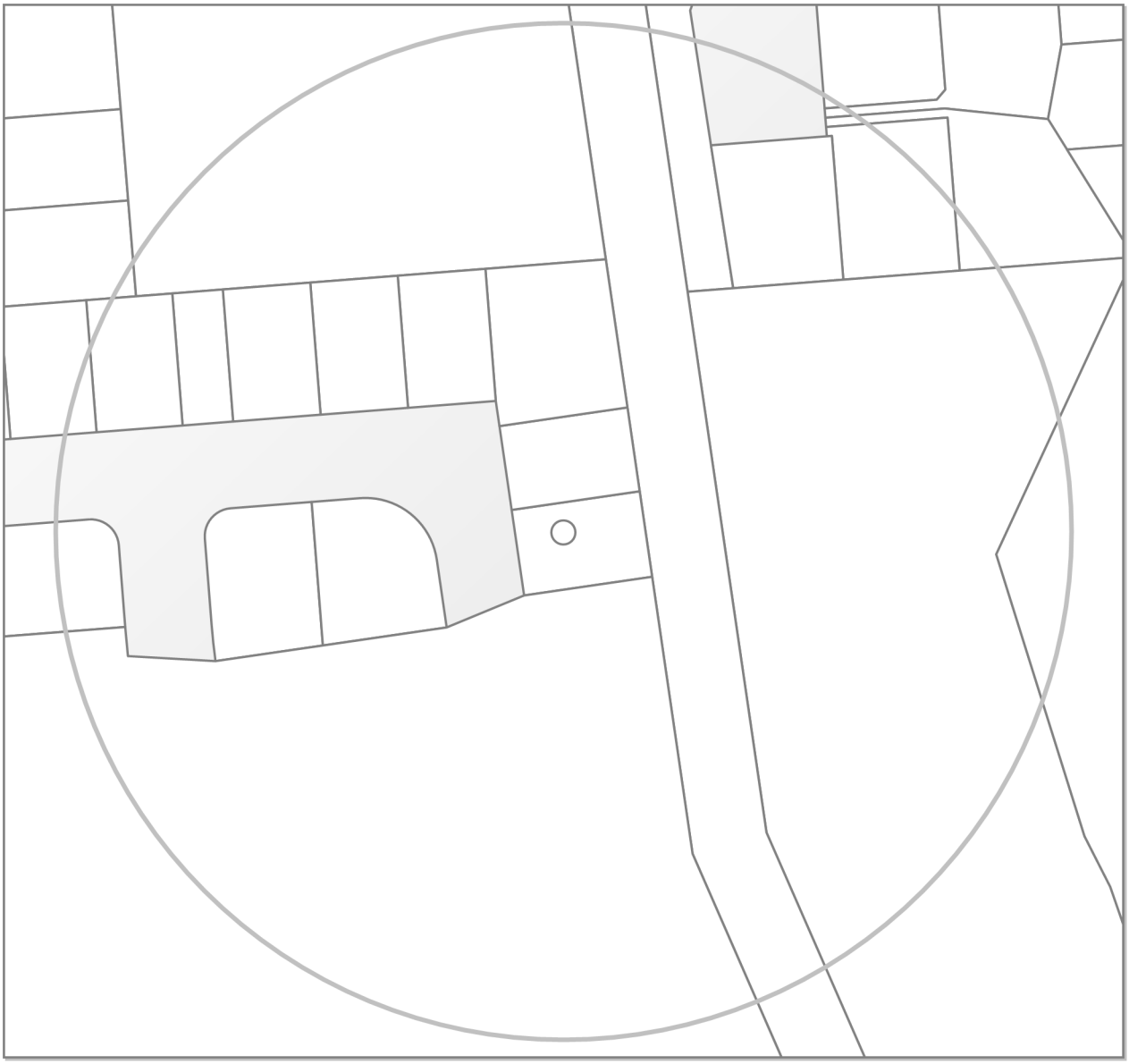
Christchurch City Council

Land Information Memorandum



Property address:

51 Timara Crescent

LIM number: H01280623

Christchurch City Council

53 Hereford Street, PO Box 73015
Christchurch 8154, New Zealand
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Fax 64 3 941 8984

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Application details

Date issued	28 July 2023
Date received	24 July 2023

Property details

Property address	51 Timara Crescent, Burwood, Christchurch
Valuation roll number	21800 47633
Valuation information	Capital Value: $410,000 Land Value: $410,000 Improvements Value: $0 *Please note: these values are intended for Rating purposes*
Legal description	Lot 1028 DP 577687
Existing owner	CDL Land New Zealand Limited PO Box 3248 Auckland 1140

Council references

Rate account ID	73205648
LIM number	H01280623
Property ID	1197809

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Land Information Memorandum

Document information

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

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

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

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

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

Property file service

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

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

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Land Information Memorandum

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

1. Special features and characteristics of the land

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

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

- **Borelog/Engineer Report Image Available**

  Borelog/Engineer Report Image Available

- **Fill**

  This property is located in an area known to have been filled. The year the fill occurred is 2022. The filling was, according to the Councils records carried out in a controlled manner and comprises Sand.

- **Liquefaction Assessment**

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

- **Consultant Report Available**

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

Related Information

- There is attached a soil investigation report for this property.

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2. Private and public stormwater and sewerage drains

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

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

- **Vacuum Sewer System Constraint**

  This property is connected to a vacuum sewer system. The vacuum sewer system has limited capacity and development must align with the Prestons Sewer Master Plan. Developers wanting to develop in the Prestons area should send an enquiry to the Council's wastewater capacity mailbox (WastewaterCapacity@ccc.govt.nz) to see what can be accommodated.

