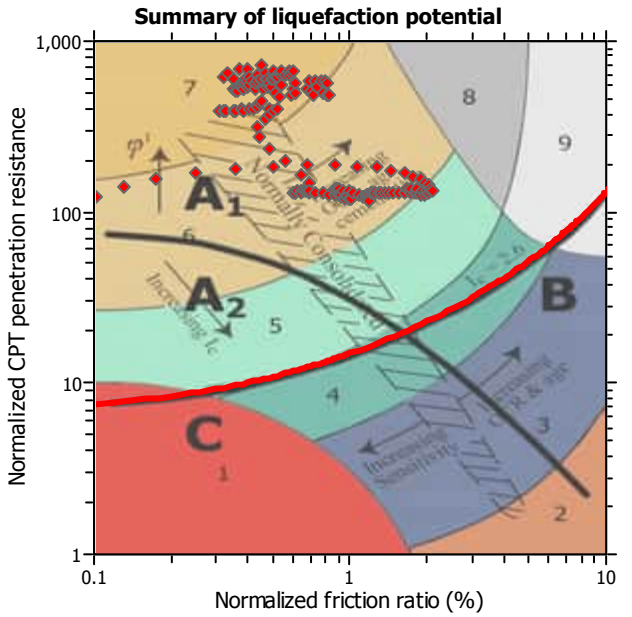
CPT file : CPT_45

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.40 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

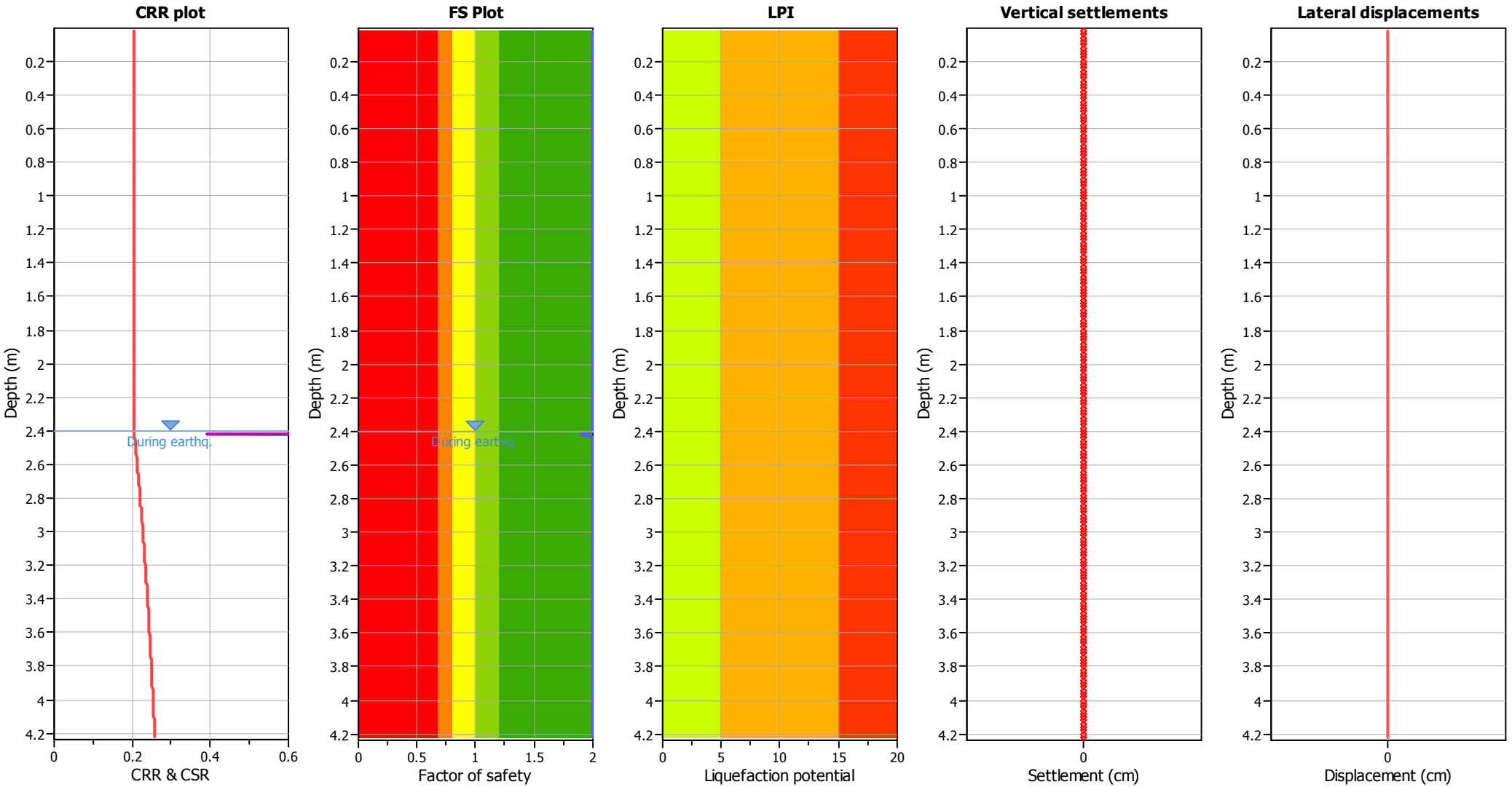






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.40 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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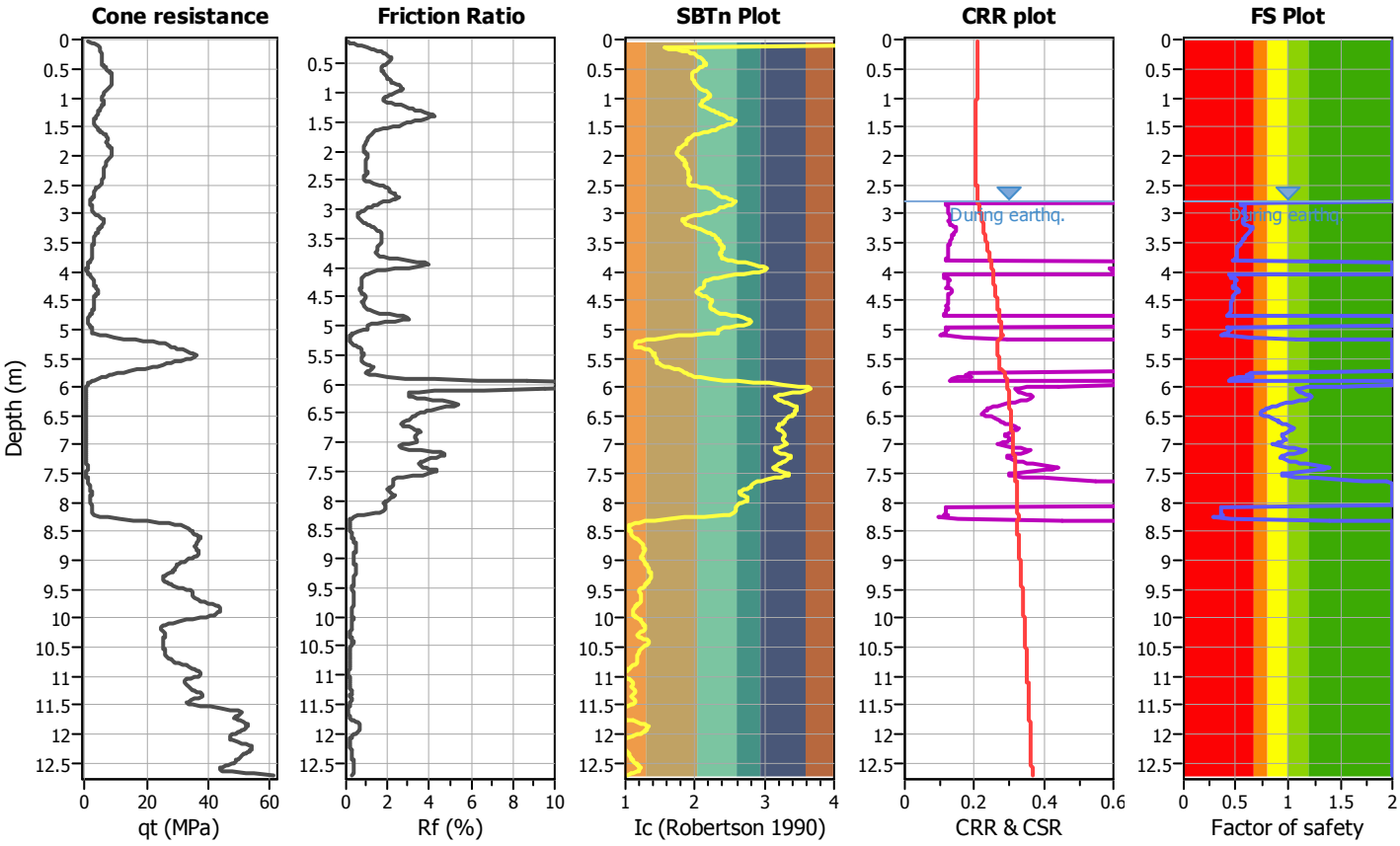
LIQUEFACTION ANALYSIS REPORT

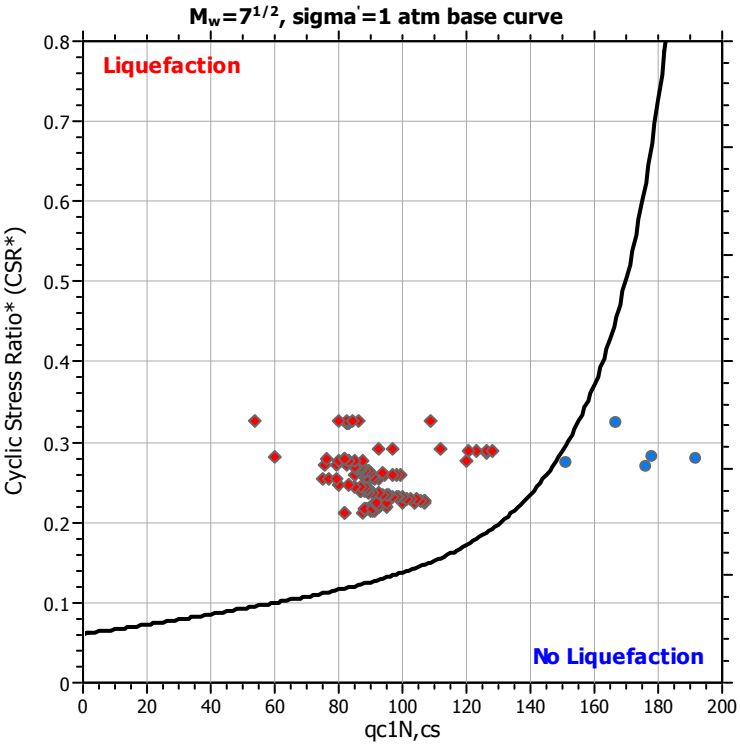
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

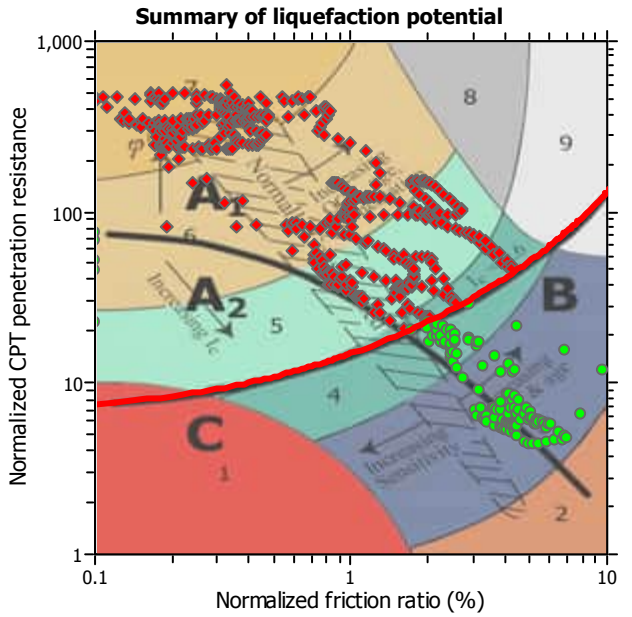
CPT file : CPT_46

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

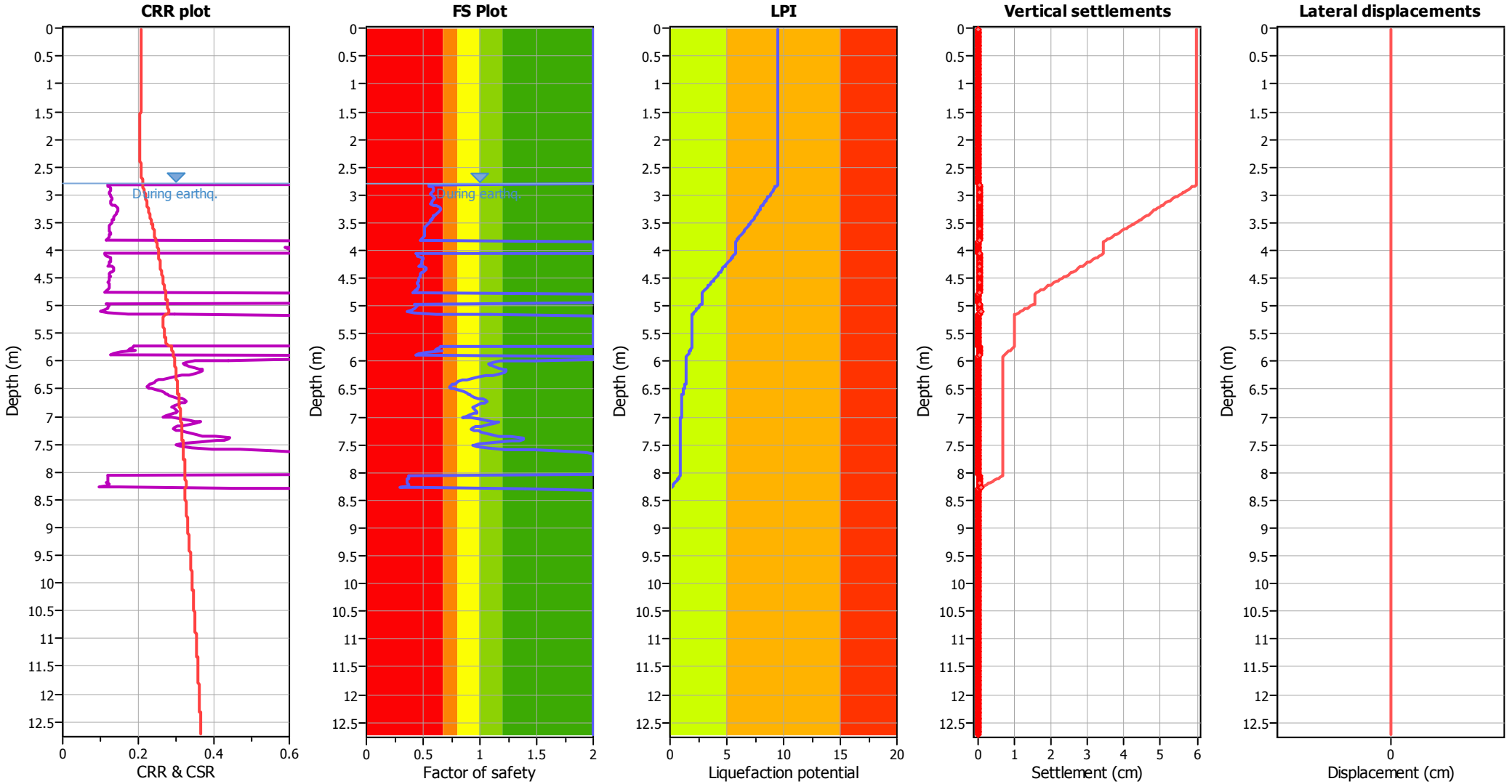






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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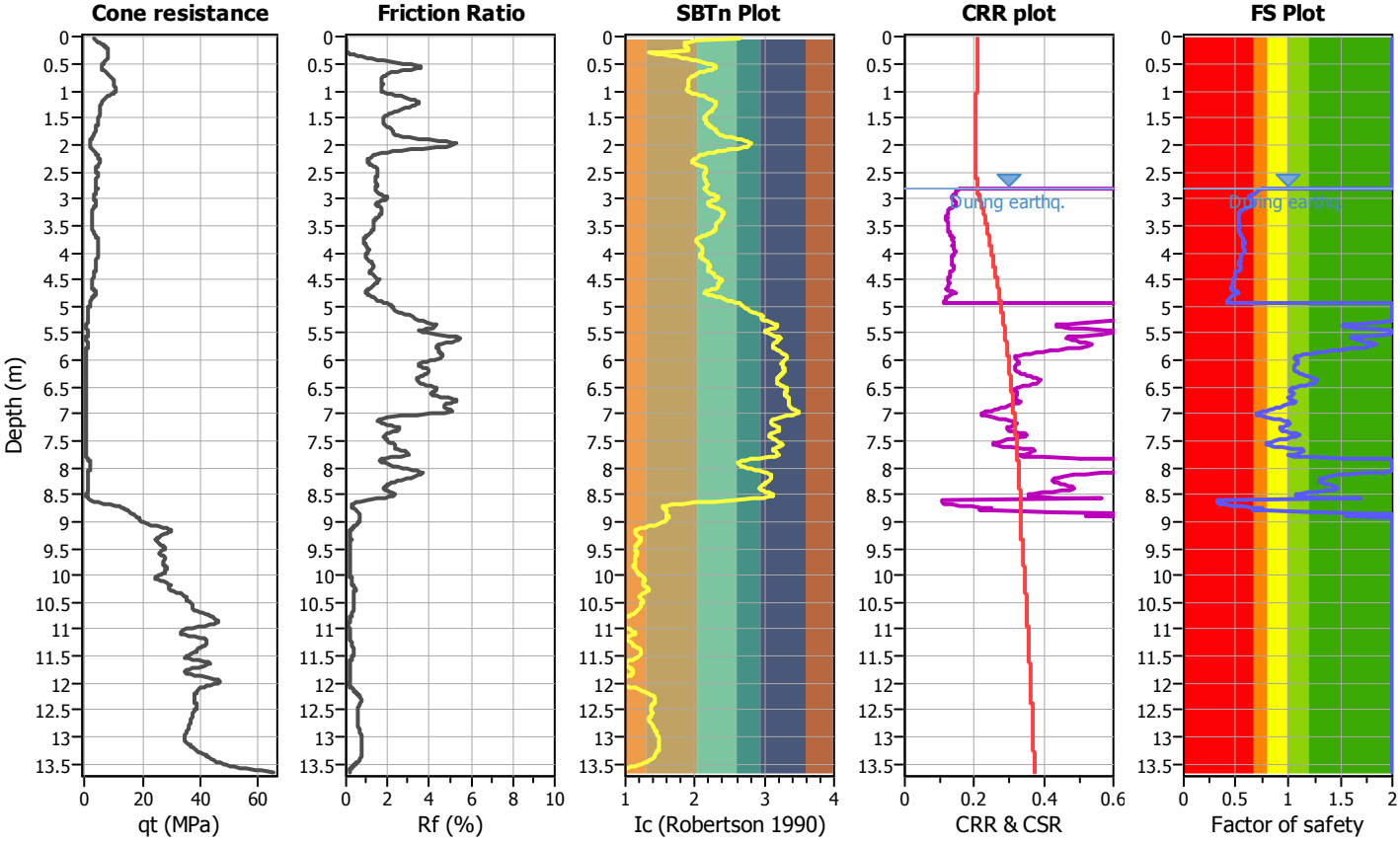
LIQUEFACTION ANALYSIS REPORT

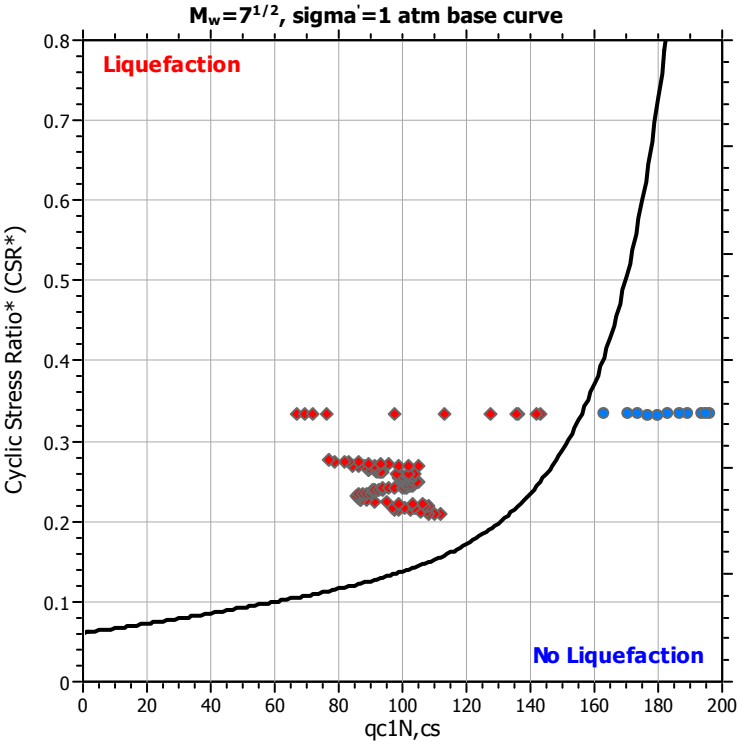
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

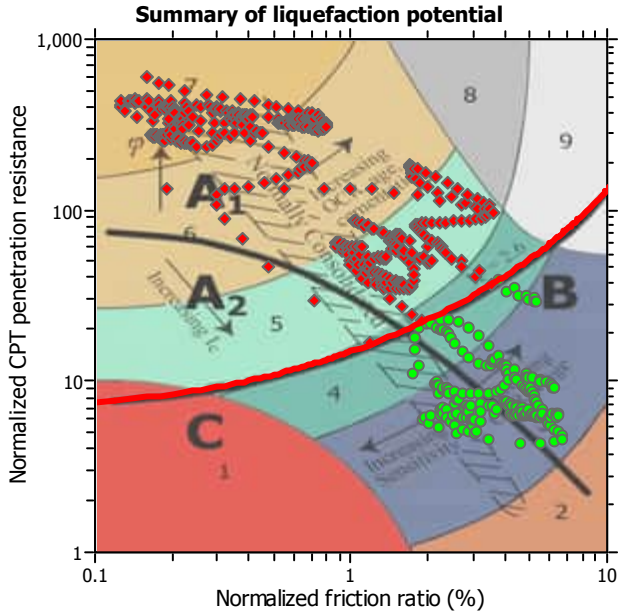
CPT file : CPT_47

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

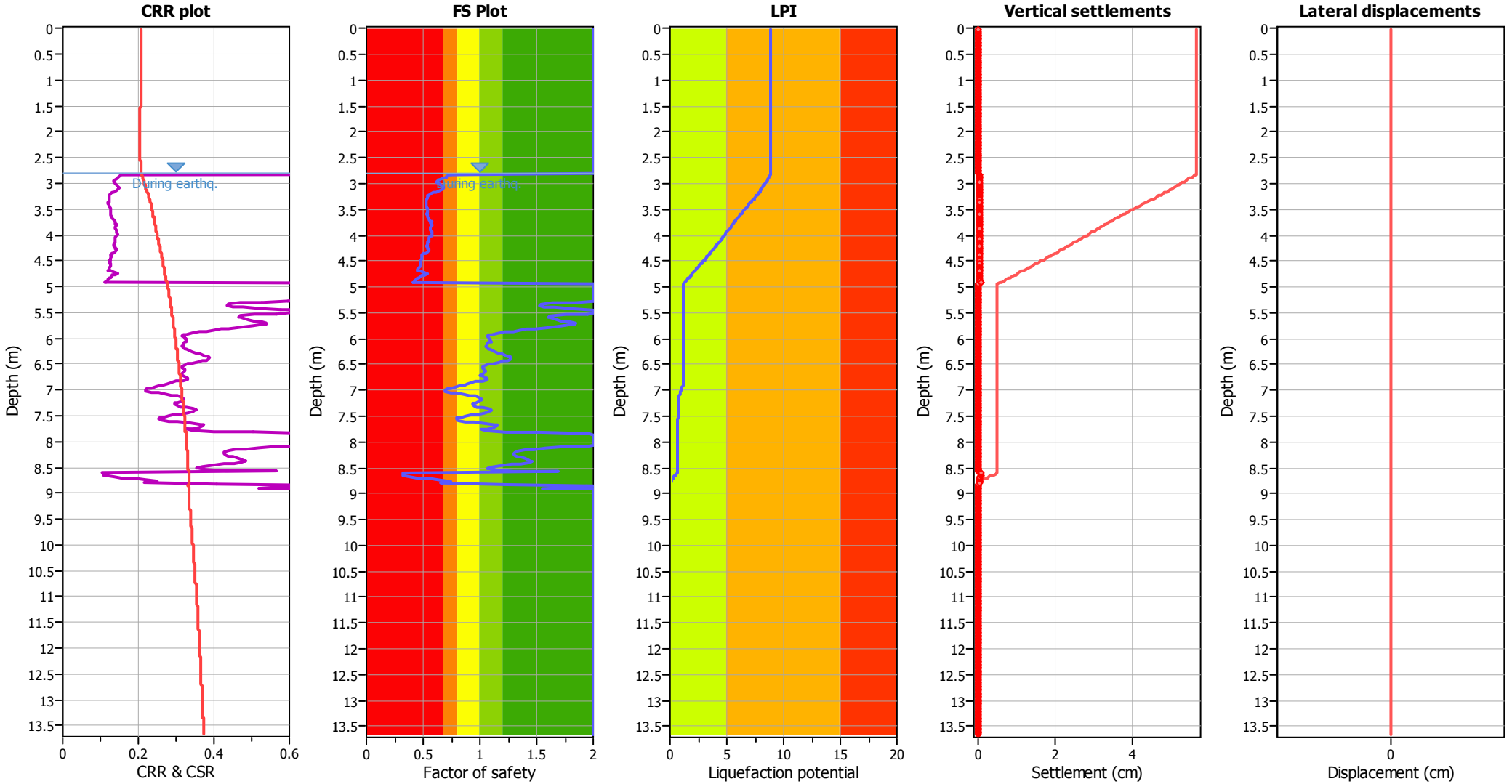






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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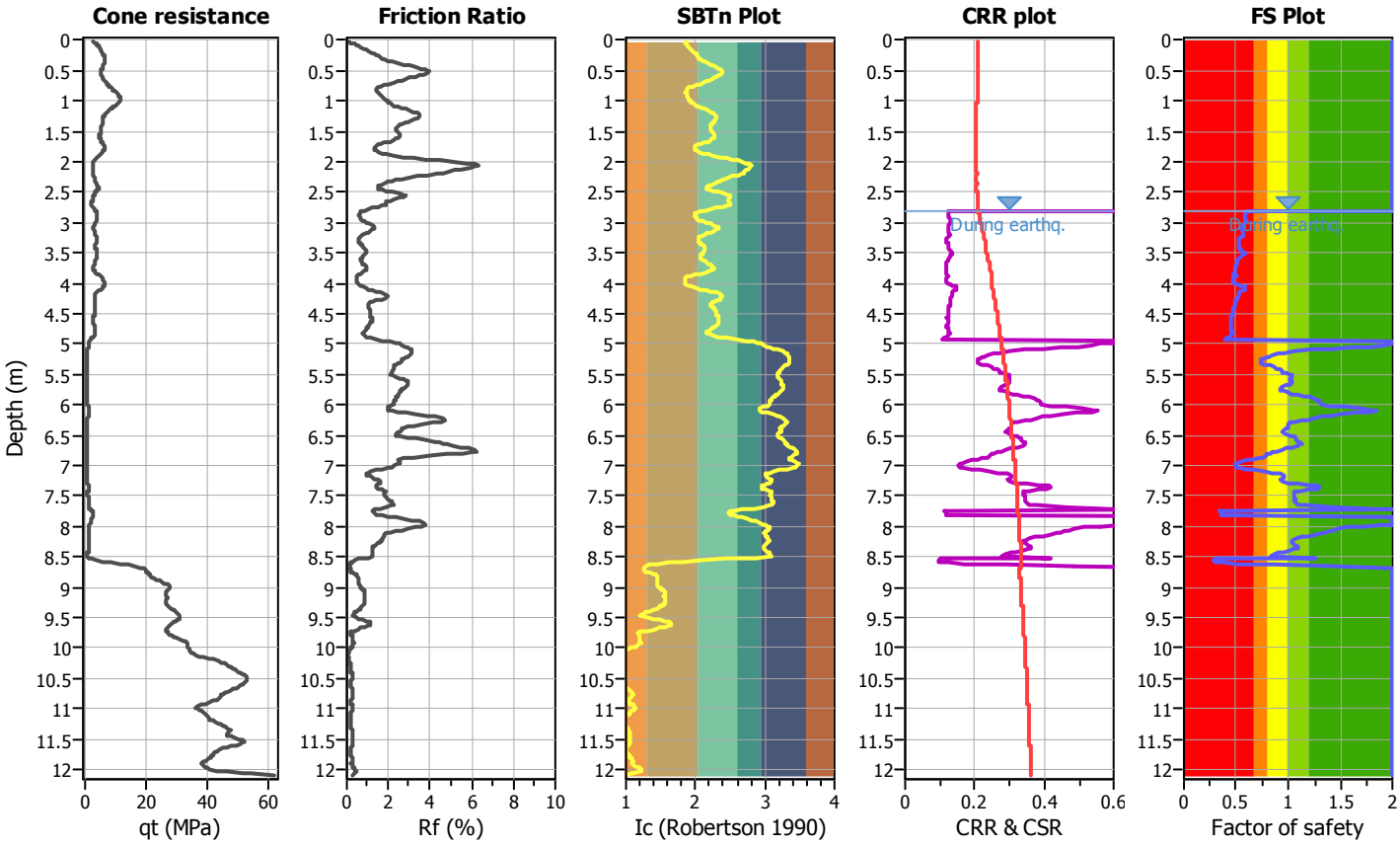
LIQUEFACTION ANALYSIS REPORT

