Christchurch City Council

Land Information Memorandum

Property address:

5/1 Stark Drive

LIM number: H09598455

Christchurch City Council

53 Hereford Street, PO Box 73015
Christchurch 8154, New Zealand
Tel 64 3 941 8999
Fax 64 3 941 8984

www.ccc.govt.nz

Land Information Memorandum

Christchurch City Council

Application details

Date issued	14 May 2026
Date received	5 May 2026

Property details

Property address	5/1 Stark Drive, Hornby, Christchurch
Valuation roll number	23436 00900 E
Valuation information	Capital Value: $610,000 Land Value: $315,000 Improvements Value: $295,000 *Please note: these values are intended for Rating purposes*
Legal description	Unit 5 DP 476863 on Lots 9 10 DP 457595 having share in 1036
Existing owner	Wisdom Properties Investment Limited PO Box 8907 Christchurch 8440

Council references

Rate account ID	73175776
LIM number	H09598455
Property ID	1173537

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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. It is essential that the applicant undertakes their own due diligence to verify the suitability of the property for their intended use.

Under Information Privacy Principle 3A (IPP3A) of the Privacy Act 2020, if personal information is collected indirectly (from someone other than the individual concerned), the affected person should be notified. If you are submitting a request on behalf of another individual and providing personal information to Council, please ensure that they are made aware of this prior to submission.

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

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

1. Special features and characteristics of the land

Section 44(A)(2)(aa) LGOIMA. This is information known to the Council but is not apparent from 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 the likely presence of hazardous contaminants.

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

Natural Hazards

Section 44A(2)(a) LGOIMA. This is information known to the Council about natural hazards that is required by section 44B LGOIMA.

Council's information has primarily been obtained from external specialists with the technical expertise to carry out research, investigation or analysis. Under the Local Government (Natural Hazard Information in Land Information Memoranda) Regulations 2025, the Council isn't required to:

- prepare a risk assessment of the land concerned.
- undertake any further analysis relating to the land.
- conduct additional searches or inquiries about the existence of natural hazard information.

It is the LIM recipient's responsibility to seek qualified advice about any identified natural hazard and/or the suitability of the land for its intended purpose.

This section may also include natural hazard information provided by Environment Canterbury. Christchurch City Council is required to include such information in LIMs where Environment Canterbury considers it meets the criteria under section 44C of LGOIMA.

The following statement has been provided by Environment Canterbury:

This Land Information Memorandum includes natural hazard information deemed by Environment Canterbury to be the most up to date, useful, and relevant, and is provided in accordance with the Local Government (Natural Hazard Information in Land Information Memoranda) Regulations 2025. All due care has been taken to ensure current information required to be provided under the regulations is presented below.

Environment Canterbury may hold superseded or less reliable natural hazards information relating to the land that has not been included in this Land Information Memorandum. Please contact Environment Canterbury if you would like to enquire about this information.

(a) Coastal Hazards

- Regional Hazard Information: Shoreline Modelling

  Future shoreline modelling has not been completed for this area, however given the distance of the property from the coast, it will not be susceptible to coastal erosion for at least the next 100 years.

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(b) Earthquakes

- Liquefaction Assessment

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

  Title of report: Christchurch liquefaction vulnerability study
  Purpose of report: To provide a district-wide liquefaction vulnerability assessment and to provide expected land performance for a range of potential future earthquake and groundwater scenarios. For use in land use planning, subdivision and building consenting
  Scope of report: Christchurch urban area from the Waimakariri River mouth to Godley Head, and inland to the Selwyn District boundary
  Where or how to access the report: https://ccc.govt.nz/assets/Documents/Environment/Land/CCC-Liquefaction-ReportBody.pdf
  Date of report: July 2020
  Name of person/entity that commissioned report: Christchurch City Council
  Name of person/entity that prepared the report: Tonkin & Taylor Ltd

  Title of Report: Geotechnical information on horizontal land movement due to the Canterbury earthquake sequence
  Purpose of report: Background geotechnical information about shallow ground movements as a result of the earthquake sequence
  Scope of Report: Christchurch City flat area, excluding Port Hills and Banks Peninsula
  Where or how to access the report: https://www.linz.govt.nz/resources/research/geotechnical-information-horizontal-land-movement-due-canterbury-earthquake-sequence
  Date of report: March 2015
  Name of person/entity that commissioned report: Land Information New Zealand
  The name of person/entity that prepared the report: Tonkin & Taylor Ltd

- Regional Liquefaction Information

  Areas where there was evidence of liquefaction were mapped following the 2010/11 Canterbury earthquakes by Tonkin & Taylor for the Earthquake Commission (urban areas) and by a group of researchers for Environment Canterbury (rural, commercial and industrial areas). These are available in the Christchurch Liquefaction Viewer at https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/.

  Technical report information:
  Title: Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts.
  Date: December 2012.
  Author: H Brackley (compiler).
  Commissioned by: Environment Canterbury.
  Purpose of report: To collate liquefaction occurrence during the 2010/11 Canterbury earthquakes, and to determine liquefaction vulnerability. For use in land use planning, subdivision and building consenting.
  Study area: Coastal Canterbury from the Waipara River mouth to the Rakaia River mouth, including Banks Peninsula, and inland to Rangiora, Aylesbury, Selwyn and Southbridge.
  Accessible at: https://www.ecan.govt.nz/document/download?uri=1702192.

- Regional Hazard Information: Earthquake fault deformation

  There are no known earthquake faults at the ground surface in Christchurch. However, it is possible there are some faults in Christchurch that are yet to be identified because they are not visible at the ground surface. More information on fault deformation is available on Environment Canterbury's fault deformation map at https://mapviewer.canterburymaps.govt.nz/?webmap=b5f859bd18ee4912828cb092bef6c449.

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(c) Flooding

- Flooding

  Flood models are used to show the probability and potential location of flooding in Christchurch. These are computer-based models, and use the data on the Council stormwater network, rainfall, topography, hydrology, soil, land-use and historic flooding. They also incorporate outputs of other modelling such as urban growth, ground water, sea level rise and climate change. Detailed reports on the modelling including its assumptions and limitations can be found at https://ccc.govt.nz/consents-and-licences/property-information-and-lims/land-information-memorandum-lim.

- Predicted 1 in 50 Year Flood Extent

  Flood modelling shows this property, or parts of this property, is within a 1-in-50-year flood extent, including impacts of climate change and sea level rise. You can view this on the flood extent map at https://ccc.govt.nz/flood-and-floor-level-viewer. If changes such as land development or major infrastructure have occurred on this property, or in the surrounding area since the flood modelling, this may change the flood extent. For more information, please refer to https://ccc.govt.nz/flooding-and-floor-levels.

- Predicted 1 in 200 Year Flood Extent

  Flood modelling shows this property, or parts of this property, is within a 1-in-200-year flood extent, including impacts of climate change and sea level rise. You can view this on the flood extent map at https://ccc.govt.nz/flood-and-floor-level-viewer. If changes such as land development or major infrastructure have occurred on this property, or in the surrounding area since the flood modelling, this may change the flood extent. For more information, please refer to https://ccc.govt.nz/flooding-and-floor-levels.

- Regional Hazard Information: Flood Photographs

  Photographs showing the property during or following past flood events may be available. Flood photographs are available on Environment Canterbury's flood imagery register at https://apps.canterburymaps.govt.nz/FIR.

- Regional Hazard Information: Site Specific Flood Assessment

  A site specific flood hazard assessment may have been completed for the property by Environment Canterbury. The information contained in this assessment may now be outdated. Please contact Environment Canterbury if you would like to request a copy.

- Regional Hazard Information: Flood Assessment Request

  You can request a new site-specific flood hazard assessment for the property from Environment Canterbury at: https://www.ecan.govt.nz/do-it-online/property-information/flood-hazard-assessments.

(d) Landslides

As at the date of this LIM, Council research found no information under this heading.

(e) Subsidence

- 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.

(f) Tsunamis

As at the date of this LIM, Council research found no information under this heading.

(g) Volcanic and Geothermal Hazards

As at the date of this LIM, Council research found no information under this heading.

(h) Wind

As at the date of this LIM, Council research found no information under this heading.

(i) Any Other Natural Hazards

As at the date of this LIM, Council research found no information under this heading.

(j) District Plan Natural Hazard Information

Please refer to *Section 8. Land use and conditions* of this report for District Plan related natural hazard information.

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(k) Building Notices

Please refer to *Section 5. Consents, certificates, notices, orders, or requisitions affecting the land and buildings* of this report for Building Act notice information.

Other Special Features or Characteristics of the Land

- 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 2013. The filling was, according to the Councils records carried out in a controlled manner and comprises Gravel.
- Landfill - Former Landfill On Site

  This property is located in an area known to have been a landfill. Given the former activity, potential issues may arise as to subsidence, soil contamination, landfill gas, and the use of groundwater.
- Landfill - Potential For Contaminants in Soil

  As a consequence of the former activity, it is possible that there will be contaminants under the surface of the property. The presence of contaminants may raise health issues if there is exposure to such contaminants. The Council is unaware whether any soil testing for contaminants has taken place on this property.
- Landfill - Potential For Landfill Gas

  Landfill gas, which is produced by decomposing organic material, is a potential concern on former landfills. It has explosive potential once certain concentrations have been reached - usually in enclosed areas. The Council is unaware whether any testing for gas has been carried out at this site.
- Landfill - Potential For Subsidence

  Land previously used for a landfill, is unlikely to have a bearing capacity of normal ground. A site test will usually be required for any new building work on this property. In some circumstances, specially designed foundation may be required.
- Landfill - Potentially Contaminanted Groundwater

  It is possible that ground water may have become contaminated because of the migration of leachate from former landfills. There are therefore risks associated with bores under or close to former landfill sites. The Council is unaware whether any groundwater testing has been carried out at this site.

Related Information

- The latest soil investigation report for this property is attached for your information

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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.

Related Information

- This property is shown to be served by Christchurch City Council Sewer and Stormwater.
- Attached are all drainage plans that Council hold for details of private and public drainage. Not all plans provided are verified by Council, and therefore Council cannot be liable for inaccuracies. Site investigation will be required by owners to determine exact layouts.
- Council Trade Waste Bylaw regulates the use of the sewer system for sources other than domestic sewage. A trade waste consent must be obtained by the new owner or occupier before any wastewater from an industrial or commercial processes including but not limited to wash down grease traps and cooling systems may be discharged to Council sewer system.

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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.

Water supply

Christchurch City Council is the networked supplier of water to this property. This property is connected to the Christchurch City Council Water Supply. The conditions of supply are set out in the Christchurch City Council Water Supply and Wastewater Bylaw (2022), refer to www.ccc.govt.nz.

