Appendix D – Landscape & Visual Impact Assessment Report

OTAIHANGA ESTATES SUBDIVISION PROPOSAL

MANSELL

Landscape and Visual Impact Assessment

Project No. 2020_142 | F

OTAIHANGA ESTATES SUBDIVISION PROPOSAL LVIA

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1. INTRODUCTION AND PROPOSAL

DCM Urban has been commissioned by the Mansell family to prepare a Landscape and Visual Impact Assessment for a 49-lot subdivision (including earthworks and infrastructure) in the Rural Residential zone of the proposed Kapiti Coast District Plan named the 'Otaihanga Estates'.

A detailed Project Description is provided in Section 3 of the AEE accompanying the resource consent applications.

In summary, the proposal involves the subdivision of 17ha (western) portion of the Mansell Farm into 49 lots: 22 rural life-style lots in the northern part of the site, and 27 residential lots adjacent to Otaihanga Road in the south of the site. Two local purpose reserves (one recreation reserve and one stormwater reserve) are proposed on Otaihanga Road. Access to 19 of the rural life-style lots in the north will be via Tieko Street, and the remainder of the rural-lifestyle and residential lots will be accessed via Otaihanga Road.

The proposed subdivision of this area involves earthworks, construction of roads, installation of services and the identification of a notional 20m building circle area on the rural life-style lots.

2. METHODOLOGY

2.1 INTRODUCTION

The landscape and visual impact assessment considers the likely effects of the proposal in a holistic sense. There are three components, or tasks, to the assessment:

1. Identification of the receiving environment and a description of the existing landscape character, including urban and natural character (s.6(a)) of wetlands and their margins, areas of significant indigenous vegetation (s.6(c)) and landscape amenity (s.7(c)). An assessment is made of the sensitivity of the existing landscape character and its ability to absorb change;
2. The visual impact assessment is primarily concerned with the effects of the proposal on visual amenity and people, evaluated against the character and quality of the existing visual catchment;
3. An assessment of the proposal against the existing landscape values. The landscape assessment addresses whole-of-landscape issues, particularly if there are any matters identified by Sections 6 and 7 of the RMA. The landscape assessment utilises the description developed in task 1 that describes landscape character, natural character (s.6(a)) of wetlands and their margins, areas of significant indigenous vegetation (s.6(c)) and landscape amenity (s.7(c)), and an evaluative component that addresses landscape values in terms of the requirements of s.6(b). In this proposal Section 6(b) is not applicable as the area is not an Outstanding Natural Landscape (ONL) as outlined in the relevant District Plan.

The methodology is based on the Landscape Assessment and Sustainable Management 10.1, (NZILA Education Foundation), dated 2.11.2010 and Visual Assessment Best Practice Methodologies (Lisa Rimmer) dated 4.11.2007.

2.2 LANDSCAPE CHARACTERISATION

Landscape elements fall into 3 broad categories: biophysical features, patterns and processes; sensory qualities; and spiritual, cultural and social associations, including both activities and meanings.

- Biophysical features, patterns and processes may be natural and/or cultural in origin and range from the geology and landform that shape a landscape to the physical artefacts such as roads that mark human settlement and livelihood;
- Sensory qualities are landscape phenomena as directly perceived and experienced by humans, such as the view of a scenic landscape, or the distinctive smell and sound of the foreshore; and
- Associated meanings are spiritual, cultural or social associations with particular landscape elements, features, or areas, such as tupuna awa and waahi tapu, and the tikanga appropriate to them, or sites of historic events or heritage. Associative activities are patterns of social activity that occur in particular parts of a landscape, for example, popular walking routes or fishing spots. Associative meanings and activities engender a sense of attachment and belonging.

Describing the landscape character is a process of interpreting the composite and cumulative character of a landscape, i.e. how attributes come together to create a landscape that can be distinguished from other landscapes. International best practice in characterisation has two dimensions of classification: the identification of distinctive types of landscape based on their patterns of natural and cultural features, processes and influences; and their geographical delineation. The characterisation of a landscape is not to rank or rate a landscape, as all landscapes have character, but determine what landscape attributes combine to give an area its identity, and importantly to determine an area's sensitivity, resilience or capacity for change.

Section 6(a) of the RMA requires that a sub-set of landscape character – natural character – be subject to specific analysis where of wetlands and streams and their margins are present. Natural landscape character is a narrowly defined aspect of landscape character. In simple terms it is an assessment of the degree to which a given landscape is the product of nature, as opposed to cultural intervention. It can be assessed along a continuum of states from pristine wilderness, where no evidence of human intervention is apparent, to wholly developed, where scant evidence of natural elements, patterns, and processes remains. It is important to emphasise that natural character is not an absolute quality that either exists or does not, but rather occurs across a continuum in matters of degree. Human interventions may diminish natural character, but do not necessarily eliminate it altogether. Natural character is generally understood to be determined by the extent to which the natural elements, patterns and processes occur in the landscape, and the extent to which they are modified by human interventions. The highest degree of natural character (greatest naturalness) occurs where there is least modification.

- **Natural elements**: these are the products of ecological, erosional and depositional processes; the biophysical characteristics of the landscape, such as landforms, rock outcrops, hydrological features and vegetation communities;

- **Natural patterns:** patterns are formed through the interactions between landscape elements and the processes operating on them. Patterns are apparent through the interactions of plants, soils, aspect and slope, or through the erosion of the coastline through wave action. The regimented character of a forestry plantation or apple orchard compared with the apparently random patterns of trees in an indigenous forest, illustrates how natural and unnatural patterns might be understood; and

- **Natural processes:** Natural processes are the dynamic processes at work on the biophysical landscape, shaping landform and vegetation communities through processes of erosion and deposition, soil forming processes, colonisation and succession, regeneration and energy and nutrient flows.

Table 1: Continuum of Natural Character

Natural	Near-natural	Semi-natural (including pastoral agriculture and exotic forests)	Agricultural (arable and intensive cropping)	Near-cultural	Cultural
Very high-pristine	High	Moderate High	Moderate / Moderate-low	Low	Very Low-nil

2.3 VISUAL ASSESSMENT METHODOLOGY

In response to s.7(c) of the RMA, an evaluation is undertaken to define and describe visual amenity values. As with aesthetic values, with which amenity values share considerable overlap, this evaluation was professionally based using current and accepted good practice. Amenity values are defined in the Act as *"those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes."* The visual assessment looks at the sensitivity of receptors to changes in their visual amenity through the analysis of selected representative viewpoints and wider visibility analysis. It identifies the potential sources for visual effect resulting from the Proposal and describes the existing character of the area in terms of openness, prominence, compatibility of the project with the existing visual context, viewing distances and the potential for obstruction of views.[1]

The visual impact assessment involves the following procedures:

- Identification of key viewpoints: A selection of key viewpoints is identified and verified for selection during the site visit. The viewpoints are considered representative of the various

[1] Reference: NZILA Education Foundation - Best Practice Guide – Landscape Assessment and Sustainable Management/ Best Practice Guide – Visual Simulations (2.11.2010)

viewing audiences within the receiving catchment, being taken from public locations where views of the proposal were possible, some of which would be very similar to views from nearby houses. The identification of the visual catchment is prepared as a desktop study in the first instance using Council GIS for aerials and contours. This information is then ground-truthed on site to determine the key viewpoints and potential audience. Depending on the complexity of the project a 'viewshed' may be prepared which highlights the 'Theoretical Zone of Visual Influence' (TZVI) from where a proposal will theoretically be visible from. It is theoretical as the mapping does not take into account existing structures or vegetation so is conservative in its results (given the scale and form of the proposal, the creation of a TZVI was not considered necessary).

- Assessment of the degree of sensitivity of receptors to changes in visual amenity resulting from the proposal: Factors affecting the sensitivity of receptors for evaluation of visual effects include the value and quality of existing views, the type of receiver, duration or frequency of view, distance from the proposal and the degree of visibility. For example, those who view the change from their homes may be considered highly sensitive. The attractiveness or otherwise of the outlook from their home will have a significant effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the change from their workplace may be considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies also depends on factors such as whether the workplace is industrial, retail or commercial. Those who view the change whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity and a greater sensitivity to those commuting. For example, walkers or horse riders in open country on a long-distance trip may be considered to be highly sensitive to change while other walkers may not be so focused on the surrounding landscape. Those who view the change whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed and direction of travel and whether the view is continuous or occasionally glimpsed.
- Identification of potential mitigation measures: These may take the form of revisions/refinements to the engineering and architectural design to minimise potential effects, and/or the implementation of landscape design measures (e.g. screen tree planting, colour design of hard landscape features etc.) to alleviate adverse urban design or visual effects and generate potentially beneficial long-term effects.
- Prediction and identification of the effects during operation without mitigation and the residual effects after the implementation of the mitigation measures.

2.4 LANDSCAPE VALUES

The values the wider public places on landscapes are reflected in national directives included in the purpose and principles of the RMA (s.6), and in national policy statements prepared under the RMA.

The values the community places on the landscape are reflected in the objectives, policies and rules outlined in a regional or district plan which are relevant to landscape. Where Planning

Documents have identified Outstanding Natural Features or Landscapes, the objectives, policies, and rules contained within the plan are used as the basis to determine the landscape significance or value, and it is these values which a proposal is assessed against. Where there is some uncertainty of the landscape value, such as when the plan has a broad description of an Outstanding Natural Landscape (ONL), but it is not site specific, or the site neighbours an ONL, it is often necessary to complete an assessment against the values of the plan for completeness sake. The current site does not contain any ONL/F but like most plans KCDC Proposed District Plan (PDP) does have objectives and policies which are relevant to Landscape and Natural Character if proposed in a rural or sensitive environment under Section 6(a), 7(c) of the RMA, and/or the New Zealand Coastal Policy Statement(NZCPS.).

2.5 EFFECTS METHODOLOGY

Analysis of the existing landscape and visual environment is focused upon understanding the functioning of how an environment is likely to respond to external change (the proposal). The assessment assesses the resilience of the existing character, values or views and determines their capacity to absorb change. The proposal is assessed in its 'unmitigated' form and then in its mitigated form to determine the likely residual effects. The analysis identifies opportunities, risks, threats, costs and benefits arising from the potential change.

Assessing the magnitude of change (from the proposal) is based on the NZILA Best Practice Guide – Landscape Assessment and Sustainable Management (02.11.10) with a seven-point scale, being:

EXTREME / VERY HIGH / HIGH / MODERATE / LOW / VERY LOW / NEGLIGIBLE

In determining the extent of adverse effects, taking into account the sensitivity of the landscape or receptor combined with the Magnitude of Change proposed, the level of effects is along a continuum to ensure that each effect has been considered consistently and in turn cumulatively. This continuum may include the following effects (based on the descriptions provided on the Quality Planning website):

- **Indiscernible Effects** No effects at all or are too small to register;
- **Less than Minor Adverse Effects** Adverse effects that are discernible day-to-day effects but too small to adversely affect other persons;
- **Minor Adverse Effects** Adverse effects that are noticeable but will not cause any significant adverse impacts;
- **More than Minor Adverse Effects** Adverse effects that are noticeable that may cause an adverse impact but could be potentially mitigated or remedied;
- **Significant Adverse Effects that could be remedied or mitigated** An effect that is noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied; and
- **Unacceptable Adverse Effects** Extensive adverse effects that cannot be avoided, remedied or mitigated.

The following table assists with providing consistency between NZILA and RMA terms to determine where effects lie.

NZILA Rating	Extreme	Very High	High	Moderate			Low	Very Low	Negligible
				Moderate-High	Moderate	Moderate-Low			
RMA Effects Equivalent	Unacceptable	Significant		More than Minor		Minor	Less than Minor		Indiscernible

The NZILA rating of 'Moderate' has been divided into 3-levels. A 'Moderate' magnitude of change may result in either 'More than Minor' or 'Minor' effects but maybe one or the other depending on site conditions, context, sensitivity or receiving character and its degree of change. Identification of potential mitigation or offsetting/compensation measures: These may take the form of revisions/refinements to the engineering and architectural design to minimise potential effects, and/or the implementation of landscape design measures (e.g. screen tree planting, colour design of hard landscape features etc.) to alleviate adverse urban design or visual effects and/or generate potentially beneficial long-term effects.

Prediction and assessment identification of the residual adverse effects occurs after the implementation of the mitigation measures. Residual effects are considered to be five years after the implementation of the proposed mitigation measures, allowing for planting to get established but not to a mature level.

2.6 PHOTOGRAPHY METHODOLOGY

All photos are taken using a SONY A6000 digital camera with a focal length of 50mm. No zoom was used. In the case of stitched photos used as the viewpoint images, a series of 4 portrait photos were taken from the same position to create a panorama. The photos were stitched together automatically in Adobe Photoshop to create the panorama presented in the figures.

3. LANDSCAPE ASSESSMENT

3.1 EXISTING LANDSCAPE CHARACTER AND SENSITIVITY TO CHANGE

3.1.1 Existing Wider Landscape Character

The landscape character of the area is in a typical New Zealand rural-residential setting with a mixture of natural and modified hills close to existing urban areas, consisting of large, heavily undulating grazing paddocks, small farmlets with large houses and plantation plantings. The area is recognised as being part of the coastal environment in the District Plan and is listed as part of the Foxton Ecological District being described as *'low-lying sand country of a geologically recent* composition'. The majority of trees and vegetation are set back from the road and are not of a natural form, with the majority forming shelter belts and screening for privacy. Some of the gullies at the base of the hills act as small catchments, and the majority of plants grow in these areas. The underlying typology of the area is a major element of the receiving environment, with the remnant dune form creating a relatively unique character to the area but has been modified significantly by the Kapiti Expressway project (Expressway). Earthworks including the removal of

dunes, cut slopes and retaining walls are now part of the receiving environment. The topography is described below in further detail.

Housing in the area, although not directly impacted by the proposed design, is of a rural residential density transitioning to low suburban and of no consistent style or character with lot sizes within a 500m radius varying considerably from 500m^2 (on Pitoitoi Street) to over 10,000m^2. Houses are a mix of single and double storey dwellings and again range from small standalone dwellings to large dwellings with multi-car garaging. There is no 'infill' or medium density housing in the immediate area with the closest higher density areas being either in central Paraparaumu, at the beach or in Waikanae. The underlying cadastral layout, or urban settlement pattern, is shown on page 4 of the attached figures which highlights the proximity (within 500m) of suburban residential development to the proposal.

3.1.2 Landscape Character - The Proposal Site

The project site has a relatively open character in parts but an enclosed, compartmentalised character in others due to existing vegetation and topography. Along the Kapiti Expressway edge there is minimal vegetation with the underlying landform clearly evidence and restricting views into a large proportion of the site. Clumps of both native and exotic species dotted through the site particularly around the end of Tieko Street where large (over 15m in height) pine and poplar trees are present.

The ecological report (Wildlands, May 2021) has identified a number of wetlands which are described below in further detail with the most notable and open wetland being Wetlands 1 and 3. These are located at the northern end of the site where the wetland is immediately adjacent to the Expressway within future lot 5 and in the central part of the development as part of future lot 20 respectively.

The rural-residential, urban edge character of development complements the underlying topographical form in most locations with roads (except the Expressway), accessways and lanes running along low points between remnant dunes[2]. The Expressway has cut through the existing dune formation to create a more modified environment. In the nearby gullies and shelterbelts away from the motorway a mixture of exotic and native tree, shrub, and tussock species reside and are visible from the Expressway, with visibility depending on the height and size of the mounds and hills neighbouring the expressway.

The landscape character of the receiving environment is considered to have a **moderate** sensitivity to change given the existing level of modification which has occurred combined with the presence of some natural features.

Topography

The topography of the receiving environment has been modified significantly from its original form although several hillocks remain. Earthworks have been required to level the ground for the Expressway, and have changed the natural topography of the area. Away from the Expressway, topography on the site and nearby paddocks varies with significant changes in height reflecting the original dune system. Some of these large changes in height screen views through to residential areas, although in some areas the Expressway is higher than the neighbouring farmland.

[2] Wildlands (2021), Noting that these no longer function as an 'active dune system'.

Page 6 in the **attached** figures shows the existing topography highlighting the undulating nature of the site and existing high points.

Overall, it is considered that the topography has a **moderate** sensitivity to change given its undulating form, reduced due to the degree of modification that has already occurred to the Expressway.

Vegetation

Vegetation in the wider area is a mix of native and exotic species of varying sizes and degree of stewardship. In terms of native vegetation types, the categorised as Dune-Land under the Kāpiti District Endemic Floral Species List (2012)[3].

The overall impression of the area in terms of vegetation is a mixture of scrubby exotics and natives on rural farmland with suburban areas being heavily planted. The hillocks tend to have little to no vegetation, while the gullies have a mixture of native and exotic tree, and shrub species. The main exotic tree species visually dominant in the area are a mixed variety of established *conifers*, *pines*, and *silver birch (Betula pendula)*. These major tree species are also used to screen residential properties. Extensive planting has been undertaken as part of the Expressway works around important nodes including the following species: *toe toe (Austroderia toetoe), flax species (Phormium spp.), grasses / sedges (Carex spp.*), and *cabbage trees (Cordyline australis).* Minor areas of importance or edges of the Expressway tend to have less emphasis on them in terms of planting and landscaping. These are commonly areas which have strong rural character or are used for grazing and farming. A detailed description of the vegetation on site has been undertaken in the Ecological report prepared by Wildlands, dated May 2021.

Vegetation varies greatly through the proposal site with a high degree of modification for grazing purposes but with clumps of native vegetation (kanuka (*Kanuka robusta)*) present (Figure 4 of the Wildlands Report). Large exotic shelter belt species exist along Tieko Street as well as within the site.

Overall, the sensitivity to change of the existing vegetation is **low.**

Natural Character (Waterways and Waterbodies)

The Wildlands Report (May 2021) identified six potential wetland areas. These wetlands have been investigated in terms of the National Policy Statement Freshwater Management (NPSFM), with four wetlands (wetlands 1, 3, 5 and 6 shown on Figure 3 of the Wildlands report) being classified as *natural inland wetlands* subject to the regulations included in the National Environmental Standards – Freshwater (NES-F). Greater Wellington Regional Council (GWRC) have also endorsed this assessment (in writing) following a site visit last year. The proposal has been significantly modified to ensure any land disturbance within 10m of these *natural inland wetlands* is avoided.

In the wider area beyond the site there are few significant waterways, with the closest waterway being Muaupoko Stream approximately 125m to the east (on the other side of the Expressway and accessway to nearby dwellings), and the Waikanae River approx. 300m to the north. The development of the Expressway has meant the construction of artificial stormwater ponds with

[3] Matt Ward (2012), Kāpiti District Endemic Floral Species List- A species guide to use for Restorative Planting Foxton Ecological District Version, Kāpiti Coast District Council

native planting, as stated above. The site has natural process functions with the presence of wetlands, although modified as well as the cleared land needed for farming and grazing.

Overall, the sensitivity to change to the natural character of waterways and waterbodies is **moderate**.

Built Structures

Buildings within a 500m offset of the proposal site consist of a mix of large (greater than 200m^2) rural residential dwellings and smaller standalone dwellings. These houses are a mix of style, ages, and condition with no consistent style or form. On Tieko Street and Pitoitoi Street, the character is more low-density suburban residential with a mix of single and two storey dwellings. Accessory buildings are common in the area.

There is little built form on the proposed site, apart from fencing, an existing house which will become Lot 30 and power poles.

Overall, the built form therefore has a **low** sensitivity to change.

3.1.3 Effects on Landscape and Natural Character

Landscape character is the combination and composition of biophysical elements such as topography, vegetation, built form and sensory qualities perceived by humans. Landscape character is also spiritual, cultural, and social associations.

The character of the receiving environment is semi-open, rural-residential and is used principally for agricultural or residential purposes. The proposed development modifies the landscape from one that is semi-open and agricultural in character to one that is denser and more suburban in nature, where infrastructure and amenities are more concentrated for Lots 20-49. Where lots 1-19 are proposed, the open rural-residential character will be retained to a degree due to the lots being of a larger size with an average size of almost 4,000m^2 (discounting Lot 5 which is 2.8Ha. and contains the largest wetland pushes the average lot size up to 5,300m^2). Aspects of rural character can and will be maintained through the mitigation of fencing types/position and landscape planting. The character of existing housing is typically detached dwellings, which the proposal intends to continue, albeit at a higher density.

Natural character is highly modified, having been cleared for agricultural land use. This is reflective in the lack of native vegetation present in the wider area. Existing amenity of the natural landscape is to be enhanced and retained through the planting and development of green networks connecting the wider landscape. Shared pedestrian/cycle/bridleway connections to adjoining developments and access to areas which are not currently accessible enhances the amenity of the site.

Overall, the character and land use of the area will shift from open and agriculturally focused to a more concentrated, high amenity development for Lots 20-49. The proposed recreation reserve (lot 105) fronting Otaihanga Road will assist with retaining an open character, with the majority of lots setback from the road, separated by the proposed constructed wetland which will occupy the majority of this frontage. For lots 1-19 an open, rural residential character will be maintained. Through mitigation measures, open character and significant landscape components will be retained and enhanced, where possible.

I consider that the effects on Landscape and Natural Character will be **low to very low** (or less than minor in RMA terms) due to the modified rural-residential character of the receiving environment and key landscape elements being retained. The receiving landscape character has a rural-residential character with limited buildings and large grassed hillocks. The buildings which are present are large scale dwellings, generally in excess of 200m². The Expressway has made a major effect on the character of the area with substantial earthworks undertaken, the installation of road related infrastructure including signs, and the imposition of traffic. Middle distance views are largely contained along the road corridor with large grass hillocks or knolls framing views, as well as screening views of the proposed site from nearby properties.

Table 2: Assessment of Effects on Landscape Character and elements

Landscape Character / Element	Sensitivity of Change	Magnitude of Change	Effect (before mitigation)	Residual Effect (after mitigation)	Comment
Character		Low	Minor	Less than Minor	The character of the area has been modified due to the construction and operation of the Expressway with the installation of associated road infrastructure including retaining walls and signage as well as the carriageway itself and traffic. While the character of the area is rural residential with a moderate sensitivity to change, the magnitude of change is considered to be low with minor effects. Additional dwellings can be absorbed into the receiving environment while maintaining key landscape elements.
Topography	Moderate	Moderate	More than Minor	Minor	Key topographical features on site have been identified with the proposed earthworks plan limiting modifications to less sensitive areas and protecting the dominant dune formation.
Vegetation	Low	Very Low	Minor	Less than Minor	Vegetation of note, kanuka stands, will be protected from development with the large open grass paddocks being retained.
Waterways and natural character	Moderate	Very Low	Minor	Less than Minor	Four natural inland wetlands (in terms of the NPSFM) have been identified on the site and any development has avoided these areas with the necessary buffers in place – development is away from these features.
Built Structures	Low	Very Low	Less than Minor	Less than Minor	There will be an increase in the number of built structures in the receiving environment,

					but the proposal will not have an adverse effect on this aspect.

3.2 VISUAL AMENITY

The visual context of the receiving environment is considered to be relatively contained from the edge of the proposed development. This is due to the receiving environment's undulating topography limiting views into the site, resulting in views from further away either not being possible or being indiscernible at distance. A series of key viewpoints were selected to show a representative sample of the likely visual effects which could result from the proposal (**refer to attached figures for the relevant photos**). Viewpoints are generally located on public land, and where possible located as close as possible to existing or proposed residential dwellings. The quality and openness of the view is considered by identifying visually sensitive receptors. These were as follows:

1. View north from near 31F Tieko Street;
2. View north east from near 110 Otaihanga Road;
3. View north from near 134 Otaihanga Road;
4. View northwest near 150 Otaihanga Road;
5. View from the end of Grand Poppa Way;
6. View from 189 Otaihanga Road (accessway adjacent to the Expressway);
7. View from 189 Otaihanga Road (accessway adjacent to the Expressway);
8. View from 189 Otaihanga Road (accessway adjacent to the Expressway); and
9. View northeast from near 34 Pitoitoi Street.

3.3 VISUAL AMENITY EFFECTS

In assessing the potential effects on visually sensitive receptors, the key viewpoints outlined above have been used as a reference point where it is considered that the effects are likely to be similar to the viewpoint and for a group of viewers. The viewpoint is a representative view, as close as possible to the view likely to be experienced from a private residence or property but obtained from a public location.

The following table outlines the potential visual effects each visually sensitive receptor might receive. The effects take into account the likely sensitivity of the receptor (based on type), combined with the likely magnitude of effects (a combination of distance from the proposal and degree of change) to determine what the likely residual effects from the proposal will be.

Table 3: Assessment of Effects on Visually Sensitive Receptors

Viewpoint	Visually Sensitive Receptors (VSR)	Distance from Proposal (m)	Type of View (open, partial, screened)	Sensitivity of VSR	Magnitude of Change	Effects (before Mitigation)	Residual Effects (after Mitigation)
1. View north from near 31F Tieko Street	Residents at 44 Tieko Street	<50m	Partial	High	Moderate	Minor	Less than Minor
2. View northeast from near 110 Otaihanga Road 3. View north from near 134 Otaihanga Road 4. View northwest near 150 Otaihanga Road	Vehicle users along Otaihanga Road	<50m	Partial	Low	Low	Minor	Less than Minor
	Residents at 115, 134 and 150 Otaihanga Road	<50m	<50m	High	Moderate	Minor	Less than Minor
5. View from the end of Grand Poppa Way	Residents at 20, 21, 23 and 24 Grand Poppa Way	240m	Partial and screened	High	Low	Less than Minor	Less than Minor
6. View from 189 Otaihanga Road	Vehicle users along the Expressway	<50m	Open	Low	Low	Less than Minor	Indiscernible
7. View from 189 Otaihanga Road 8. View from 189 Otaihanga Road	Pedestrians and cyclists on the CWB			Medium	Low	Minor	Less than Minor
9. View northeast from near 34 Pitoitoi Street	Residents on Pitoitoi Street	360m	Screened	High	Very Low	Less than Minor	Indiscernible

3.4 SUMMARY OF EFFECTS ON VISUAL AMENITY

The likely visual effects are described above in the Assessment of Effects table.

The proposal would result in an overall change in character from open and rural-residential character to one that is more dense and suburban in nature for Lots 20-49, though this activity is not inconsistent with nearby residential or rural residential areas. The open rural residential character will be maintained for lots 1 - 19. The

receiving environment is to maintain aspects of openness through the protection of hillocks, native vegetation and the avoidance of development near wetlands as well controls on fencing. Management of fencing and bulk and location of the development will also help create a sense of openness throughout the site and limit visual effects for passing motorists. The highest likely effects after mitigation will be experienced by those residential properties closest to the proposal, along Otaihanga Road and Tieko Street although views are often blocked by either vegetation or topography or a combination of both. Though there is a change from rural-residential to a higher density for lots 20-49, the magnitude of change is considered low as the proposal appears as a natural extension of existing development to the west of the proposal.

Overall, the open, rural residential character will be maintained for lots 1 -19, while the scale and bulk and location of the higher density of lots 20-49 would allow it to appear as a natural extension of existing development within Otaihanga, with an anticipated low magnitude of change to the existing visual amenity.

3.5 LANDSCAPE VALUES

As discussed in section 2.4 above, values the wider public and the community places on the landscape are reflected in the principles included in the RMA, national policy statements, and in objectives, policies and rules outlined in a regional or district plan which are relevant to landscape.

3.5.1 Wider Public Landscape Values

RESOURCE MANAGEMENT ACT 1991 (RMA)

Section 6 of the RMA identifies matters of national importance:

> *"In achieving the purpose of this Act, all persons exercising functions and powers under it, it relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:*
>
> *s.6 (a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development;*
>
> *s.6 (b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development;*
>
> *s.6 (c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna."*

Other matters are included under Section 7:

> *"In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to-*
>
> *(c) The maintenance and enhancement of amenity values;*

(f) The maintenance and enhancement of the quality of the environment."

Response

The proposal has identified key areas to preserve the natural character of the coastal environment, wetlands and their margins from inappropriate subdivision as follows:

- Development avoids the wetlands with the wetlands having been identified and included into the concept plan for protection. These wetlands will be enhanced with a 10m wide (its margins) planted buffer and fenced off within the site to prevent stock entering these areas. Buildings will not be allowed in these areas;
- Development avoids the larger dune forms which provide a degree of natural character to the coastal environment. Mapping the existing topography, earthwork and building exclusion areas have been identified to ensure the character of the area is retained. Smaller, internal landforms will be modified to provide access and building sites but it is consider these changes are acceptable with the key topographical elements being retained. The building and earthwork exclusion areas are highlighted on the Scheme Plan – Ecological Constraints and Earthworks prepared by Cuttriss.

NATIONAL POLICY STATEMENT – URBAN DEVELOPMENT

Policy 8: Local authority decisions affecting urban environments are responsive to plan changes that would add significantly to development capacity and contribute to well-functioning urban environments, even if the development capacity is:

a. *unanticipated by RMA planning documents; or*
b. *out-of-sequence with planned land release.*

Response

The proposed subdivision is considered to naturally extend existing residential development at Otaihanga. At the edge of existing residential settlement, the continuation of residential dwellings at a similar density is likely to be seen as an anticipated natural extension when compared to the broader context. While the proposed density is higher than the existing environment, the proposed subdivision retains similar levels of density when compared to nearby residential development in Tieko and Pitoitoi Streets. Viewpoint 9 in the appended figures show the existing type of residential development on Pitoitoi Street. It is considered appropriate for its setting on the edge of the township when considering the significant addition to development capacity that contributes to well-functioning urban environments. It is considered that the subdivision area is in-sequence developments adding to developments capacity of the receiving area, while retaining a similar level to existing surrounding development.

NEW ZEALAND COASTAL POLICY STATEMENT 2010

- *Objective 1*, Objective 2 and Objective 6
- *Policy 6 – activities in the Coastal Environment*
- *Policy 13 – Preservation of natural character*
- *Policy 14 – Restoration of natural character*
- *Policy 15 – Natural features and natural landscapes*

Response

The proposal has identified key remnant dunes and wetlands (and their margins) within the proposal site, developing the subdivision design and level of intensity in direct response to these elements or attributes. By creating no build and no earthworks areas (Earthwork and Building exclusion areas), the design has worked with the underlying landform to minimise proposed cut and fill works while creating build sites for additional housing for people (the community). The dune ridge running parallel to the Expressway is to be protected from development along with the wetland at its northern end (within future lot 5). The highest dune form, being at the southern end of the site immediately south of the existing old road is protected from development and forms a strong natural break between the rural residential lots in the northern section of the site and the higher, albeit still low density, lots adjacent to Otaihanga Road.

Where earthworks are proposed, the scale of the dunes is much lower and have been modified to a degree by farming practices. The installation of infrastructure has been minimised with low impact design solutions proposed for stormwater collection/detention and the road design being modified to avoid sensitive areas or result in significant amounts of earthworks. The type of infrastructure is considered appropriate for the needs of the future population without compromising other values of the coastal environment. The development will connect to the existing urban infrastructure, being an extension of the development in Tieko and Pitoitoi Streets.

As outlined above, the preservation of natural character has heavily influenced the design and layout of the proposed subdivision and landuse. Wetlands, native vegetation and important dune features have been identified and protected from development. Enhancement planting around wetlands is proposed, which will assist in restoring the natural character of these wetlands which are currently degraded with weed species and stock grazing. Existing stands of Kanuka have been mapped and will be supplemented with additional plantings. This work is likely to create improved habitats for indigenous species.

Overall, from a landscape and natural character perspective, it is considered the proposed subdivision is consistent with intent of the Objective and Policies of the New Zealand Coastal Policy Statement 2010.

NATIONAL POLICY STATEMENT – FRESHWATER MANAGEMENT 2020

- *Section 3.22 – Natural inland wetlands – (3)(a) – relating to loss of amenity values*

Response

In terms of amenity values, the proposal is considered to have the potential to improve the value of the wetlands. A 10m wide planted buffer is proposed around the edge of each identified wetland within the site, which will be fenced to prevent stock entry. The wetland management will also include the management of weed species noting that the wetlands currently have several weed species present. A public pedestrian walkway is also proposed which will increase recreational opportunities for Otaihanga Road, through the development and to Tieko Street with views out to Kapiti Island, from the high point and to the wetlands. Parts of the site have been set aside as no build areas to retain key dune landforms, and this measure will also serve to preserve amenity for future residents of the subdivision.

3.5.2 Community Landscape Values

WELLINGTON REGIONAL POLICY STATEMENT 2013

- *Landscape: Objective 17; Policies: 35, 50, 56, 67*
- *Rural development – subdivision – Objective 22; Policies: 3, 36, 55, 56, 67*
- *Urban Design - Objective 22; Policies: 3, 31, 36, 54, 55, 56, 67*

- *Urban development – subdivision - Objective 22; Policies: 3, 31, 36, 54, 55, 67*

WELLINGTON PROPOSED NATURAL RESOURCES PLAN (PNRP)

- *Objective O17 – natural character*
- *Objective O32 – outstanding natural features and landscapes*
- *Policy P24 – assessing natural character*
- *Policy P48 – natural features and landscapes*

Response

The site is not identified an Outstanding Natural Landscape or Feature (ONLF), but the proposal has identified, and protected, elements which contribute to the natural character of the coastal environment. The proposal avoids habitats and features in the coastal environment that have significant landscape values (as required by Policy P24 and P48) with the major dune forms protected by the creation of Earthworks and Buildings Exclusion areas.

The form, density and layout of the design recognises the receiving environment, landscape and natural features which are of value, developing the site to a density which is appropriate for one which is on the edge of existing suburban development. The design has a high level of connectivity, while the development of long cul-de-sacs is not usually a preferred option a design perspective, this has been offset by the provision of a shared path through the design linking Tieko Street to Otaihanga Road and has several other benefits including reduction of the earthworks required, provides the ability to retain more remnant dune formation and is more sensitive to the protected wetland areas. Previous designs had a connected road but this would have resulted in significant earthworks close to wetlands and dune features, discounting this layout as an option. The proposal provides a mix of housing types with different lot sizes proposed.

No views to Kapiti Island or to the Tararua range are affected by the proposal. As outlined below in the visual amenity assessment, views into the 'built' part of the project site are relatively limited to a small stretch of the Expressway (by the northern wetland) and at the entrance of the cul-de-sac on Otaihanga Road. In both instances, the views will be intermittent and fleeting.

Overall, the proposal is considered consistent with the Regional Policy Statement and the Proposed Natural Resources Plan.

PROPOSED KAPITI COAST DISTRICT PLAN (PDP)

The PDP has Special Amenity Landscapes (SAL) and ONLF which are mapped on Map 9D. There are no SALs or ONLFs near the site. The Muaupoko Stream that flows just east of the access road is shown on the planning map but is not a recognised SAL. The closest ONLF is the Waikanae River margins which is not affected by the proposal. Under the Operative Kapiti Coast District Plan (PDP), the site is zoned Rural Residential.

Given that the PDP process has identified landscapes of value, as per Section 6(b) of the RMA, it is not necessary to carry a further assessment.

There are several Objectives and Policies of the PDP which relate to Landscape Values and amenity which have been addressed below.

CHAPTER 2 - OBJECTIVES:

O2.3 – Development Management *– to maintain a consolidated urban form within existing urban areas and a limited number of identified growth areas which can be efficiently serviced and integrated into existing townships – delivering:*

e. *management of development in areas including freshwater systems of special character or amenity so as to maintain, and where practicable, enhance those special values*

f. *sustainable natural processes including freshwater systems, ecological integrity, identified landscapes and features, and other places of significant natural amenity.*

Response

The proposal is not located within an identified landscape or feature and while the undulating dune form of the topography provides a degree of natural amenity, the proposal has identified and protects the most prominent landforms from inappropriate development while recognising that rural residential development (buildings) are anticipated in the zone. Development controls are proposed to ensure natural processes and natural amenity is maintained.

O2.4 – Coastal Environment

To have a coastal environment where:

a. *areas of outstanding natural character and high natural character, outstanding natural features and landscapes, areas of significant indigenous vegetation and significant habitats of indigenous fauna are identified and protected*

b. *areas of outstanding natural character and high natural character are restored where degraded;*

c. *effects of inappropriate subdivision, use and development are avoided, remedied or mitigated; and*

d. *relating inappropriate development does not result in further loss of coastal dunes in the areas mapped as the dominant coastal environment.*

Response

The proposal is not located in an area of outstanding natural character or high natural character. Clumps of indigenous vegetation have been identified on site (see Ecological report) and are to be protected from inappropriate development (i.e. the siting of dwellings and cadastral boundaries).

The subdivision (both layout and earthworks) has been designed to minimise effects on the underlying dune form and ensuring that key elements are retained and protected from inappropriate development.

O2.9 – Landscapes, Features and Landforms *– to protect District's identified outstanding natural features and landscapes from inappropriate subdivision, use and development; and*

a. *maintain or enhance landscape values of special amenity landscapes and identified significant landforms; and*

b. *avoid, remedy or mitigate manage adverse effects of earthworks on natural features and landforms.*

Response

There are no ONLFs or SALs on the site. Potential adverse effects from earthworks on dune forms and wetlands are managed through avoiding development in sensitive areas. The scale of proposed development is considered appropriate for the zone with more intensive residential development proposed close to Otaihanga Road where the underlying topography is less sensitive. Originally a 'spine' road was proposed through the site to provide a higher level of connectivity for all modes but this required a higher level of earthworks than the proposed design. As a result the original design was modified to ensure earthworks are minimised.

Key landforms are identified and protected from inappropriate development (see proposed mitigation measures below).

O2.11 – Character and Amenity Values *– to maintain and enhance the unique character and amenity values of the District's distinct communities so that residents and visitors enjoy:*

e. *well managed interfaces between different types of land use areas (e.g. between living, working and rural areas and between potentially conflicting land uses) so as to minimise adverse effects.*

Response

The proposed subdivision design is of a scale appropriate to its rural-residential setting on the fringe of urban development without adversely affecting the character of adjoining land uses. Views into the site are relatively limited due to the underlying landform and existing vegetation, and with the proposed retention of key landforms combined with the low density of development, the unique character and amenity values of the receiving environment will be maintained. A key aspect to maintain the existing character is controls over solid, close board timber fencing where its installation in the inappropriate locations could compartmentalise the open, undulating character of the site.

CHAPTER 2A – DISTRICT-WIDE POLICIES:

DW1 – Growth Management

New urban development of residential activities will only be located within existing urban areas and identified growth areas in a manner which:

d. *avoids urban expansion that would compromise … unique character values in the rural environment between and around settlements;*

Response

The site is positioned between the existing low density suburban development of Otaihanga and the Expressway with the receiving environment having a rural-residential character on the fringe of urban development. The imposition of the Expressway, and its associated earthworks, has introduced a significant infrastructure element into the area and has rendered the land uneconomic to farm.

DW4 – Managing Intensification

Residential intensification will be managed to ensure that adverse effects on local amenity and character are avoided, remedied or mitigated, including through achievement of the following principles:

a) development will complement existing environment in terms of retaining landforms.

b) building bulk and scale will be managed.

Response

The proposal has been designed with high density development (lots 20-49) located where the landscape can readily absorb more housing while less houses are planned in the area which is more open and has higher landscape character (lots 1-19). The density proposed strikes a good balance between providing additional dwellings and working with the existing landform to retain its character. Building bulk and scale are managed through the creation of non-build areas to ensure future buildings are visually subservient to existing landforms, retaining a high degree of local amenity and character.

DW10 – Accessibility

Subdivision, landuse and development will be undertaken in a manner which enables all urban residences to have access to public open space within a distance of 400metres.

Response

The proposal has a high level of pedestrian connectivity and accessibility to open spaces. The closest existing open space is approximately 800m away on Otaihanga Road with a new recreation reserve proposed immediately abutting Otaihanga Road, adjacent to Lot 49 of the proposal, which is allow the development to achieve the minimum 400m walking distance. Within the development, the proposed walkways will provide a high level of passive recreation (walking) and connectivity.

DW11 – Parks and New Development

A. New publicly accessible local parks which are of a size, shape and location that meet the open space and recreational needs of the Community will be provided within new subdivisions; and

B. New parks or upgrades to parks will be provided for to accommodate open space and recreational demand created by infill housing.

Response

A new recreation reserve, in consultation with the Parks Department of KCDC, is proposed immediately abutting Otaihanga Road. The reserve is 3,245m^2 in size and is accessible from Otaihanga Road, the proposed cul-de-sac and the accessway. The design of this space is yet to be resolved but it is likely to include an Active Space of 430m^2, paths, carparking and open space.

DW14 – Amenity Values

A. New subdivision, land use and development within reserves and areas of significant scenic, ecological, cultural, scientific and national importance will provide for the amenity values of these areas, including (but not limited to) values associated with:

a) a sense of openness and visual relief from more intensive urban areas;

d) natural character;

B. New subdivision and development of land outside of the areas identified in A. above will be undertaken in a manner that does not compromise the amenity values of those areas.

Response

The proposed subdivision and development of land is outside of the areas identified as having significant scenic, ecological, cultural, scientific and national importance. The proposed mitigation measures outlined below in Section 4 will ensure that the development is undertaken in a manner that does not compromise the amenity values of the site.

The amenity values of the of the site will not be compromised with the proposal retaining the key elements of the receiving environment while allowing for residential development to occur.

CHAPTER 3 – NATURAL ENVIRONMENT

P3.12 – Protecting Outstanding Natural Features and Landscapes

Outstanding natural features and landscapes will be protected from inappropriate subdivision, use and development which has the potential to adversely affect and erode the values of features and landscapes identified in Natural Environment Schedule 3.4 of this Plan.

Response

The site is not in an ONF or ONL.

P3.13 – Special Amenity Landscapes

Subdivision, use and development in special amenity landscapes will be located, designed and of scale and character that maintains or enhances the values of the landscape areas identified in Schedule 3.5 of this Plan and taking into account existing land uses including primary production.

Response

There are no SALs on the site so this policy is not applicable.

CHAPTER 4 – COASTAL ENVIRONMENT

P4.1 – Coastal Environment

Recognise the extent and characteristics of the coastal environment including:

c) elements or features … that contribute to the natural character, landscape, visual quality or amenity value of the coast

Response

As outlined above and below in the description of landscape character, wetlands, vegetation and the underlying landform have been identified (refer to the Ecologist report) for protection where necessary. The proposed mitigation measures, including no build areas on key remnant dune formation have been designed to ensure that elements and features which contribute to the character, landscape and visual quality are retained.

P4.3 – Preservation of Natural Character

Preserve the natural character in the coastal environment and protect it from inappropriate subdivision, use and development including by:

b. avoiding significant adverse effects and avoiding, remedying or mitigating other adverse effects of activities on natural character in all other areas (not outstanding) of the coastal environment

Response

As outlined above in the Landscape Character Assessment section, there are no significant adverse effects on the landscape elements which provide natural character with the proposed mitigation measures, including the subdivision layout and density, ensuring that the elements which provide natural character are not adversely affected significantly.

P4.4 – Restore Natural Character

Promote restoration of the natural character of the coastal environment where practicable, by …

a. creating or enhancing indigenous habitats and ecosystems, using local genetic stock;

b. encouraging natural regeneration of indigenous species, while effectively managing weed and animal pests;

c. rehabilitating dunes and other natural coastal features or processes, including saline wetlands and intertidal saltmarshes;

Response

Buffers with fencing and weed management and planting are proposed (see Ecological report) for natural wetland areas. The constructed wetland in lot 200 adjacent to Otaihanga Road provides the opportunity for native landscape planting which will add to the natural character of the road corridor.

P4.5 – Amenity and Public Access

Maintain and enhance amenity values in the coastal environment, such as open space and scenic values.

Response

The proposed walkway linking the proposed Tieko Street extension to Otaihanga Road and the proposed cul-de-sac provide a public amenity which is not currently accessible. The walkway will allow views of existing dune forms and combined with proposed native planting will enhance local amenity values.

P4.7 – Natural Dunes

Natural dune systems will be protected and enhanced (including through restoration) and natural dune function will be enabled where practicable.

Response

The main dunes forms will be protected from inappropriate development with proposed dwellings located internally within the development and on flatter areas.

CHAPTER 7 – RURAL ZONE POLICIES:

P7.2 – Rural Character –

Subdivision, use and development in the Rural Zones will be undertaken in a manner that maintains or enhances District's rural character, includingr:

a) general sense of openness;

b) natural landforms;

c) overall low density of development; and

d) predominance of primary production activities.

Response

A general sense of openness will be maintained for the majority of site (reserves; dunes). Controls on the location of development, including fencing, will ensure natural landforms are unaffected largely. Natural inland wetlands within the site are being retained, and protected from development with higher density (but still considered low density in urban terms) located in less sensitive areas, close to Otaihanga Road and the Expressway. The lots close to Otaihanga will be seen as an extension of existing residential development on Tieko and Pitoitoi Streets which front Otaihanga Road.

P7.6 – Management of Conflicting Uses –

Manage the interface *between activities on adjoining properties in the Rural Zones in order to avoid, remedy or mitigate adverse effects on amenity values and on the effective and efficient operation of rural activities.*

Response

The Expressway provides a buffer between the proposed activities on site and nearby rural areas. The underlying zone is rural – residential which provides for a degree of residential development where the land is no

longer used for rural purposes. The site is relatively contained by the Expressway, Otaihanga Road, and the larger rural sections proposed near Tieko Street. Any opportunity for interaction between the residential activities proposed and rural activities is limited.

P7.10 – Household Units and Buildings

New household units and other buildings in all Rural Zones will be provided in a manner which avoids, remedies or mitigates adverse environmental effects (including cumulative effects) on productive potential and landscape character of rural area including:

a. *limiting the number of household units and minor flats to one each per site except where Development Incentive Guidelines complied with; and*

b. *manage location and scale of buildings.*

Response

The Expressway has already reduced any primary production potential of the site. The location of buildings and fencing is being managed to ensure the open character of the site, particularly when viewed from the east and the Expressway, is maintained.

P9.5 – Protect via Natural Buffers

Natural features that have the effect of reducing hazard risk by buffering development from the effects of natural hazards will be protected through:

a. *development controls, including the use of minimum setbacks, from rivers and streams for new and relocated buildings; and*

b. *undertaking and encouraging restoration of such natural features*

Response

See mitigation measure below. The existing natural inland wetlands are to remain with buffers to provide further protection. The location of building footprints are to be setback from the wetland areas and the main dune features to be retained.

CHAPTER 11 – INFRASTRUCTURE

P11.2 – Reverse Sensitivity

Reserve sensitivity effects from subdivision, land use and development will be avoided, as far as reasonably practicable, by ensuring:

a. *infrastructure corridors are identified and effects upon those corridors from subdivision, land use and development are considered in all resource management decision-making;*

Response

The proposal is considered to have less than minor to indiscernible visual effects on users of the Expressway or along Otaihanga Road. There will be a magnitude of change but the level is considered low to very low given the proposed mitigation measures. See the visual assessment above.

P11.4 – Managing adverse effects

Any adverse environmental effects arising from the establishment, operation, maintenance and upgrading of infrastructure will be avoided, remedied or mitigated as far as reasonably practicable by:

b. *minimise effects of infrastructure on amenity values … in particular visual effects with respect to scale and sensitivity of environment*

c. *considering all waterbodies to be valued assets and protecting the mauri of fresh and coastal water resources*

Response

See response above with regard to users of the Expressway. The scale and style of the proposal is such that it will not have an effect on existing infrastructure. The design has minimised roading to reduce earthworks and retain a higher degree of natural topographical character.

4. MITIGATION MEASURES

The following mitigation measures are suggested to either avoid, remedy, or mitigate any potential adverse environmental effects on Landscape Character, Landscape Values and/or Visual Amenity from the proposed subdivision:

MM1	Provide a diversity of house size and lot size to provide choice, with higher density development located in less sensitive locations. • This is provided for through the proposed location of low and rural-residential density housing.
MM2	Locate higher density towards Otaihanga Road, buffered by lower density development along the Expressway and adjoining rural residential area. • This is provided for through the placement of smaller sections close to Otaihanga Road
MM3	Create streets which have a high level of amenity, provide for different modes, and allow for the use of low impact design techniques including grass swales and detention basins. Suggested street tree species included, but will be confirmed after consultation with KCDC: • Rhopalostylis sapida, nikau • Cordyline australis, ti kouka • Podocarpus totara, totara • Alectryon excelsus var. excelsus, titoki • Sophora microphylla, SI Kowhai • Hoheria sextylosa, Lacebark
MM4	Create a well-connected walking and cycling network which combines with the green / blue network and existing facilities, prioritising walking and cycling with a mix of on-road, separate, and off-road facilities to promote active transport modes • Key connections are provided for through the site, linking the Tieko Street extension with the proposed cul-de-sac and Otaihanga Road

MM5	Identify and protect important topographical features on site. • Restrict buildings to less prominent locations
MM6	Solid fencing should preferably be restricted to side yards to retain an open character along streets and existing roads or at a minimum front boundary fencing will have restrictions. Side fencing should not extend forward of the front wall closest to the street of a house or would need to be limited in height. • Refer to Landscape Concept Plan
MM7	Identify and protect important wetland features on site. • Create a 10m wide buffer around existing natural inland wetland areas to prevent future buildings or earthworks having a detrimental effect. The following species are proposed around the natural wetlands, being Mix A – Wetland Planting in the following percentages at 750mm,1500mm or 3,000mm centres depending on the species: o Cordyline australis - 10%, 3,000mm crs o Phormium tenax – 10%, 1,500mm crs o Leptospermum scoparium – 15%, 3,000mm crs o Kunzea robusta (raised land only) – 20%, 3,000mm crs o Coprosma propinqua – 10%, 1500mm crs o Coprosma robusta (raised land only) - 10%, 1500mm crs o Podocarpus totara (raised land only) - 10%, 3,000mm crs o Muehlenbeckia complexa – 10%, 1,500mm crs o Carex geminata (plant closest to wetland margin) – 10%, 750mm crs
MM8	Identify and protect important vegetation features on site. • Protect existing kanuka stands from development. A 10m buffer is proposed around existing Kanuka trees which is to be planted with: o Kunzea robusta –3,000mm crs

5. C O N C L U S I O N S

In terms of the National Policy Statement: Urban Development, Policy 8, the proposed subdivision will add residential capacity with a proposed density consistent with the character of the receiving environment. While the proposed density on Lots 20-49 is higher than the existing pattern of residential development on adjacent sites on Otaihanga Road which are typically around 2-3000m^2 in area, it is considered lots 20-49 are consistent with existing residential development on Tieko and Pitoitoi Streets. The placement of the proposed recreation reserve and constructed wetland fronting Otaihanga Road will also assist with mitigating potential landscape character and amenity effects. The density for Lots 1-19 is consistent with a rural residential development. Any amenity effects on existing and future residents can be successfully mitigated through the proposed mitigation measures.

In terms of landscape character and natural character of the area, subject to the mitigation measures proposed, the proposal will result in an acceptable magnitude of change on the existing rural-residential landscape

character and values. The existing character of the receiving environment is already modified with any natural features of note being protected, and enhanced, through the proposed mitigation measures.

In terms of visual amenity, the adjacent rural-residential properties will experience a change in the existing views but these are not necessary considered adverse. Nearby suburban residential properties, current and future, overlooking the subdivision area will have a mix of open, partial, and screened views of future development. Changes to experience by these residents are considered Low given the character of existing views and existing boundary treatments.

In terms of Landscape Values and the objectives and policies of the PDP, the proposal recognises and avoids developing on the landscape elements of value while creating a rural residential and residential development.

Overall, adverse residual effects from the proposal are considered to be low.