Related Information

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

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3. Drinking Water Supply

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

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

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

Related Information

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

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4. Rates

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

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

(a) Annual rates

Annual rates to 30/06/2024: $1,539.53

	Instalment Amount	Date Due
Instalment 1	$384.84	15/09/2023
Instalment 2	$384.84	15/12/2023
Instalment 3	$384.84	15/03/2024
Instalment 4	$385.01	15/06/2024

Rates owing as at 28/07/2023: $ 384.84

(b) Excess water charges

From January 2023 excess water use charges will apply based on water meter readings. Check to see how this property may be affected. https://www.ccc.govt.nz/services/water-and-drainage/water-supply/water-reporter/.

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

(c) Final water meter reading required?

No Reading Required

☎ To arrange a final water meter reading, please phone (03) 941 8999 or visit www.ccc.govt.nz.

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

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

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

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

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

(a) Consents

(b) Certificates

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

(c) Notices

(d) Orders

(e) Requisitions

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6. Certificates issued by a building certifier

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

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

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7. Weathertightness

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

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

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

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8. Land use and conditions

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

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

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

- **Regional plan or bylaw**

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

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

(ii)Christchurch District Plan

- **Development Constraint**

  Council records show there is a specific condition on the use of this site: Consent Notice

- **Liquefaction Management Area (LMA)**

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

- **Outline Development Plan**

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

- **District Plan Zone**

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

(b) Resource consents

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

- RMA/2015/1309 - Subdivision Consent
  Fee Simple - Sixty Five Lots - Residential Layout changes - applicant to respond - Historical Reference RMA92029567
  Status: Withdrawn
  Applied 15/05/2015

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- RMA/2015/2996 - Subdivision Consent
  Fee Simple Subdivision - Three Lots - Historical Reference RMA92031377
  Status: Processing complete
  Applied 28/10/2015
  s223 Certificate issued 08/08/2017
  s224 Certificate issued 08/08/2017
  Granted 14/01/2016
  Decision issued 15/01/2016

- RMA/2019/2745 - Subdivision Consent
  Fee simple subdivision - 254 lots and a number of amalgamation and boundary adjustments to Stage 2 Prestons Park. Replaced by RMA/2022/772 Reapplied under 2021 DC Policy
  Status: s223 Certificate issued
  Applied 25/11/2019
  s223 Certificate issued stage 1 02/11/2020
  s223 Certificate issued stage 2 04/03/2021
  s223 Certificate issued stage 3 04/05/2021
  s223 Certificate issued stage 4 15/06/2021
  s223 Certificate issued stage 5 07/10/2021
  s223 Certificate issued stage 6 15/12/2021
  s223 Certificate issued stage 7 15/05/2023
  s224 Certificate issued stage 1 02/11/2020
  s224 Certificate issued stage 2 04/03/2021
  s224 Certificate issued stage 3 19/05/2021
  s224 Certificate issued stage 4 25/06/2021
  s224 Certificate issued stage 5 05/11/2021
  s224 Certificate issued stage 6 16/02/2022
  Granted 17/03/2020
  Decision issued 17/03/2020

- RMA/2022/772 - Subdivision Consent
  155 Mairehau Road Burwood
  Fee simple subdivision - 118 lots - Stage 5 Prestons Park Reapplied under 2021 DC Policy - Replaces RMA/2019/2745
  Status: s223 Certificate issued
  Applied 16/03/2022
  08/04/2022
  s223 Certificate issued stage 1 25/08/2022
  s224 Certificate issued stage 1 16/09/2022
  s223 Certificate issued stage 2 09/11/2022
  s224 Certificate issued stage 2 07/12/2022
  s223 Certificate issued stage 3 28/04/2023
  Granted 08/04/2022
  Decision issued 11/04/2022

Related Information

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- The Council system shows a Development Constraint/Ongoing Condition Consent notice for this property. The consent notice should be registered against the record of title for the property and a search of that title and the consent notice will provide details in respect of the constraint / condition. If a search of the title does not record the consent notice or the consent notice is not clear then we suggest you contact the duty planner by either calling 941 8999 or emailing DutyPlanner@ccc.govt.nz. The Consent notice is as follows:
  Specific foundation design taking into consideration the potential for liquefaction and associated effects (vertical settlement / lateral spread).

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9. Other land and building classifications

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

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

Please refer to Section 1 for details

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10. Network utility information

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

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

- **None recorded for this property**

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11. Other information

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

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

(a) Kerbside waste collection

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

(b) Other

- **Floor Levels Information**

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

- **Guest Accommodation**

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

- **Community Board**

  Property located in Coastal-Burwood-Linwood Community Board.

- **Tsunami Evacuation Zone**

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

- **Electoral Ward**

  Property located in Burwood Electoral Ward

- **Listed Land Use Register**

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

- **Spatial Query Report**

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

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Prestons Park Subdivision

Stage E3 Geotechnical Completion Report

CDL Land New Zealand Ltd

Reference: 235361

Revision: 0

2022-11-02

aurecon

Bringing ideas to life

Document control record

Document prepared by:

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Document control						aurecon
Report title		Stage E3 Geotechnical Completion Report				
Document code			**Project number**		235361	
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Client		CDL Land New Zealand Ltd				
Client contact		Jason Adams	**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
A	2022-07-13	For review	C. Scott	J. Muirson		
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Current revision		**0**				

Approval			
Author signature		Approver signature	
Name	Chris Scott	Name	Dr Jan Kupec
Title	Geotechnical Engineer	Title	Principal – Ground Engineering

Contents

Executive Summary

CDL Land New Zealand Limited is developing Stage E3 of the Prestons Park Subdivision, located on Prestons Road, Christchurch. As part of the work, a geotechnical completion report is required to confirm that the site works have been carried out to the required standard and provide recommendations for building developments. This report describes the earthworks and ground improvement involved with Stage E3 of the Prestons Park Subdivision.

The Client's brief on previous stages of the Prestons Park project was to develop the land to Technical Category 1 (TC1) equivalent performance. Based on Aurecon's geotechnical assessment, Stage E3 comprised ten lots classified as TC2 and eight lots classified as TC1 equivalent prior to earthworks commencing.