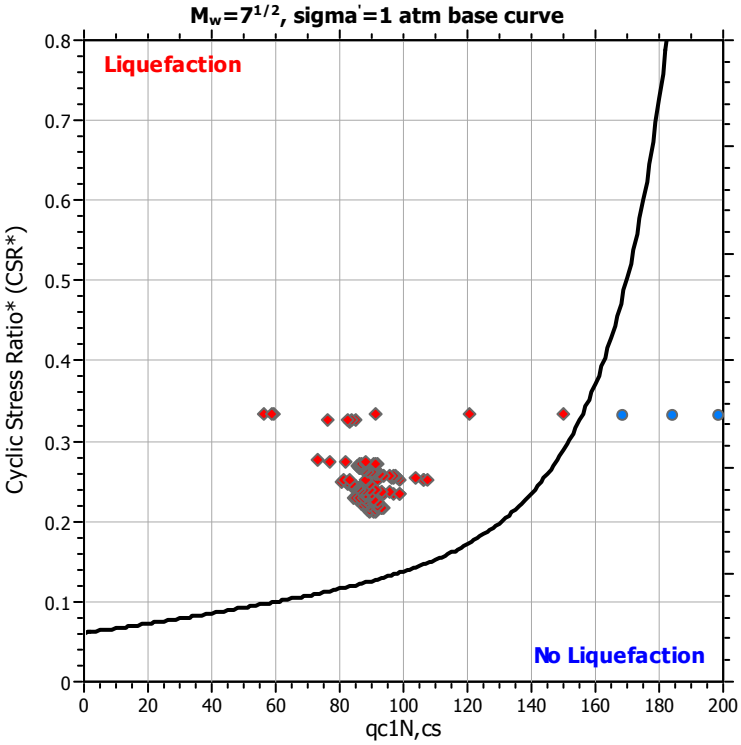
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

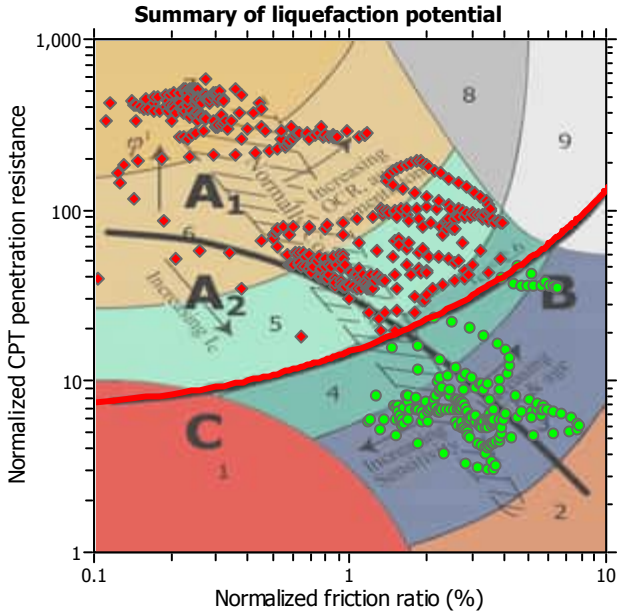
CPT file : CPT_48

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

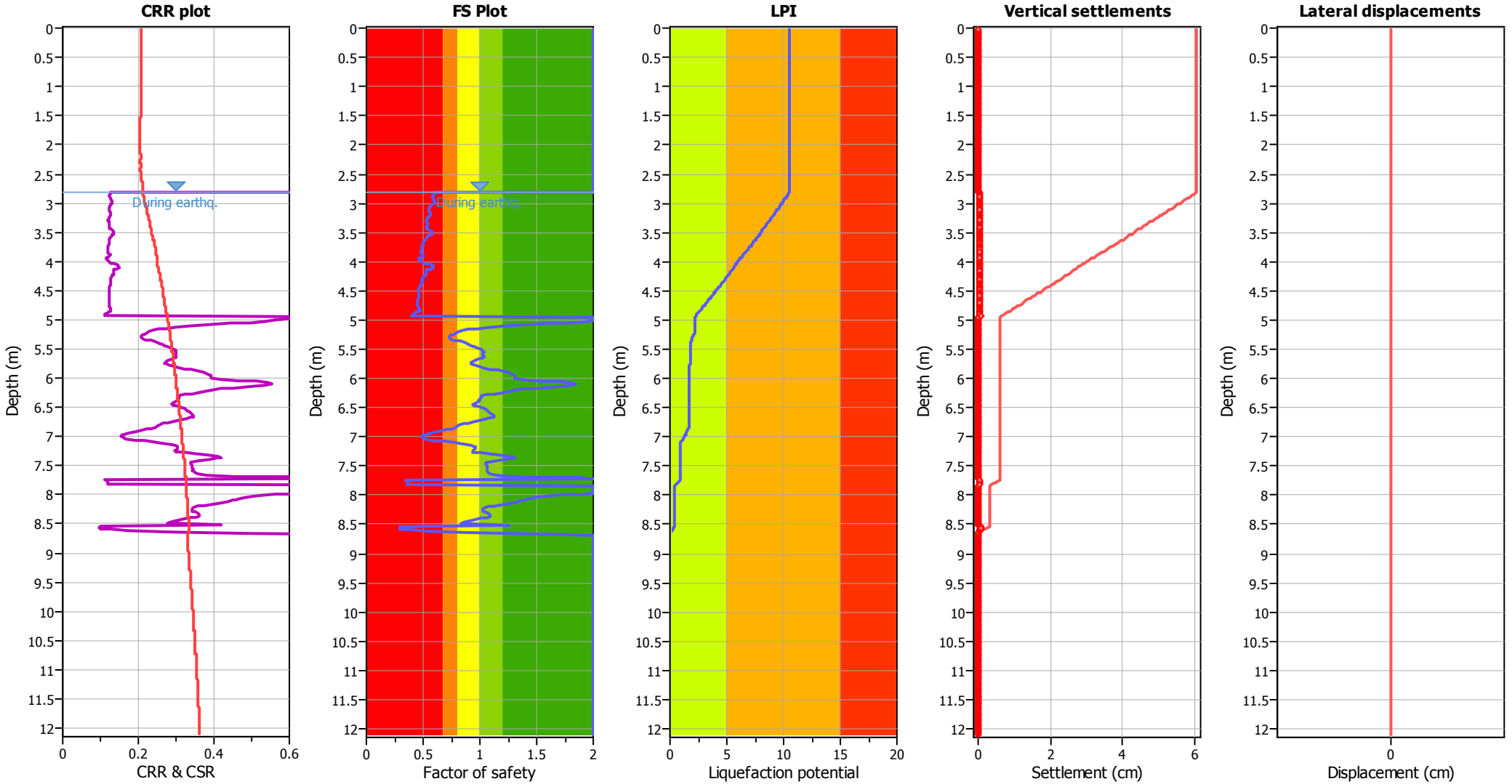






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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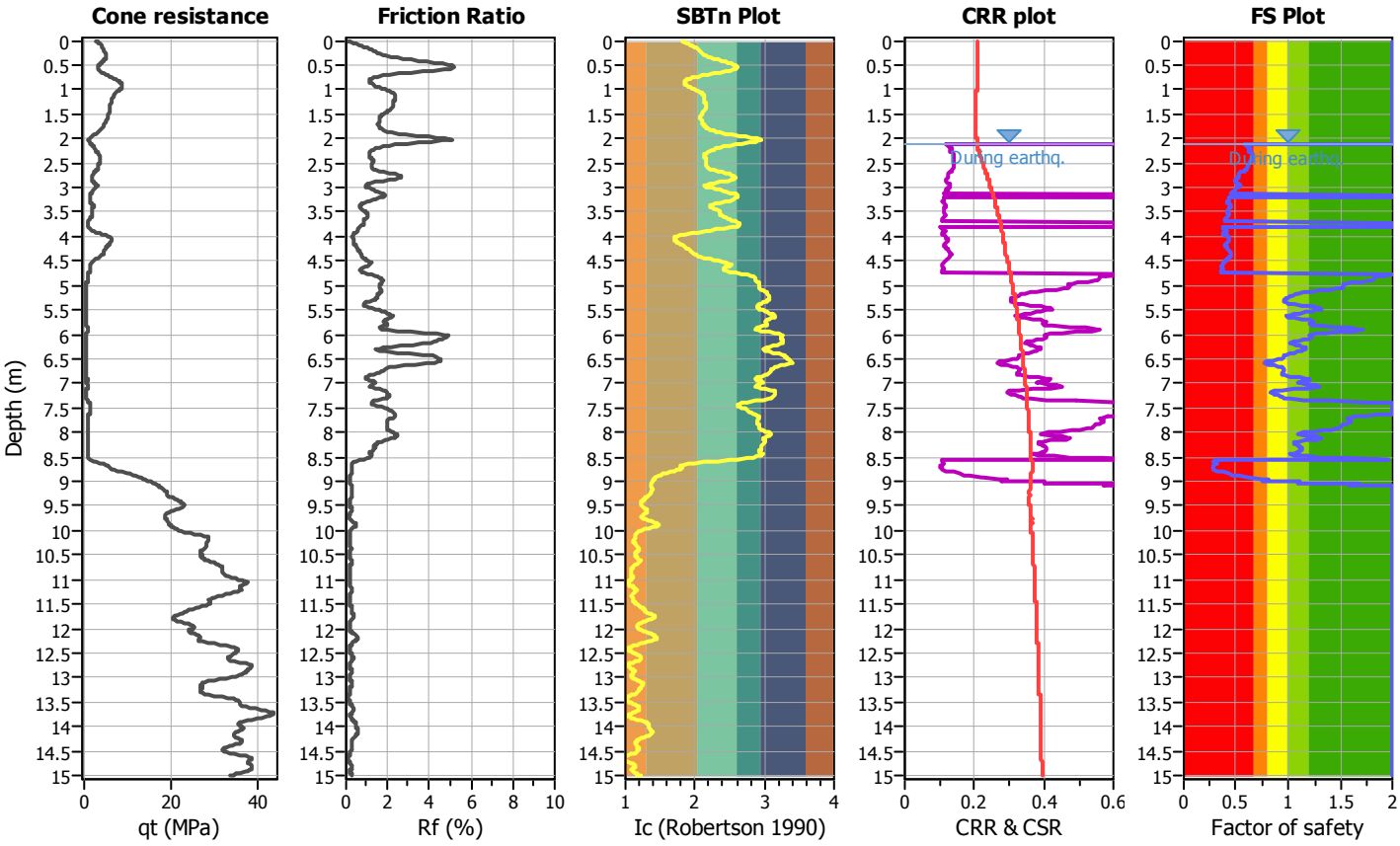
LIQUEFACTION ANALYSIS REPORT

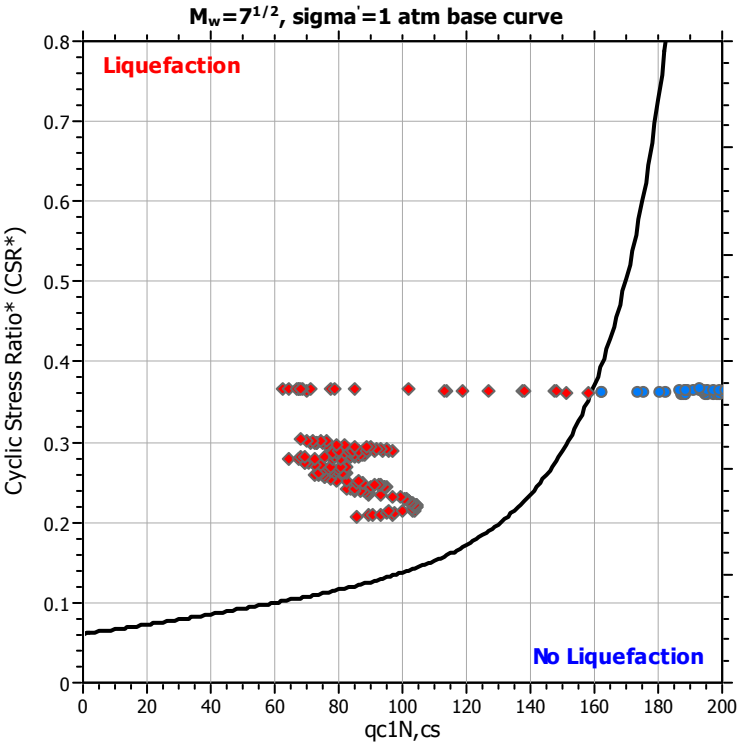
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

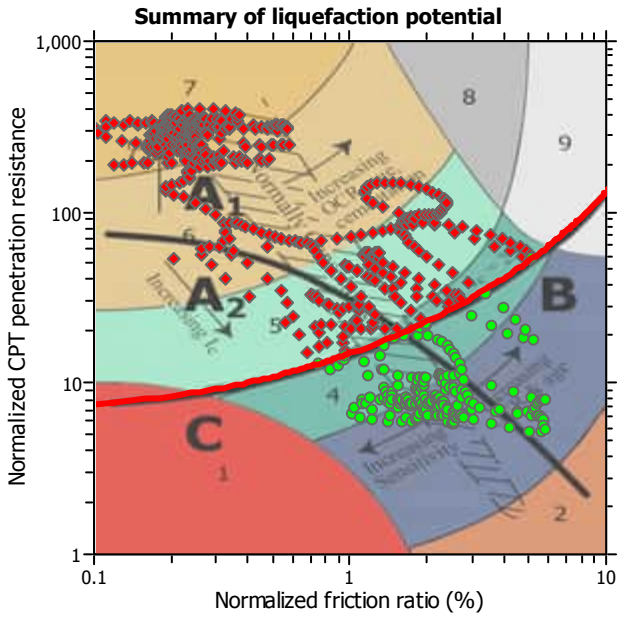
CPT file : CPT_49

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

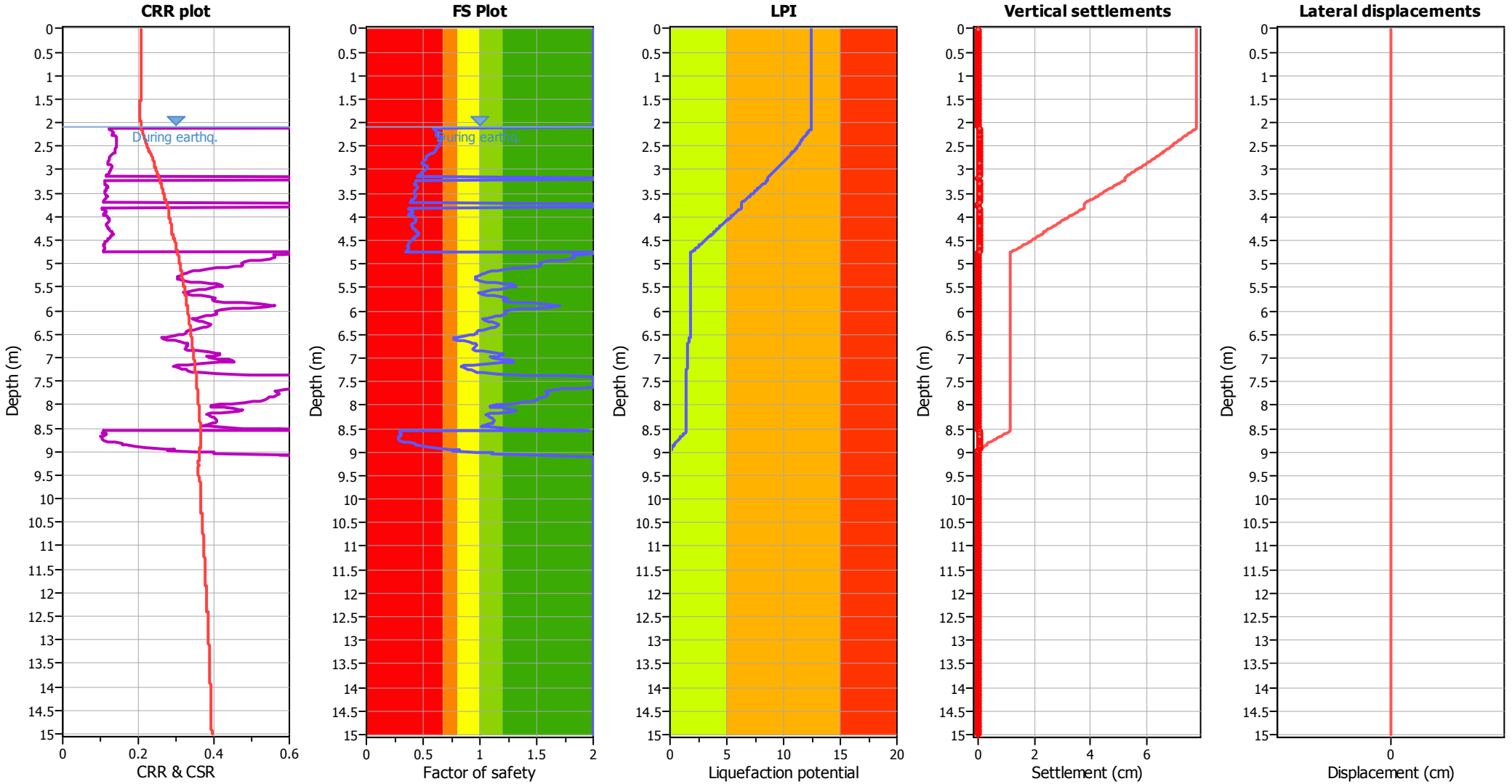






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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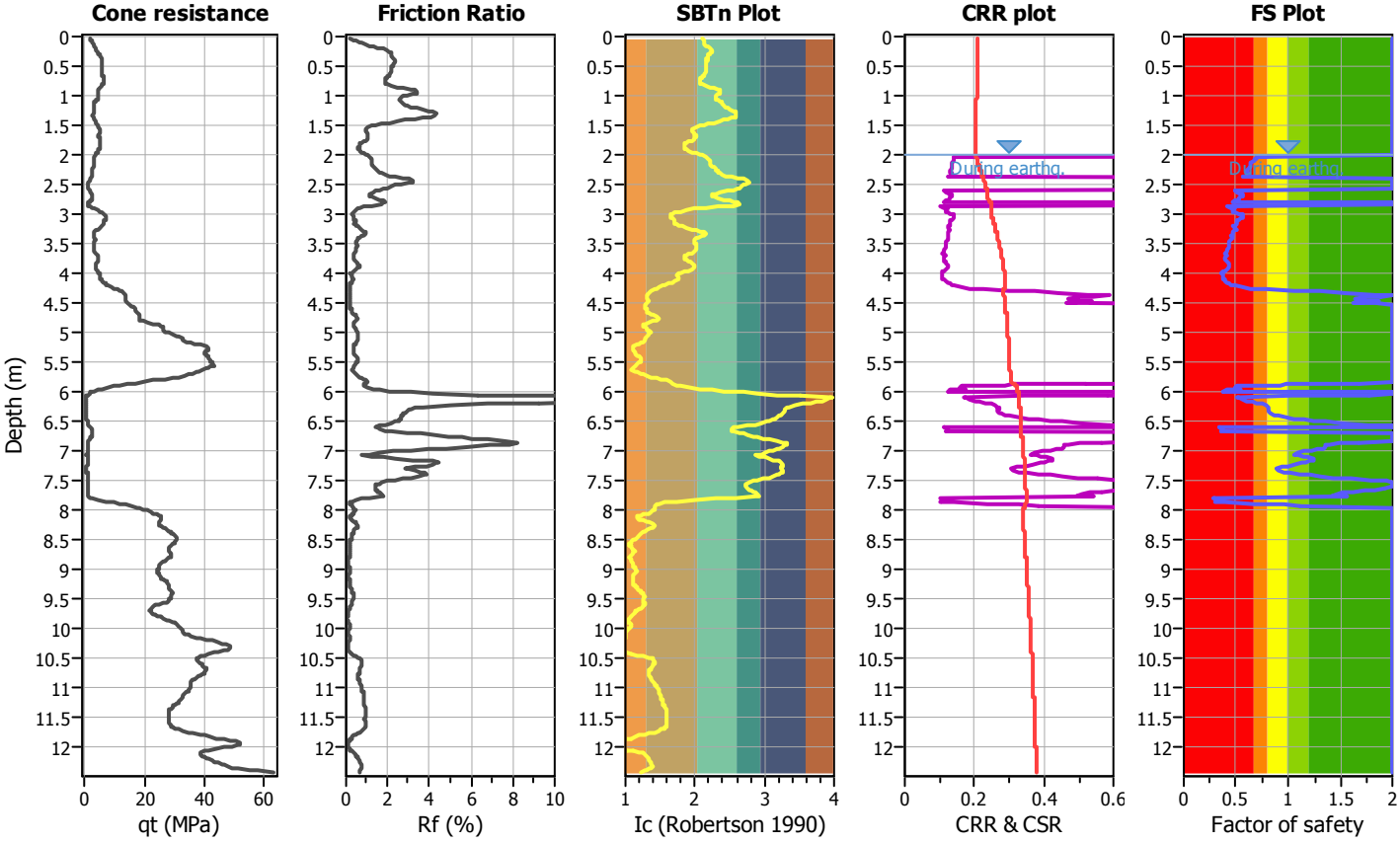
LIQUEFACTION ANALYSIS REPORT

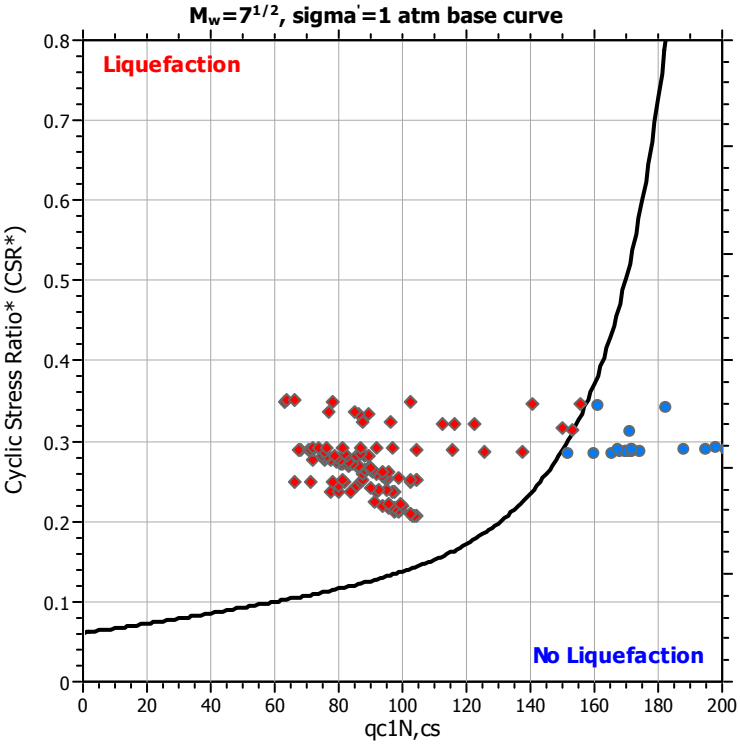
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