APPENDIX ONE - LANDSCAPE AND VISUAL IMPACT ASSESSMENT FIGURES

OTAIHANGA SUBDIVISION PROPOSAL

FOR MANSELL

REVISION F
29 June 2021

dcm URBAN

OTAIHANGA SUBDIVISION PROPOSAL

Project no: 2020_142
Document title: LANDSCAPE AND VISUAL IMPACT ASSESSMENT
Revision: F
Date: 29 June 2021
Client name: Mansell

Author: David Compton-Moen
File name: 2020_142 Mansell Otaihanga Subdivision LVIA Figures_F

DOCUMENT HISTORY AND STATUS

REVISION	DATE	DESCRIPTION	BY	REVIEW	APPROVED
A	12/01/2021	LVIA Figures	SB	DCM	
B	27/01/2021	Update	DCM		
C	24/02/2021	Additional information	DCM		
D	02/03/2021	Finalised Draft	DCM		
E	04/06/2021	Update to Scheme Plan and Ecological report	DCM		
F	29/06/2021	RCA	DCM		

DCM URBAN DESIGN LIMITED

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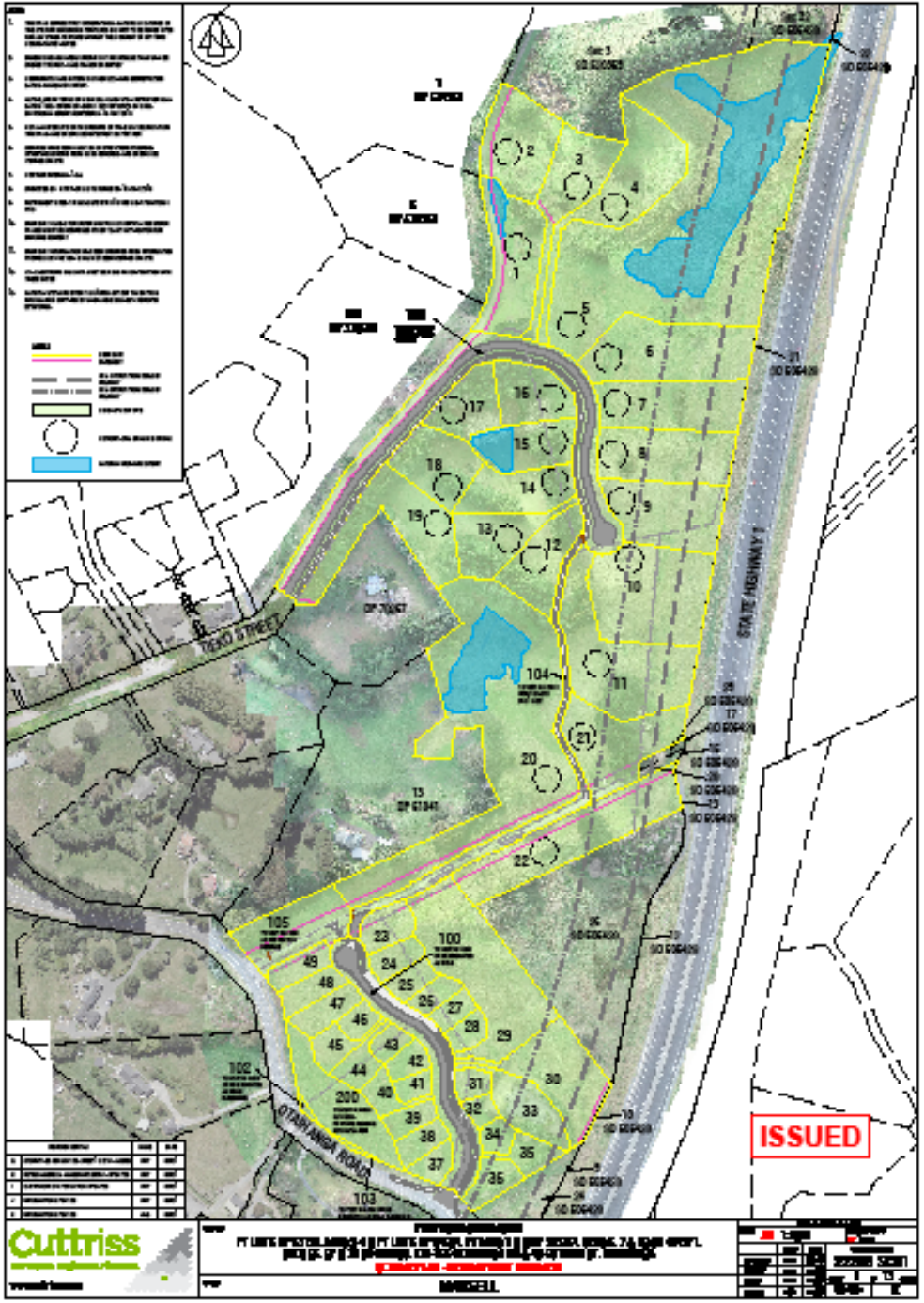
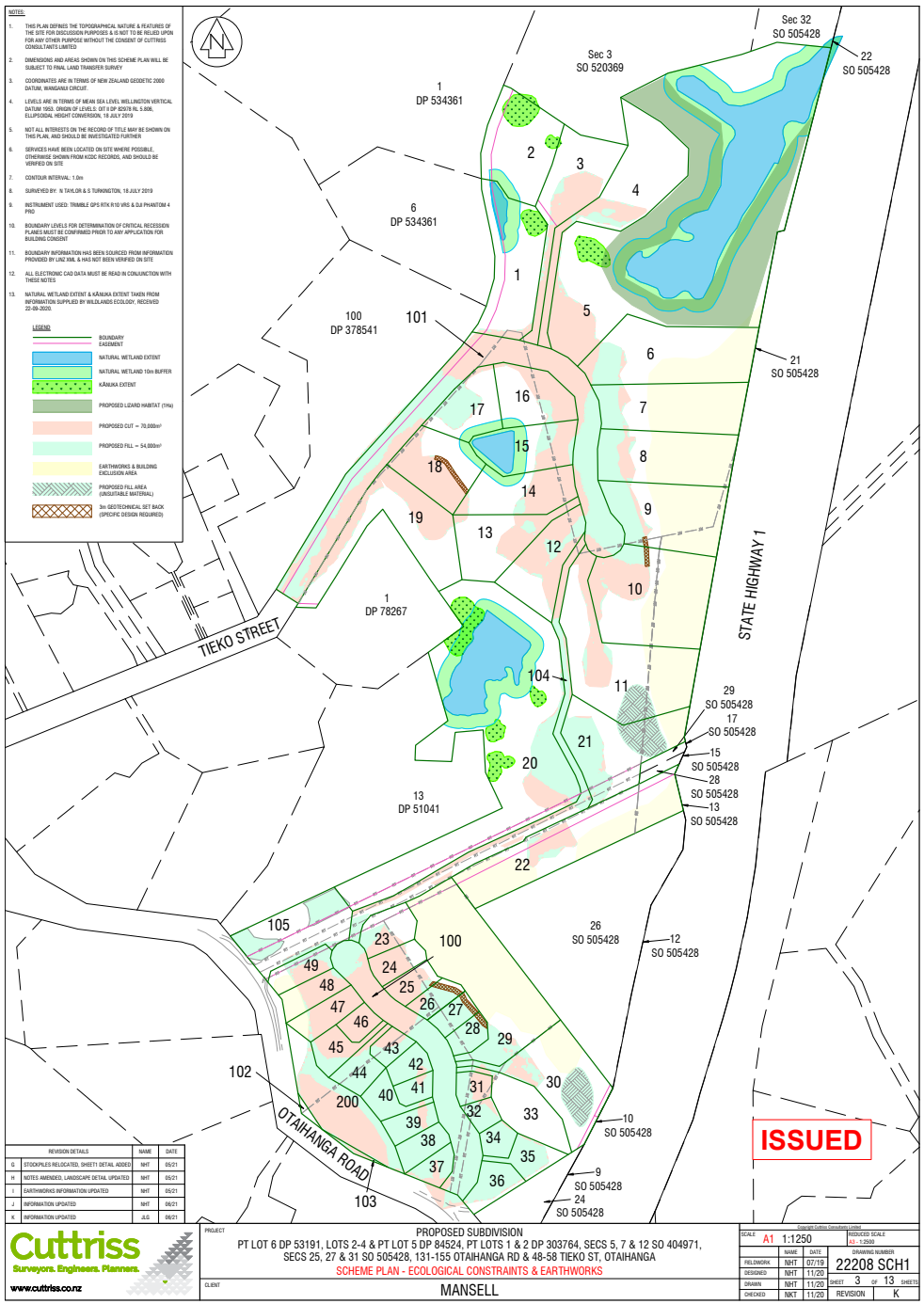
Christchurch 8013

CONTENTS

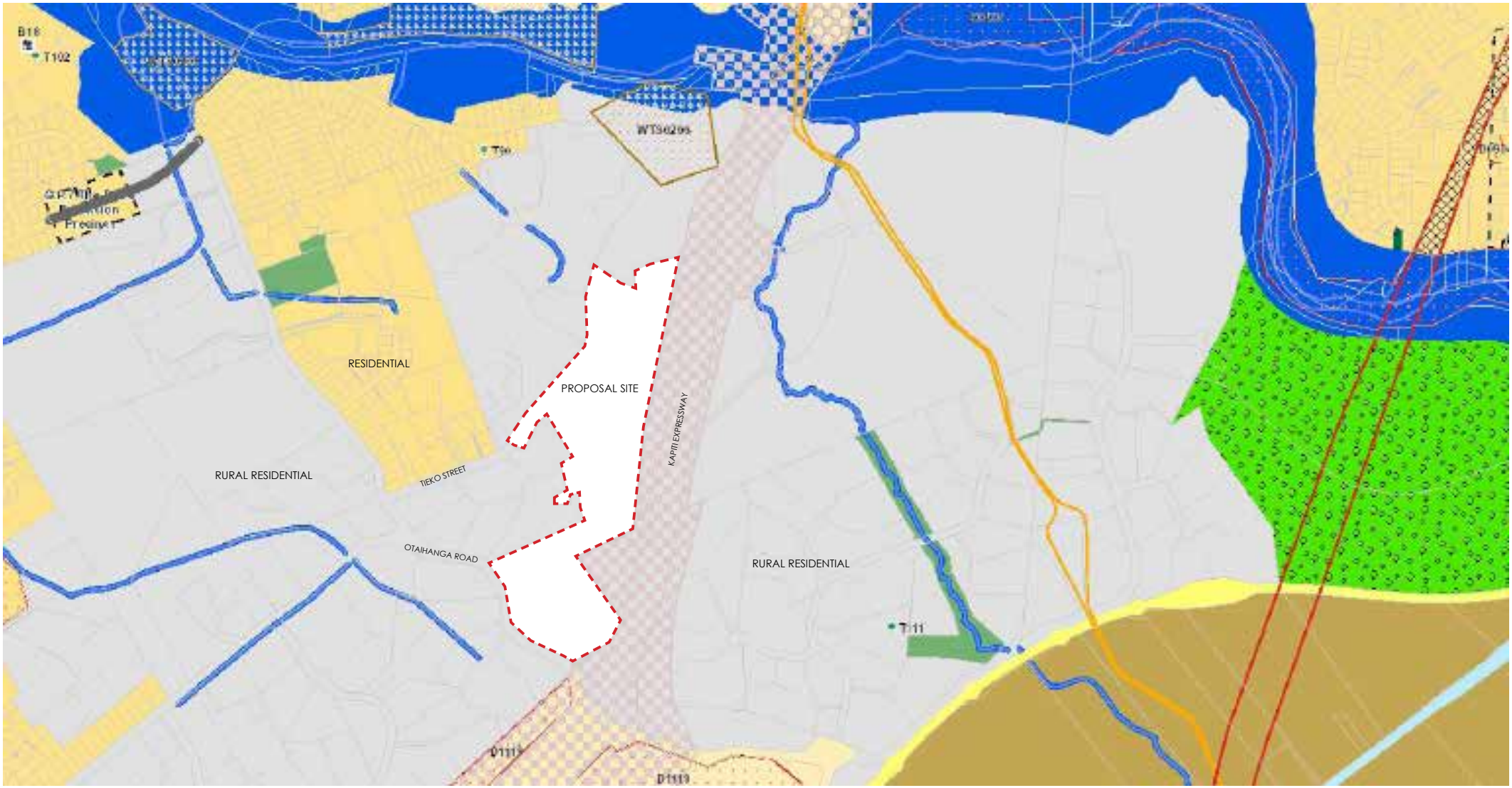


A. SCHEME PLAN - DEVELOPMENT OVERVIEW

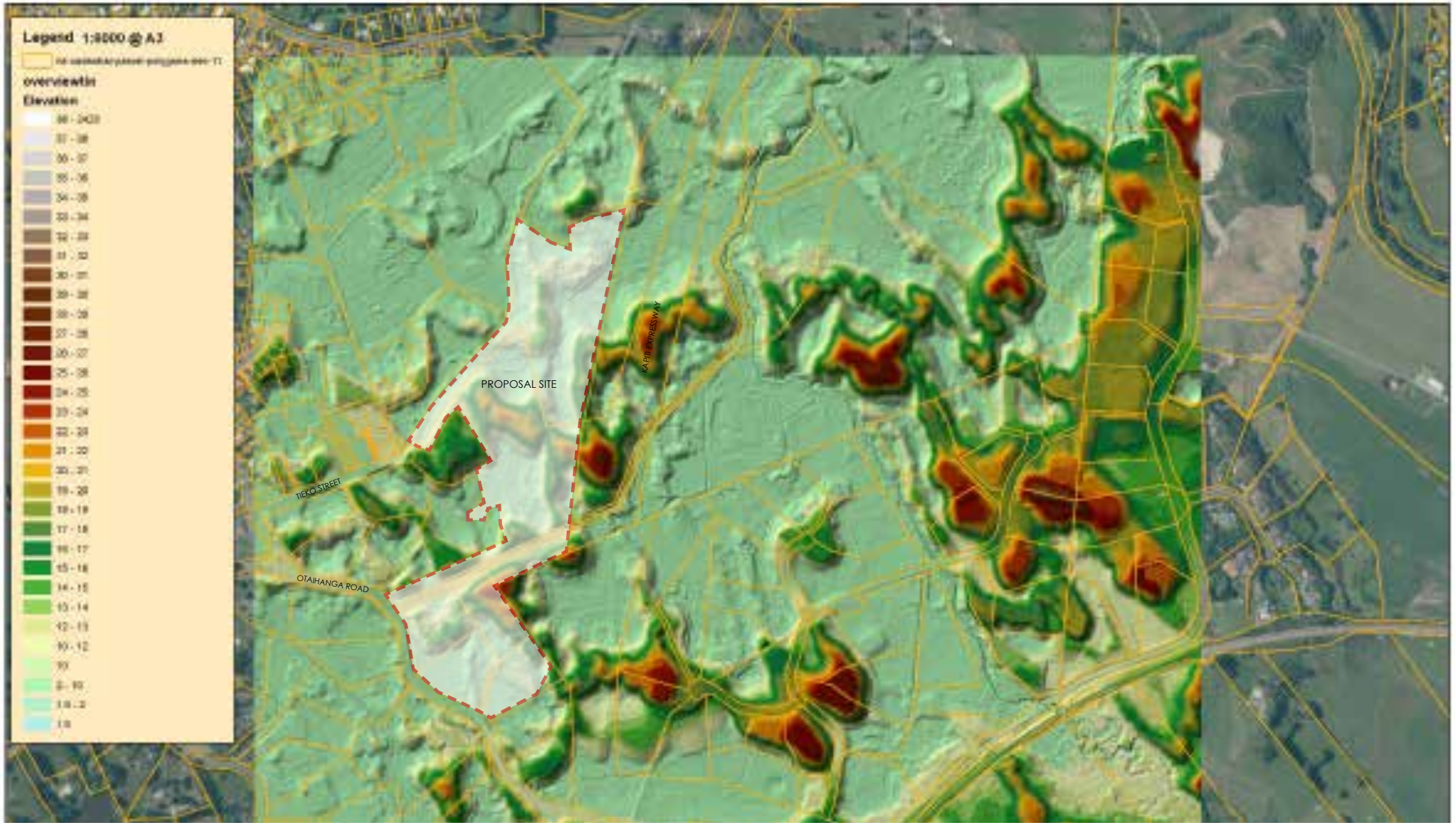


B. SCHEME PLAN - EARTHWORKS AND ECOLOGICAL CONSTRAINTS

Map / image source: Greater Wellington Regional Council GIS



Map / image source: Kapiti District Council EPlan

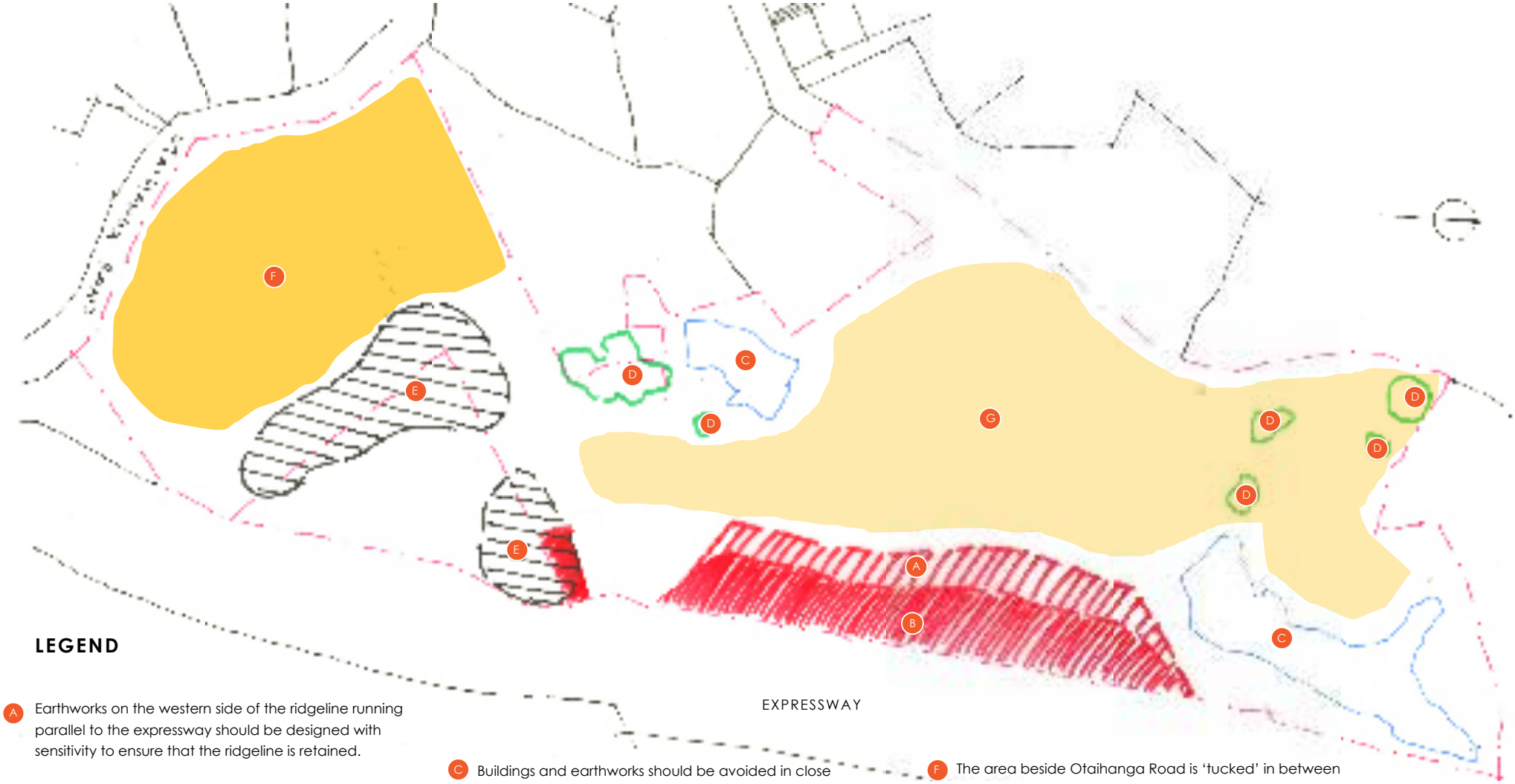


A. EXISTING TOPOGRAPHY

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CONTEXT - TOPOGRAPHY (PRE-EXPRESSWAY)

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST



LEGEND

A Earthworks on the western side of the ridgeline running parallel to the expressway should be designed with sensitivity to ensure that the ridgeline is retained.

B Buildings on the eastern side of the ridgeline running parallel to the expressway should be avoided to ensure that the ridgeline is retained - guides on the treatment of proposed boundaries should be established to reduce visual effects from compartmentalisation of the site when viewed from the motorway.

C Buildings and earthworks should be avoided in close proximity to wetlands.

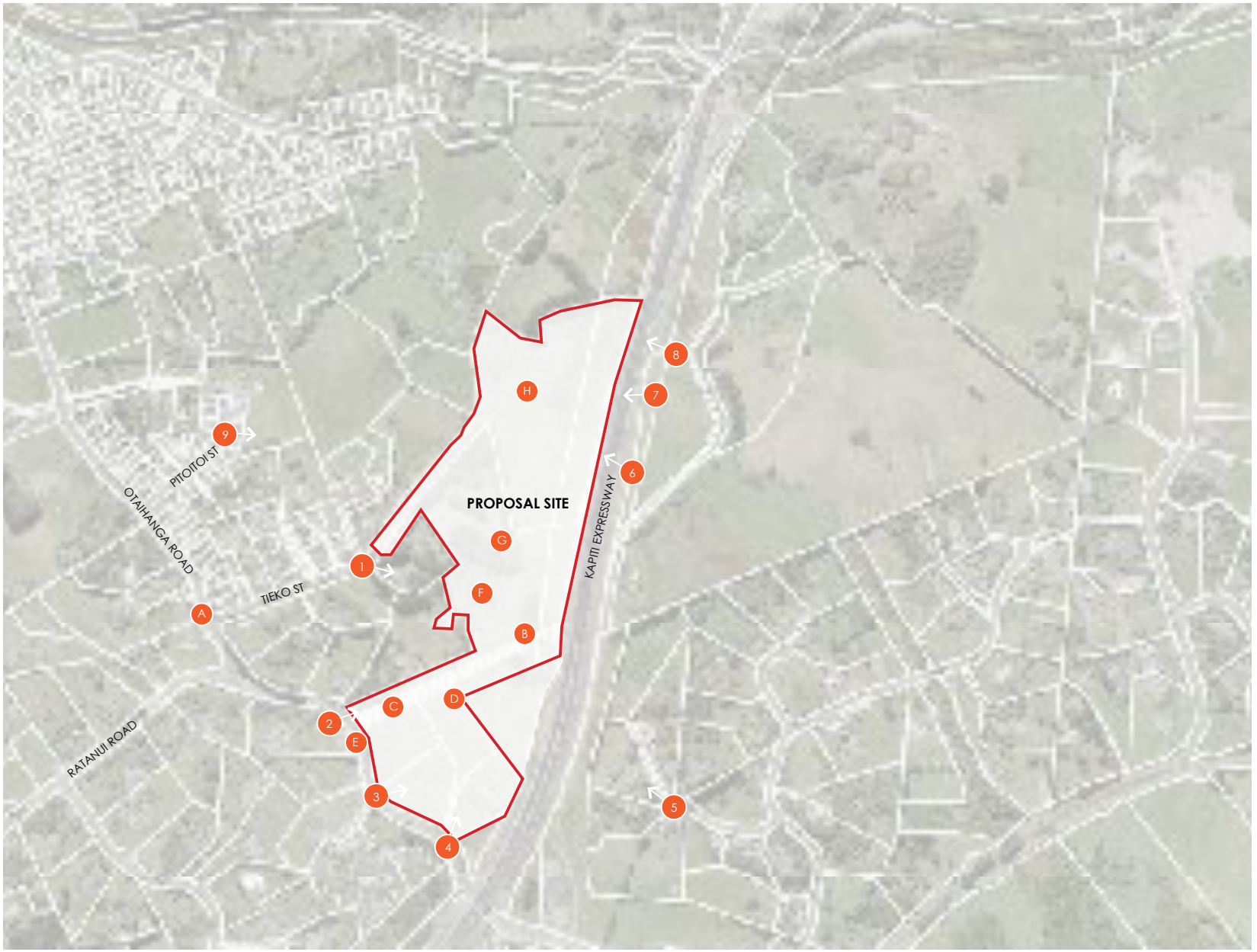
D Existing kanuka clumps should be retained and protected.

E The highest dunes should be protected from earthworks and buildings.

F The area beside Otaihanga Road is 'tucked' in between the expressway and existing topography creating an area suitable for higher density residential development. It is also clsoe to existing residential development on Otaihnga Rod and Pi to toi Street.

G This area provides an opportunity for larger lots consistent with current development on Tieko Street, retaining existing landscape elements (vegetation, wetlands and topography) without adversely affecting the character of the receiving environment.

A. LANDSCAPE CONSTRAINTS MAP (1:2,500 @A3)



LEGEND

CHARACTER PHOTOS

- A Residential Development on Otaihanga Road
- B Vegetation types
- C Photo of existing dune/hillock and ROW
- D Photo of Expressway overbridge and Otaihanga Road
- E Otaihanga Road frontage
- F Wetland and kanuka stand
- G Pinus radiata shelter belts
- H Dune form and expressway

VIEWPOINT LOCATIONS

1. View north from near 31F Tieko Street
2. View north east from near 110 Otaihanga Road
3. View north from near 134 Otaihanga Road
4. View northwest near 150 Otaihanga Road
5. View from the end of Grand Poppa Way
6. View from 189 Otaihanga Road (accessway adjacent to the expressway)
7. View from 189 Otaihanga Road (accessway adjacent to the expressway)
8. View from 189 Otaihanga Road (accessway adjacent to the expressway)
9. View northeast from near 34 Pitoitoi Street

A. LOCATION MAP FOR CHARACTER PHOTOS AND KEY VIEWPOINTS

A Residential Development - Existing housing in Teiko Street, along Otaihanga Road and Pitoitoi Street is a mix of styles and sizes with no consisent character. Lot sizes vary considerably with lots of 500m² to over 3ha

B Vegetation - the project area is a mix of native and exotic species but predominantly covered in exotic pasture grass speces. Clumps of kanuka are present and have been identified in the ecological report.

C Topography - the site has several dune features which give the underlying topography an undulating character. This photo is looking northeast along the existing right of way towards the expressway. This access will be retained as a future entrance to the proposed recreation reserve.

D Character - The character of the receiving environment is rural residential on the fringe of suburban development. The construction of the expressway has had a significant effect on the character of the receiving environment with changes to the topography, removal of vegetation and the installation of infrastructure.

E The Otaihanga Road frontage will not change much with all proposed lots being accessed internally via the proposed cul-de-sac. The area in the foreground is to be used as a stormwater detention area with native plantings. The existing right of path access will form a new entrance to the proposed recreation reserve (lot 105).

F One of the existing 4 natural wetlands on site. This wetland is located entirely within proposed Lot 20 with a 10m setback proposed to prevent any earthworks or structures. The stand of kanuka in the middle of the photo is to be retained with a 10m buffer proposed.

G There are several large stands of Pinus radiata and poplar which will be removed as part of the development. While the trees are part of the existing rural character, their presence and scale prevent the establishment of native species.

H Looking from a high point on proposed 3/4, the existing landform screens the majority of the site from the expressway with the ridgeline protected from development. The wetland on the left of the photo is to be protected from developed

A. IMAGE LOCATION

APPROXIMATE PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP1 - VIEW NORTH FROM NEAR 31F TIEKO STREET

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 12:44 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

APPROXIMATE PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP2 - VIEW NORTHEAST FROM NEAR 110 OTAIHANGA ROAD

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 12:50 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP3 - VIEW NORTHEAST FROM NEAR 134 OTAIHANGA ROAD

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 12:58 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

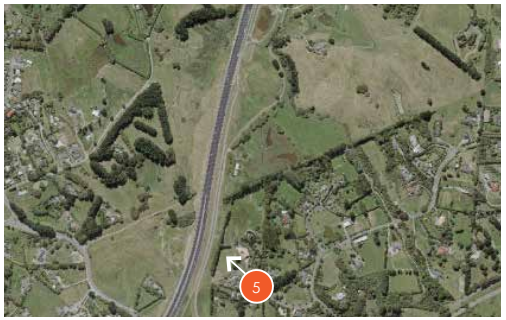
PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP4 - VIEW NORTH FROM NEAR 150 OTAIHANGA ROAD

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 12:59 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama



A. IMAGE LOCATION

APPROXIMATE PROPOSAL LOCATION
(not visible)

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP5 - VIEW FROM THE END OF GRAND POPPA WAY

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 1:26 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP6 - VIEW FROM 189 OTAIHANGA ROAD (ACCESSWAY ADJACENT TO EXPRESSWAY)

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 1:18 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP7 - VIEW FROM 189 OTAIHANGA ROAD (ACCESSWAY ADJACENT TO EXPRESSWAY)

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 1:20 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP8 - VIEW FROM 189 OTAIHANGA ROAD (ACCESSWAY ADJACENT TO EXPRESSWAY)

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 1:22 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama

A. IMAGE LOCATION

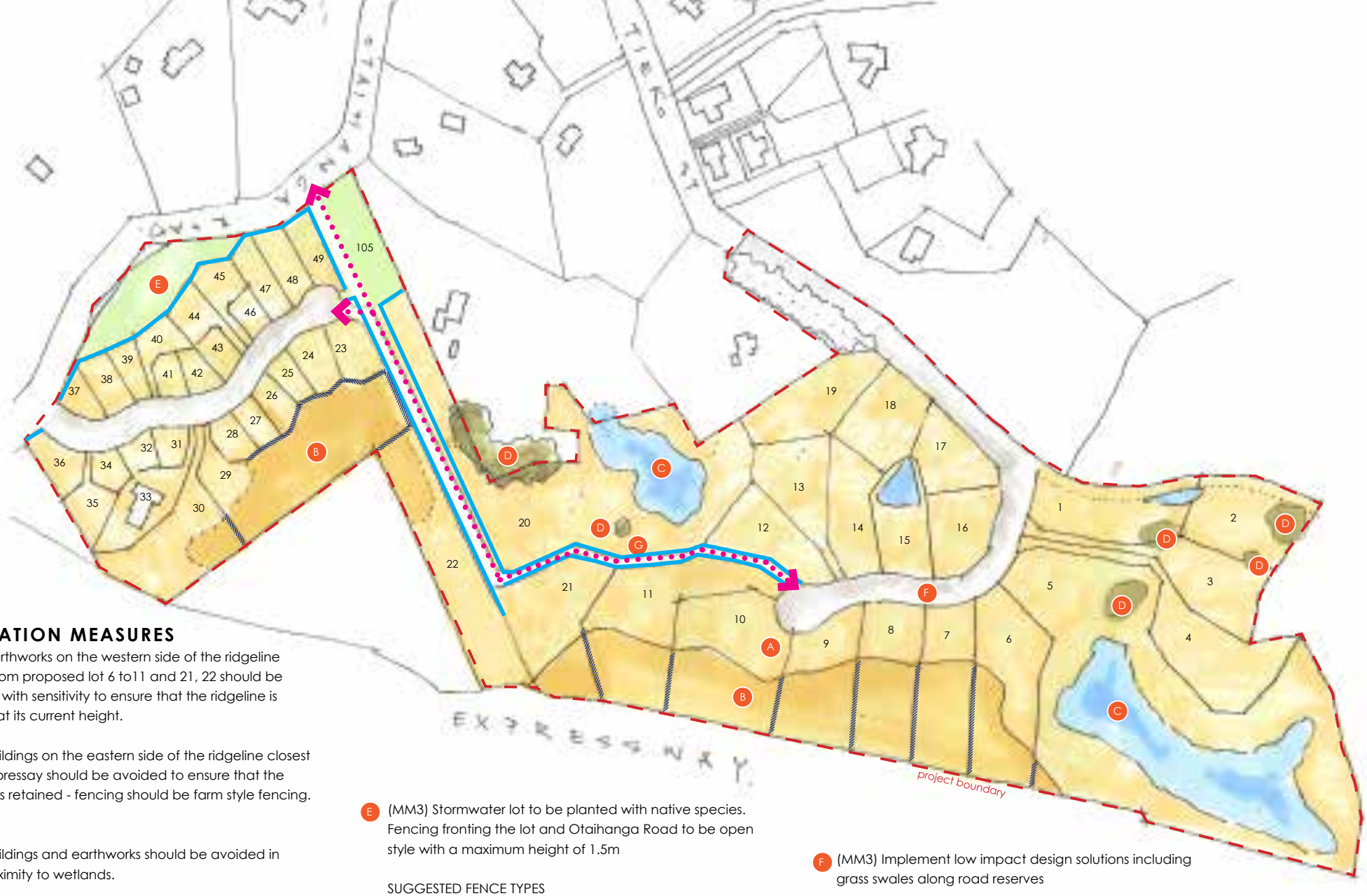
APPROXIMATE PROPOSAL LOCATION

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

VP9 - VIEW NORTHEAST FROM NEAR 34 PITOITOI STREET

MANSELL - OTAIHANGA SUBDIVISION PROPOSAL, KAPITI COAST

Image captured on Sony A6000
Focal length of 50mm
Date: 29th November 2020 at 1:26 pm
Height of 1.7 metres
Photos merged in Photoshop CS to create panorama



MITIGATION MEASURES

A (MM5) Earthworks on the western side of the ridgeline running from proposed lot 6 to11 and 21, 22 should be designed with sensitivity to ensure that the ridgeline is retained at its current height.

B (MM5) Buildings on the eastern side of the ridgeline closest to the expressay should be avoided to ensure that the ridgeline is retained - fencing should be farm style fencing.

C (MM7) Buildings and earthworks should be avoided in close proximity to wetlands.

D (MM8) Existing kanuka clumps should be retained and protected.

E (MM3) Stormwater lot to be planted with native species. Fencing fronting the lot and Otaihanga Road to be open style with a maximum height of 1.5m

SUGGESTED FENCE TYPES

Open style fence, maximum height 1.5m

Farm fence or post and rail fence - maximum height 1.2m

F (MM3) Implement low impact design solutions including grass swales along road reserves

(MM4) Create well connected pedestrian and cycle links

A. LANDSCAPE MITIGATION PLAN (1:2,500 @A3)

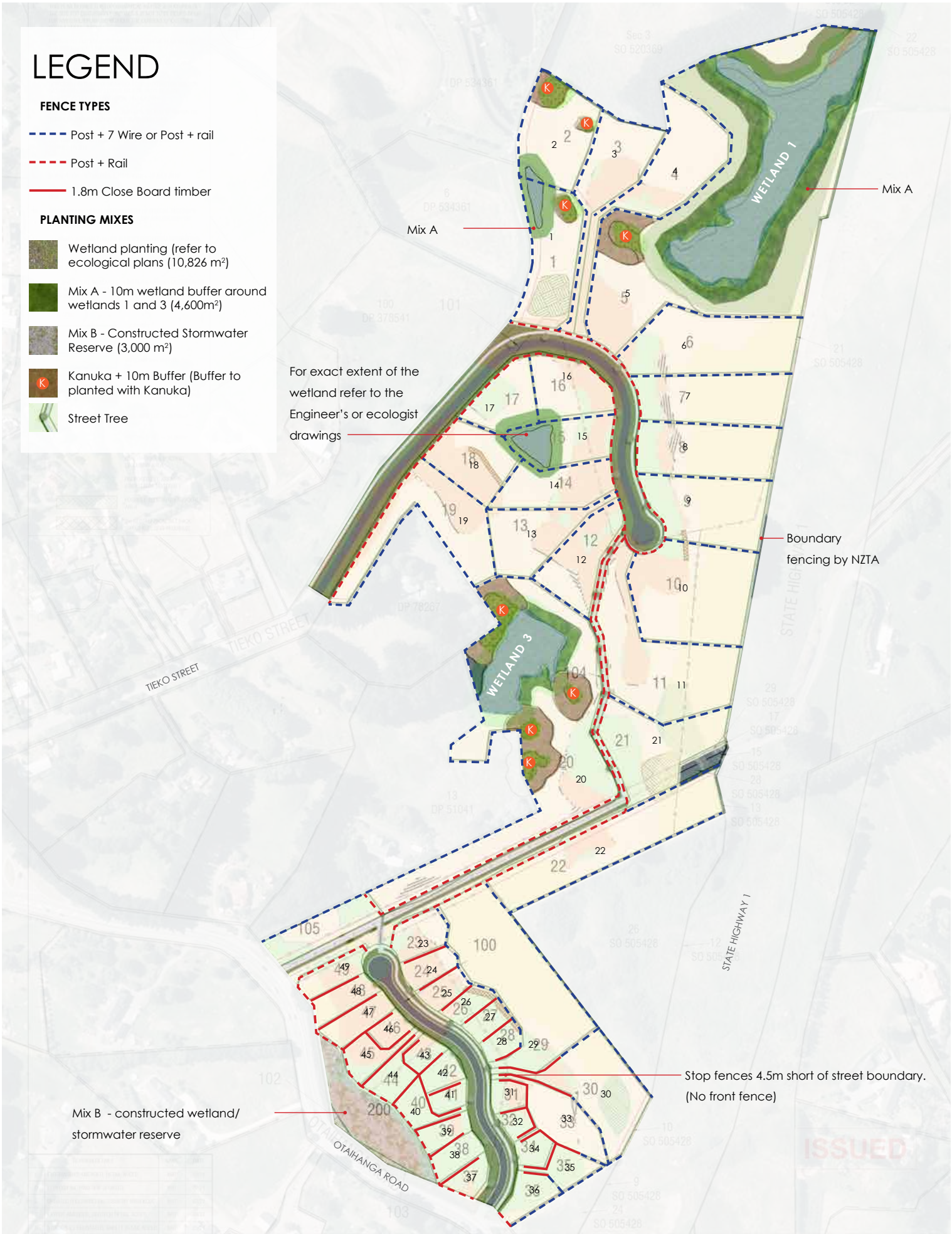
LEGEND

FENCE TYPES

- Post + 7 Wire or Post + rail
- Post + Rail
- 1.8m Close Board timber

PLANTING MIXES

- Wetland planting (refer to ecological plans (10,826 m²)
- Mix A - 10m wetland buffer around wetlands 1 and 3 (4,600m²)
- Mix B - Constructed Stormwater Reserve (3,000 m²)
- Kanuka + 10m Buffer (Buffer to planted with Kanuka)
- Street Tree



A. LANDSCAPE CONCEPT PLAN (1:2500)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE CONCEPT PLAN**
Designed by: Dave Compton Moen / Tom Morrison

Original issue date: 23 FEBRUARY 2021
Scales: 1:2500 @ A3

Revision no:	Amendment:	Approved	Date
A	Draft Issue	DCM	23/02/2021
B	Draft Final	DCM	2/03/2021
C	RC Issue	DCM	8/06/2021
D	Fence update	DCM	21/06/2021

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Project no / drawing no: Revision: **D**
2020_142/ 0100

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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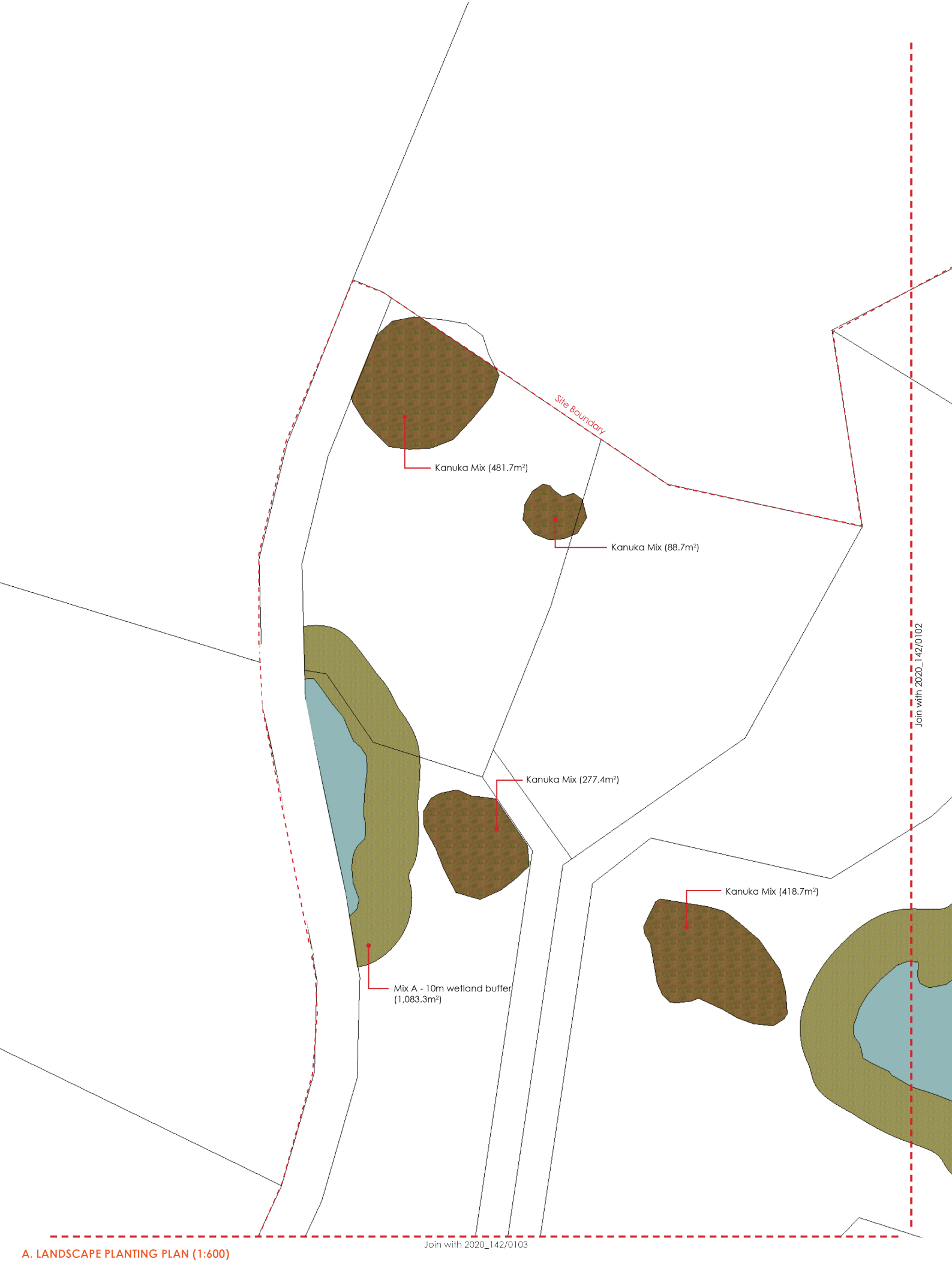
Project / drawing no: **2020_142/ 0100** Revision: **A**



A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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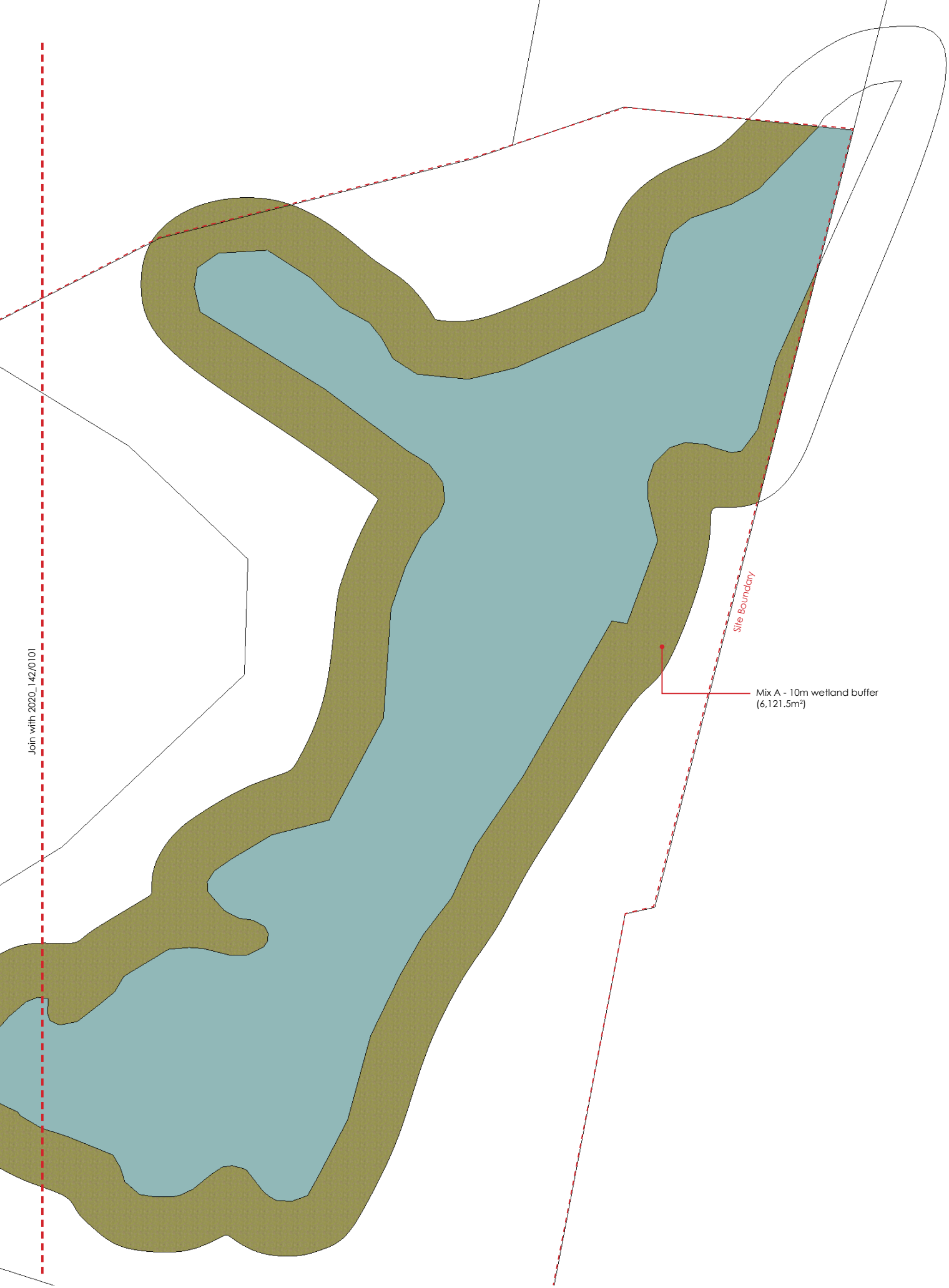
Project / drawing no: **2020_142/ 0101** Revision: **A**



A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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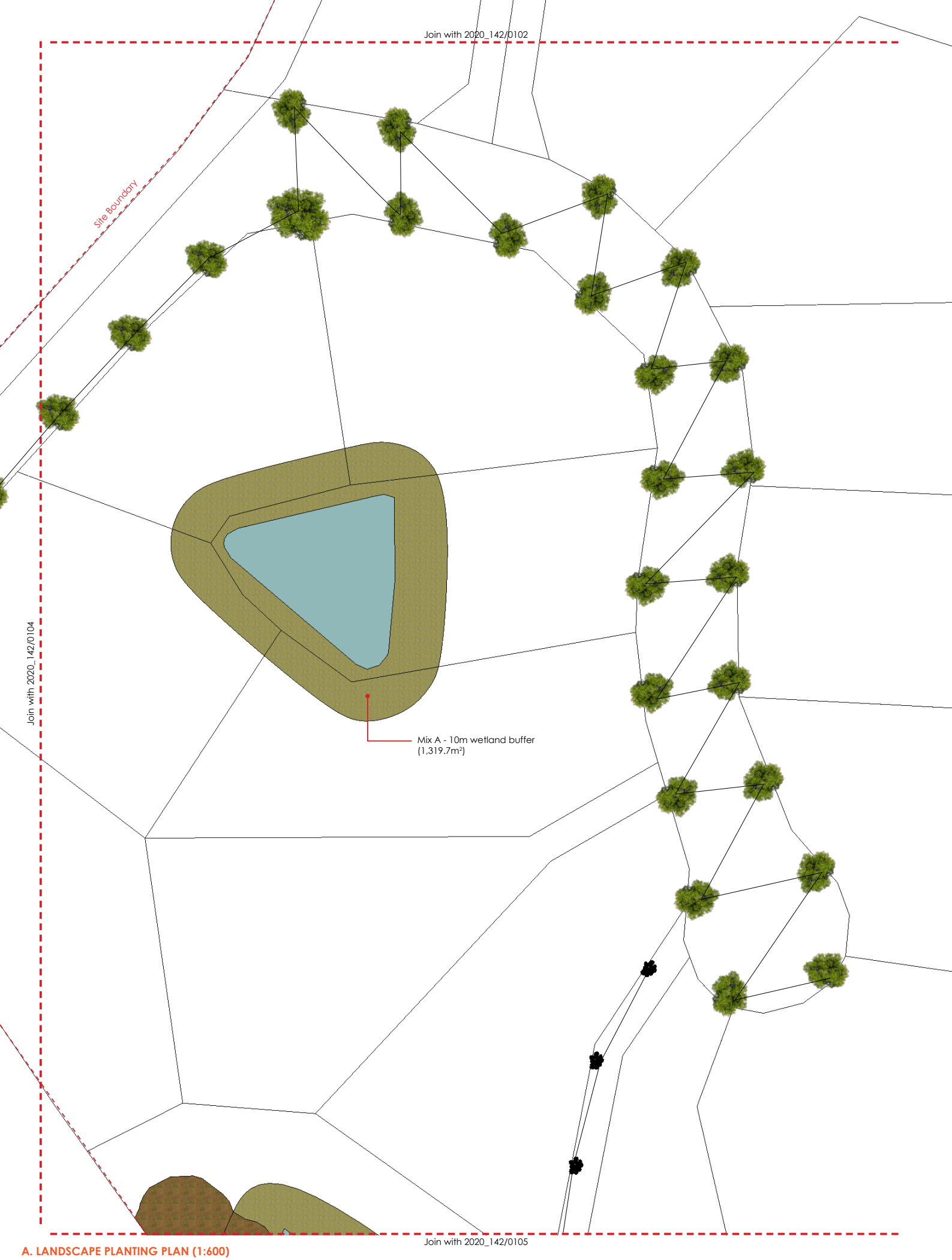
Project / drawing no: **2020_142/ 0102** Revision: **A**



A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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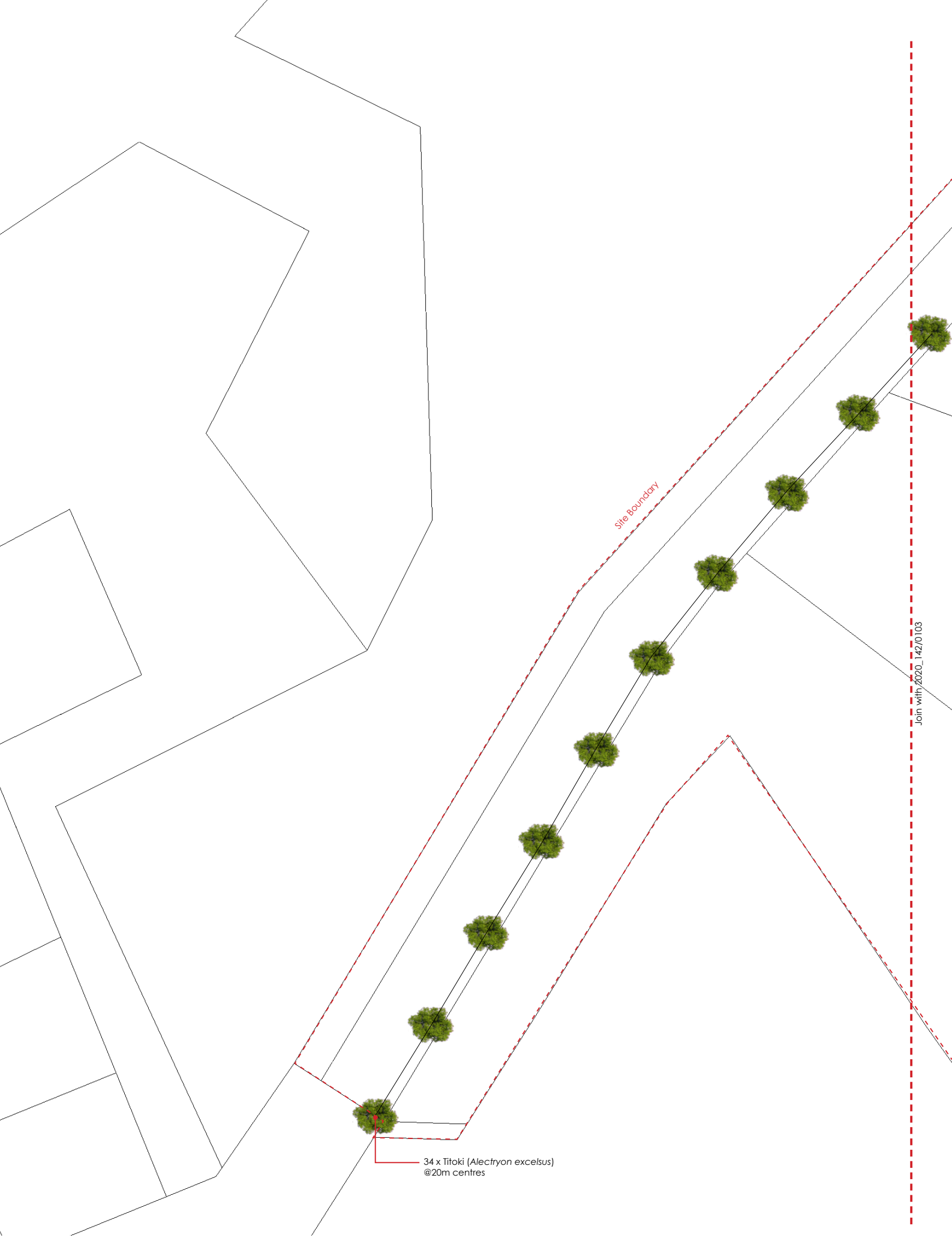
Project / drawing no: **2020_142/ 0103** Revision: **A**



A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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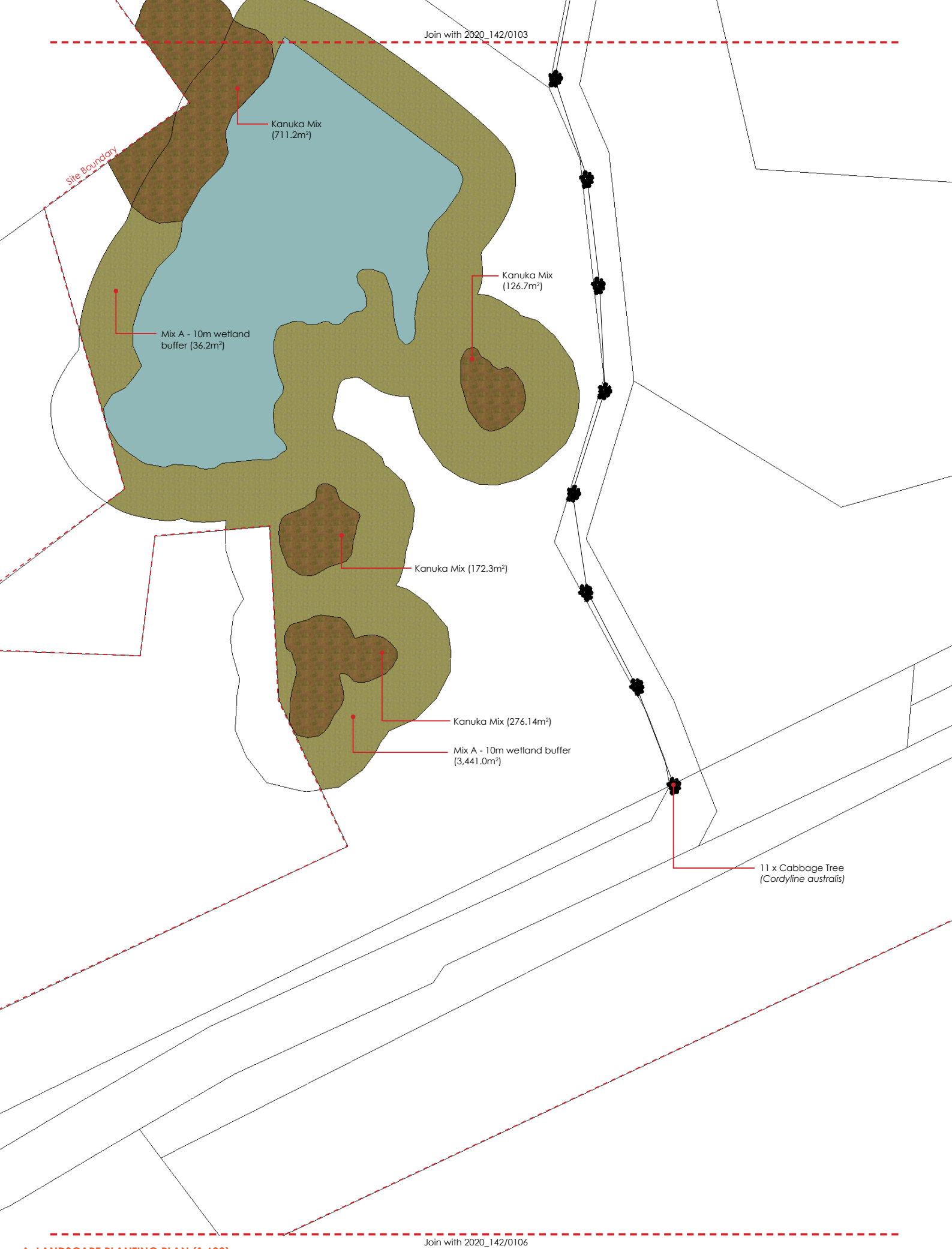
Project / drawing no: **2020_142/ 0104** Revision: **A**



A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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Project / drawing no: **2020_142/ 0105** Revision: **A**

A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION Drawing name: **LANDSCAPE PLANTING PLAN** Designed by: Dave Compton Moen / Tom Morrison Original issue date: 29 JUNE 2021 Scales: As stated	**Revision no:** A	**Amendment:** RCA	**Approved** DCM	**Date** 29/06/2021	**DCM URBAN DESIGN LIMITED** 10/245 ST ASAPH STREET CHRISTCHURCH 8013 WWW.DCMURBAN.COM 021 114 0337 Project / drawing no: **2020_142/ 0106** Revision: **A**

A. LANDSCAPE PLANTING PLAN (1:600)

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **LANDSCAPE PLANTING PLAN**
Designed by: Dave Compton Moen / Tom Morrison
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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Project / drawing no: **2020_142/ 0107** Revision: **A**

Botanical Name	Common Name	Size (H, Bagsize)	Spacing (mm)	Unit	Quantity
Specimen (Native) Trees					
Cordyline australis	*Cabbage Tree*	1.5m, Pb40	As shown	No	11
Alectryon excelsus	*Titoki*	2.5m, Pb95	20,000	No	56
Podocarpus totara	*Totara*	1.5m, Pb40	As shown	No	7
Wetland Buffer Plant Mix A (10m wide)				Area (m^2) =	12001.7
Carex geminata	*Rautahi*	0.5L	705	10%	2415
Coprosma propinqua	*Mingimingi*	0.5L	1400	5%	306
Coprosma robusta	*Karamu*	0.5L	1400	10%	612
Cordyline australis	*Ti kouka*	0.5L	1400	10%	612
Dacycarpus dacrydioides	*Kahikatea*	2L pot	5000	5%	24
Kunzea robusta	*Kanuka*	0.5L	1400	20%	1225
Leptospermum scoparium	*Kanuka*	0.5L	1400	15%	918
Muehlenbeckia complexa	*Pohuehue*	0.5L	1000	10%	1200
Phormium tenax	*Harakeke*	0.5L	1400	10%	612
Podocarpus totara	*Totara*	2L pot	5000	5%	24
Mix B Constructed Wetland				Area (m^2) =	3490.6
Carex geminata	*Rautahi*	RX90	700	15%	1069
Coprosma propinqua	*Mingimingi*	RX91	700	15%	1069
Muehlenbeckia complexa	*Pohuehue*	RX92	700	25%	1781
Phormium tenax	*Harakeke*	RX93	700	20%	1425
Ficinia nodosa	*Knobby club rush*	RX94	700	25%	1781
Kanuka Buffer 10m wide				Area (m^2) =	2552.84
Kunzea robusta	*Kanuka*	0.5L	3000	100%	284

Project name: MANSELL - OTAIHANGA SUBDIVISION
Drawing name: **PLANT SCHEDULE**
Designed by: Dave Compton Moen
Original issue date: 29 JUNE 2021
Scales: As stated

Revision no:	Amendment:	Approved	Date
A	RCA	DCM	29/06/2021

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Project / drawing no: **2020_142/ 0107** Revision: **A**

Appendix E – Transport Assessment Report

Harriet Fraser Traffic Engineering & Transportation Planning

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29 June 2021

Chris Hansen
Chris Hansen Consultants Ltd

Via email: **chris@rmaexpert.co.nz**

Dear Chris

117-155 Otaihanga Road, Paraparaumu – Proposed Residential Subdivision
Transportation Assessment

Further to your request, I am pleased to provide below a transportation assessment for the proposed residential subdivision at 117-155 Otaihanga Road in Paraparaumu. As shown within the detail of the Cuttriss drawing set, the proposal includes the subdivision of 17ha (western) portion of the Mansell Farm into 49 lots: 22 rural life-style lots in the northern part of the site, and 27 residential lots adjacent to Otaihanga Road in the south of the site.

Access to 19 of the rural life-style lots in the north will be via Tieko Street, and the remainder of the rural-lifestyle and residential lots will be accessed via a new road connection with Otaihanga Road. There is an existing residential dwelling on the site which is currently accessed from Otaihanga Road via a driveway immediately to the west of the Expressway overbridge. The plans show this existing access is to be closed with all vehicle access being via the new road. It is intended that the existing vehicle access adjacent to 115 Otaihanga Road provides vehicle access to a reserve which will be vested in Council. There will be no vehicle access into the subdivision from this access.

A cycleway, walkway, bridleway (CWB) is included through the site from the reserve on Otaihanga Road to the cul de sac head at the end of the extension to Tieko Street. The section that runs along the existing formed access will be shared with vehicle access to Lots 20, 21 and 22 from the end of the cul de sac at the end of the new road from Otaihanga Road.

The assessment includes a review of the local traffic environment, the internal traffic arrangement and compliance with the Proposed Kapiti Coast District Plan (Proposed District Plan) transportation provisions. In summary the findings of the review show that the proposed subdivision and its associated traffic can be appropriately, safely and efficiently accommodated within the local road network.

1. Site Location and Context

The proposed subdivision site is located on the northern side of Otaihanga Road immediately to the west of the Expressway. The site is currently undeveloped apart from the existing dwelling. The land is used for grazing livestock.

Otaihanga Road is classified as a Local Community Connector in the road hierarchy included in the Proposed District Plan with the characteristics of:

- providing main access routes through suburbs
- connecting local centres

- traffic movement mainly locally generated
- significant walkways/ cycleways between local centres, schools and employment areas
- may be some routes with relatively high traffic volumes
- expect moderate speed.

Photos 1 and 2 show views along Otaihanga Road from the site frontage in the vicinity of the proposed intersection. In this location there are both centreline and edge-line markings. A sight line of around 150m was measured towards the east (Expressway) and 105m towards the west. The sightline towards the west is limited by vegetation within the roadside paddock. As shown there is a shared path along the northern side of Otaihanga Road in this location. The existing driveway in this location provides access to a single dwelling within the site.

Photos 1 and 2: Looking East and West along Otaihanga Road from the Proposed Intersection

Photos 3 and 4 show views along Otaihanga Road further to the west in the vicinity of the existing main access to the site. A sight line of 125m was measured towards the left on exiting from 5m back from the edgeline, this increased closer to the edgeline. A sight line of 92m was measured towards the right on exiting from 5m back from the edgeline, this was measured in front of the power pole located within the road reserve on the opposite side of the road. The sight line increased to around 96m at a distance of 3.5m from the edgeline and looking between the power pole and the fence.

Photos 3 and 4: Looking South and North along Otaihanga Road from the Existing Access

As shown in the photos the shared pedestrian and cyclist path also crosses this access.

A Council traffic count for Otaihanga Road in February 2019 in the immediate vicinity of the site shows an average daily two-way traffic volume of 4,853 vehicle movements per day with weekday peak flows of around 470 vehicle movements per hour between 5pm and 6pm. The 85th percentile speed was recorded at 58 to 60km/h in both directions which is well aligned with the 60km/h posted speed limit. The traffic volumes on Otaihanga Road have reduced since the opening of the Kapiti Expressway with a traffic count on Otaihanga Road prior to the opening of the Expressway showing 5,860 vehicle movements per day.

Tieko Street is around 270m long and has a generally straight alignment as shown in Photo 5 with a curve towards the left at the end. The road rises slightly from Otaihanga Road along its length. There is no kerb and channel. The road has a sealed width of around 5.6m at each end with the width typically varying between 4.5 and 5.0m along its length with around a 50m length with a width of less than 4.5m. There is no existing street lighting along Tieko Street or along the right-of-way off the end of Tieko Street which is owned by the Applicant.

With regard to safe intersection sight distances there is a clear sight line to the left from Tieko Street all the way along Otaihanga Road to the adjacent intersection with Ratanui Road, a distance of some 95m. There is a potential sight distance to the right from Tieko Street along Otaihanga Road of 128m which is obstructed by vegetation next to the power pole. The views along Otaihanga Road in each direction from Tieko Street are shown in Photos 6 and 7.

Photo 5: Looking along Tieko Street from Otaihanga Road

Photos 6 & 7: Looking along Otaihanga Road from Tieko Street

Traffic movements at the intersection of Tieko Street and Otaihanga Road have previously been counted on Tuesday 15 May 2018 during the morning and afternoon traffic peaks and on Saturday 12 May 2018 during the midday peak. The results of these surveys are summarised as follows:

Tuesday AM

- busiest hour was between 7.45 and 8.45am with a total of 117 vehicle movements through the intersection;
- no pedestrians or cyclists were observed on Tieko Street during the full 7.30am to 9.00am survey period;
- 23 vehicle movements were counted on Tieko Street during the peak hour with 19 departures and 4 arrivals;

Tuesday PM

- busiest hour was between 5.00 and 6.00pm with a total of 173 vehicle movements through the intersection;
- two pedestrians and no cyclists were observed on Tieko Street during the full 3.00pm to 6.00pm survey period;
- 19 vehicle movements were counted on Tieko Street during the peak hour with 4 departures and 15 arrivals;

Saturday Midday

- busiest hour was between 12.30 and 1.30pm with a total of 175 vehicle movements through the intersection;
- two pedestrians and one cyclist were observed on Tieko Street during the full 11.00am to 2.00pm survey period; and
- 29 vehicle movements were counted on Tieko Street during the peak hour with 13 departures and 16 arrivals.

It is estimated that Tieko Street provides access to some 24 existing dwellings. As such the trip rate per dwelling is 1.0, 0.8 and 1.2 during the weekday morning, weekday afternoon and Saturday midday peaks respectively. From looking at aerial images it appears that there are some four undeveloped lots and a yet to be implemented resource consent (RM 170306) allows for a further five additional dwellings to access Tieko Street off the right of way at the end of the street. Based on the observed traffic activity, nine dwellings could be expected to generate 9vph, 7vph and 11vph during the weekday morning, weekday afternoon and Saturday midday peaks respectively. The forecast total traffic activity at the Otaihanga Road end of Tieko Street including existing traffic, traffic associated with undeveloped lots and associated with the consented subdivision would be expected to be around 32vph, 26vph and 40vph during the weekday morning, weekday afternoon and Saturday midday peaks respectively.