Related Information

- All Commercial and industrial properties are required to have a Reduced Pressure Zone backflow prevention device at the boundary to protect the Christchurch water supply network. The installation of this device is a condition of supply and is the responsibility of the property owner in accordance with the Christchurch City Council Water Supply and Wastewater Bylaw 2022. For more information visit our website https://ccc.govt.nz/backflow-prevention/ or contact the backflow installation team on 03 941 8999.

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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 30/06/2026: $6,454.23

	Instalment Amount	Date Due
Instalment 1	$1,613.50	31/08/2025
Instalment 2	$1,613.50	30/11/2025
Instalment 3	$1,613.50	28/02/2026
Instalment 4	$1,613.73	31/05/2026

Rates owing as at 14/05/2026: $7,678.17

(b) Excess Water Rates

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

(c) Final water meter reading required at settlement?

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

To advise of a property settlement, please complete the request for settlement information form at www.ccc.govt.nz/services/rates-and-valuations/solicitors-request.
A settlement statement of accounts will be provided on the expected settlement date advised.

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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.

The building consents recorded in this LIM are only those that the Council has issued or been notified of by a stand-alone BCA. There may be others if a stand-alone BCA has issued consents without notifying the Council.

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.

Sections 71 to 74 of the Building Act 2004 require the Building Consent Authority to consider natural hazards when it receives a building consent application for the construction or major alteration of a building on land that is subject to, or likely to be subject to, a natural hazard. A building consent for this property may have been issued subject to a section 72 or 73 notice. This means at the time of building consent the Building Consent Authority was not satisfied that adequate provision would be made to protect the building and land from the natural hazard and was subsequently required to notify the Registrar-General of Land to record the natural hazard on the Record of Title. The Building Act 2004 defines natural hazards as erosion (including coastal erosion, bank erosion, and sheet erosion), falling debris (including soil, rock, snow, and ice), subsidence, inundation (including flooding, overland flow, storm surge, tidal effects, and ponding), and slippage.

If your property contains a notice under s73 of the Building Act 2004, this will be identified on the building consent decision below (decision under s72 of the Building Act 2004) and on the properties' Record of Title. The Record of Title may also record this as a s36 notice under the Building Act 1991, or a s641A notice under the Local Government Act 1974.

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

(a) Consents

- BCN/2013/6258 Applied: 02/07/2013 Status: Completed
  14/3 Stark Drive Hornby
  Accepted for processing 24/07/2013
  Building consent granted 04/11/2013
  Building consent issued 08/11/2013
  Code Compliance Certificate Issued 23/10/2014
  Commercial - Warehouse Units x 3
- BCN/2013/9896 Applied: 30/10/2013 Status: Completed
  1/1 Stark Drive Hornby
  Accepted for processing 21/11/2013
  Building consent granted 16/04/2014
  Building consent issued 01/05/2014
  Certificate for Public Use Applied: 05/02/2015 Issued: 25/02/2015 Expiry: 31/05/2015
  Certificate for Public Use Applied: 09/03/2015 Issued: 11/03/2015 Expiry: 30/06/2015
  Code Compliance Certificate Issued 09/04/2015
  4x Commercial Buildings and Associated Siteworks

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- BCN/2013/9896/A Amendment Applied: 17/10/2014 Status: Completed
  1/1 Stark Drive Hornby
  Accepted for processing 21/10/2014
  Building consent granted 21/11/2014
  Building consent issued 24/11/2014
  Amendment 1 - Amendment to an existing Building Consent - Fitout of Unit 9 and Unit 1. Structural Alterations to Unit 9.
- BCN/2015/12723 Applied: 21/12/2015 Status: Lapsed
  10/1 Stark Drive Hornby
  Accepted for processing 22/12/2015
  Building consent granted 25/02/2016
  Building consent issued 02/03/2016
  Extension to start date Applied: 24/02/2017 Issued: 27/02/2017 Expiry: 25/08/2017
  Building consent lapsed 25/08/2017
  Commercial Alterations - Internal fit out of dental surgery
- BCN/2016/4001 Applied: 11/05/2016 Status: Completed
  9/1 Stark Drive Hornby
  Exemption from building consent approved 01/06/2016
  Office fit out for 1st floor unit 9, additional toilet and basin
- BCN/2017/1839 Applied: 16/03/2017 Status: Completed
  1/1 Stark Drive Hornby
  Exemption from building consent approved 31/03/2017
  Fit out - Cephas Rock – Unit 1 Level 2
- BCN/2017/1859 Applied: 17/03/2017 Status: Completed
  15/3 Stark Drive Hornby
  Exemption from building consent approved 21/03/2017
  Minor internal alterations – partitions and chiller - Ethique
- BCN/2019/3825 Applied: 17/06/2019 Status: Completed
  8/1 Stark Drive Hornby
  Exemption from building consent approved 20/06/2019
  New staffroom with storage area above. New internal timber stair. Toilet facilities.
- BCN/2019/7757 Applied: 14/11/2019 Status: Completed
  20/1 Stark Drive Hornby
  Exemption from building consent approved 27/11/2019
  New timber framed internal walls and Unisex Toilet Facilities
- BCN/2024/1914 Applied: 19/03/2024 Status: Completed
  9/1 Stark Drive Hornby
  Exemption from building consent approved 27/03/2024
  Access Control - removal
- BCN/2025/5804 Applied: 27/07/2025 Status: Completed
  20/1 Stark Drive Hornby
  Exemption from building consent approved 11/08/2025
  Office alterations - First Floor - Unit 5B

(b) Certificates

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

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(c) Notices

- WOF/2020/5070 Expires: 01/09/2026
  Compliance schedule BAE issued 23/01/2026

(d) Orders

(e) Requisitions

Related Information

- In the property file there is an electrical and/or gas fitters certificate relating to works that have been carried out on the current building at this address.

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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 Conditions**

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

- **Development Constraint Conditions**

  Council records show there is a specific condition on the use of this site: Specific Foundation Design Required

- **Liquefaction Management Area (LMA)**

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

- **District Plan Zone**

  Property or part of property within the Industrial General 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/2001/2681 - Subdivision Consent
  BOUNDARY ADJUSTMENT 223 REQUESTED 04/03/02 Certified 11/3/02 224 Requested 3/5/02 Issued 3/5/02
  DP 306799 - Historical Reference RMA20008602
  Status: Processing complete
  Applied 31/10/2001
  Granted 21/12/2001
  Decision issued 21/12/2001
- RMA/2002/334 - Subdivision Consent

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FEE SIMPLE SUBDIVISION - 50 LOTS 224 requested 3/10/02 Issued 8/11/02 DP 312563 224 requested 10/6/03 Issued 10/7/03 DP 323205 323207 - Historical Reference RMA20009308
Status: Processing complete
Applied 05/02/2002
Granted 16/05/2002
Decision issued 16/05/2002

- RMA/2003/2701 - Subdivision Consent
  FEE SIMPLE SUBDIVISION - 2 LOTS SEC 223 Received 13/10/03 released 06/11/03 224 released 21/01/04 dp 327510 - Historical Reference RMA20015036
  Status: Processing complete
  Applied 13/10/2003
  Granted 31/10/2003
  Decision issued 31/10/2003

- RMA/2011/409 - Subdivision Consent
  SECTION 127 APPLICATION TO RMA92012276.2 - Historical Reference RMA92017939
  Status: Processing complete
  Applied 14/04/2011
  Granted 28/06/2011
  Decision issued 28/06/2011

- RMA/2013/949 - Subdivision Consent
  74 LOT FEE SIMPLE SUBDIVISION - Stage 5V and 5Z s223 Stage 5Z Certified 6/11/2013 DP 466370 s224 Stage 5z Iss 4/12/2013 - Historical Reference RMA92022587 Stage 5V2 LT 498978
  Status: Processing complete
  Applied 27/05/2013
  Granted 22/08/2013
  Decision issued 22/08/2013
  s223 Certificate issued stage 3 17/08/2016
  s224 Certificate issued 06/12/2018

- RMA/2014/307 - Subdivision Consent
  UNIT TITLE SUBDIVISION - 22 UNITS stg2 req 2/3/2015 s223 PUD & Stage 1 Issued 24/7/2014 DP 476863 s224 Stage 1 Issued 24/7/2014 Amended 223/224 30/1/2015 - Historical Reference RMA92024912
  Status: Processing complete
  Applied 12/02/2014
  Granted 23/06/2014
  Decision issued 23/06/2014

- RMA/2013/1097 - Land Use Consent
  1 Stark Drive Hornby
  Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
  Status: Processing complete
  Applied 19/06/2013
  Granted 15/08/2013
  Decision issued 15/08/2013

- RMA/2014/264 - Within scope amendment
  3 Stark Drive Hornby
  "Within scope" changes to RMA92022743 - Historical Reference RMA92024869
  Status: Processing complete
  Applied 10/02/2014
  Granted 20/02/2014
  Decision issued 20/02/2014

Christchurch City Council

53 Hereford Street, PO Box 73015
Christchurch 8154, New Zealand
Tel 64 3 941 8999
Fax 64 3 941 8984

www.ccc.govt.nz

- RMA/2014/1164 - s127 Change / cancellation of condition(s)
  1 Stark Drive Hornby
  Change of Condition to RMA 92022743 - Historical Reference RMA92025807
  Status: Processing complete
  Applied 16/05/2014
  Granted 17/06/2014
  Decision issued 18/06/2014

(c) Resource Consents Natural Hazard Information

Related Information

- 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:
  All hardstand runoff from allotments shall be pre-treated in swales prior to discharge to receiving waters.
  Any development to be in accordance with 'Post Construction Phase" SMP prepared to manage ground conditions and/or landfill gas measures.

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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 Thursday. Please leave your organics at the Kerbside by 6:00 a.m.
- Your recycling is collected Fortnightly on the Week 1 collection cycle on a Thursday. Please leave your recycling at the Kerbside by 6:00 a.m. Your nearest recycling depot is the Parkhouse Road EcoDrop.
- Your refuse is collected Fortnightly on the Week 1 collection cycle on a Thursday. Please leave your rubbish at the Kerbside by 6:00 a.m. Your nearest rubbish depot is the Parkhouse Road EcoDrop.

(b) Other

- **Floor Levels Information**

  Council holds a variety of information on requirements for building or property development. This includes:
  • required minimum finished floor levels, which 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 property, you can view it online at https://ccc.govt.nz/flooding-and-floor-levels.
  Otherwise, if you are building or developing on this land, you can request a calculation on required finished floor levels for your proposed building by emailing us at floorlevels@ccc.govt.nz.

- **Community Board**

  Property located in Halswell-Hornby-Riccarton 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 Halswell 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**

  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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Related Information

- Dangerous Goods Licences have been replaced with Location Test Certificates/ Location Compliance Certificates administered by Worksafe. You can contact a local Test Certifier to advise you or to issue the type of test certificate you need.