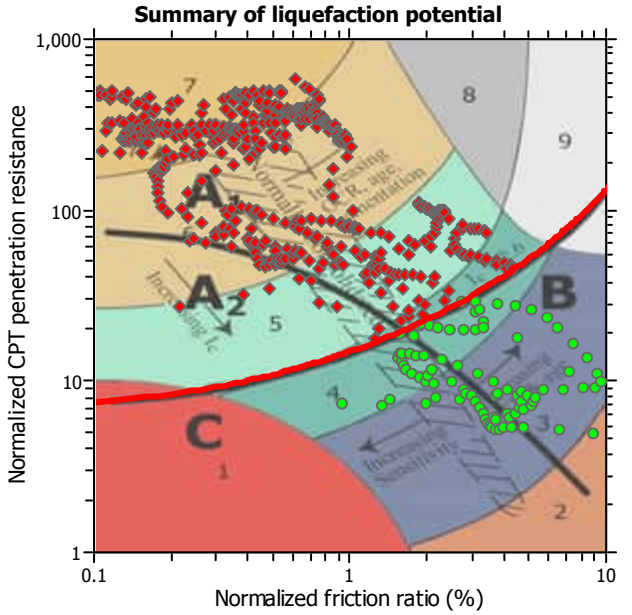
CPT file : CPT_50

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

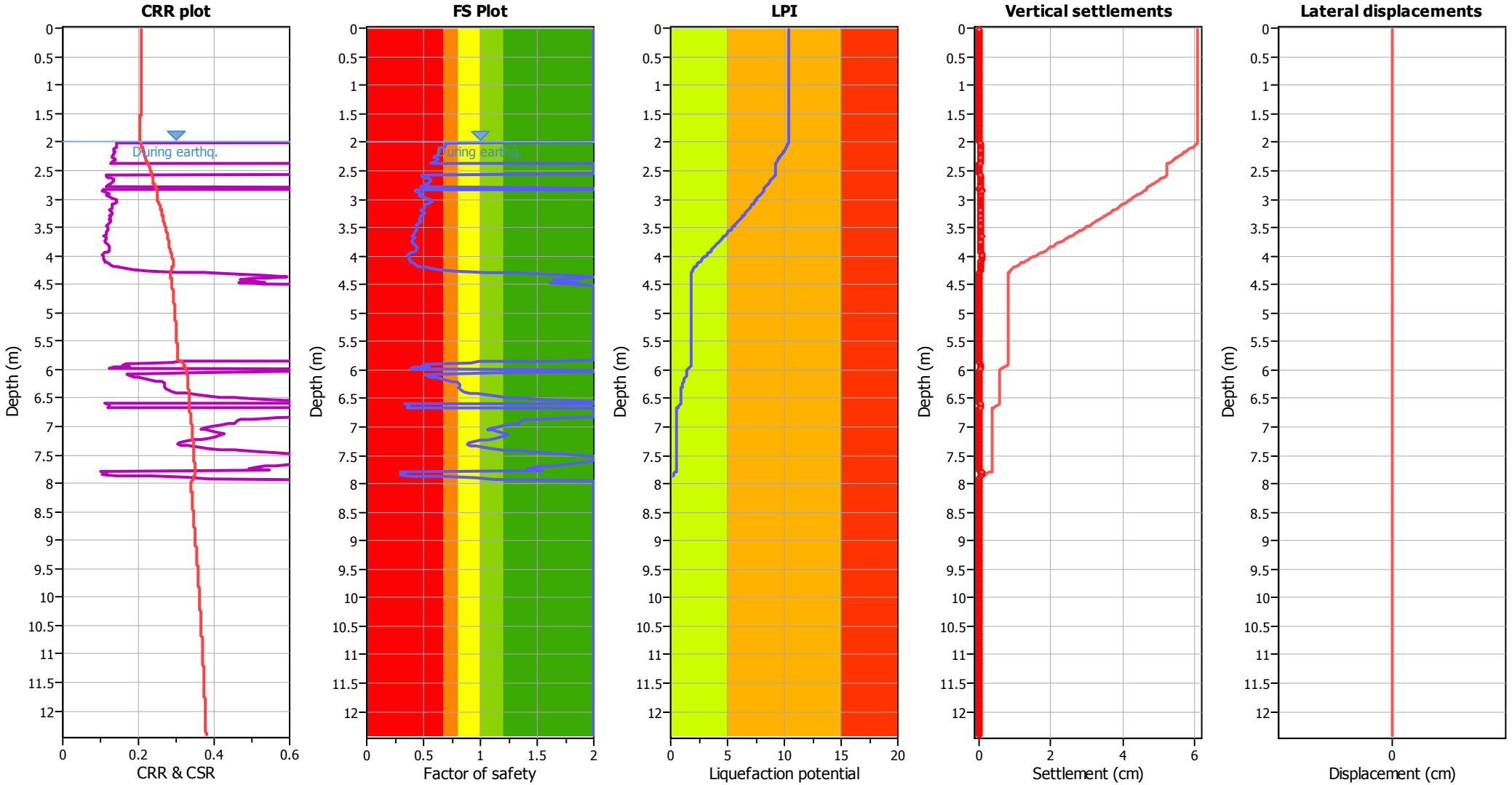






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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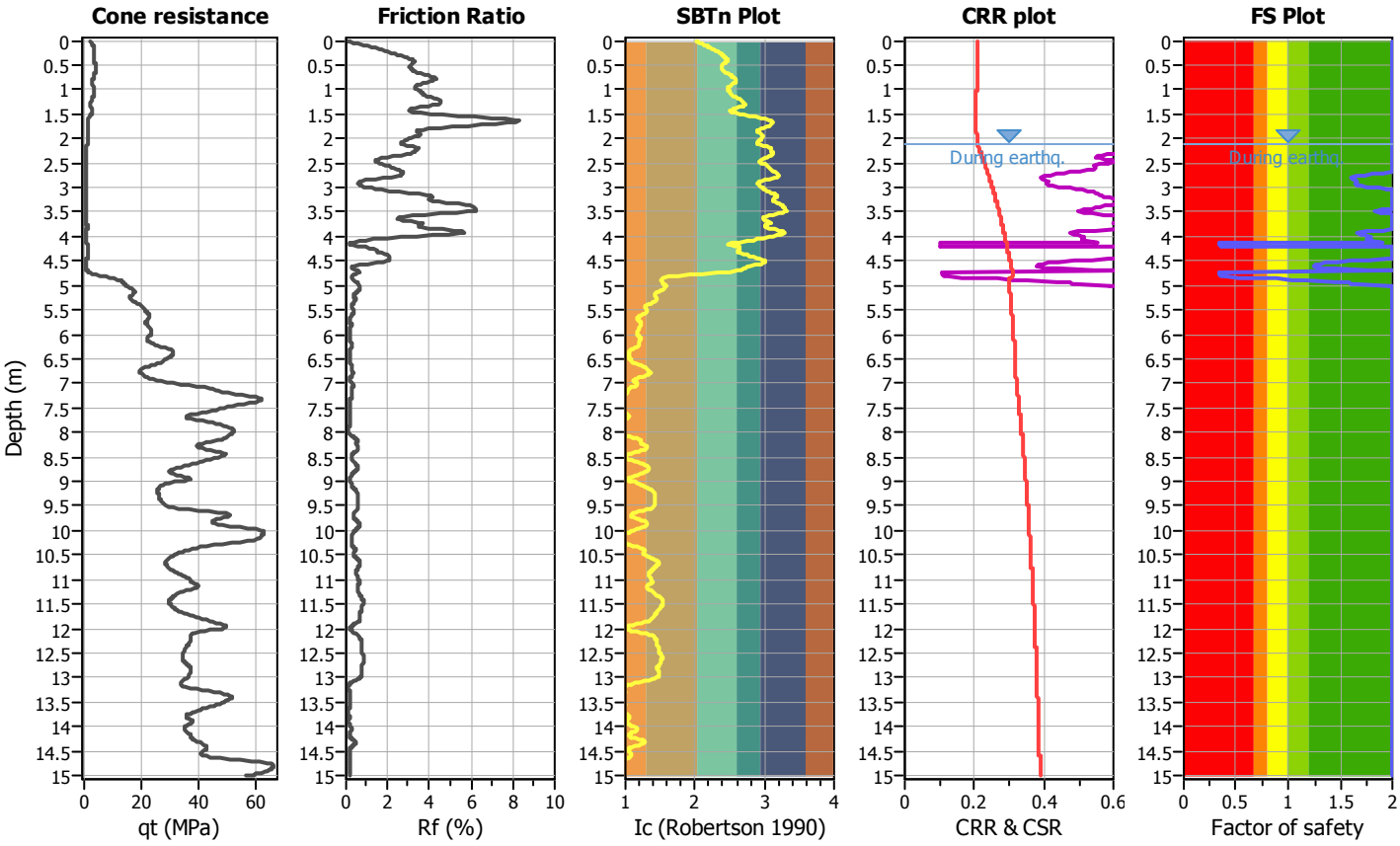
LIQUEFACTION ANALYSIS REPORT

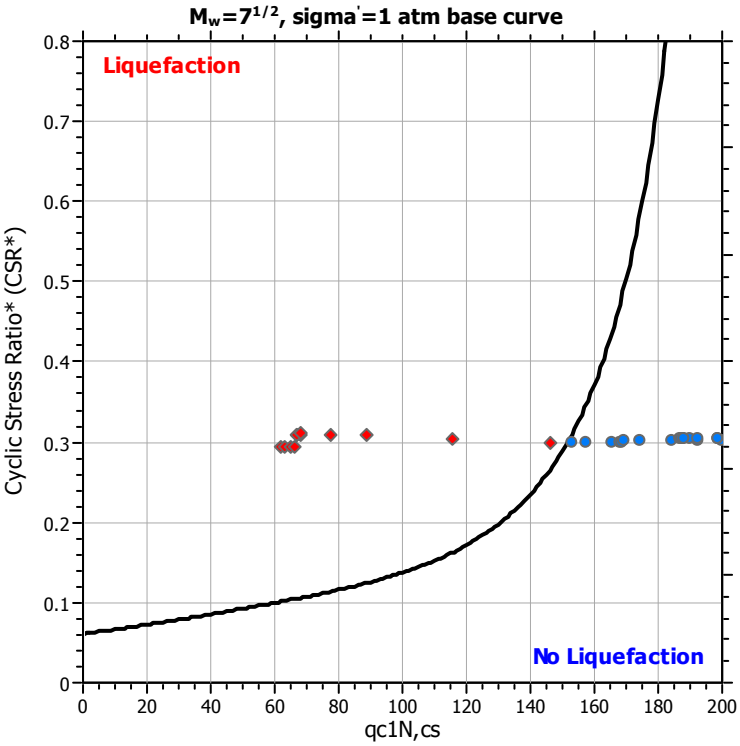
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

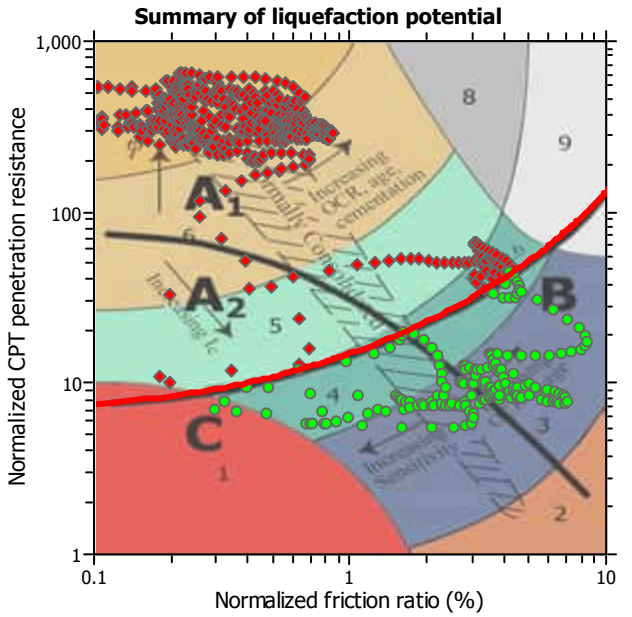
CPT file : CPT_51

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

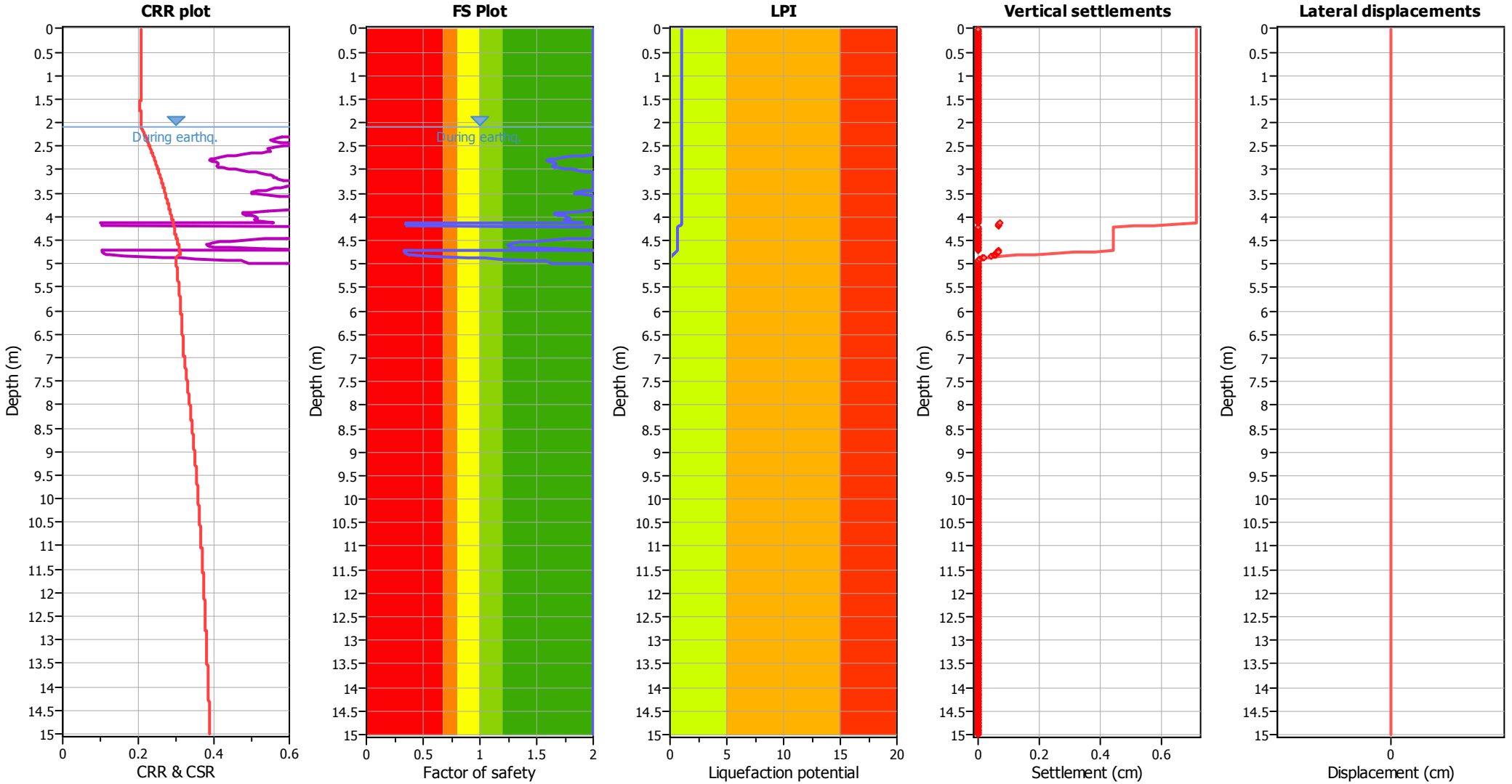






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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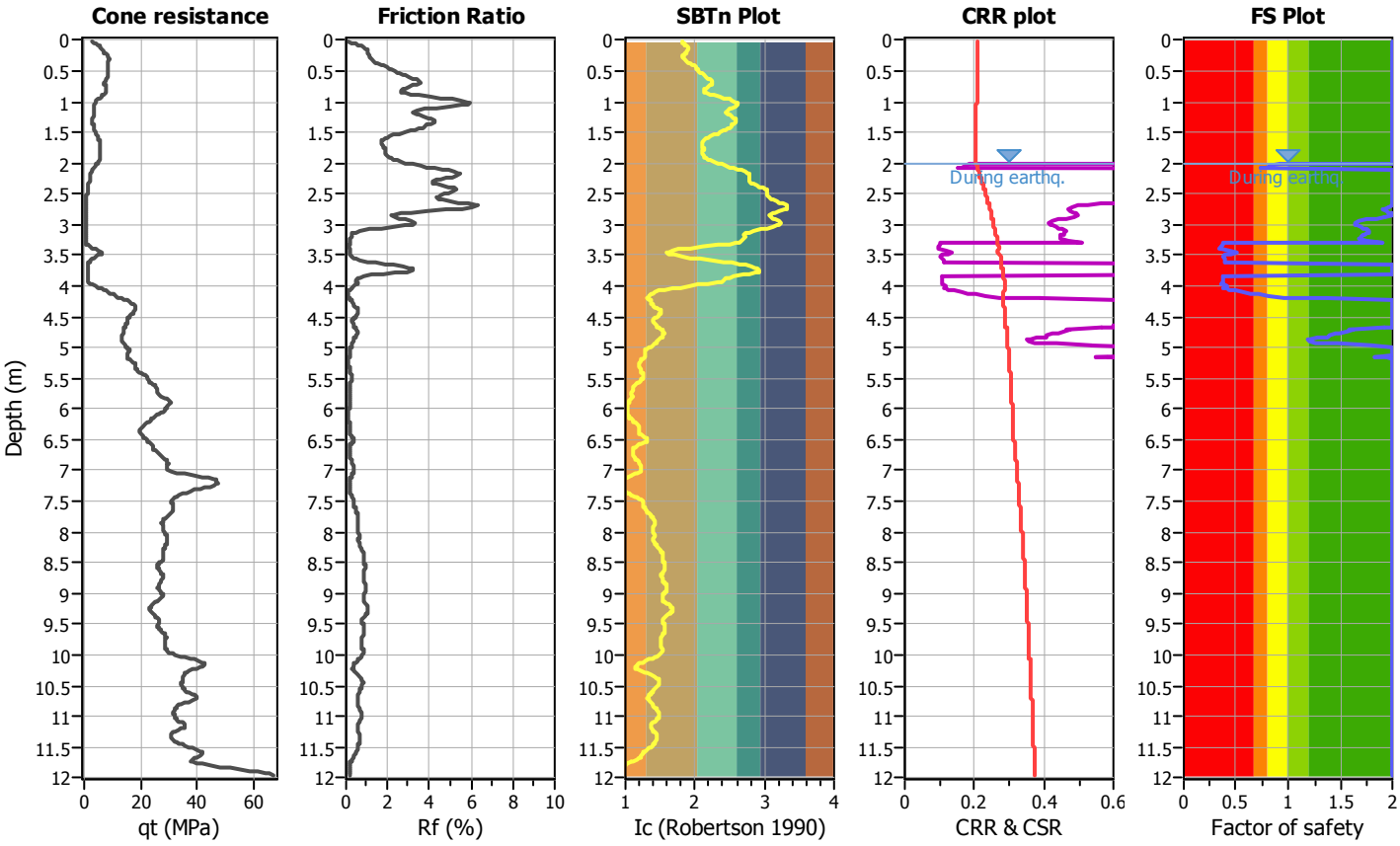
LIQUEFACTION ANALYSIS REPORT

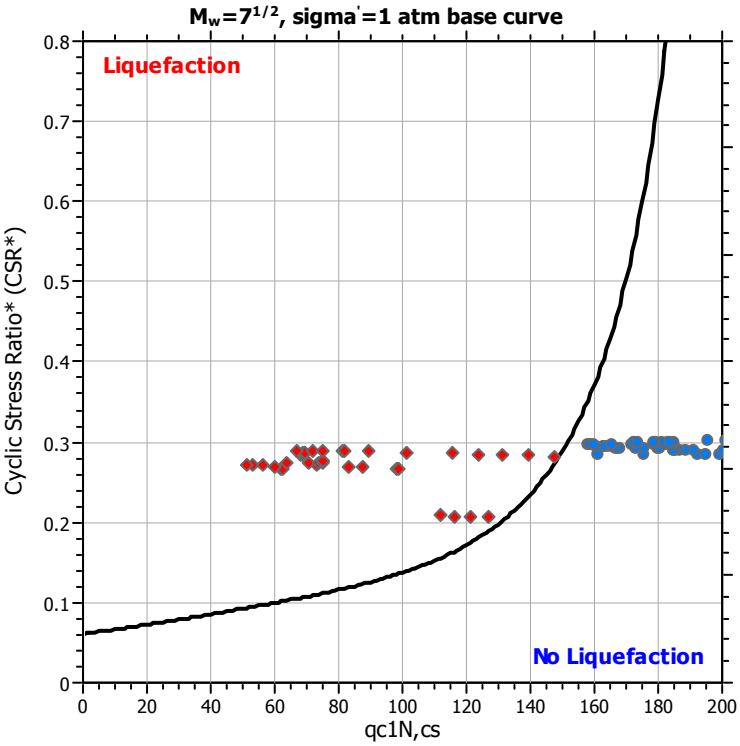
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

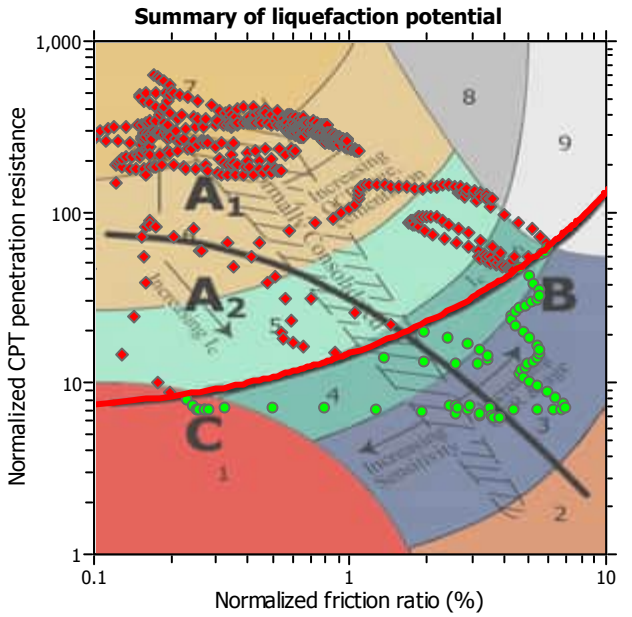
CPT file : CPT_52

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

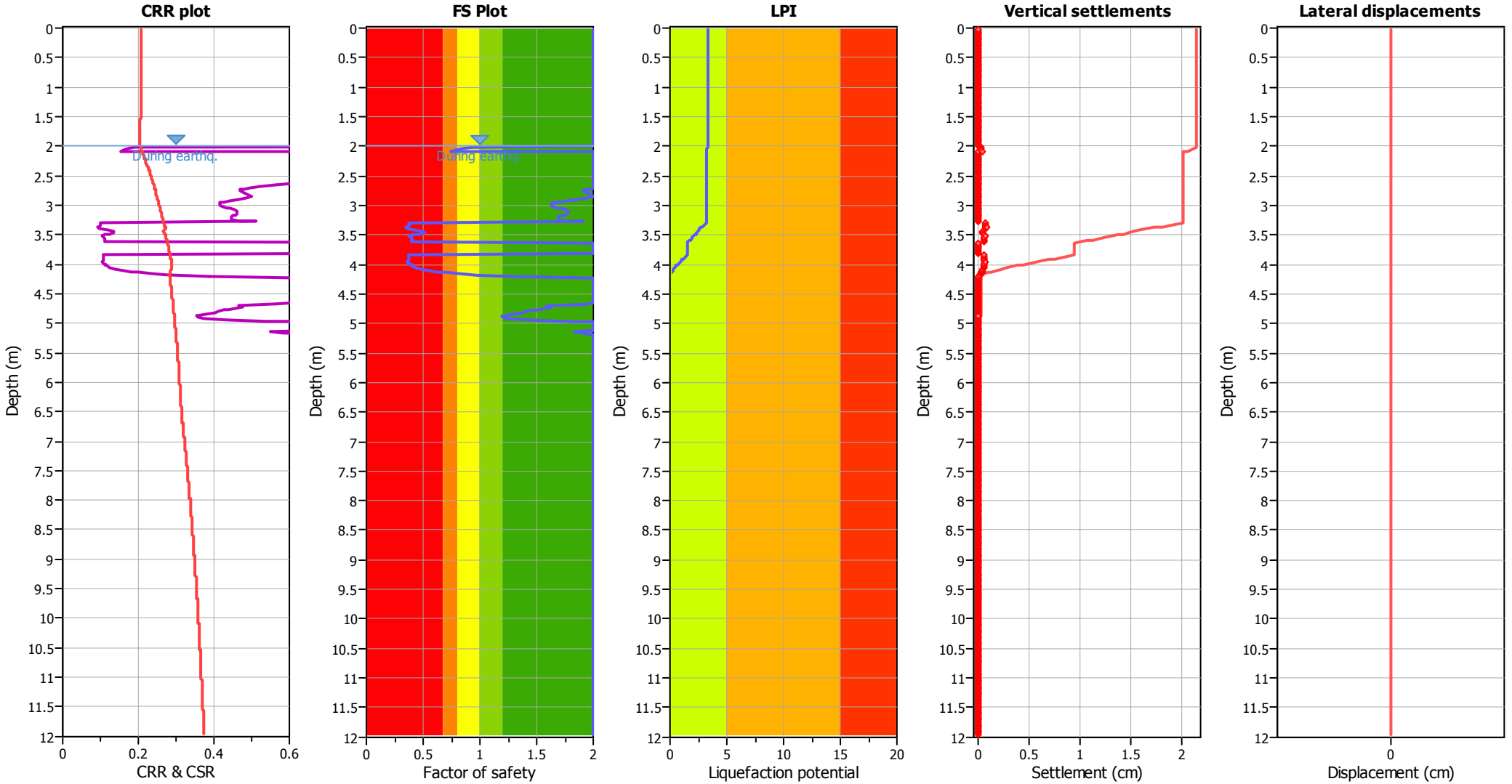






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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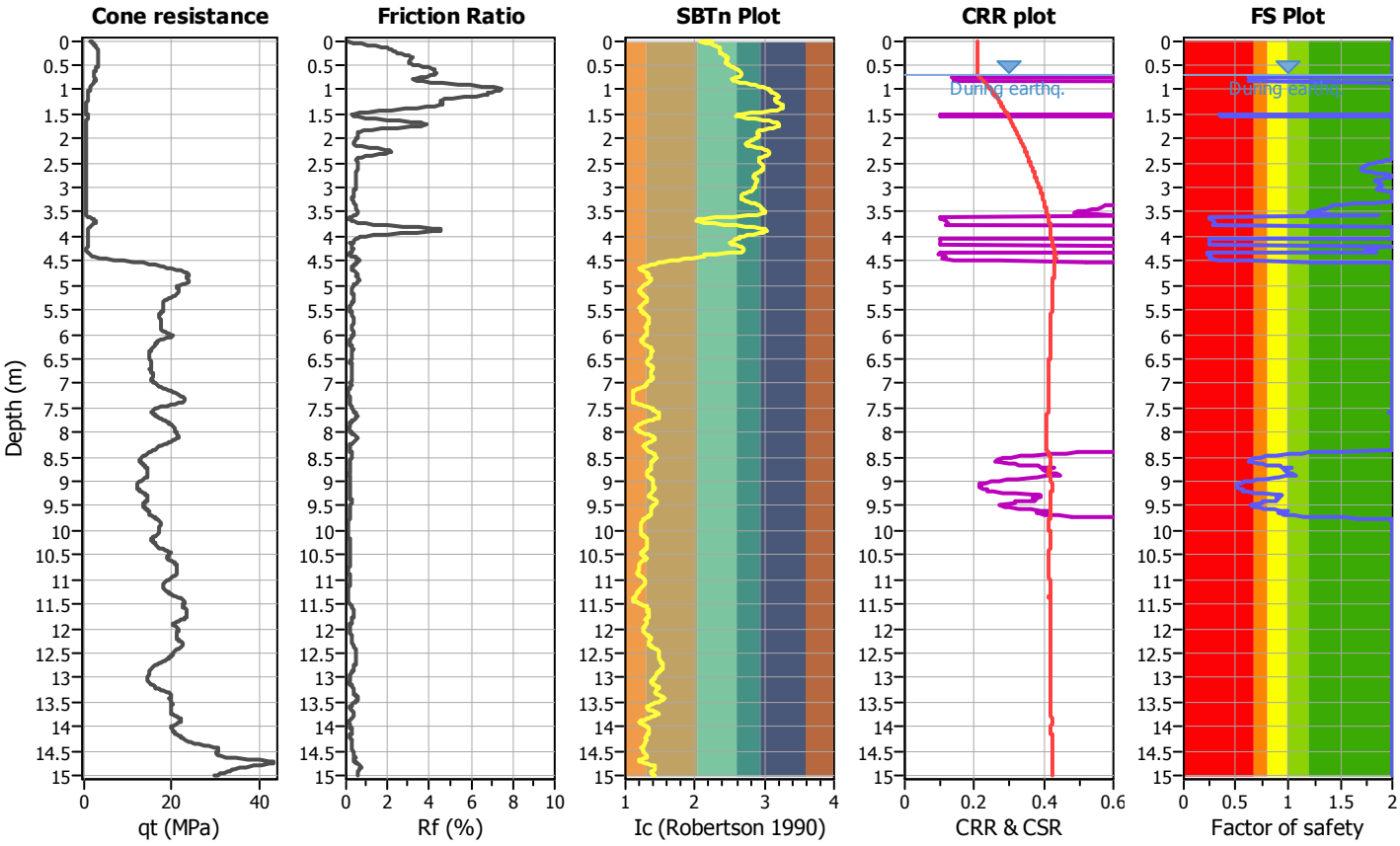
LIQUEFACTION ANALYSIS REPORT

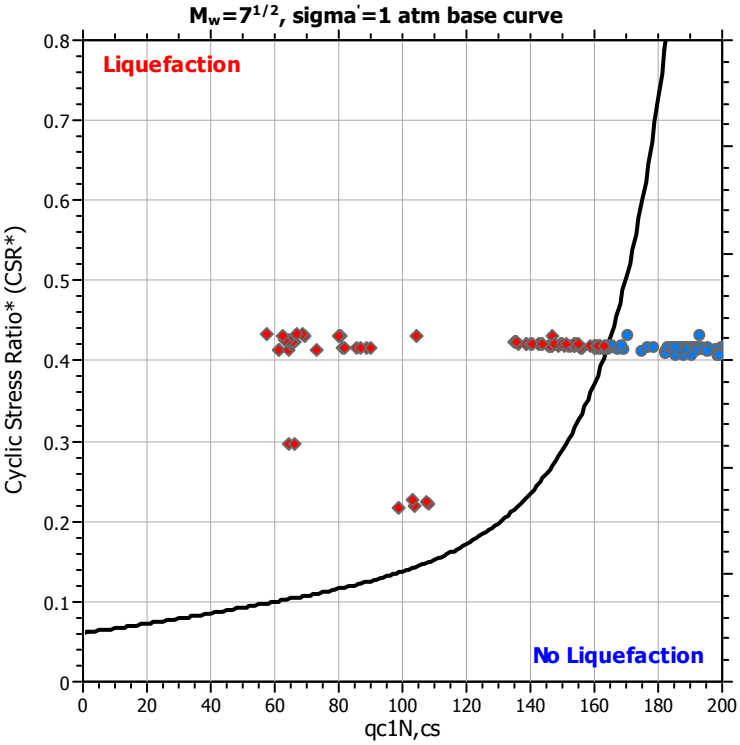
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