RM 170306 provides for a further five additional dwellings to access Tieko Street off the right of way at the end of the street. Conditions 9 to 15 of the consent address access matters and can be summarised as follows:

- ROW to be sealed and constructed in accordance with KCDC RD-0016. This includes a minimum sealed width of 3m plus 0.5m shoulders on each side where 4 or more lots are served;
- the connection between the ROW and the end of Tieko Street within the road reserve to be sealed;
- passing bays to be no more than 100m and closer where needed for visibility to the next passing opportunity;
- driveways cannot be used as passing places;
- passing bays to be 5.5m wide for a length of no less than 15m;
- provision to be included at the end of the ROW at Tieko Street for 18 rubbish bins (3 per lot);
- a turning head to be provided, this is further to the north on the ROW beyond the proposed access to the site for this application; and
- both Detailed Design and Post Construction Road Safety Audits required.

A search of the Waka Kotahi NZTA crash database for the area shown in Figure 1, shows that there have been six reported crashes on the local road network during the most recent five year period. These can be summarised as follows:

- no reported crashes on Tieko Street or at its intersection with Otaihanga Road;
- a minor injury crash at the intersection of Otaihanga Road and Pitoitoi Street involving a northbound vehicle on Otaihanga Road losing control turning right. The crash factors include alcohol test above limit or test refused;
- a minor injury crash at the intersection of Ratanui Road and Otaihanga Road involving a northbound vehicle on Ratanui Road leaving the road and hitting trees and fence. The crash factors include alcohol test above limit or test refused;
- a non-injury crash on Otaihanga Road, 300m to the east of Ratanui Road involving a car losing control turning right and hitting poles and ditches. The crash factors included slippery road due to rain; and
- three crashes on Otaihanga Road to the east of the Expressway involving:
    - a westbound car losing control and going off the road resulting in serious injury. The crash factors include alcohol test above limit or refused and attempted suicide;
    - a collision between a westbound motorcyclist and a turning cyclist resulting in minor injury; and
    - a non-injury crash with an eastbound car losing control and going off the road. The crash factors include alcohol test above limit or refused.

Of the six reported crashes, five were single vehicle incidents.

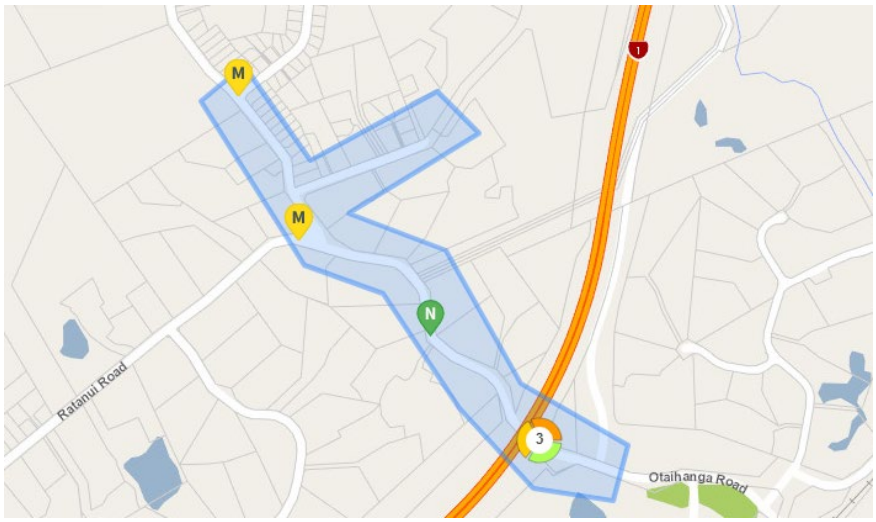


Figure 1: Extract from Waka Kotahi NZTA Crash Database

While the site is located on the edge of the urban area, there is ready access to the cycleway and walkway along Otaihanga Road and the Kapiti Expressway alignment. The site is located within a five minute drive of Paraparaumu railway station and less than a 15 minute cycle ride from central Paraparaumu.

2. Proposed Development

As shown within the detail of the Cuttriss Drawings 22208 SCH1 Rev H, the proposal includes the subdivision of 17ha (western) portion of the Mansell Farm into 49 lots: 22 rural life-style lots in the northern part of the site, and 27 residential lots adjacent to Otaihanga Road in the south of the site. Access to 19 of the rural life-style lots in the north will be via Tieko Street, and the remainder of the rural-lifestyle and residential lots will be accessed via Otaihanga Road. There is an existing residential dwelling on the site which is currently accessed from Otaihanga Road via a driveway immediately to the

west of the Expressway overbridge. The plans show this existing access is to be closed with the existing house having access to the new road. Particular characteristics of the proposed layout and access arrangements include:

- a new intersection onto the northern side of Otaihanga Road to the west of the Expressway bridge. The proposed layout includes a right turn bay;
- this new road provides access to 30 residential lots including the existing house. This road includes:
    - a legal width of at least 15m;
    - a carriageway width of 5.7m with a 2m wide shared path along the eastern side;
    - a maximum grade of 1:25; and
    - a standard residential turning head.
- the existing formed access to the site adjacent to 115 Otaihanga Road will provide access to a reserve which will be vested in Council. The existing sight lines are 125m towards the left and 92m towards the right on exiting. No vehicle access into the subdivision is provided from this access;
- vehicle access to Lots 20, 21 and 22 is from the end of the cul de sac via an initial section with a two-way trafficable width and then shared with the CWB. The shared section makes use of the existing driveway which has a formed width of 2.5 to 3.0m. Passing bays are included along the access and can accommodate passing with an occasional larger vehicle. It is recommended that the formed width is increased to 3.5m to allow for a vehicle to slowly pass a pedestrian or cyclist;;
- 19 lots will have access to an extension of Tieko Street. The right of way off the end of Tieko Street will be upgraded over a length of around 230m to provide a 6m wide carriageway with a 2.5m wide shared path along the western side. Noting that RM 170306 provides for the sealing of the ROW over a width of at least 3m plus 0.5m shoulders on each side and widening to 5.5m at passing places;
- the new road then follows a curve into the site continuing to provide a 6m wide carriageway with a 2.5m wide shared path along one side within an overall legal width of at least 15.5m. The maximum grade on the upgraded and new section of road from Tieko Street is 1:15;
- there is provision for pedestrians and cyclists to continue through the site from Tieko Street and onto the shared path along Otaihanga Road which in turn connects with the shared paths along the Expressway alignment;
- the internal roads are expected to operate with a 50km/h speed limit;
- an 8m rigid truck including general fire appliances and rubbish collection vehicles will be able to travel along the roads and turn within the standard residential turning heads; and
- the 50m access sight distance requirement can be met for all lot frontages and the right of way with the following recommendations for the individual driveways:
    - Lot 16 – locate vehicle access close to the boundary with Lot 17;
    - Lot 37 – position driveway next to boundary with Lot 38; and
    - Lot 43 – position driveway close to boundary with Lot 44.

Discussions are underway with Council with regard to safety improvements being made to Tieko Street to address existing maintenance issues and deficiencies and provide for improved safety for existing and future users of the street.

Table 1 summarises the available sight lines at both the new intersection with Otaihanga Road and the existing intersection of Tieko Street with Otaihanga Road. The key design parameter with regard to the design of a safe intersection is the available sight lines. The Austroads Guides to Road Design are generally considered to provide best practice guidance in this regard. With some minor trimming of vegetation safe sight lines can be achieved at both intersections.

Sight Line	Austroads Guidance with 50km/h Design Speed, 2s Reaction Time	Existing Tieko St Intersection	Austroads Guidance with 60km/h Design Speed, 2s Reaction Time	New Otaihanga Intersection
Stopping Sight Distance(SSD) (must be provided for all approaches and turns)	55m	>55m on all approaches	73m	>55m on new road approach >73m on Otaihanga Rd approaches
Approach Sight Distance(ASD) (to be provided on the new road approach to the intersection)	55m	>55m on all approaches	73m	>55m on new road approach >73m on Otaihanga Rd approaches
Safe Intersection Sight Distance (SISD) (to be provided in each direction from side road and for right turn in from main road)	97m	To achieve towards right from Tieko St either trim vegetation or 1m shift in intersection markings towards the west.	123m	>123m in both directions along Otaihanga Rd with vegetation trimming/ removal
Minimum Gap Sight Distance (MGSD)	Left out, 5s gap= 69m Right out, 5s gap= 69m Right in, 4s gap= 55m	To achieve for turns from Tieko St either trim vegetation or 1m shift in intersection markings towards the west.	Left out, 5s gap= 83m Right out, 5s gap= 83m Right in, 4s gap= 67m	Achieved for all turns.

Table 1: Sight Distances at Intersections

3. Proposed District Plan Provisions

The site is located within the Rural Residential Zone. The level of compliance with the Proposed District Plan permitted standards for access and roading which apply to this proposal is discussed in Table 2.

KCDC 11.7.3 Rules & Standards – Transport, Access and Off-Street Parking Table 11E.1. Permitted Activities	**Comment**
2. Vehicle Movements	
2) In all other zones, any activity must not generate more than 100 vpd, except extractive industries that are provided.	As set out in Section 4.1 of this report, the total development is forecast to generate between 392 and 490 vehicle movements per day. This is considerably less than the 4,900 vehicle movements per day with a 100vpd allowance for each of the 49 lots.
3. Property access and loading for vehicles	
1) Access – every property must provide vehicular access over land or by mutual right of way or service lane for parking and/or loading and shall be in accordance with Diagram A2 (Schedule 11.1).	Complies. All lots will have either direct access to public road or via a right of way.
2) Access – all vehicle accesses must be designed, constructed and maintained to ensure that: a. they are able to be used in all weather conditions; b. they have no adverse impact on the roadside drainage system; and	 Complies. Complies. Complies.

KCDC 11.7.3 Rules & Standards – Transport, Access and Off-Street Parking Table 11E.1. Permitted Activities	Comment
c. surface water and detritus (including gravel and silt) does not migrate onto the highway pavement.	
3) Access – all accesses must meet the following: a. to be minimum of 3.5m wide and minimum unobstructed height of 2.8m. b. maximum width 9m.	 Complies. Complies.
7) Where a site is located near an intersection having volumes less than 1,000vph in any peak hour, the minimum distance between the crossing point and the roadway edge or kerbline must be: a. 9m from the intersecting point of the kerb lines or road edge lines or 4.5m from the tangent point of the kerb lines whichever is greater; and b. 12m where a Stop or Give Way control exists on the roadway measured from the intersecting point of the kerb lines or road edge lines.	Complies.
9) For a private access onto a non-State Highway road with a 50km/h speed limit, a minimum sight distance of 50m is required. Increases to 60m with a 60km/h speed limit.	Can comply with some controls on a few of the driveway locations.
12) Private residential access – unless the driveway accesses directly from a local road, sufficient manoeuvring space must be provided on-site to ensure no reversing onto the road is necessary.	Complies. No reverse manoeuvres to/from Otaihanga Road are expected.
15) Landscaping – all landscaping adjoining the road boundary of sites, must be designed and maintained so that visibility to and from the crossing point complies at all times with the minimum sight distances set out in Table 2 above.	Can comply. Recommended that berms are grassed to minimise risk of obstruction to sight lines.

Table 2: Proposed District Plan Rules and Standards

New roads are a controlled activity in the Proposed District Plan. A standard is included for cycle paths to be provided either as on-street cycle lanes, off-street shared paths or off-street dedicated cycle paths. The proposed subdivision includes off-street shared paths along all sections of the internal roading.

With regard to the design of accesses and roads the Council's Subdivision and Development Principles and Requirements 2012 sets out that Table 3.2 in NZS 4404 should be used as the basis for design. The provisions for suburban residential roads serving up to 100 dwellings as included in Table 3.2 are summarised below in Table 3:

Access Type	Target Operating Speed (km/h)	Maximum Grade	Pedestrians & Cyclists	Minimum Road Width (m)
Lane serving up to 20 dwellings (200vpd)	20	16%	Pedestrians and cyclists shared in movement lane.	5.5-5.7m movement lane within minimum 9m road width.
Primary access to up to 100 dwellings	40	12.5%	1.5m footpath on one side or on each side where more than 20 dwellings or more than 100m in length. Cyclists and parking shared in movement lane.	5.5-5.7m movement lane within minimum 15m road width.

Table 3: Extract from NZS4404:2010 Table 3.2

The only area of partial or non-compliance with the transportation matters included in the Proposed District Plan are the provision of a footpath on only one side of the new road from Otaihanga Road which provides access to more than 20 dwelling units. The traffic effects associated with this is discussed in Section 4.

The alignment of the proposed subdivision with the Access and Transport Policies included in Section 11.7.2 of the Proposed District Plan which apply to this proposal is summarised in Table 4.

KCDC 11.7.2 Access and Transport Policies	Comment
Policy 11.30 – Integrated Transport and Urban Form	
Development and subdivision will be integrated with and consistent with the transport network hierarchy in Schedule 11.2, and undertaken in a manner and at a rate to ensure:	
a) the transport network is capable of serving the projected demand safely and efficiently;	a) The traffic effects associated with the proposed subdivision are discussed in a later section of this assessment.
b) the location of development is appropriate, including providing for the co-location of compatible developments and land use and transport networks to reduce unnecessary travel;	b) The site has ready access to Otaihanga Road which in turn connects with the Arterial road network. The site is within a commutable distance of Paraparumu for cyclists with shared paths through the site and access to the frontage shared path on Otaihanga Road and then the Expressway path.
c) travel time and distance to services are minimised for all modes of travel;	c) As per comment above.
d) development is consistent with Council's Subdivision and Development Principles and Requirements 2012; and	d) The roading design meets the requirements of NZS4404:2010 and is in turn consistent with the Subdivision and Development Principles and Requirements 2012.
e) enhanced community connectivity is achieved, resulting in more efficient travel patterns from the community.	e) The proposal results in improved connectivity for pedestrians and cyclists.

KCDC 11.7.2 Access and Transport Policies	Comment
Policy 11.31 – Sustainable Transport and Maximising Mode Choice	
Development and subdivision will be integrated with a transport system that offers a wide range of travel mode choices, which connects residents to essential community services, centres and social infrastructure, through:	
a) well-integrated and connected communities;	a) The site has ready access to the road and shared path network.
b) development that is conducive to active modes of travel, particularly walkable communities which reduce demand for vehicular travel, particularly by private vehicle;	b) As per response to 11.30 e) above.
c) land use that is integrated with the transport network;	c) As above.
f) consistency with the Council's Subdivision and Development Principles and Requirements 2012; and	f) As per comment on Policy 11.30 d).
g) development that ensures adequate access and space for all modes, including pedestrians, people with mobility problems, cyclists, public transport and private car travel.	g) As above.
Policy 11.34 – Effects of Land Use on Transport	
The potential adverse effects on the transport network from development and subdivision will be avoided, remedied or mitigated by identifying both the key existing transport routes and proposed transport routes likely to be required long term as part of the District's transport network and having regard to these when considering applications for subdivision or development.	The proposed subdivision is not expected to have any discernible adverse effect on any key existing or proposed transport routes.
Policy 11.35 – Safety	
The safety of all transport users will be enhanced during the development, operation, maintenance and upgrading of the transport network, by:	
a) implementing the principles set out in Appendix 5.5 – Crime Prevention Through Environmental Design (CPTED) Guidelines;	a) The shared paths are adjacent to roads with associated passive surveillance or within a wide cross-section.
b) requiring that all developments provide for safe vehicular and pedestrian access, and have adequate visibility (sight lines);	b) Safe sight lines for the local speed environment can be achieved.
c) requiring all developments to have safe connections to the wider transport network.	c) The safety and performance of the proposed new intersection with Otaihanga Road and the existing Tieko Street intersection are discussed in a later section of this assessment.
Policy 11.37 – Cycling, Walking and Bridleway Links and Safety	
Subdivision, use and development will be as far as practicable, located and designed to make walking, cycling and the use of bridleways safer, more enjoyable and convenient in accordance with the Crime Prevention Through Environmental Design (CPTED) Guidelines set out in Appendix 5.5 and the following principles:	

KCDC 11.7.2 Access and Transport Policies	Comment
a) new street linkages will provide safe pedestrian access to shops and services and public transport nodes;	a) The proposed shared paths within the site will improve the connectivity for pedestrians and cyclists.
b) subdivision and development will:	
i. enable cycle and pedestrian routes, both on and off road, which offer good continuity;	b)i. As above.
ii. avoid large blocks that sever connectivity; and	b)ii. Reasonable level of connectivity given the topography of the site and other constraints.
iii. consider opportunities to provide bridleways in suitable locations; and	b)iii. Provision of a bridleway is not considered appropriate in this future suburban setting.
d) pedestrian and cycle routes will have well designed and built facilities including surface conditions, lighting, signage and passive surveillance from adjacent development.	d) This will be delivered as part of the detailed design.

Table 4: District Plan Access and Transport Policies

With regard to the Crime Prevention Through Environmental Design (CPTED) Guidelines set out in Appendix 5.5 of the District Plan, the following extract refers to access provisions:

[1] Access: Safe movement and connections

Spaces should be designed and development in a manner that achieves:

a) clear routes for different transport modes.

b) maximised movement safety, especially after dark.

c) safe access between key destinations and elimination of entrapment spots.

d) routes which lead to destinations that people want to reach.

Transport modes clearly defined

The shared paths will be used by both pedestrians and cyclists. Given the expected usage level in this peripheral part of the suburban road network, pedestrians and cyclists will be able to safely share the paths. Where the paths are located next to roads they will benefit from street lighting. The paths away from roads within the rural residential part of the site will not be lit in line with the more rural environment. The shared path within the rural residential area is set within a width of at least 5.5m between adjacent boundaries with any planting controlled so as not to create entrapment spots. The provision of the paths will enable a recreational loop to be formed and will improve access to existing shared paths along Otaihanga Road and the Expressway.

Section 9 of the Engineering Infrastructure Report, that forms part of the application, includes further assessment of the proposed CWB against the CPTED Guidelines.

In summary, the proposed subdivision delivers roading, accesses and lots which are well aligned with the policies for access and transport included in the Proposed District Plan.

4. Traffic Effects

4.1 Traffic Generation

The site can be expected to generate a total of some 392 to 490 vehicle movements per day with up to around 60 vehicle movements per hour in the busiest hours. Traffic flows on Otaihanga Road will remain below the level of activity prior to the opening of the Expressway.

The Council traffic counts show a directional split in travel of 54% eastbound and 46% westbound in the morning peak and 49% eastbound and 51% westbound in the afternoon peak. As such and assuming 70% departing traffic in the morning and 60% arriving traffic in the evening peak the turning patterns shown in Table 5 can be expected during the weekday peaks at the proposed new intersection. Equal arrivals and departures are expected during the Saturday midday peak.

The forecast turning patterns at the Tieko Street intersection are also included in Table 5. The existing turning patterns have been used to determine the forecast patterns.

	IN		OUT		Total
	Left	Right	Left	Right	
New Otaihanga Road intersection					
AM Peak Hour	4	5	11	10	30
PM Peak Hour	7	7	5	5	24
Saturday Midday	9	9	9	9	36
Existing Tieko Street intersection (total movements= existing + consented + proposed)					
AM Peak Hour	0	9	40	2	51
PM Peak Hour	0	32	7	2	41
Saturday Midday	2	33	26	2	63

Table 5: Forecast Vehicle Turning Movements(vph)

Given the low level of traffic activity, the even distribution of traffic flows to and from the east and west along with the inclusion of a right turn bay, the proposed new intersection with Otaihanga Road can be expected to perform with no discernible change in traffic capacity or delays for existing users of Otaihanga Road.

The forecast vehicle turning movements at the Tieko Street intersection amount to around one turning movement per minute at the busiest times. At peak times there are two-way traffic flows through the intersection of up to 150vph. This level of traffic flow includes large gaps in the traffic flow and vehicles will be able to continue to turn to and from Tieko Street with little if any queuing.

4.2 Intersection Safety

The key design parameter with regard to the design of a safe intersection is the available sight lines. The Austroads Guides to Road Design are generally considered to provide best practice guidance in this regard. With the trimming/removal and control of planting close to the Otaihanga Road carriageway, the proposed new intersection can meet the Austroads sight line requirements. The inclusion of the right turn bay will ensure that following traffic can continue along Otaihanga Road without being disrupted.

While there is no history of a safety problem at the Tieko Street intersection, it is recommended that the sight line towards the north from Tieko Street is increased to better match the Austroads guidance, either by adjusting the road markings through the intersection to facilitate shifting the Tieko Street hold line by 1m towards the west or trim the vegetation over a length of 1m back from the power pole immediately to the north of the intersection. This is a maintenance issue, Council have the authority to trim roadside trees on private land for this purpose under the district plan. With this improvement the Austroads sight line provisions can be readily achieved with benefits for existing and future users of the intersection.

4.3 Footpaths and Cycle Lanes

For roads serving more than 20 dwellings or that are longer than 100m, NZS4404: 2010 includes the provision for footpaths on both sides of the road. Given the Rural Residential zoning with the site being on the edge of the urban area along with the no exit nature of the roads with low traffic flows, the inclusion of a footpath in the form of a shared path along one side of each of the roads is considered a balanced approach well matched to the local environment.

While NZS4404:2010 anticipates that cyclists will share the traffic movement lane on roads serving up to 200 dwellings, the standards included in the Proposed District Plan include for cycle paths to be provided on new roads either as on-street cycle lanes, off-street shared paths or off-street dedicated cycle paths. The expectation with the proposed subdivision is that confident (commuter and sports) cyclists will cycle in the traffic lanes and that less confident cyclists can choose to use the shared paths within the site. As such the provision for cyclists within the site is well matched to the District Plan requirements.

The creation of the shared path, pedestrian loop (as opposed to the number of additional dwellings) and lack of footpath in Tieko Street may trigger concerns for pedestrian safety along the section of Tieko Street where there is no footpath. These are exacerbated by overdue roading maintenance on Tieko Street and would ideally be addressed with the addition of a footpath along one side of the road but could also be mitigated by adding ‘share the road’ signs to reinforce to drivers that they need to move around pedestrians and cyclists.

4.4 Construction Traffic

The earthworks have been designed to be contained within the site with areas set aside for unsuitable material and also for topsoil stockpiles. The only material to be imported is roading aggregate with a preliminary estimate of 2,500m^3 of compacted material needed. With a compaction factor of 1.2 and assuming 8m^3 per truckload this equates to 375 loads (750 movements total).

How this relates to daily truck movements will vary due to a number of factors. It is estimated that it would take 15 to 20 minutes to spread each load, so between 3 and 4 loads could be received each hour. With an eight hour working day there might be up to 24 to 32 loads per day with an associated 48 to 64 truck movements equating to 6 to 8 truck movements per hour. Trucks will need to access the site from both Otaihanga Road and Tieko Street. It is understood that a similar number of truck movements could be expected on each approach, that is a total of 375 truck movements with up to 64 truck movements per day or 8 truck movements per hour. In practice the delivery rates will vary and this is considered a high daily estimate of truck activity.

The Proposed District Plan includes a calculation whereby a single rigid truck is equivalent to six vehicle movements. As such, 64 truck movements per day would be equivalent to 384 vehicle movements per day with up to 48 vehicle movements per hour. This level of vehicle activity is similar to that expected with the subdivision completed and occupied. As such, the construction traffic is expected to be able to be safely and efficiently accommodated. It is anticipated that a Construction Traffic Management Plan will be provided to cover such matters as days and hours of construction traffic access, access to the site to avoid trucks queuing on Otaihanga Road, avoiding trucks passing on Tieko Street and the right of way, and wheel washing.

4.5 Positive Effects

The proposed subdivision has a number of positive traffic effects including:

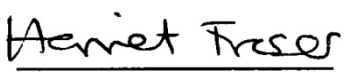
- provision of a shared paths within the site;
- able to take advantage of the proximity to the recreational active mode routes along Otaihanga Road and the Expressway; and
- easy access to the wider road network and to central Paraparaumu and Waikanae via the old SH1 route.

5. Conclusion

The findings of the transportation assessment show that the part of the proposed subdivision accessed via Otaihanga Road can be appropriately, safely and efficiently accommodated with no discernible change in traffic capacity or delays for existing users of Otaihanga Road. Minor overdue safety improvements and maintenance activities including, signage, vegetation trimming and possible lighting of Tieko Street are being discussed directly with Council's roading team. As such it is my view that the part of the proposed subdivision accessed from the end of Tieko Street can be safely accommodated. Any adverse traffic effects associated with the proposed subdivision will be properly mitigated and there will be wider benefits in terms of connectivity for active modes and improved safety for all users of Tieko Street.

Please do not hesitate to be in touch should you require clarification of any of the above.

Yours faithfully



Harriet Fraser

Appendix F – Geotechnical Report

REPORT ON:
GEOTECHNICAL INVESTIGATION

PROJECT:

MANSELL FARM SUBDIVISION
OTAIHANGA RD, PARAPARAUMU

CLIENT: MR RICHARD & MR ALASTAIR MANSELL

C/- CHRIS HANSEN CONSULTANTS LTD
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R-195340402-02

EXECUTIVE SUMMARY

Chris Hansen Consultants Ltd (CHC), on behalf of Mr Richard and Mr Alastair Mansell, engaged Resource Development Consultants Ltd (RDCL) to complete a geotechnical investigation at 131 Otaihanga Rd, Paraparaumu.

We understand the intent is to subdivide the site into forty-nine (49) rural life-style and residential lots. Currently the land is being used as farmland. Our geotechnical investigation and reporting are required to support resource consent application. For the purpose of geotechnical assessment, the proposed development is assumed to be of Importance Level (IL) 2.

Based on results from this investigation we have developed the following generalised soil profile:

- Silty/sandy TOPSOIL to ~0.25m bgl; overlying
- Loose to dense silty SAND to 16m bgl.

Ultimate Bearing Capacity of 300kPa is generally available:

- Between 0.3m and 1.7m bgl.

Liquefaction assessment results indicate little to no risk of liquefaction hazards across the site, including free field settlement and lateral spreading.

Based on the results of our investigation, we consider the proposed development is suitable from a geotechnical perspective following:

- Building setback of at least 5m is maintained from slopes > 15°;
- NZS3604:2011 foundations are considered appropriate.

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FIGURES

APPENDICES

1 OVERVIEW

Chris Hansen Consultants Ltd (CHC), on behalf of Mr Richard and Mr Alastair Mansell, engaged Resource Development Consultants Ltd (RDCL) to complete a geotechnical investigation at 131 Otaihanga Rd, Paraparaumu.

The legal description of the site is LOT 6 DP 53191, SEC 31 SO 505428, PT LOT 5 DP 84524, LOT 1 & LOT 3 DP 303764, LOT 4 DP 84524, LOT 3 DP 84524, LOT 2 DP 84524.

This geotechnical investigation report is to meet the requirements for:

- Resource consent application, including:
  - Confirmation of site suitability; and
  - Recommendations for foundations and earthworks.

1.1 UNDERSTANDING OF THE PROJECT

RDCL have been supplied with scheme plans for the proposed subdivision, prepared by Cuttriss Consultants Ltd (Ref. 22208 SCH1, Revision C, dated November 2020).

We understand the intent is to subdivide the site into forty-nine (49) rural life-style and residential lots. A detailed Project Description is provided in Section 3 of the AEE accompanying the resource consent applications.

In summary, the proposal involves the subdivision of 17ha (western) portion of the Mansell Farm into 49 lots: 22 rural life-style lots in the northern part of the site, and 27 residential lots adjacent to Otaihanga Road in the south of the site. Access to 19 of the rural life-style lots in the north will be via Tieko Street, and the remainder of the rural-lifestyle and residential lots will be accessed via Otaihanga Road.

The proposed subdivision of this area involves earthworks, construction of roads, installation of services and identification of notional 20m building circle areas on the rural life-style lots.

1.2 SCOPE OF WORK

This work was completed in general accordance with RDCL proposal 19534, issued to the client on 16th August 2019.

2 SITE DESCRIPTION

The proposed subdivision is located within sand dunes in the centre of Otaihanga.

The site is currently farmland comprising:

- Predominantly gently to steeply sloping rolling dunes (approximately 18.15ha):
  - With localised areas of ponding (Figure 1).

2.1 REGIONAL GEOLOGICAL MAPPING

GNS maps indicate the proposed subdivision is underlain by:

- Holocene windblown sand deposits (inactive sand dunes).

2.2 GEOHAZARDS

2.2.1 ACTIVE FAULTS

No active faults directly impacting the site have been identified in the New Zealand Active Faults Database (GNS Science, 2018).

The Wairau Fault is approximately 17km east of the site. This fault requires a near fault factor in accordance with NZS1170.5:2004.

2.2.2 FLOODING

The KCDC natural hazard maps indicate the proposed subdivision site is:

- Susceptible to ponding within low lying areas.

2.2.3 LIQUEFACTION RISK

GWRC hazard mapping for this region indicates that the proposed development has:

- A liquefaction risk category of “high”;
- A ground shaking hazard rating of “moderate”; and
- A combined hazard rating of “moderate-high”.

3 SITE INVESTIGATION

RDCL carried out a general site walkover and subsurface field testing (Figure 1), which comprised:

- Seventeen (17) test pits;
  - terminated between 1.7-3.0m bgl;
- Sixteen (16) Dynamic Cone Penetrometer (DCP) tests;
  - terminated between 0.5-2.4m bgl, and
- Eleven (11) CPT tests,
  - terminated between 4.5-16.6m bgl.

Test pits and DCPs were completed in dry summer conditions.

CPTs were carried out in spring conditions.

Site investigation logs are in Appendix A.

3.1 SUBSURFACE CONDITIONS

We have developed several simplified soil profiles based on our investigations. Shallow profiles were developed based on results of test pit investigations. Deep soil profiles were developed based on results from CPT testing.

Full investigation logs are available in Appendix A.

3.1.1 SHALLOW SOIL PROFILE

Test pit investigations show that shallow conditions generally comprise:

- Silty/sandy TOPSOIL to ~0.25 – 0.6m bgl; underlain by
- Loose to dense silty SAND to at least 3.0m bgl.

Test locations fell into categories; dune crests, or low lying dune edges and valleys.

- Dune crest materials generally comprise dry, silty, sand (fine) that is loose at surface and becomes more dense with depth.
- Low lying dune edges and valleys generally comprise medium dense to dense, silty sand that is wet to saturated and tends to be dilatant.
- Topsoil in TP03 was deep (0.6m bgl) and highly peaty.

3.1.2 Deep Soil Profile

Deep soil testing comprised CPT testing. A simplified soil profile correlated to Soil Behaviour Type (SBT) indicate the site is generally underlain by:

- Sand and silty sand (sands) interbedded with silty sand to sandy silt (sand mixtures) to at least 16.62m bgl.

3.2 Groundwater

Groundwater levels encountered during site investigations are in Table 1.

Table 1: Depth to Groundwater as Encountered During Site Investigations

Test ID	Groundwater Level (m bgl)
TP01	1.7
TP02	2.5
TP03	1.6
TP06	1.6
TP10	1.8
TP11	1.4
TP12	2.1
TP13	2.9

4 GEOTECHNICAL ASSESSMENT

4.1 SHALLOW BEARING CAPACITY

We identified no significant peat or organic soil deposits in this investigation in regard to potential for static settlements.

DCP test results have been correlated to Ultimate Bearing Capacity (UBC) in accordance with Stockwell (1977) (Table 2).

Depth to 200kPa ultimate soil bearing capacity was identified:

- between 0.2m and 1.3m bgl.

Depth to 300kPa ultimate soil bearing capacity was identified:

- between 0.3m and 1.7m bgl.

TABLE 2: SUMMARY OF SHALLOW ULTIMATE BEARING CAPACITY

Test ID	Indicative Depth to 200 kPa UBC (m bgl)	Indicative Depth 300 kPa UBC (m bgl)
DCP01	0.2	0.3
DCP02	1.3	1.7
DCP03	1.1	1.4
DCP04	0.6	0.7
DCP05	0.4	0.4
DCP06	0.4	0.9
DCP07	0.3	0.9
DCP08	0.7	1.1
DCP09	0.3	1.2
DCP10	0.4	0.9
DCP11	0.2	0.8
DCP12	0.4	1.1
DCP13	0.2	1.1
DCP14	0.9	1.0
DCP15	1.1	1.1
DCP16	0.4	0.9

4.3 SEISMIC SOIL CLASS

The site is classified as site subsoil "Class D Site" in accordance with NZS1170.5:2004, part 5: Earthquake Actions – New Zealand; based on

- NZGD borehole record BH_76860 to a depth of 63m bgl, roughly 150m southeast of the south corner of the site.

4.4 LIQUEFACTION ASSESSMENT

4.4.1 LIQUEFACTION POTENTIAL

A liquefaction assessment was carried out on the results of the CPT investigation, which indicates:

- Low risk of liquefaction during Serviceability Limit State (SLS) design seismic event, with
  - LSN of 0, indicating little to no expression of liquefaction; and
- Low risk of liquefaction during Ultimate Limit State (ULS) design seismic event, with
  - LSN of 0 to 0.461, indicating little to no expression of liquefaction.

Results are presented in Appendix B.

4.4.2 VERTICAL SETTLEMENT

The settlements presented in Table 3 are estimates of the free field settlement, which is the amount of vertical settlement anticipated in the site. These values do not necessarily represent actual building settlement resulting from structural loading.

Estimated vertical settlement during SLS and ULS design seismic events is in Table 3.

TABLE 3: ESTIMATED VERTICAL SETTLEMENT DURING SLS AND ULS DESIGN SEISMIC EVENTS

Design Seismic Event	Test ID	Vertical Settlement (mm)	LSN
SLS	CPT01	0	0
	CPT02	0	0
	CPT03	0	0
	CPT04	0	0
	CPT05	0	0
	CPT06	0	0
	CPT07	0	0
	CPT08	0	0
	CPT09	0	0
	CPT10	0	0
	CPT11	0	0
ULS	CPT01	1.1	0.461
	CPT02	0.5	0.124
	CPT03	0.5	0
	CPT04	0.4	0.187
	CPT05	0	0
	CPT06	0	0
	CPT07	0	0
	CPT08	1.8	0.274
	CPT09	1.0	0.187
	CPT10	0	0
	CPT11	0.9	0.116

4.4.3 LATERAL SPREAD ASSESSMENT

Lateral spreading occurs on sites which have un-retained free faces or slopes combined with liquefaction risk. When the site liquefies, soil moves towards the free face or slope resulting in cracks developing as the soil displaces.

Estimated lateral spread during SLS and ULS design seismic events is in Table 4.

TABLE 4: ESTIMATED LATERAL SPREAD DURING SLS AND ULS DESIGN SEISMIC EVENTS

Design Seismic Event	Test ID	Lateral Spread (mm)	LSN
SLS	CPT01	0	0
	CPT02	0	0
	CPT03	0	0
	CPT04	0	0
	CPT05	0	0
	CPT06	0	0
	CPT07	0	0
	CPT08	0	0
	CPT09	0.6	0
	CPT10	0	0
	CPT11	0.2	0
ULS	CPT01	18	0.461
	CPT02	4	0.124
	CPT03	15	0
	CPT04	7	0.187
	CPT05	0	0
	CPT06	0	0
	CPT07	1	0
	CPT08	29	0.274
	CPT09	15	0.187
	CPT10	0	0
	CPT11	10	0.116

4.4.4 BASIS OF ASSESSMENT

The liquefaction assessment for the site was carried out using CLiq (accepted industry software package), CPT data of current ground conditions and the following input parameters (NZTA Bridge Manual v.3.2 section 5 [NZ Transport Agency, 2013]):

- Magnitude (M) = 6.2 SLS & 6.9 ULS;
- PGA = 0.08g (SLS) & 0.34g (ULS), based on:
  - $C_{0,\,1000}$ = 0.44 (map 6.1a),
  - f = 1.0 (Class D Soil), and
  - R = 0.25 (SLS) & 1 (ULS)
- Groundwater levels taken from CPT measurements.

Lateral spreading assessment was carried out for a generic model of gently sloping ground with a slope grade of S (%) = 1.00.

The design earthquake was chosen based on probability of recurrence, which is based on historical earthquakes. A 50 year design life was assigned. For an importance level 2 building, this correlates with a 25 year return period (SLS) and 500 year return period (ULS).

5 GEOTECHNICAL RECOMMENDATIONS

5.1 GEOTECHNICAL SITE SUITABILITY

Results of our liquefaction assessment indicate little to no risk of liquefaction for this site.

Based on the results of this investigation, we consider the proposed development is suitable from a geotechnical perspective, following our recommendations below.

5.2 FOUNDATION RECOMMENDATIONS

NZS3604:2011 shallow foundations are considered suitable for the overall site. Building platforms will require testing to confirm site requirements in accordance with NZS3604:2011.

5.3 SETBACK FROM SLOPES

We observed evidence of shallow slope instability localised to a single dune (see Figure 1).

A nominal setback of 5.0m from slopes of > 15° is recommended to protect against the potential for shallow slope instability.

5.4 PARAMETERS FOR EARTHWORKS AND/OR RETAINING

We recommend the following slope limits for earthworks design; for:

- Permanent batters in:
  - Loose material 1V:2H; and
  - Dense material 1V:1.5H.
- Temporary batters in:
  - Loose Material 1V:1.5H; and
  - Dense material 1V:1H.

We recommend the following geotechnical parameters are adopted for retaining wall design:

TABLE 5: ESTIMATED EFFECTIVE SOIL PARAMETERS (DRAINED)

Soil Type	Friction Angle, ϕ' (°)	Cohesion, c' (kPa)	Density (kN/m^3)
Loose Silty Sand	30	0	15
Dense Silty Sand	40	0	20

5.5 ROAD CONSTRUCTION

Results of DCP testing have been correlated with California Bearing Ratio (CBR).

For loose silty sands, we recommend an average of 7% CBR for roading construction.

CBR values presented here are based on test results at the time of our investigations and should be re-evaluated once the project enters the building consent stage.

6 FURTHER GEOTECHNICAL INPUT

We recommend a suitably qualified geotechnical professional be engaged:

- To confirm bearing for specific house foundations at the time of construction;
- To provide construction monitoring and issue a Statement of Professional Opinion on Suitability of Land for Construction; and/or
- Should ground conditions be found to differ from those contained in this report.

7 REFERENCES

1. Dellow, G.D.; Abbott, E.R.; Heron, D.W.; Scott, B.J.; Ries, W.F.; Lukovic, B. 2016. *Update of hazard Information for 2015 Lifelines Risk & Responsibilities Report, GNS Science Consultancy Report 2016/40*. 33 p.
2. GNS Science. 2000. WELLINGTON. *Institute of Geological and Nuclear Sciences, 1:250,000 Geological Map 10*. (Begg, J.G.; Johnston, M.R., Compilers) GNS Science.
3. GNS Science. 2015. *New Zealand Active Faults Database: Active Faults 250K.* [online] Available at https://data.gns.cri.nz/af/ [Accessed 15 May. 2019].
4. Ministry of Business, Innovation and Employment. 2012. *Guidance: Repairing and rebuilding houses affected by the Canterbury earthquakes (Part A: Technical Guidance)*. Wellington: Ministry of Business, Innovation and Employment.
5. NZ Transport Agency. 2013. *Bridge Manual*. NZTA SP/M/022 version 3.2. Wellington: New Zealand Transport Agency.
6. Standards New Zealand. 2004. *Structural Design Actions Part 5: Earthquake Actions*. NZS 1170.5:2004. Wellington: Standards New Zealand.
7. Standards New Zealand. 2011. *Timber-framed Buildings*. NZS3604:2011. Wellington: Standards New Zealand.
8. Standards New Zealand. 1989. *Code of Practice for Earthfill for Residential Development. NZS4431:1989*. Wellington: Standards New Zealand.
9. Stockwell, M. 1977. *Determination of allowable bearing pressure under small structures*. New Zealand Engineering, 32(6), pp.132-135.

8 LIMITATIONS

- This report has been prepared for the particular purpose outlined in the project brief and no responsibility is accepted for the use of any part in other contexts or for any other purpose.
- Ground conditions assessed in this report are inferred from published sources, site inspection and the investigations described. Variations from the interpreted conditions may occur, and special conditions relating to the site may not have been revealed by this investigation, and which are therefore not taken into account. No warranty is included either expressed or implied that the actual conditions will conform to the interpretation contained in this report.
- No responsibility is accepted by Resource Development Consultants Ltd for inaccuracies in data supplied by others. Where data has been supplied by others, it has been assumed that this information is correct.
- Groundwater conditions can vary with season or due to other events. Any comments on groundwater conditions are based on observations at the time.
- This report is provided for sole use by the client and Kāpiti Coast District Council (KCDC) and is confidential to the client and their professional advisors. No responsibility whatsoever for the contents of this report shall be accepted for any person other than the client.

9 CLOSURE

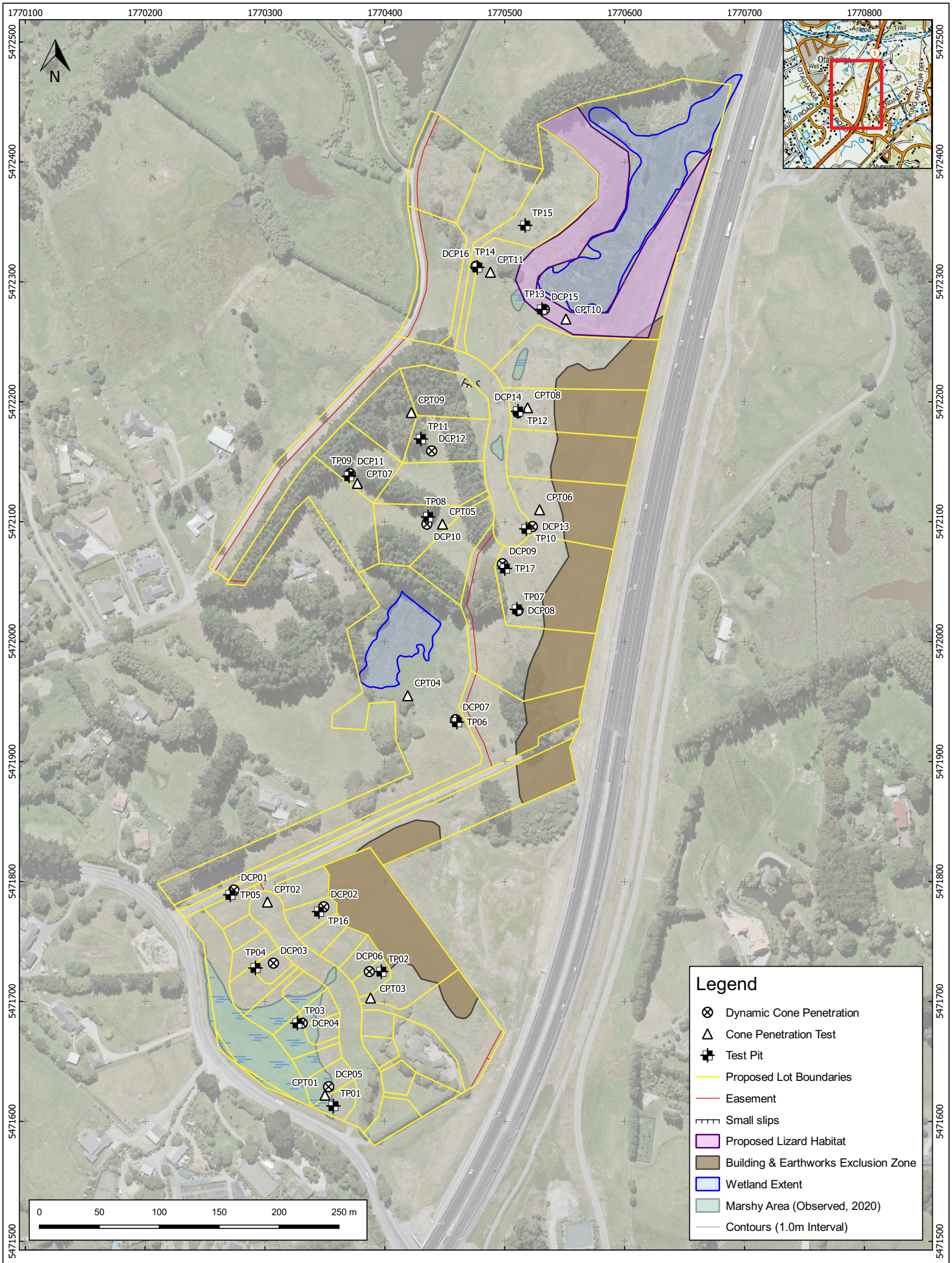
We trust this meets your current needs. Should you wish to discuss any aspect of the contents of this document please contact the undersigned on 06 877-1652.

Sincerely,

Rachael Delaney	Jethro Neeson	Cam Wylie
MSc	BEng, NZGS	MSc; MIPENZ; CPEng
Engineering Geologist	Geotechnical Engineer	Principal

Attachments:
Figure 1: Site Investigation Layout
Appendix A: Site Investigation Logs
Appendix B: Liquefaction Assessment Results
Important Information about this Geotechnical Report

FIGURE 1: SITE INVESTIGATION LAYOUT



RDCL	RDCL PO Box 28057 8/308 Queen St East Hastings, NZ Tel: +64 6 8771652 Fax: +64 6 877 5015 Email: info@rdcl.co.nz	Title	Investigation Layout	Drawn By RD	Date 22/02/21	A3
		Project	195340402 - 131 Otaihanga Rd	Checked By JJN	Date 22/02/21	Figure 1
		Client	Mr Richard & Mr Alastair Mansell	Approved By JJN	Date 22/02/21	Rev. 2

APPENDIX A: SITE INVESTIGATION LOGS

TEST PIT LOG

TP01

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770357.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471613.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0		TS	Silty TOPSOIL, with trace sand; dark brown. Moist; sand, fine; rootlets.	M					
				Silty SAND, with trace clay; brown; blocky. Soft to firm; non-plastic; moist; sand, fine; rootlets.		S - FM				
0.5	-0.5			Silty SAND, with trace rootlets; dark brown. Loose; wet; sand, fine; becoming blocky and tannish grey with depth.	W	L				
1.0	-1.0									
1.5	-1.5	▼		Silty SAND; blue; blocky. Medium dense; dilatant; saturated; sand, fine.	S	MD				
2.0	-2.0			EOH: 2.10m						
2.5	-2.5									

REMARKS

SYMBOLS

▼ Standing Water Level

◁– Out flow

▷– In flow

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TEST PIT LOG

TP02

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770397.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471725.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Silty TOPSOIL, with some clay, with trace sand; brown. Moist; sand, fine; rootlets.	M					
0.5	-0.5			Silty SAND, with some rootlets; tan; blocky. Loose to medium dense; moist becoming wet; sand, fine; becoming yellowish tan with trace iron staining with depth.	M becoming W	L - MD				
1.0	-1.0									
1.5	-1.5			Silty SAND; greyish blue. Medium dense; dilatant; wet; sand, fine.	W	MD				
2.0	-2.0									
2.5	-2.5	▼		EOH: 2.50m						

REMARKS

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP03

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770327.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471682.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0			TS	TOPSOIL (PEATY), with trace sand; very dark brown. Soft; moist to dry; peat, fibrous; sand, fine; trace logs up to 1.0m long; eggy odour; rootlets.	M - D	S				
0.5	-0.5			Silty SAND, with trace rootlets; dark brown; blocky. Medium dense; non-plastic; wet; sand, fine.	W	MD				
1.0	-1.0			Silty SAND; blueish grey. Medium dense; wet; sand, fine.						
1.5	-1.5	▼		Silty SAND, with trace rootlets; greyish blue becoming blue; blocky. Medium dense; wet to saturated; sand, fine.	W - S					
2.0	-2.0			EOH: 2.20m						
2.5	-2.5									

REMARKS

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP04

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770292.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471728.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with some sand; dark brown. Moist; sand, fine; rootlets.	M	L				
0.5	-0.5			Silty SAND; yellowish tan. Loose; moist; sand, fine; becoming greyish tan at 1.1m bgl.						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0			EOH: 2.30m						
2.5	-2.5									

REMARKS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP05

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770271.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471789.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Moist; sand, fine; rootlets.	M					
0.5	-0.5			Silty SAND; tan. Very loose; non-plastic; dry becoming moist; sand, fine.	D becoming M	VL				
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5			EOH: 2.60m						

REMARKS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP06

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770460.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471933.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Silty TOPSOIL, with trace sand; dark brown. Dry to moist; sand, fine; rootlets.	D - M					
0.5	-0.5			Sandy SILT; tan; blocky. Loose to medium dense; moist; sand, fine; rootlets.	M	L - MD				
1.0	-1.0			Silty SAND; blueish grey. Medium dense; wet; sand, fine.						
1.5	-1.5	▼			W	MD				
				EOH: 1.90m						
2.0	-2.0									
2.5	-2.5									

REMARKS

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP07

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770510.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472027.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; brown. Moist to dry; sand, fine; rootlets.	M - D					
0.5	-0.5			Sandy SILT, with some roots; tan/greyish brown. Loose; dry; sand, fine.	D	L				
1.0	-1.0			Silty SAND; yellowish tan; blocky. Loose to dense; dry; sand, fine; becoming moist with depth.						
1.5	-1.5									
2.0	-2.0					L - D				
2.5	-2.5			EOH: 3.00m						

REMARKS

Pine roots throughout.

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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TEST PIT LOG

TP08

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770436.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472104.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Sandy TOPSOIL, with some silt; dark brown. Dry to moist; sand, fine; rootlets.						
0.5	-0.5	Groundwater Not Encountered		Silty SAND; tan. Loose; dry to moist; sand, fine; becoming moist with depth.	D - M	L				
1.0	-1.0									
1.5	-1.5			EOH: 1.80m						
2.0	-2.0									
2.5	-2.5									

REMARKS

SYMBOLS

- ▼ Standing Water Level
- ◁– Out flow
- ▷– In flow

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TEST PIT LOG

TP09

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770370.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472138.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Sandy TOPSOIL, with some silt; dark brown. Dry to moist; sand, fine; rootlets.	D - M					
0.5	-0.5			Silty SAND; tan. Loose; dry; sand, fine; rootlets.	D	L				
1.0	-1.0									
1.5	-1.5			EOH: 1.70m						
2.0	-2.0									
2.5	-2.5									

REMARKS

Pine roots throughout.

SYMBOLS

- ▼ Standing Water Level
- ◁– Out flow
- ▷– In flow

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TEST PIT LOG

TP10

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770518.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472094.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0			TS	Sandy TOPSOIL, with trace silt; dark brown. Moist to dry; sand, fine; rootlets.	M - D					
0.5	-0.5			Silty SAND, with trace rootlets; tan. Loose to medium dense; moist; sand, fine.	M	L - MD				
1.0	-1.0			Silty SAND; grey with orange mottle. Medium dense; dilatant; saturated; sand, fine; orange mottle inferred to be iron staining.	S	MD				
1.5	-1.5	▼								
2.0	-2.0			EOH: 2.20m						
2.5	-2.5									

REMARKS

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP11

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770430.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472169.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0		TS	Sandy TOPSOIL, with trace silt; dark brown; blocky. Moist; sand, fine.						
				Silty SAND; reddish brown. Loose; moist; sand, fine.	M	L				
0.5	-0.5									
				Silty SAND, with trace rootlets; grey; blocky. Medium dense; wet; sand, fine.	W	MD				
1.0	-1.0	▼								
1.5	-1.5									
				EOH: 2.00m						
2.0	-2.0									
2.5	-2.5									

REMARKS

Roots throughout.

SYMBOLS

▼ Standing Water Level

◁– Out flow

▷– In flow

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TEST PIT LOG

TP12

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770511.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472192.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0			TS	Sandy TOPSOIL, with some silt, with trace clay; dark brown. Moist; sand, fine; rootlets.						
0.5	-0.5			Silty SAND, with trace iron stain; tan. Loose to medium dense; moist; sand, fine.	M	L - MD				
1.0	-1.0			Silty SAND, with trace iron stain; grey. Medium dense; wet; sand, fine.						
1.5	-1.5				W	MD				
2.0	-2.0	▼		EOH: 2.10m						
2.5	-2.5									

REMARKS

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP13

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770531.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472277.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS TS	Sandy TOPSOIL, with trace silt; dark brown. Moist; sand, fine; rootlets.	M					
0.5	-0.5			Silty SAND; tan. Loose; moist to dry; sand, fine.	M - D	L				
1.0	-1.0			Silty SAND; dark tan. Loose to medium dense; moist; sand, fine; becoming wet and greyish tan from 1.9m bgl.	M	L - MD				
1.5	-1.5									
2.0	-2.0									
2.5	-2.5	▼		EOH: 2.90m						

REMARKS

SYMBOLS

▼ Standing Water Level

◁– Out flow

▷– In flow

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TEST PIT LOG

TP14

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770477.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472312.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Dry; sand, fine; rootlets.	D	L				
0.5	-0.5			Silty SAND, with trace rootlets; tan. Loose; dry; sand, fine; some iron staining starting at 0.9m bgl.						
1.0	-1.0									
1.5	-1.5			EOH: 1.80m						
2.0	-2.0									
2.5	-2.5									

REMARKS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP15

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28/02/2020
PROJECT:	195340402	EASTING:	1770517.00	FINISHED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472347.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 28/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0			TS	Sandy TOPSOIL, with some silt; light brown. Dry; sand, fine; rootlets.	D					
0.5	-0.5	Groundwater Not Encountered		Silty SAND; tan. Loose becoming medium dense; dry becoming moist; sand, fine; rootlets.	D becoming M	L becoming MD				
1.0	-1.0									
1.5	-1.5			EOH: 1.90m						
2.0	-2.0									
2.5	-2.5									

REMARKS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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TEST PIT LOG

TP16

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770345.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471775.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0		Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Moist to dry; sand, fine.	M - D					
0.5	-0.5			Silty SAND, with trace rootlets; tan. Loose; dry to moist; sand, fine.	D - M	L				
1.0	-1.0			Silty SAND, with trace iron stain; tan; blocky. Loose to medium dense; moist; sand, fine; trace rootlets.	M	L - MD				
1.5	-1.5									
2.0	-2.0									
2.5	-2.5			EOH: 2.90m						

REMARKS

Buried topsoil (likely ancient) at 0.6m bgl.