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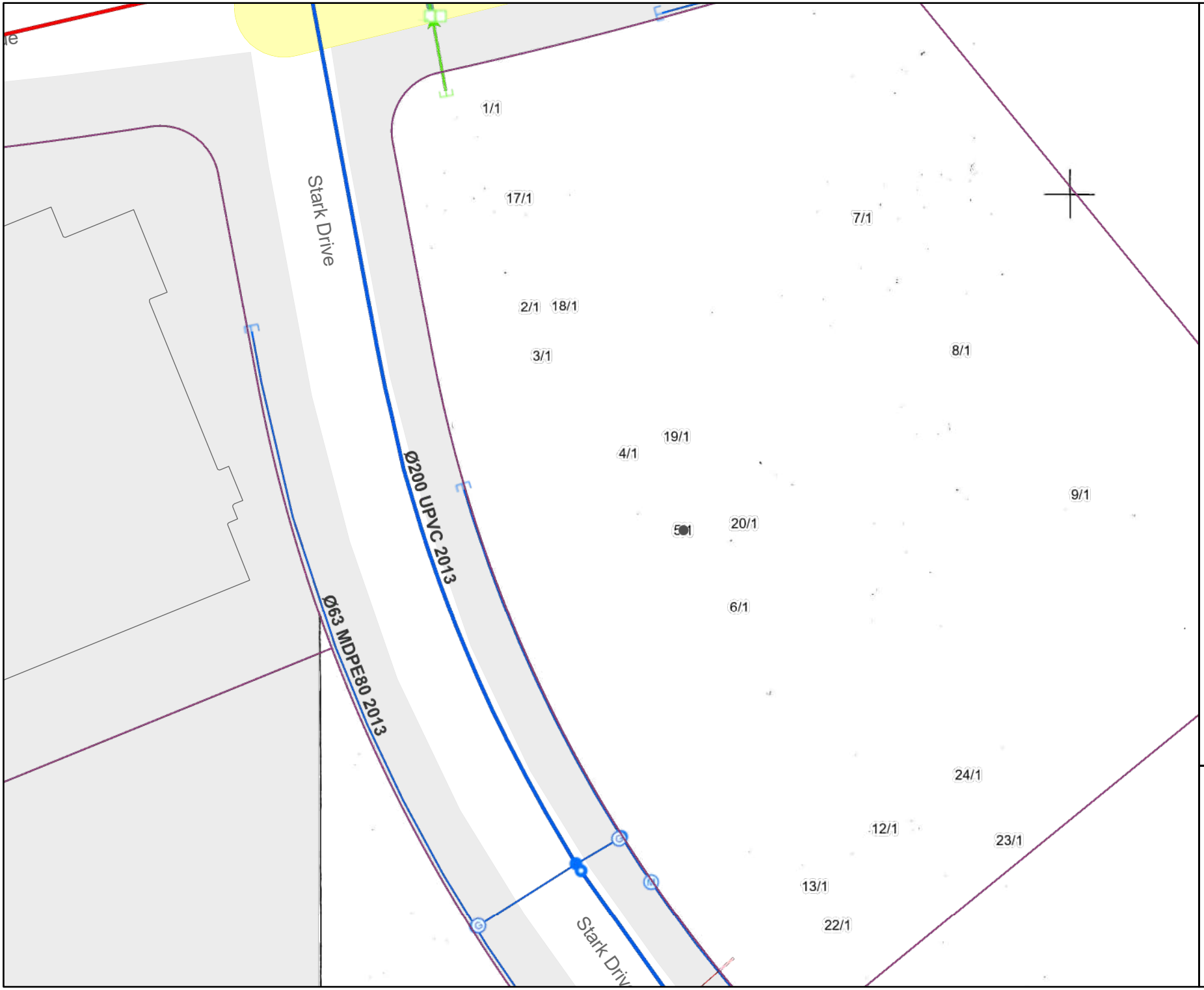


5/1 Stark Drive

WwPrivateDrainFieldNo
WwPump
WwAccess
Type
Flush Manhole
Flushing Point
Trap
Inspection Point
Sealed Manhole
Standard Manhole
Vacuum Storage Manhole
Vented Manhole
WwValve
WwVent
WwAirGapSeparator
WwLocalPressureBoundaryK
WwLocalPressureControlPa
WwLocalPressureTankSyste
WwOutfall
WwPipeRestraint
WwFitting
Type
Change
End Cap
Junction
WwEye
Type
Eye
Eye (Vertical)
WwLateralFitting
Type
Raised Inspection Point
Lateral Fitting
WwVacuumBreather
WwVacuumChamber
Type
Collector
Interceptor Tank
Valve
Riser
WwVacuumBreatherPip
WwPipeFlowDirection
WwPipeBlockageCount
NumberOfBlockages
2 or less Blockages
3 or more Blockages
WwPipe
NominalDiameter
Diameter is 200mm or smaller
Diameter is greater than 200mm, up to 450mm
Diameter is greater than 450mm
Other (non-circular pipes)
WwPipe (non-gravity)
NominalDiameter
Diameter is 200mm or smaller
Diameter is greater than 200mm, up to 450mm
Diameter is greater than 450mm
Other (non-circular pipes)
WwLateral
WwPipeProtection
WwFlushTank
WwStructure
WwStation
WwPumpStationCatchme
WwPipe (non CCC)
In Service
Abandoned
Removed
Out of Service
WwLateral (non CCC)
In Service
Abandoned
Removed
Out of Service
Proposed
SwPrivateDrainFieldNot
SwPump
SwFacilityDischargePoin
SwAccess
SwValve
Type
Check
Duck Bill
Flap
Gate
Inline Check
Sluice
Valve
SwHeadwall
Type
Inlet
Outlet
SwFlowRestriction
SwGrill
Type
Inlet
Outlet
SwInlet
Type
Single Sump
Dome Sump
Double Sump
Triple Sump
Inlet
Pipe End
Gross Debris Trap
Silt Trap
SwOutlet
SwPipeRestraint
SwFitting
Type
Change
Bend
Junction
End Cap
SwEye
SwPipeFlowDirection
SwLateralFitting
Type
Single Sump
Double Sump
Inspection Point
Manhole
Lateral Fitting
Soak Pit
SwPipe
NominalDiameter
Diameter is 450mm or smaller
Diameter is greater than 450mm, up to 700mm
Diameter is greater than 750mm
Other (non-circular pipes)
SwLateral
SwPipeProtection
SwFacility
SwStructure
SwStation
SwRainGarden
SwPipe (non CCC)
In Service
Abandoned
Removed
Out of Service
Proposed
SwLateral (non CCC)
In Service
Abandoned
Removed
Out of Service
WsPump
WsValve
NormalPosition,Type
Air Release
Backflow Prevention
Butterfly
Gate
Non Return
Pressure Activated
Sluice
Sluice, Normally Closed
Valve
WsHydrant
WsInlet
WsConnection
Type
Fire
Restrictor
Toby
Meter
WsOutlet
WsPipeRestraint
WsFieldNote
WsFitting
Type
Bellows
End Cap
Connector
WsPipeProtection
WsPipe
NominalDiameter
Diameter is 110mm or smaller
Diameter is greater than 110mm, up to 225mm
Diameter is greater than 225mm
Other (non-circular pipes)
WsPipe (non Potable)
NominalDiameter
Diameter is 110mm or smaller
Diameter is greater than 110mm, up to 225mm
Diameter is greater than 225mm
Other (non-circular pipes)
WsLateral
WsStructure
WsReservoir
WsStation
WsPipe (non CCC)
In Service
Abandoned
Removed
Out of Service
Unknown
WsLateral (non CCC)
In Service
Abandoned
Removed
Out of Service
Proposed
BGConnector
BGEndCap
BGValve
BGPipe