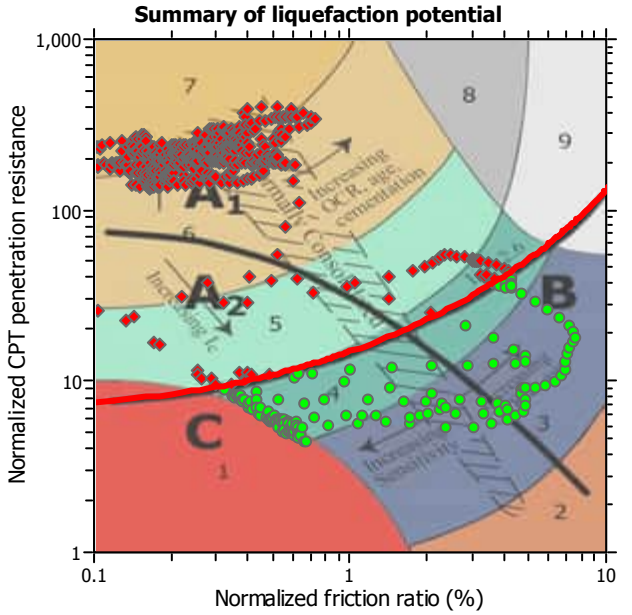
CPT file : CPT_53

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

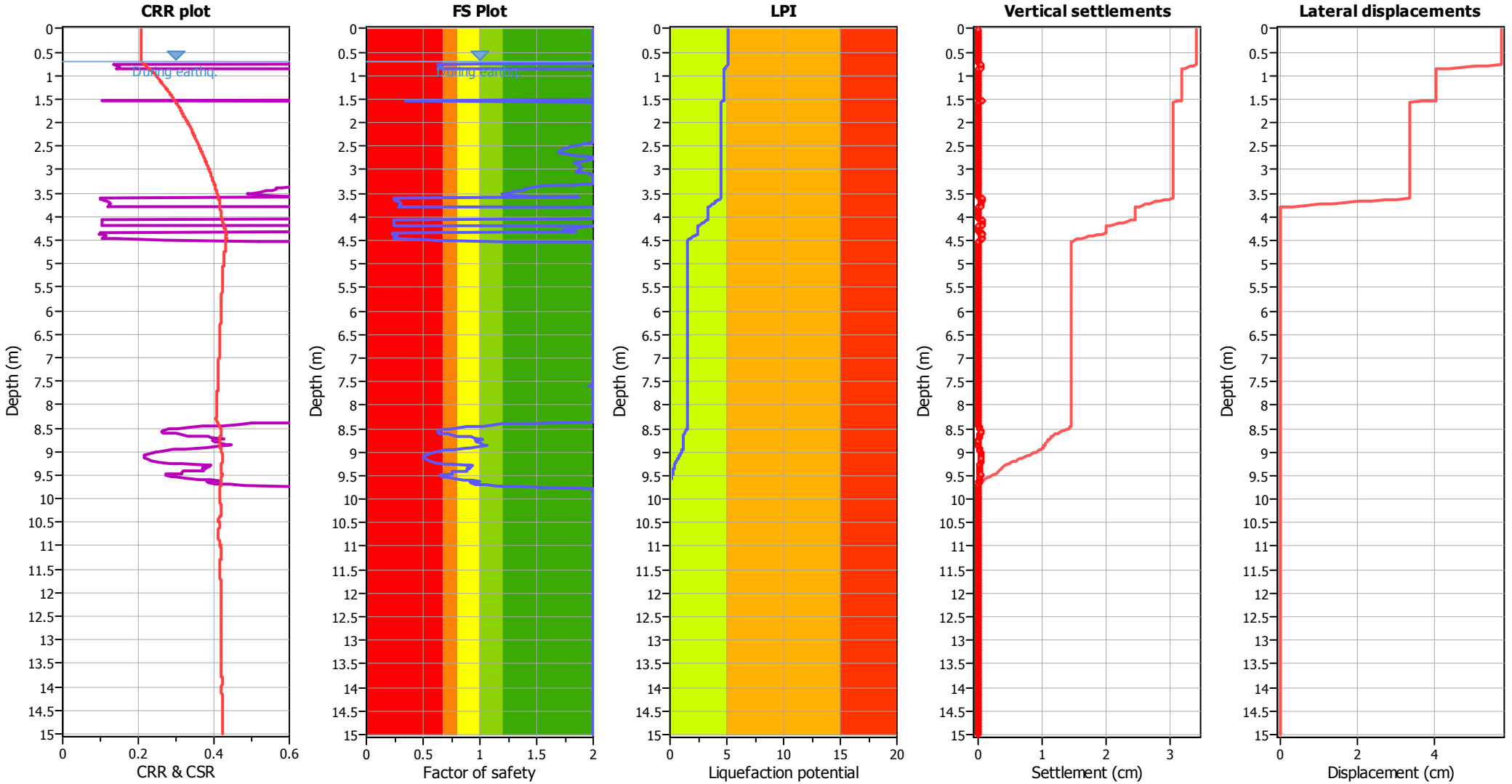






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.70 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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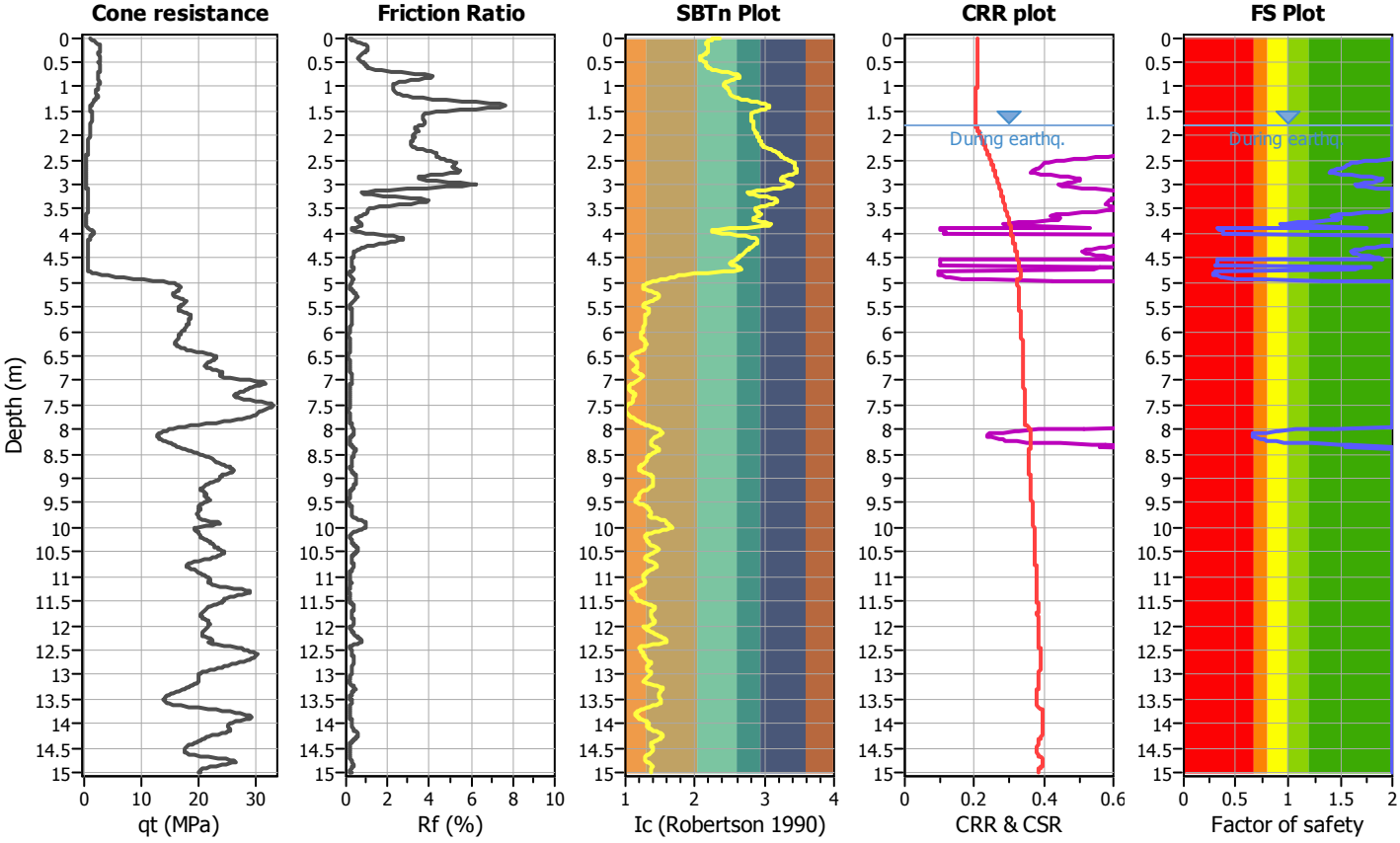
LIQUEFACTION ANALYSIS REPORT

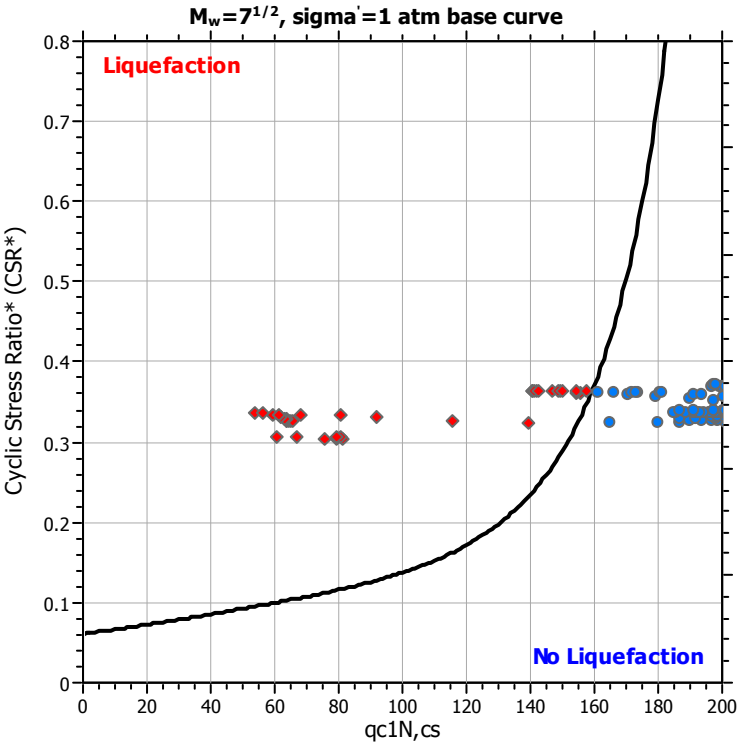
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

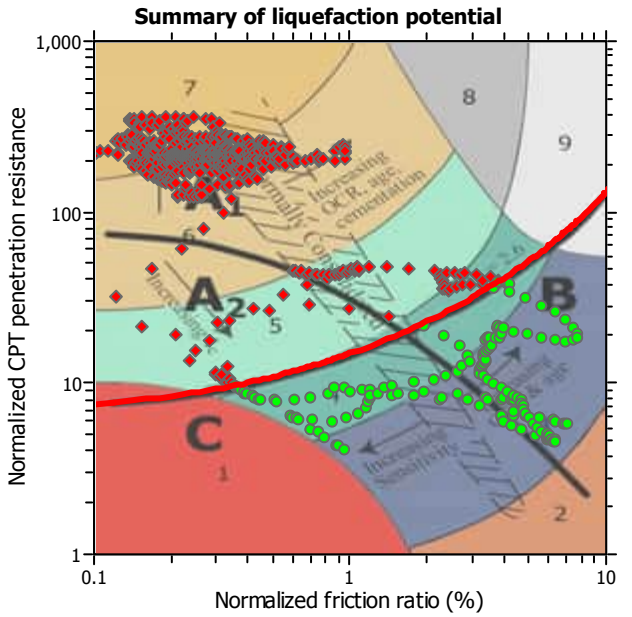
CPT file : CPT_54

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.80 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.80 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

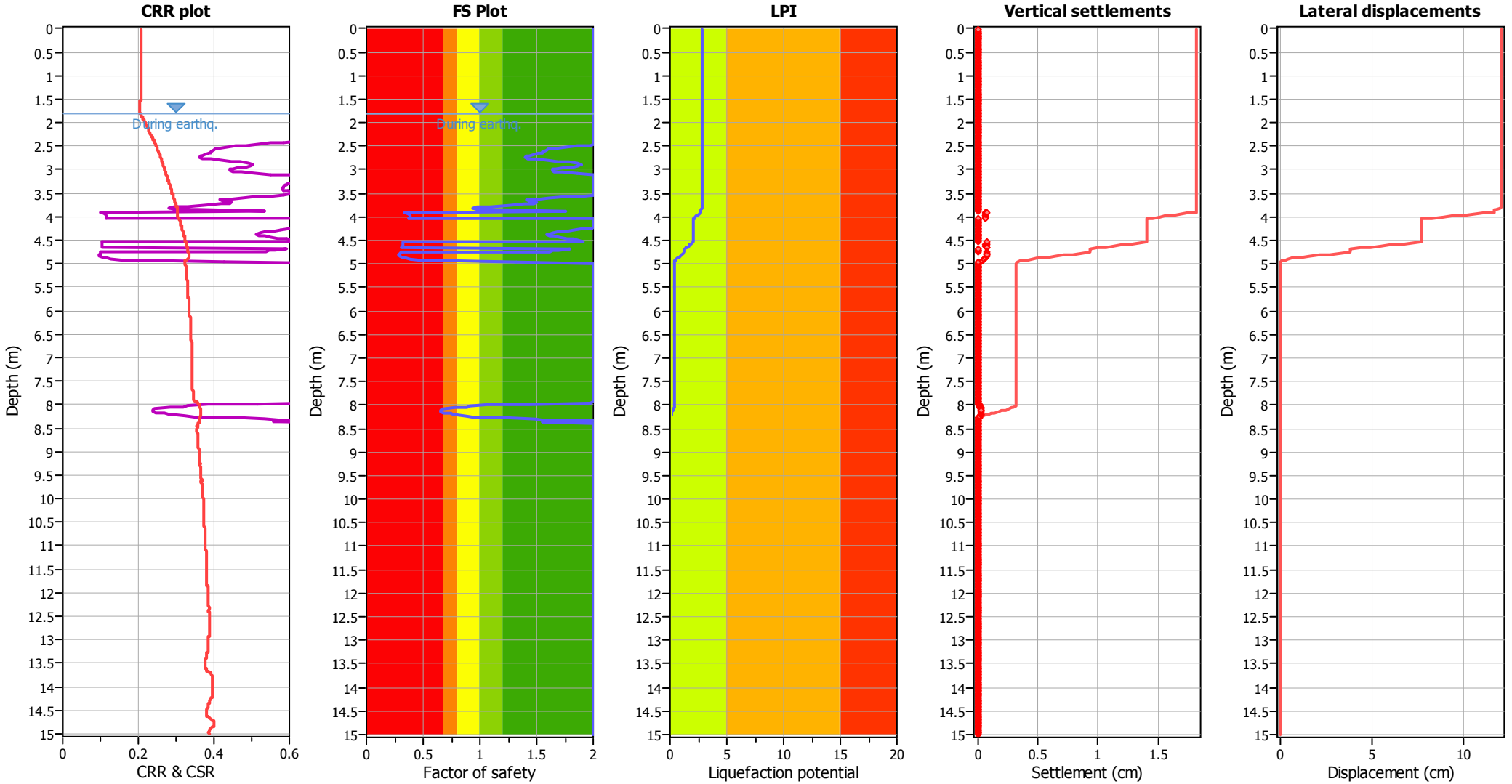






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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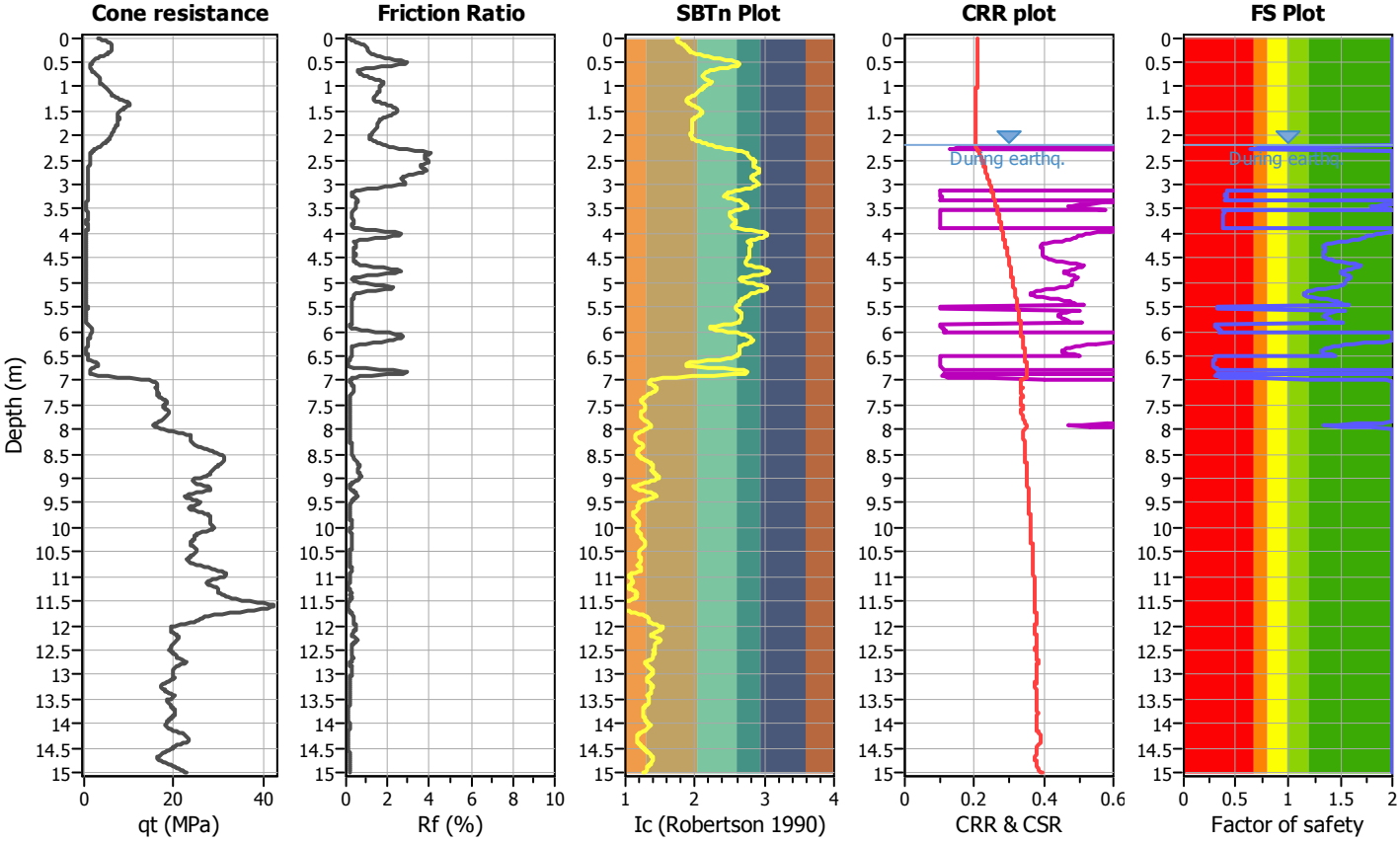
LIQUEFACTION ANALYSIS REPORT

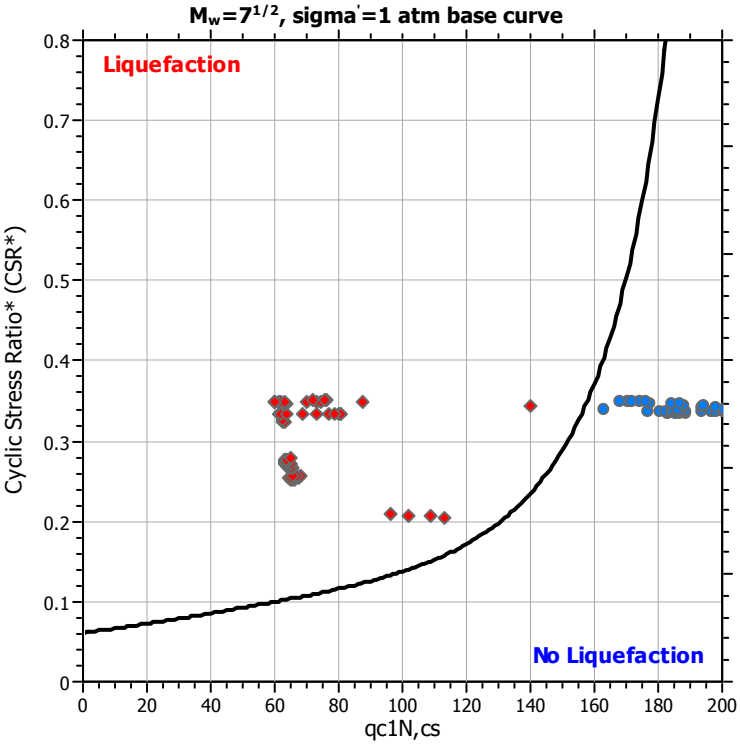
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

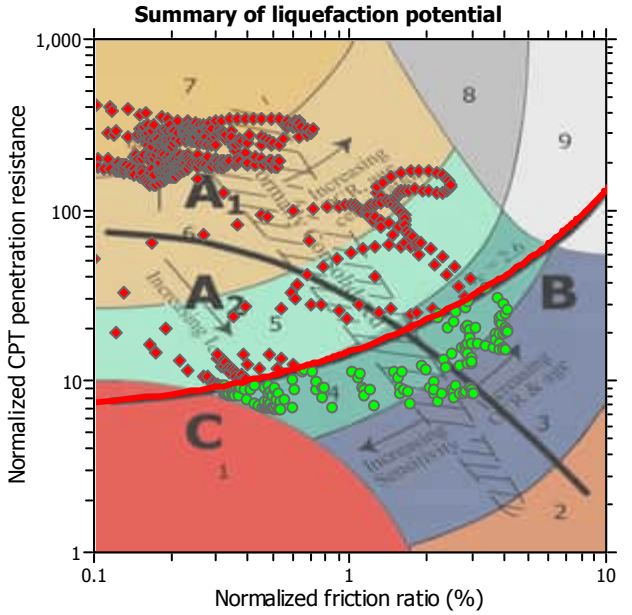
CPT file : CPT_55

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

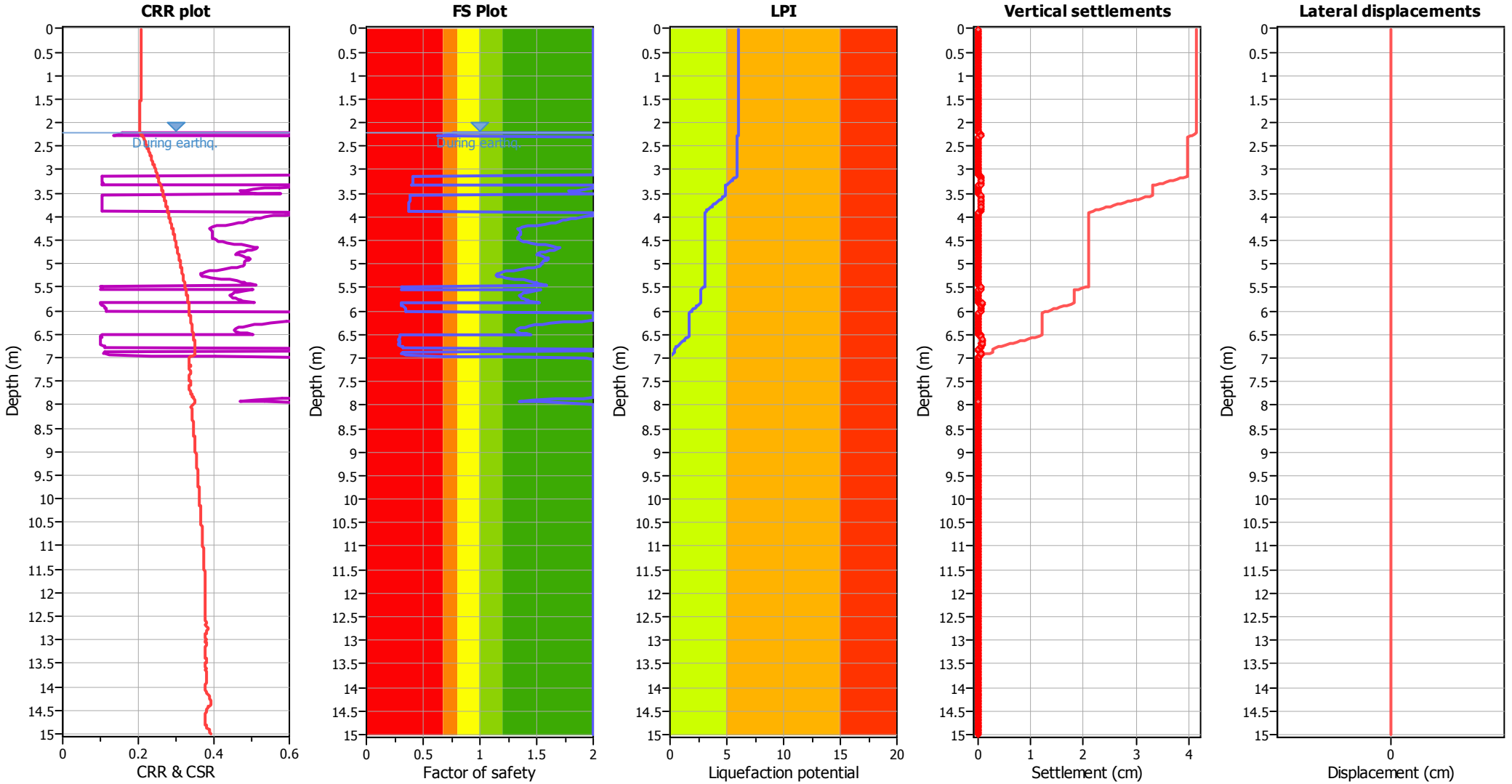






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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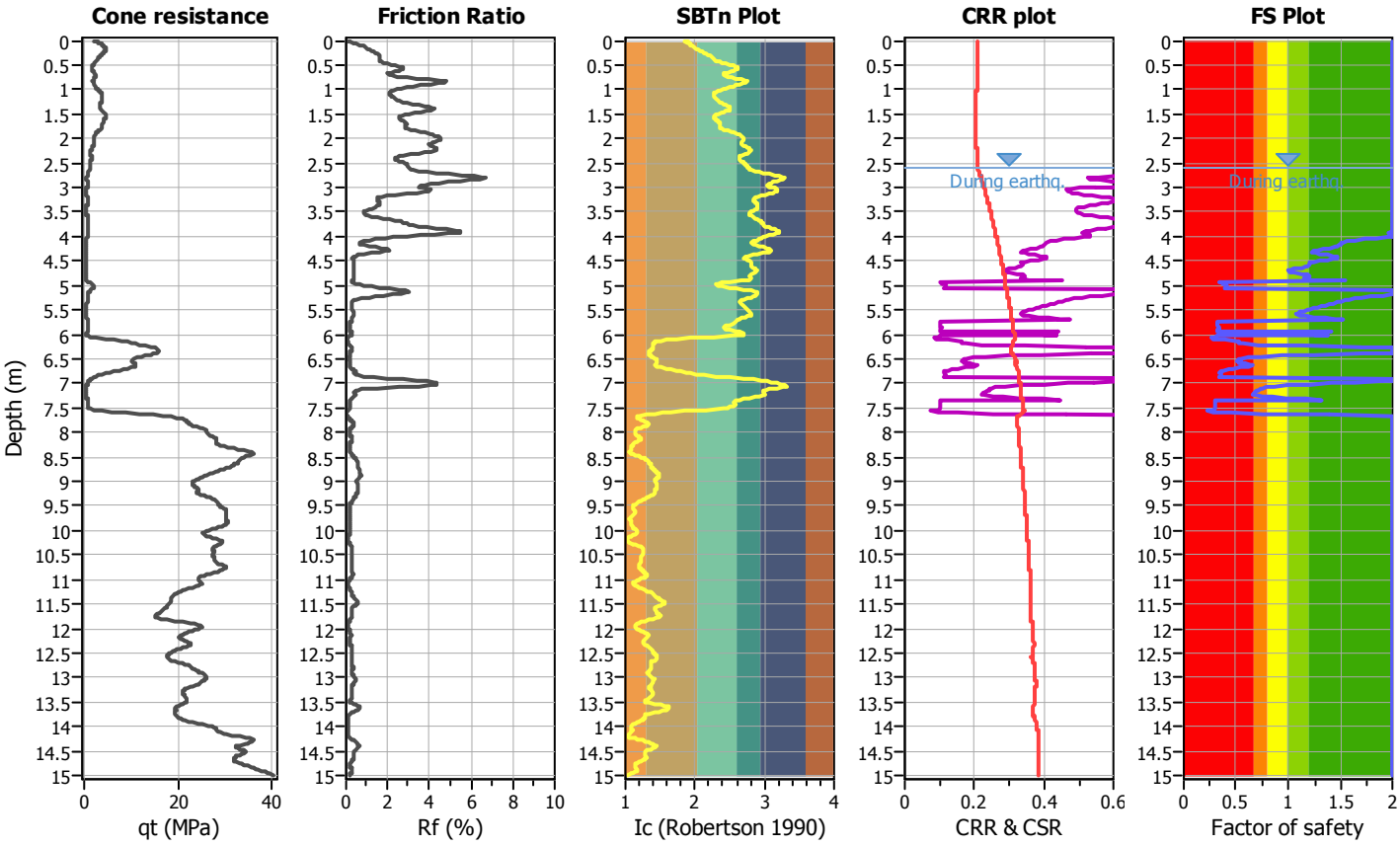
LIQUEFACTION ANALYSIS REPORT