SYMBOLS

- ▼ Standing Water Level
- ◁– Out flow
- ▷– In flow

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TEST PIT LOG

TP17

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27/02/2020
PROJECT:	195340402	EASTING:	1770500.00	FINISHED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472061.00		
	131 Otaihanga Rd	DATUM:	-	LOGGED BY:	MT/RD
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Draft data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DATE: 27/02/2020

DATE:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	0.0	Groundwater Not Encountered	TS	Sandy TOPSOIL, with trace silt; dark brown. Moist; sand, fine; rootlets.	M					
0.5	-0.5			Silty SAND; tan. Dry to moist; sand, fine; trace blocky iron-pan inclusions.	D - M					
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5			EOH: 2.50m						

REMARKS

SYMBOLS

- ▼ Standing Water Level
- ◁– Out flow
- ▷– In flow

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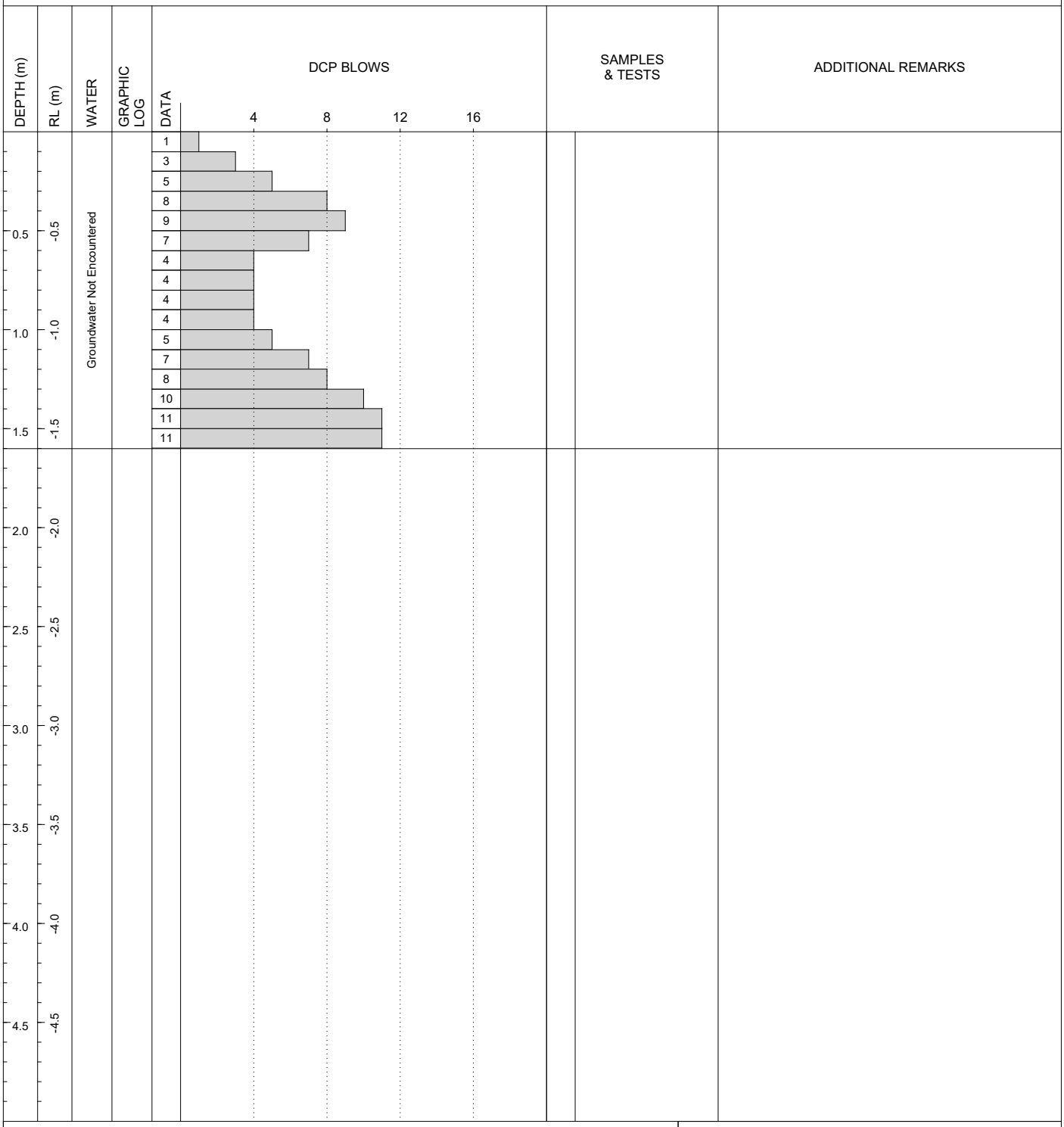
DCP LOG

DCP01

SHEET 1 OF 1

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION: 131 Otaihanga Rd
PROJECT: 195340402	EASTING: 1770274.00	STARTED: 27/02/2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471793.00	FINISHED: 27/02/2020
	DATUM: -	LOGGED BY: MT/RD DATE: 27/02/2020
OFFICE: RDCL - Hastings	ELEVATION: -	CHECKED BY: DATE:
ENGINEER:	AZUMITH: PLUNGE: 90°	STATUS: Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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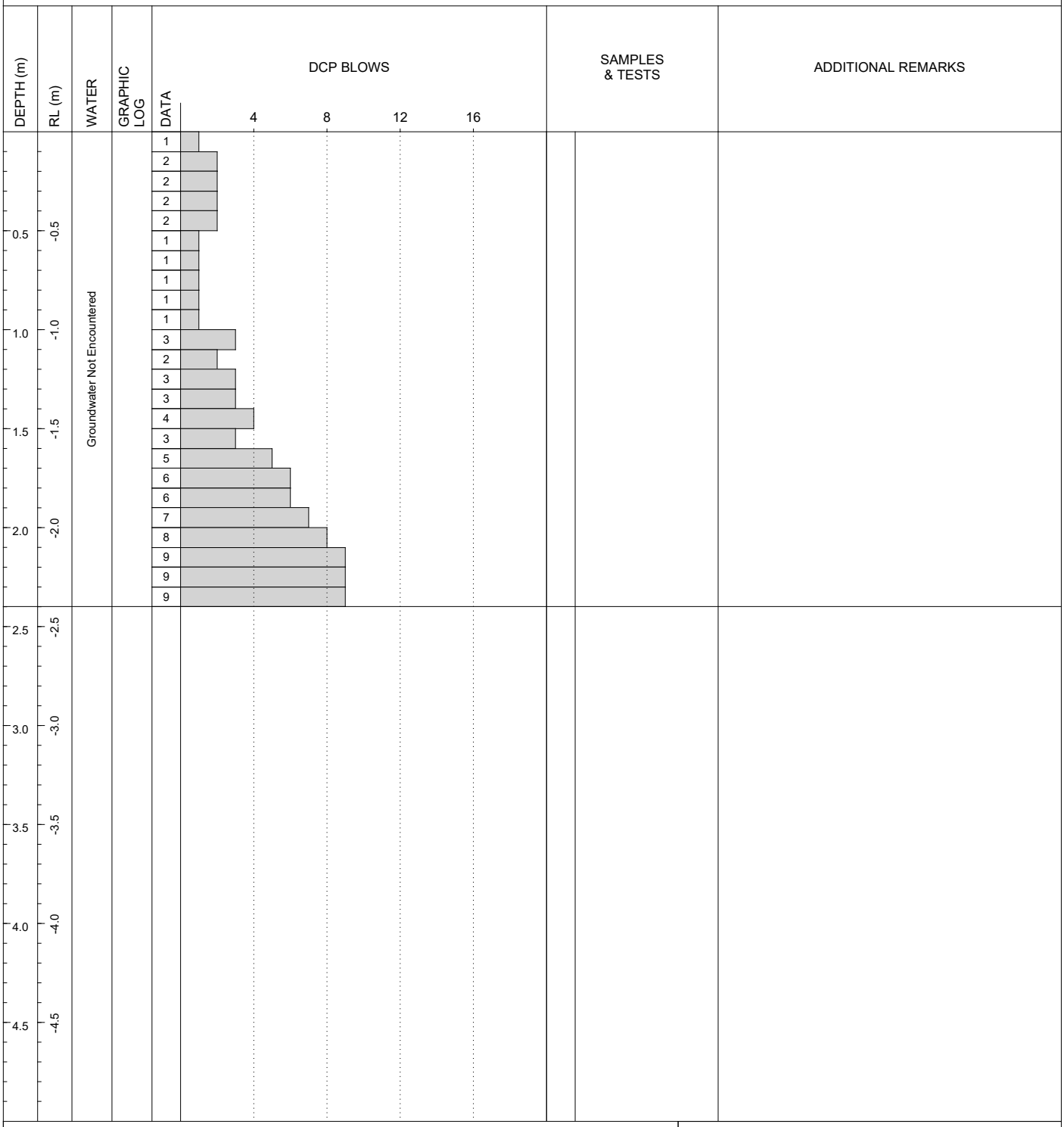
DCP LOG

DCP02

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770349.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471779.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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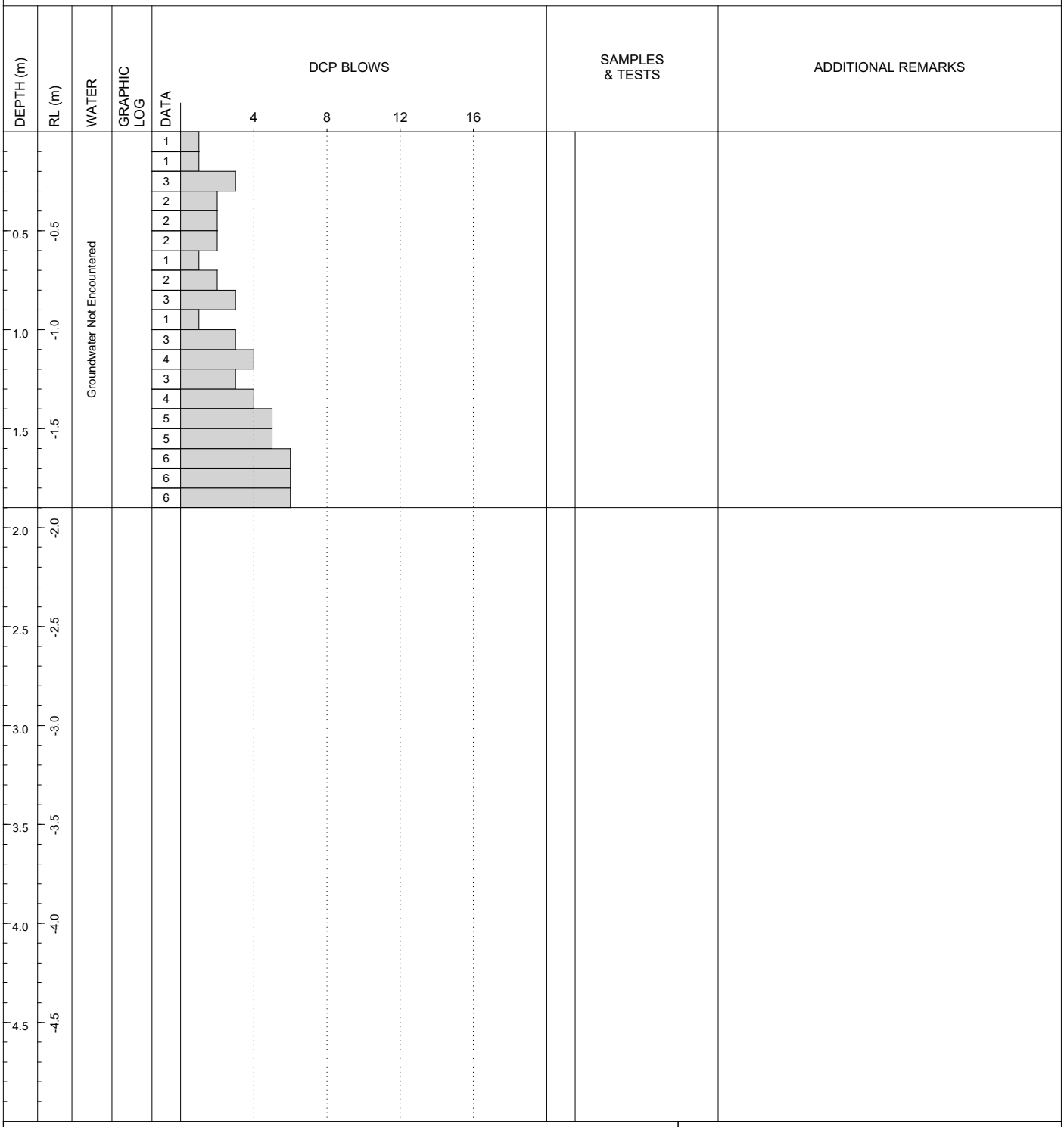
DCP LOG

DCP03

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770307.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471732.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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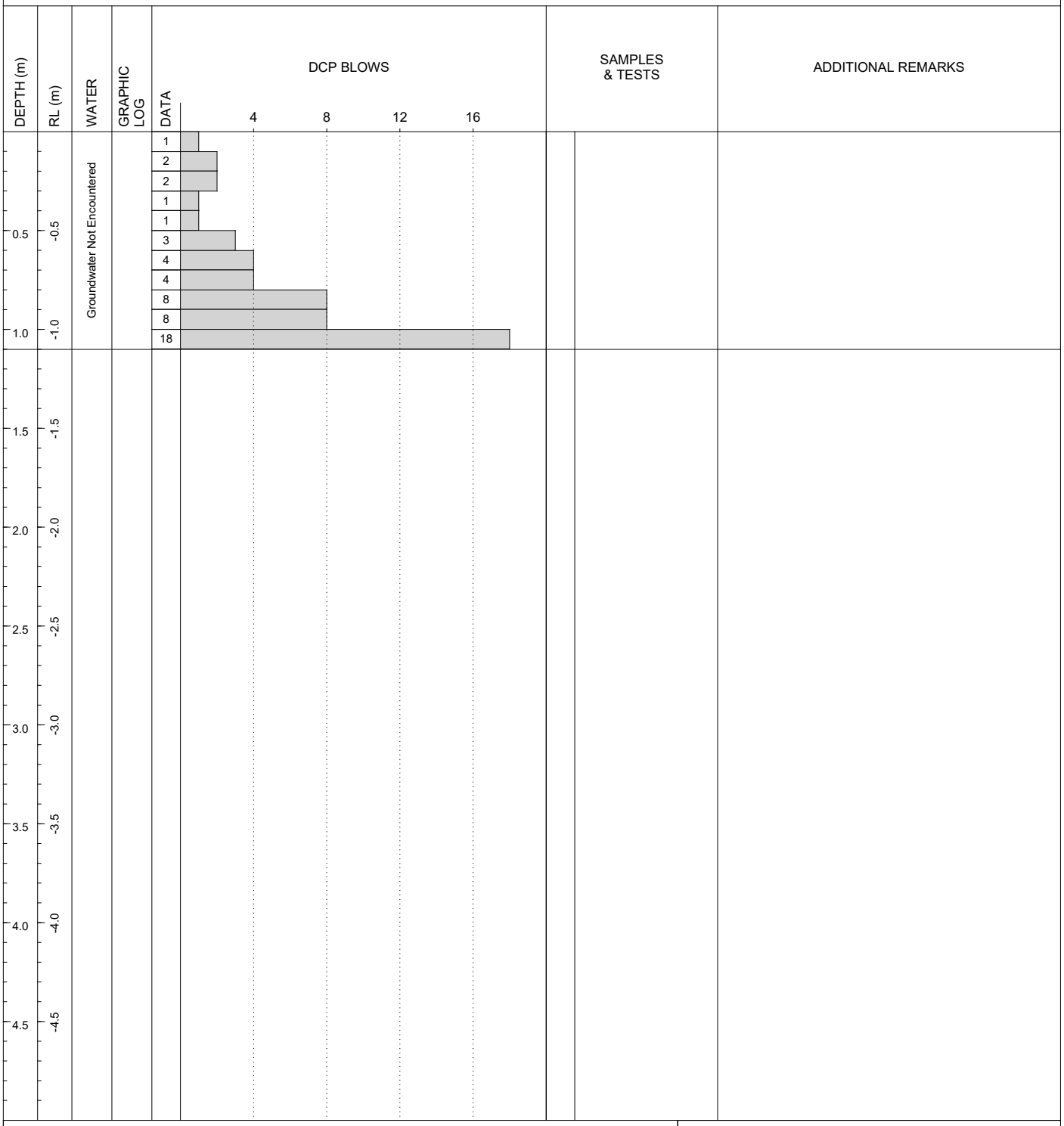
DCP LOG

DCP04

SHEET 1 OF 1

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION: 131 Otaihanga Rd
PROJECT: 195340402	EASTING: 1770331.00	STARTED: 27/02/2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471682.00	FINISHED: 27/02/2020
	DATUM: -	LOGGED BY: MT/RD DATE: 27/02/2020
OFFICE: RDCL - Hastings	ELEVATION: -	CHECKED BY: DATE:
ENGINEER:	AZUMITH: PLUNGE: 90°	STATUS: Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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DCP LOG

DCP05

SHEET 1 OF 1

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION: 131 Otaihanga Rd
PROJECT: 195340402	EASTING: 1770353.00	STARTED: 27/02/2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471629.00	FINISHED: 27/02/2020
	DATUM: -	LOGGED BY: MT/RD DATE: 27/02/2020
OFFICE: RDCL - Hastings	ELEVATION: -	CHECKED BY: DATE:
ENGINEER:	AZUMITH: PLUNGE: 90°	STATUS: Draft data

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	-0.5	dwater Not Encoun		2			
				2			
				2			
				7			
0.5				13	Double bounce		
1.0	-1.0						
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						
4.0	-4.0						
4.5	-4.5						

DCP BLOWS: 4, 8, 12, 16

REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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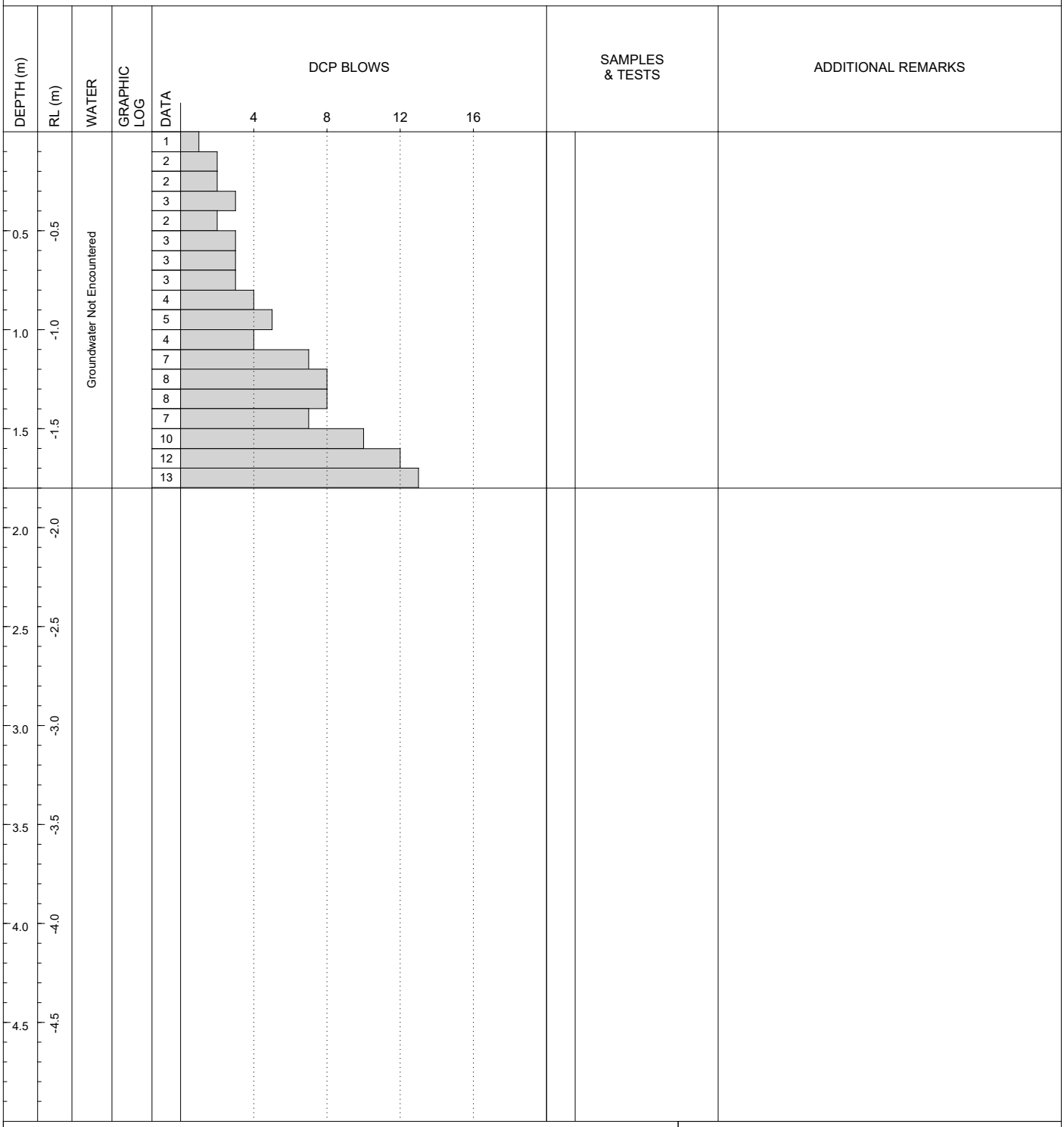
DCP LOG

DCP06

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770387.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471725.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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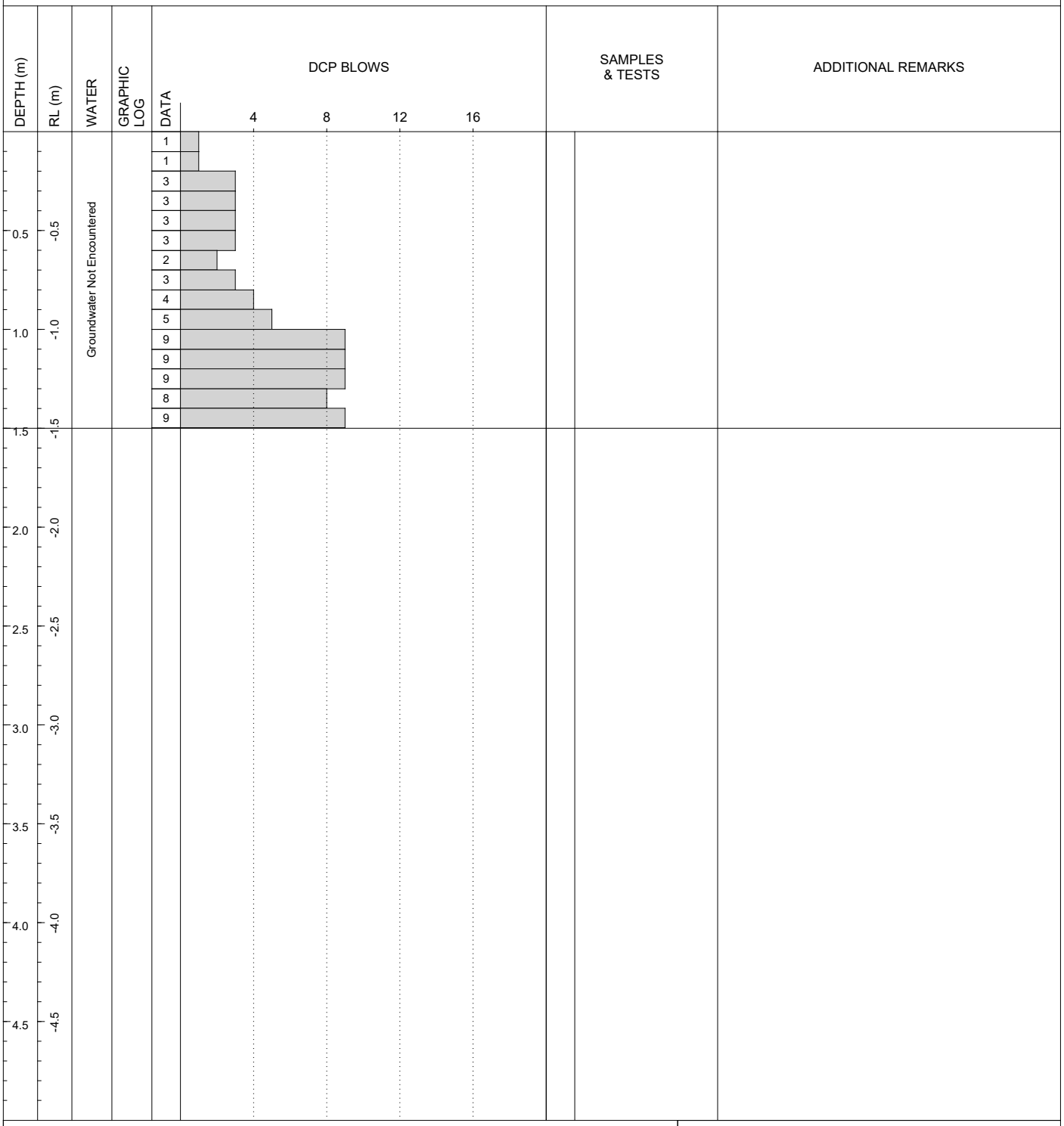
DCP LOG

DCP07

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770459.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471935.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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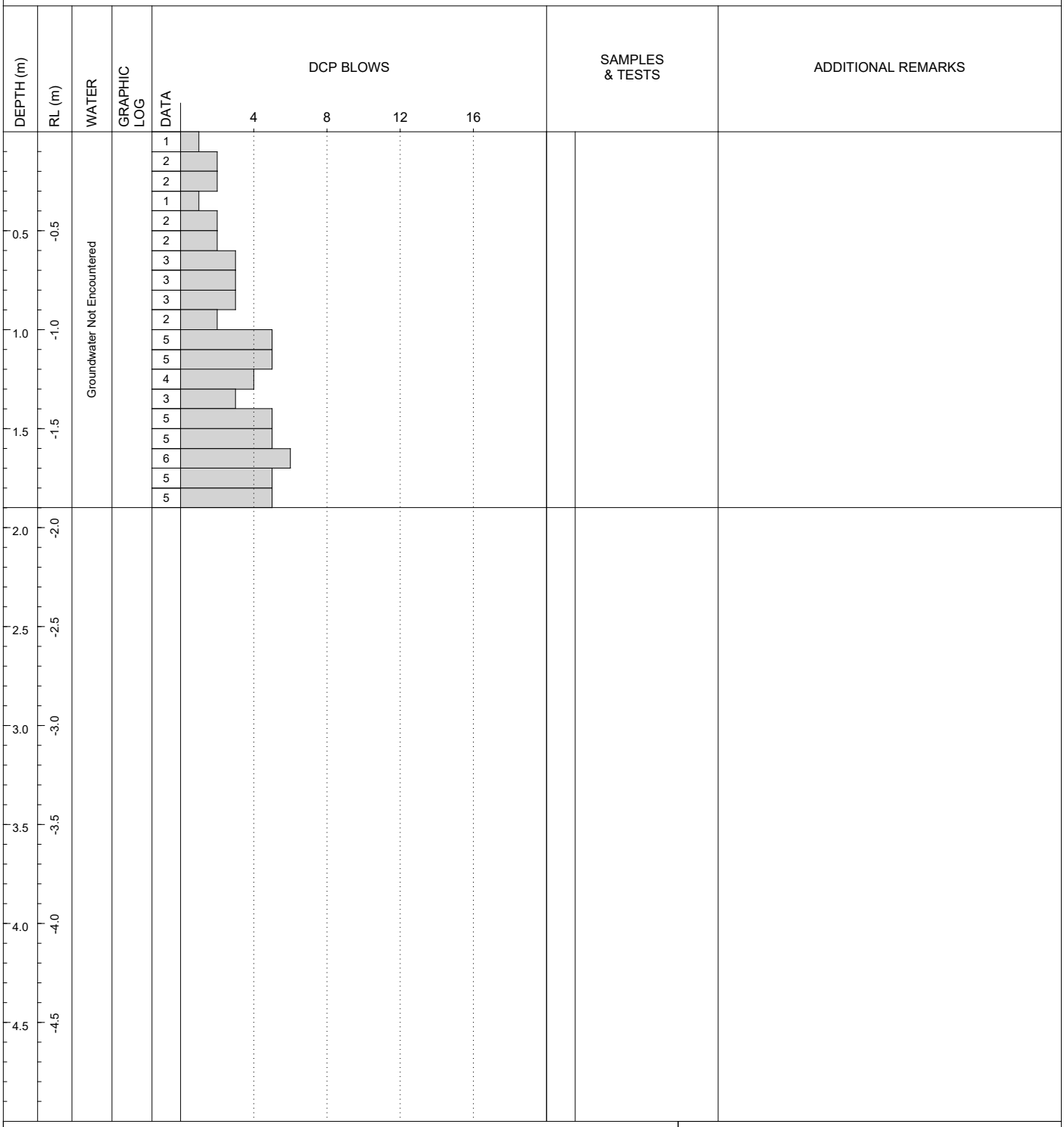
DCP LOG

DCP08

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770511.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472026.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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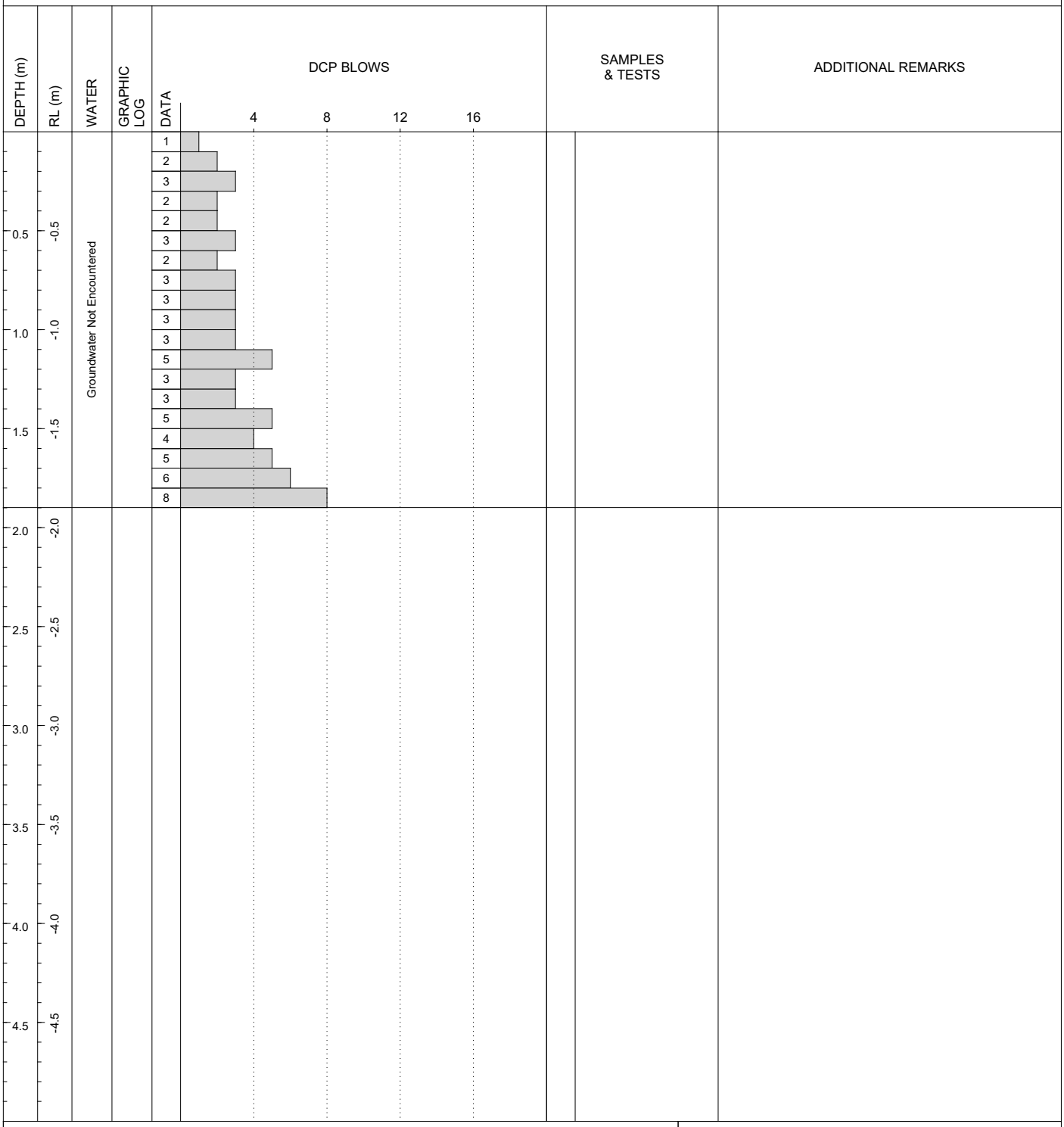
DCP LOG

DCP09

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770498.00	STARTED:	27/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472065.00	FINISHED:	27/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 27/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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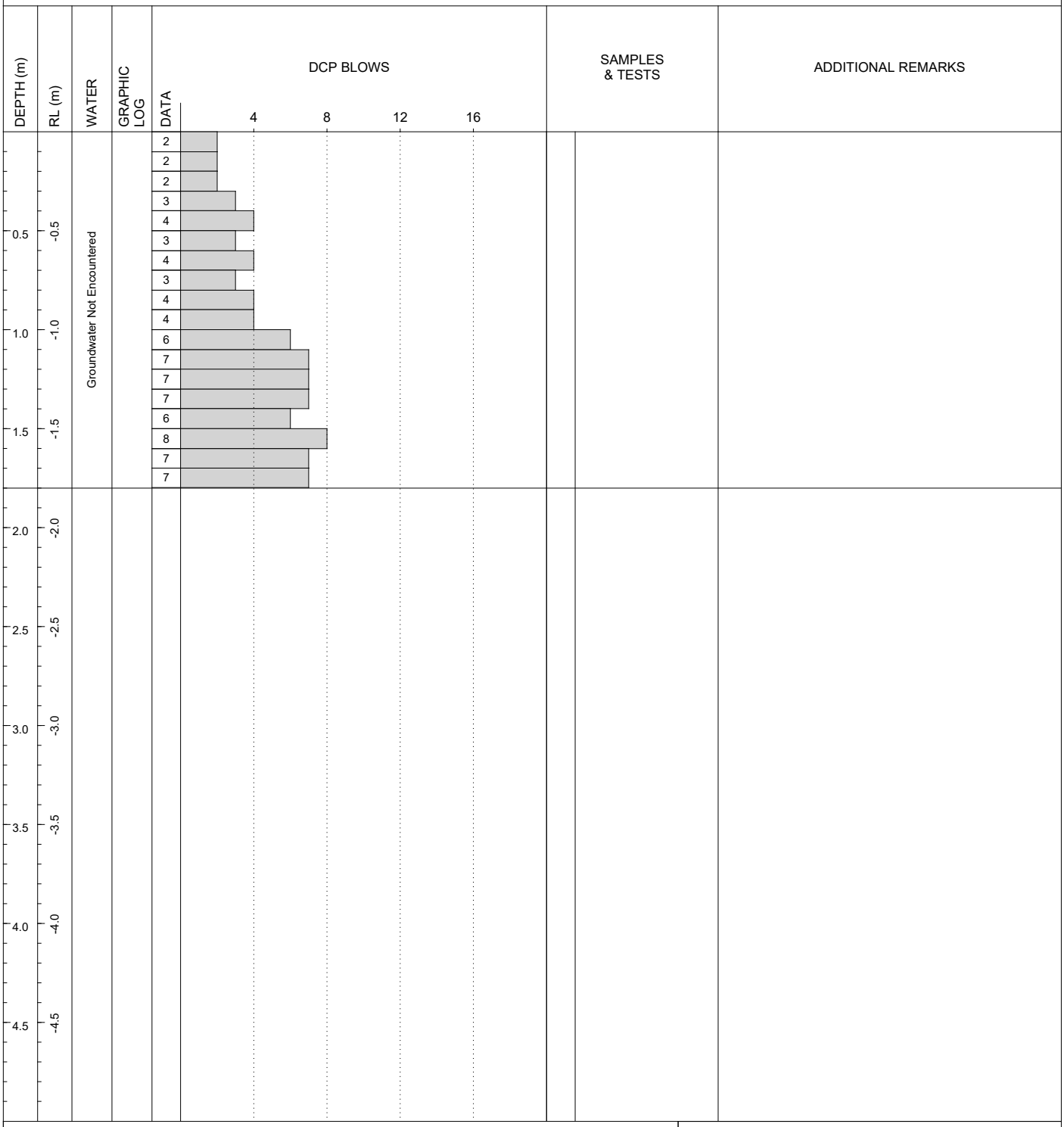
DCP LOG

DCP10

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770435.00	STARTED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472098.00	FINISHED:	28/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 28/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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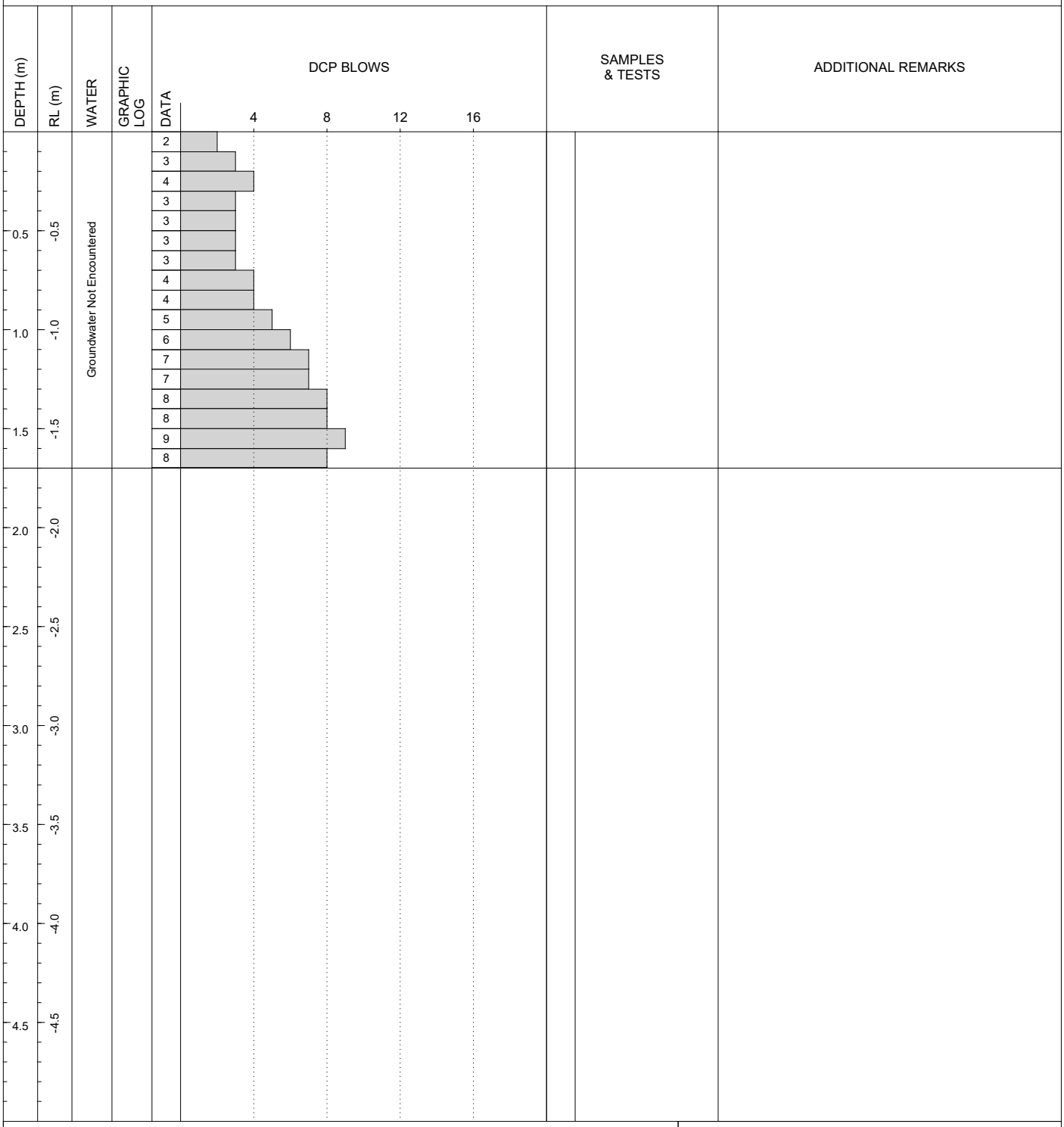
DCP LOG

DCP11

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770371.00	STARTED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472140.00	FINISHED:	28/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 28/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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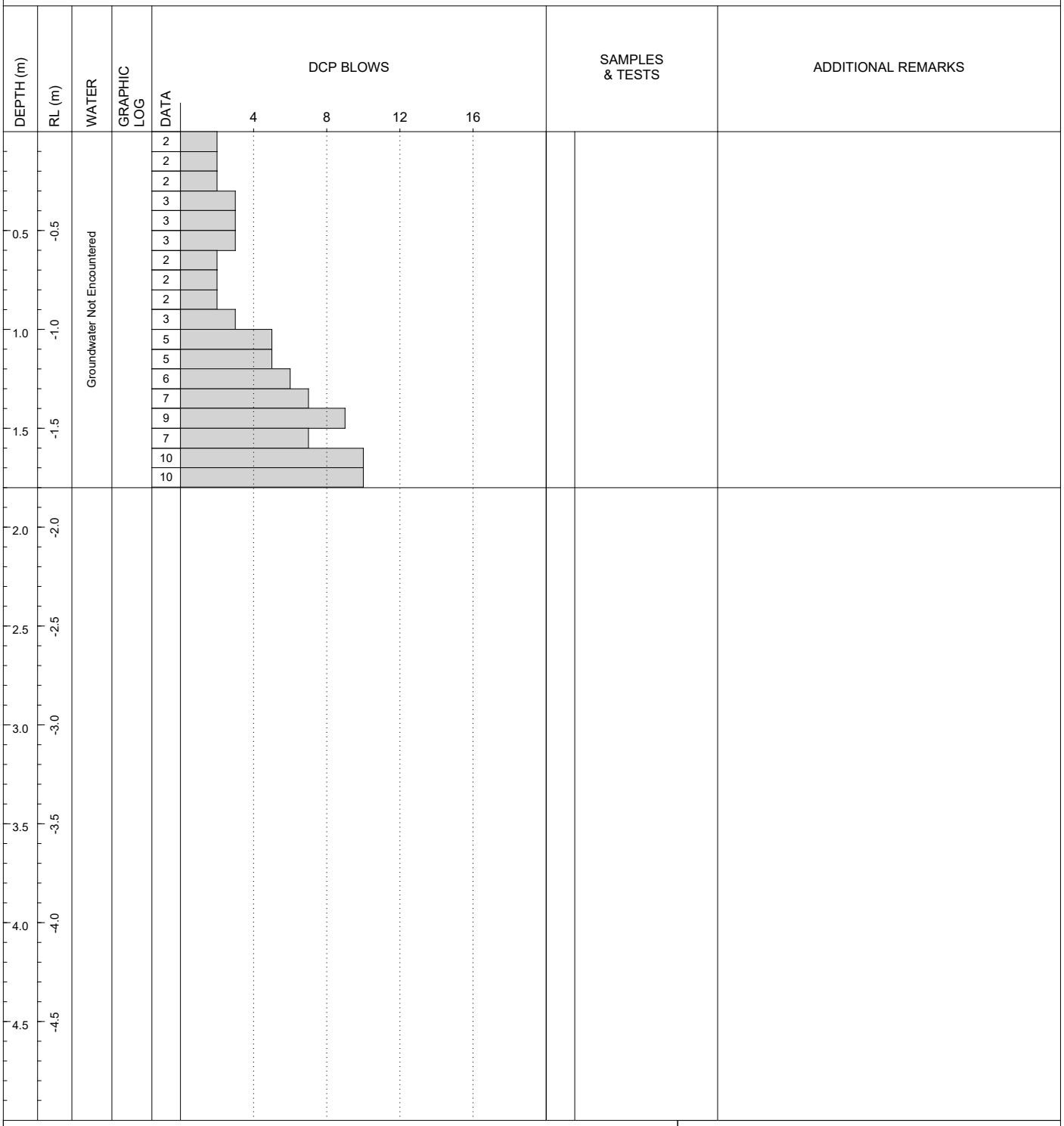
DCP LOG

DCP12

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770439.00	STARTED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472159.00	FINISHED:	28/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 28/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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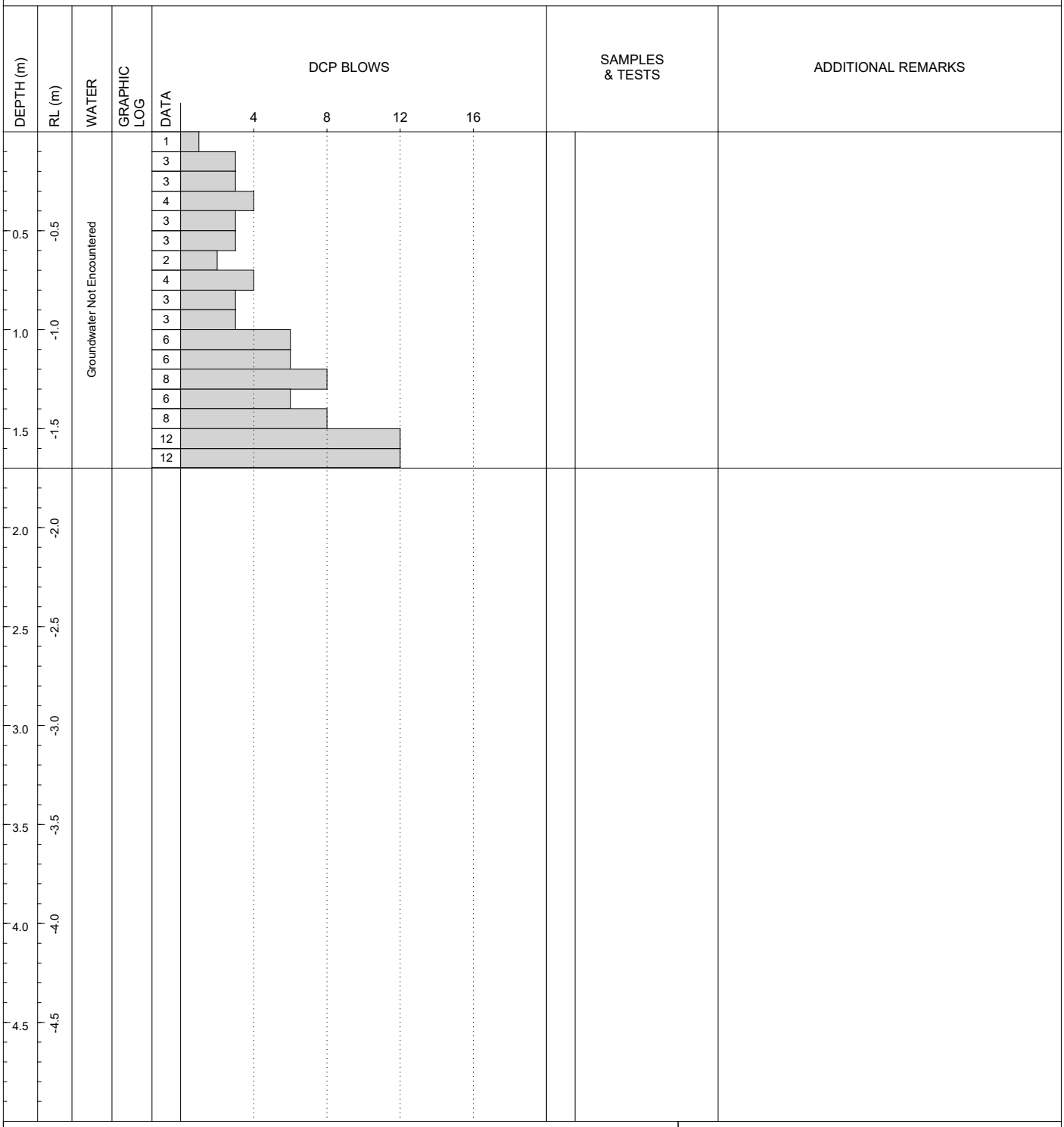
DCP LOG

DCP13

SHEET 1 OF 1

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION: 131 Otaihanga Rd
PROJECT: 195340402	EASTING: 1770523.00	STARTED: 28/02/2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472096.00	FINISHED: 28/02/2020
	DATUM: -	LOGGED BY: MT/RD DATE: 28/02/2020
OFFICE: RDCL - Hastings	ELEVATION: -	CHECKED BY: DATE:
ENGINEER:	AZUMITH: PLUNGE: 90°	STATUS: Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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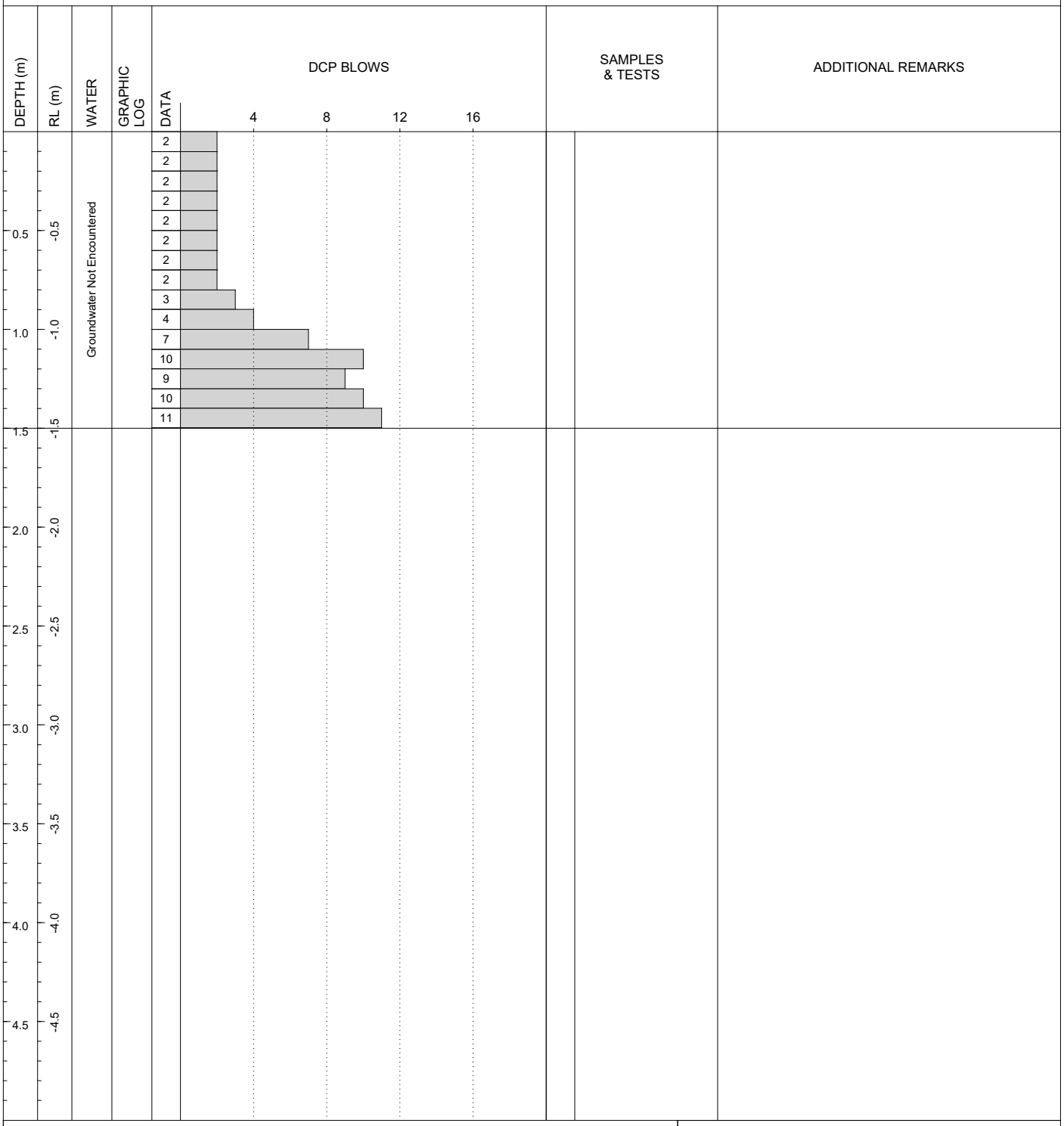
DCP LOG

DCP14

SHEET 1 OF 1

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION: 131 Otaihanga Rd
PROJECT: 195340402	EASTING: 1770511.00	STARTED: 28/02/2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472191.00	FINISHED: 28/02/2020
	DATUM: -	LOGGED BY: MT/RD DATE: 28/02/2020
OFFICE: RDCL - Hastings	ELEVATION: -	CHECKED BY: DATE:
ENGINEER:	AZUMITH: PLUNGE: 90°	STATUS: Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

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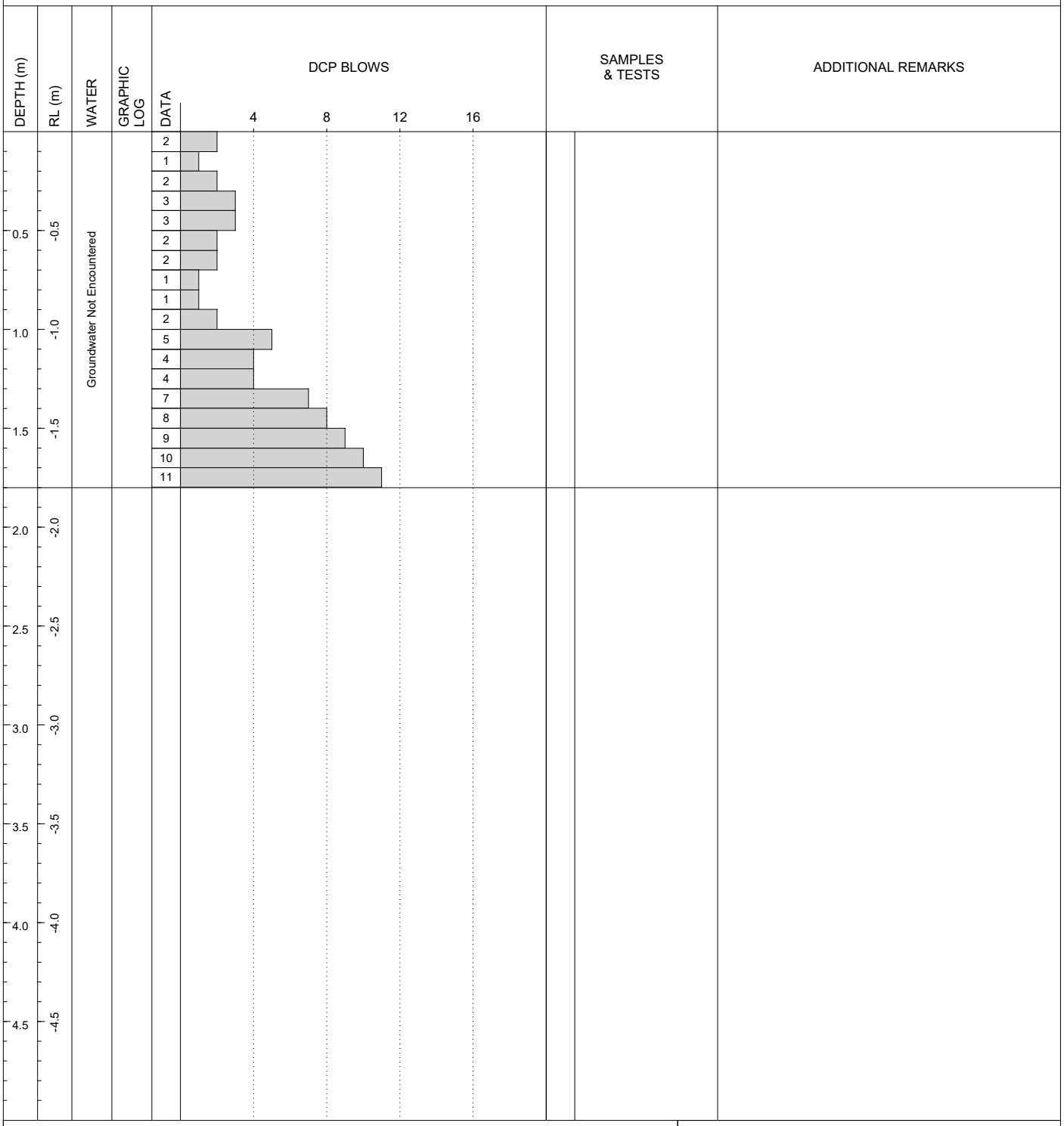
DCP LOG

DCP15

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770533.00	STARTED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472277.00	FINISHED:	28/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 28/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- ▼ Standing Water Level
- ◁ Out flow
- ▷ In flow

RDCL

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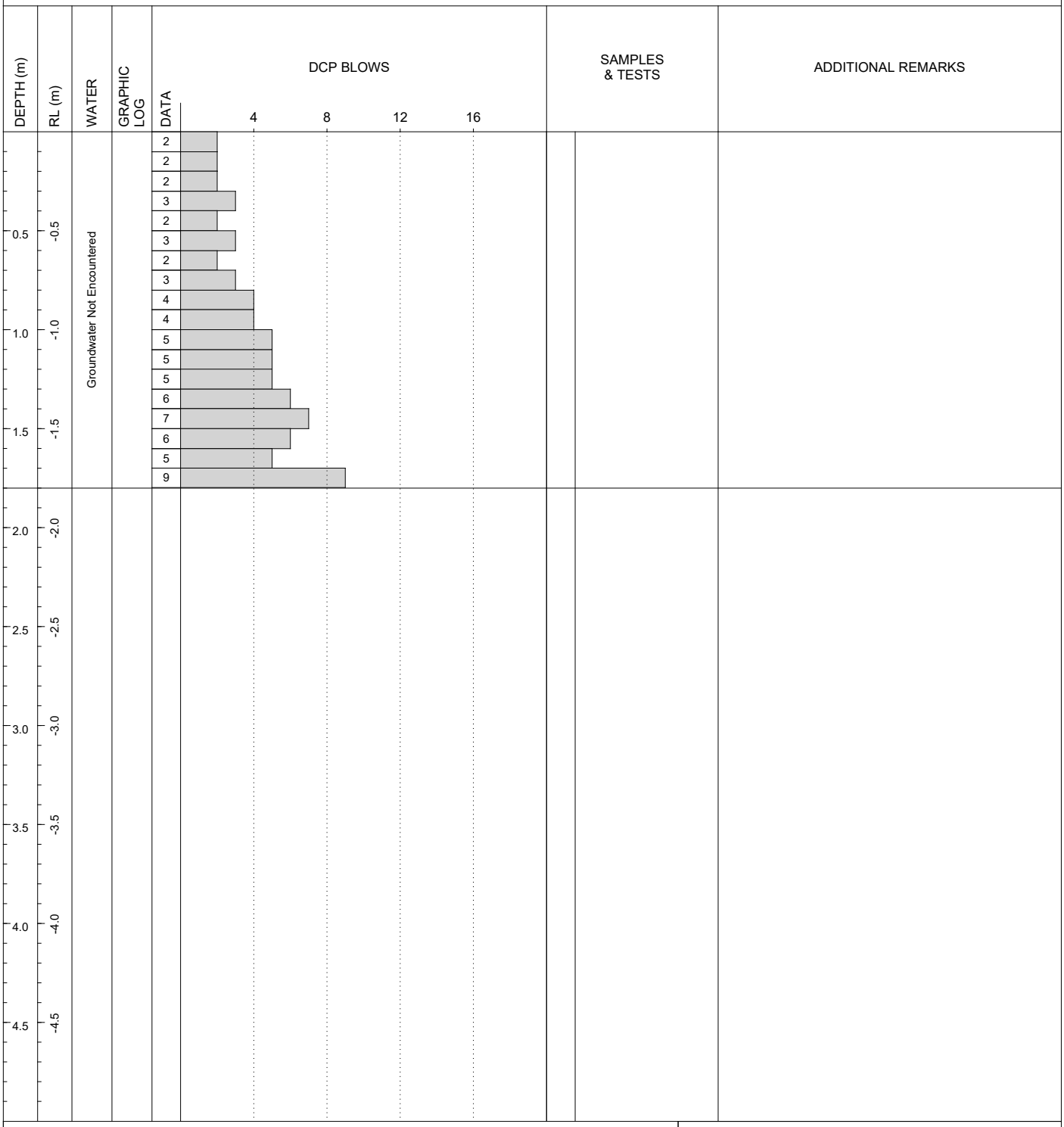
DCP LOG

DCP16

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	131 Otaihanga Rd
PROJECT:	195340402	EASTING:	1770476.00	STARTED:	28/02/2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472313.00	FINISHED:	28/02/2020
		DATUM:	-	LOGGED BY:	MT/RD DATE: 28/02/2020
OFFICE:	RDCL - Hastings	ELEVATION:	-	CHECKED BY:	DATE:
ENGINEER:		AZUMITH:	PLUNGE: 90°	STATUS:	Draft data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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APPENDIX B: LIQUEFACTION ASSESSMENT RESULTS

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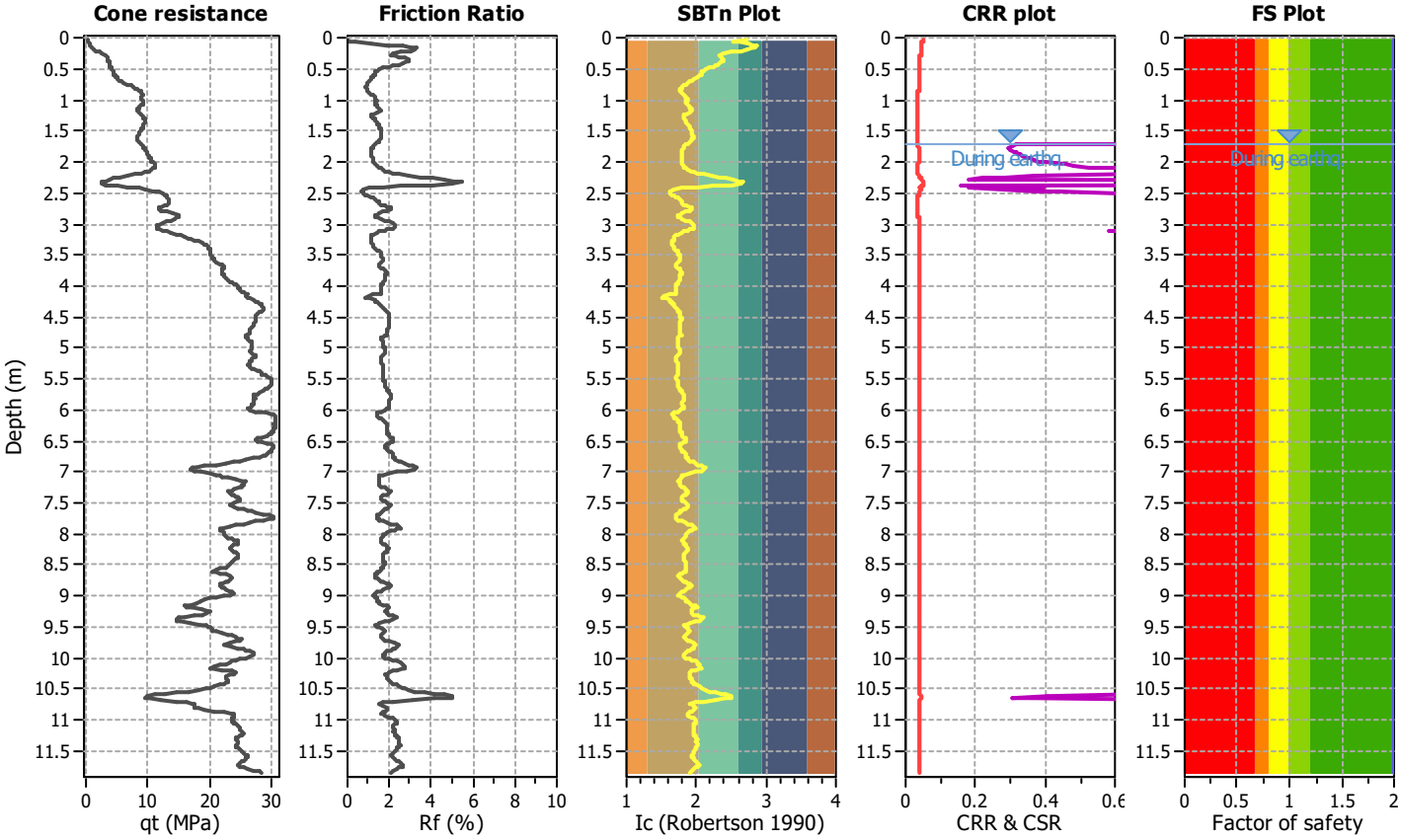
LIQUEFACTION ANALYSIS REPORT