Aurecon's role was to monitor the earthworks, fill compaction testing and complete post earthworks quality assurance testing, which comprised Cone Penetration Testing (CPT).

Extensive earthworks predominantly comprising filling have occurred on the site. The quality assurance testing of the engineered earthfill indicates that the earthfill placed within the Stage E3 area has achieved the required compaction levels as per NZS4431:1989.

Following completion of the earthworks and topsoil placement throughout the subdivision, a series of CPTs was carried out to confirm the ground conditions. The purpose of the CPTs was to allow an assessment of the future land performance during large earthquakes and to determine the equivalent Technical Category of the land. The assessment results changed the classification of four lots from TC2 to TC1.

From the monitoring and testing undertaken as part of the development of Stage E3 the following is concluded:

Certificate of Compliance

The standard of bulk earthworks generally meets the earthworks specification and the applicable codes, including NZS4431:1989 (since superseded by the NZS 4431:2022 '*Engineered fill construction for lightweight structures*').

Building Considerations

General

This report shall not be used for building consent application for buildings on individual lots. Site specific geotechnical investigations, in-line with NZS3604:2011, shall be undertaken at building consent application stage.

TC1 Foundations

For lots identified as TC1, NZS 3604:2011 type foundations are considered suitable. At the time of writing this report, the location and structural form of the future dwelling on the lots are unknown and this recommendation relates to NZS3604:2011 type lightweight timber or steel framed residential buildings only.

TC2 Foundations

For lots identified as TC2, dwellings shall be founded on TC2 type 'enhanced foundation slabs' as per Options 2, 3 or 4 from the MBIE Guidelines (2012) Section 5.3 to mitigate the effects of liquefaction induced vertical settlement. Alternatively, a specific design in accordance with MBIE Guidelines Section 5.4 could be undertaken by a suitably qualified chartered professional engineer.

Explanatory Statement

This report shall be read as a whole and our explanatory statement is presented in Section 8.

1 Introduction

1.1 Geotechnical Completion

CDL Land New Zealand Limited are developing Stage E3 of the Prestons Park Subdivision, located on Prestons Road, Christchurch. Stage E3 is a sub-stage within Stage Five of the subdivision. The site works in Stage E3 included bulk earthworks for the development of the lots. As part of this work, a geotechnical completion report is required to certify the site works have been carried out to the required standard and provide recommendations for building developments.

This report has been prepared for CDL Land New Zealand Limited and issued to Christchurch City Council (CCC). It describes the earthworks involved within Stage E3 of the Prestons Park Subdivision (see Figure 1 in Appendix A).

The purpose of this geotechnical completion report is to present the following:

- Summarise information from previous investigations carried out as part of the subdivision consent and detailed design;
- Summarise the ground conditions and liquefaction risk;
- Extent of earthworks on the lots and compliance testing of bulk earthworks;
- Quality assurance of the construction of gravel embankments;
- Quality assurance testing of land for the purposes of technical category assessment;
- Summary of the findings, land technical category and recommendations for building development.

This report has been prepared based on geotechnical data from site observations and compaction testing during and after earthworks construction and ground improvements. All references to cut-fill depths are based on subgrade levels.

This report shall be read as a whole. Our explanatory statement is presented in Section 7.

1.2 Site Description

The Prestons Road subdivision is located on the northern fringes of Christchurch City. The site is made up of a series of adjacent properties forming an irregular and elongated rectangle shape, orientated approximately north to south. The total area of the overall Prestons Subdivision site is approximately 190ha. The site can be separated into two distinct blocks. Prestons North runs from the Lower Styx Road in the north through to Prestons Road in the south. Prestons Park continues from Prestons Road, through to Mairehau Road to the south.

The focus of this geotechnical completion report is on Stage E3 of the Prestons Park Subdivision. Stage E3 incorporates a block in the south east part of the Prestons Park subdivision (see Figure 1 in Appendix A).

2 Pre-Development Geotechnical Work

2.1 Geotechnical Testing

The subdivision consent and detailed geotechnical design for the subdivision included an extensive series of geotechnical investigations. These comprised Cone Penetration Tests (CPT), test pits, groundwater measurements and laboratory testing.

The details of these investigations are presented in the following Aurecon reports:

- *Caldwell Block Subdivision Resource Consent Geotechnical Report,* Revision 0 dated 11 July 2018.
- *Prestons Park Stage Five Gravel Embankment Design*, Revision 0 dated 9 October 2019.

The investigation tests carried out within Stage E3 of the Prestons Park area are presented in Figure 2 in Appendix A.

2.2 Ground Conditions

From the extensive geotechnical investigations, the ground conditions within the Prestons Park Subdivision were defined into various geological areas. The typical ground conditions in the area are presented in Table 1.

Table 1: Typical ground conditions within Stage E3.

Depth to Top of Unit (m)	Depth to Base of Unit (m)	Soil Unit
0	0.3 to 0.4	TOPSOIL.
0.3 to 0.4	3	SAND with minor silt, loose to medium dense.
3	12	SAND with minor silt, medium dense to dense.
12	Not determined	SAND, dense to very dense.

Groundwater levels ranged from 1m to 2.5m below ground level. During the site earthworks the above soil profile and groundwater levels were typically encountered within the area of interest.

2.3 Liquefaction Potential

As part of the geotechnical assessment and detailed design, a liquefaction assessment was carried out. The details of the liquefaction assessments are presented in the above reports. The land categorisation was based on the criteria of Ministry of Business, Innovation and Development (MBIE), Technical Category deformation performance limits are set out in Table 2.

Table 2: Technical category definitions and foundation implications (MBIE, 2012).