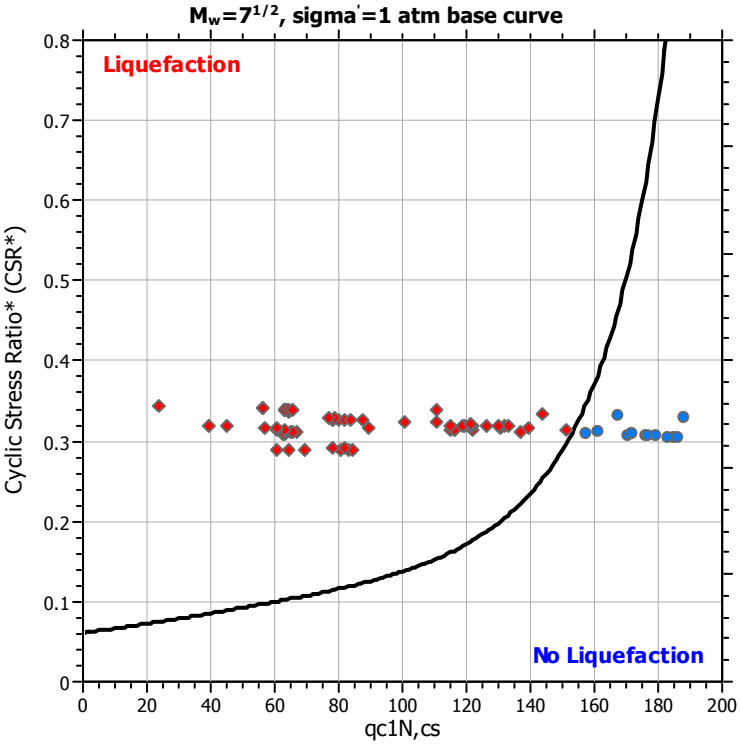
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

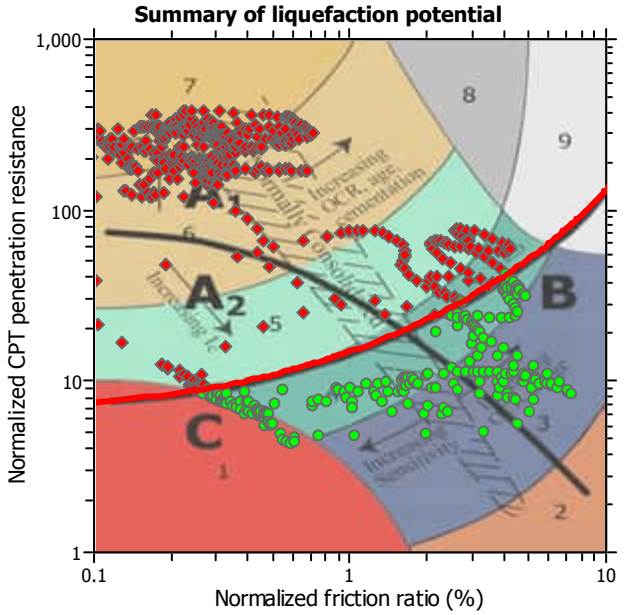
CPT file : CPT_56

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.60 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.60 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

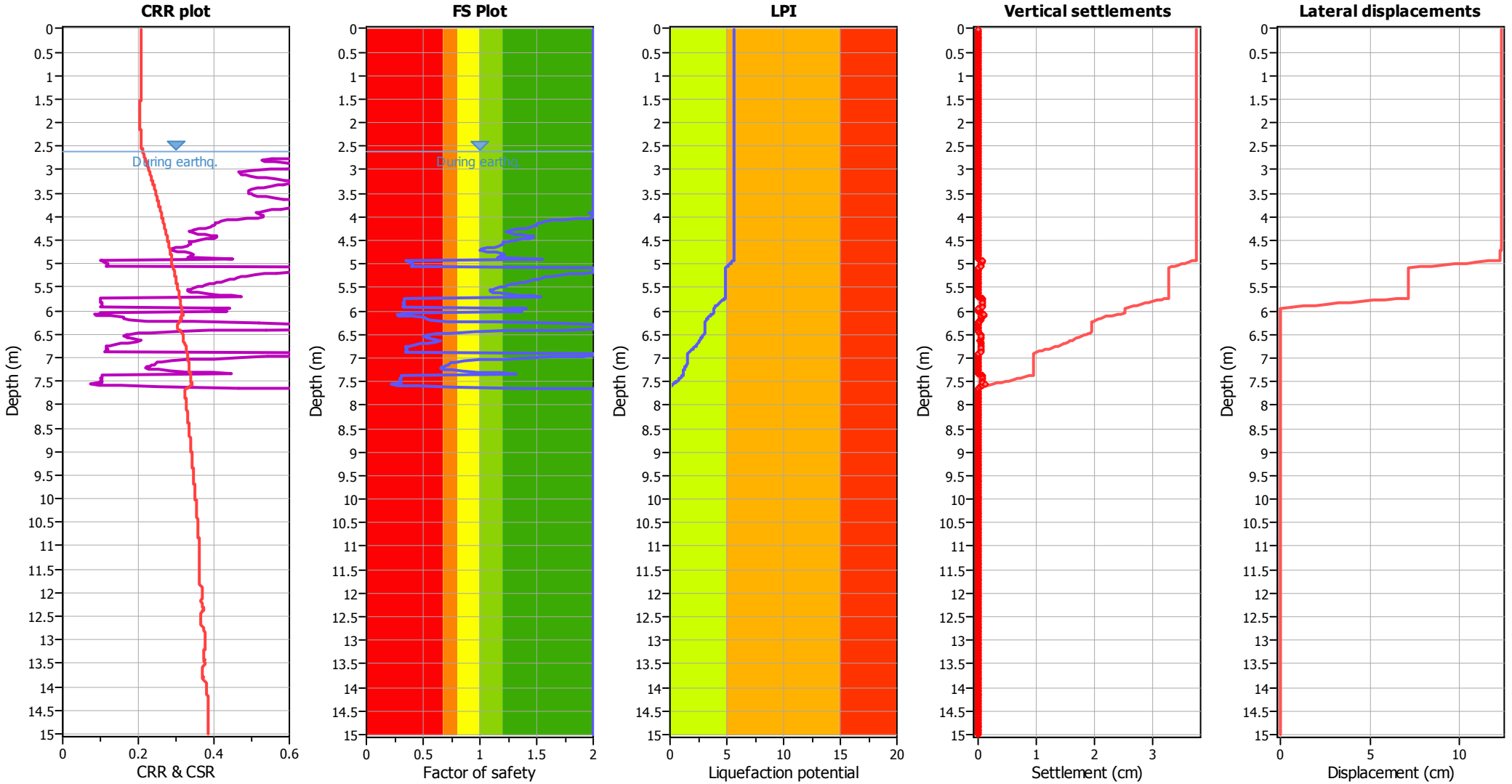






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.60 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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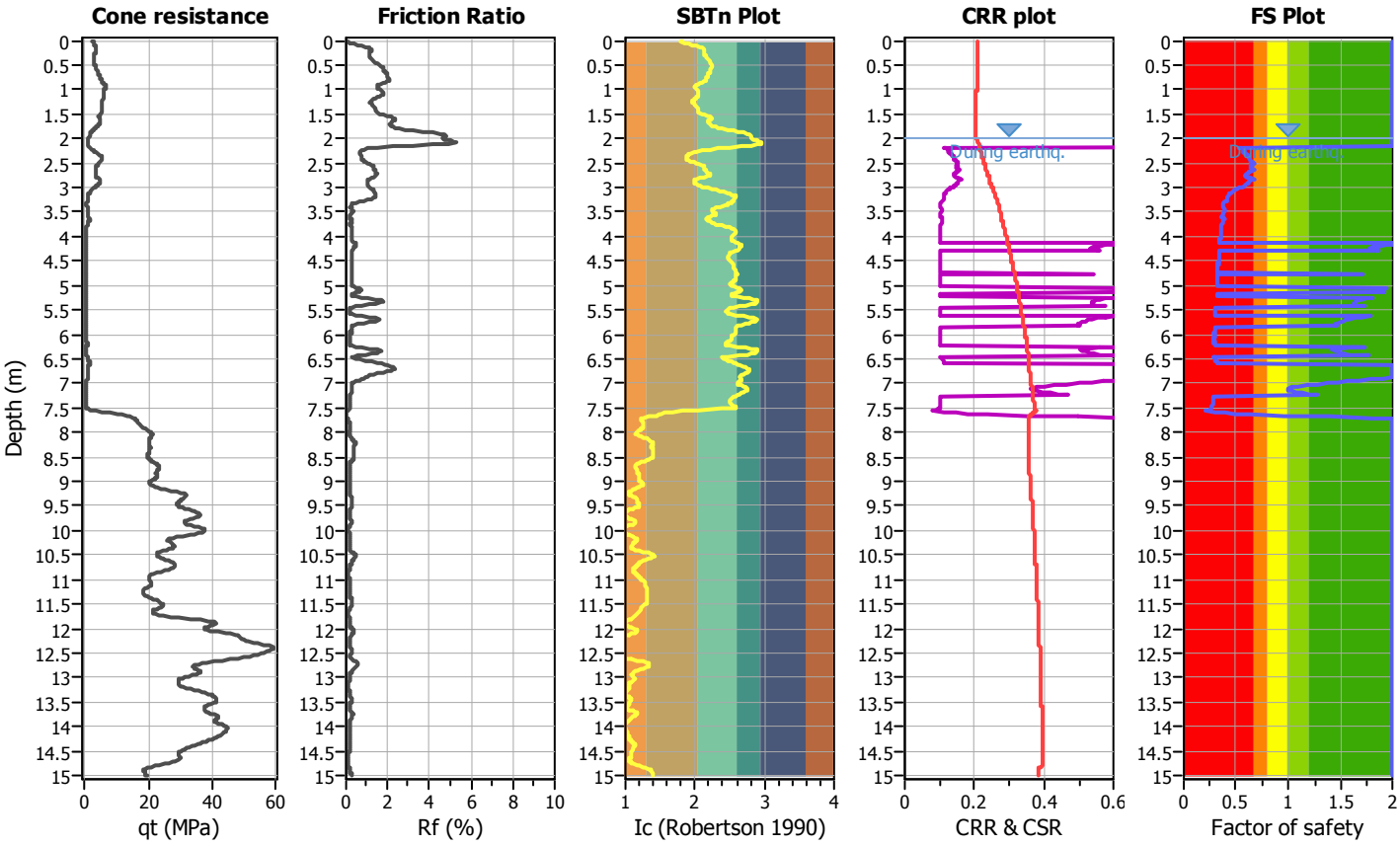
LIQUEFACTION ANALYSIS REPORT

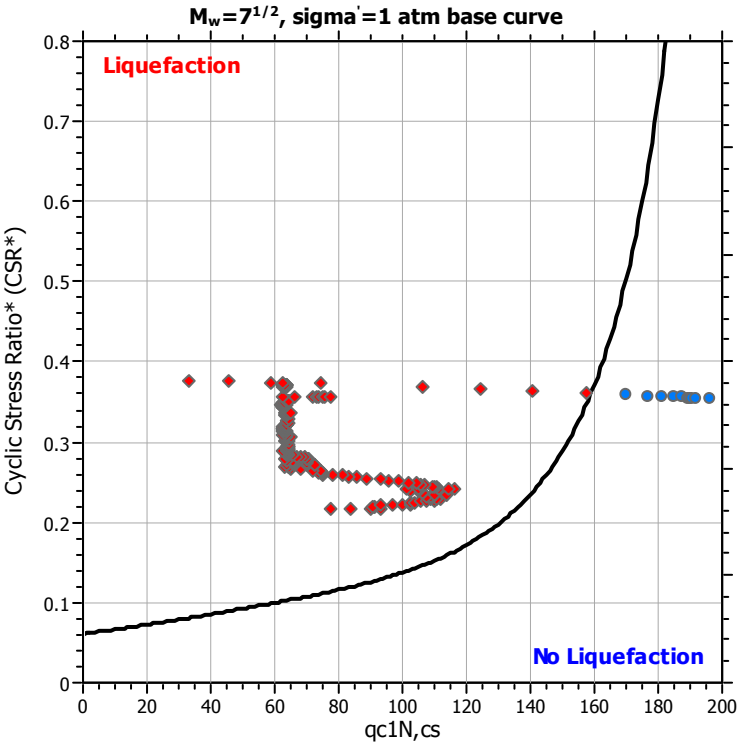
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

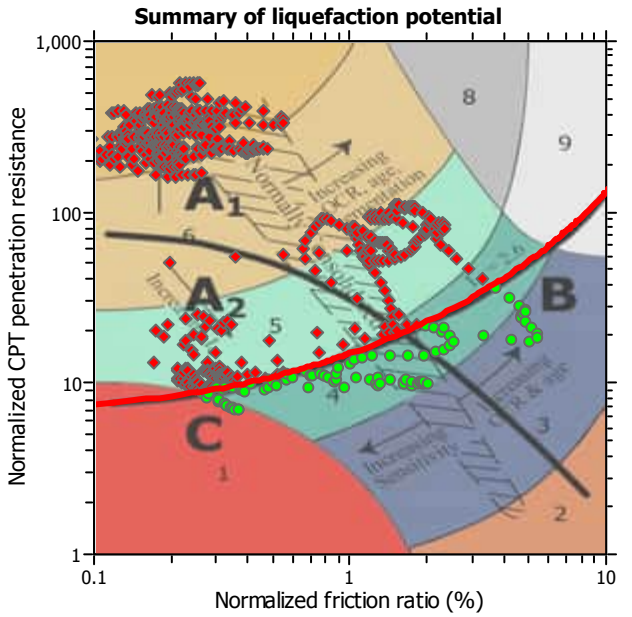
CPT file : CPT_57

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

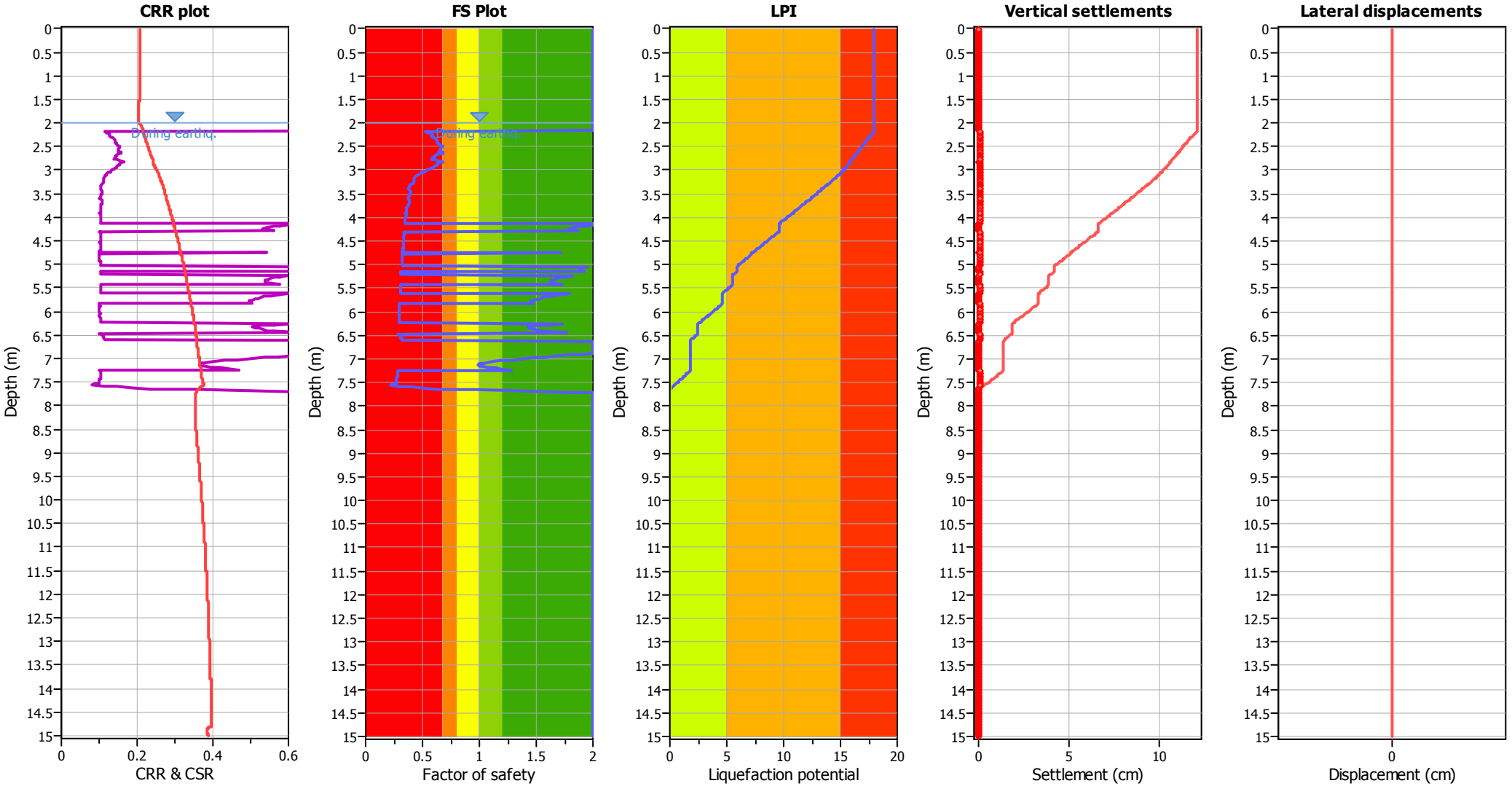






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
Addington
P O Box 589
Christchurch 8140

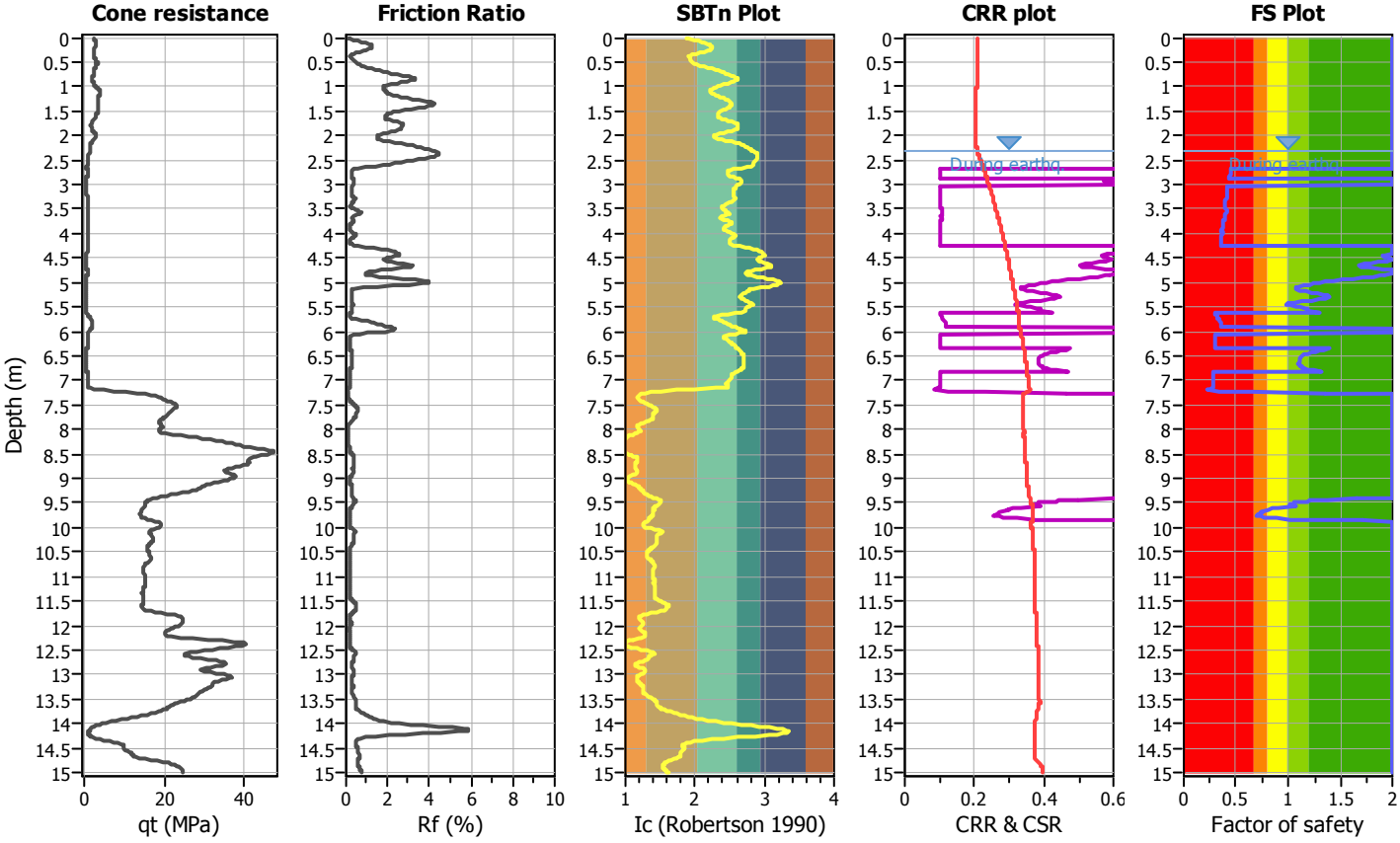
LIQUEFACTION ANALYSIS REPORT

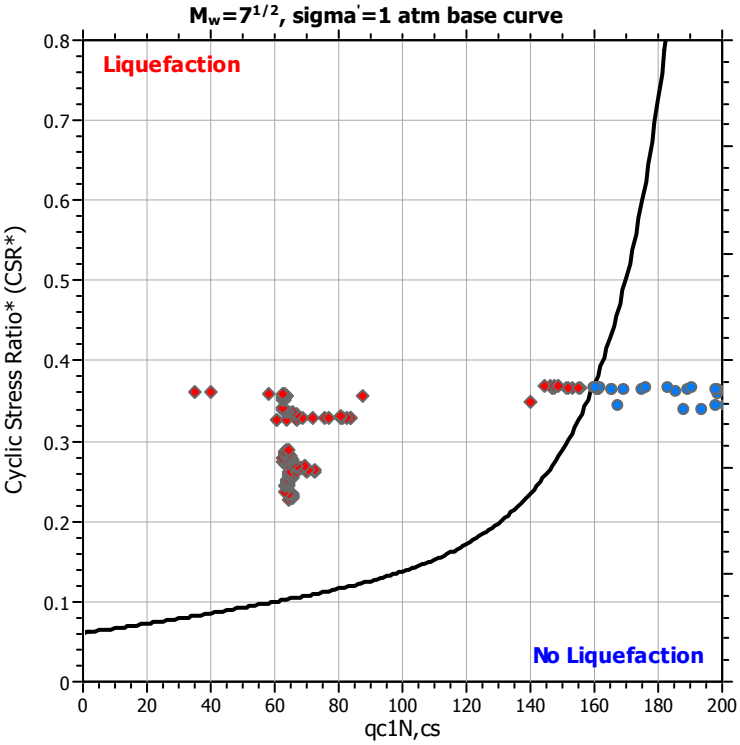
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

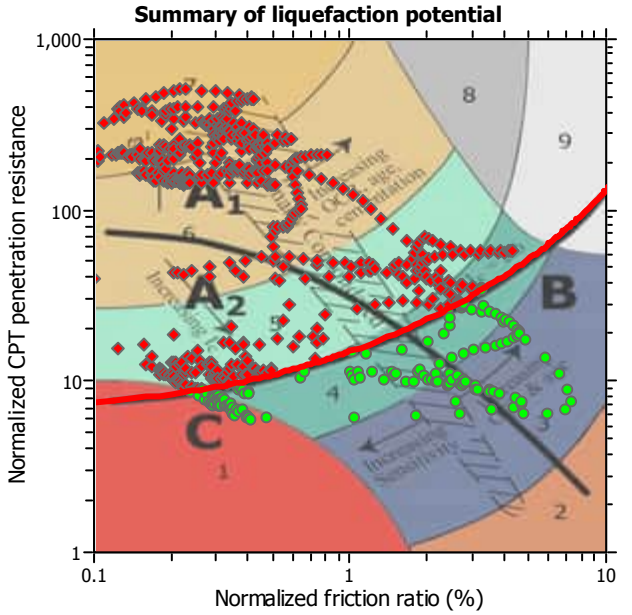
CPT file : CPT_58

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

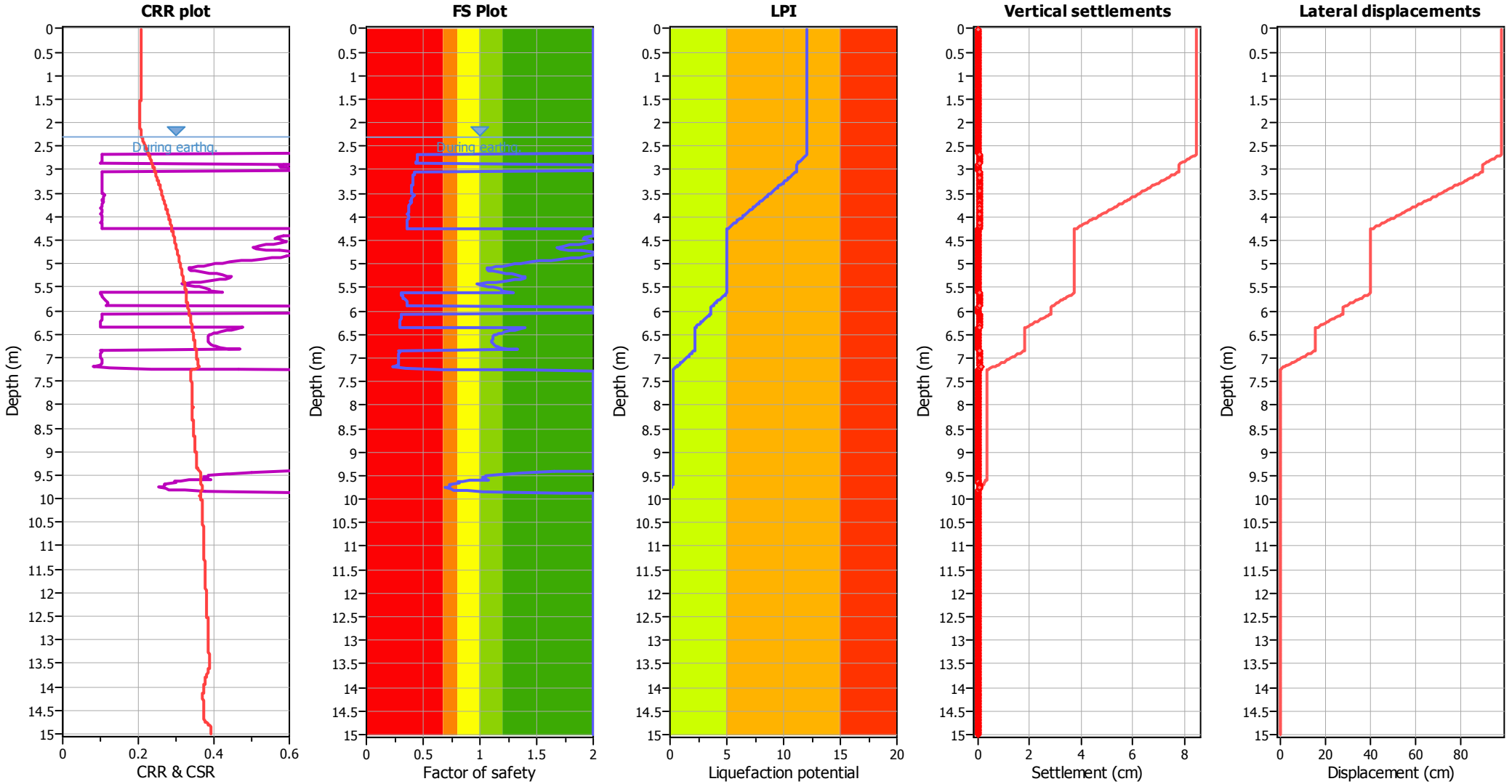






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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Christchurch 8140