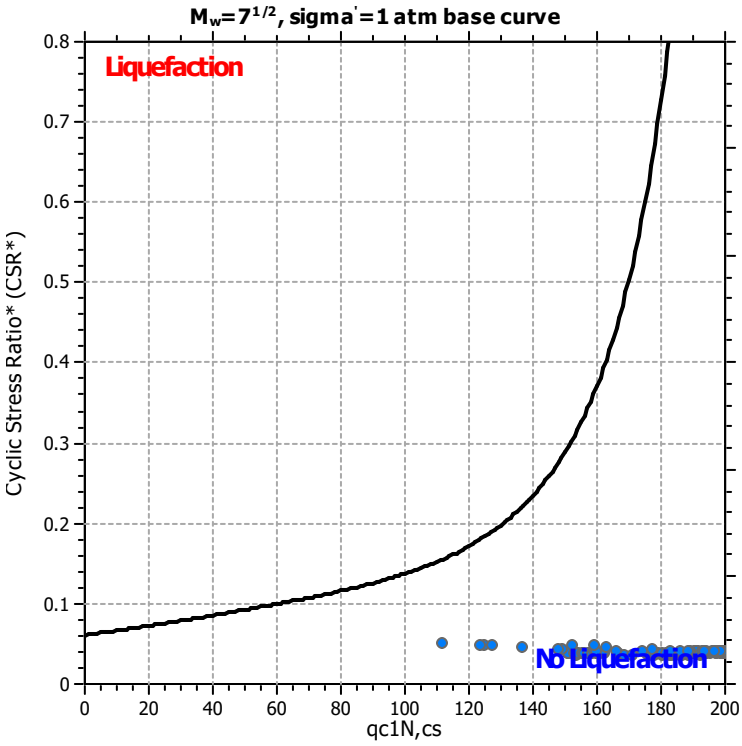
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

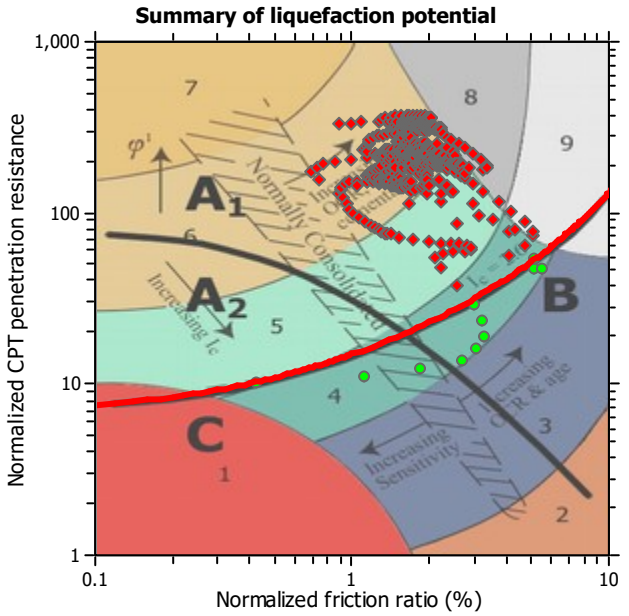
CPT file : CPT01_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

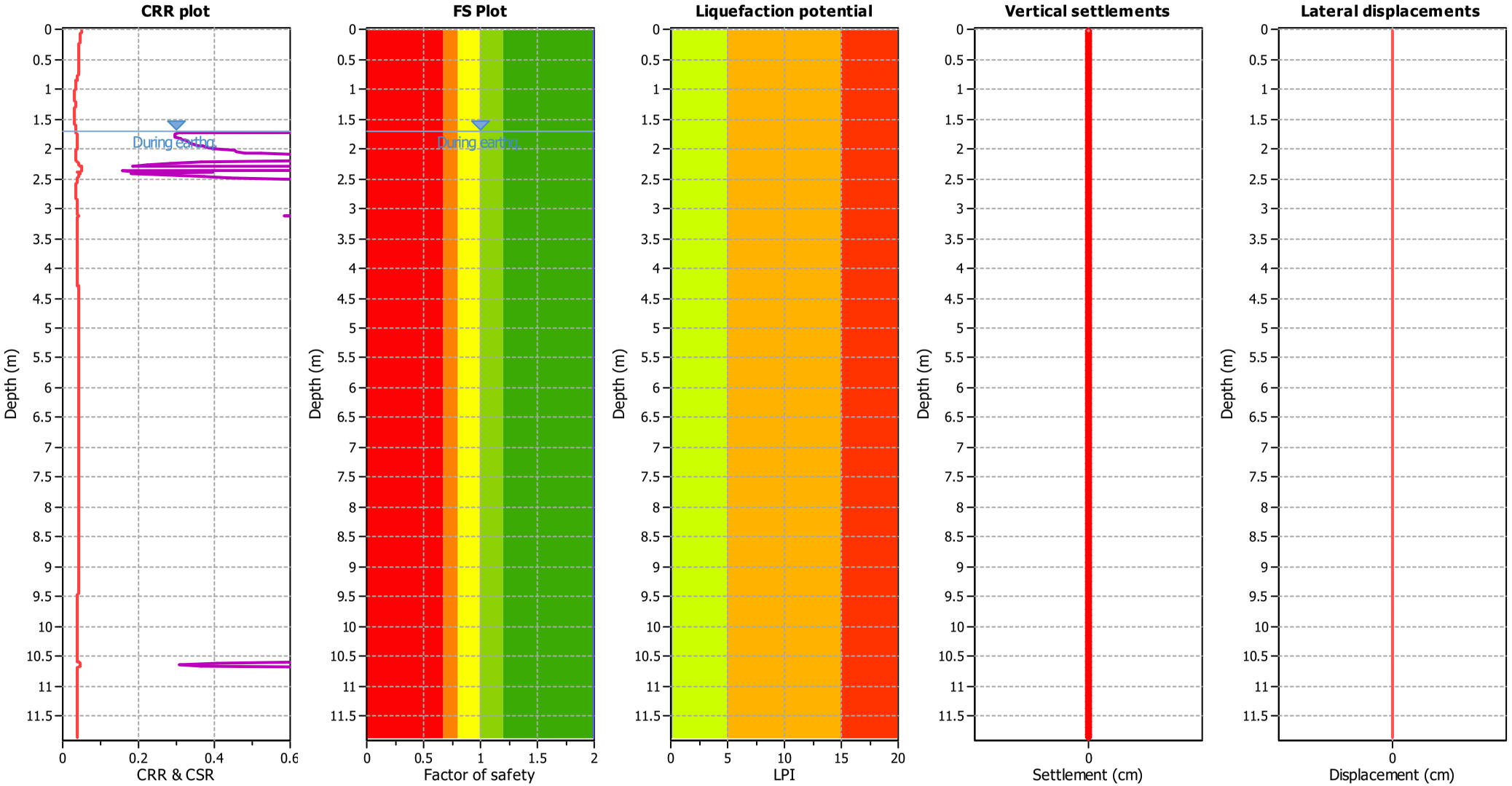






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 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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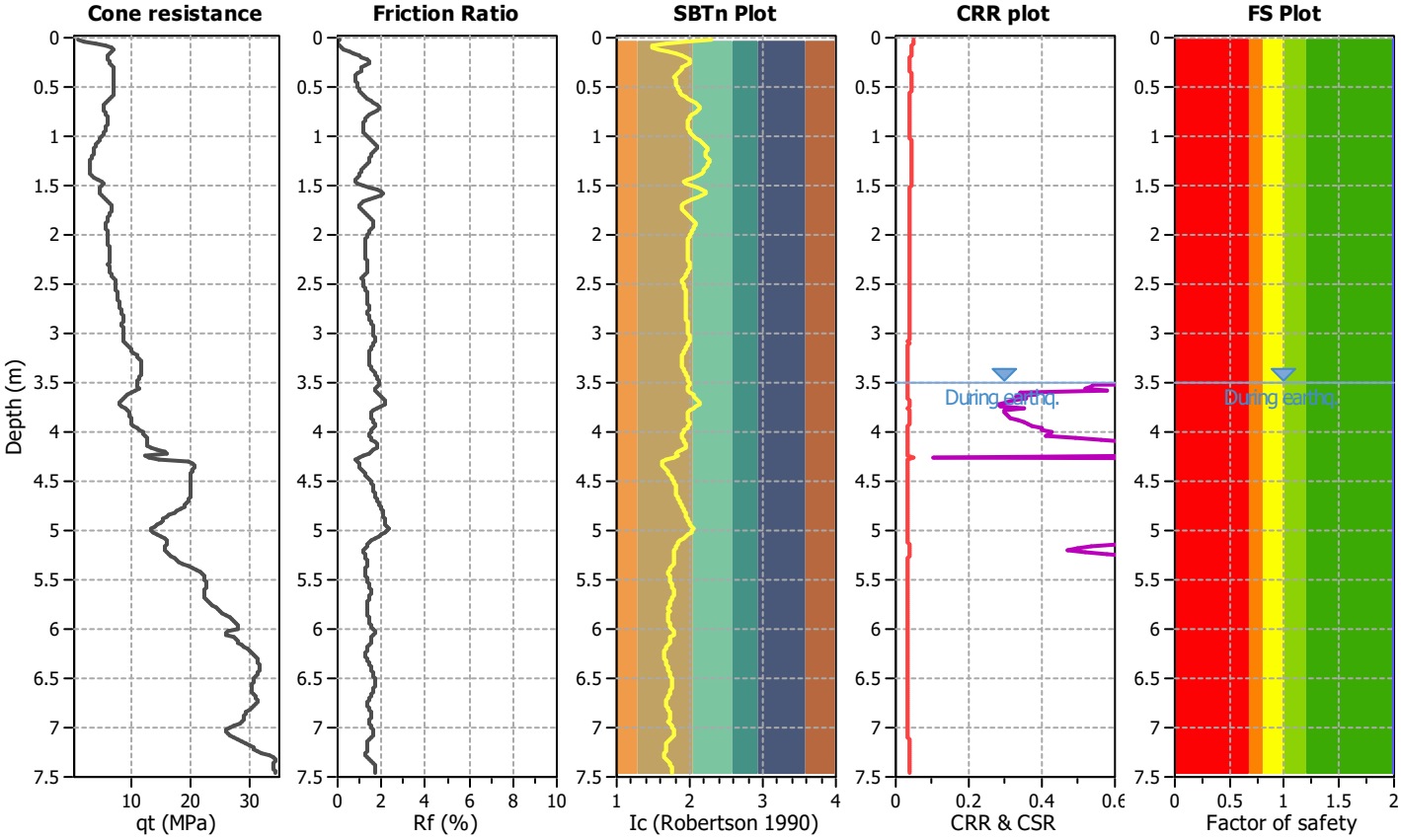
LIQUEFACTION ANALYSIS REPORT

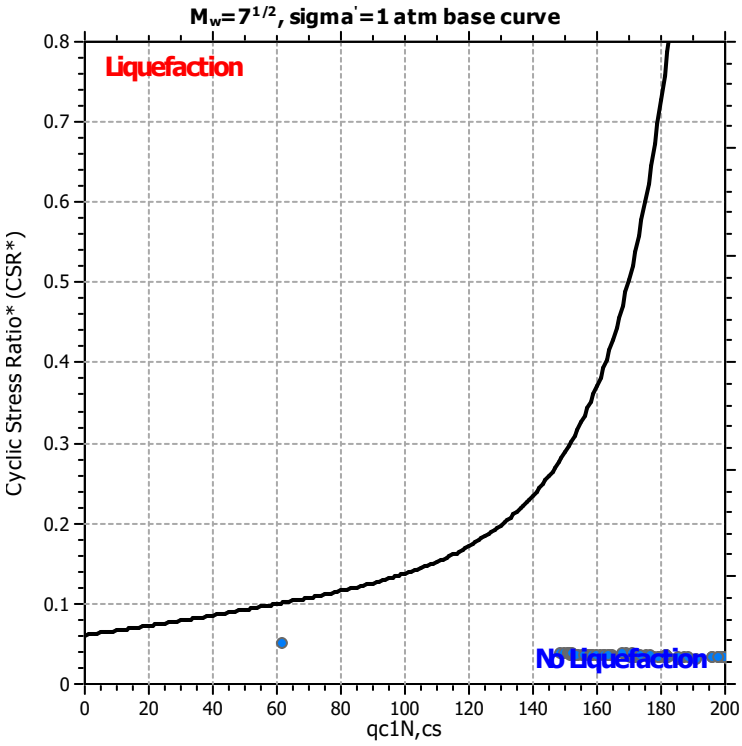
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

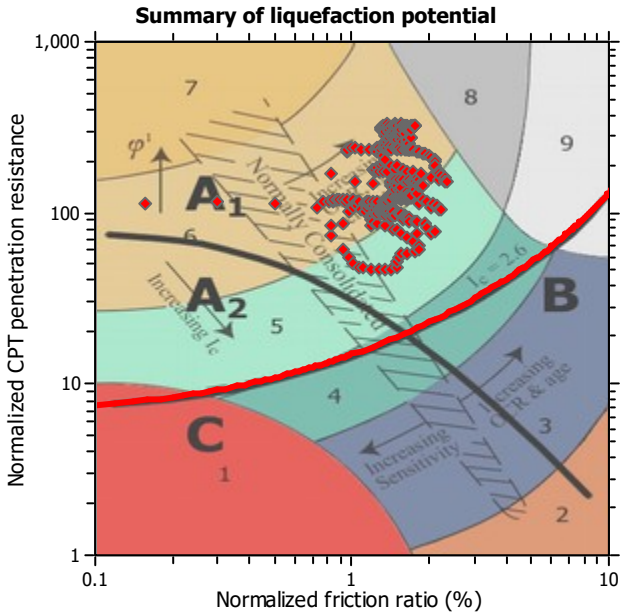
CPT file : CPT02_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

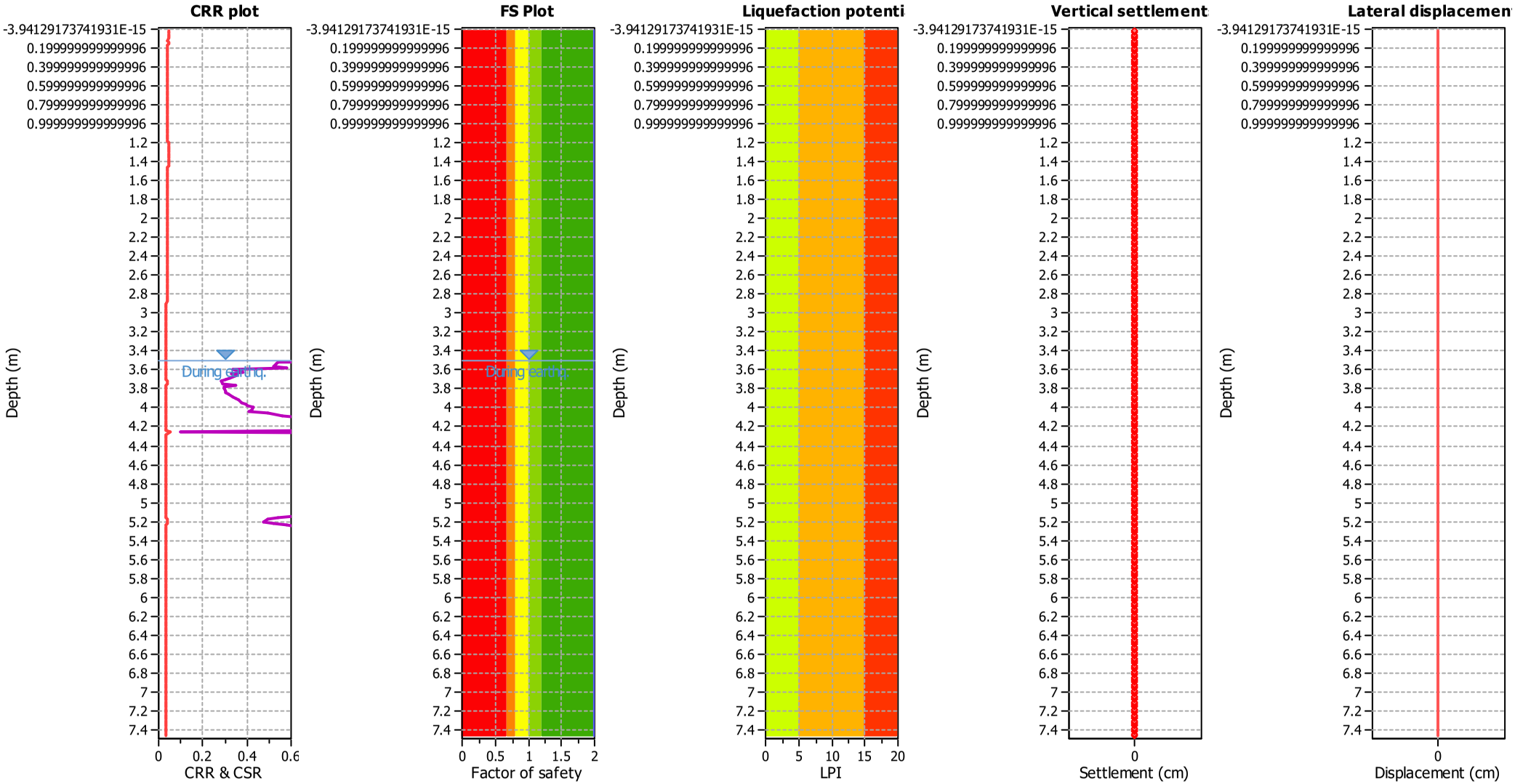






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	3.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.50 m	Fill height:	N/A	Limit depth:	20.00 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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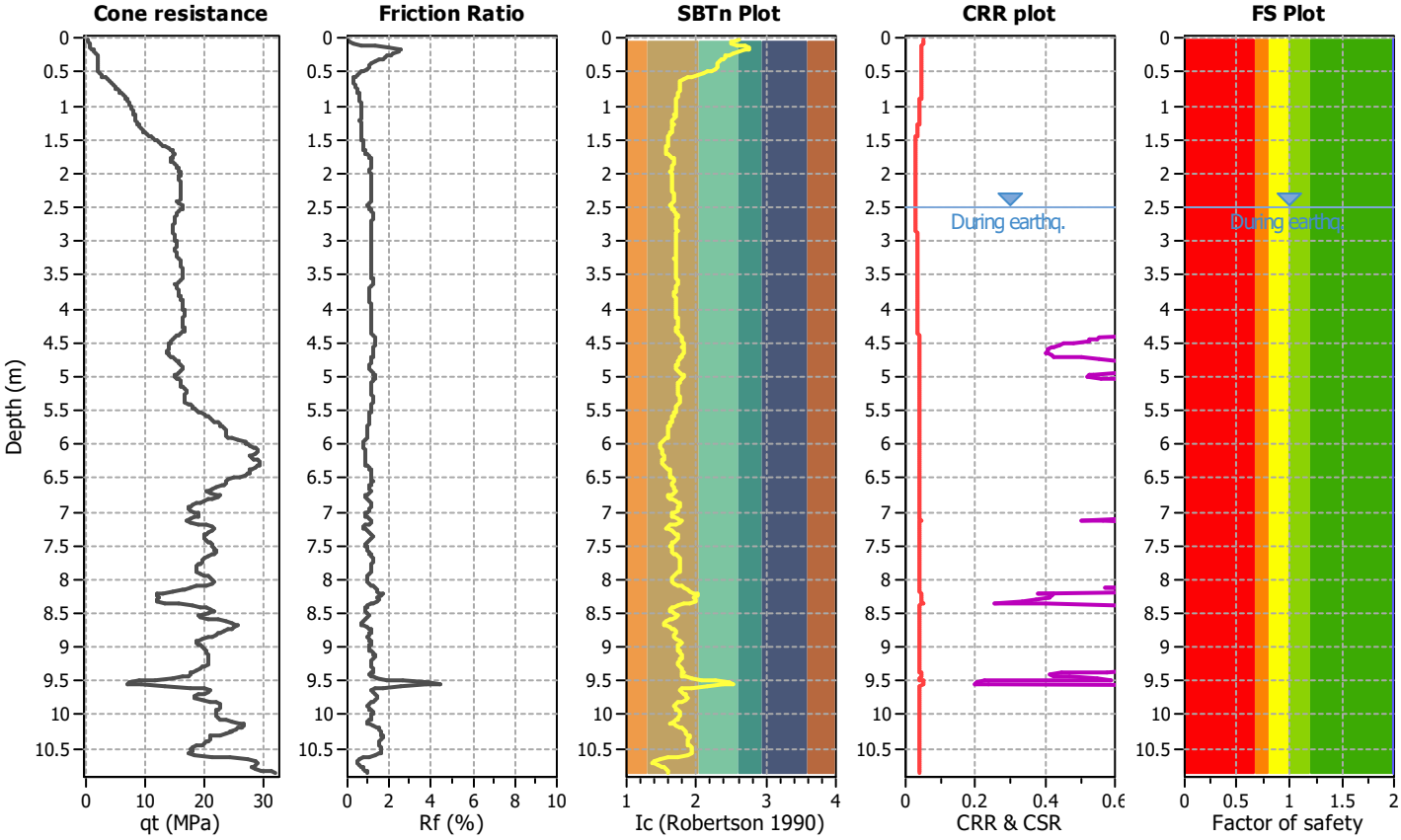
LIQUEFACTION ANALYSIS REPORT

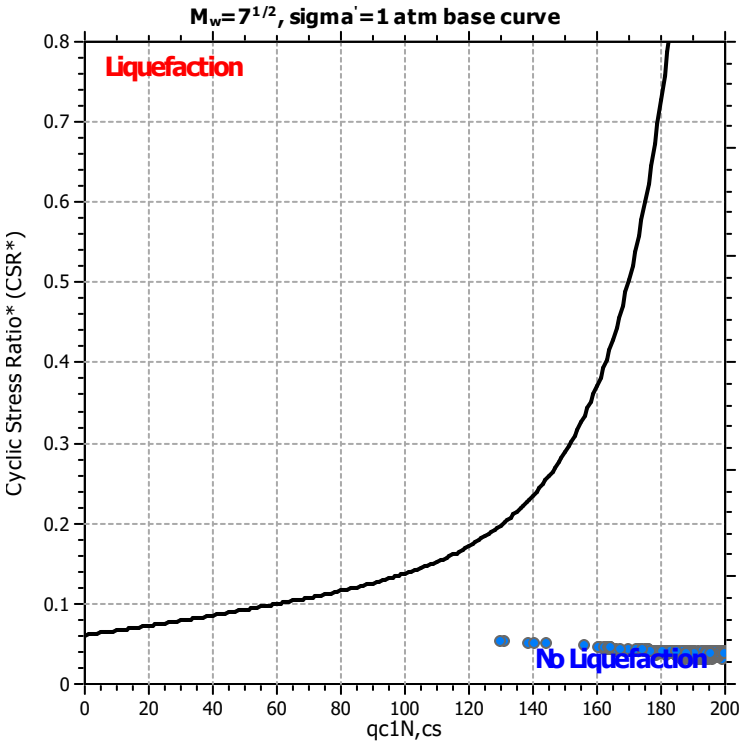
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

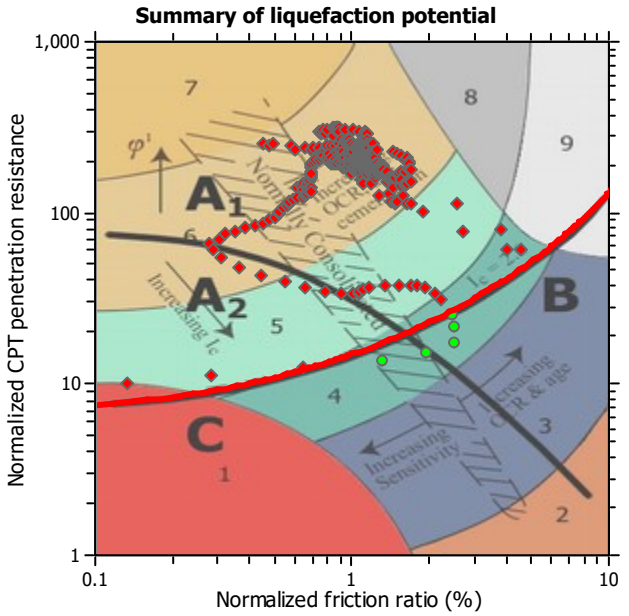
CPT file : CPT03_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

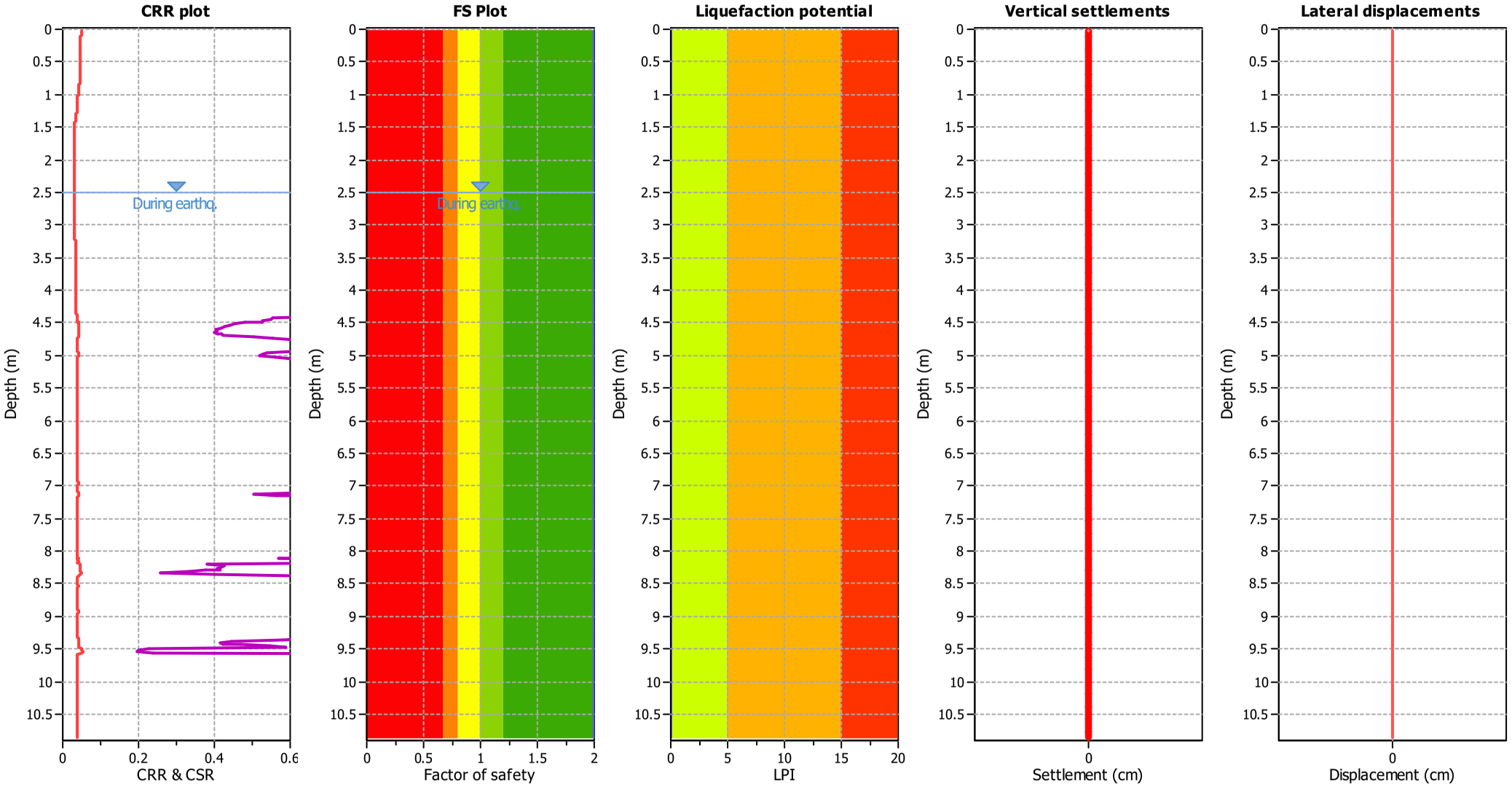






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	20.00 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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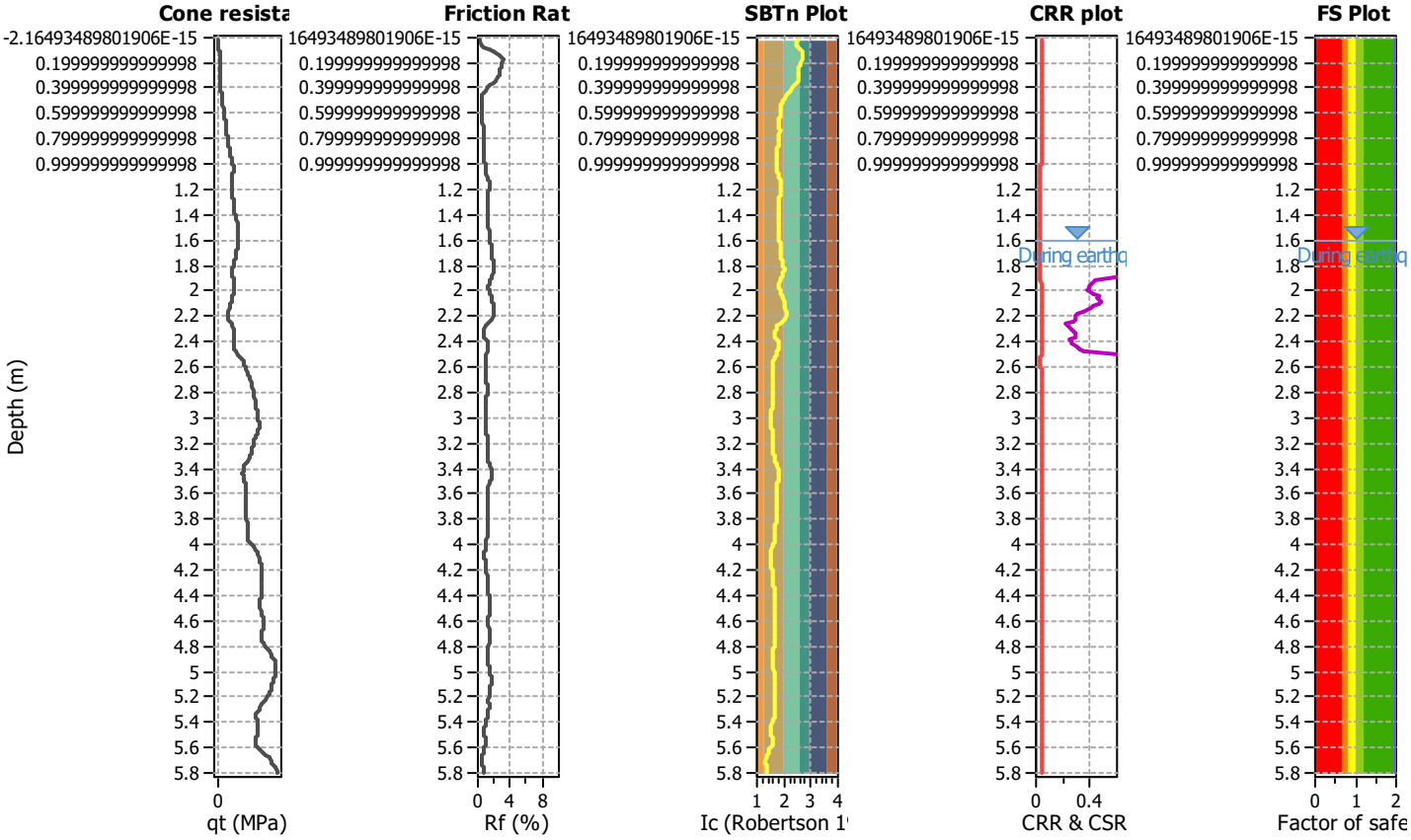
LIQUEFACTION ANALYSIS REPORT

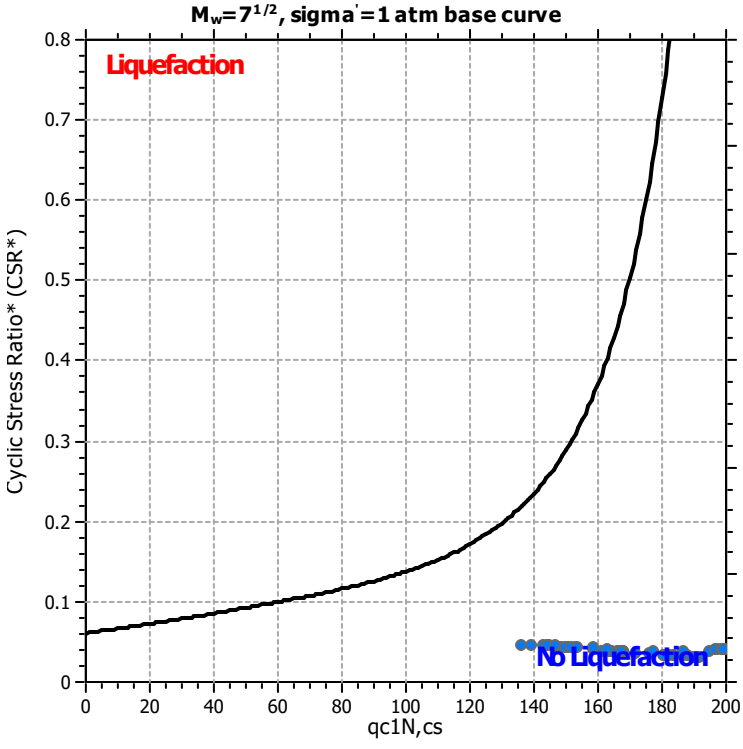
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

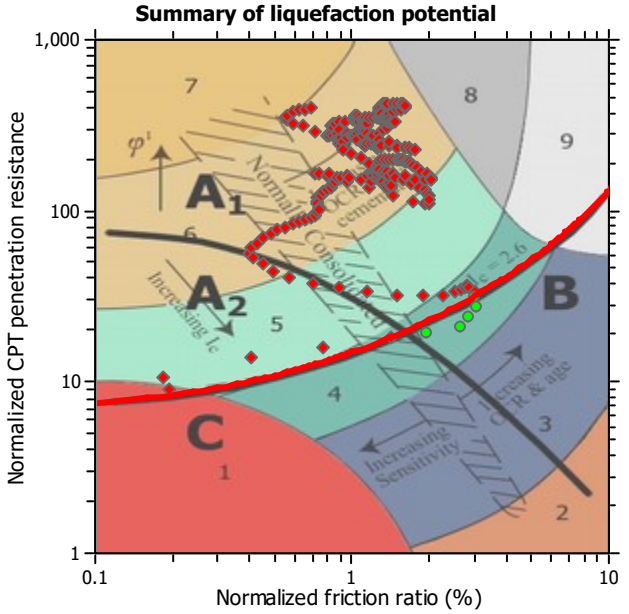
CPT file : CPT04_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

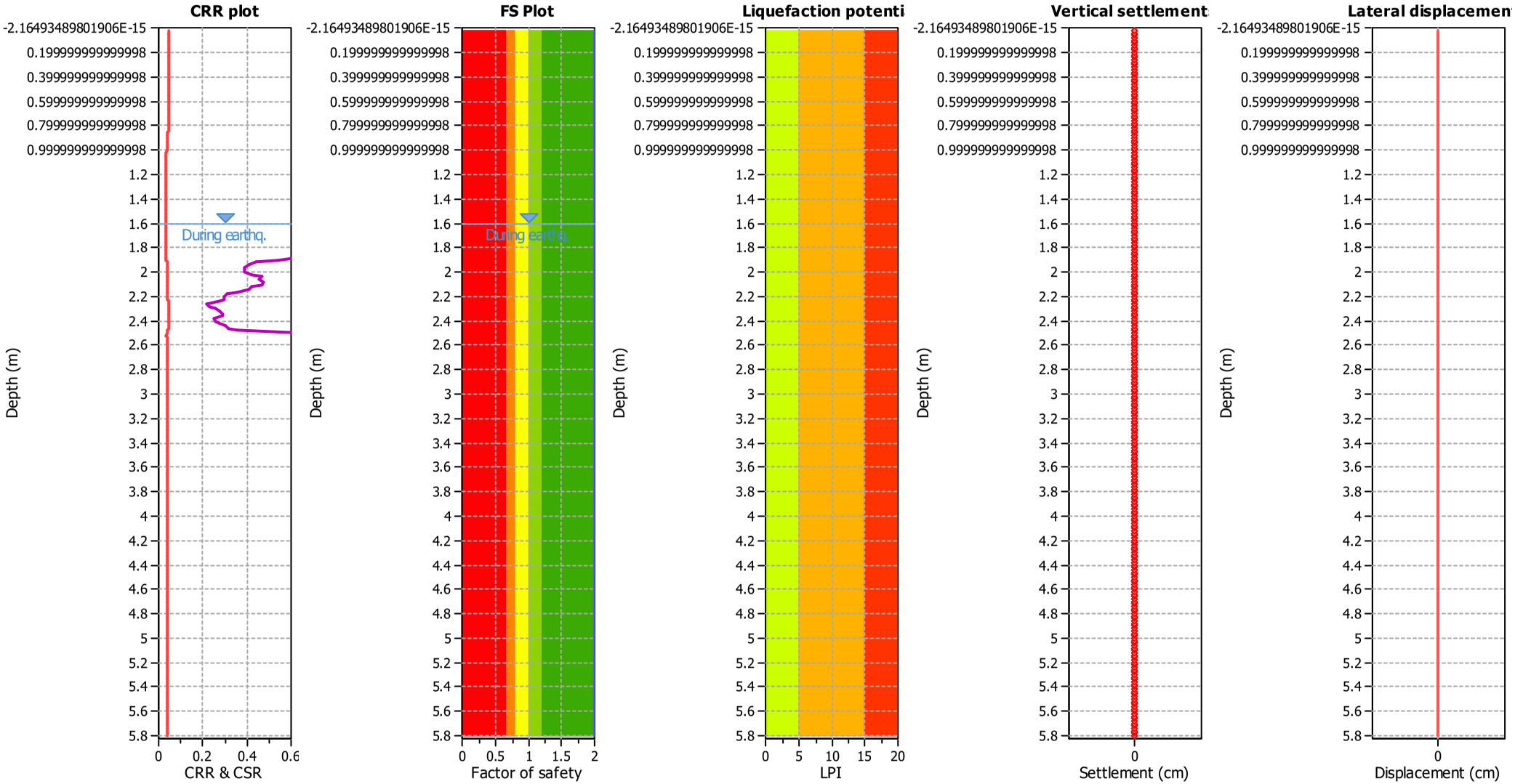






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	20.00 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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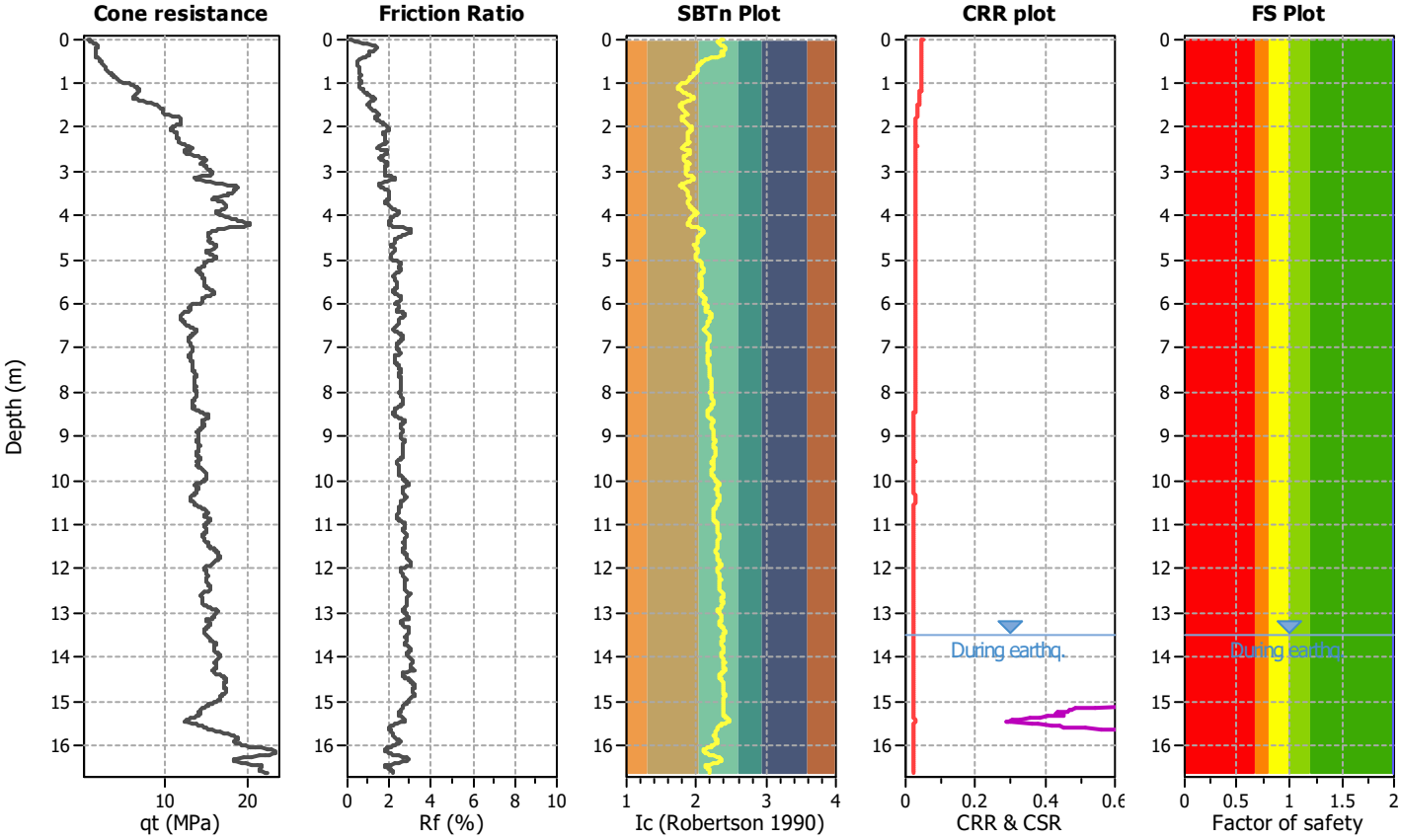
LIQUEFACTION ANALYSIS REPORT

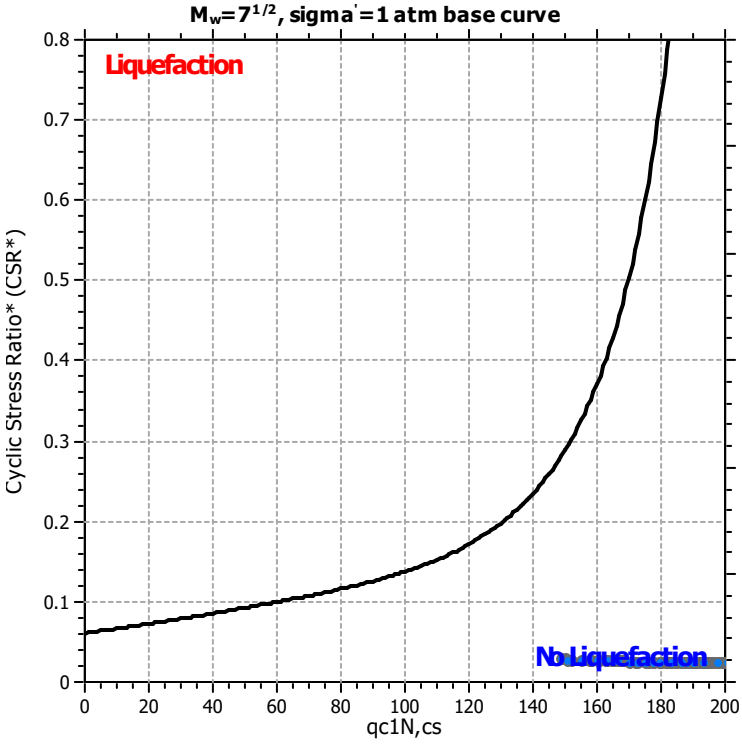
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

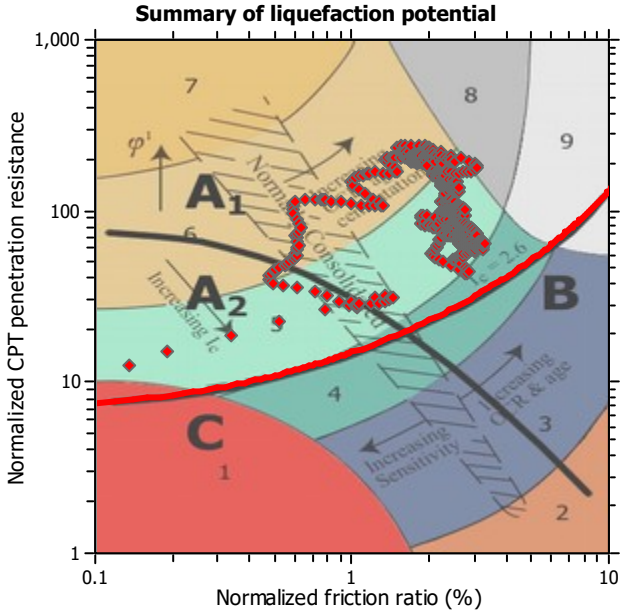
CPT file : CPT05_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	13.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	13.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

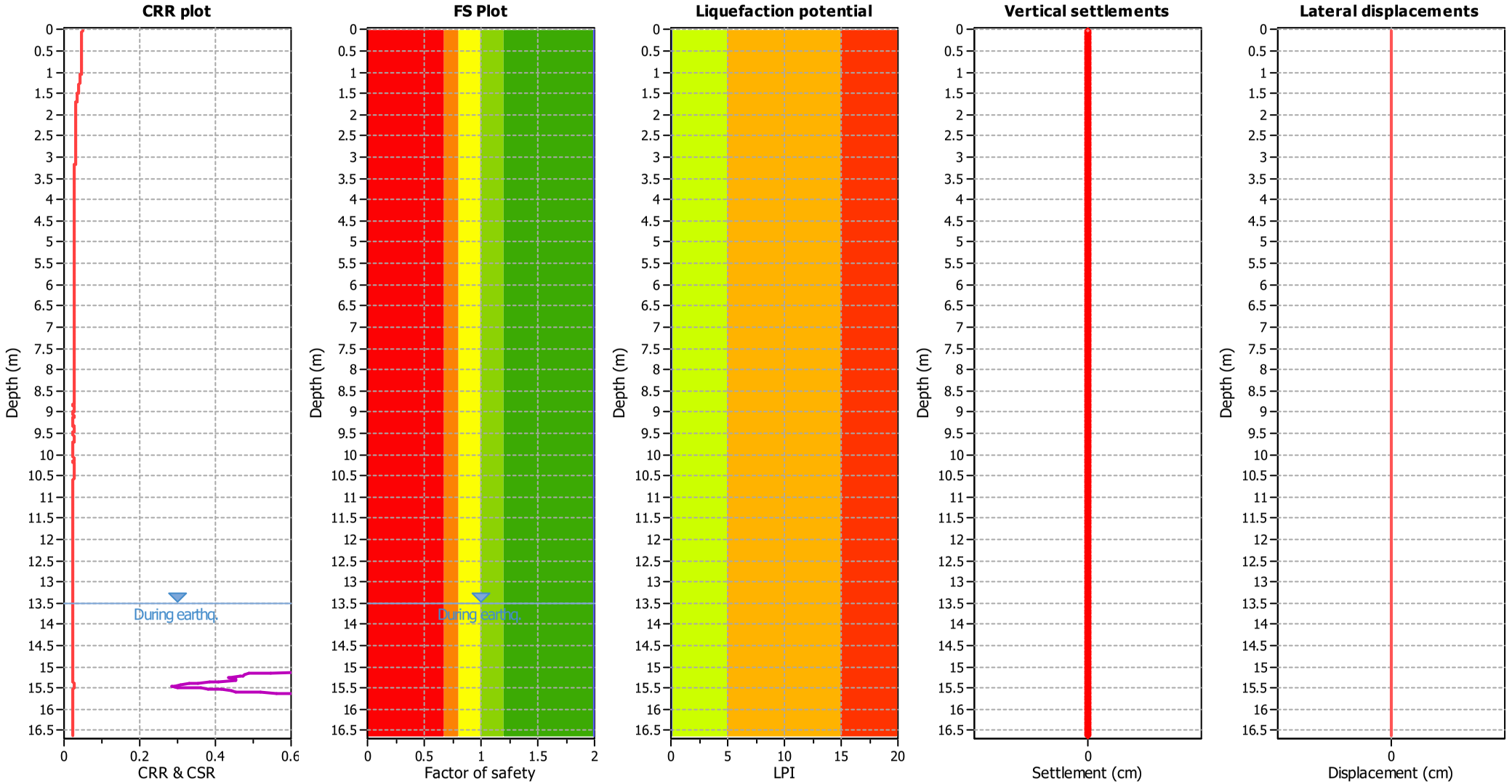






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	13.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	13.50 m	Fill height:	N/A	Limit depth:	20.00 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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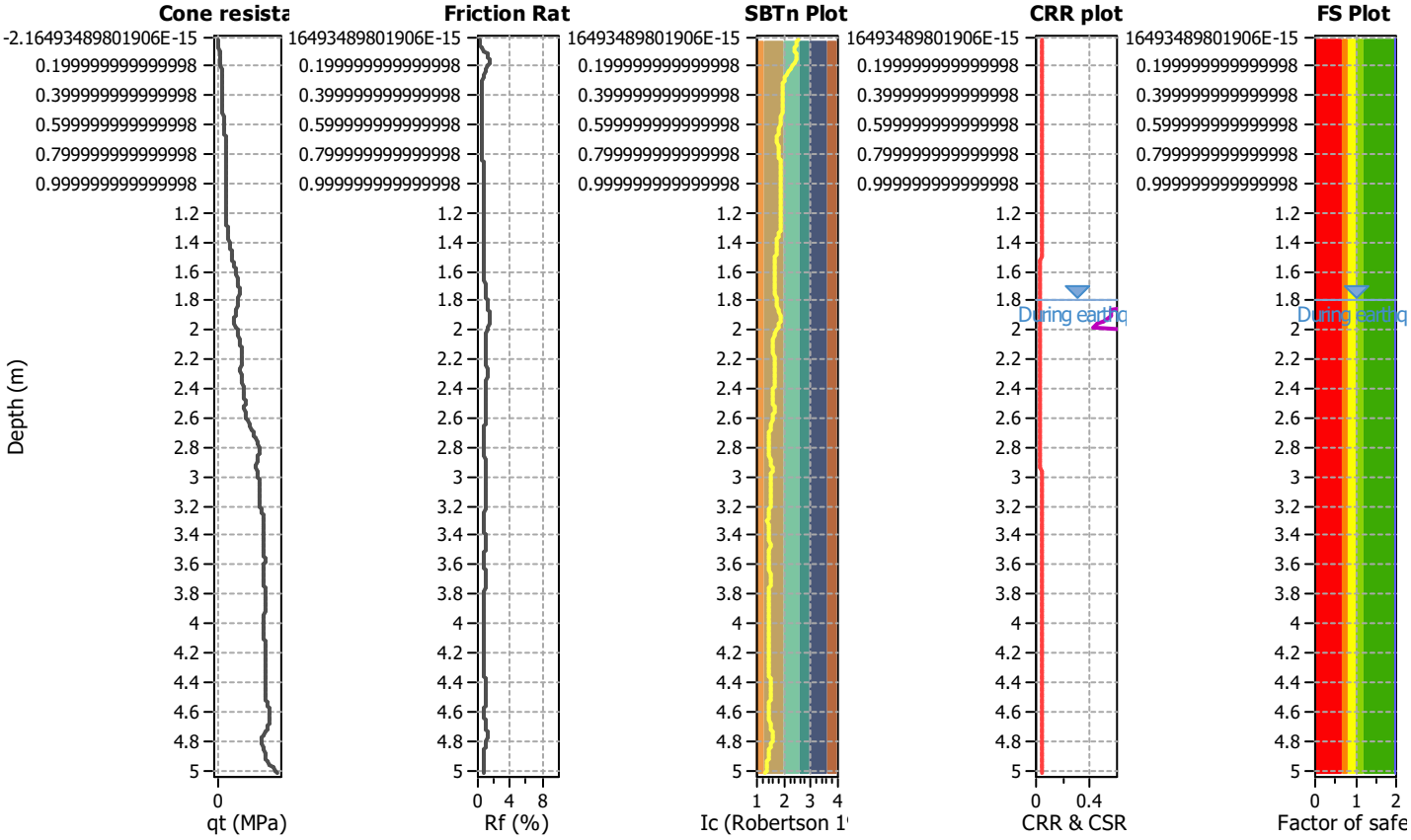
LIQUEFACTION ANALYSIS REPORT

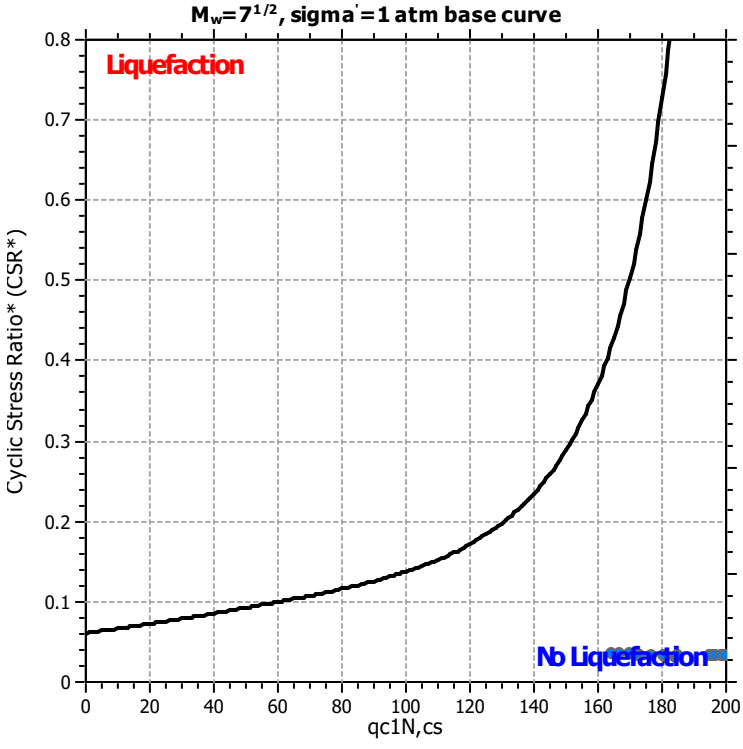
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

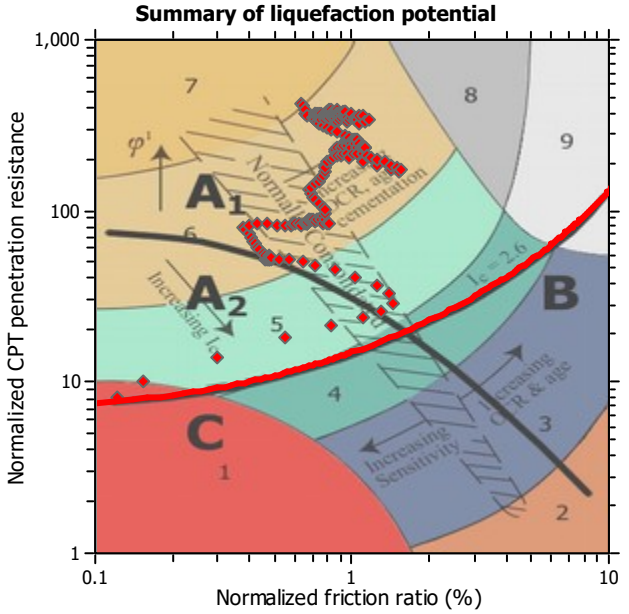
CPT file : CPT06_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

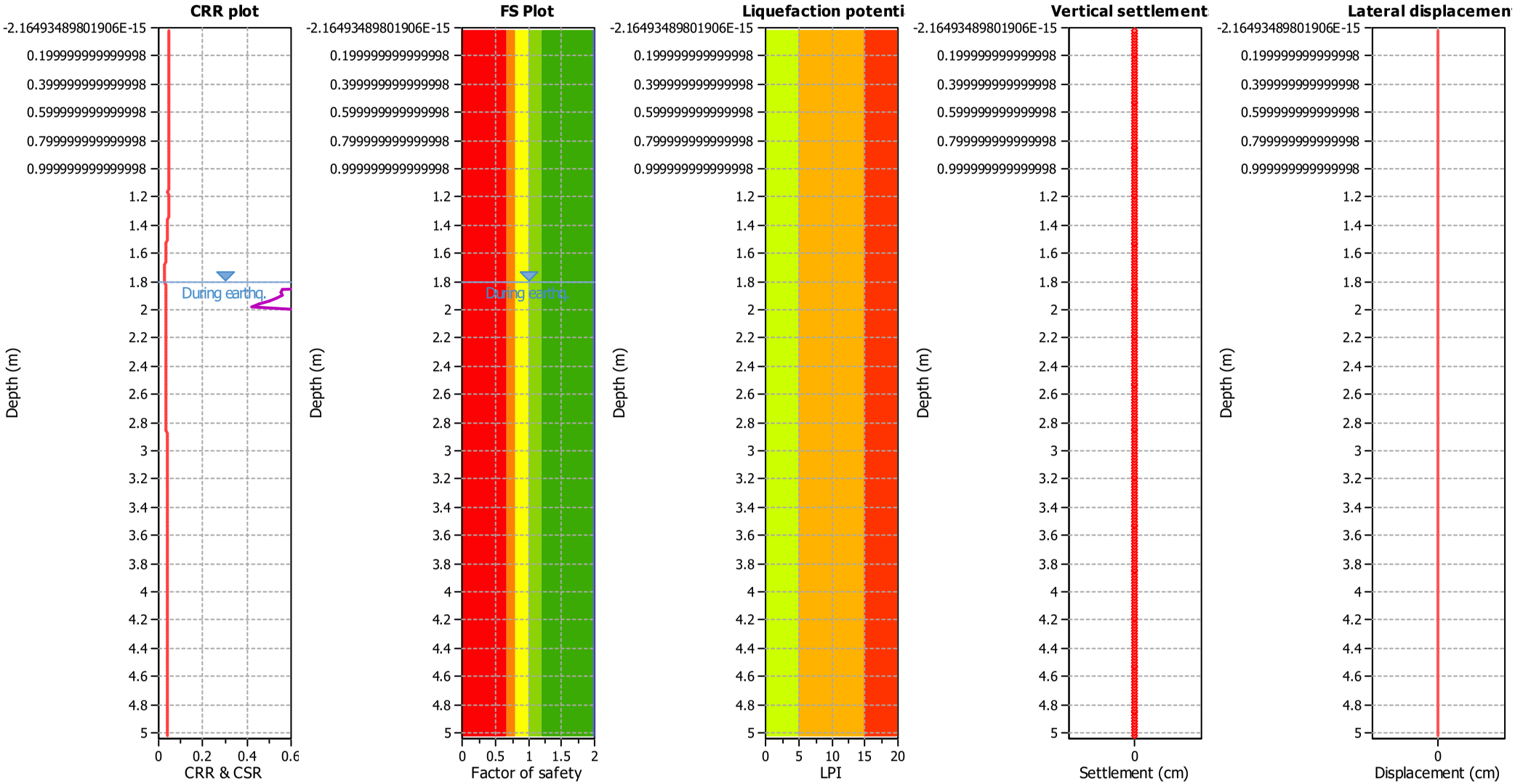






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	20.00 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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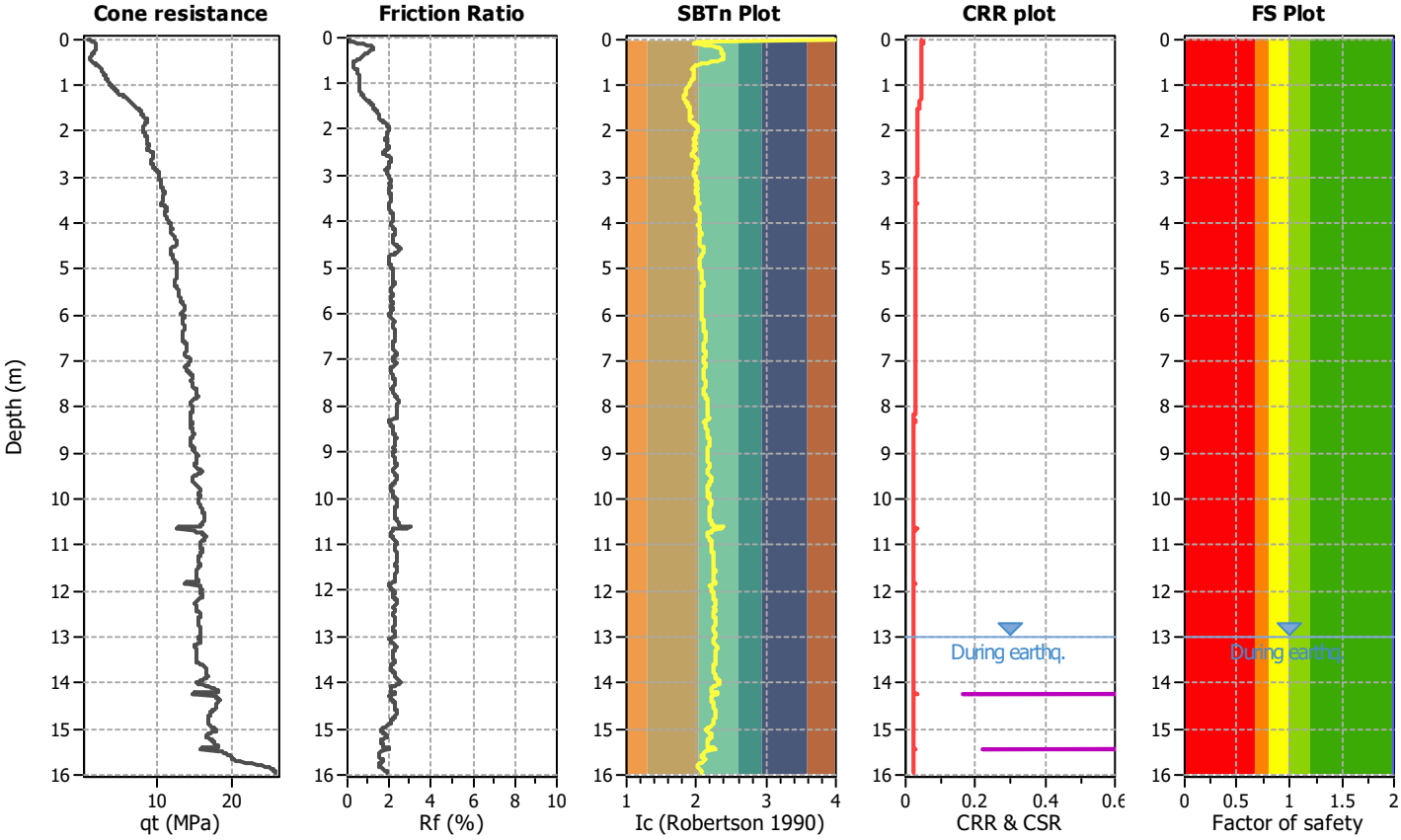
LIQUEFACTION ANALYSIS REPORT