Technical Category	Liquefaction Deformation Limits				Likely Implications for House Foundations (Subject to individual assessment)
	Vertical		Lateral Spread		
	SLS	ULS	SLS	ULS	
TC1	15mm	25mm	nil	nil	Standard 3604-like foundation with tied slabs
TC2	50mm	100mm	50mm	100mm	MBIE Enhanced Foundation Solutions
TC3	>50mm	>100mm	>50mm	>100mm	Site Specific Measures – Piles or Ground Improvement

The results from the liquefaction assessment, detailed in the geotechnical report dated 11 July 2018, indicated that the Stage Five of Prestons Park Subdivision can be classified as Technical Category 1 (TC1) and Technical Category 2 (TC2).

3 Subdivision Earthworks

3.1 General

Bulk earthworks for Stage E3 of Prestons were carried out in accordance with the requirements of NZS 4404:2010, "*Code of Practice for Urban Subdivision*" and NZS4431:1989 "*Code of Practice for Earthfill for Residential Development*" (since superseded by the NZS 4431:2022 "*Engineered fill construction for lightweight structures*"). The earthworks typically comprised stripping the site of topsoil, filling using imported pit run gravel or site-won sand, and then replacing topsoil. No excavation to remove in-situ organic material was undertaken as organics were infrequent, typically thin seams if encountered and at depths of greater than 2m.

3.2 Areas of Cut and Fill

Site earthworks within Stage E3 has included predominantly filling in comparison to the site subgrade levels. The fill material comprises site-won sand and pit run gravel overlying a natural sand subgrade. A layer of topsoil overlies the fill material. The extent of filling is shown in Figure 3 in Appendix A.

3.3 Compaction Quality Control Testing

Independent testing of earthfill compaction completed using traditional earthworks techniques was carried out using a Nuclear Densometer (NDM). The acceptance criterion was based on the Prestons Park Subdivision earthworks specification as follows:

- Compaction of fill is to be in accordance with NZS 4431: 1989.
- Compaction standard is 95% Maximum Dry Density (MDD) for all areas of bulk filling, per NZS4402 Test 4.1.3.

Fill materials comprised of site-won sand and imported pit run gravel. Compaction curves for each of the fill materials are presented in Appendix B.

The MDD from the compaction curves were used to determine the level of compaction required for the fill material. A summary of these NDM results is presented in Appendix C and the NDM testing locations are presented in Figure 4 in Appendix A.

On those occasions where quality control testing did not meet the specification, the Contractor was required to rework the fill to achieve the required compaction.

3.4 Compaction Results

The results presented in Appendix C indicate that 95% MDD or greater compaction has been consistently achieved in the areas of bulk fill. Where NDM results indicated the required compaction had not been achieved, the Contractor completed additional compaction effort and conforming NDM results were achieved. From these results and our site observations, we confirm that the earthfill placed within Stage E3 has achieved the required compaction.

4 Gravel Embankments

4.1 Introduction

The construction of the Snelling Drain upgrade running to the east of Stage E3 was identified as being a potential cause of lateral spreading in a large seismic event, even with ground improvement by impact rolling undertaken on previous stages. As the liquefiable layers are typically in the upper 2.5m to 3m depth of the soil profile, it was considered more feasible to remove the liquefiable layers and form a compacted gravel embankment to limit the potential hazard.

Lateral spreading requires the need for a continuous liquefiable layer through to the free face. By removing this continuous liquefiable layer and reinstating with compacted gravel, lateral spreading can be limited or eliminated.

The gravel embankments constructed for the stormwater infrastructure to the north of Stage E3 have been described separately in "*Prestons Subdivision Geotechnical Completion Report, Prestons South Stages W, X and Y*", Revision 0 dated 18 April 2017. Due to the size of the gravel embankments to the north, the lateral spreading risk to the north of Stage E3 has likely been eliminated.

4.2 Gravel Embankment Details

The design of the gravel embankments within Stage Five of Prestons Park Subdivision was undertaken by Aurecon and is presented in *"Prestons Park Stage Five Gravel Embankment Design"*, Revision 0 dated 9 October 2019. The gravel embankments were designed to limit lateral spreading displacements to within TC2 acceptable limits, which are given in Table 2. The purpose of the gravel embankments is to intercept the continuous layer of liquefiable soils adjacent to the free edge (basin or open channel), as lateral spreading requires a continuous liquefiable layer.

Depending on the depth and the extent of liquefiable layers near the free face, the gravel embankment size and depth varied. The gravel embankment design comprised compacted AP65 or pit run gravel with a layer of overlying topsoil. The design shape, extent and location of the gravel embankments is shown in PS-S5-EW-05, which has been included in Appendix D.

4.3 Gravel Embankment Construction

The gravel embankment design required that a well graded sandy gravel material (such as AP65 or approved pit run) was used for the embankment construction. Material used on site comprised of imported, well graded pit run sandy gravel (AP100). The gravel was topped with approximately 300mm of topsoil. The design drawing required that compaction to 98% of MDD for the gravel was achieved, to ensure that the required embankment design parameters were attained.

Site observations by Aurecon Geotechnical and Civil Engineers confirm the gravel embankments have been constructed with imported well graded pit run gravel. In addition, the compaction quality testing discussed in Section 3 indicates that compaction of at least 95% of MDD has been achieved for the sandy gravel embankment fill material. This level of compaction is slightly less than the 98% of MDD specified in the design drawings but based on our site observations, the gravel embankment will meet the minimum design parameters required to achieve the intended performance of the embankments.

A review of as-built earthworks information provided by the civil engineers indicates that the required toe width and depth of the gravel embankment profile has been achieved. The cut slope angle of the gravel embankment sides was not specified, and the contractor was only required to construct the correct toe width and depth. As-built plans for the gravel embankments are provided in Appendix D.

Based on the intended design and the gravel embankment construction, Aurecon considers that the gravel embankments have been constructed appropriately and lateral spreading exceeding TC2 limits adjacent to the Snelling Drain is unlikely. From a lateral spreading perspective, the lots adjacent to Snelling Drain are likely to perform to the level of TC2 equivalent.