Christchurch City Council

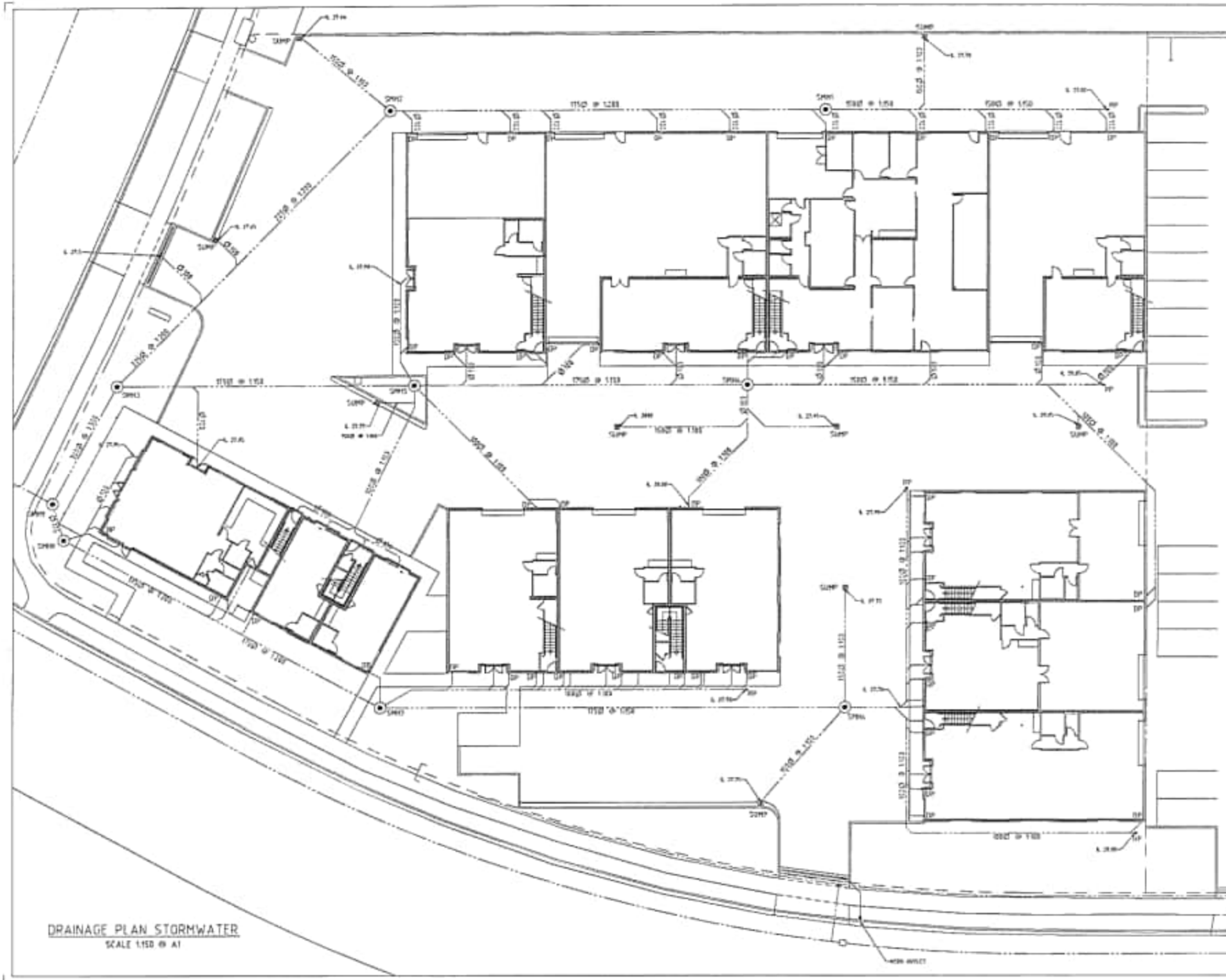
ph: 03 941 8999 web: ccc.govt.nz

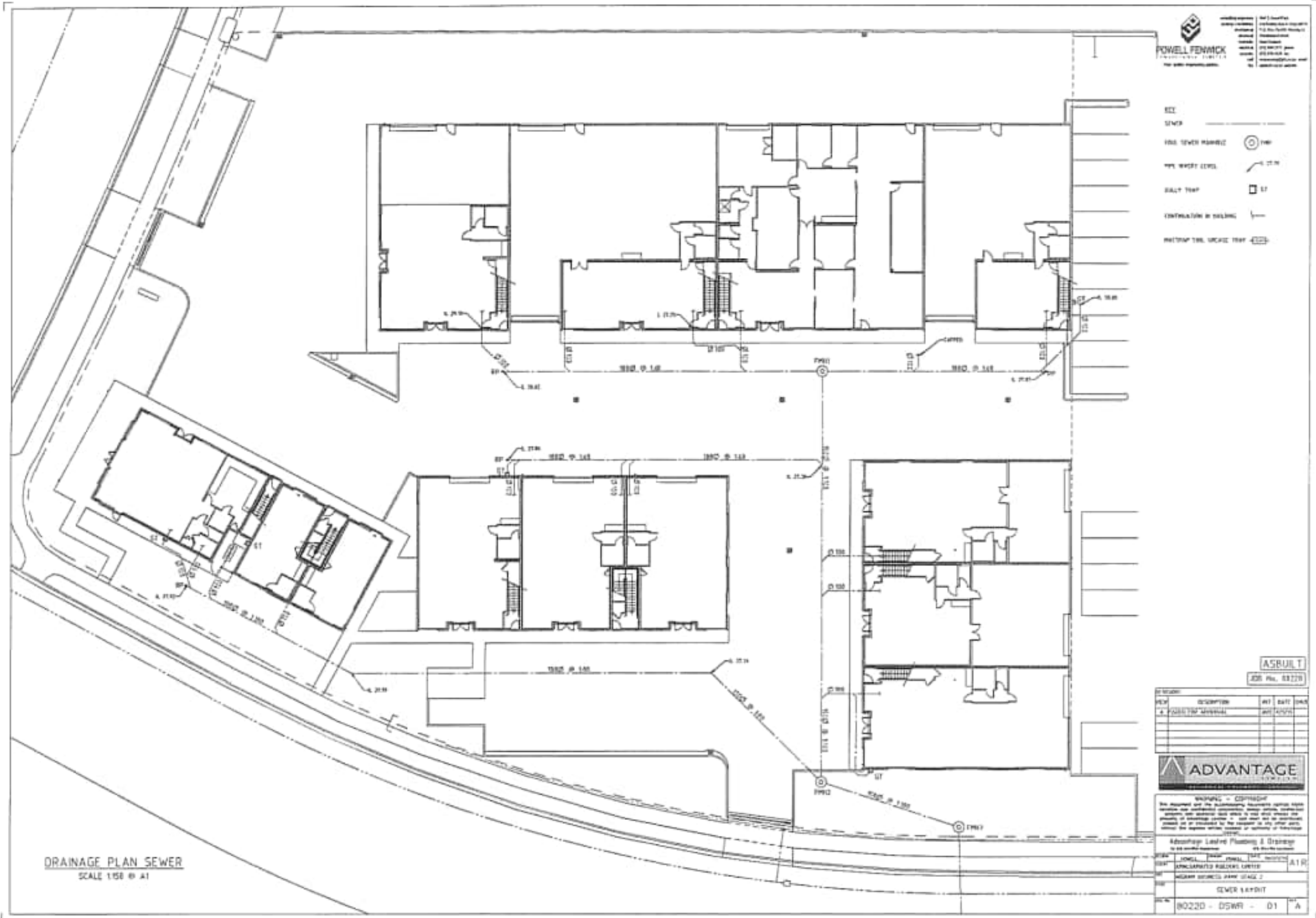
Accuracy not guaranteed. Onsite verification required.
Display of data scale dependant.
Client selected legend.

N

Date: 14/05/2026 12:21 PM
Scale: 1: 500 on A4

0 2.5 5 10 15 20
Metres


DRAINAGE PLAN STORMWATER
SCALE 1:150 @ A1
POWELL FENWICK
STORMWATER
STORMWATER MANHOLE
SURFACE WATER SUMP
THRESHOLD DRAIN
ASBUILT
ADVANTAGE
Advantage Limited Planning & Drawings
STORMWATER LAYOUT
80220 - DSTW - 01
A


POWELL FENWICK
SEWER
EXISTING SEWER MANHOLE
PIPE INVERT LEVEL
DAILY TRAP
CONTINUATION OF BUILDING
PROPOSED SEWER MANHOLE
DRAINAGE PLAN SEWER
SCALE 1:150 @ A1
AS BUILT
ADVANTAGE
SEWER LAYOUT
80220 - DSWR - 01
A

LODESTAR AVENUE

STARK DRIVE

extg chorus connection point
Orion power box
extg 200ϕ
2x150ϕ conduits under driveway capped for future use. 600 cover
INV 27.66
SUMP
150ϕ @ 1:100
SMH2
225ϕ @ 1:200
INV 27.65
INV 27.50
ACO drain in concrete surround, with Class D grate & sloped invert to inline sump. Refer to detail on sheet C3.3
Accrete channel drain with 2 Stage grate at door thresholds. (typ.) detail on C3.3
INV 27.90
INV 28.10
600x600 cable pit. Allow to coordinate position to avoid services clashing
SMH3
SMH5
INV 27.77
150ϕ @ 1:100
175ϕ @ 1:150
INV 27.85
INV 27.95
300ϕ @ 1:300
extg 375ϕ
SMH9
175ϕ @ 1:200
SMH8
Refer to Architect's docs for continuation of internal plumbing
PROPOSED BUILDING FFL 28.75
'Mactrap' 500L grease trap Detail on C3.4
ORG
RP INV 27.92
2x150ϕ conduits under pathway capped for future use. 600 cover
SMH7
INV 27.70
2x150ϕ conduits under carpark capped for future use. 600 cover
100ϕ @ 1:80
100ϕ @ 1:100
100ϕ @ 1:60
DP
RSD
100ϕ
175ϕ @ 1:200
SMH1
150ϕ @ 1:150
RP INV 27.82
INV 27.78
150ϕ @ 1:100
PROPOSED BUILDING FFL 28.75
Refer to Architect's docs for continuation of internal plumbing
Note: all accrete threshold drains to have inline sump with 100ϕ submerged outlet
SMH4
RP INV 28.02
INV 28.00
INV 27.95
150ϕ @ 1:100 under channel
concrete cover pipe protection as shown
RP INV 27.86
INV 27.75
ORG (with ht above)
2x150ϕ conduits under hardstand capped for future use. 600 cover
FMH1
150ϕ @ 1:100
INV 27.75
INV 27.38
RP INV 27.90
SMH6
INV 27.36
INV 27.70
RP INV 27.70
2x150ϕ conduits under driveway capped for future use. 600 cover
ACO drain in concrete surround, with Class D grate & sloped invert to inline sump. Refer to detail on sheet C3.3
FMH2
FMH3
bubble up chamber with kerb outlet adaptor. Refer to detail on C3.3
ORG (with ht above)
INV 28.00
RP INV 28.05
RP INV 27.87
150ϕ submerged outlet. INV 28.05
concrete cover pipe protection as shown
RP INV 28.10
INV 27.75
INV 28.30
RP INV 28.00
ORG (with ht over)
site benchmark MN in kerb RL: 27.91
extg 200ϕ
extg 225ϕ
ORIGIN OF LEVELS
Wig 1 Cors
Wigram Control Tower
71 Corsair Drive
RL = 48.29
datum CDD (Jan 2012)

KEY:

1:200 @ A1 1:400 @ A3	
approximate property boundary for information only	
+26.60	extg levels
× 26.60	new levels
	new 40mm asphalt
	new exposed aggregate concrete
	extg sump
SUMP	new standard sump
(KO)	new kerb only
(K&C)	new kerb and flat channel
(3VC)	300 wide 'V' channel
(TE)	new timber edge
	extg stormwater
	new stormwater
	extg sewer
	new sewer
	extg water
	extg power
	extg comms.
	extg sewer manhole
FMH	new foul sewer manhole
	extg stormwater manhole
SMH	new stormwater manhole
	new threshold drain
ORG	new overflow relief gully
GT	new gully trap
G	new trapless gully
RP	new rodding point
DP	new down pipe

ISSUE	DATE	AMENDMENT	CHECKED
D	27.03.14	Consent Amendments	
C	25.03.14	Consent Amendments	
B	04.03.14	Consent Amendments	
A	21.01.14	Construction	
1	25.10.13	Consent	

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engineering@pfc.co.nz: email
www.pfc.co.nz: website

WIGRAM BUSINESS PARK

STAGE 2 – LOT 9

DRAINAGE PLAN

SCALES: (original size A1)			
1:200	DESIGNED	MLH	10.13
	DRAWN	MLH	10.13
	CHECKED		

JOB NO.	SHEET NO.	ISSUE
130431	C2.2	D

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE

GEOTECHNICAL INTERPRETIVE REPORT

Lots 9 & 10, Wigram Business Park, Stage 1

For **Stark Drive LP**

25 September 2013

Eliot Sinclair

surveyors | engineers | planners

GEOTECHNICAL INTERPRETIVE REPORT

Lots 9 & 10, Wigram Business Park, Stage 1

Eliot Sinclair
surveyors | engineers | planners

20 Troup Drive, Tower Junction | PO Box 9339
Christchurch 8149 | New Zealand | 03 379 4014

Prepared by:	Firas A. Salman Civil/Geotechnical Engineer	PhD, MSc, BSc, GIPENZ
Reviewed and approved for release by:	John Aramowicz Associate, Senior Civil/Geotechnical Engineer	BE(Hons), MIPENZ (1008112), CPEng, IntPE(NZ)
Date:	25 September 2013	
Reference:	381322_13259130606_Letter_jta.docx	
Status:	FINAL	
Distribution:	1 Original	Stark Drive LP
	File copy	Eliot Sinclair

Limitations: This report has been prepared according to the instructions from Stark Drive LP, for the particular objectives described in the report. The information contained in the report should not be used by anyone else or for any other purposes unless specifically authorised in writing by Eliot Sinclair.