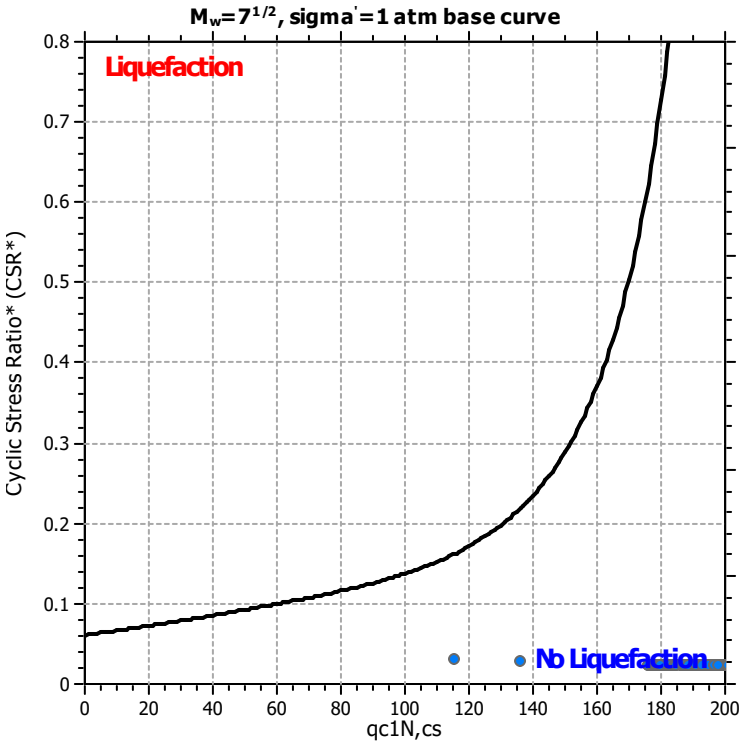
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

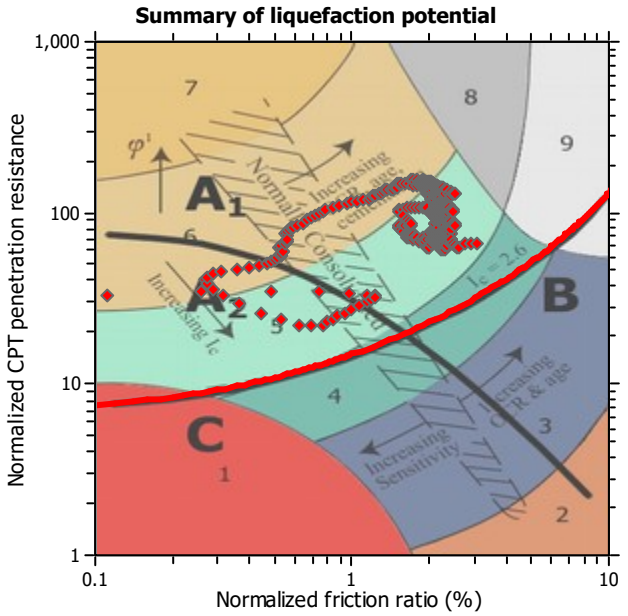
CPT file : CPT07_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	13.00 m	Use fill:	No	Clay like behavior applied:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

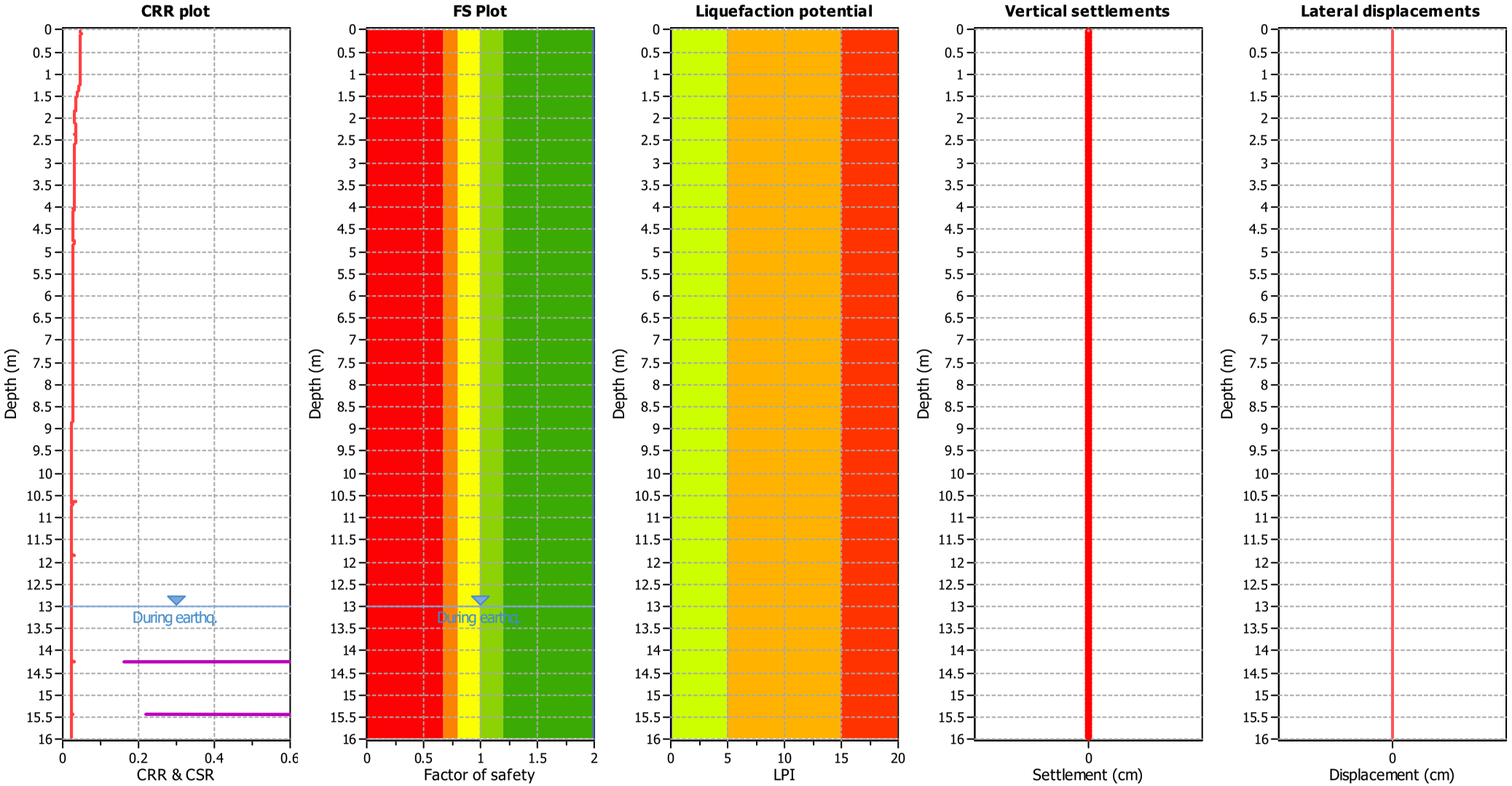






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	13.00 m	Fill height:	N/A	Limit depth:	20.00 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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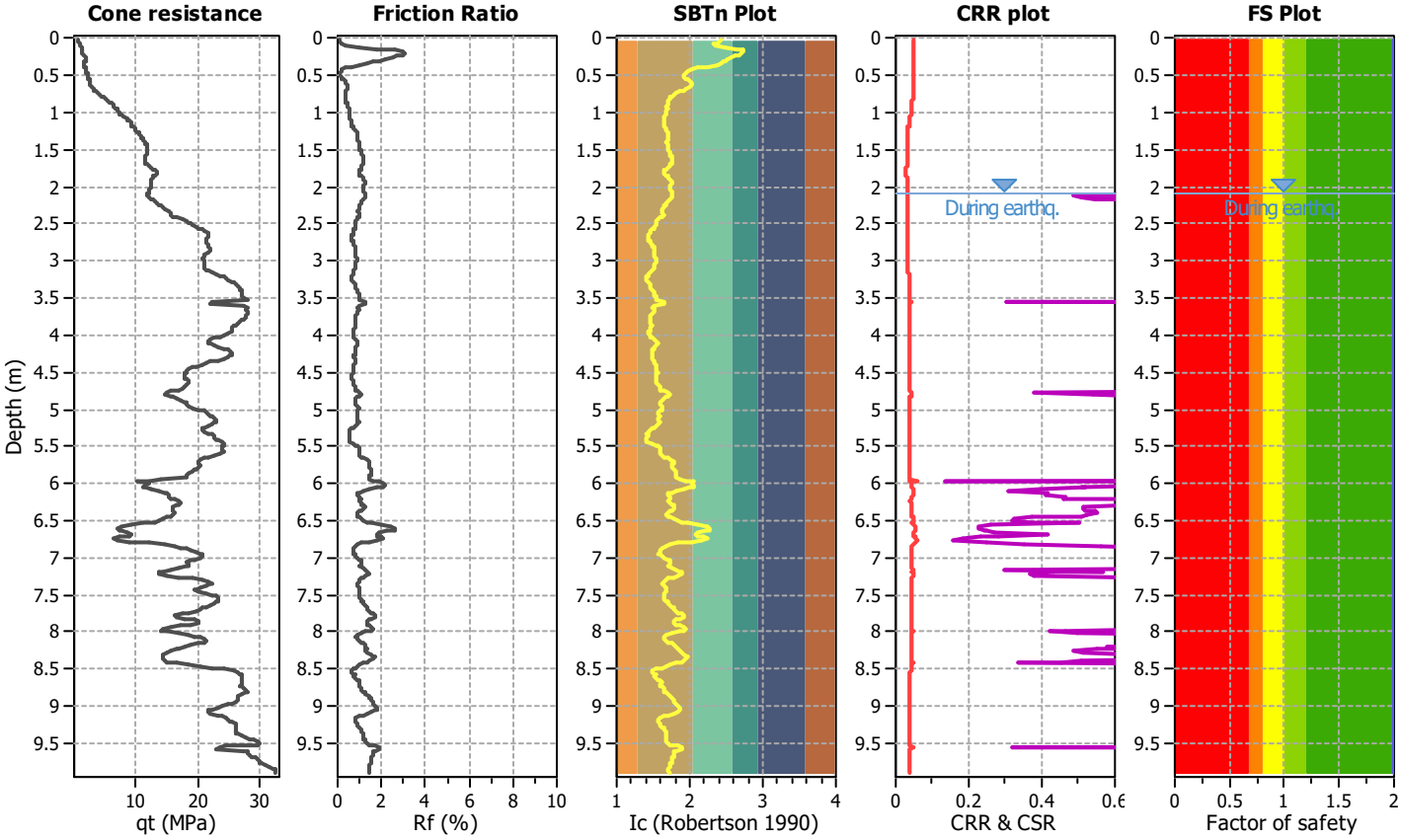
LIQUEFACTION ANALYSIS REPORT

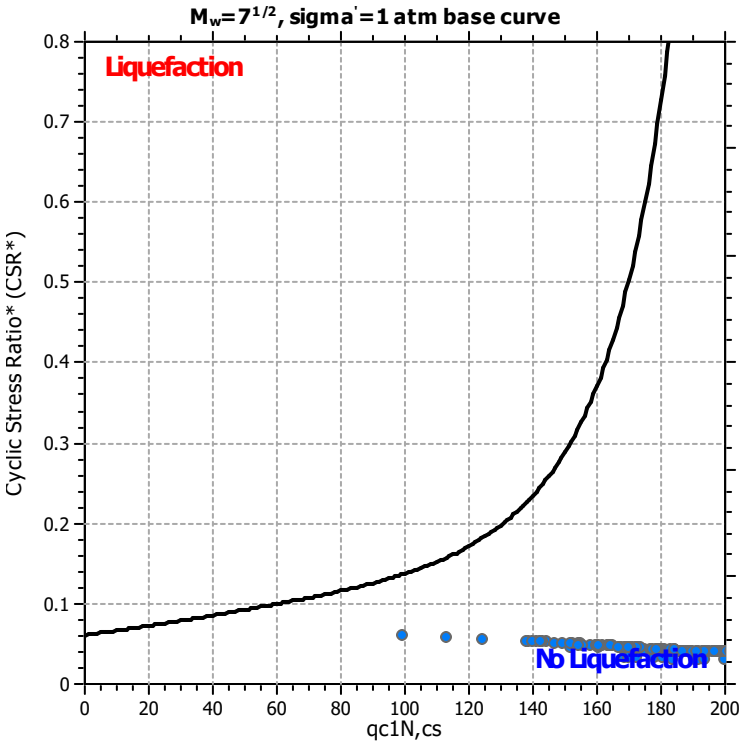
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

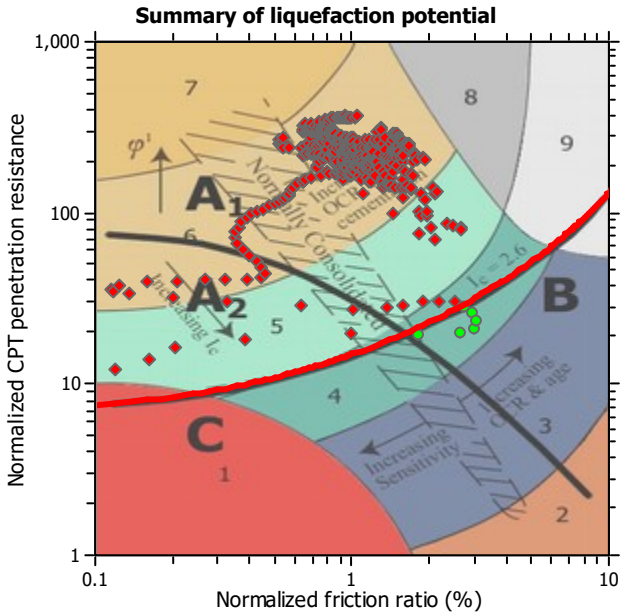
CPT file : CPT08_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

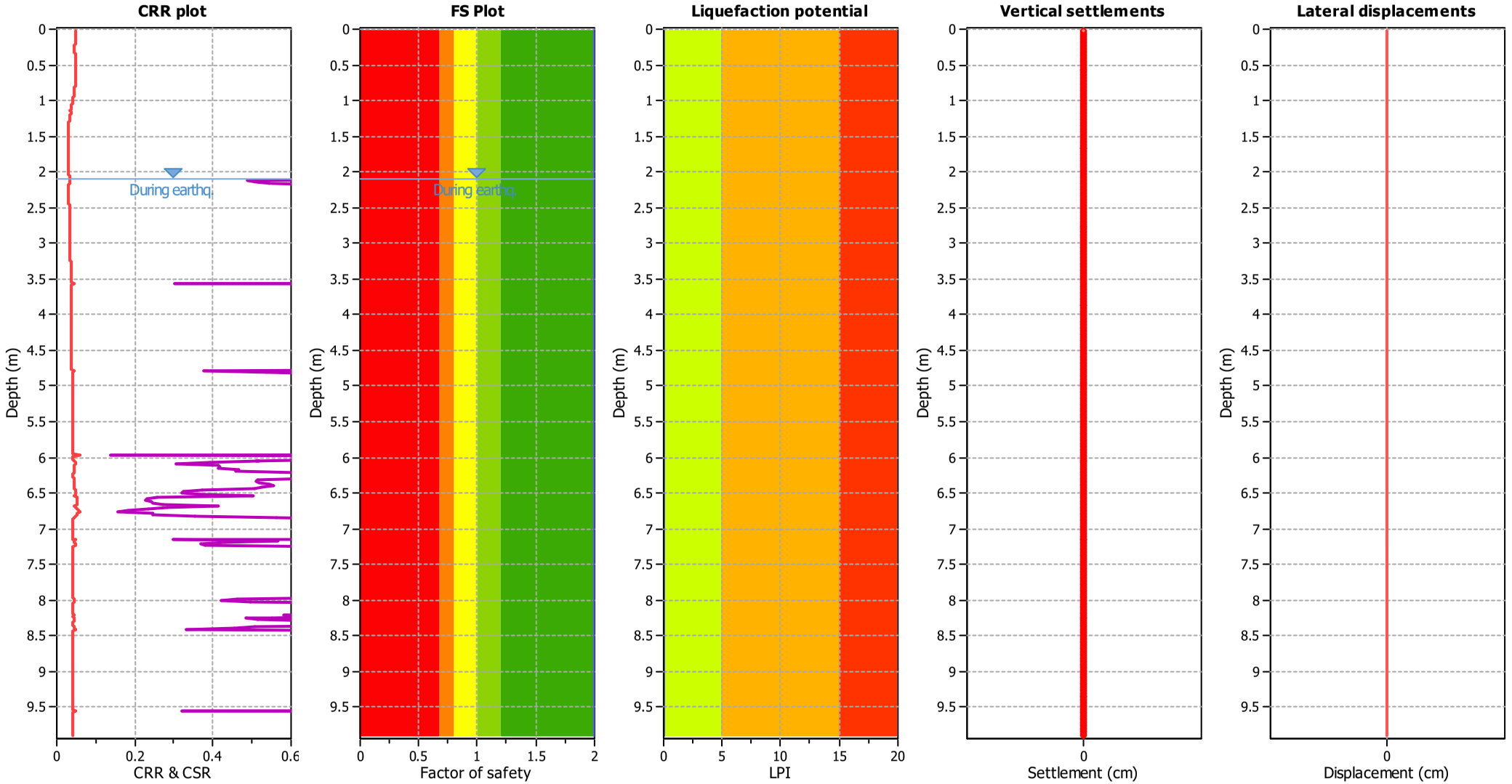






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	20.00 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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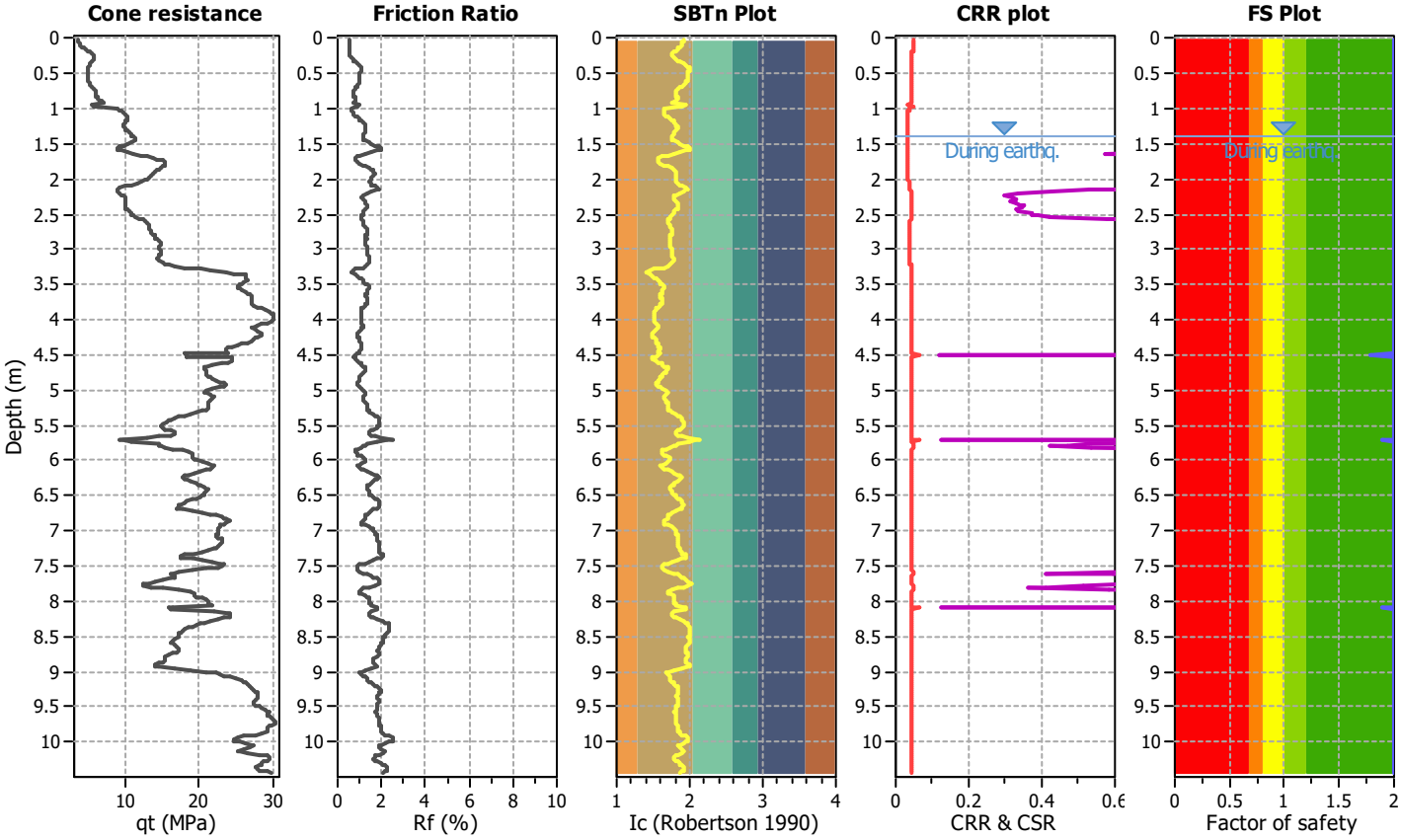
LIQUEFACTION ANALYSIS REPORT

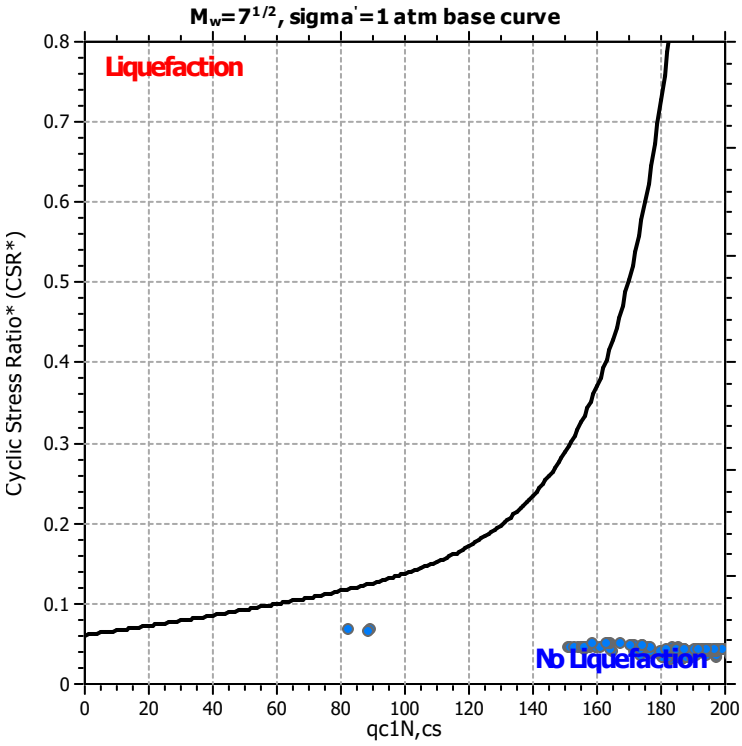
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

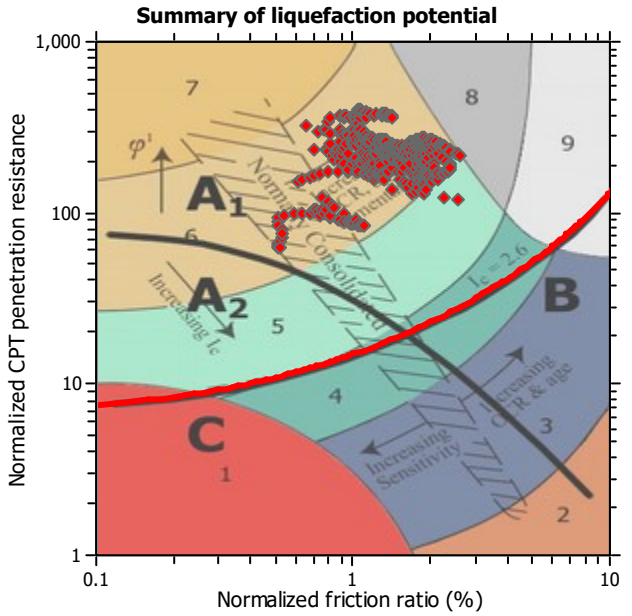
CPT file : CPT09_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

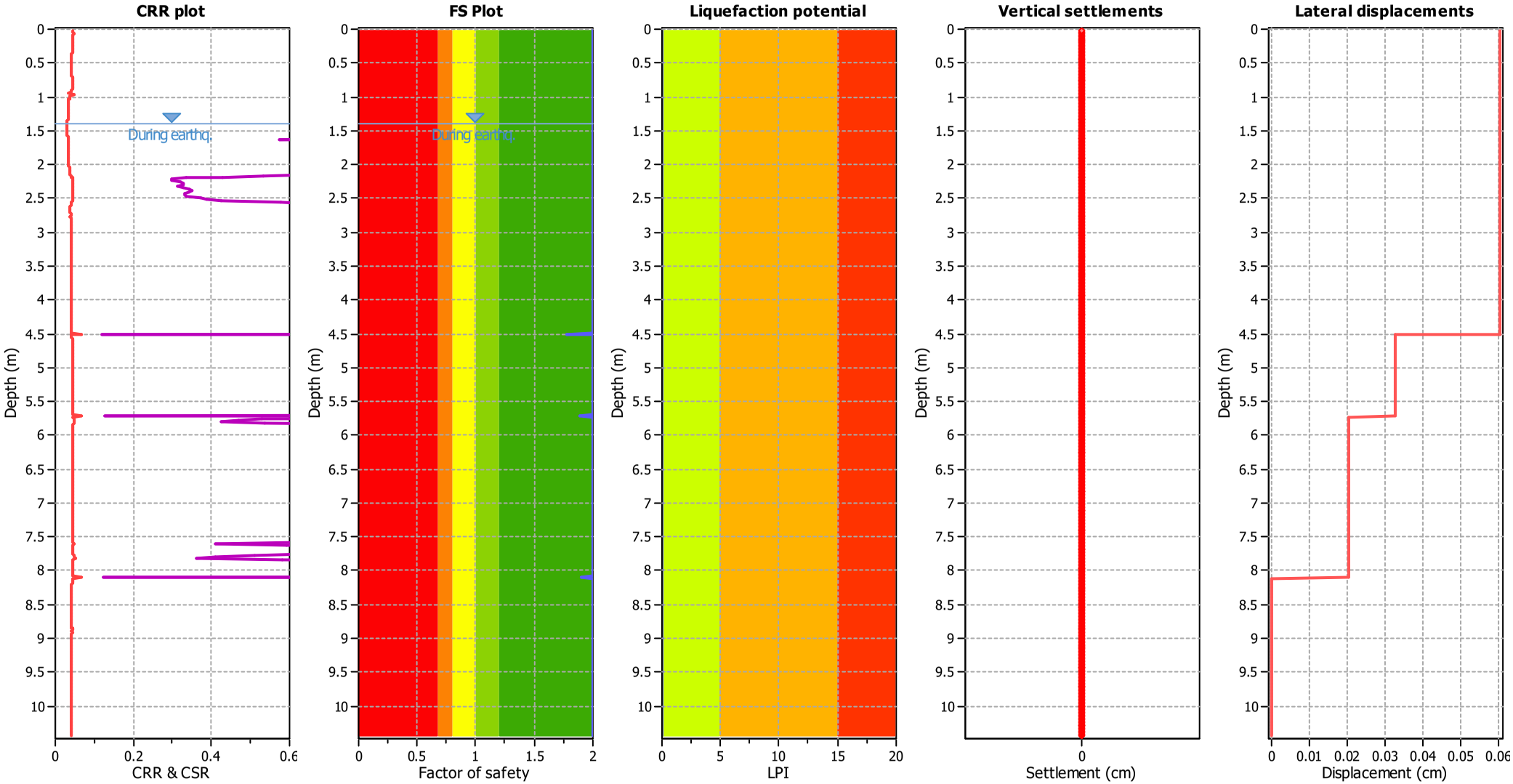






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	20.00 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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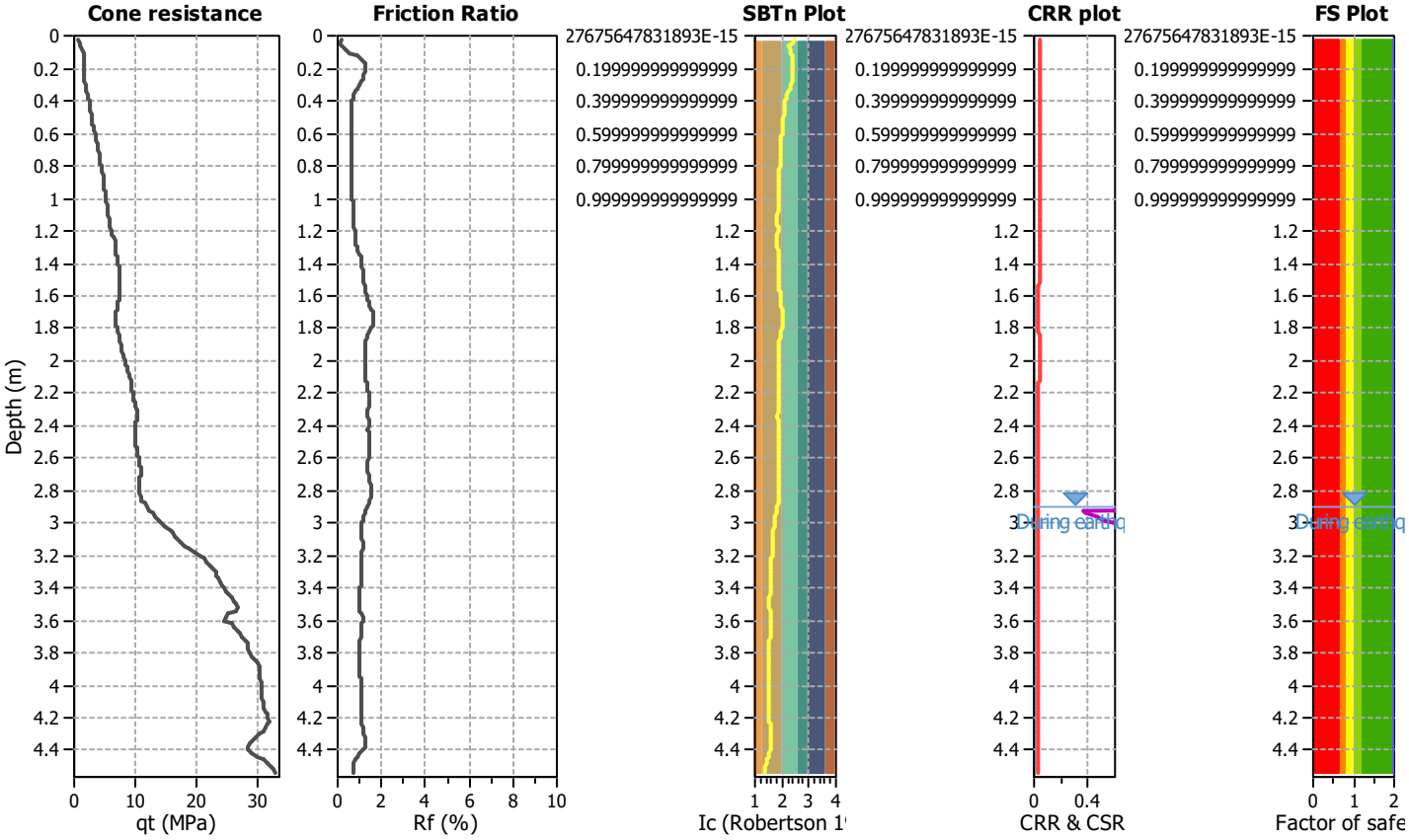
LIQUEFACTION ANALYSIS REPORT

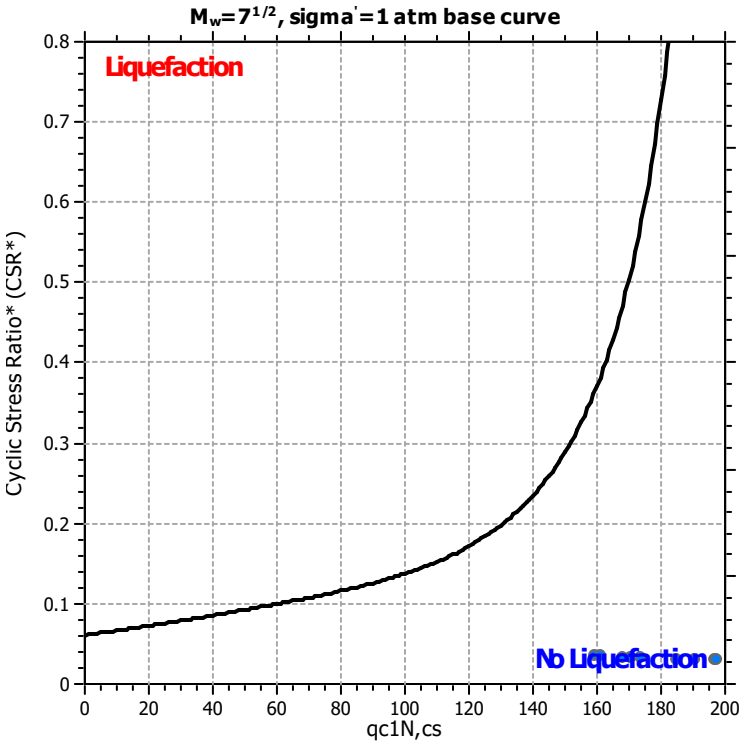
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

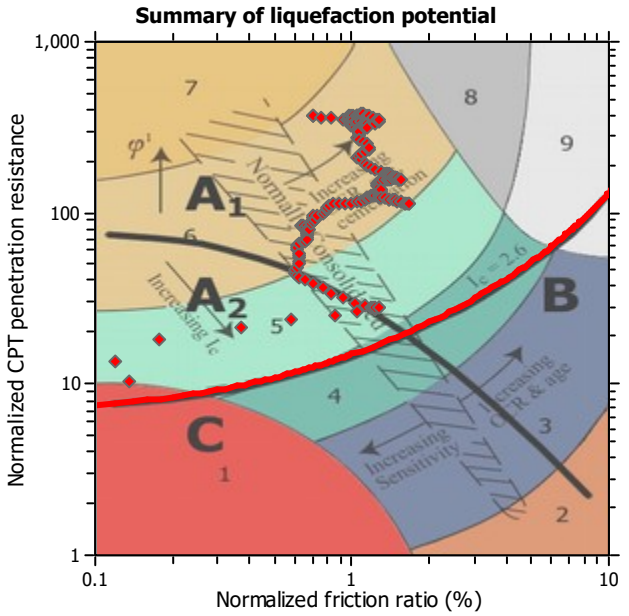
CPT file : CPT10_SLS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

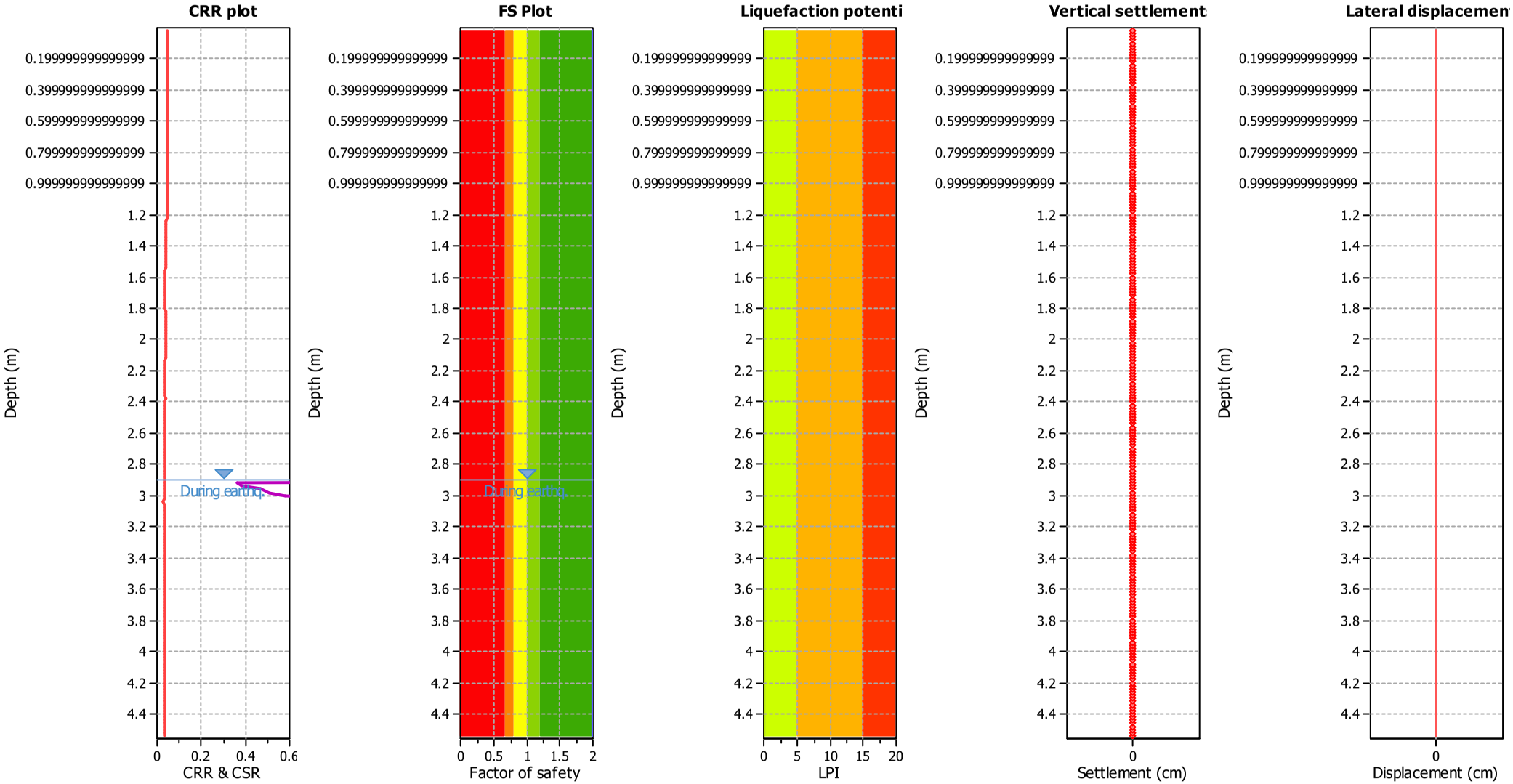






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.90 m	Fill height:	N/A	Limit depth:	20.00 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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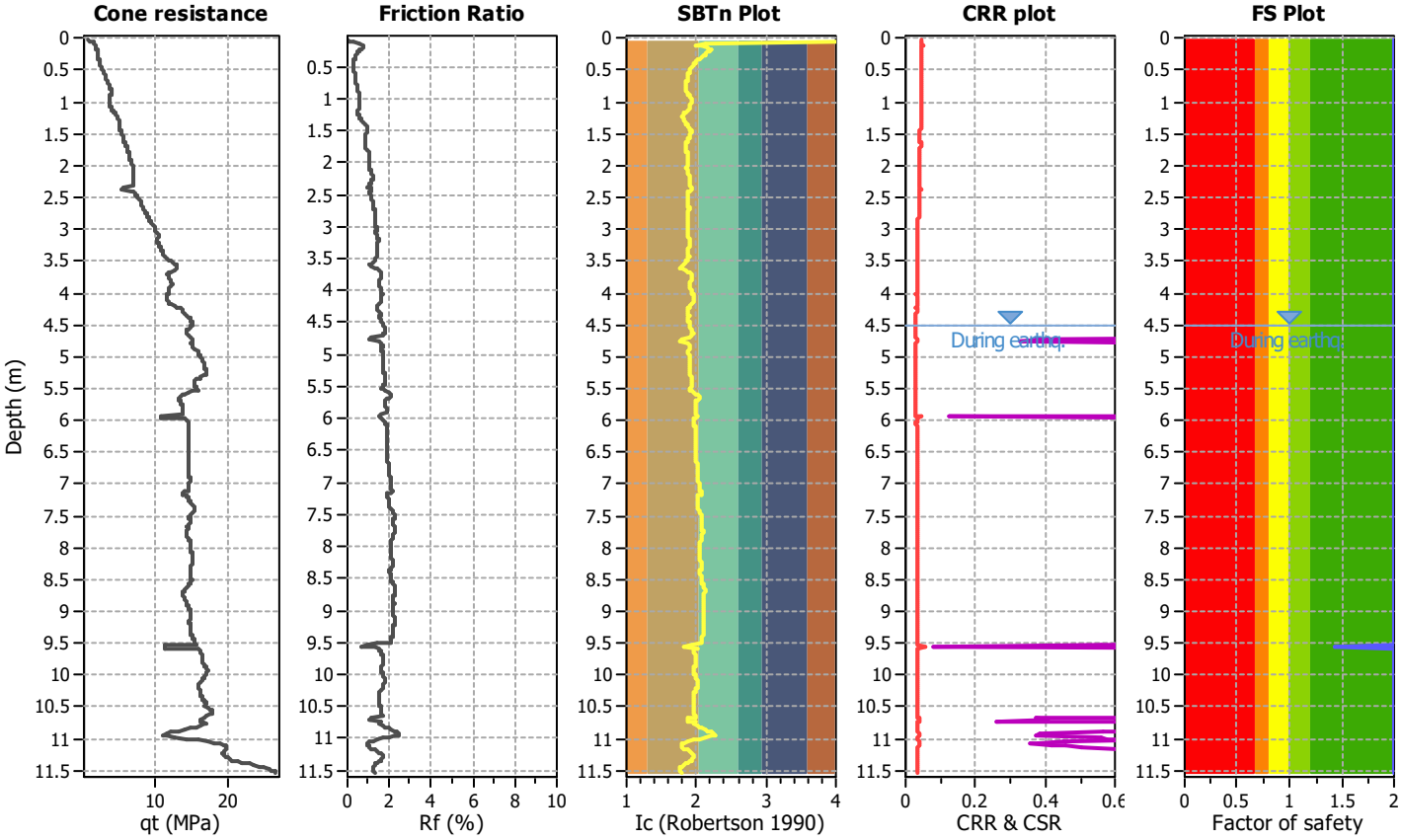
LIQUEFACTION ANALYSIS REPORT

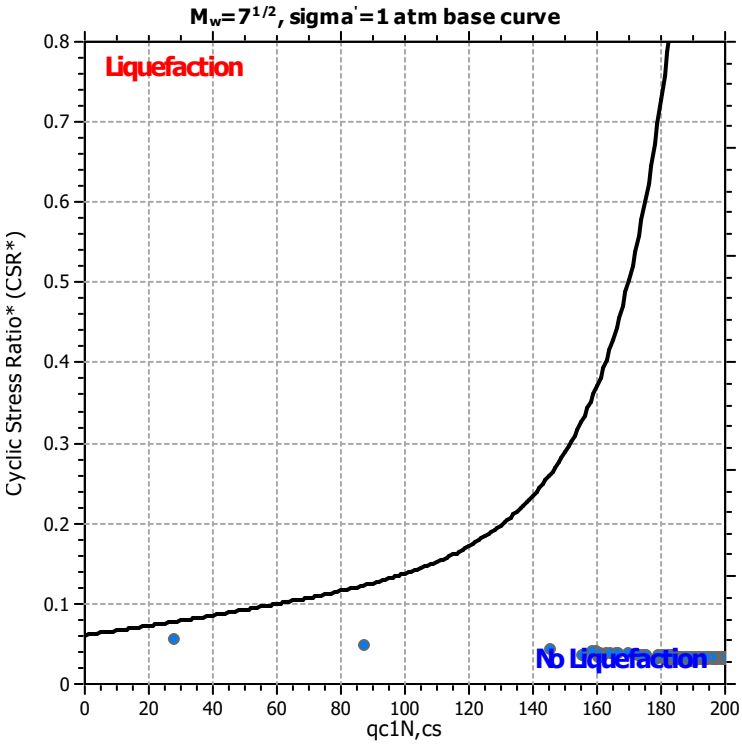
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

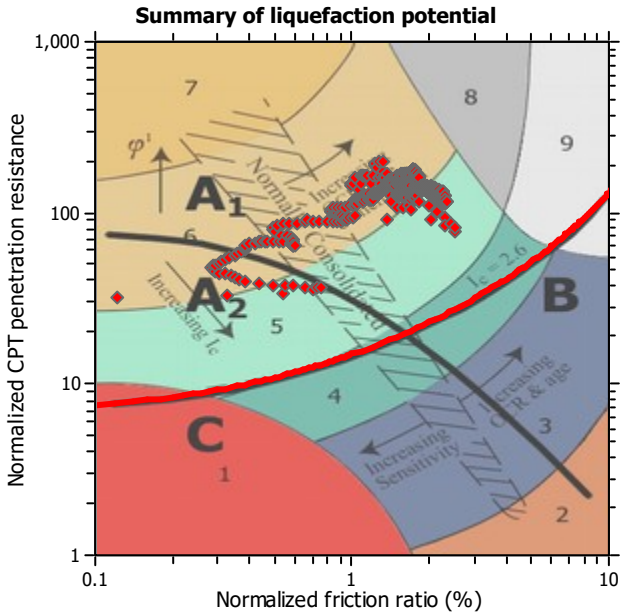
CPT file : CPT11_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.08	Unit weight calculation:	Based on SBT	K_σ applied:	No		

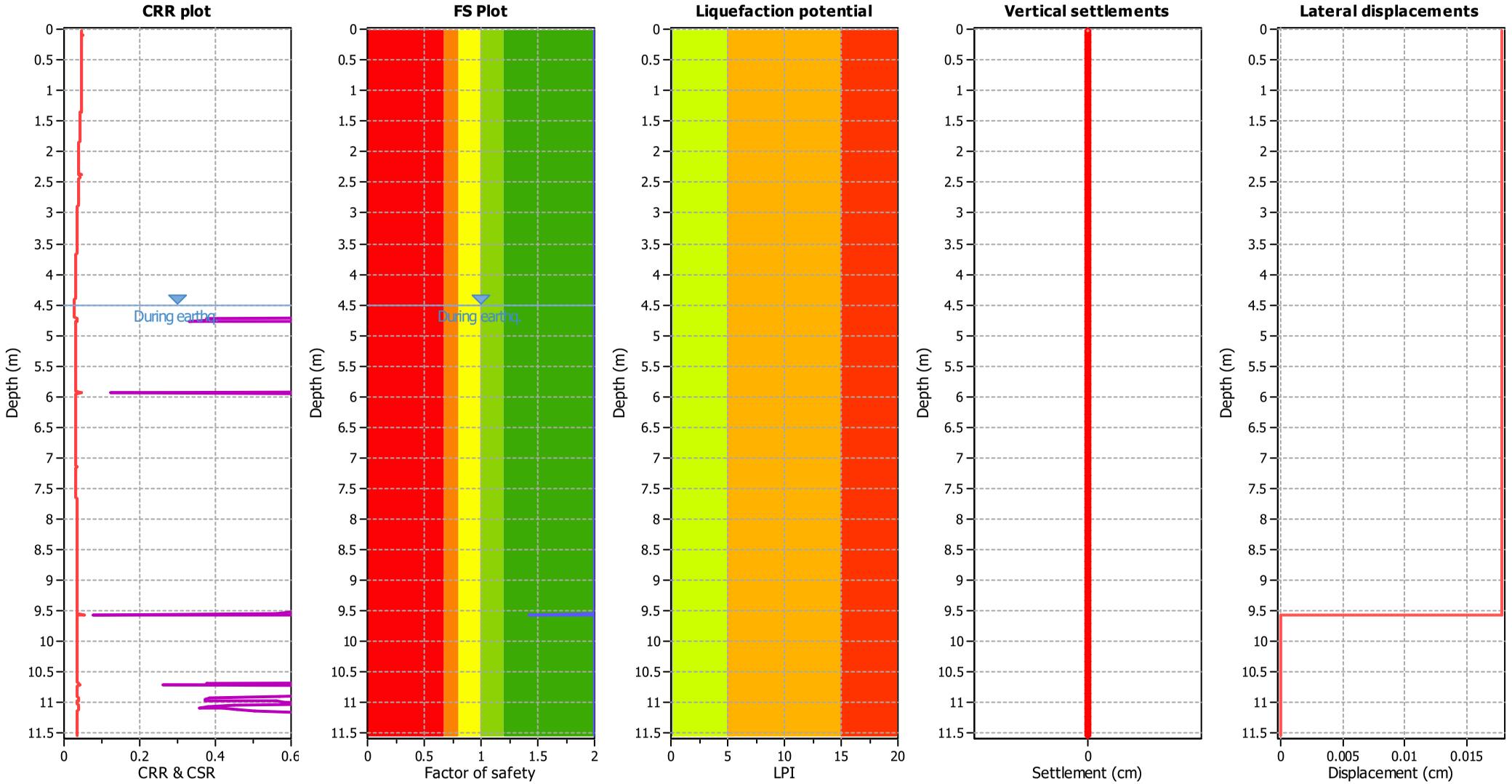






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	4.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.50 m	Fill height:	N/A	Limit depth:	20.00 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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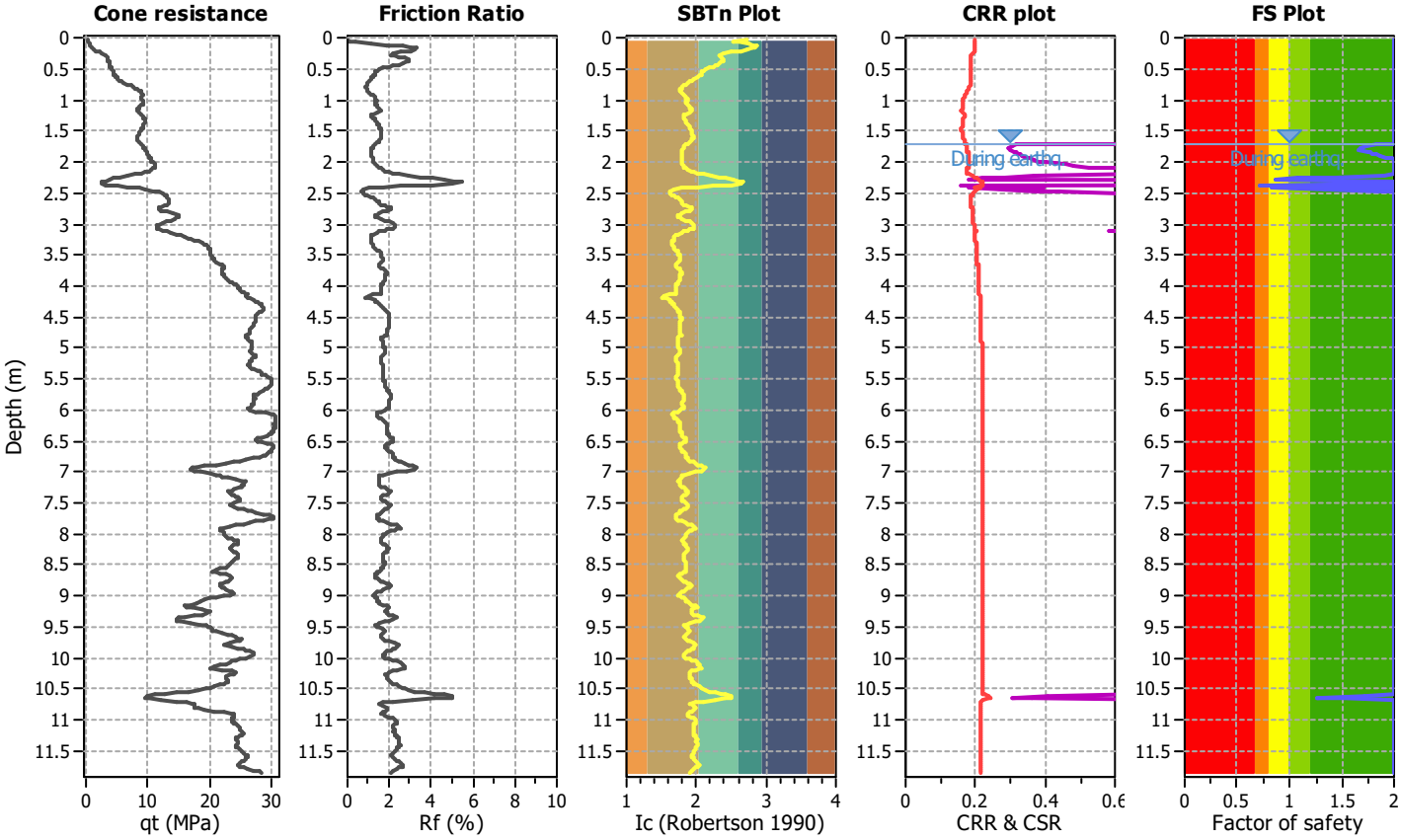
LIQUEFACTION ANALYSIS REPORT

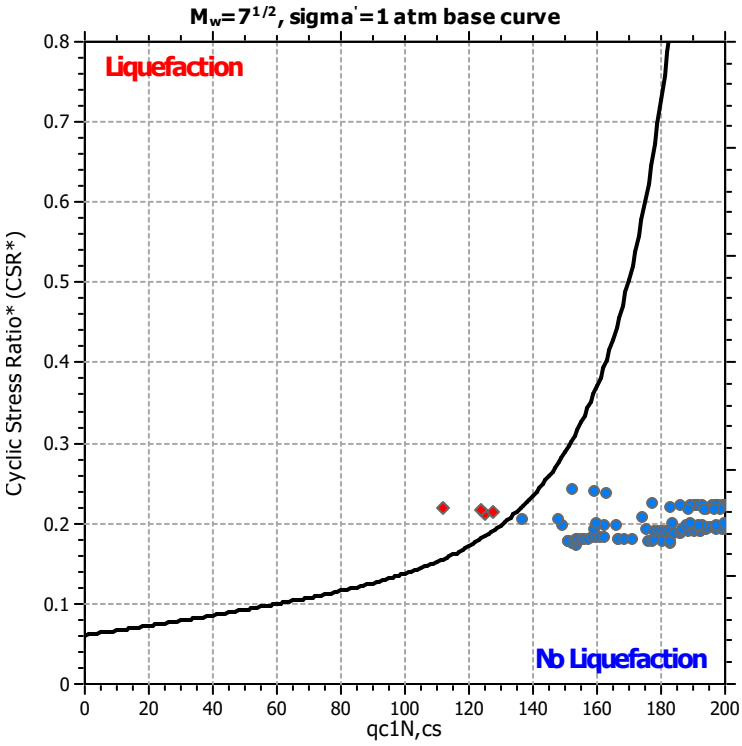
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

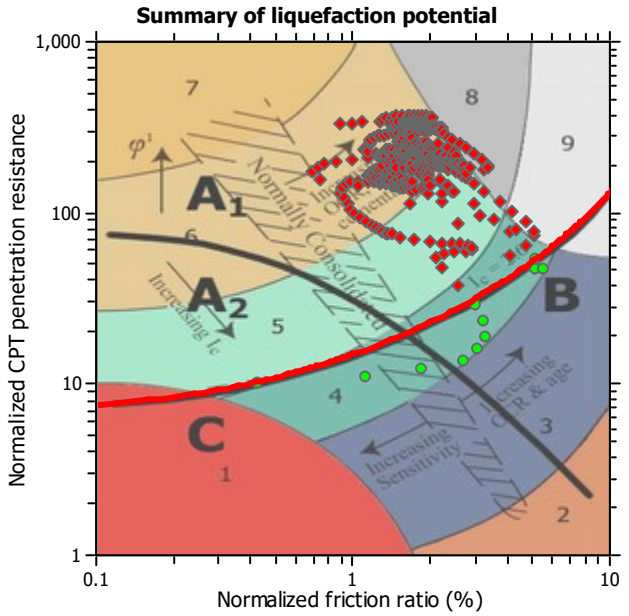
CPT file : CPT01_ULS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