5 Post Earthworks CPT

5.1 Introduction

Following completion of the earthworks and topsoil placement throughout Stage E3, a series of CPT tests were carried out to confirm the ground conditions. Areas of Stage E3 which were identified as TC1 in Aurecon's previous assessment were not retested, as the earthworks undertaken would only improve the technical categorisation. As such, post earthworks CPT have been undertaken in the TC2 area on the northern boundary of Stage E3, to confirm if the technical category has improved as a result of the subdivision earthworks. The area tested was chosen as it is outside of the assessed extent of any potential lateral spreading, which is a requirement for a TC1 classification. The post earthworks CPTs are presented in Appendix E and the locations are shown in Figure 5 in Appendix A.

5.2 Liquefaction Assessment

To allow an assessment of the land technical category, a liquefaction assessment has been carried out on the post earthworks CPTs. The liquefaction assessment methodology has been discussed below.

Introduction

As technical categories are derived by liquefaction induced deformation limits, a liquefaction assessment on the post compaction CPTs has been carried out to determine the extent of liquefaction and the induced settlements. To allow CPT testing to be undertaken on the natural sand subgrade, predrilling has been undertaken through the granular pit run fill material. The pit run fill is non-liquefiable by inspection due its density and being located above the groundwater table.

Earthquake Cases

Earthquake induced ground acceleration and sustained shaking, leading to sufficient load cycles, is a requirement and a potential trigger of liquefaction. For this assessment we have reviewed three levels of seismic shaking.

1. Serviceability Limit State (SLS) design level earthquake, as defined by MBIE.
2. Intermediate design level earthquake, as defined by the subdivision consent conditions.
3. Ultimate Limit State (ULS) design level earthquake, as defined by MBIE.

Each of these earthquake cases is discussed in detail below:

Serviceability Limit State (SLS) Earthquake

From the NZGS/MBIE Guidelines (2021), a Peak Ground Acceleration (PGA) of 0.13g has been derived for a SLS event with a Magnitude 7.5 earthquake.

Intermediate Level (Int) Earthquake

Subdivision consent conditions indicate that liquefaction mitigation measures for the subdivision infrastructure shall be designed for a 1 in 150-year return period under the serviceability limit state (SLS) and as defined by NZS1170.5:2004.

Based on NZS1170.5:2004 for an Importance Level 2 (IL2) structure, with an increased Z hazard factor of 0.3, a PGA of 0.2g has been derived for a 1 in 150-year period of return. A Magnitude 7.5 has been used.

Ultimate Limit State (ULS) Earthquake

The NZGS/MBIE Guidelines (2021) recommend a PGA of 0.35g for residential buildings in Christchurch. This PGA value with a magnitude 7.5 earthquake has been adopted for the ULS assessment.

Liquefaction Methodology

In assessing the liquefaction potential, the method of Boulanger and Idriss (2014) has been utilised to assess the potential settlement for each design level event, as per the MBIE Guidelines (2012) for residential properties. The assessment was carried out using an excel spreadsheet developed by Aurecon. The method of Robertson and Wride (1998) with the modified fines content was used to assess the liquefaction potential from the CPT results. The method of Zhang et al (2002) was used for estimating the liquefaction induced settlements from CPT results.

The CPT analysis has been performed to a depth of 10m, as this is the required depth in the MBIE Guidelines for the technical category assessment.

In addition to determining the liquefaction induced reconsolidation settlement, we have assessed the potential for liquefaction induced ground damage based on the Liquefaction Severity Number (LSN), as defined by Tonkin and Taylor (2013). Other ground damage potential methods (such as Ishihara, 1985) were assessed but LSN was considered the more appropriate method. Tonkin & Taylor (T&T) developed the Liquefaction Severity Number (LSN) based on investigation data and observations made following major earthquake events in Christchurch. The LSN number is an index number which qualitatively assesses the effects of liquefaction on a site and on a shallow founded building. The LSN number is calculated by the equation below.

$$LSN = 1000 \int \frac{\varepsilon_v}{z} . dz$$

Where: ε_v = volumetric reconsolidation strain
z = depth of liquefaction below ground level

The LSN number is likely to be a better index of surface damage than reconsolidation settlement because the LSN number is weighted more heavily by shallow liquefaction and less by liquefaction at depth, which is less likely to affect the ground surface or shallow founded buildings. Reconsolidation settlement places the same weighting on deep liquefaction as shallow liquefaction, even though settlement will have less impact at the ground surface with increasing depth. LSN numbers have been correlated to observed liquefaction effects during recent earthquakes in Christchurch as shown in Table 3.

Table 3: LSN Ranges and Observed Effects (Tonkin and Taylor, 2013).

LSN Range	Predominant Performance
0-10	Little to no expression of liquefaction, minor effects
10-20	Minor expression of liquefaction, some sand boils
20-30	Moderate expression of liquefaction, with sand boils and some structural damage
30-40	Moderate to severe expression of liquefaction, settlement can cause structural damage
40-50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures
>50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services

When compared to the broad descriptions of expected land performance in TC1, TC2 and TC3, as outlined in Section 2.3, the LSN number can be approximately correlated to technical categories as follows:

- TC1 = $LSN_{(ULS)} < 10$
- TC2 = $LSN_{(SLS)} < 20$ and $LSN_{(ULS)} < 30$
- TC3 = $LSN_{(SLS)} > 20$ or $LSN_{(ULS)} > 30$

A groundwater depth of 2.0m below finished earthworks level has been used for the purposes of this liquefaction assessment. Testing information throughout Stage Five indicates the groundwater level is typically greater than 2.0m depth (more likely to be at depths of 2.5m or greater) therefore a conservative groundwater level of 2.0m below ground level has been used for the assessment.

Liquefaction Assessment Results

The results of the liquefaction induced reconsolidation settlement analysis are presented in Table 4. The results for the liquefaction induced ground damage potential (LSN numbers) are presented in Table 5.