Table of Contents

1. INTRODUCTION

Eliot Sinclair were engaged by Stark Drive LP to prepare a geotechnical interpretative report for Lots 9 & 10, Wigram Business Park, Stage 1 including recommendations for geotechnical design parameters for shallow foundation design for the proposed industrial buildings.

2. SCOPE OF WORK

The scope of work for this geotechnical interpretive report was;

- Review Eliot Sinclair and Partners (ESP)'s Geotechnical Factual Report dated 25 September 2013,
- Review available data from Canterbury Geotechnical database (CGD), Environment Canterbury's GIS database, and the Institute of Geological and Nuclear Sciences (GNS) database,
- Calculate the risk of liquefaction,
- Outline the geotechnical conditions encountered,
- Comment on geotechnical parameters for shallow foundation design for the proposed industrial buildings, and
- Prepare a Geotechnical Interpretive Report.

3. DISCLAIMER

Comments made in this geotechnical interpretive report are based on information shown on the Canterbury Geotechnical Database, Environment Canterbury's GIS, Geological and Nuclear Sciences, site investigation results from Tonkin & Taylor's (T&T) reports[1,2&3], Eliot Sinclair previous investigation within Wigram Business Park, Stage 1, results of the recent deep and shallow testing, and inspection of the general area.

Whilst every care was taken during our interpretation of the subsurface conditions, there may be subsoil strata and features including historical fill or in-situ organic materials that were not detected.

Additionally, on-going seismicity in the general area may lead to deterioration or additional ground settlement that could not have been anticipated at time of writing of this report. The exposure of such conditions, or occurrence of additional strong seismicity, may require a review or additional investigations. Should this occur then Eliot Sinclair should be advised in order to confirm the recommendations of this report.

---

[1] Tonkin & Taylor Ltd, 'Realignment of Hayton Drain – Assessment of Impact to Water Quality, Wigram Airfield, Christchurch', for Ngai Tahu Property Ltd, February 2011, T&T Ref: 51262.011.

[2] Tonkin & Taylor Ltd, '*Wigram Skies – Hayton Road Industrial Subdivision: Geotechnical & Liquefaction Assessment Report',* for Ngai Tahu Property Ltd, January 2012, T&T Ref: 51262.012.

[3] Tonkin & Taylor Ltd, '*Wigram Skies Subdivision: Geotechnical Assessment'*, report for Ngai Tahu Property Ltd, August 2013/Revision 1, T&T Ref: 51262.019.

This report has been prepared for the benefit of Stark Drive LP and the Christchurch City Council, in accordance with the Scope of Work.

No liability is accepted by Eliot Sinclair or any employee of Eliot Sinclair with respect to the use of this report by any other party, or for any other purpose other than outlined in the Scope of Work.

4. SITE HISTORY

Parts of the general area were previously used for disposal of rubbish, debris and soils from a variety of sources, and was previously investigated by Tonkin & Taylor, and the results of this are summarised in their September 2011 report[4].

The depth and extent of the areas of fill could not been fully delineated at that time as it was historically surfaced with relatively clean, compacted silt fill and top-soiled with grass, making visual identification of any surface expression of these areas quite difficult.

Recent subdivision construction earthworks have removed surface topsoil, and obvious uncontrolled fill down to a maximum depth of 2.2m, before replacement with various layers of screened, compacted silty gravel fill. Refer to Appendix A.

Lots 9 & 10 are located within Stage 1 of Wigram Business Park.

5. DESKTOP INVESTIGATION

The Canterbury Geotechnical Database (CGD) contains a large range of photographic, topographic, geological, geotechnical, land classification, survey records and field observations that relate to the Canterbury earthquake sequence. The database is coordinated by the Canterbury Earthquake Recovery Authority (CERA). Some of the following information has been secured from the CGD.

5.1. Geological maps

The geological map of Christchurch indicates the site is underlain by '*Modern river floodplain/low-level degradation terrace. Unweathered, variably sorted gravel/sand/silt/clay*'[5].

The Geology of the Christchurch urban area[6] notes the site is close to the interface between '*dominantly alluvial sand and silt overbank deposits*' (spy) to the west, and '*alluvial gravel, sand and silt of historic river flood channels*' (spy) to the east. Refer to Figure 1.

---

[4] Tonkin & Taylor's (T&T) report '*Wigram Airfield - Stage 1 and 2, Industrial Zone Development and Stream Diversion Remediation Action Plan and Health & Safety Plan*', September 2011, Version 2.0, T&T Ref:51262.011.

[5] GNS Geological Map of Christchurch, showing the surficial soil geology and surrounding area (source: Canterbury Geotechnical Database, Feb. 2013).

5.2. CERA land classification

The Ministry of Business, Innovation and Employment (MBIE) defines three technical categories for residential foundation design described in its guidance for repairing and rebuilding earthquake damaged homes in Canterbury. These categories apply to liquefaction prone flat land in the green zone in the greater Christchurch urban area and surrounding communities, predominantly for residential land.

As this site is new subdivision industrial area, it has been classified by CERA as 'Green Zone, Urban Non-residential'.

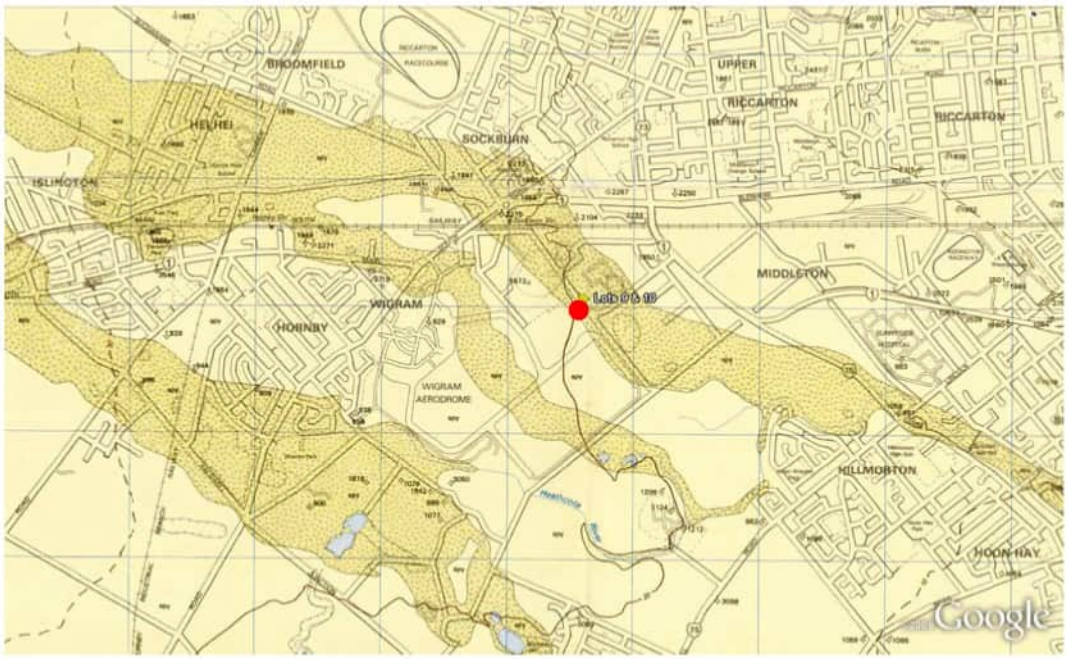


Figure 1: Geology of the Christchurch urban area[6]

5.3. Active faults

The 4 September 2010 M7.1 earthquake occurred on the Greendale Fault, with its eastern limit of surface rupture located around 15km to the west.

The 22 February 2011 M6.2 earthquake occurred on a blind fault located under the Port Hills, with its projected intersection with the ground surface located close to the lower north slopes of the Port Hills, south of the Christchurch CBD.

The 13 June 2011 M6.0 earthquake was located on a NW-SE fault that is estimated to be approximately parallel to, and just east of, the New Brighton coast.

Refer to Figure 2.

[6] Brown, L.J.; Weeber, J.H. 1992: Geology of the Christchurch urban area. Scale 1:25 000. Institute of Geological & Nuclear Sciences geological map 1. 1 sheet + 104p. Institute of Geological & Nuclear Sciences, Lower Hutt, New Zealand.

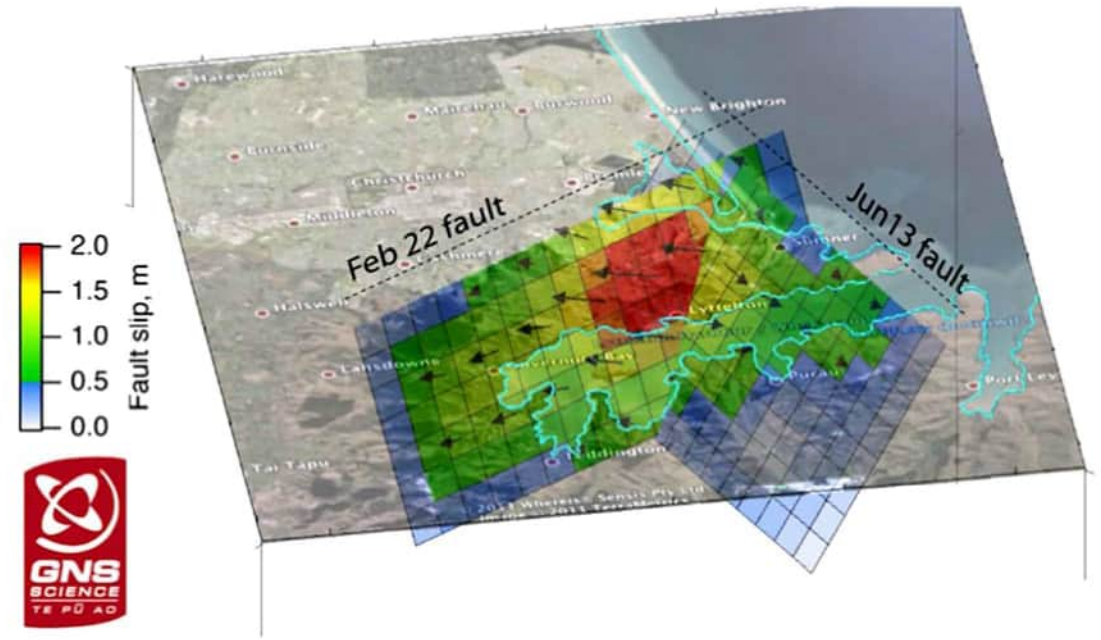


Figure 2: Semi-transparent graphic giving a simplified view of the two faults that ruptured causing the earthquakes on 22 February and 13 June in Christchurch (GNS, 06/09/2011, http://www.gns.cri.nz/Home/News-and-Events/ Media-Releases/ Two-main-faults).