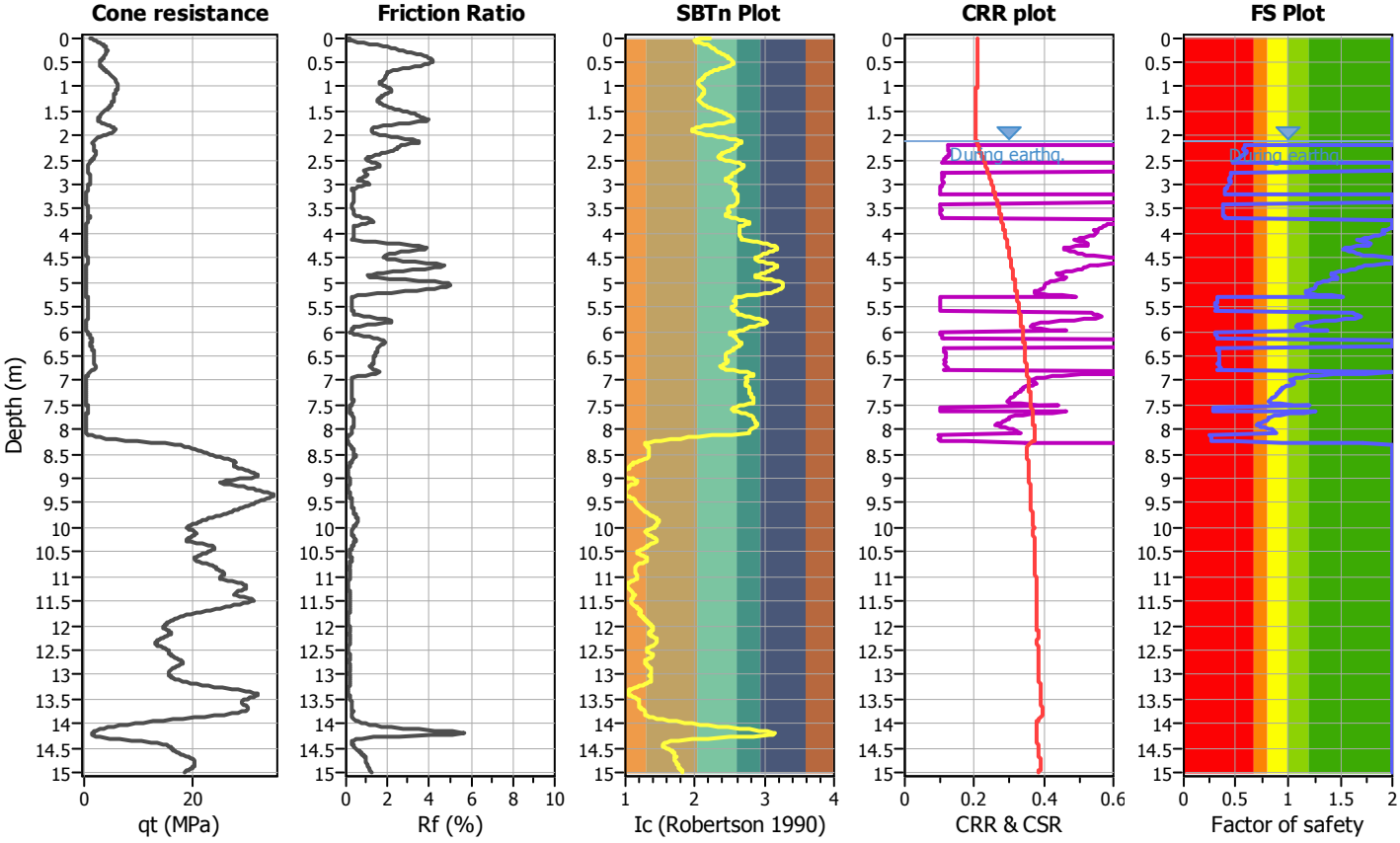
LIQUEFACTION ANALYSIS REPORT

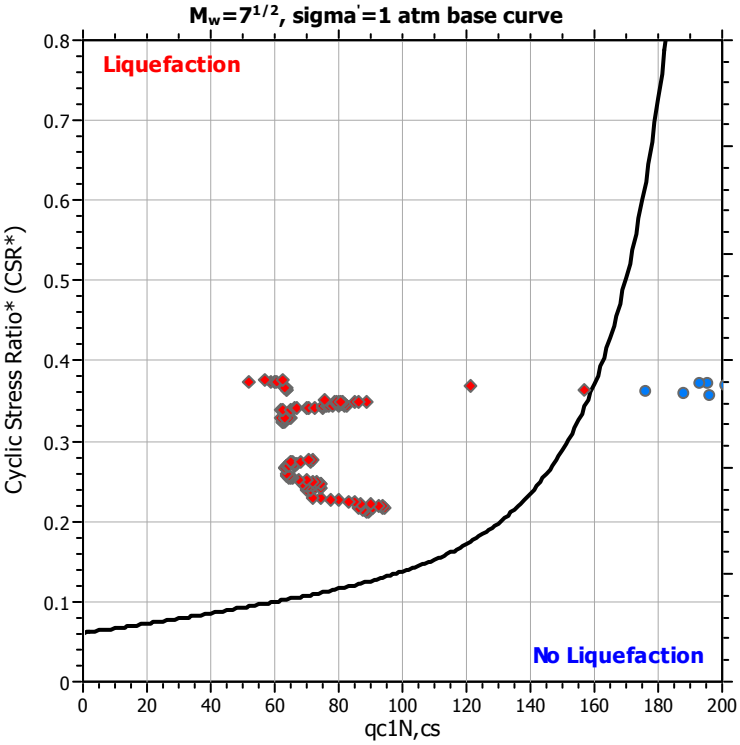
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

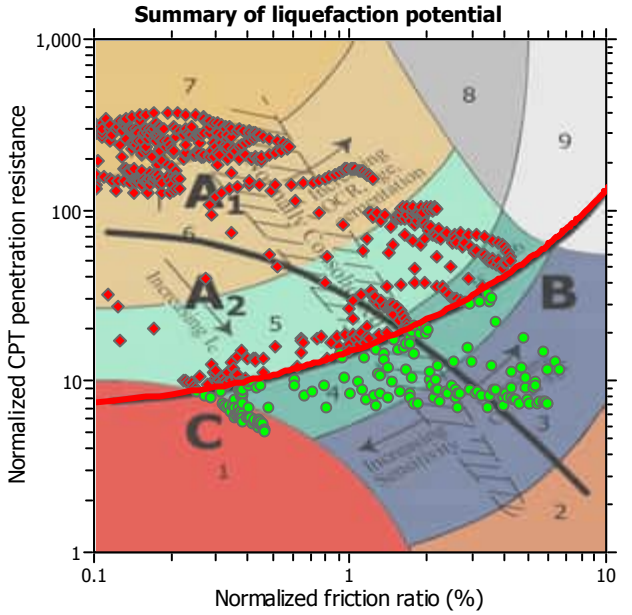
CPT file : CPT_59

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

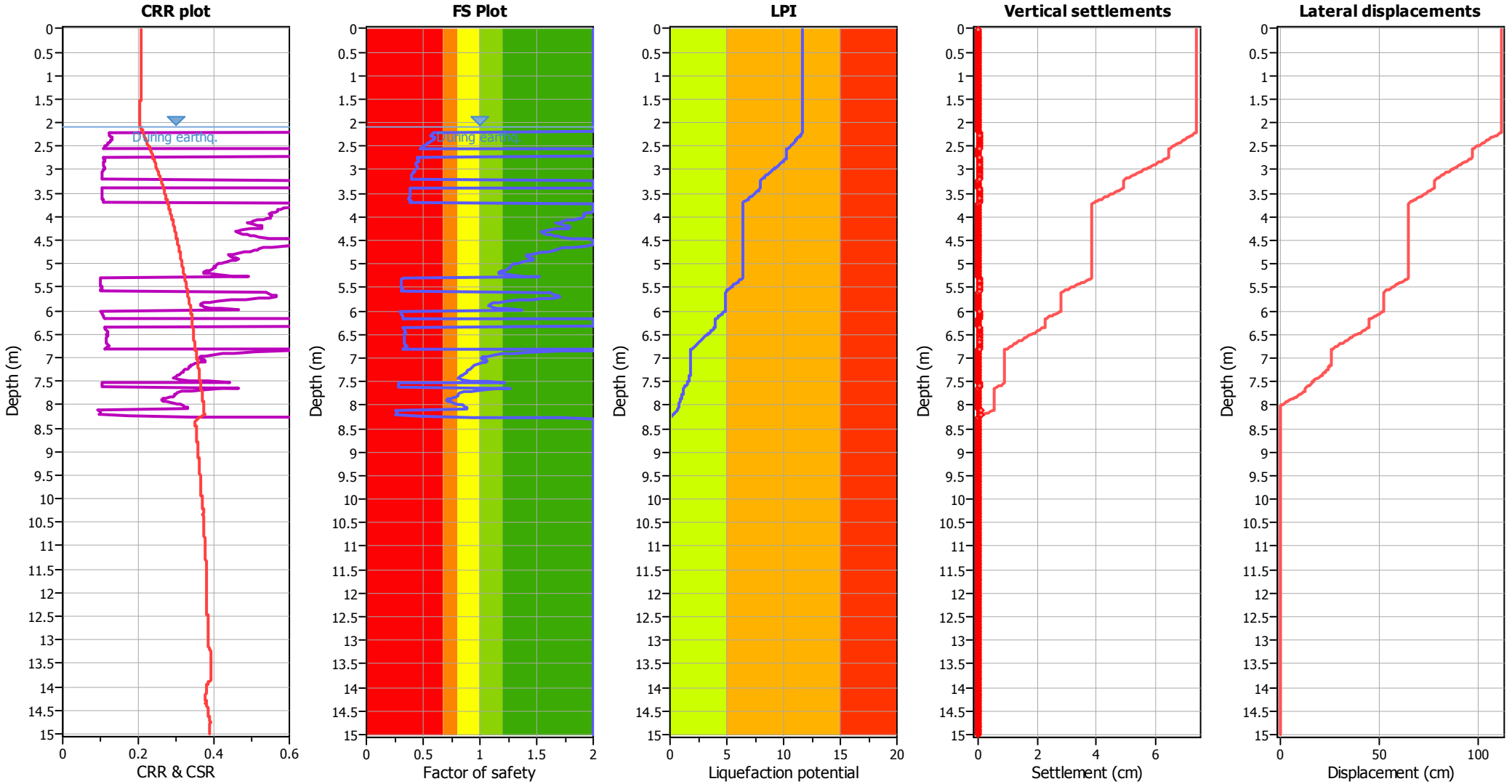






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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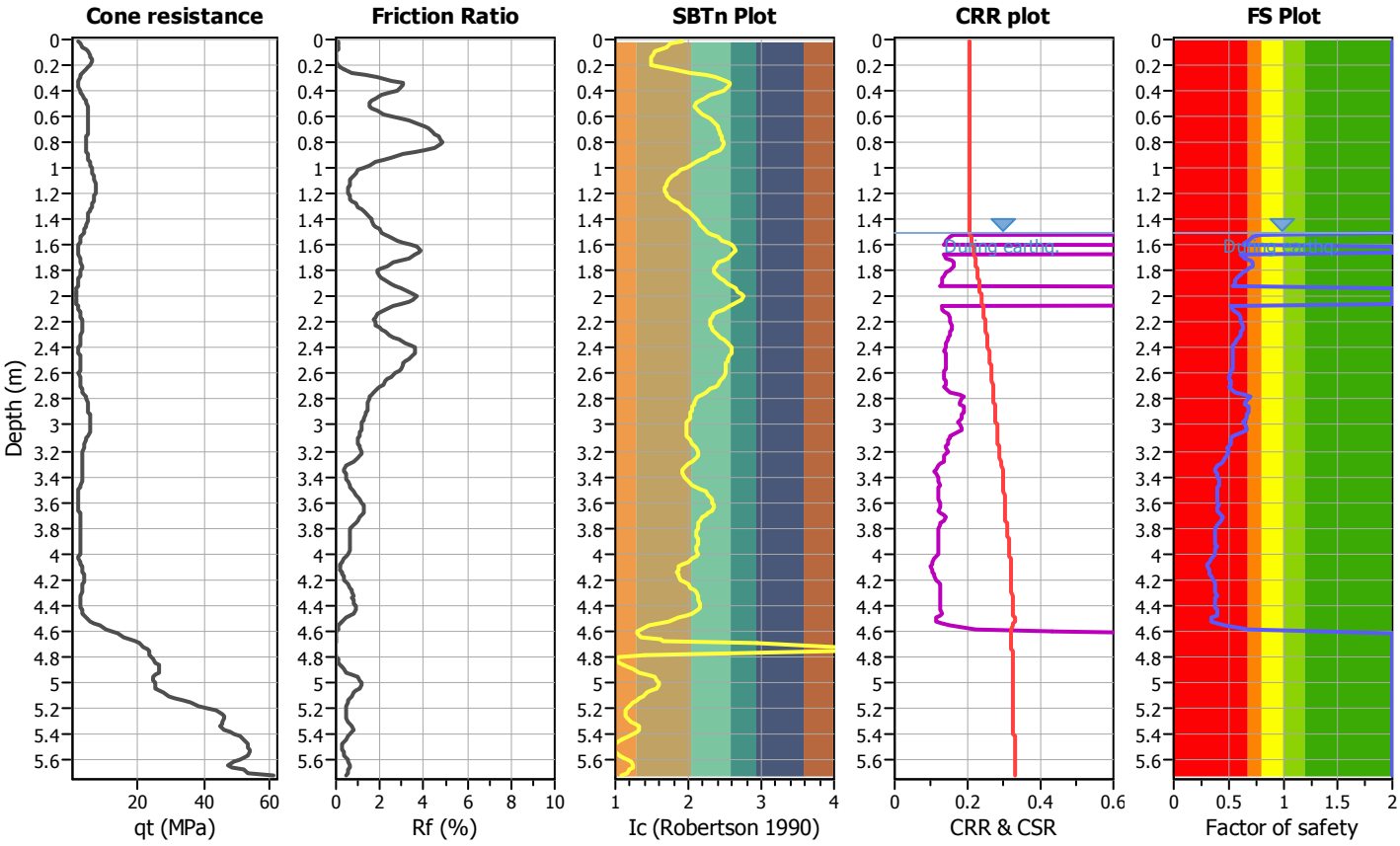
LIQUEFACTION ANALYSIS REPORT

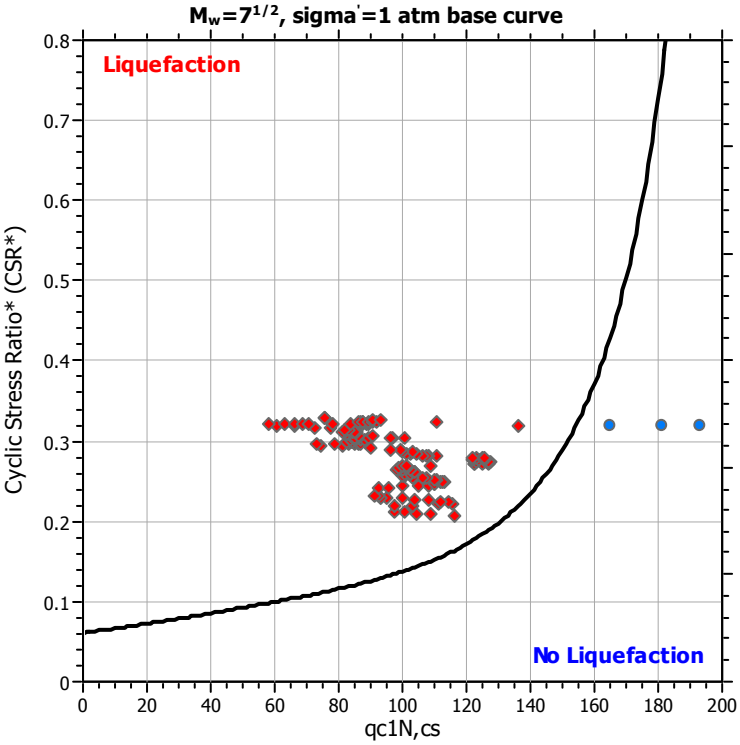
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

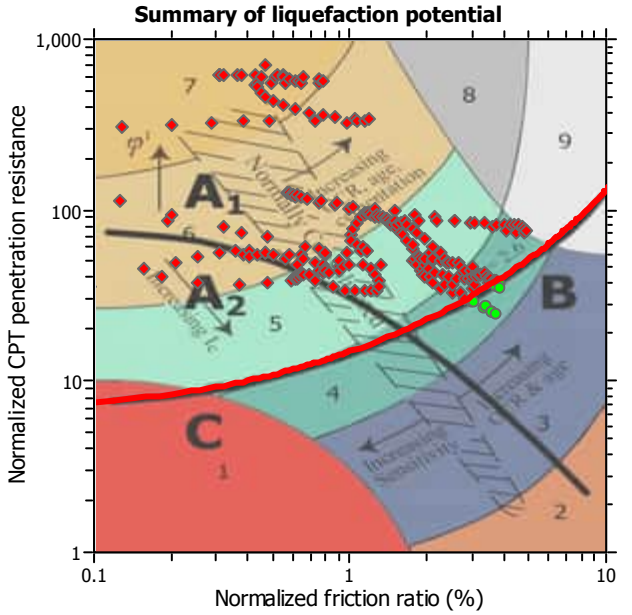
CPT file : CPT_60

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

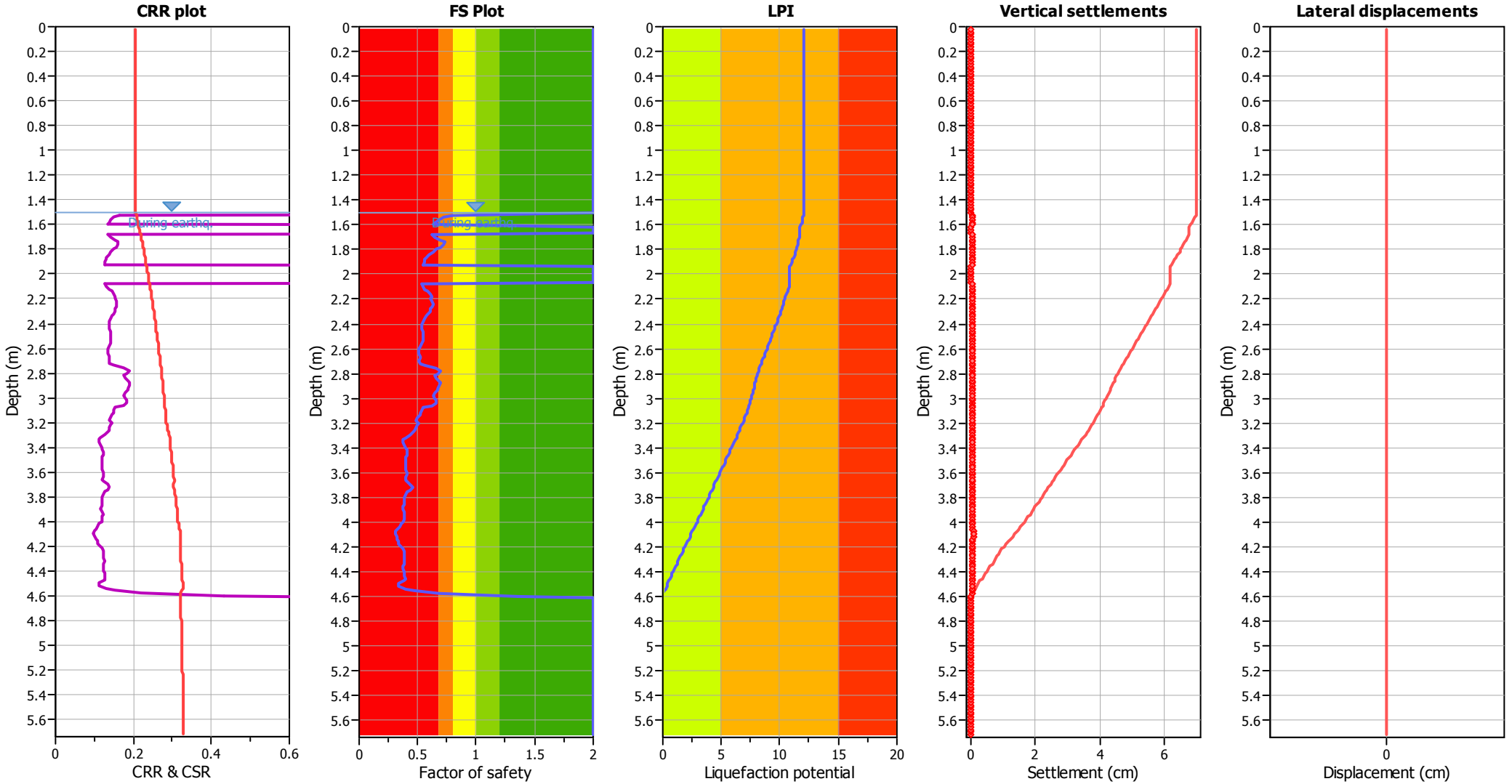






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

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Christchurch 8140

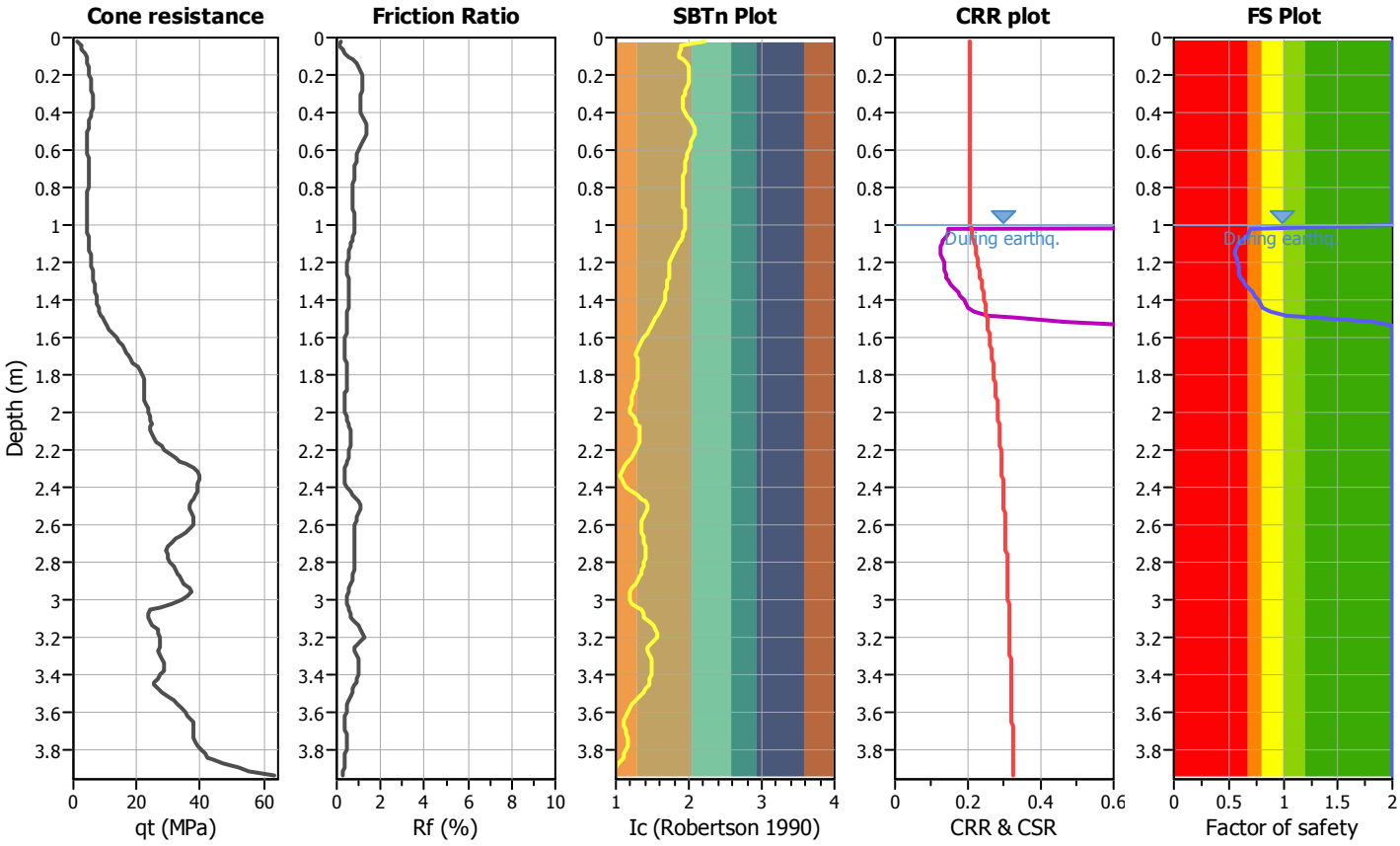
LIQUEFACTION ANALYSIS REPORT

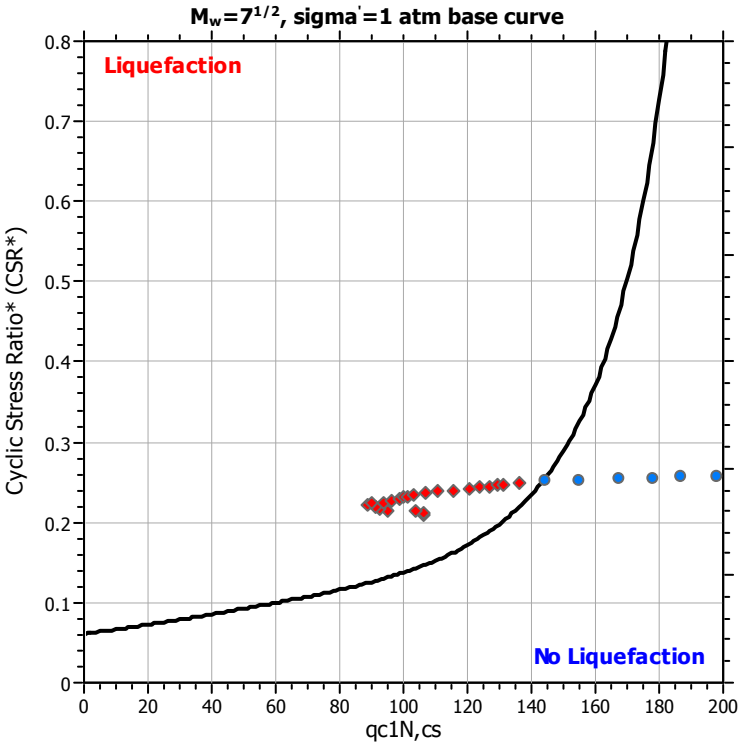
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