Table 4: Liquefaction induced settlements for post earthworks CPTs to 10m depth.

Earthquake Magnitude 7.5, Water Depth 2m, 10m Analysis			
CPT	SLS Design Event (0.13g)	Intermediate Design Event (0.20g)	ULS Design Event (0.35g)
	Settlement (mm)	Settlement (mm)	Settlement (mm)
CPTu301	<5	<5	15
CPTu302	<5	<5	10
CPTu303	<5	<5	30

Table 5: LSN for post earthworks CPTs to 10m depth.

Earthquake Magnitude 7.5, Water Depth 2m, 10m Analysis			
CPTs	**SLS Design Event (0.13g)**	**Intermediate Design Event (0.20g)**	**ULS Design Event (0.35g)**
	LSN	*LSN*	*LSN*
CPTu301	0	0	2
CPTu302	0	0	1
CPTu303	0	0	4

Based on these results, it is considered that part of the TC2 area on the northern boundary of Stage E3 is likely to be TC1 equivalent.

6 Building Development

6.1 Technical Category

Geotechnical testing has been carried out as part of the subdivision development. The testing indicates the lots within Stage E3 are likely to perform to TC1 and TC2 equivalent. The technical category classification of the lots is provided in Figure 6 in Appendix A.

6.2 Earthworks on Building Lots

The extent of earthfill on the lots in Stage E3 is shown on Figure 3 in Appendix A.

The fill areas have been constructed using materials and processes that have been randomly measured by independent testing. The testing shows that the placement of filling is generally in accordance with the specification and relevant standards.

6.3 Soil Suitability Criteria

Section 3 of New Zealand Standard NZS 3604:2011 "*Timber Framed Buildings not requiring specific Engineering Design*" provides several criteria for defining foundation soil suitability for lightweight timber or steel framed residential buildings.

Clauses 3.1.3 and 3.3 of NZS 3604:2011 provide criteria for determining strength and suitability of founding soils. Clauses 3.4.1 and 3.4.2 of NZS 3604:2011 discuss depths to competent founding. For purposes of this report, we have interpreted these clauses as meaning that for sound bearing at depths of 200mm to 600mm, standard shallow type foundations can be utilised. For depths greater than this, specific foundation designs could be used or alternatively excavations can be backfilled to the required level with 10MPa site concrete or compacted hardfill. In line with the Client's brief, Aurecon will be undertaking site specific investigations on each residential lot. We will prepare site specific geotechnical reports addressing the foundation requirements on individual building lots. The testing data for the lot specific investigations will be uploaded to the New Zealand Geotechnical Database. For building consent purposes reports prepared for individual lots shall be used.

6.4 Building Considerations

The recommendations in this report shall not be used for individual building consent applications. Site specific investigations in accordance with NZS 3604:2011 are required.

TC1 Foundations

For lots identified as TC1 we consider NZS 3604:2011 type foundations are suitable. We note that at the time of writing this report, the location and structural form of the future dwelling on the lots are unknown and our recommendations relate to NZS3604:2011 type lightweight timber or steel framed residential buildings only.

TC2 Foundations

For lots identified as TC2 we recommend founding dwellings on TC2 type 'enhanced foundation slabs' as per Option 3 or 4 from the MBIE Guidelines (2012) Section 5.1.3 to mitigate the effects of liquefaction induced vertical settlement. Alternatively, in accordance with MBIE Guidelines Section 5.4 a specific design could be undertaken by a suitably qualified chartered professional engineer.

6.5 Future Earthworks

We do not anticipate that future earthworks will be required on the majority of the lots, however should such work be required the following should be noted.

- All earthworks should be carried out in accordance with the Health and Safety at Work Act 2015 and the Worksafe New Zealand Excavation Safety Good Practice Guidelines, 2016.
- Cuts that exceed 0.6m high around any of the house sites must be retained by a suitable retaining wall designed by a Chartered Professional Engineer.
- We recommend that no more than 450mm of fill is placed on the allotment without detailed engineering design.
- Earthworks (cut and fill) should not be undertaken adjacent to any timber retaining wall, if present.
- Any development where excavations greater than 1.2m in depth are proposed, must be subject to specific investigation and design to confirm these works will have no adverse effect on land stability, infrastructure and/or structures on adjacent lots. Excavations near sensitive structures or near boundaries may require geotechnical engineering input even if shallower than 1.2m.

6.6 Construction Observations

The suitability of foundation conditions must be verified at the time of construction. Foundation inspections by a Building Inspector or a Chartered Professional Engineer who are familiar with this report must be carried out to ensure the adequacy of the foundation subgrade prior to the placement of granular hardfill or the construction of foundations.

7 References

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Robertson and Wride, 1998. *Evaluating cyclic liquefaction potential using the cone penetration test*. Canadian Geotechnical Journal, Vol. 35, pp. 442 – 459.

Tonkin and Taylor (2013) *Liquefaction Vulnerability Study*, Tonkin and Taylor Report 52020.0200/v1.0. February 2013. 52 pages and 14 appendices.

Zhang, Robertson, and Brachman, 2002. *Estimating liquefaction-induced ground settlements from CPT for level ground.* Canadian Geotechnical Journal, Vol. 39, pp.1168 – 1180.

8 Explanatory Statement

This report has been prepared for CDL Land New Zealand Limited. It may be made available to others but only in full. As noted above, it shall not be used by any person as a substitute for specific field observations and testing once house sites are confirmed.

This report has been prepared as part of the development of the Prestons Park Stage E3 Subdivision. It has been prepared to provide the following information:

- To report on the management of the earthworks during construction, including compaction standards of fills.
- To report on the extent of ground improvement and the resulting land technical category.