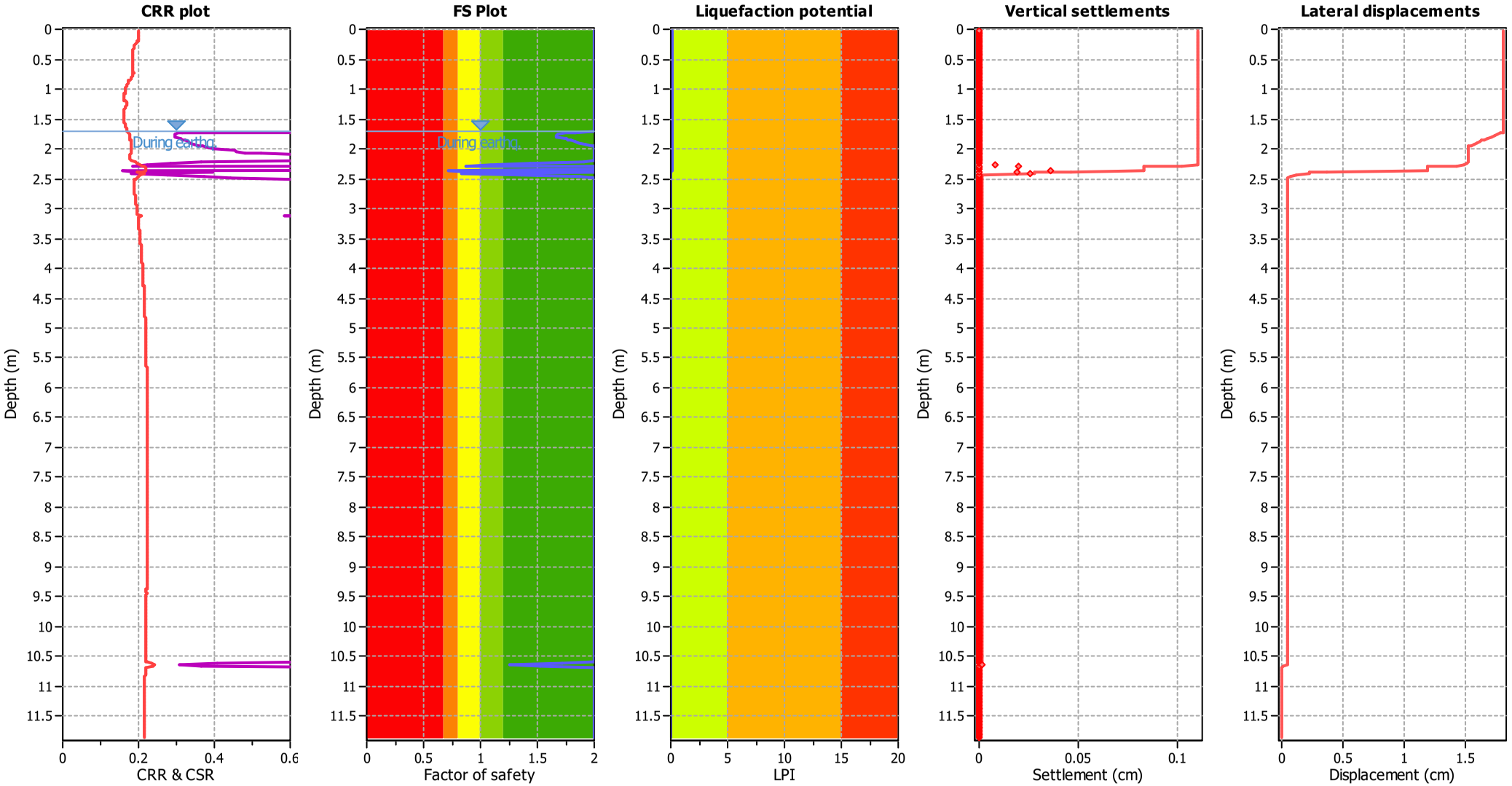






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 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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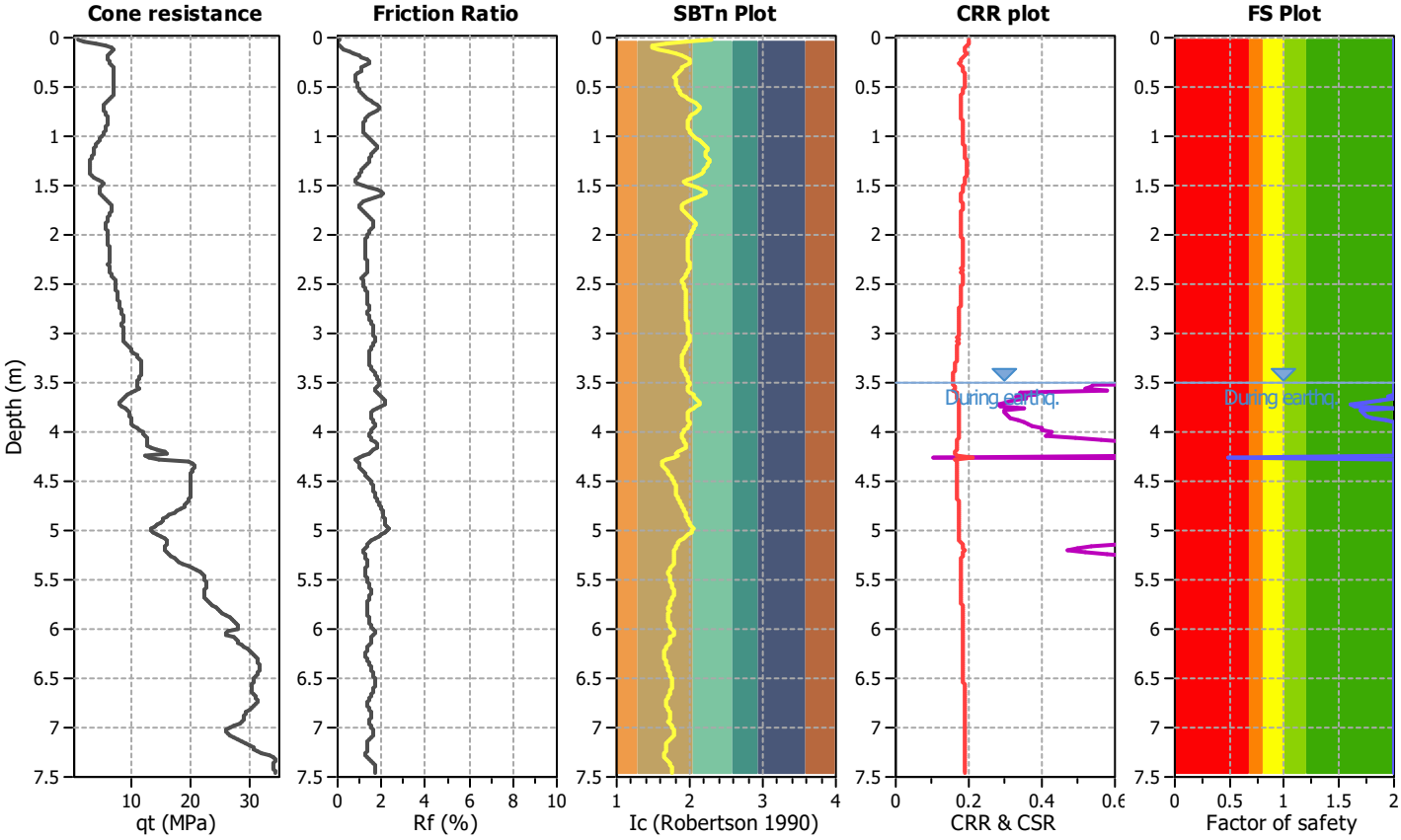
LIQUEFACTION ANALYSIS REPORT

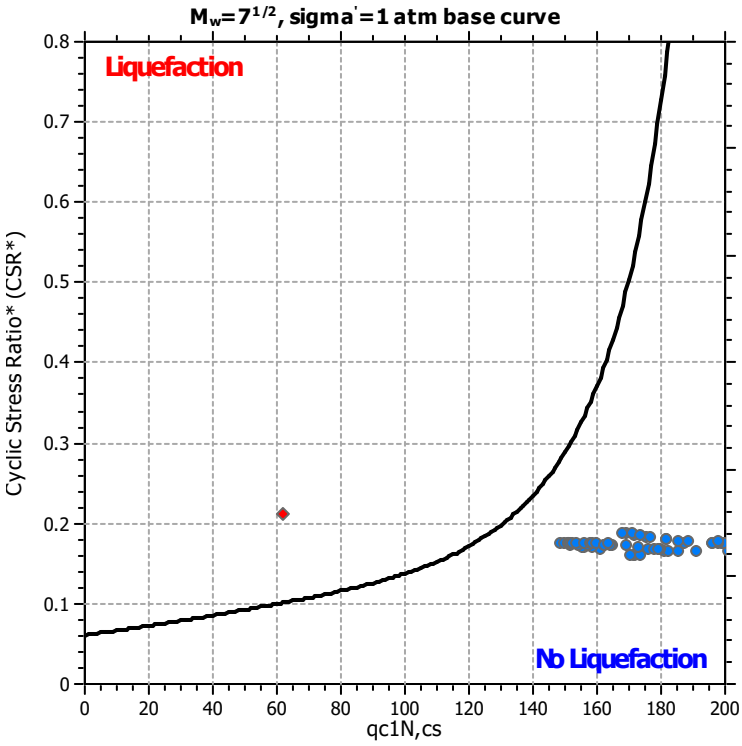
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

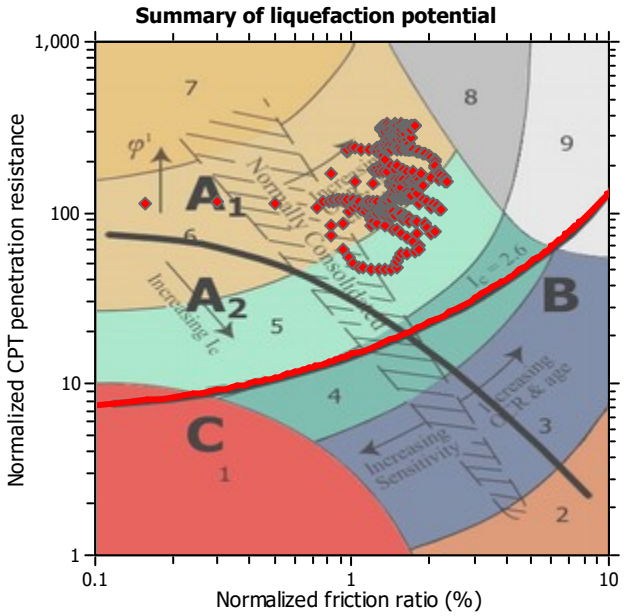
CPT file : CPT02_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

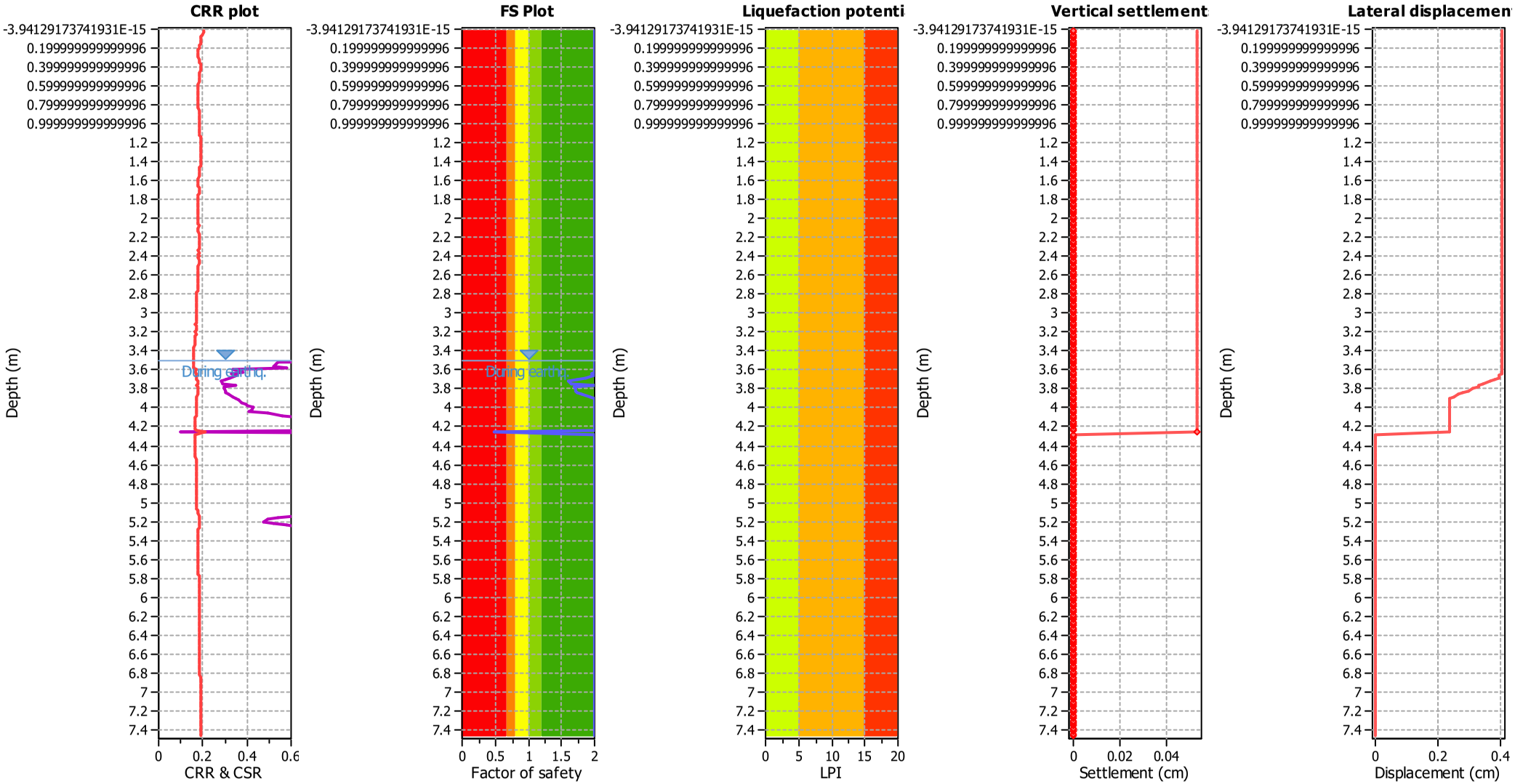






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	3.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.50 m	Fill height:	N/A	Limit depth:	20.00 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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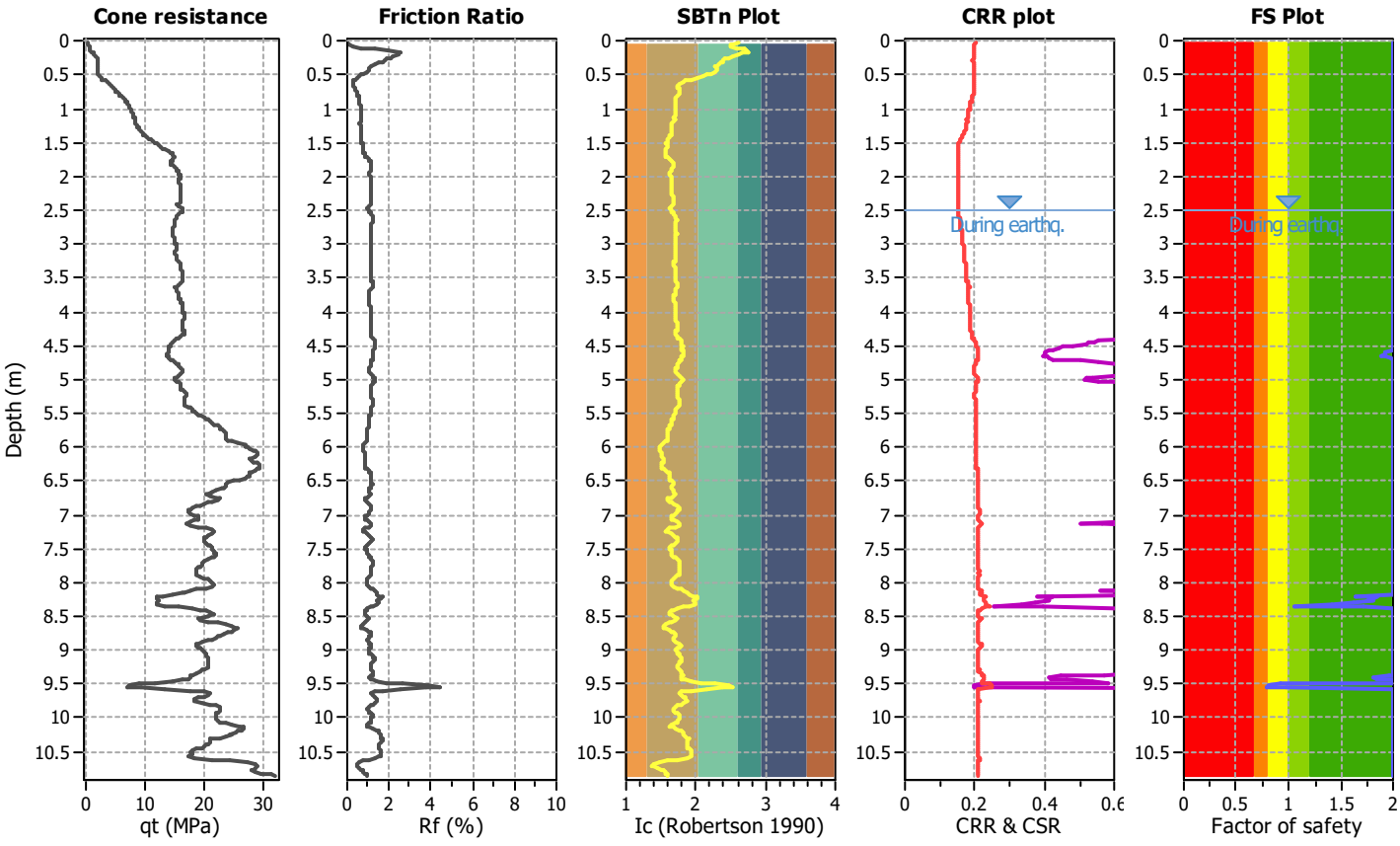
LIQUEFACTION ANALYSIS REPORT

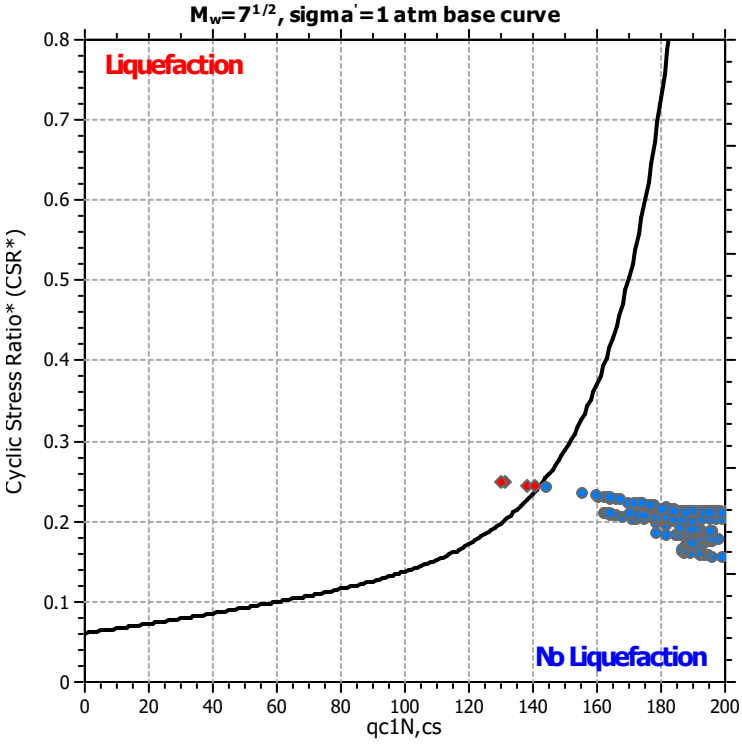
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

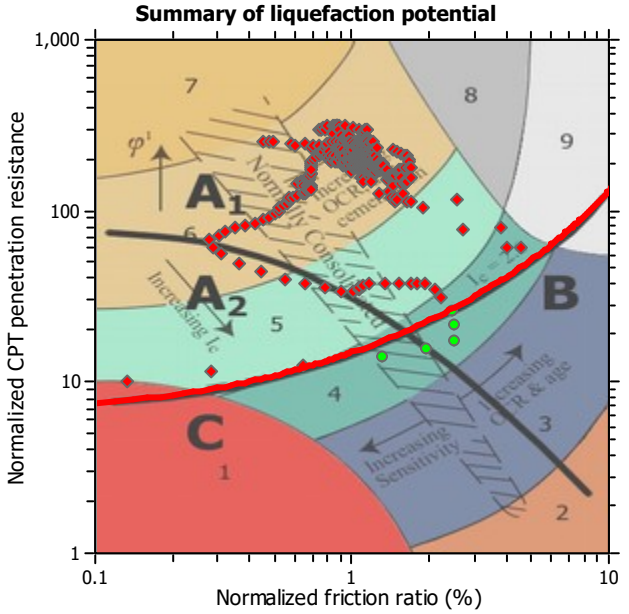
CPT file : CPT03_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

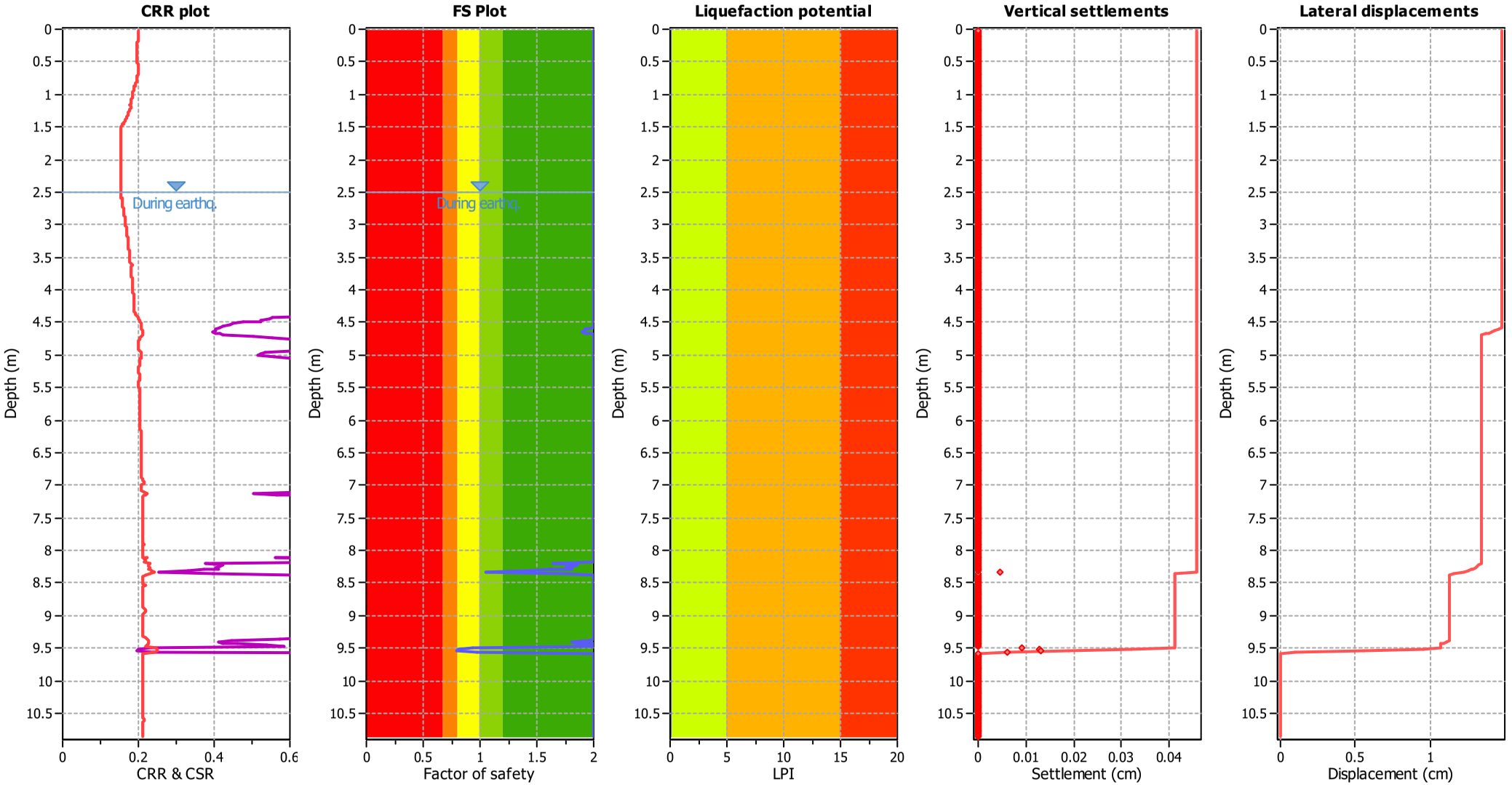






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	20.00 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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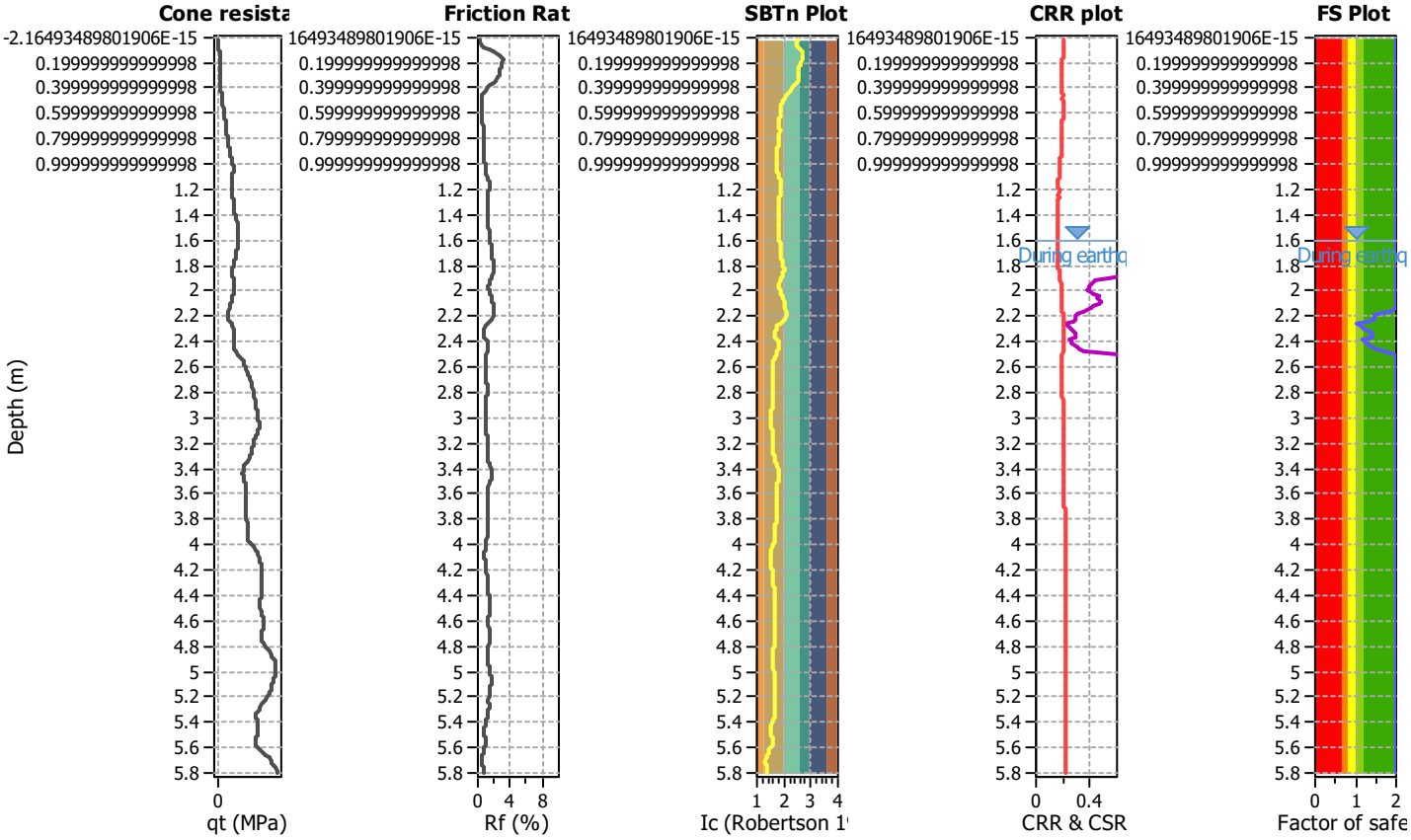
LIQUEFACTION ANALYSIS REPORT

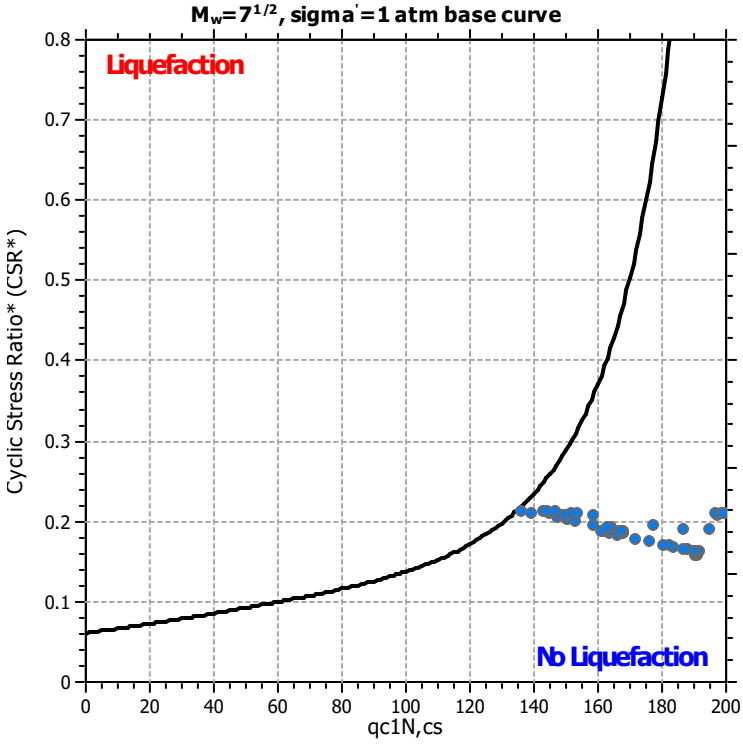
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

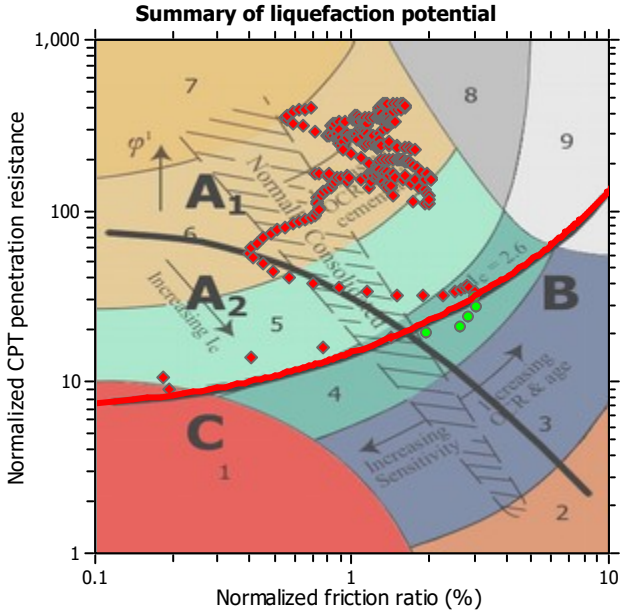
CPT file : CPT04_ULS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

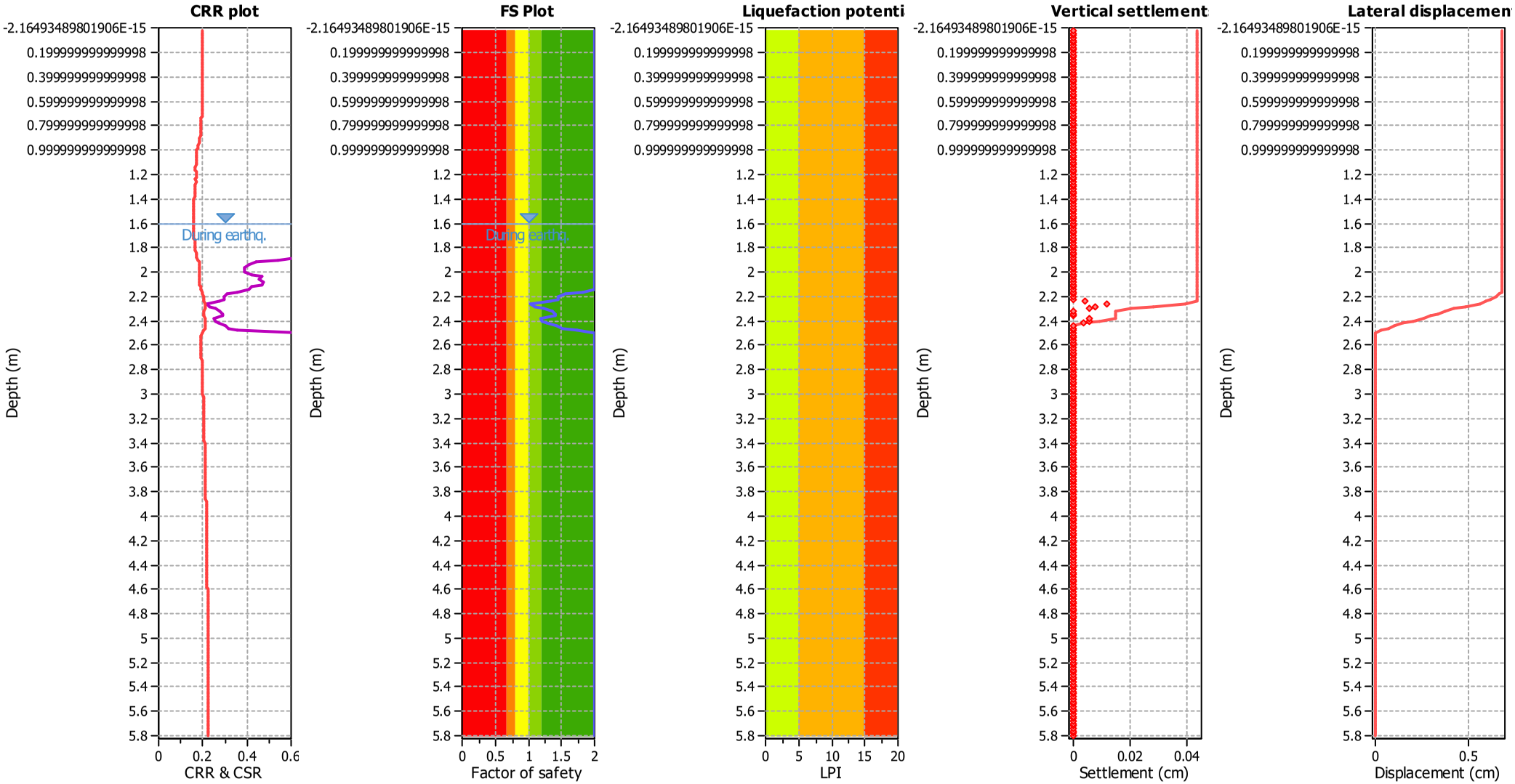






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.60 m	Fill height:	N/A	Limit depth:	20.00 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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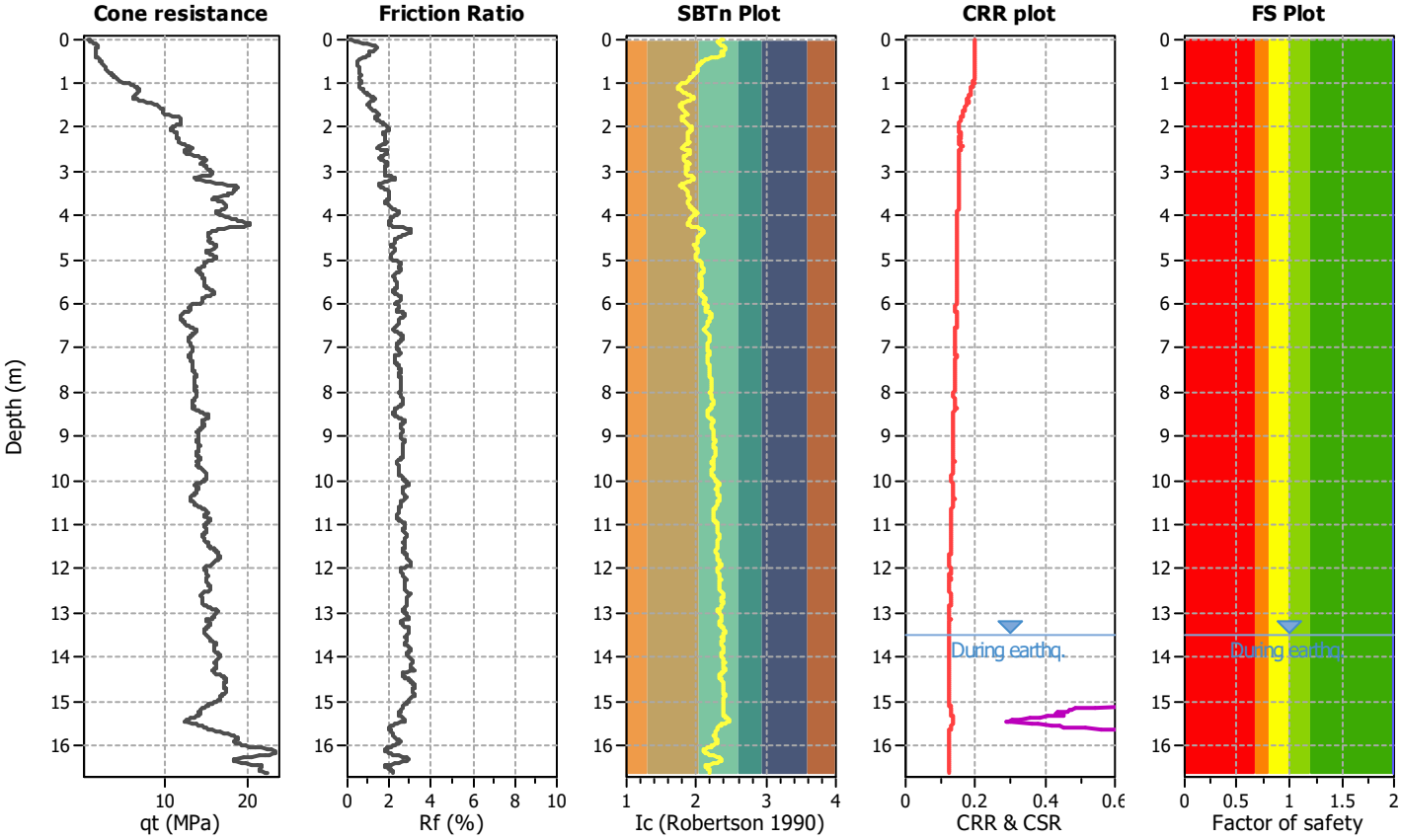
LIQUEFACTION ANALYSIS REPORT

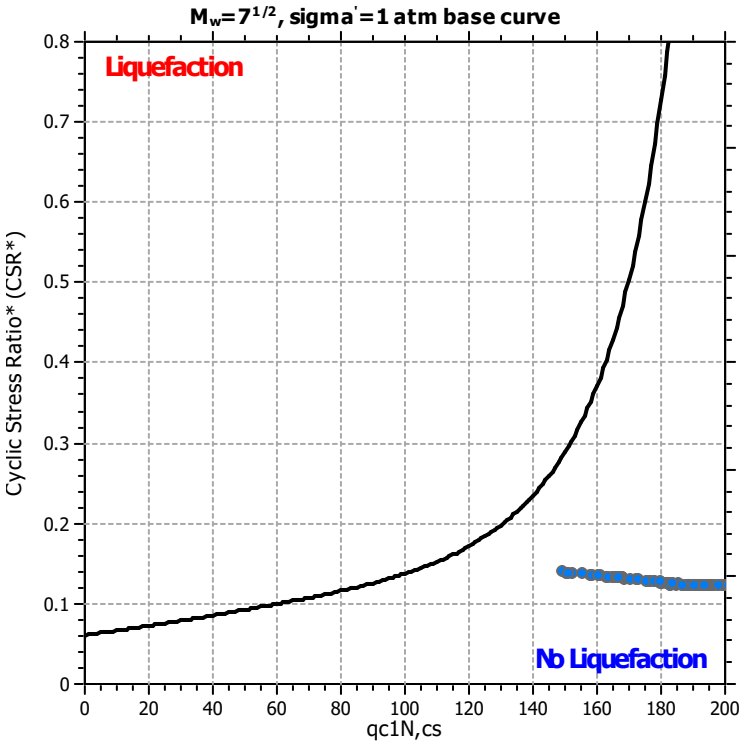
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

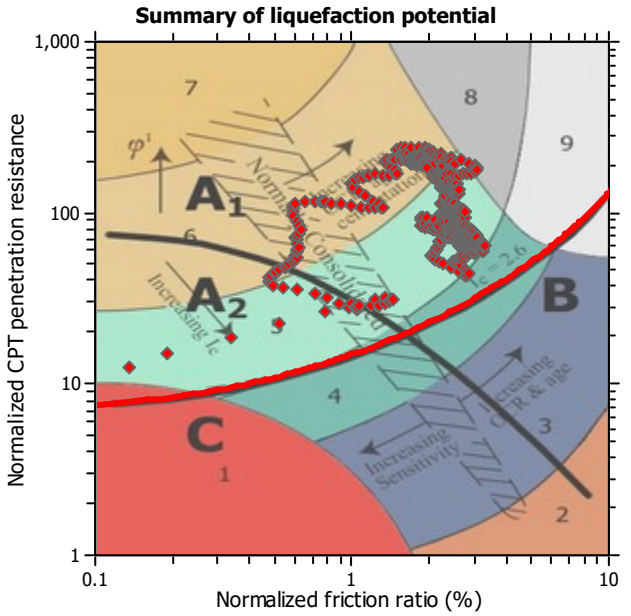
CPT file : CPT05_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	13.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	13.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

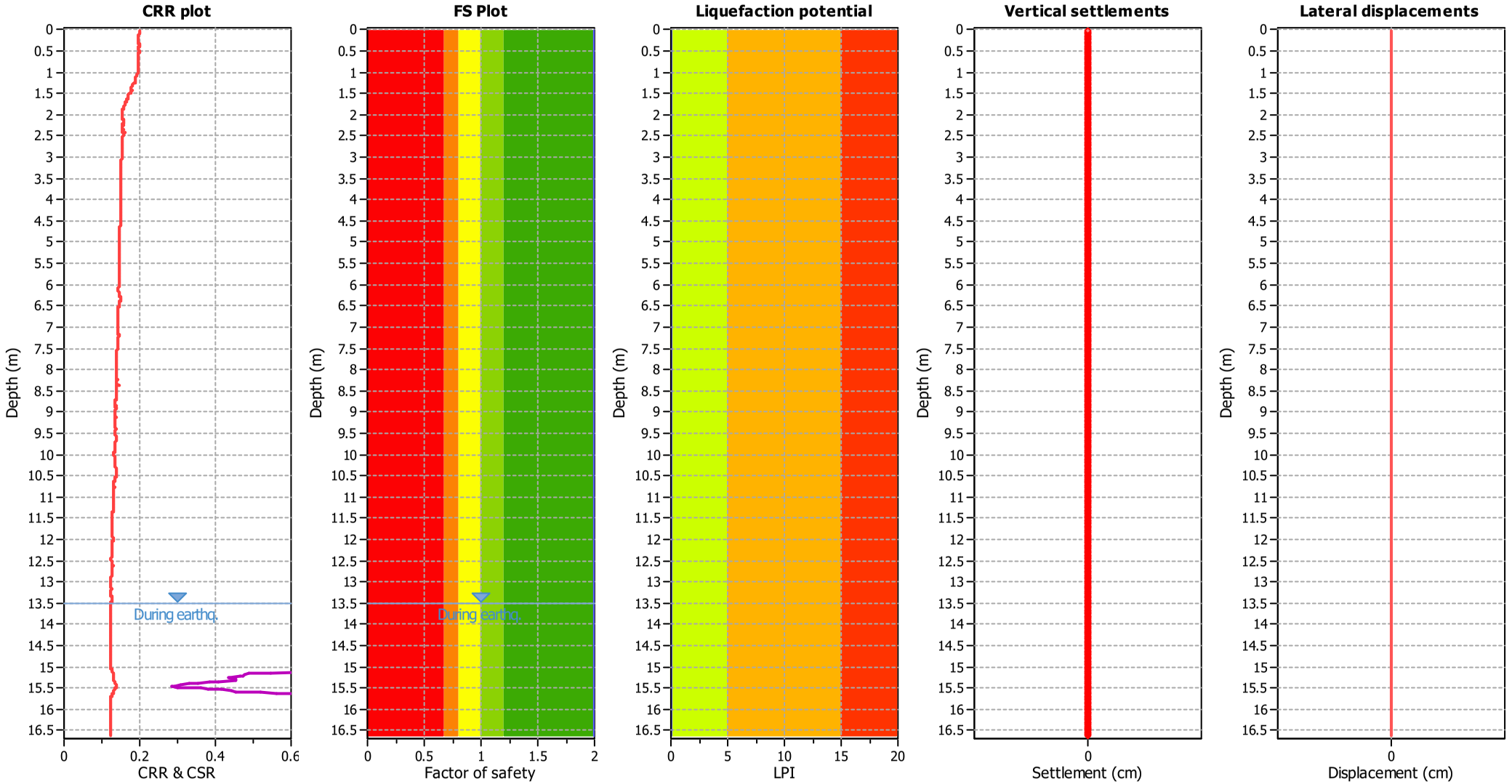






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	13.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	13.50 m	Fill height:	N/A	Limit depth:	20.00 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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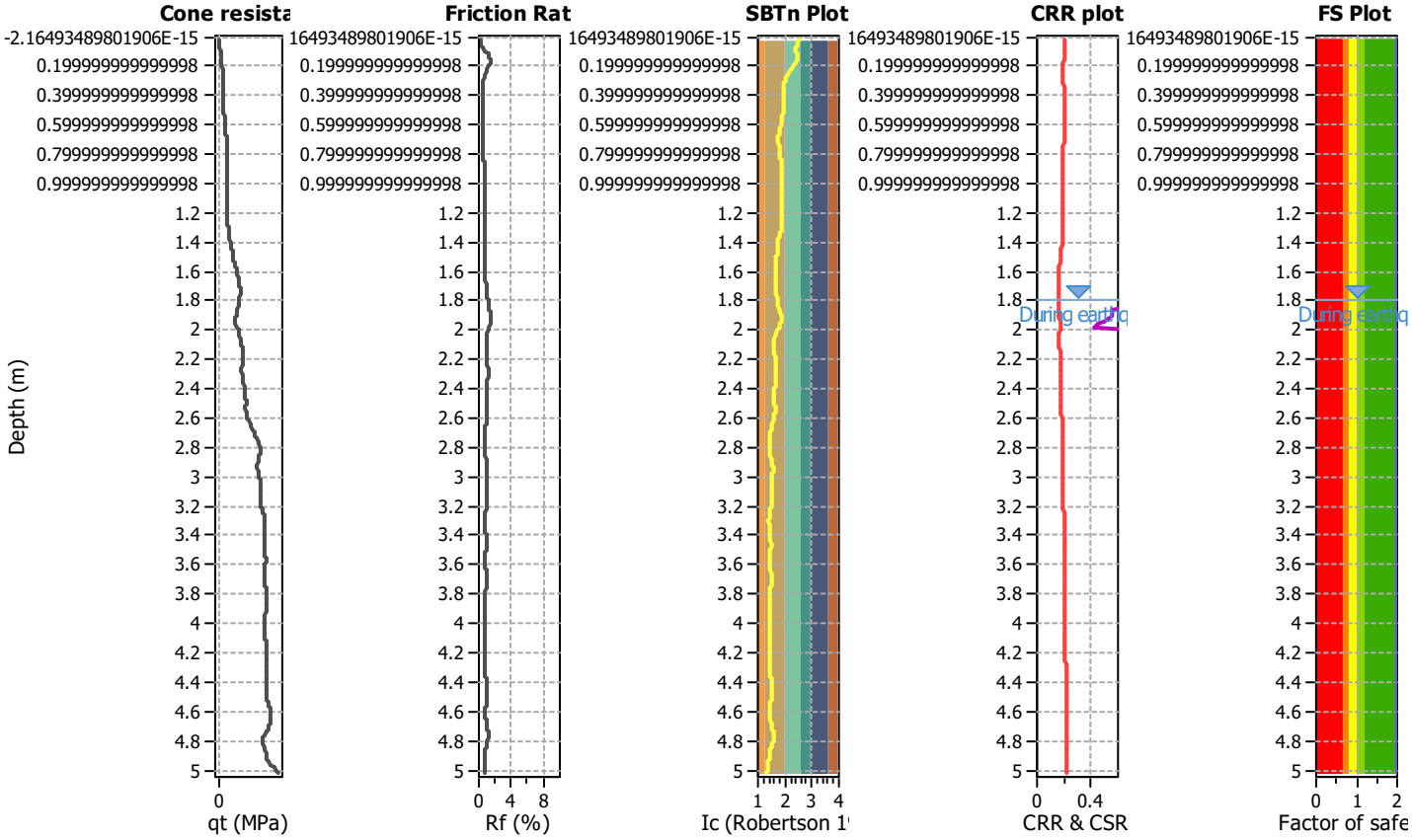
LIQUEFACTION ANALYSIS REPORT

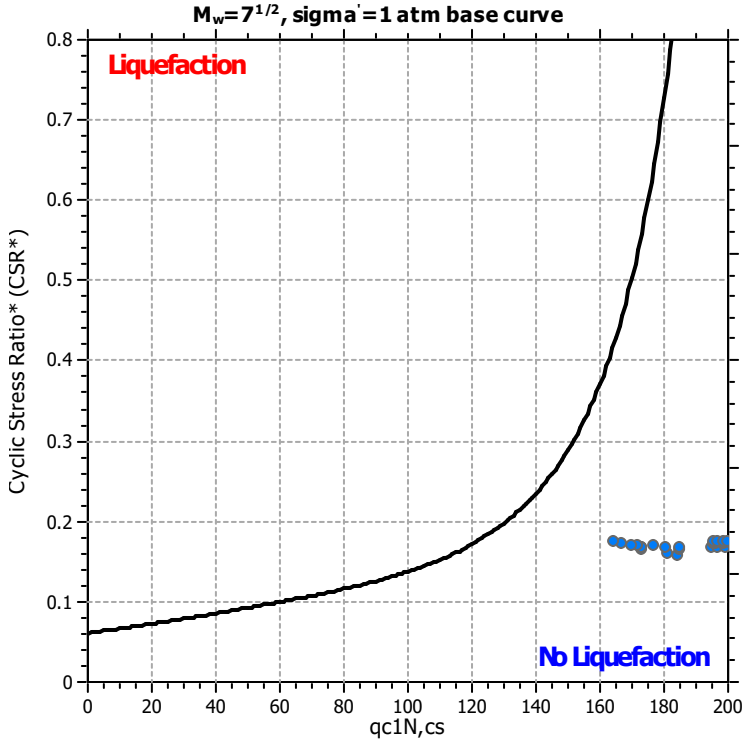
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

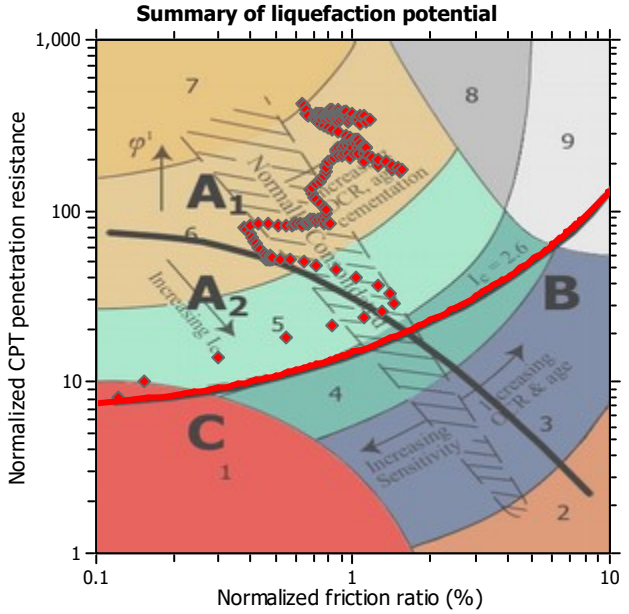
CPT file : CPT06_ULS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

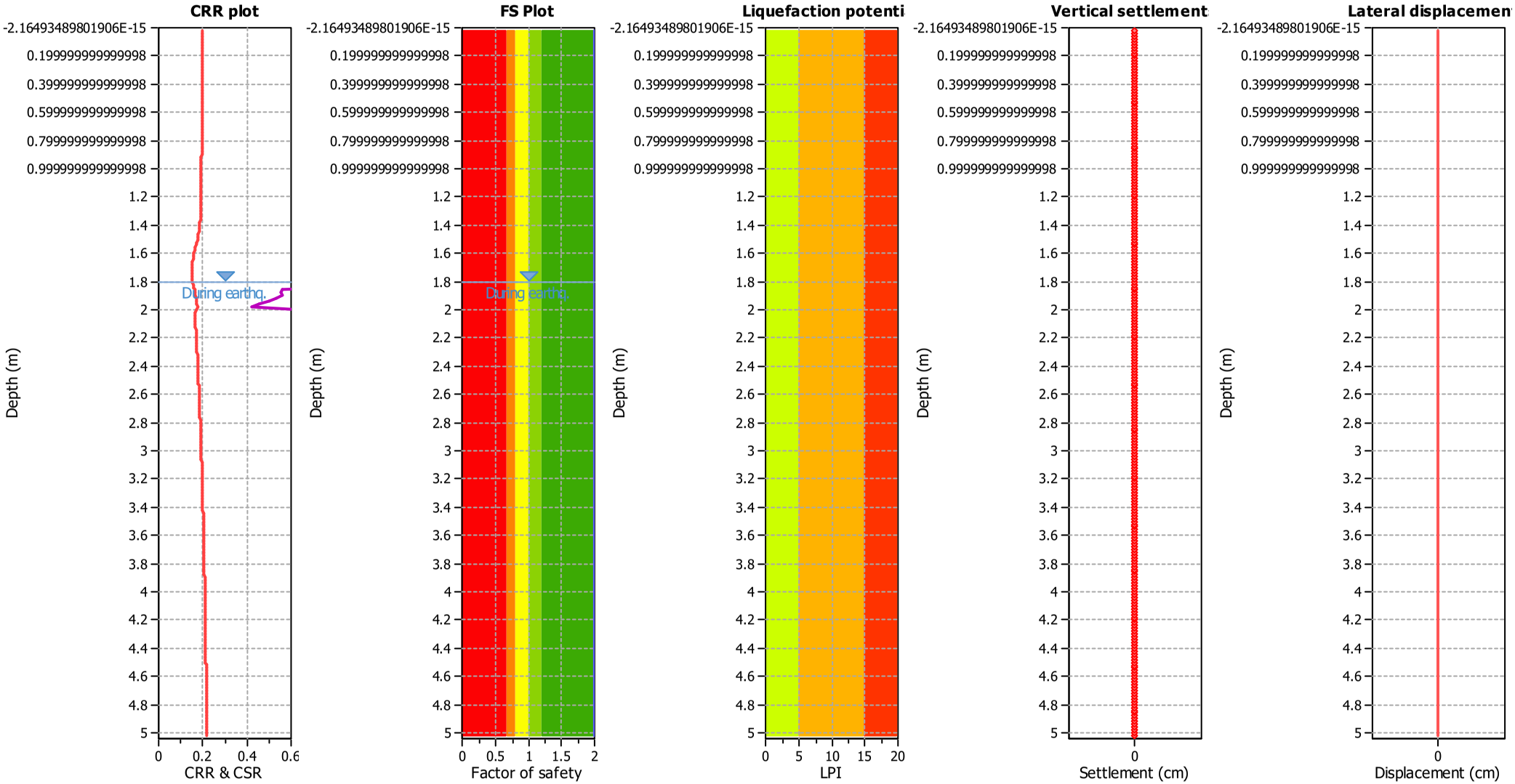






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	20.00 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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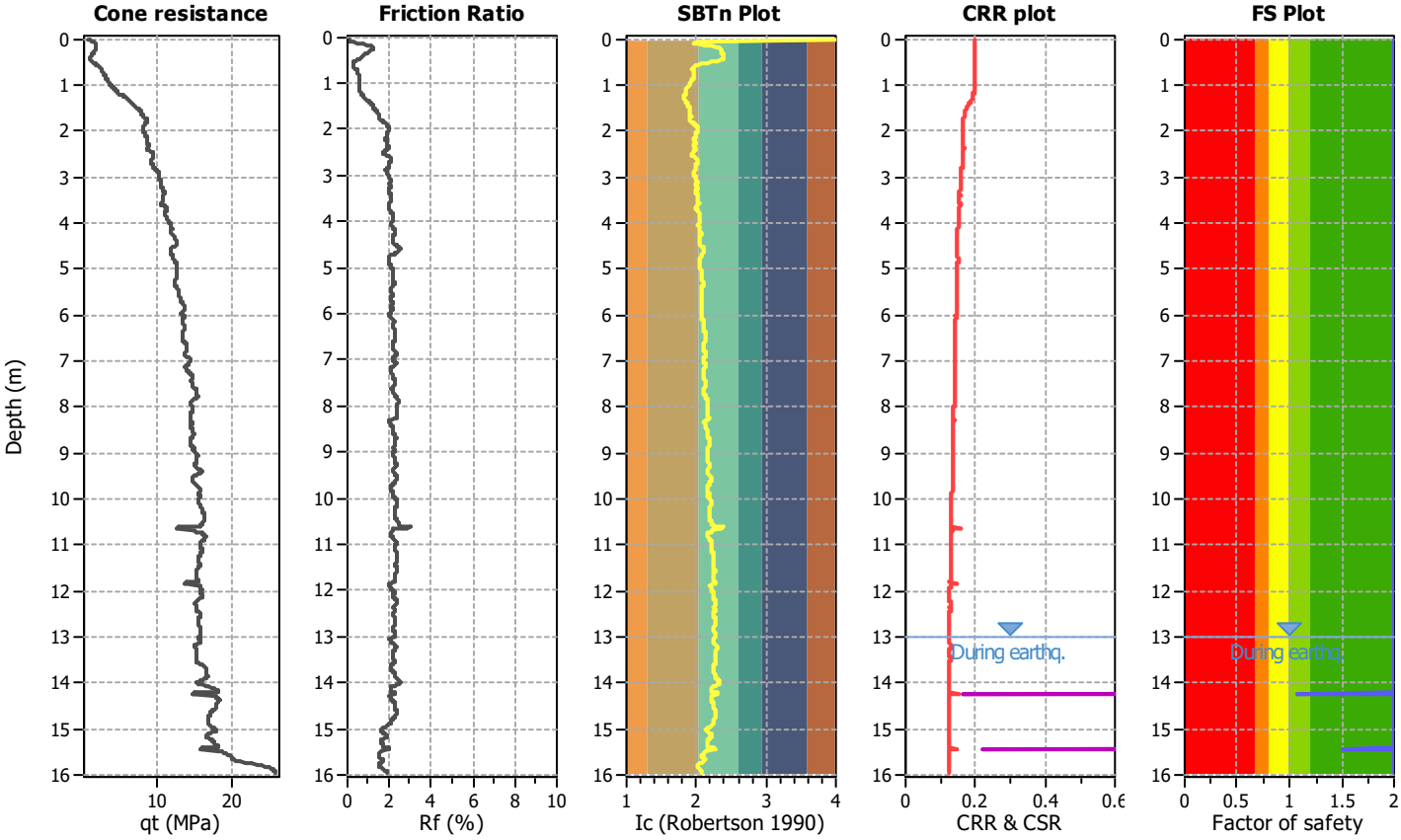
LIQUEFACTION ANALYSIS REPORT

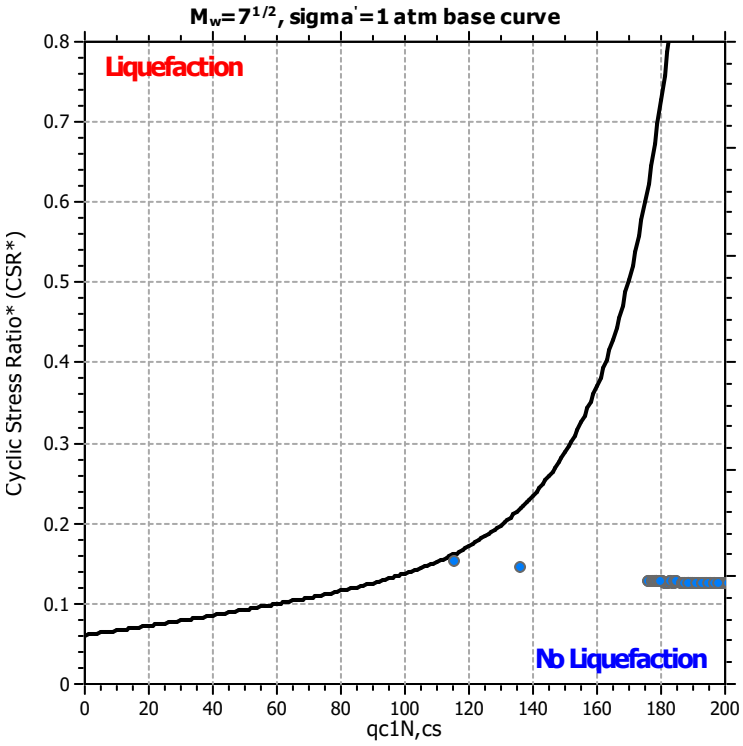
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