5.4. Conditional PGA for Liquefaction Assessment

The Ministry for Business, Innovation and Employment's (MBIE) '*Guidance for repairing and rebuilding houses affected by the Canterbury earthquakes*' (December 2012) specifies, for residential land, the peak ground acceleration ($PGA_{M7.5}$) to be adopted for liquefaction assessment in a serviceability limit state (SLS) event as $PGA_{M7.5}$ = 0.13g, and $PGA_{M7.5}$= 0.35g in an ultimate limit state (ULS) event.

In the absence of any standard for commercial/industrial land, the values prescribed in MBIE's guidelines have been adopted for this site.

The equivalent conditional median peak horizontal ground accelerations recorded in the general area in each of the September 2010 and February 2011 events are likely to have exceeded the Serviceability Limit State (SLS, $PGA_{M7.5}$=0.13g), but were much less than the Ultimate Limit State (ULS, $PGA_{M7.5}$=0.35g). Refer to Table 1.

Table 1: Comparison of peak horizontal ground accelerations close to site

PGA (horizontal)	SLS (1/25, M7.5)	ULS (1/500, M7.5)	04 Sept 2010 (M7.1)	22 Feb 2011 (M6.2)	13 June 2011 (M6.0)
Design (as of December 2012)	0.13g	0.35g			
Conditional Median PGA			0.26g	0.31g	0.16g
Magnitude Scaling Factor (MSF)			**1.11**	**1.41**	**1.48**
Equivalent to $PGA_{M7.5}$			**0.23g**	**0.22g**	**0.11g**

5.5. EQC vertical ground movements

LiDAR data from the CGD indicates the 4 September 2010 event resulted in an increase in ground levels of '0.1 to 0.2m', however the 22 February and 13 June 2011 events each resulted in negligible (*'-0.1 to 0.1m')* vertical ground movement at this site.

5.6. EQC horizontal ground movements

'Local' horizontal ground displacement data for the site is not available on the CGD, however, data for the land northeast of Hayton Road and northwest towards Pilkington Way does not indicate any particular pattern of movement.

There was no evidence of lateral spreading in the general area.

5.7. EQC liquefaction interpreted from aerial photography

EQC's Aerial Photography taken after each of the major earthquakes of 4 September 2010 and 13 June 2011 did not extend to this site.

The EQC Aerial Photography taken soon after 22 February 2011 earthquake does not show any evidence of liquefaction ejecta in general area.

5.8. EQC observed ground crack locations

No ground cracking was recorded on the CGD in the general area for any of the earthquakes.

5.9. Liquefaction hazard mapping

Environment Canterbury's review of the liquefaction hazard for eastern Canterbury[7] notes the site is located in an area where '*low to moderate liquefaction potential may be expected*'.

5.10. Lateral spreading hazard

Based on the risk of liquefaction, Tonkin & Taylor[2] divided Stage 1 into Area A and Area B (refer to Appendix B). Lots 9 & 10 are located within Area A, i.e. insignificant liquefaction risk in moderate to large earthquakes, and therefore, no lateral spreading is likely to occur across the site.

5.11. Flood hazard

The Paparua Stream has been realigned as part of subdivision construction, and is designed to convey the stormwater runoff from a storm with a 2% annual exceedance probability (AEP). Therefore, the site is not likely to be subject to a high risk of inundation.

[7] Brackley, H.I. (2012): Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts – Environment Canterbury, Report No. R12/83

5.12. Controlled filling

The site has been subject to a controlled filling operation to remediate areas of obvious uncontrolled fill materials, and to raise ground levels.

Fill materials comprised clean silt and sandy gravels which had been excavated from other parts of the subdivision development, or screened silty gravel landfill materials (which are largely free of unsuitable materials).

Nuclear density testing of the compacted fill materials confirmed that compacted dry densities achieved within the controlled fill range from 1571 to 2859 kg/m^3, with an average of 1873kg/m^3.

We note that elevated dry densities are likely to be due to a local increase in gravel content.

5.13. Previous geotechnical investigation data

- *Investigation by Tonkin & Taylor*

Borehole BH-5, undertaken in December 2010[1] was located between Lots 2 and 3, and encountered shallow topsoil over medium to very dense sandy gravels to 5m below ground surface, loose to medium dense sandy silt to 8m, very loose sand to 9.7m, medium dense silt to 12.7m, and sand to 15m, over very dense sandy gravel to 18m where the borehole terminated. Groundwater was encountered around 3.6m below ground level.

Boreholes BH-01 to BH-04 were subsequently undertaken in November 2011[2] across various parts of Stage 1, and encountered gravels to around 5 to 6m below ground surface, interbedded layers of sands and silts to 12 to 16m, over gravels to 17.5m depth where the deepest boreholes terminated.

BH-01 indicates the presence of loose sandy silt from around 1.5 to 2.5m below ground level. This material was not encountered in T&T BH-03, or any of the other boreholes further north, and indicates this layer does not influence the shallow geotechnical conditions across Lots 9 & 10. Refer to Appendix C, Fig. No. 51262.012-FA2.

We note T&T's testing was undertaken before subdivision earthworks had commenced.

Multichannel Analysis of Surface Wave (MASW)[3] testing undertaken across the northwest part of Stage 1, and just southeast of Stage 1, infers the presence of dense gravel areas in the upper layers, underlain by softer silts, sandy silts, and sands.

Refer to Appendix C.

- *Investigations by Eliot Sinclair*

In February/March 2013, Eliot Sinclair undertook additional shallow geotechnical investigation across Stage 1 with a number of the test pits located across and close to Lots 9 & 10. Refer to Appendix D.

TP11, TP13, TP15, TP17, TP18 and TP20 were located within Lots 9 & 10. The machine excavated test pits were excavated to 3m to 3.7m depth and

generally encountered a silty topsoil layer to 0.2m depth, over sandy gravel fill to around 1.5m depth, over in-situ sandy gravels to the full depth of testing.

Nearby test pits TP5, TP10, TP16, TP21, TP22, TP26 and TP34 were undertaken within Lots 1, 4, 5, 11 and 17 also encountered similar soil profiles.

Groundwater was typically encountered around 3.0m below ground level, but may increase slightly under wet winter conditions.

Scala penetrometer testing was not practical due to the gravel content of the near-surface soils.

The excavated test pits were generally reinstated with compacted sandy gravels using an excavator mounted vibrating plate compactor, and with nuclear density testing (ND) carried out within the upper 1m of fill.

The density of the compacted backfill below 1m depth could not be safely verified by ND testing and, as a conservative approach, it should be assumed that the backfill to the test pits is only lightly compacted.

BH003 (located at the corner boundary between Lots 8, 11 and 16) encountered medium to very dense sandy gravel to 6m below ground level, very loose to loose interbedded silty sand and silt to 11m, stiff silt to 13.5m, medium dense silty sand to 14m, over dense to very dense sandy gravel to the terminating depth of 18.7m.

BHG (undertaken to 15m depth) encountered of medium to very dense sandy gravel to 6m, over very loose to medium dense interbedded silts and silty sands to 14.6m, over very dense sandy gravel to 15.5m depth where the hole was terminated. Groundwater was encountered between 3.1 to 3.4m below ground level.

Refer to Appendix E.

6. SITE SPECIFIC INVESTIGATION

Eight shallow boreholes, with standard penetration testing (SPT) at 1m centres, and to 4m depth were undertaken across the site, and were typically located near the corners of the proposed buildings. Also, two deep borehole to 15m depth were undertaken at the northwest and south corners of the site.

Refer to Appendix D for test location plan.

Cone penetration testing (CPTu) testing was not practical within the upper gravels which prevent the penetration of the CPT cone.

6.1. Boreholes & standard penetration testing (SPT)

BH003 to BH010 (each 4m depth) encountered medium to very dense silty gravel fill to 1.5m to 2.7m depth, over dense to very dense sandy gravel to 4m depth of testing where the boreholes were terminated.

BH001 (15m depth) encountered medium dense silty sandy gravel fill to 2m depth, medium to very dense sandy gravel to 5.5m, very loose to medium dense interbedded silts and sands to 14.2m, over very dense sandy gravel to 15.5m depth where the hole was terminated.

BH002 (15m depth) encountered very dense sandy silty gravel fill to 1.2m depth, dense sandy gravel to 2m, medium to very dense sandy gravel to 6m, partially decayed wood to 7m, very loose interbedded sands, silts and peats to 12.8m, over dense silty gravel to 15.5m depth where the hole was terminated.

Refer to Eliot Sinclair and Partners (ESP)'s Geotechnical Factual Report dated 25 September 2013.

7. LIQUEFACTION ASSESSMENT

7.1. Method

The calculation of liquefaction triggering was undertaken using the method outlined in Idriss & Boulanger (2008)[8], and the estimation of post-liquefaction induced settlements for SPT analysis using the method by Yoshimine, et al (2006)[9].

The results were analysed for both a Serviceability Limit State (SLS)[10] and an Ultimate Limit State (ULS)[10] earthquake, assuming $PGA_{SLS,M7.5}$ = 0.13g and $PGA_{ULS,M7.5}$ = 0.35g.

For the purpose of this assessment, the depth to groundwater for liquefaction assessment was assumed 3m below ground level.

Fines content (FC) for the various soils was not specifically analysed, but has been conservatively assumed based on typical fines content for similar soil types reported in EQC's geotechnical reports for Christchurch.

Conservative fines contents, i.e. at the lower end of the range of FC values, were adopted for the liquefaction calculations.

7.2. Vertical settlement due to liquefaction

Estimates of vertical settlement are summarised in Table 2.

Table 2: Summary of calculated liquefaction-induced settlement values.