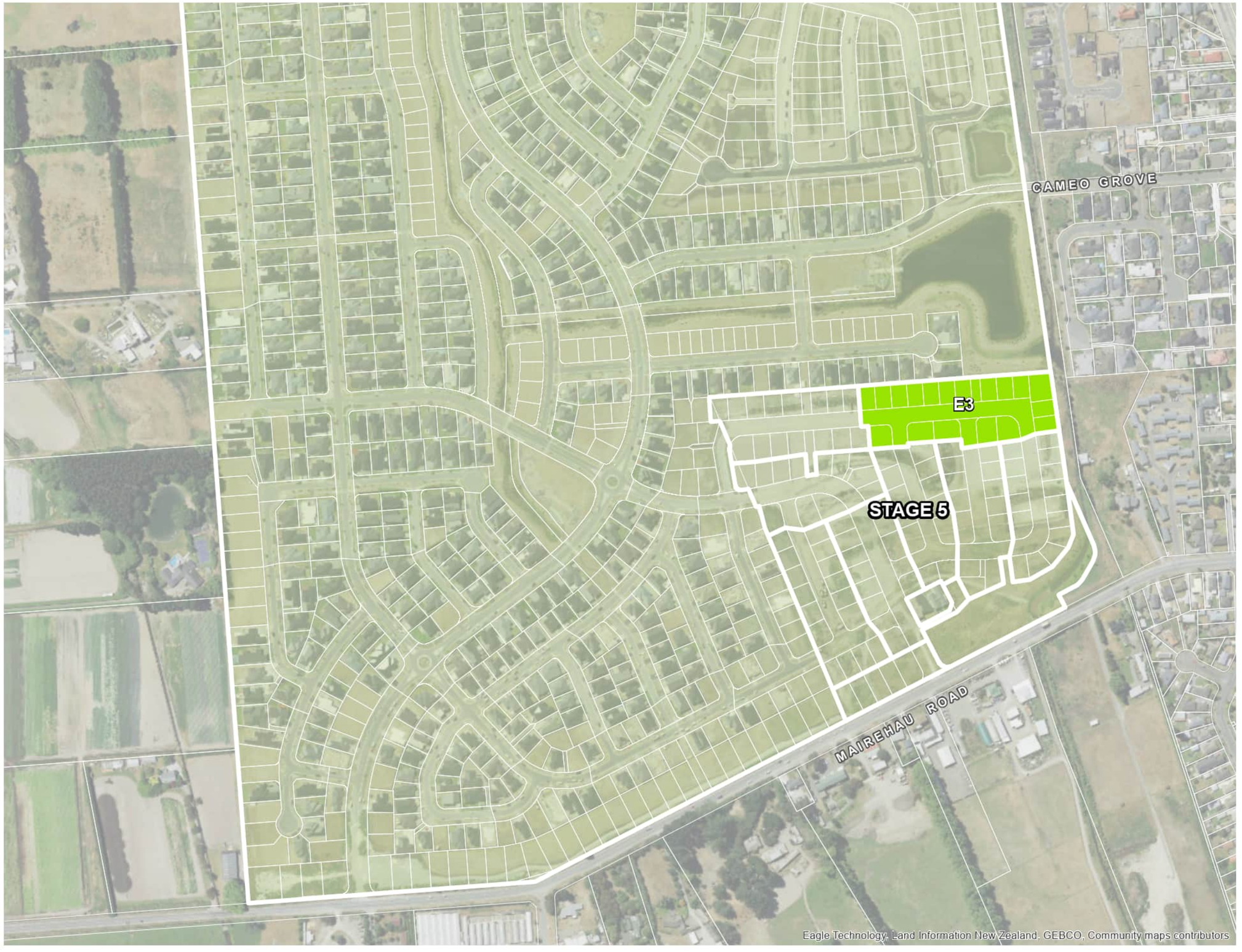
This report does not remove the responsibility of the Owner / Builder / Building Certifier to satisfy themselves of foundation depth and suitability at the finally selected house location.

Subsurface conditions relevant to construction works should be assessed by experienced Contractors and designers who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes. Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay or in wet weather.

It is strongly recommended that any plans and specifications prepared by others and relating to the content of this report, or amendments to the original plans and specifications, are reviewed by Aurecon to verify that the intent of our recommendations is properly reflected in the design. During construction we request the opportunity to review our interpretations if the exposed site conditions are significantly different from those inferred in this report.

This report is not to be reproduced either wholly or in part without our prior written permission.

Appendix A
Figures



Meters
0 40 80 120 160

NOTES - PROPERTY DATA FROM LINZ
- DEPTH BANDING DATA EXISTING TO FINISHED SURFACE

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A	22/10/17	ISSUE FOR INFORMATION	J. Kupec

DRAWN	DESIGNED
R.Dawson	C. Scott
CHECKED	
J. Muirson	
APPROVED	DATE
J. Kupec	22/10/17

PROJECT
PRESTONS SOUTH SUB-STAGE E3

TITLE
SITE PLAN

PROJECT No.
235361
SCALE
AS SHOWN
SIZE
A3
DRAWING No.
FIG 1
REV
A

Path: C:\Users\Ros.Dawson\Desktop\prestons\GIS\SOUTH STAGE 5\E3\FIG 1 SITE PLAN.mxd

Meters
0 10 20 30 40

LEGEND

- BORE HOLE
- CPT LOCATION
- TEST PIT LOCATION

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J. Kupec	14/10/22

PROJECT: PRESTONS SOUTH SUB-STAGE E3

TITLE: PREVIOUS INVESTIGATIONS

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 2
REV: A

Path: C:\Users\Ros.Dawson\Desktop\prestons\GIS\SOUTH STAGE 5\E3\FIG 2 PREVIOUS INVESTIGATIONS.mxd

LAYER
- -0.6-0.0
- 0.0-0.2
- 0.2-0.4
- 0.4-0.6
- 0.6-0.8
- 0.8-1
- 1-1.2
- 1.2-1.4

Meters
0 10 20 30 40

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PROJECT
PRESTONS SOUTH SUB-STAGE E3