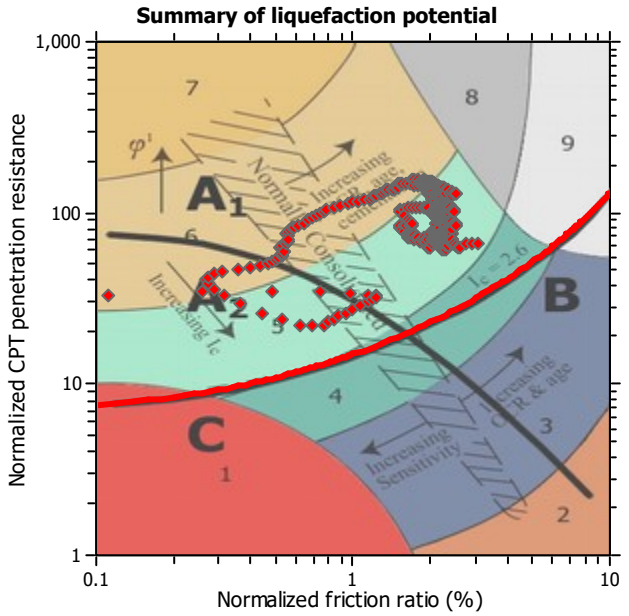
CPT file : CPT07_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	13.00 m	Use fill:	No	Clay like behavior applied:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

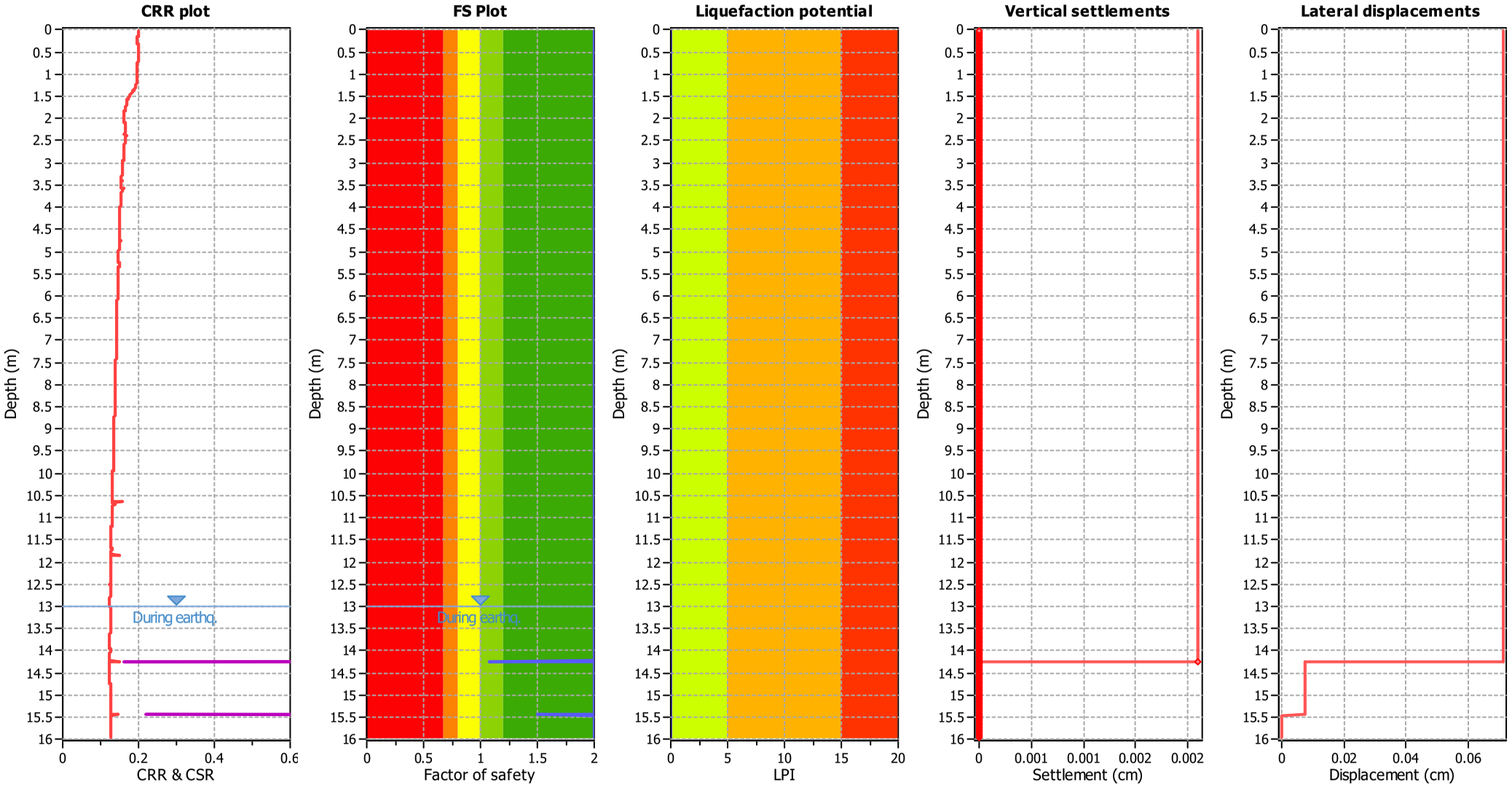






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	13.00 m	Fill height:	N/A	Limit depth:	20.00 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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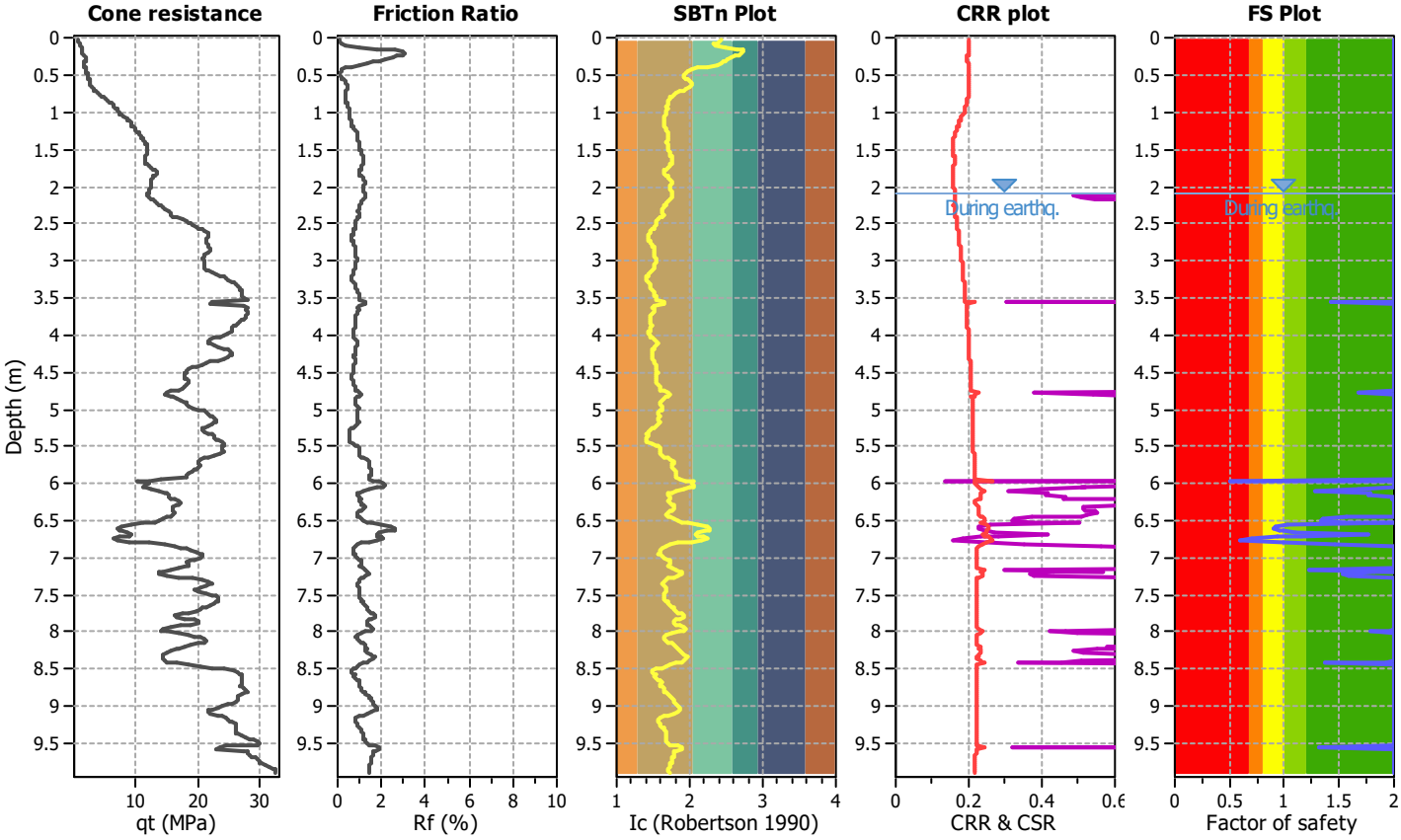
LIQUEFACTION ANALYSIS REPORT

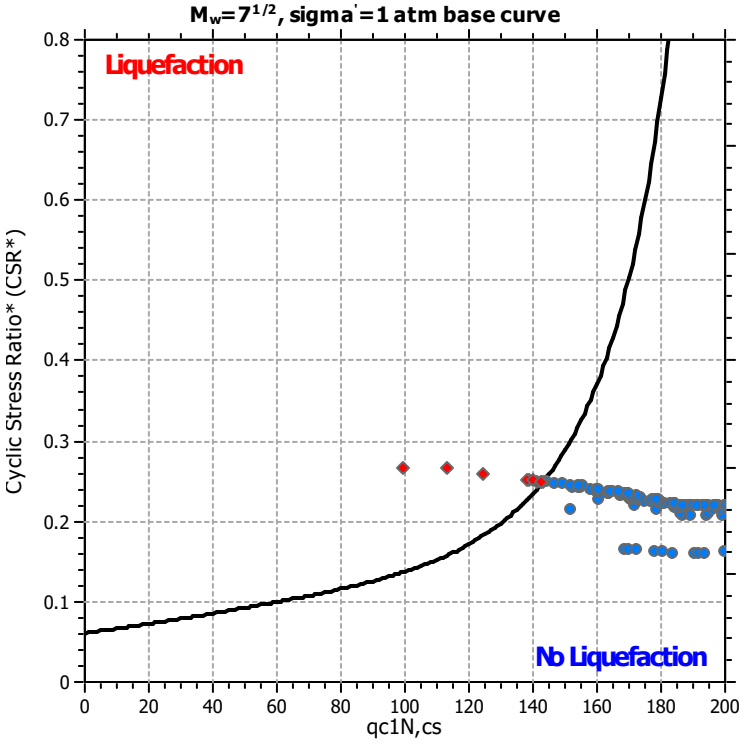
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

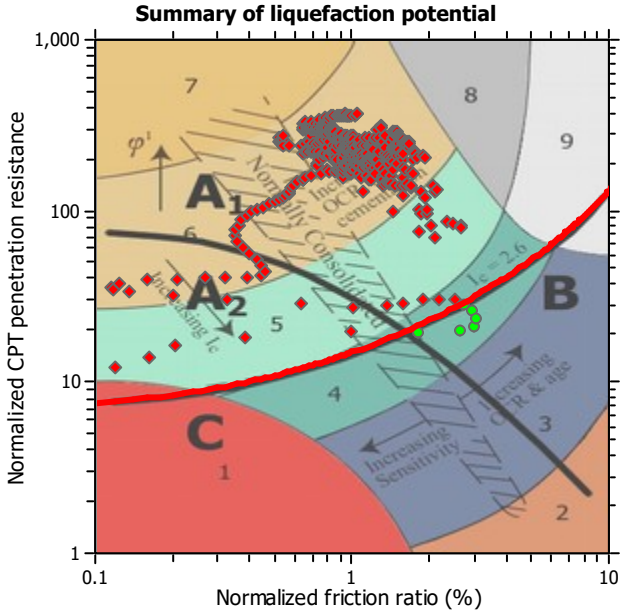
CPT file : CPT08_ULS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

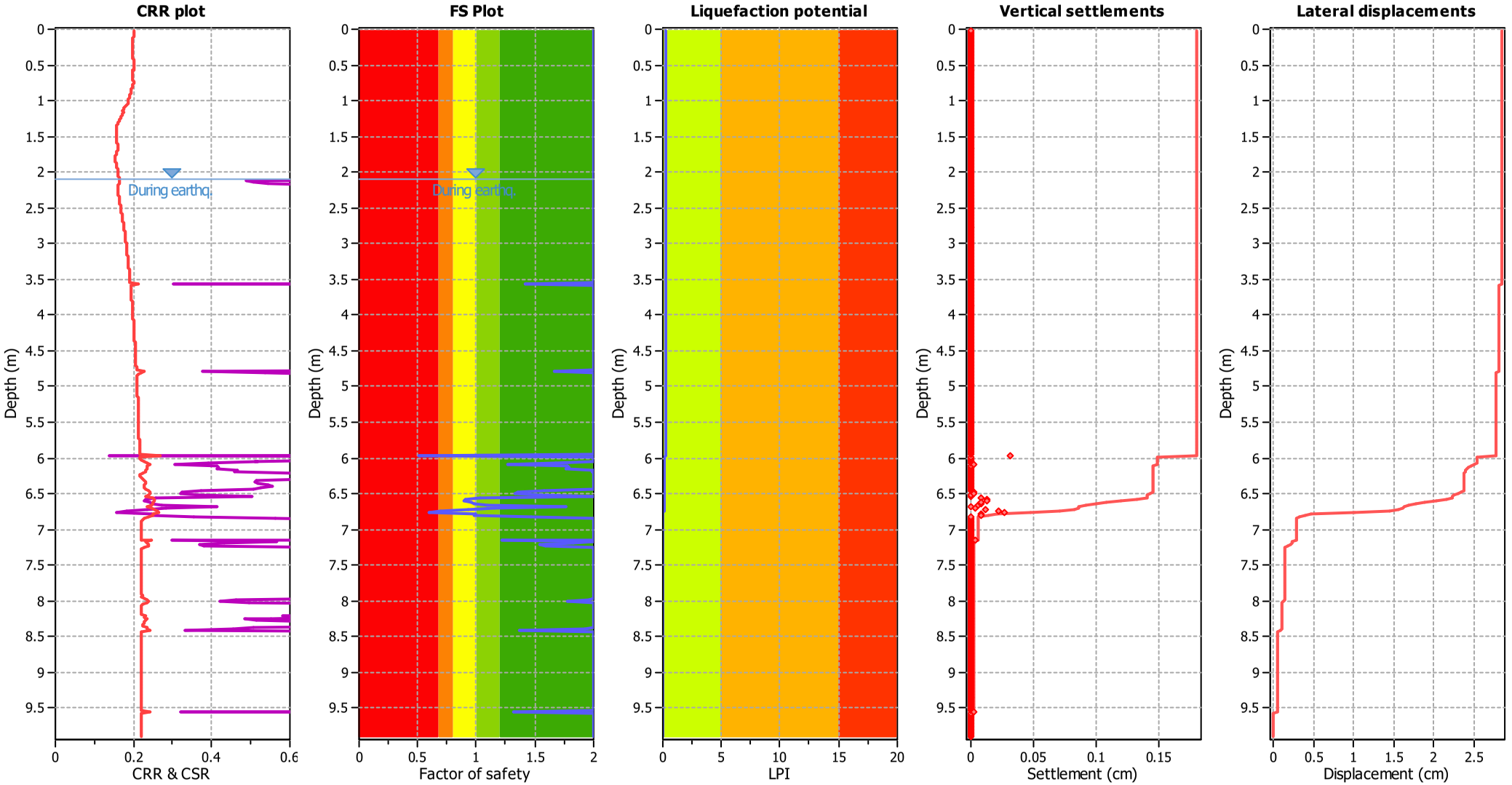






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	20.00 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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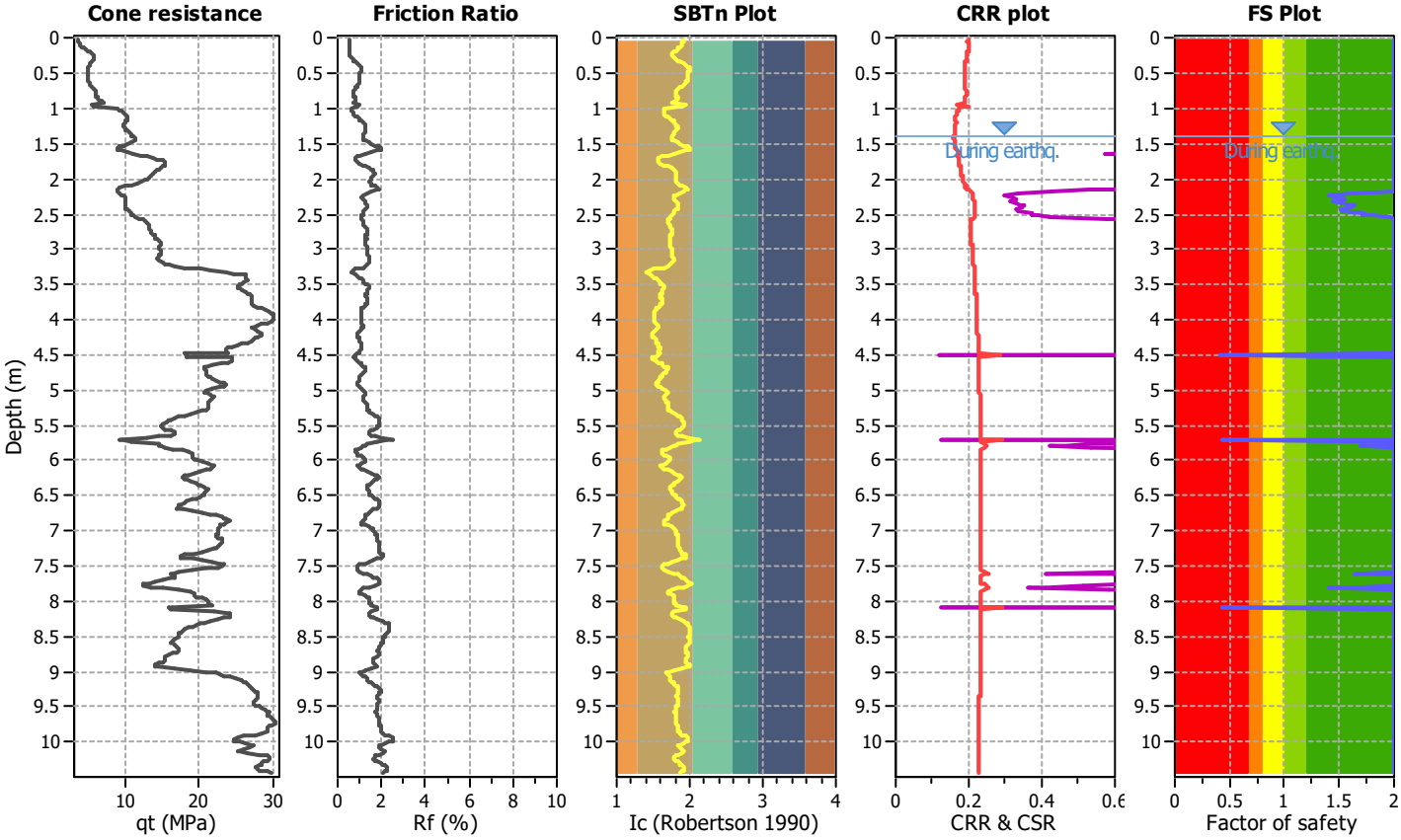
LIQUEFACTION ANALYSIS REPORT

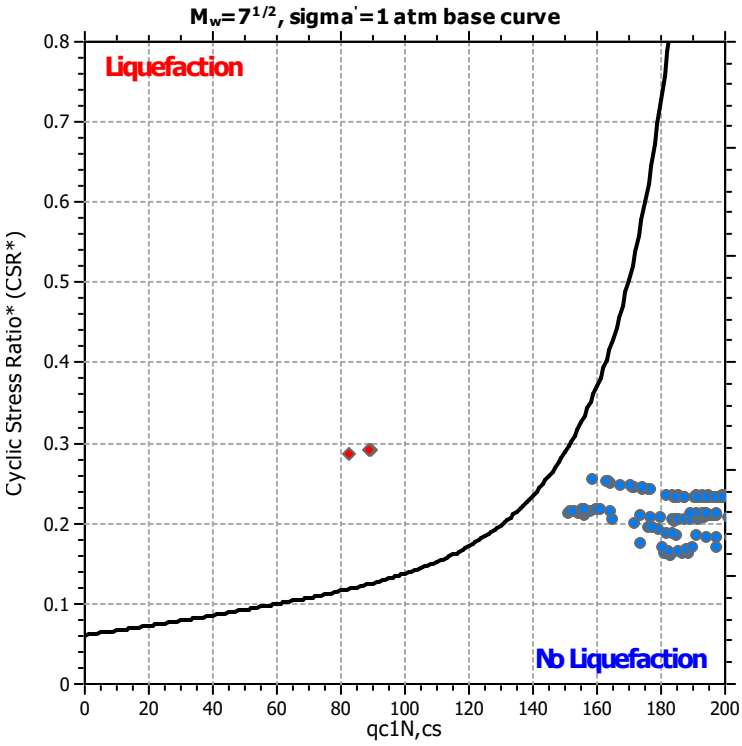
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

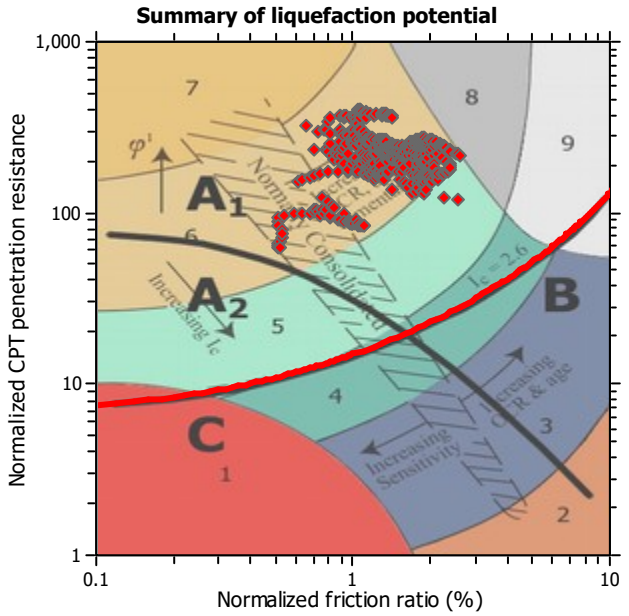
CPT file : CPT09_ULS

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:	Sands only
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:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
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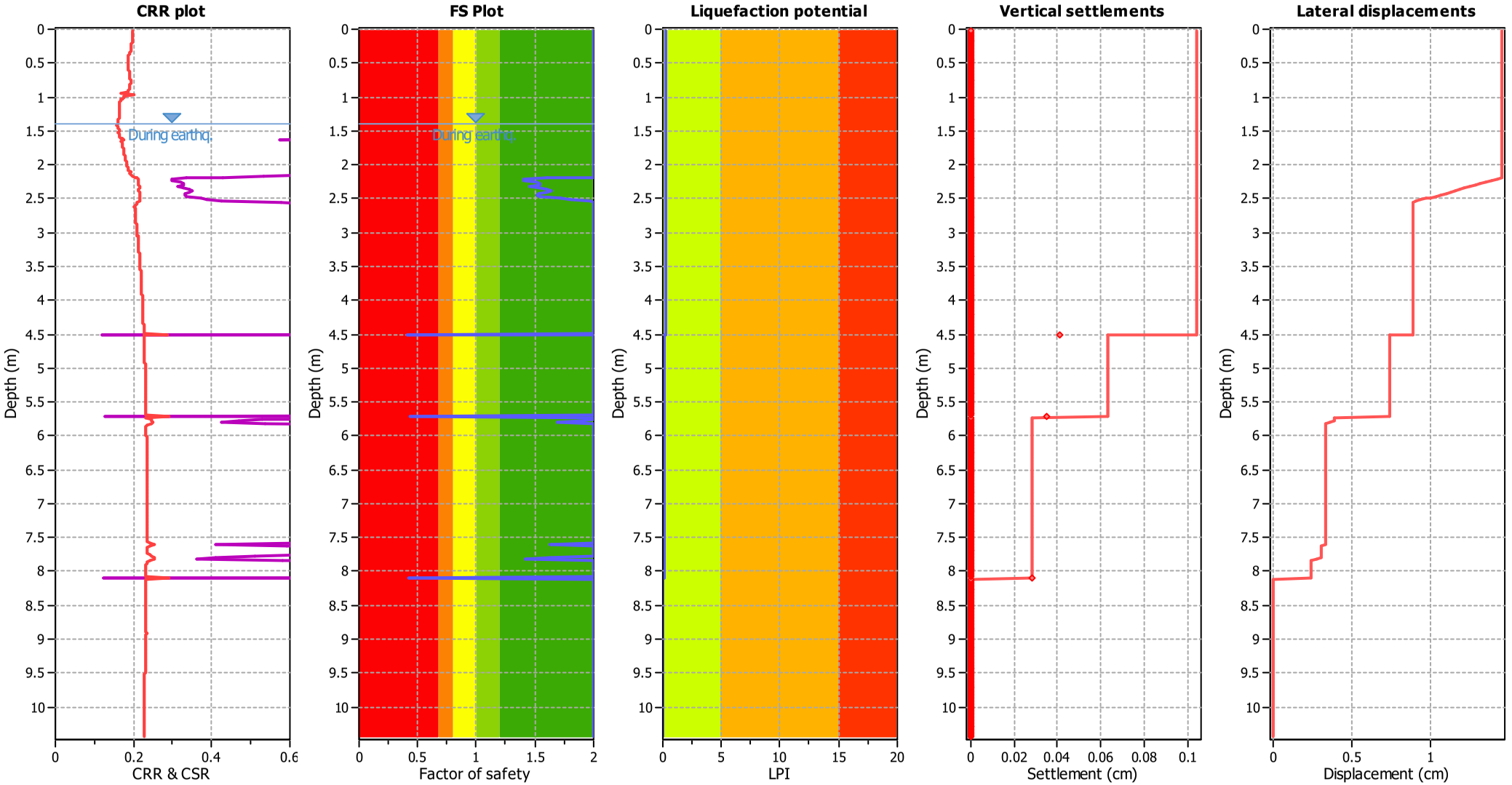
Liquefaction analysis overall plots



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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	20.00 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 : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

CPT file : CPT10_ULS

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:	Sands only
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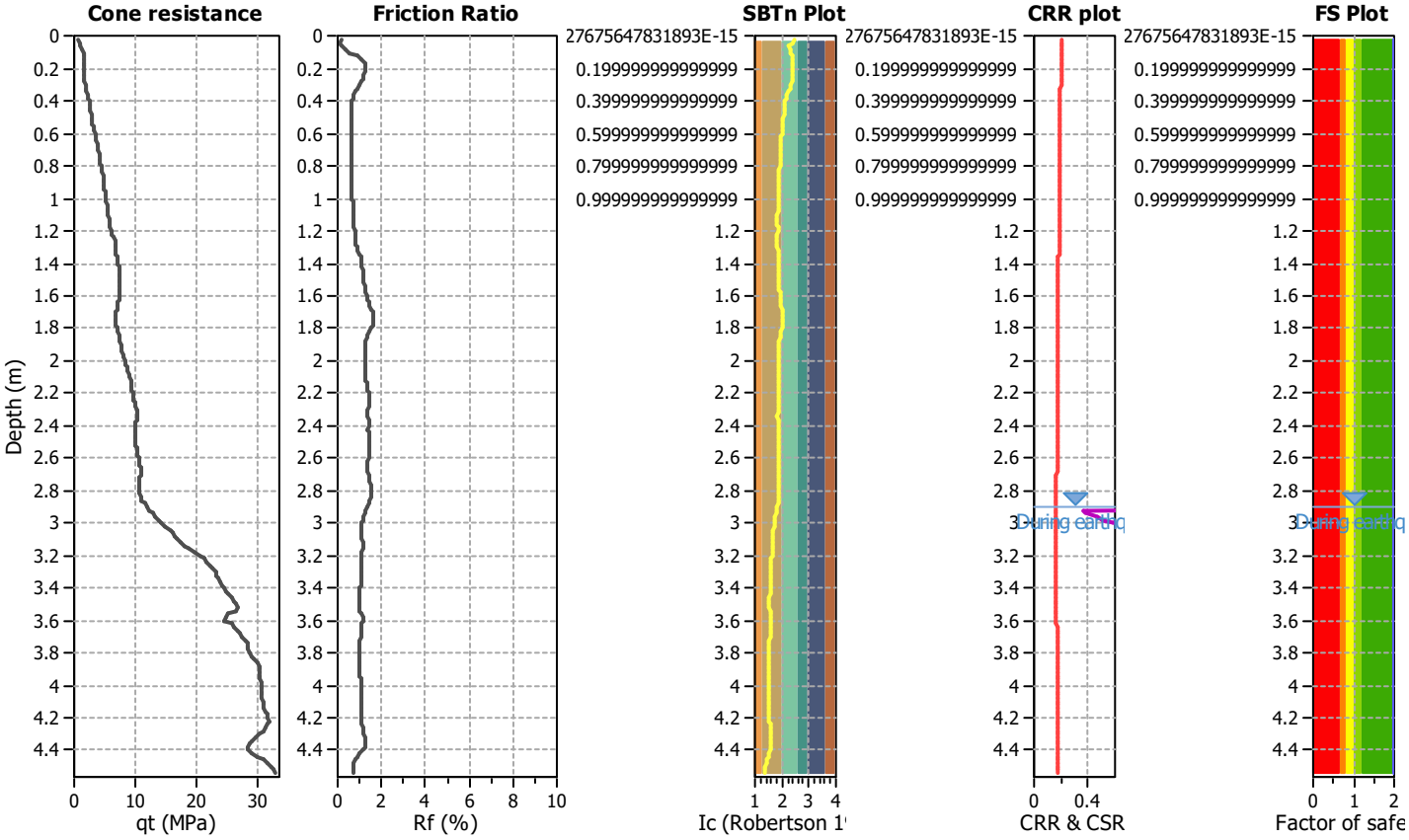
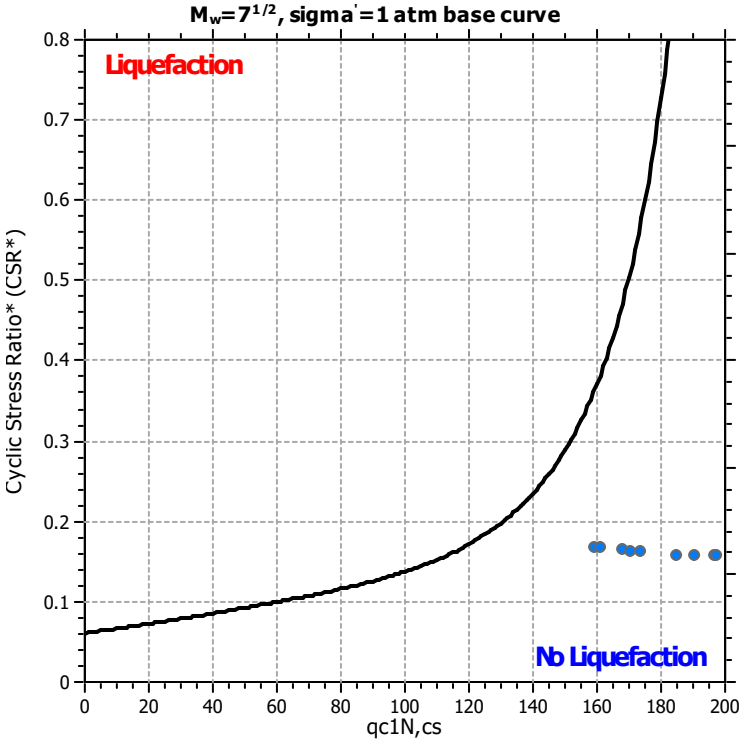
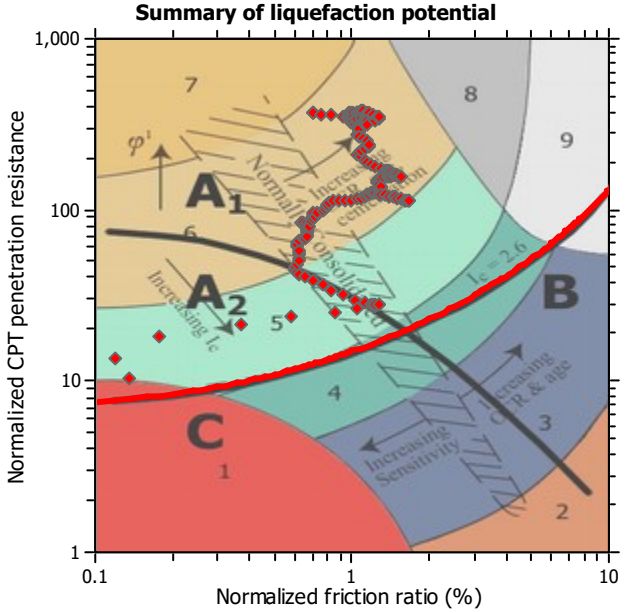
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		







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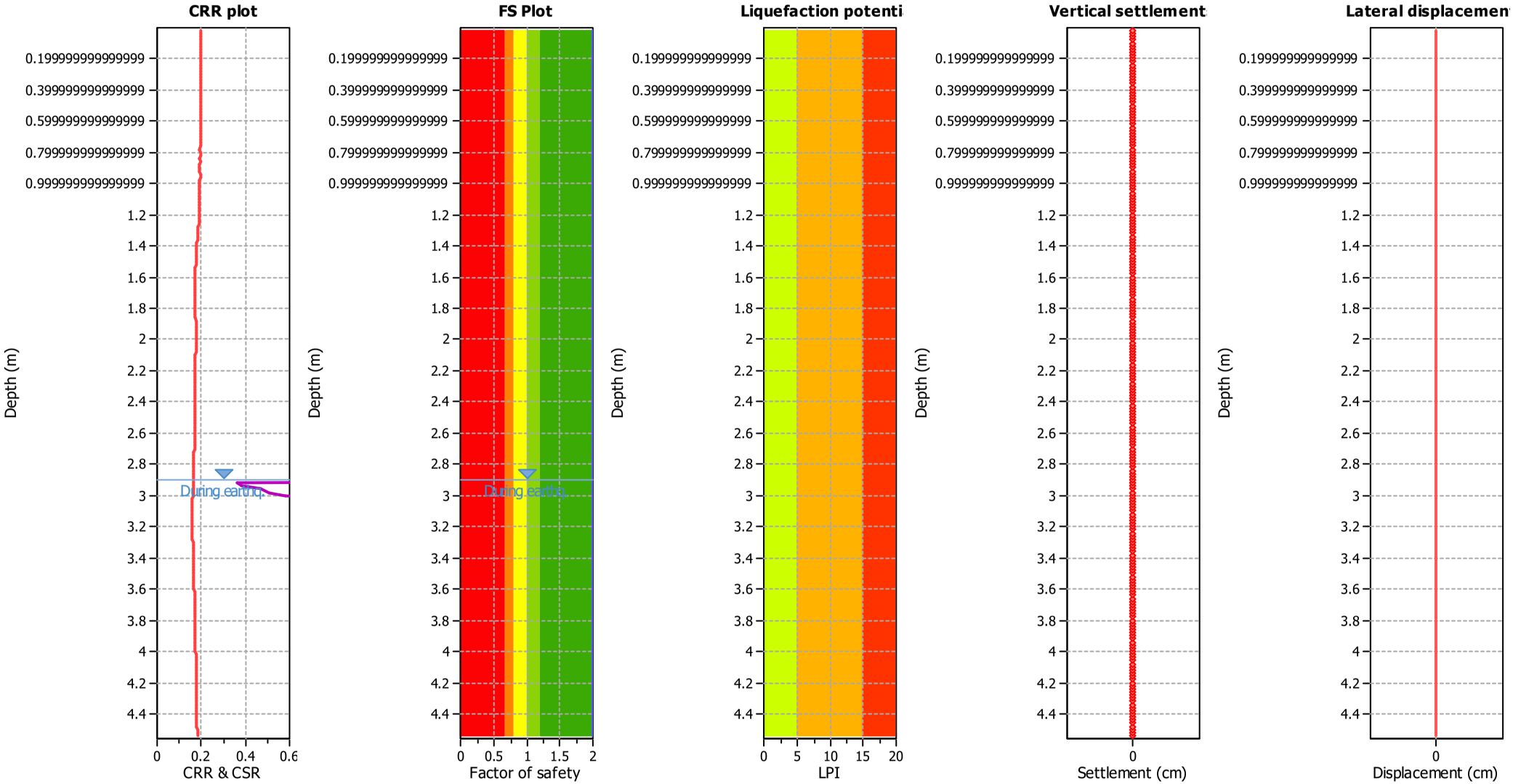
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain 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:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.90 m	Fill height:	N/A	Limit depth:	20.00 m

F.S. color scheme

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LPI color scheme

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- High risk
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LIQUEFACTION ANALYSIS REPORT

Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

CPT file : CPT11_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.50 m	Use fill:	No	Clay like behavior applied:	Sands only
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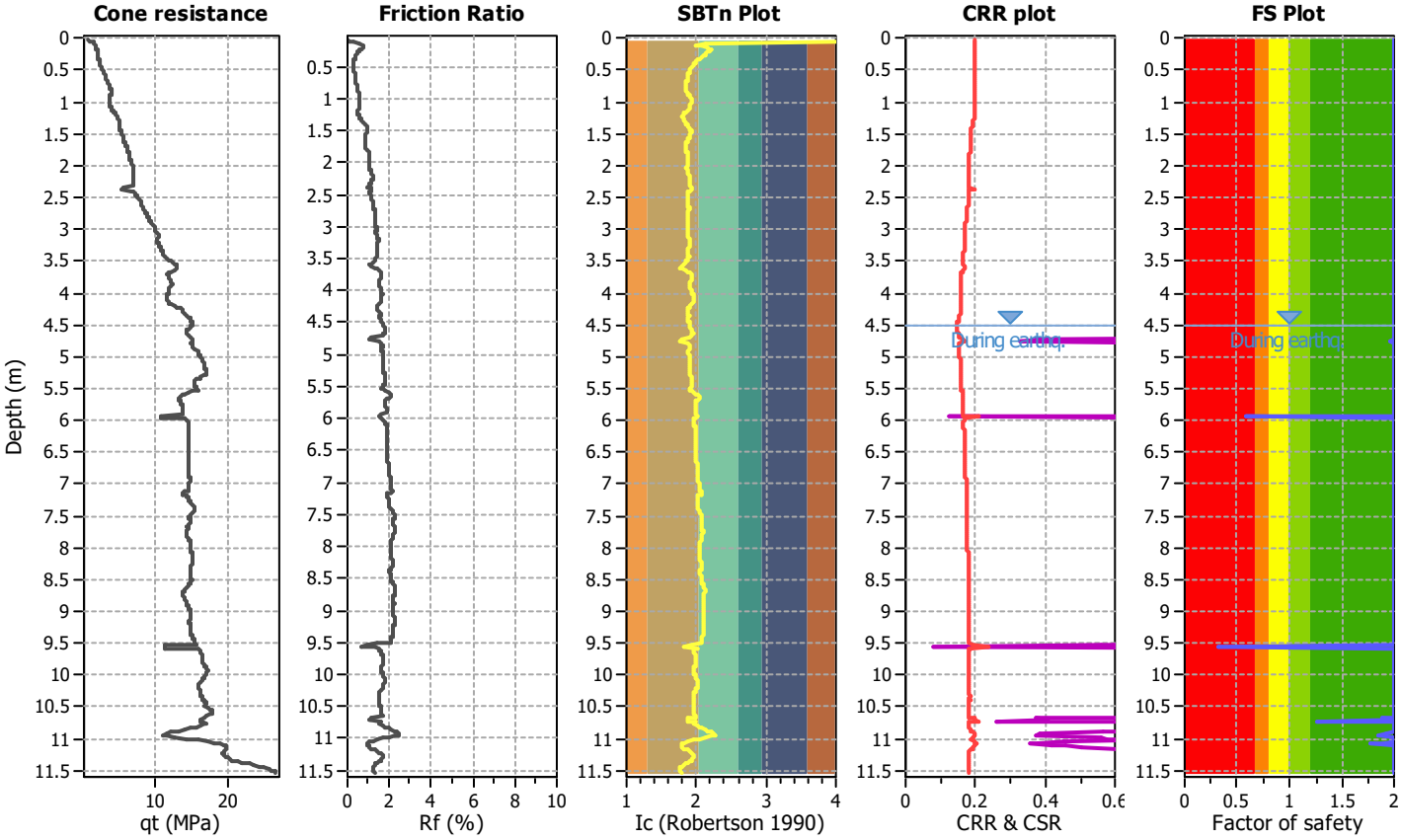
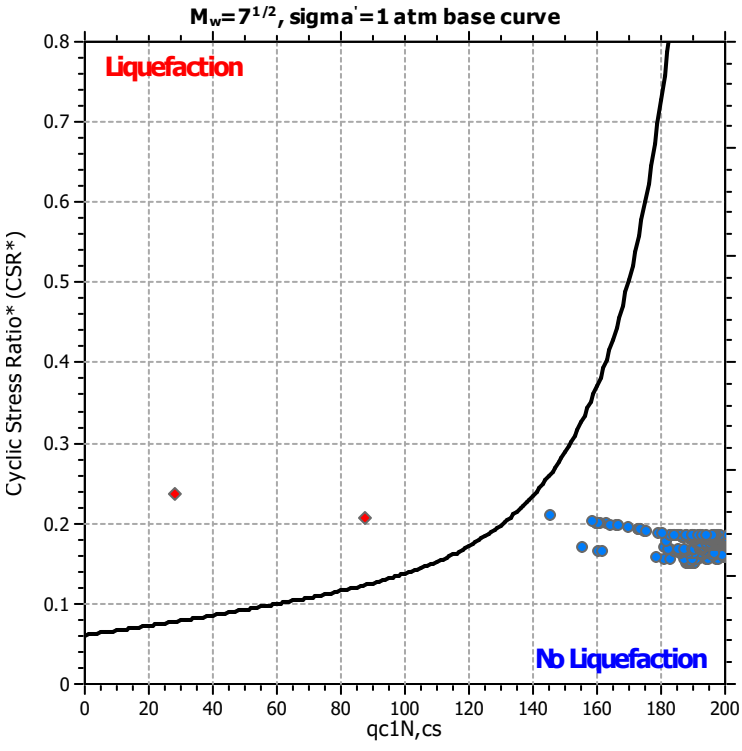
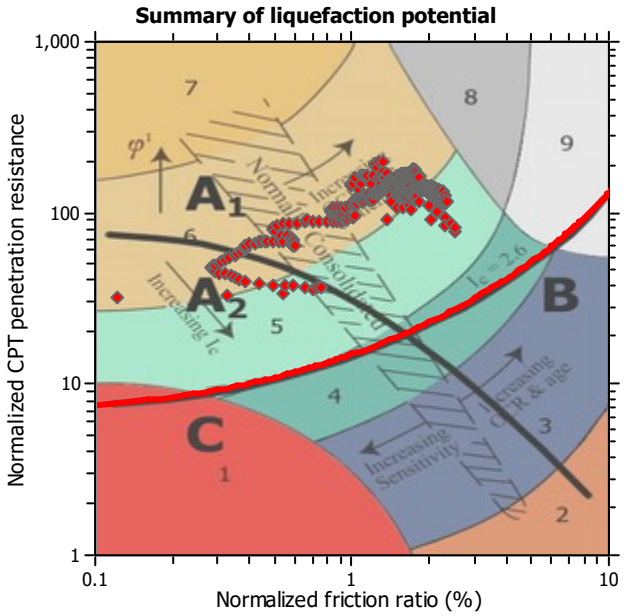
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.75	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	No		

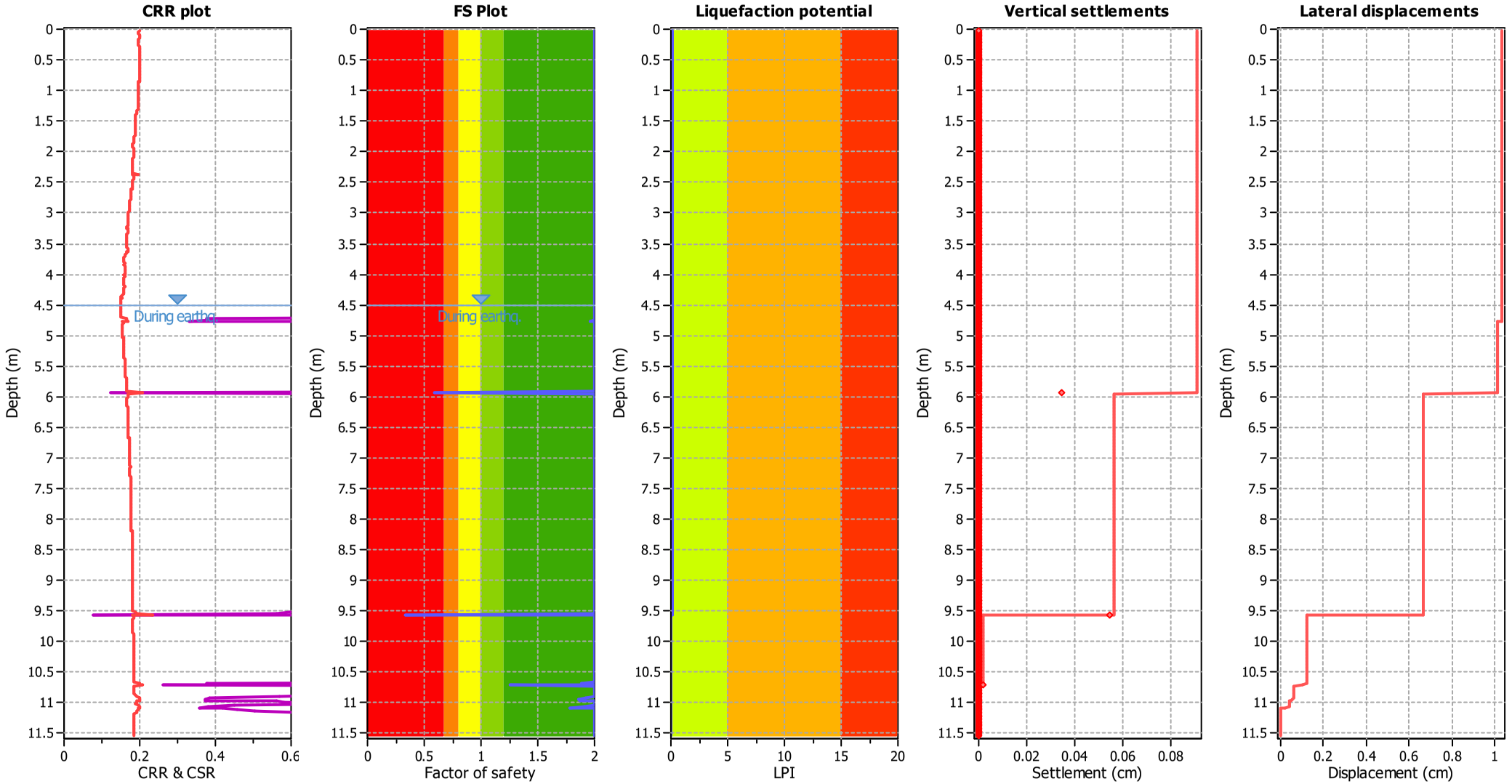






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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.):	4.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.75	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.50 m	Fill height:	N/A	Limit depth:	20.00 m

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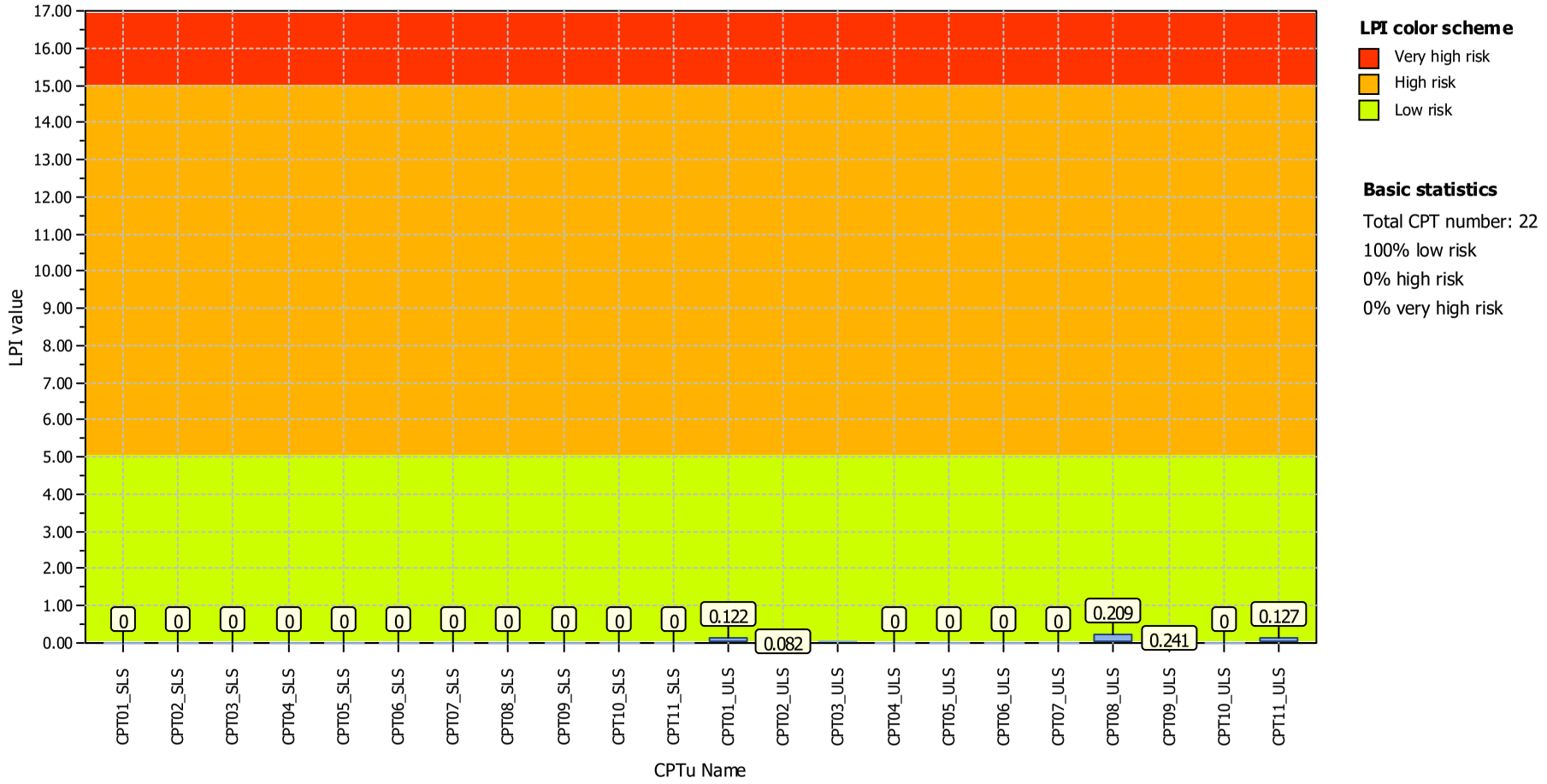
Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

Total CPT number: 22
100% low risk
0% high risk
0% very high risk

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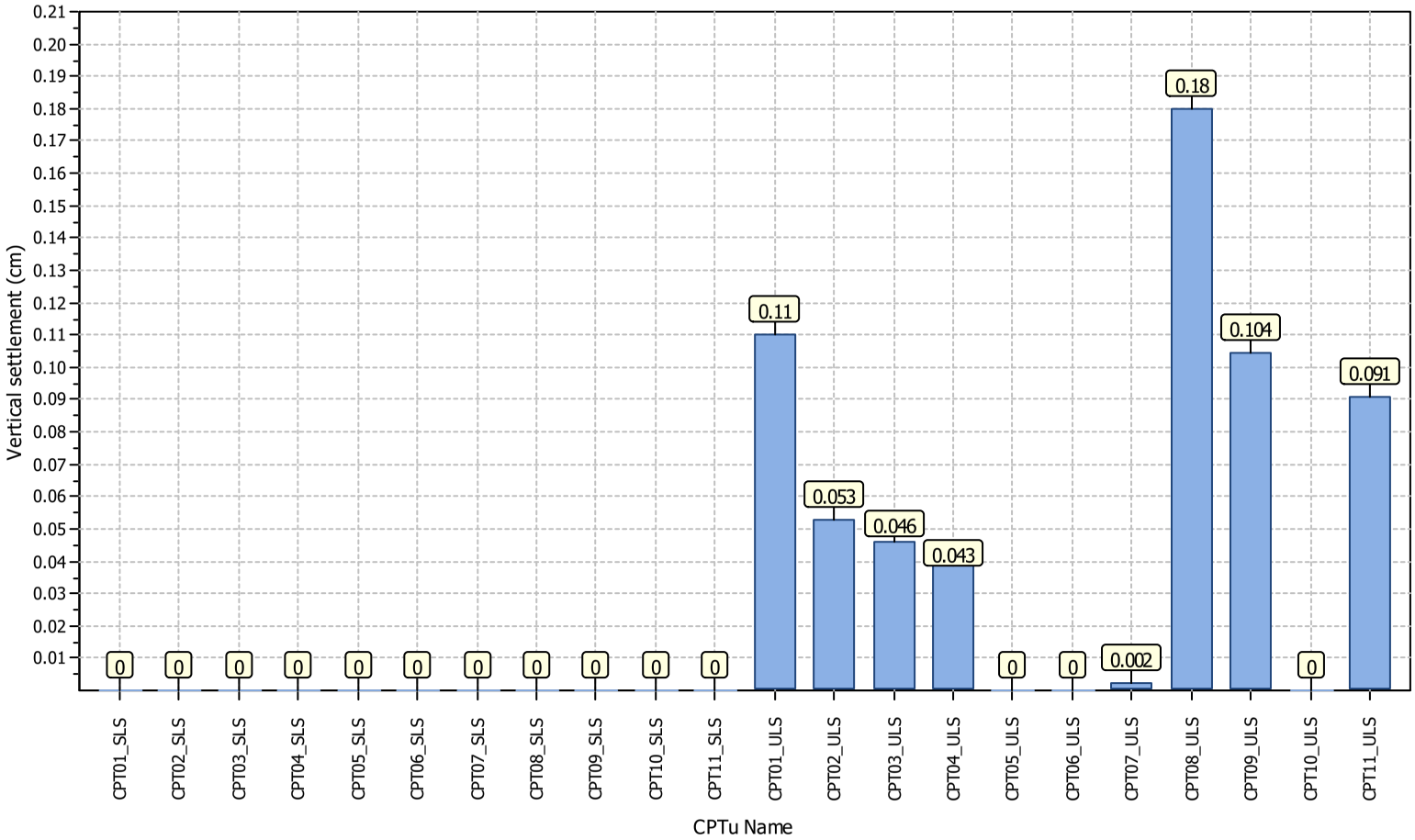
Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

Overall vertical settlements report



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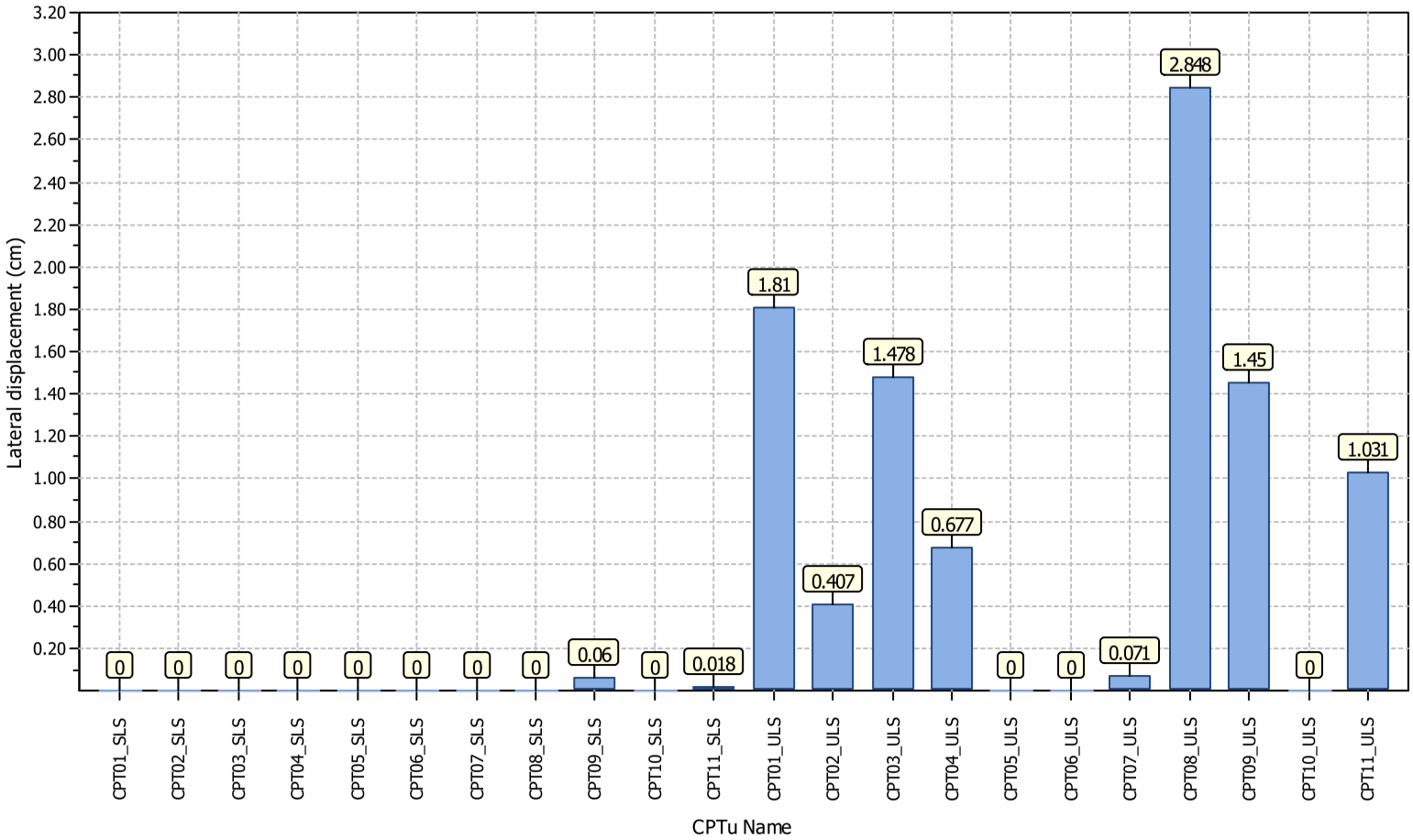
Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

Overall lateral displacements report



Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation*.

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org