Lot No.	Test No. (depth to refusal)	Limited to 10m bgl (index value)		Full depth	
		SLS (M7.5, 0.13g)	ULS (M7.5, 0.35g)	SLS (M7.5, 0.13g)	ULS (M7.5, 0.35g)

[8] Idriss, I.M. & Boulanger, R.W. (2008):Soil liquefaction during earthquakes – Earthquake Engineering Research Institute Monograph MNO12
[9] Yoshimine, M., Nishizaki, H., Amano, K. & Hosono, Y. (2006): Flow deformation of liquefied sand under constant shear load and its application to analysis of flow slide in infinite slope, Soil Dynamics and Earthquake Eng. 26, 253-264.
[10] NZS1170.0:2002, Section 3.4

Lot 9	BH001 (15m)	43mm	63mm	58mm	79mm
Lot 10	BH002 (15m)	30mm	30mm	30mm	30mm
Lot 11	BH-3 (18.7m)	59mm	80mm	63mm	135mm
Lot 16	BH-G (15m)	58mm	92mm	90mm	213m
Maximum difference		29mm	62mm	60mm	183mm

BH003 to BH010 were limited to 4m depth, and calculations confirm the very dense silty/sandy gravels are not at risk of liquefaction in either an SLS or ULS event.

Deep boreholes (BH001 and BH002 within the site, and BH003 and BH-G within Lots 11 & 16) are relatively similar and indicate the geological conditions and strata are relatively consistent across the site.

Analysis indicates the soft sandy silt from around 6 to 6.8m, and 8.4 to 10m depth may liquefy in a SLS event. Refer to Appendix F.

We note that survey records from nearby warehouse buildings to the northwest, south of Pilkington Way, indicate significant total or differential settlement did not occur as a result of the Canterbury earthquakes, with around 30mm settlement recorded from the Canterbury earthquake sequence. This indicates the calculated liquefaction-induced settlements shown in Table 2 are likely to be a conservative over-estimate.

7.3. Effect of non-liquefiable crust layer

The deep boreholes confirm the presence of dense to very dense gravels to around 5.5m to 6m below ground level across the site, over some layers of softer fine-grained soils, some which are calculated to be liquefiable. The gravel layer is underlain by a plastic silt to around 8m below ground level and can be assumed to be non-liquefiable, resulting in the upper soils of around 8m thick being non-liquefiable.

In general, the upper 9m of gravels and silts layers encountered across the site are non-liquefiable over around 3m thick of liquefiable sand layers.

'A thick non-liquefiable layer between the building's footings and the liquefiable stratum may act as a bridging layer that arches or redistribute stress and therefore results in more uniform ground settlement. In this manner a well-constructed building on shallow foundations may settle slightly but not suffer any damage, because the differential settlement is small'[8].

Based on a number of post-earthquake observations, Ishihara (1985)[11] [as stated by Idriss & Boulanger (2008)[8], Fig. 107, page 157] gives a relationship between the depth of surface crust and the depth of the liquefiable layer that defines the likelihood of ground surface damage due to liquefaction. For a 9m

[11] Ishihara, K. 2008. Stability of natural deposits during earthquakes, in Proceedings, 11th International Conference on Soil Mechanics and Foundation Engineering, San Francisco, A.A. Balkema, Rotterdam, pp. 321-376.

thick crust of non-liquefiable soil column, a liquefiable layer of 3m thickness is not likely to result in surface damage under an SLS or a ULS event.

Inspections in the locality after the September 2010 and Februarl 2011 earthquakes confirm that either liquefaction of the underlying soils did not occur, or was entirely suppressed by the overlying raft of sandy/silty gravels.

8. BUILDING FOUNDATIONS

8.1. Proposed construction

The proposed buildings consist of a number of small to medium size warehouses, generally comprising concrete tilt panel walls and steel portal frame construction supported either on pad foundations or reinforced concrete ground beams, and with attached two-storey offices constructed with a suspended concrete floor slab.

Units 1 to 13 appear to be relatively small buildings, with 3 to 4 units per building. Units 14 to 17 are a much larger warehouse-type building, again constructed as a single building.

8.2. Minimum floor levels

Paparua Stream has been recently constructed, and is sized to convey flows from a storm event of up to and including a 2% AEP.

Therefore, buildings floor levels need only to comply with the requirements of NZBC.

8.3. Liquefaction

We note the works undertaken for subdivision construction included only shallow earthworks to remediate uncontrolled landfill materials, and have not been designed to provide any deep ground improvement or stabilisation that reduce the susceptibility of the deeper soils to liquefaction.

Building foundations will need to be selected based on the area, shape, and sensitivity of the structure to differential settlement of foundations.

Based on the inferred presence of around 5 to 6m of dense to very dense gravels across the site, and survey records from nearby buildings, we expect that liquefaction-induced differential settlement of shallow foundations is unlikely to be a significant risk, although some differential settlement could be expected in a design-level SLS or ULS earthquake.

As a pragmatic approach, foundation and structural design should allow for differential settlement of around **50mm in a SLS event**, and around **100mm in a ULS event**, across the width of each building floor and in any direction.

8.4. Lateral spreading

Given the low to moderate risk of liquefaction, presence of dense to very dense gravels across the site, and distance from Paparua Stream, lateral spreading or stretch across an individual building platform is not likely.

8.5. Shallow Foundations

8.5.1. Easement

A 375mm diameter stormwater pipe located at 1.4m depth is running along the southeastern and eastern parts of Lot 10 (along the boundary with Lots 11, 16 and 17). Foundations along these boundaries will need to be located below the 1V:2H plane of influence projected up from the base of the trench for the stormwater pipe. This may require deepened foundations to avoid risk of foundation settlement should re-excavation along the stormwater pipe ever be required.

8.5.2. Peat and organic contents

BH002 (at the south part of Lot 10) encountered partially decayed wood from 6m and 7m below ground level, and soft peat from 11.2m to 12m depth. Given the depth to the wood, we infer it is likely to be an old log that is deposited under natural alluvial deposition, and is well below the water table where it is not likely to decompose or lead to ground settlement.

Other boreholes within and nearby to the site did not encounter any peat or other organic materials.

8.5.3. Bearing strength

Concept drawings from Powell Fenwick indicate the proposed foundations will comprise a series of reinforced concrete ground beams that will need to be effectively connected to each other to provide a composite load-bearing foundation system.

These drawings indicate that foundation ground beams will typically be 400 to 800mm wide and bear 300 to 1200mm below the finished floor level. Table 3 summarises the ultimate bearing strengths that can be used for foundation design, and should adopt a geotechnical strength reduction factor Φ_{bc}=0.5.

Other foundation types or sizes will require specific engineering assessment by the geotechnical engineer.

Table 3: Summary of ultimate bearing strength

Foundation dimensions		Ultimate bearing strength, q_{ult} (kPa)
Width (m)	Depth (m)	
0.4	0.3	200
0.4	0.4	200
0.4	0.7	350
0.6	1.0	500
0.8	1.2	650

8.5.4. Historic test pits

We note that the former test pits TP11 and TP20 are located within the floor plan of Unit 1 and Unit 17, and TP 17 and TP18 are located along the foundation line of Unit 9 and Unit 13. Also, TP 13 and TP15 are located on or very close to the parking area northeast of Units 7 to 10. The foundations and floor slab will need to bridge over these areas and consider these area as at risk of loss of support.

8.5.5. Floor slab

The floor slab area should be stripped of all topsoil and silt fill and replaced with compacted AP40 sandy gravels to achieve a minimum dry density of at least 2150kg/m^3, up to the underside of the floor slab in order to provide firm, uniform support across all of the floor slab.

8.5.6. Geotechnical inspection at time of excavation for foundation and stripping of floor slab

Due to the presence of fill material across the site, Eliot Sinclair & Partners should inspect all excavated foundation trenches before any placement of reinforcement, in order to confirm the bearing conditions are consistent with the recommendations of our report. The engineer will either confirm the exposed subgrade is suitable, or may require the foundations to be deepened or widened to provide suitable bearing capacity where unexpected conditions are encountered.

Upon satisfactory completion of foundations excavations to the geotechnical engineer's requirements, we will issue a Procedure Statement- Construction Review which confirms the foundation soil bearing conditions to be consistent with this report.

8.5.7. Building services

Where practical, it will be good practice to design all building services to exit through the side of the foundations, and not under the floor slab. In addition, a flexible or sliding connection to services should be used to allow for some differential movement in both a vertical and lateral direction in the event of strong earthquake shaking. These measures will assist in providing a resilient

construction that can facilitate repair if these were ever damaged in another large earthquake.

8.5.8. Landfill gas

T&T's September 2011 report[4] states '*the key landfill gas present was CO_2. The landfill gas monitoring data were evaluated against landfill gas protection screening values in the CIRIA (2007) document entitled "Assessing Risks Posed by Hazardous Ground Gases to Buildings". The evaluation showed that even though a low to very low risk was established by the screening method, some form of landfill gas protection would be required for future developments of the former landfills if they are to remain in-situ.*

Landfill gas monitoring shall be carried out during the works in accordance with Section 8.5'.

We note that T&T's recommendation was made prior to subdivision construction earthworks, however, the former landfill materials have now been screened to remove large debris and organic matter, before being reused for compacted silty gravel backfill. It may be possible that landfill gas is no longer a high risk, although we recommend that an experienced environmental consultant be engaged to determine any specific requirements for landfill gas for current ground conditions.

8.6. Piled foundations

Where there is a need to avoid, or substantially limit, differential settlement then foundations supported by deep piles that bear onto the deep gravels around 14 to 16m below ground level should be considered.

The deeper silts are relatively soft and should not be relied upon for supporting deep piled foundations.

We understand that the building design is relatively ductile and can tolerate differential settlement of around 50mm in an SLS event, and therefore from a geotechnical perspective deep piled foundations do not appear to be justified.

8.7. Car park/driveway areas

Providing all car park and driveway areas are stripped of any topsoil and soft silt fill (if any) the minimum formation requirements to provide a trafficable surface would be minimum 100mm compacted depth base-course AP40 over minimum 250mm depth compacted sub-base AP65, and then surfaced with minimum 30mm compacted depth AC10 asphalt.

Appendix A : PLAN OF CONTROLLED FILL AREAS

Screened Material - Depth of Fill
Wigram Business Park - Stage 1
For Ngai Tahu Property Ltd.