TITLE
CUT FILL BANDING

PROJECT No.
235361
SCALE
AS SHOWN
SIZE
A3
DRAWING No.
FIG 3
REV
A

Path: C:\Users\Ros.Dawson\Desktop\prestons\GIS\SOUTH STAGE 5\E3\FIG 3 CUT FILL BANDING.mxd

LEGEND

NDM TEST LOCATION

Meters
0 10 20 30 40

NOTE:
A selection of NDM test points only has been shown due to NDM testing density. Full details of all NDM test results are provided in 235361 - Prestons Park Subdivision Stage E3 Geotechnical Completion Report

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PROJECT: PRESTONS PARK SUB-STAGE E3

TITLE: NDM LOCATIONS

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 4
REV: A

Path: C:\Users\Ros.Dawson\Desktop\prestons\GIS\SOUTH STAGE 5\E3\FIG 4 NDM.mxd

Meters
0 10 20 30 40

LEGEND

- POST EARTHWORKS CPT

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PROJECT: PRESTONS SOUTH SUB-STAGE E3

TITLE: POST EARTHWORKS CPTS

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 5
REV: A

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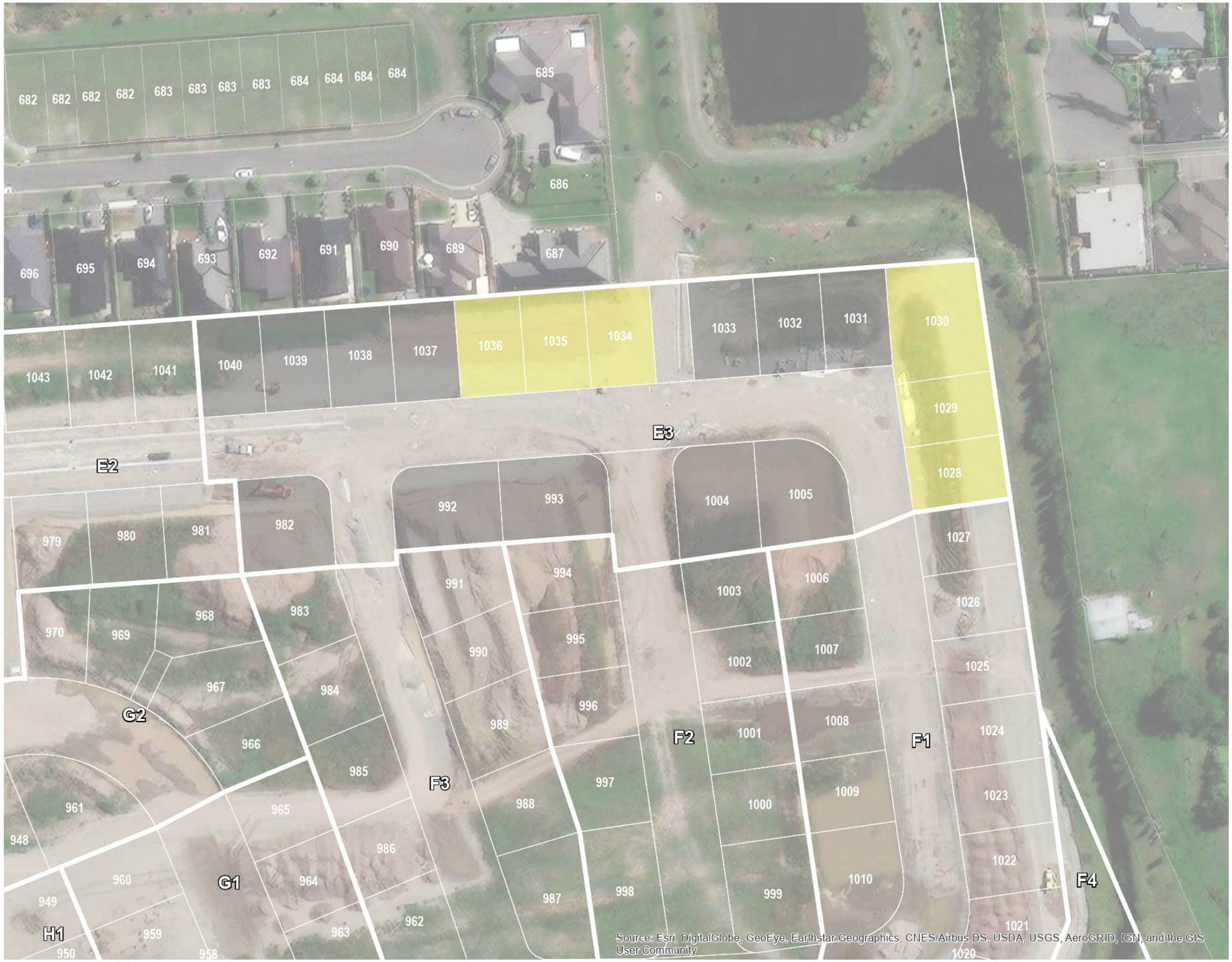

NOTE

TECHNICAL CATEGORY CLASSIFICATION HAS BEEN ASSESSED IN ACCORDANCE WITH SECTION 3 OF THE MBIE GUIDELINES (2012)

LEGEND

- TC1 EQUIVALENT BEHAVIOUR
- TC2 EQUIVALENT BEHAVIOUR

Meters

0 10 20 30 40

NOTES - PROPERTY DATA FROM LINZ

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CHECKED: J. Muirson

APPROVED: J. Kupec 17/10/2022

PROJECT: PRESTONS PARK - SUBSTAGE E3

TITLE: TECHNICAL CATEGORY PLAN

PROJECT No. 235361

SCALE: AS SHOWN | SIZE: A3

DRAWING No.: FIG 6 | REV: A

Path: C:\Users\Ros.Dawson\Desktop\prestons\GIS\SOUTH STAGE 5\E3\FIG 6 TECHNICAL CATEGORY PLAN.mxd