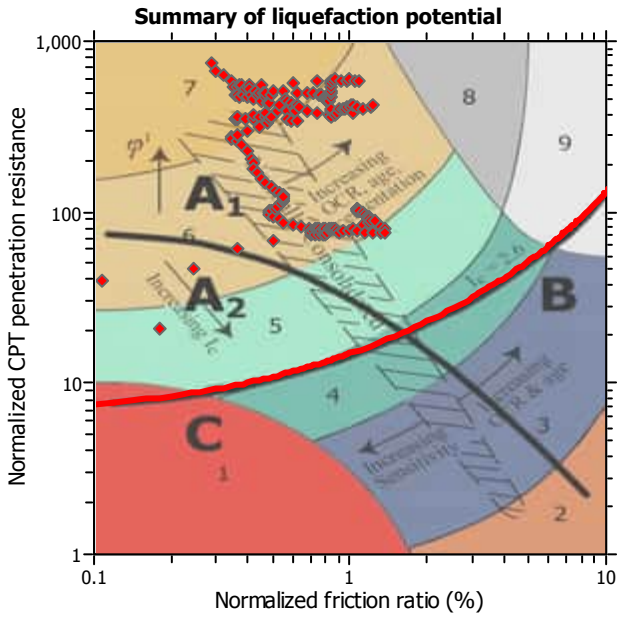
CPT file : CPT_61

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

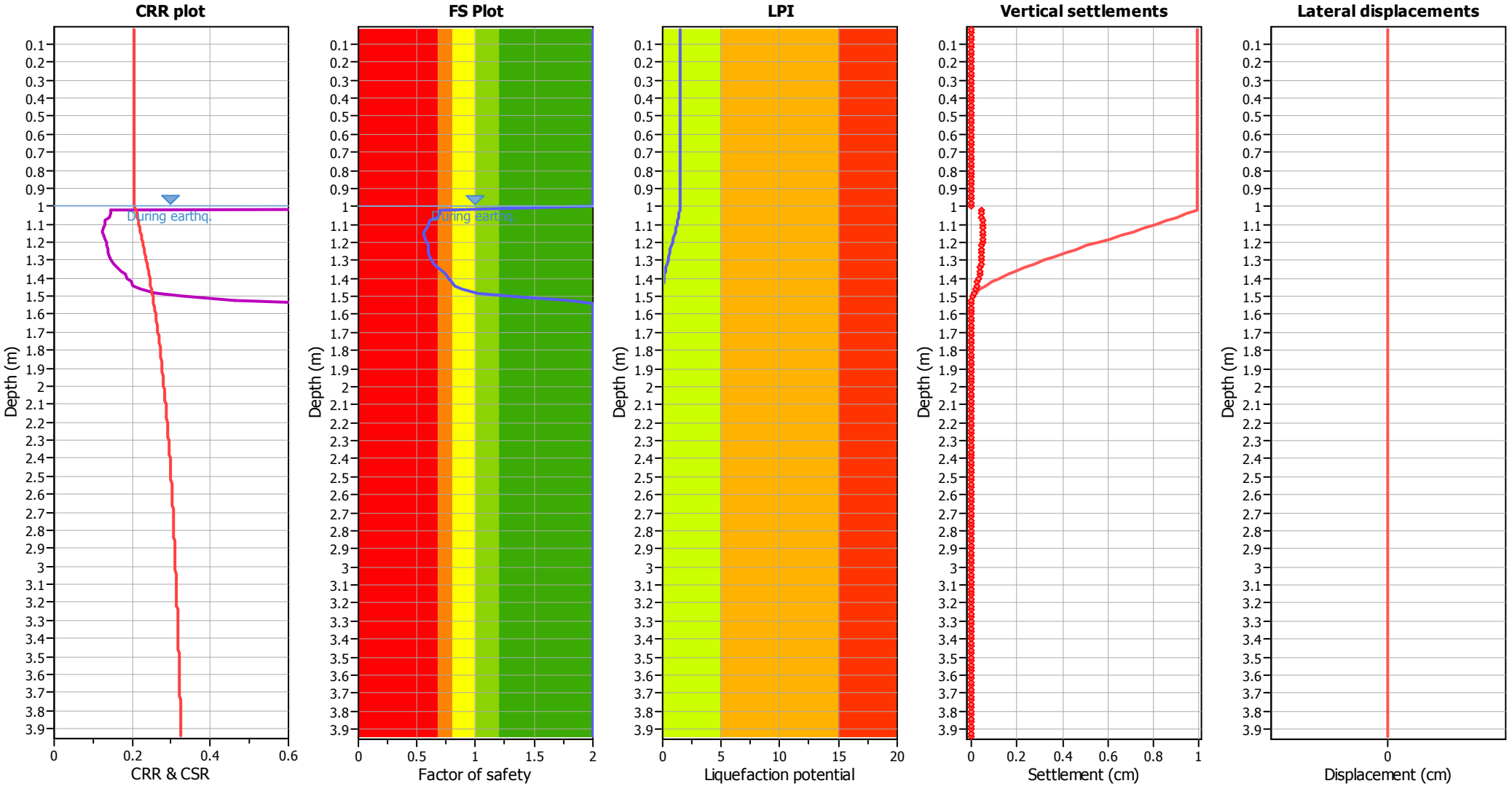






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

11 Deans Avenue
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Christchurch 8140

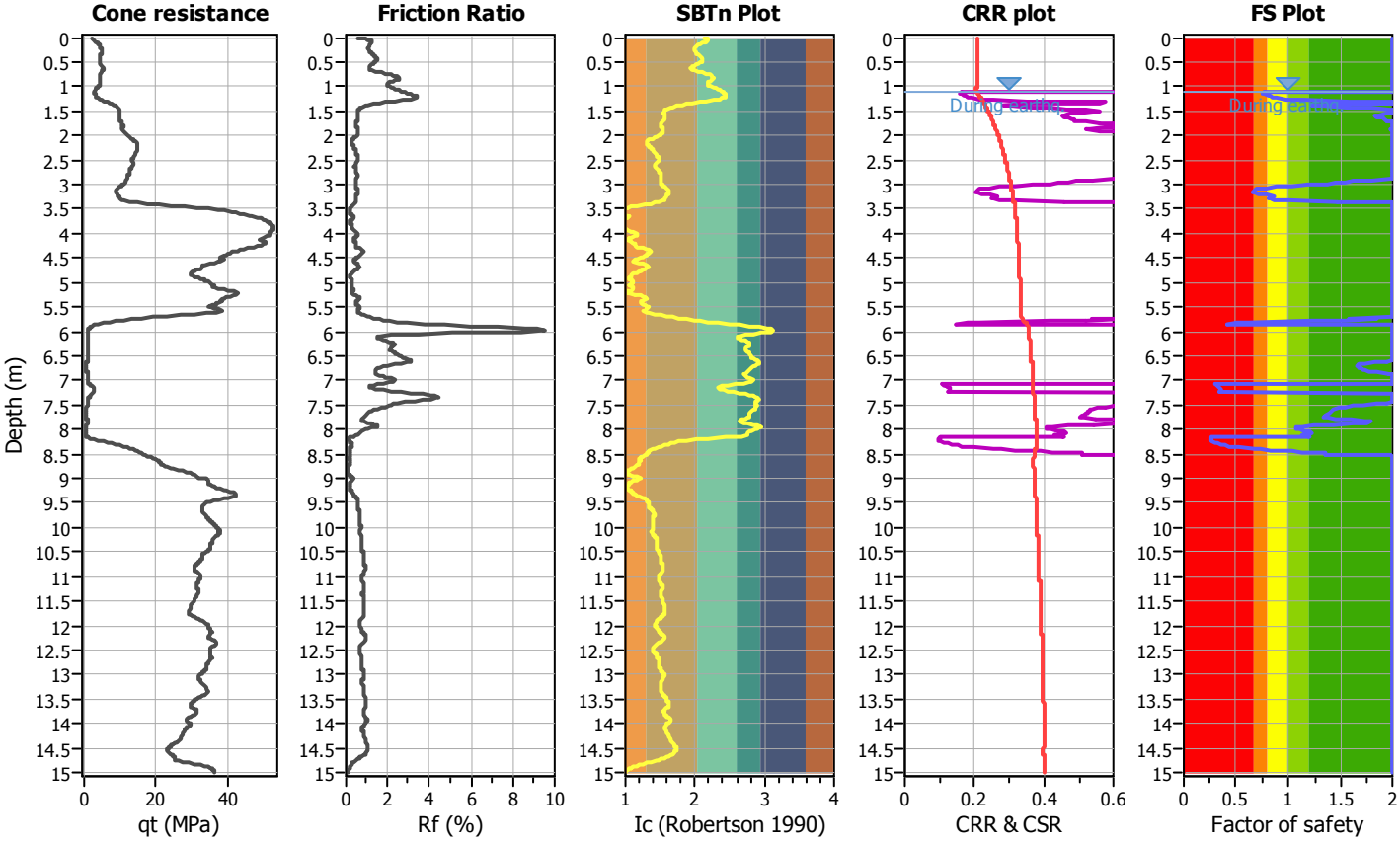
LIQUEFACTION ANALYSIS REPORT

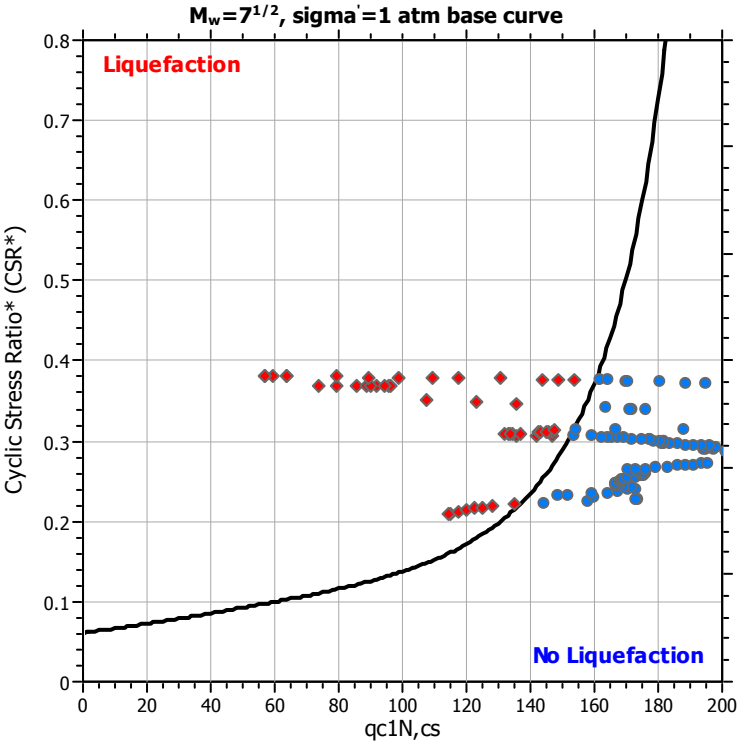
Project title : Oakbridge Subdivision **Location : Prestons Road, Christchurch**

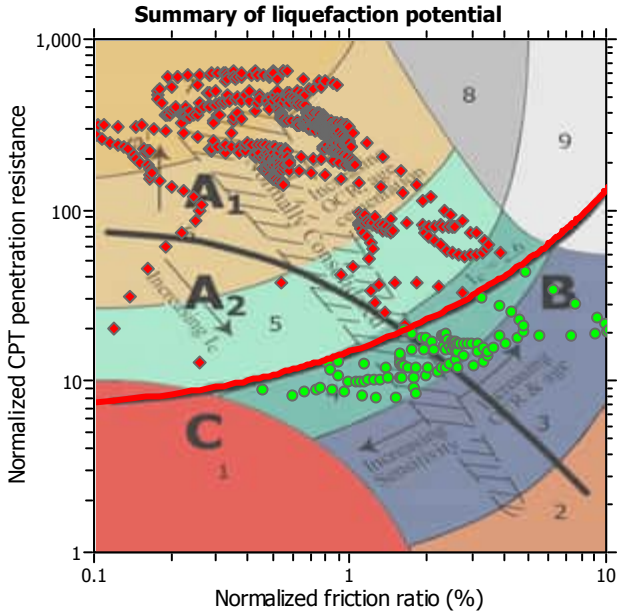
CPT file : CPT_62

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.10 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.10 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

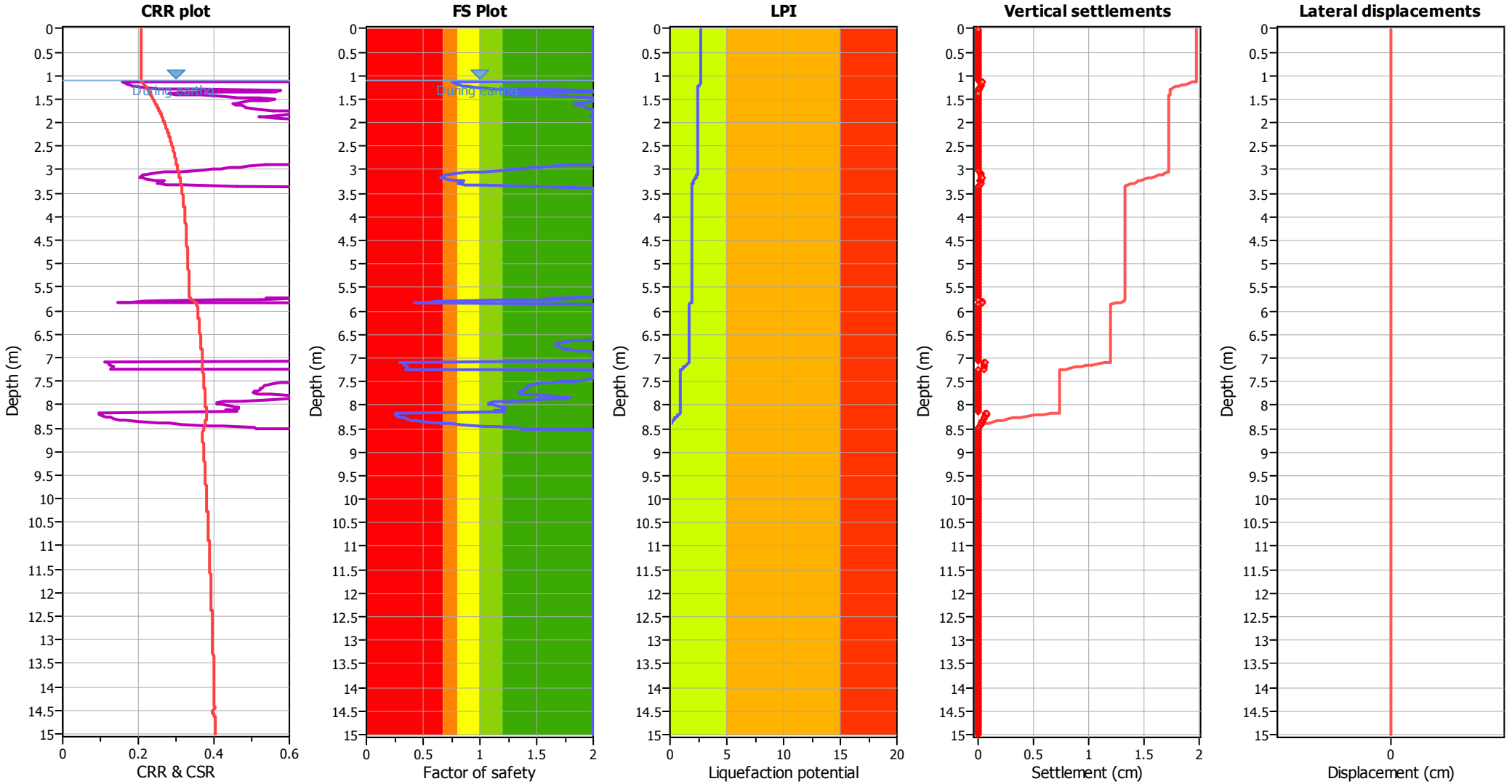






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Appendix D

Geotechnical Drawings

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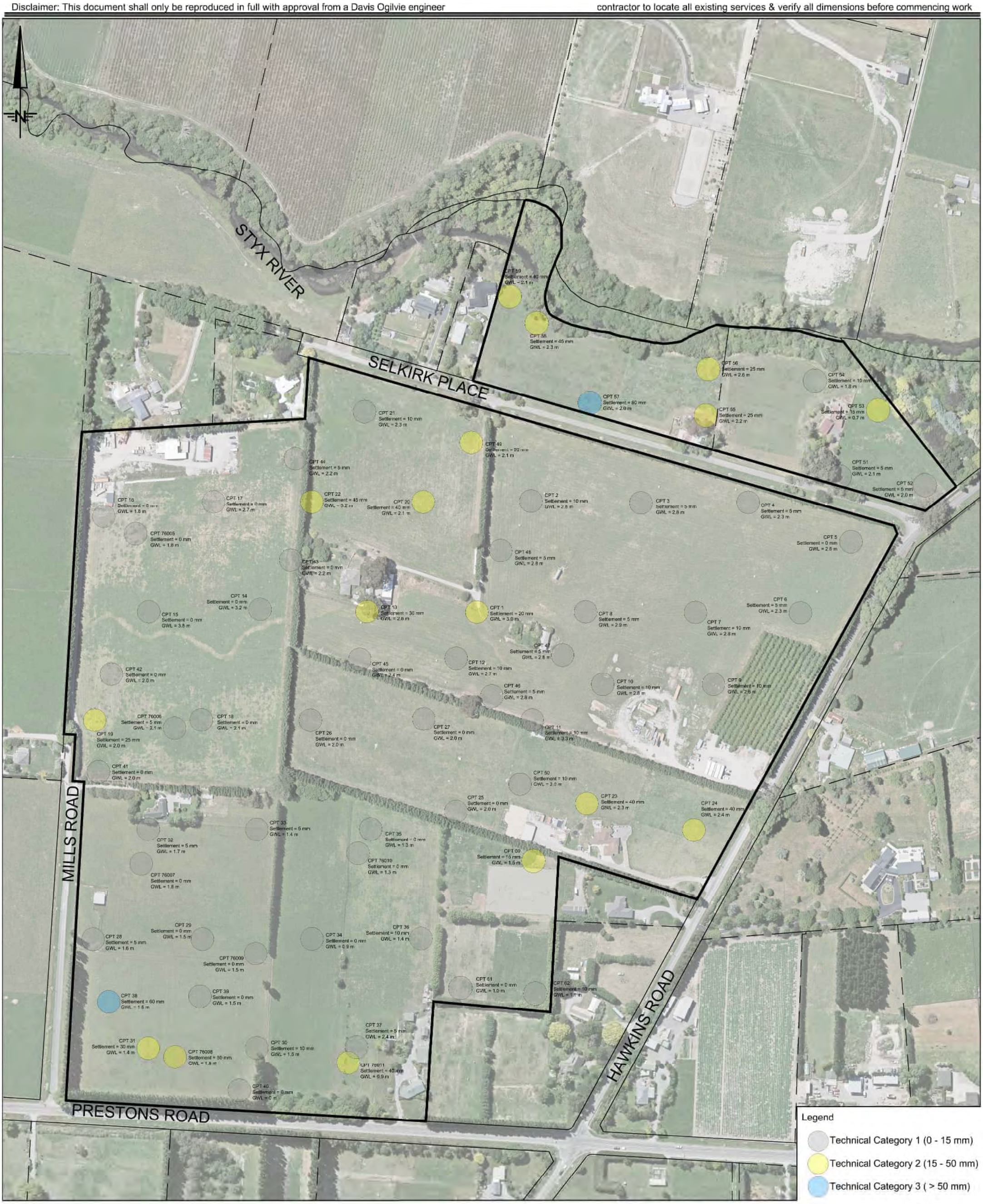
contractor to locate all existing services & verify all dimensions before commencing work



Test and building locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from LINZ
Boundaries are taken from Quickmap.

CAD ref: 161123.KT.Site Plan A.dwg

issue	date	reason	approved
A	06/17	Geotechnical Report Diagram	JLP

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P.O. Box 589 Christchurch, NZ
Ph. 03 366-1653 - 0800 999 333
Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Estimated Settlements SLS (0.13g/Mw 7.5)

design	drawn	QA check	dwg	issue
DW	KT	JLP	G02	A
scale @ A3	date	file		
1:3000	06/17	34300		

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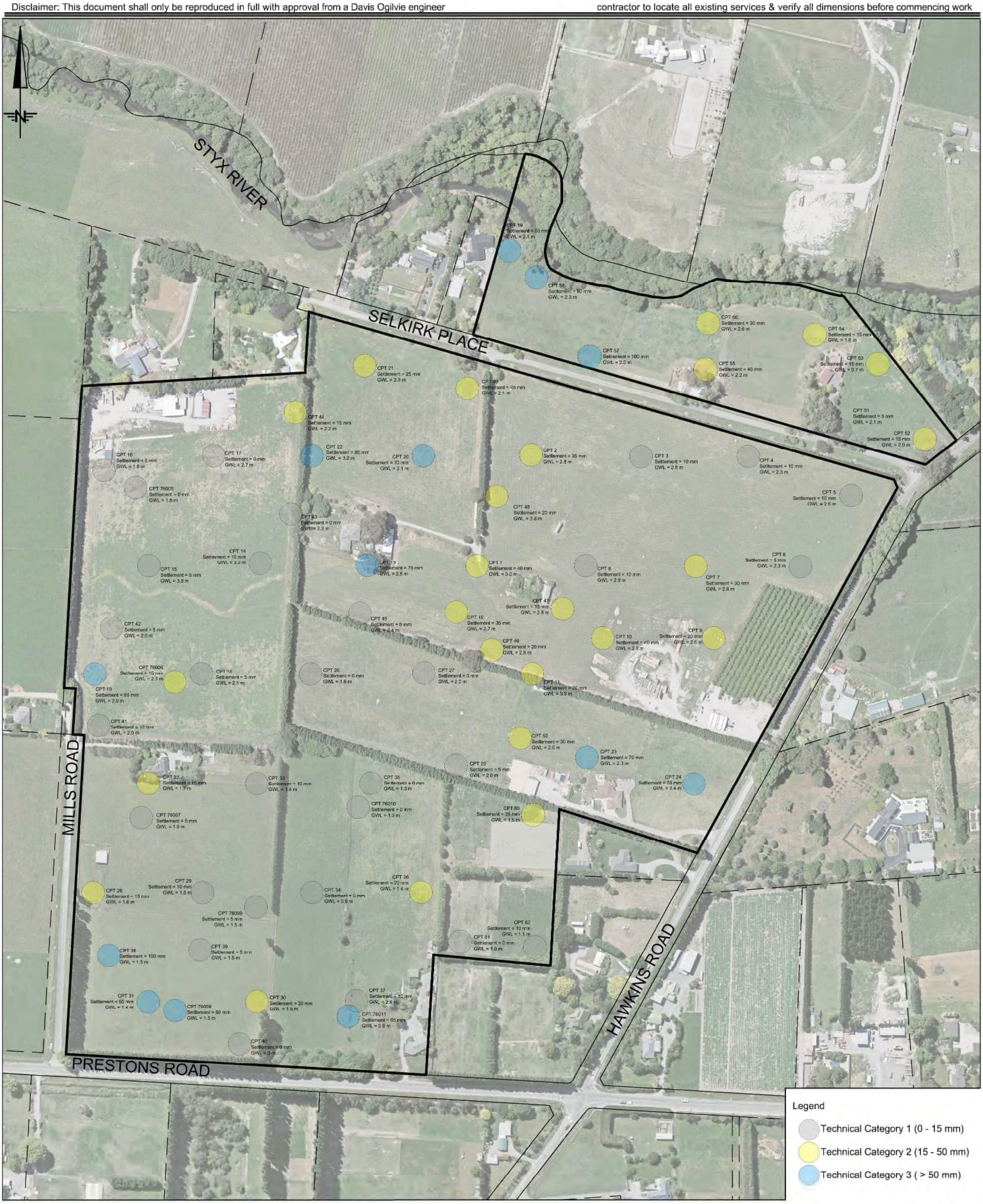
contractor to locate all existing services & verify all dimensions before commencing work



Test and building locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from LINZ
Boundaries are taken from Quickmap.

0m 50m 100m 150m 200m 250m 300m

Scale 1:3000

issue	date	reason	approved
A	05/17	Geotechnical Report Diagram	JLP

CAD ref: 161123.KT.Site Plan A.dwg

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Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Estimated Settlements SLS (0.19g/Mw 6.0)

design	drawn	QA check	dwg	issue
DW	KT	JLP	G03	A
scale @ A3	date	file		
1:3000	05/17	34300		

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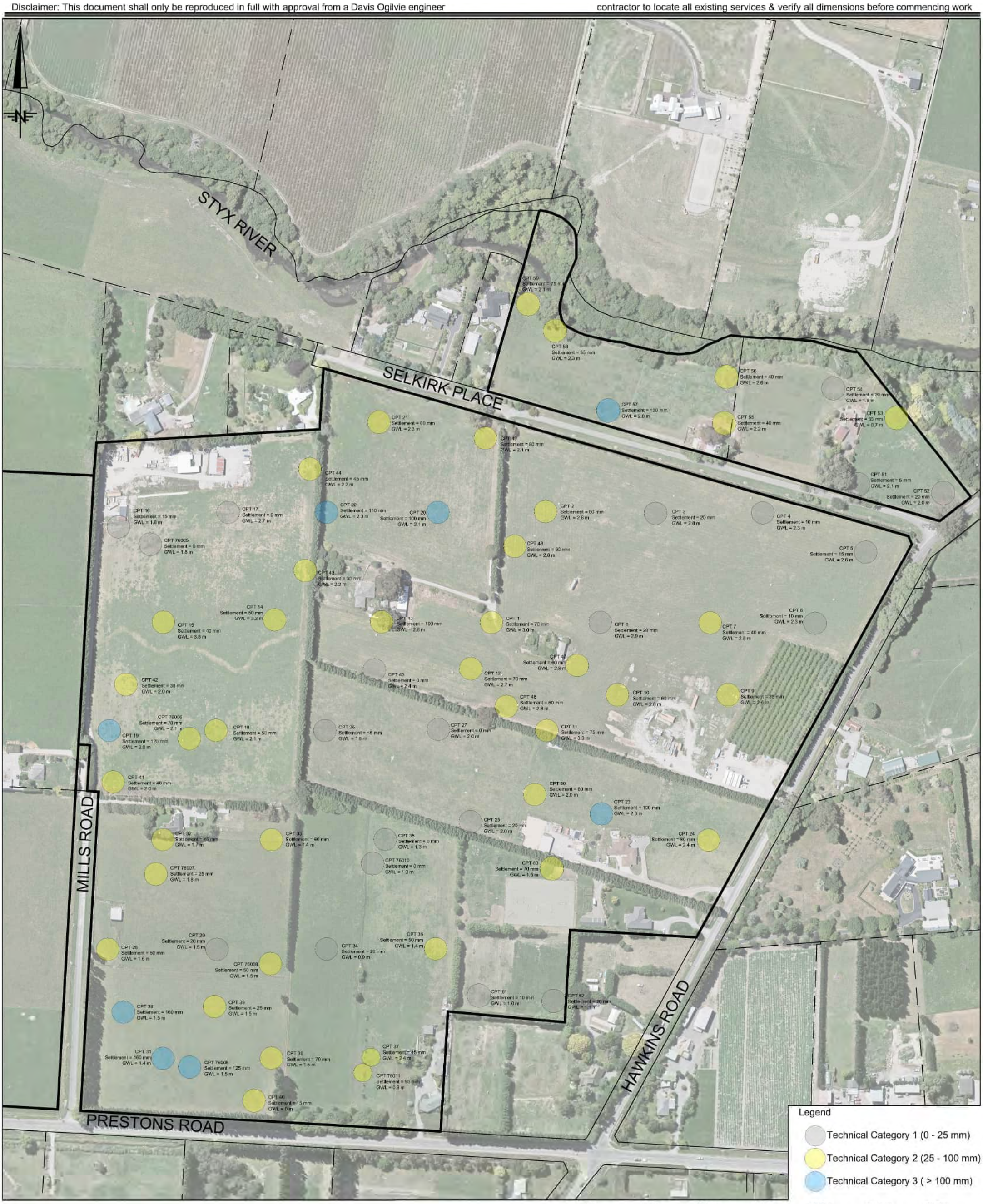
contractor to locate all existing services & verify all dimensions before commencing work



Test and building locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from LINZ
Boundaries are taken from Quickmap.

CAD ref: 161123.KT.Site Plan A.dwg

issue	date	reason	approved
A	06/17	Geotechnical Report Diagram	JLP

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P.O. Box 589 Christchurch, NZ
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Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Estimated Settlements ULS (0.35g/Mw 7.5)

design	drawn	QA check	dwg	issue
DW	KT	JLP	G04	A
scale @ A3	date	file		
1:3000	06/17	34300		

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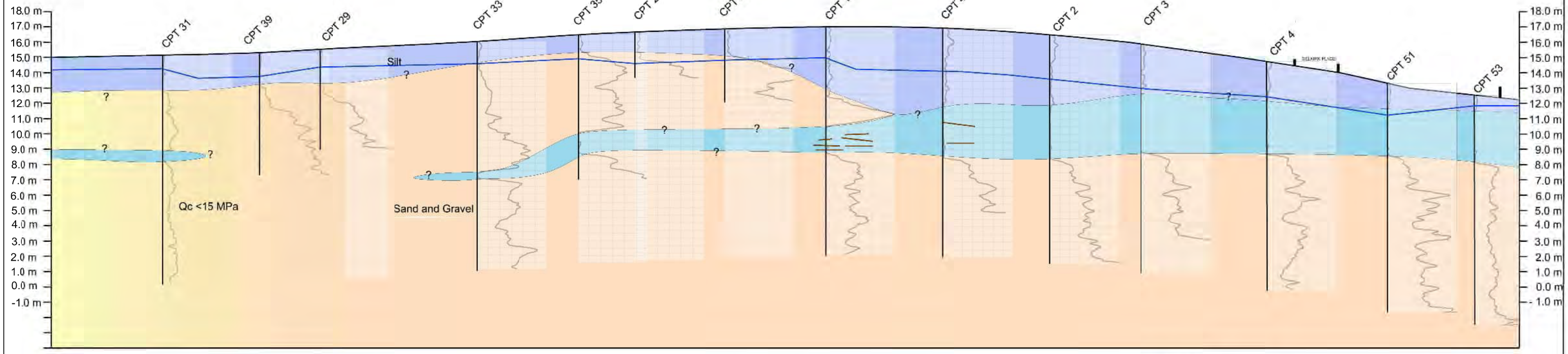
contractor to locate all existing services & verify all dimensions before commencing work

Geological Cross Section

A'
Prestons Road
Southwest

B'
Corner of Selkirk and
Hawkins Rds
Northeast



LEGEND
- Sand/Silt/Clay
- Interbedded Sand and Gravel
- Sand
- Silt/Clay
- Peat
- Groundwater

NB: Vertical Scale 1:250 (ie 10 x Exaggeration).

0m 50m 100m 150m 200m 250m

Horizontal Scale 1:2500

issue	date	reason	approved
A	05/17	Geotechnical Report Diagram	DW

CAD ref: 170130.KT.site plan.dwg

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Also - Nelson, Timaru, Greymouth

Geotechnical Cross Section
Oakbridge Subdivison

design	drawn	QA check	dwg	issue
DW	KT	DW	G05	A
scale @ A3	date	file		
1:2500	05/17	34300		

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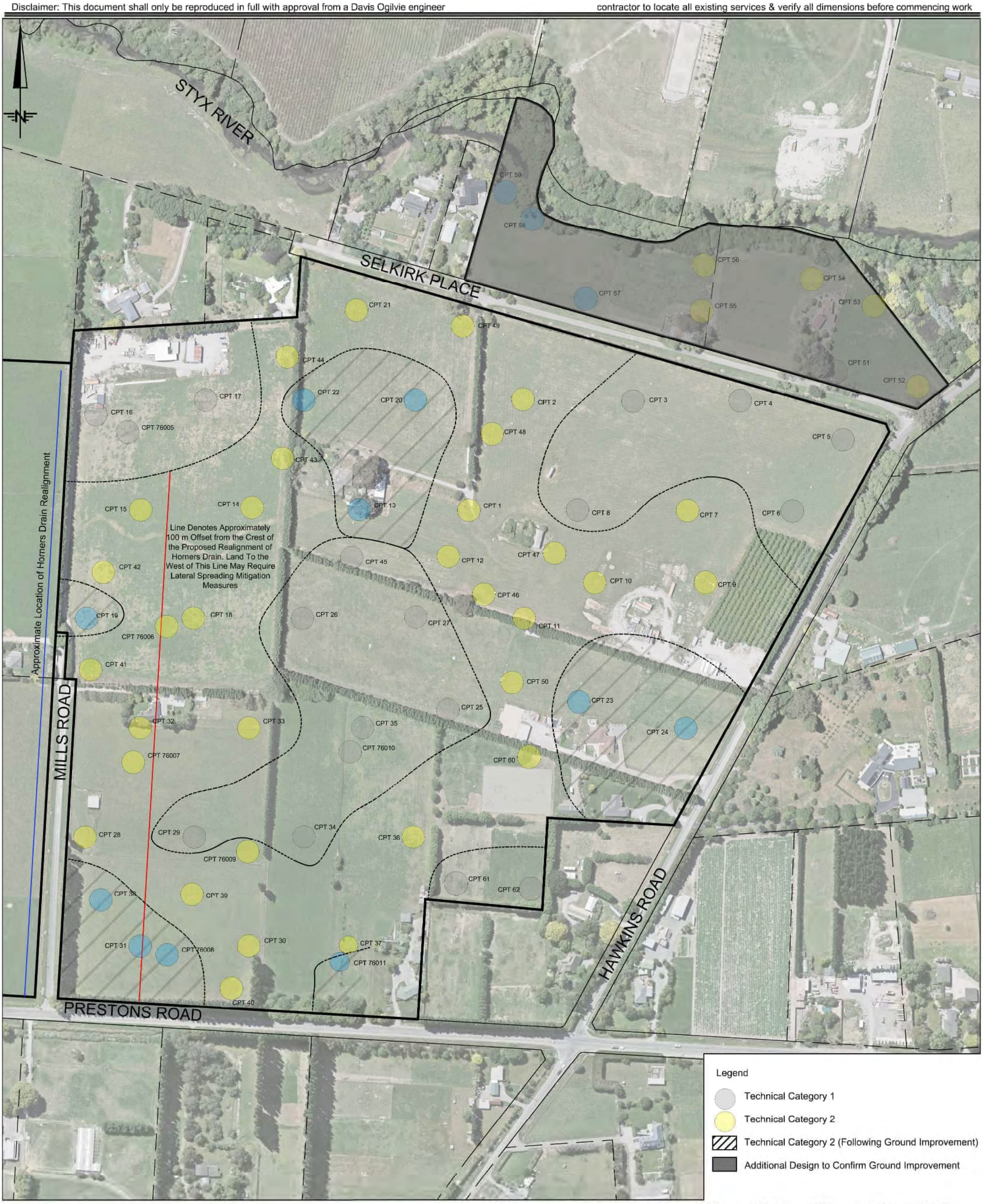
contractor to locate all existing services & verify all dimensions before commencing work



Legend

- Technical Category 1
- Technical Category 2
- Technical Category 2 (Following Ground Improvement)
- Additional Design to Confirm Ground Improvement

0m 50m 100m 150m 200m 250m 300m

Scale 1:3000

Test and building locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from LINZ
Boundaries are taken from Quickmap.
Proposed Lots are Preliminary.

CAD ref: 161123.KT.Site Plan A.dwg.jlp

issue	date	reason	approved
A	06/17	Geotechnical Report Diagram	JLP

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

Davis Ogilvie & Partners Ltd
Engineers - Surveyors - Planners
11 Deans Avenue, Addington
P.O. Box 589 Christchurch, NZ
Ph. 03 366-1653 - 0800 999 333
Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Technical Categories

design	drawn	QA check	dwg	issue
JLP	KT	JLP	G06	A
scale @ A3	date	file		
1:3000	06/17	34300		

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contractor to locate all existing services & verify all dimensions before commencing work

Test and building locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from LINZ
Boundaries are taken from Quickmap.
Proposed Lots are Preliminary.

0m 40m 80m 120m 160m 200m
Scale 1:2000

issue	date	reason	approved
B	08/17	Geotechnical Report Diagram	JLP

CAD ref: 161123.KT.Site Plan A.dwg.jlp

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Geotechnical Site Plan
Oakbridge Subdivision, Marshlands
Provisional Stage 1 Technical Categories

design	drawn	QA check	dwg	issue
JLP	KT	JLP	G07	B
scale @ A3	date	file		
1:2000	08/17	34300		

Appendix E

Statement of Suitability

STATEMENT OF PROFESSIONAL OPINION ON THE SUITABILITY OF LAND FOR SUBDIVISION

Issued by:	Davis Ogilvie & Partners Ltd *(Geotechnical engineering firm or suitably qualified engineer)*
To:	KB Contracting & Quarries Ltd and Suburban Estates Ltd *(Owner/Developer)*
To be supplied to:	Christchurch City Council *(Territorial authority)*
In respect of:	The OakBridge Subdivision of Lot 2 and Lot 3 DP 25296, Lot 2 and Lot 3 DP 24826, Lot 1, Lot 3, Lot 4, Lot 5, Lot 6 DP 23089 and Lot 2 DP 301363 (held under titles: CB37C/1043, CB37C/1044, CB19B/557, CB4A/784, CB15B/1494, CB6A/114, CB4B/247, CB2A/1469, CB4A/99 and 5293*).* *(Description of proposed infrastructure/land development)*
At:	Subdivision of 203 Prestons Road, Redwood, Christchurch. *(Address)*

I *Elliot Duke* on behalf of *Davis Ogilvie and Partners Limited* hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the owner/developer as the geotechnical engineer on the above proposed development.

2. This geotechnical subdivision report, dated 22 August 2017 has been carried out in accordance with the Ministry of Business, Innovation and Employment (MBIE) Guidance for geotechnical investigation and assessment of subdivisions and includes:
   (i) Details of and the results of the site investigations.
   (ii) An assessment of liquefaction hazards resulting from seismic activity.
   (iii) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.

3. In my professional opinion, I consider that Council is justified in granting consent incorporating the following conditions:

   Technical Categories as illustrated upon Figure 14 of the Geotechnical report are is considered appropriate, subject to the following;

   I. Shallow geotechnical site investigations are required on all individual lots, at building consent stage, to confirm ground bearing capacity and the appropriate foundation design.

The recommended density and type of shallow geotechnical testing is defined in NZS 3604:2011.

II. Where areas have been categorised as TC2 or an area requiring ground improvement, foundation systems will require specific engineer design, construction observation and certification by a suitably qualified and experienced Chartered Professional Engineer (CPEng),.

III. Ground improvement will need to be implemented during the civil construction to ensure TC2 style land performance is achieved, as illustrated upon Figure 14 of the Geotechnical report. This shall consist of a minimum of 600 mm of engineered fill placed in accordance with NZS 4431:1989.

IV. Once the realigned Horner's Drain has been confirmed, lateral spread analysis should be undertaken and mitigation measures implemented as necessary along the western limits of the site. At present a 100 metre "buffer zone" has been illustrated upon Figure 14 as means of visual representation of Horner's Drain.

V. Lot 2 and Lot 3 DP 25296 (titles: CB37C/1043 and CB37C/1044), may be subjected to lateral spreading in future large earthquakes. Additional assessment is required to provide suitable lateral spreading mitigation measures. Appropriate ground improvement will be subject to detailed engineering design, observation and certification.

4. This certificate shall be read in conjunction with the geotechnical reports referred to in Clause 2 above, and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

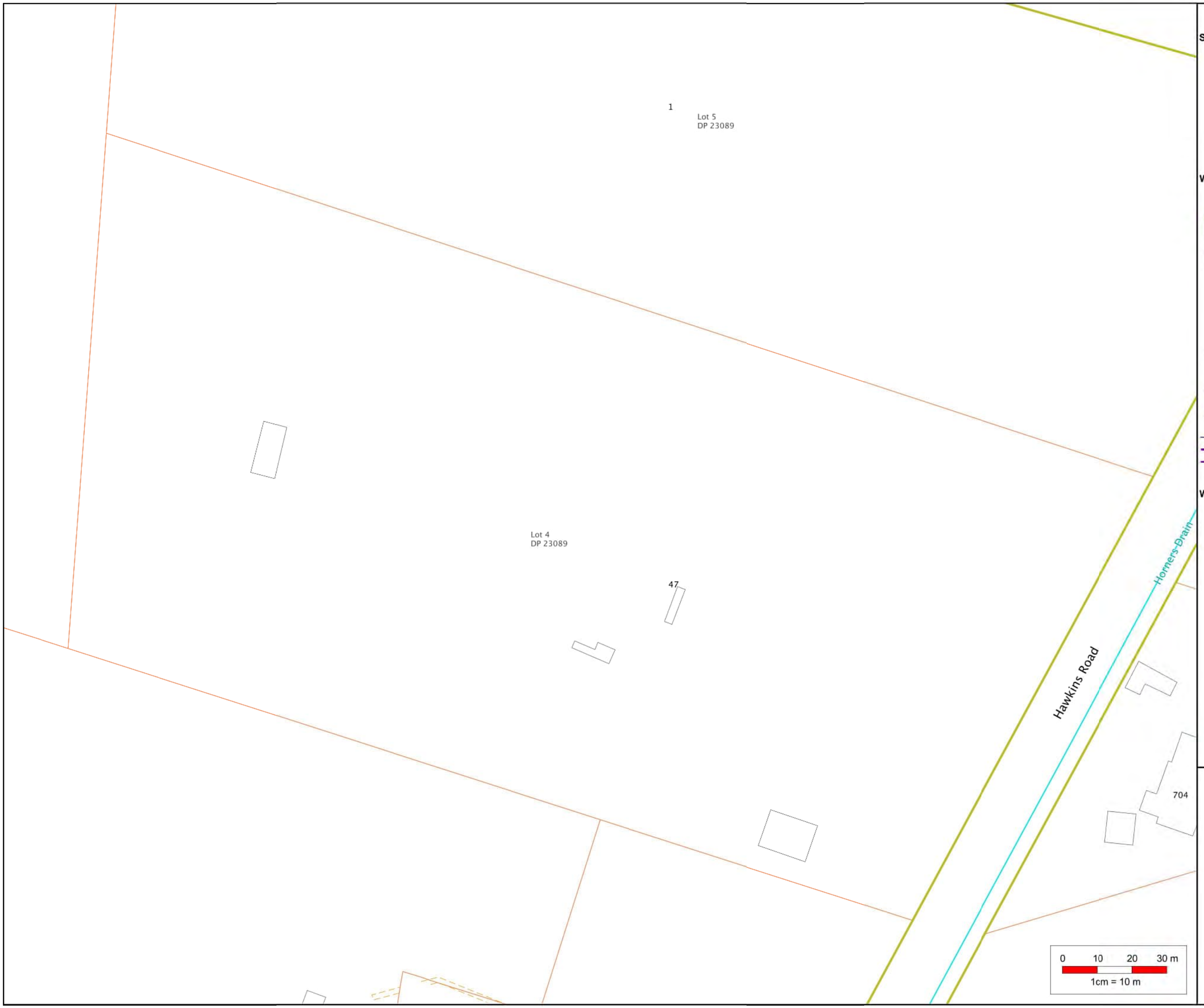
5. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than $5,000,000.00 (Minimum amount of insurance shall be commensurate with the current amounts recommended by IPENZ, ACENZ, TNZ, INGENIUM.)

……

(Signature of Engineer)

Date: 22 August 2017

Qualifications and experience: BE Natural Resources (Hons), MIPENZ, CPEng, IntPE(NZ).



Private Drainage

Standard Infrastructure
- Bio Gas
- Condensate Trap
- End Cap
- Inlet
- Outlet
- Valve
- Main
- Cable

Water Intake/Supply
- Connector
- Bellows
- Connector
- Hydrant
- Inlet
- Meter
- Outlet
- Pump
- Restrictor
- Valve
- Air Release
- Butterfly
- Flow restriction
- Gate
- Pressure Activated
- Sluice
- Valve
- Reservoir
- Structure
- Lateral
- Main
- SubMain

Wastewater
- End Cap
- Valve
- Air Gap Separator
- Vent
- Eye
- Eye (Vertical)
- Outfall
- Pump
- Junction

Access
- Flush Manhole
- Inspection Point
- Standard Manhole
- Trap
- Vented Manhole

- Lateral Fitting
- Lateral
- Main
- Pressure Main

Wastewater

Local Pressure
- Control Panel
- Boundary Kit
- Tank System
- Site
- Vacuum Chamber
- Vacuum Breather

Stormwater
- Bend
- Change
- Eye
- Flow Restriction
- Inlet
- Dome Sump
- Double Sump
- Gross Debris Trap
- Inlet
- Inlet Headwall
- Pipe End
- Silt Trap
- Single Sump
- Soak Pit
- Triple Sump
- Junction
- Standard Manhole
- Outlet
- Pump
- Structure
- Basin
- Lateral
- Main
- Lateral Fitting
- Double Sump
- Single Sump
- Soak Pit
- Inspection point
- Manhole

All services
- Pipe protection
- Abandoned
- Proposed
- Out of service

Landbase
- Easement

1 : 1,000 on A3

29/09/2023 10:41:43 AM

Christchurch City Council

ph: 941-8300 fax: 941-8385

Accuracy not guaranteed. Onsite verification required. Display of data scale dependent, full detail available at 1:500.

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Your guide to the local pressure sewer system

For problems call

Christchurch City Council

(03) 941 8999

Updated June 2022

The local pressure sewer system

The wastewater system for this property is a local pressure sewer system.

A local pressure sewer system includes an individual pump and tank. The pump is located within the tank. The tank is located underground and you will only see the lid at the surface. Wastewater from your house flows through a pipe (a private lateral) to the tank. The tank then pumps the wastewater to the pipe in the street. From the street the wastewater goes to the wastewater treatment plant.

The pressure wastewater system is very reliable and robust. There is very little you need to do and very little that can go wrong.

The local pressure sewer system

The system control panel

The IOTA OneBox Control Panel

The approved pump control panel for the pressure wastewater system is the IOTA OneBox Control Panel, which will be supplied by the system manufacturer.

It is very important that the IOTA OneBox is installed in compliance to the following specifications:

The IOTA OneBox Control Panel

Mounted on an external wall of the house (typically on corner nearest garage door)

Visible from the driveway, street, or right-of-way.

Power must always be on, and is supplied via dwelling's power.

Accessible for maintenance. **IOTA OneBox <u>may not be fenced off.</u>**

May not be painted over.

A minimum of 1.2 m from ground level to base of IOTA OneBox.

Using the system

There are a few things you need to know to ensure that the pressure wastewater system runs smoothly. The system operates like a normal wastewater system. It takes wastewater from your toilet, sink, shower, bath, dishwasher, and washing machine and transfers it to the wastewater pipes in the street, and onto the wastewater treatment plant.

As with normal gravity systems, to avoid blockages and damage to the pressure wastewater system there are a number of items that should not be disposed of via the system.

- glass
- metal
- gravel or sand, including aquarium stone
- seafood shells
- socks, rags or clothes
- plastic
- diapers, sanitary napkins or tampons
- wet wipes

- kitty litter
- explosives
- flammable materials
- lublicating oil, grease
- strong chemicals
- petrol, diesel
- storm water run off.

Before you go on holiday

Before you go on holiday, even if it is for a few days, do not shut off the power. You may flush the local pressure sewer system before you go. This is to avoid the possibility of the system becoming smelly while you are away. **To flush the system simply run a tap in the kitchen or bathroom sink for about five minutes before you go.**

Taking care of the system

- Do not flush any inappropriate items through the system.
- Do not put heavy weights on the lid of the tank. The lid can be walked on, but this should be avoided.
- Do not touch the valves in the boundary kit.
- Do not turn off the power to the pump unless evacuating in an emergency or if there is a broken wastewater pipe.
- Do not cover the unit in any way. This includes covering it with dirt, garden mulch, or concrete.
- Ensure access to the unit is available at all times.
- If you are going on holiday, even for just a few days, you should flush the system before you go. Simply run clean water down your kitchen or bathroom sink for five minutes (5 mins).
- If you do accidentally break a pipe between the pump and the street contact the Christchurch City Council on (03) 941 8999 immediately and tell them what happened. While waiting for the pipe to be repaired, minimise the amount of wastewater going through the system.
- Contact the Christchurch City Council on (03) 941 8999 if you install a swimming or spa pool.
- Contact the Christchurch City Council on (03) 941 8999 if you are making any modifications to your home which may affect the system (for example a house addition).
- Do not attempt to repair the system yourself. Always call the Christchurch City Council on (03) 941 8999.

Troubleshooting

What happens if...

1. **The system is damaged and needs repair?** If there is a complete failure, the Council will be automatically notified.

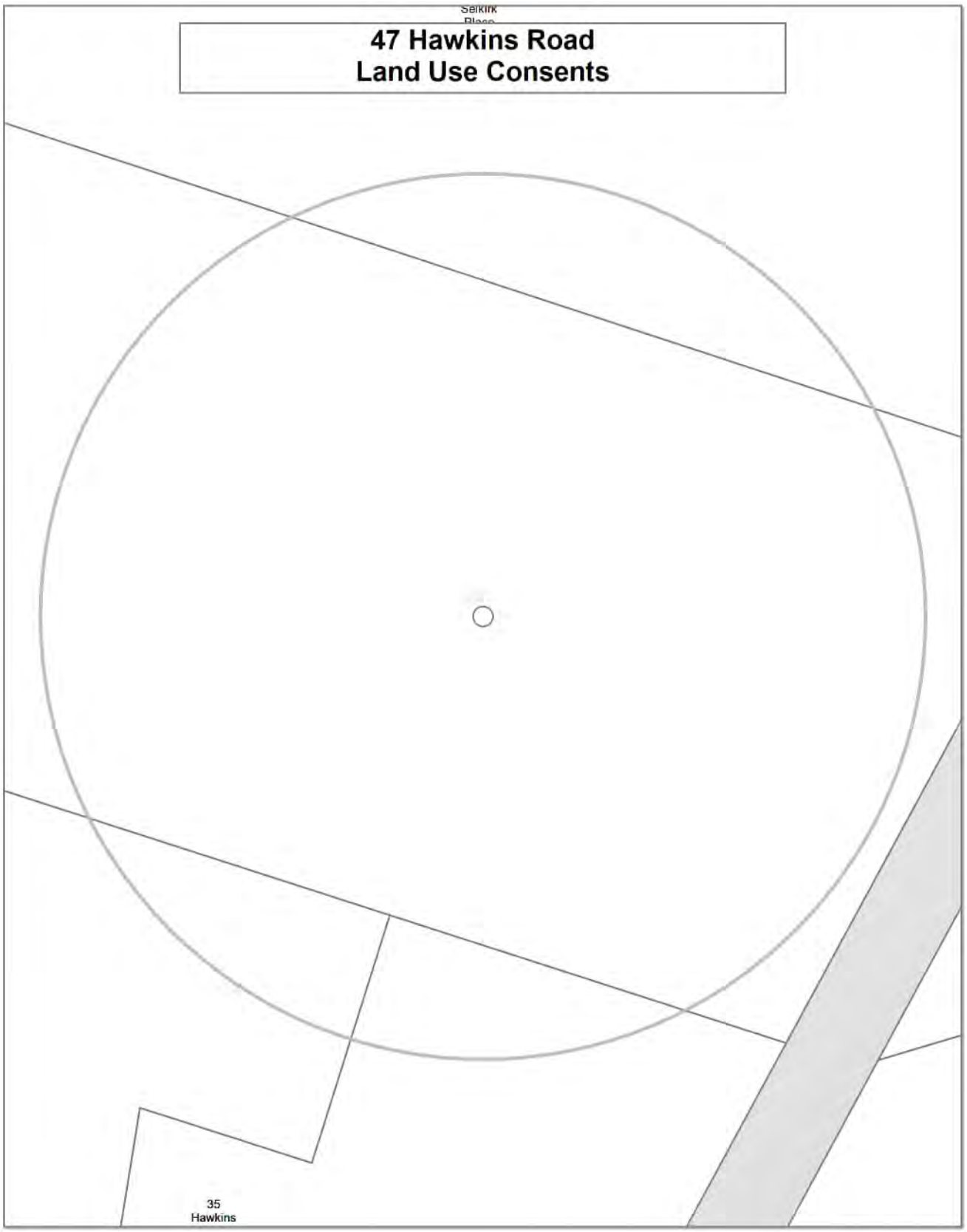
2. **You notice a bad smell around the tank:** When operating normally there should be no noticeable odours coming from the unit. If it is smelly, the unit may just need flushing. Just run clean water down your kitchen or bathroom sink for about five minutes. If the unit remains smelly, contact the Christchurch City Council on (03) 941 8999.

3. **You notice wet spots between the tank and the boundary kit:** The pumping unit and pipes are sealed. If you notice wet spots and there hasn't been any recent heavy rain contact the Christchurch City Council on (03) 941 8999.

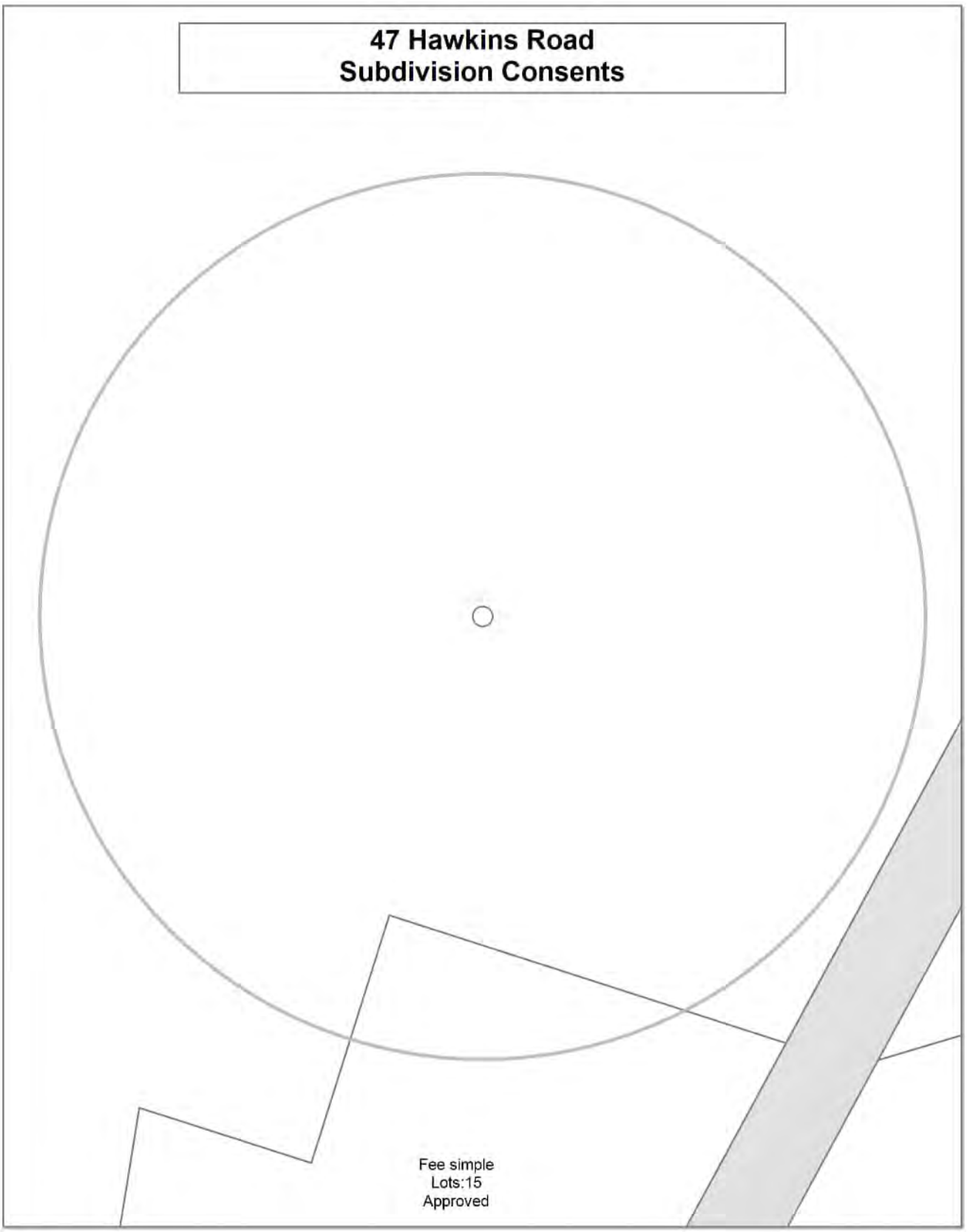
4. **There is a power failure:** If there is a power failure the pump will not run. The tank has 24 hours of emergency storage so minimise the amount of wastewater going through the system. When the power comes on again the system will restart automatically based on the level of wastewater in the tank.

5. **There is a flood:** If you can safely stay in your home in a flood then simply minimise the amount of wastewater going through the system.

6. **You need to evacuate due to an emergency (such as an earthquake):** If you can, flush out the system by running water down your kitchen or bathroom sink for about five minutes.


Selkirk
Place
47 Hawkins Road
Land Use Consents
35
Hawkins

47 Hawkins Road
Subdivision Consents



Land Use Resource Consents within 100 metres of 47 Hawkins Road

Note:This list does not include subdivision Consents and Certificates of Compliance issued under the Resource Management Act.

---

1 Selkirk Place

RMA/2023/1314

Stage 6-14 Subdivision - Fee Simple - 216 Lots with land use

Processing

Applied 29/05/2023

RMA/2023/1945

Global NESCS consent for contaminated soil disturbance

On hold - processing suspended by applicant

Applied 28/07/2023

20 Oakbridge Boulevard

RMA/2023/1314

Stage 6-14 Subdivision - Fee Simple - 216 Lots with land use

Processing

Applied 29/05/2023

RMA/2023/1945

Global NESCS consent for contaminated soil disturbance

On hold - processing suspended by applicant

Applied 28/07/2023

35 Hawkins Road

RMA/2000/2034

To erect a dwelling and attached ga does not comply with the transitional plan. - Historical Reference RMA20002773

Processing complete

Applied 14/08/2000

Decision issued 07/09/2000

Granted 05/09/2000

RMA/2003/1370

Hayburn within 10m internal boundary setback. - Historical Reference RMA20013661

Processing complete

Applied 26/05/2003

Decision issued 20/06/2003

Granted 19/06/2003

RMA/2022/1866

Subdivision - Fee simple - Fifteen lots and associated land use consent

Consent issued

Applied 07/06/2022

Decision issued 11/04/2023

Granted 11/04/2023

Data Quality Statement

Land Use Consents

All resource consents are shown for sites that have been labelled with an address. For sites that have been labelled with a cross (+) no resource consents have been found. Sites that have no label have not been checked for resource consents. This will be particularly noticeable on the margins of the search radius. If there are such sites and you would like them included in the check, please ask for the LIM spatial query to be rerun accordingly. This will be done free of charge although there may be a short delay. Resource consents which are on land occupied by roads, railways or rivers are not, and currently cannot be displayed, either on the map or in the list. Resource consents that relate to land that has since been subdivided, will be shown in the list, but not on the map. They will be under the address of the land as it was at the time the resource consent was applied for. Resource consents that are listed as Non-notified and are current, may in fact be notified resource consents that have not yet been through the notification process. If in doubt. Please phone (03)941 8999.

The term “resource consents” in this context means land use consents. Subdivision consents and certificates of compliance are excluded.

Subdivision Consents

All subdivision consents are shown for the sites that have been labelled with consent details. For Sites that have been labelled with a cross (+) no records have been found. Sites that have no label have not been checked for subdivision consents. This will be particularly noticeable on the margins of the search radius. If there are such sites and you would like them included in the check, please ask for the LIM spatial query to be rerun accordingly. This will be done free of charge although there may be a short delay.

The term “subdivision consents” in this context means a resource consent application to subdivide land. Non subdivision land use resource consents and certificates of compliance are excluded.

This report will only record those subdivision applications which have not been completed i.e once a subdivision has been given effect to and the new lots/properties have been established the application which created those lots will not be shown

All subdivision consent information is contained on the map and no separate list is supplied