Eliot Sinclair
surveyors | engineers | planners
20 Troup Drive, PO Box 9339, Tower Junction, Christchurch 8149, Phone: 03 379-4014, Fax: 03 365-2449, info@eliotsinclair.co.nz www.eliotsinclair.co.nz

no.	amendment	initial	date
A	Updated for completion of earthworks	WFP	28/4/13
B	Plan title ammended	WFP	16/9/13

designed	
manager	M A Allan
drawn	W Paulsen
checked	
surveyed	WFP
surv.date	to Apr 2013

origin of levels
WIGI Cons.
Wigram Control Tower
71 Corsair Drive
RL : 48.29m
datum CDD (Jan 2012)

NZGD 2000 (Post Quake)
Mt Pleasant CD2000

Scale: 1:750 (A1) 1:1500 (A3)
Date: 28/04/2013

Drawing Set
347299 G5
PLOT GS 130428 01

Sheet
1 of 2
rev. B

Original size mm
0 10 30 50 100 150 200 300

0 20 40 60 80 120 160 200 metres
Scale Bar

The Runway
Stark Drive
Lodestar Avenue
Lot 1
Lot 2
Lot 3
Lot 4
Lot 5
Lot 6
Lot 7
Lot 8
Lot 9
Lot 10
Lot 11
Lot 12
Lot 13
Lot 14
Lot 15
Lot 16
Lot 17

[Plotted: Monday, September 16, 2013 17:04:08] [computer operator: wfp] [Project: G:\Jobs\95\95933\95933961\2d\aurv\EWSHt\Volumes\Volumes]

0 10 30 50 100 150 200 300 Original size mm

Eliot Sinclair
surveyors | engineers | planners

Sheet 2 of 2 rev. B

Drawing Set 347299 G5
PLOT G5 130428 02

Scale: 1:750 (A1) 1:1500 (A3)
Date: 28/04/2013

NZGD 2000 (Post Quake)
Mt Pleasant GD2000

origin of levels
WIG1 Cors.
Wigram Control Tower
71 Corsair Drive
RL : 40.25m
datum CDD (Jan 2012)

surveyed WFP
surv.date to Apr 2013

designed M A Allan
manager
drawn W Paulsen
checked

no.	amendment	initial	date
A	Updated for completion of earthworks	WFP	28/4/13
B	Plan title ammended	WFP	16/9/13

Depth from Finish Level to Top of Screened Fill
Wigram Business Park - Stage 1
For Ngai Tahu Property Ltd.

20 Troup Drive, PO Box 9339, Tower Junction, Christchurch 8149, Phone: 03 379-4014, Fax: 03 365-2449, info@eliotsinclair.co.nz www.eliotsinclair.co.nz

[plotted: Monday, September 16, 2013 16:55:35] [computer operator: wfp] [Project: G:\Jobs\99\99339\12d\surv\EW\SH\Volumes\Volumes]

Appendix B : AREA LOCATIONS BY T&T

NOTES:
1. Aerial photo sourced from Terralink International (Copyright 2002–2005 Terralink International Limited and its licensors).
2. Property boundaries sourced from Land Information New Zealand data (Crown Copyright Reserved).
3. Subdivision parcel provided by Eliot Sinclair.

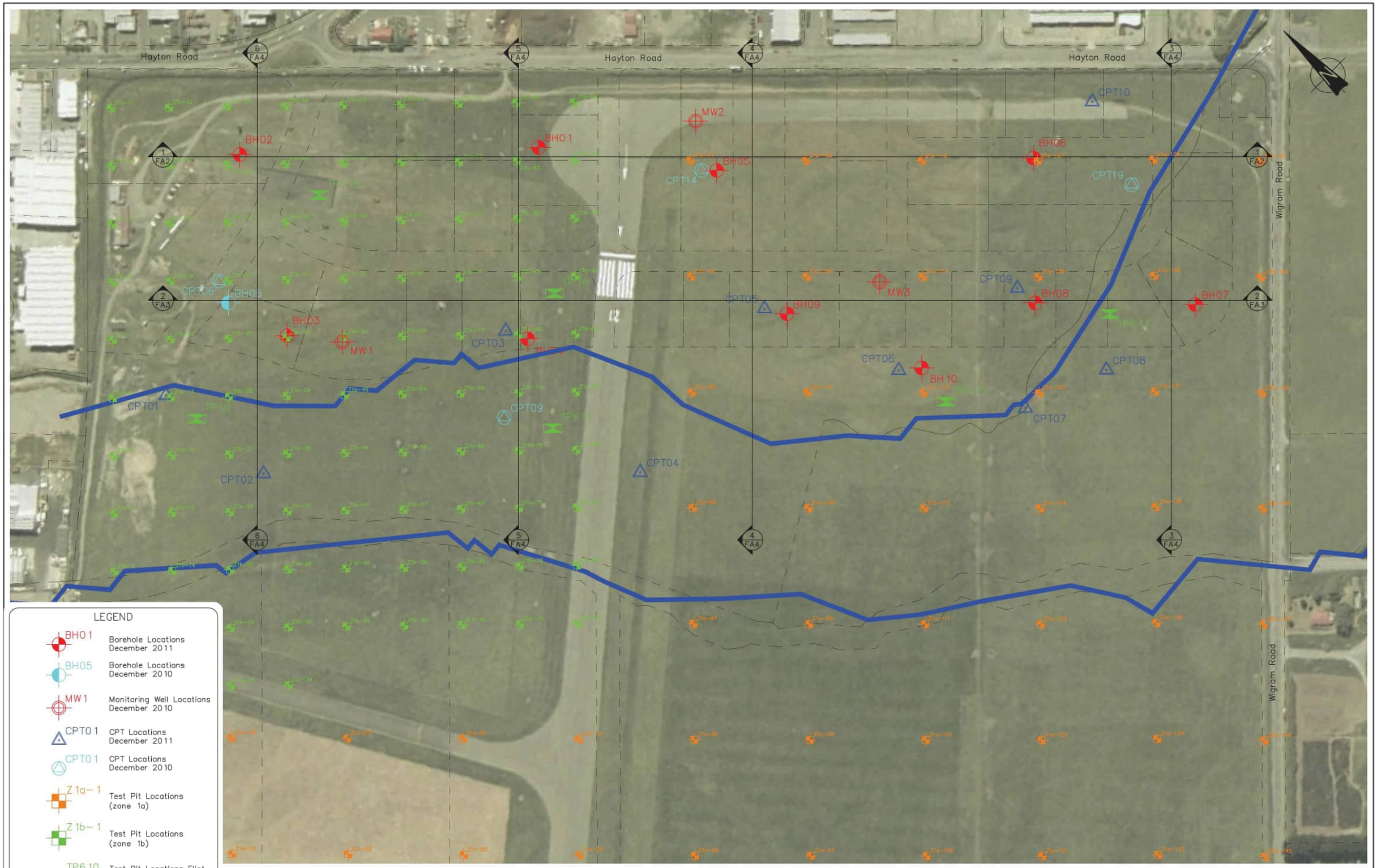
Tonkin & Taylor
Environmental and Engineering Consultants
33 Parkhouse Road, Wigram, Christchurch
www.tonkin.co.nz

DRAWN	NSW	Jan. 12
DRAFTING CHECKED		
APPROVED		
CADFILE : \\5 1262.0 12–FA5.dwg		
SCALES (AT A3 SIZE) 1: 3000		
PROJECT No. 5 1262.0 12		

NGAI TAHU PROPERTY LTD
WIGRAM SKIES SUBDIVISION
HAYTONS ROAD, WIGRAM
Area Locations

FIG. No. 5 1262.0 12–FA5 REV. 0

Appendix C : PREVIOUS GEOTECHNICAL INVESTIGATIONS BY T&T



NOTES:
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2. Property boundaries sourced from Land Information New Zealand data (Crown Copyright Reserved).
3. Subdivision parcel provided by Eliot Sinclair.

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PROJECT No.	5 1262.0 12	

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HAYTONS ROAD, WIGRAM
Geotechnical Investigations

FIG. No. 5 1262.0 12–FA 1 REV. 0

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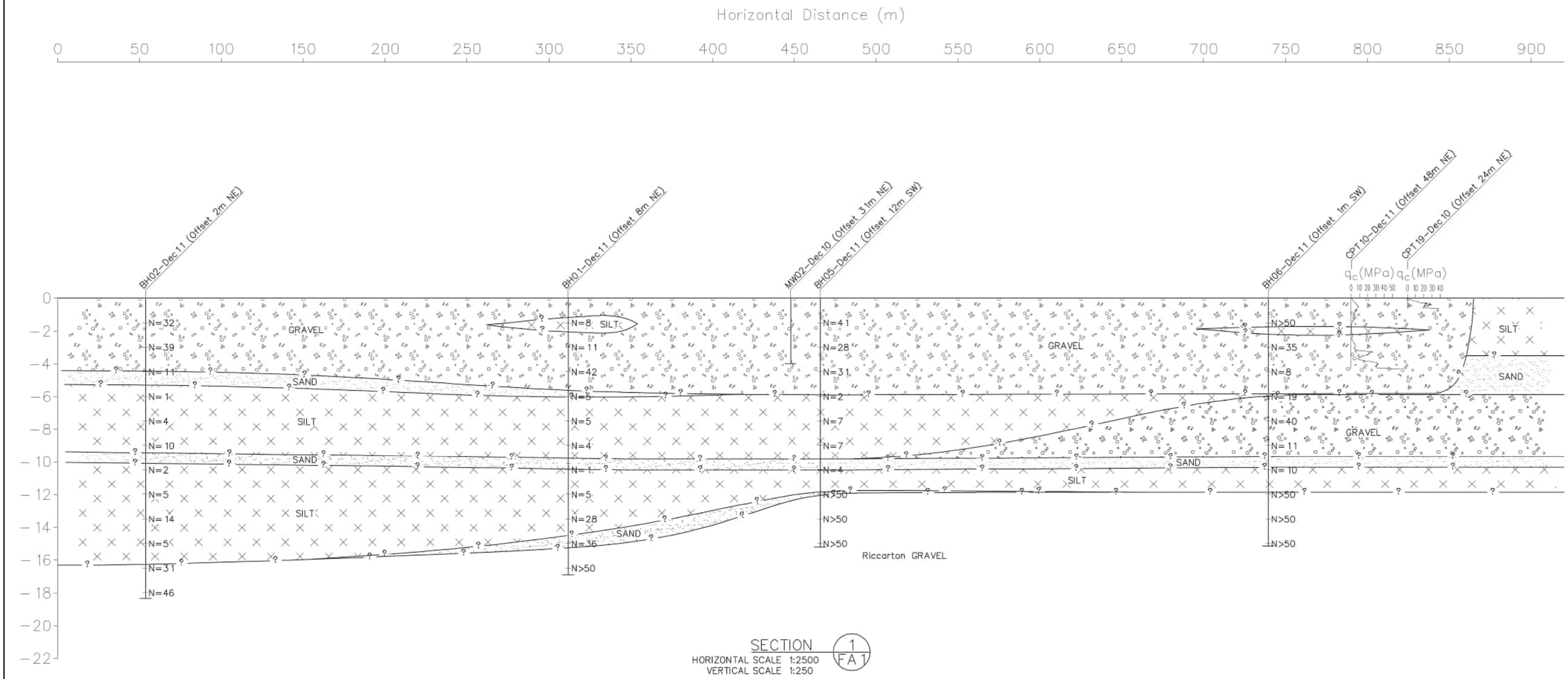

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A3 SCALE 1:2500
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A3 SCALE 1:250
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APPROVED		
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PROJECT No.	51262.012	

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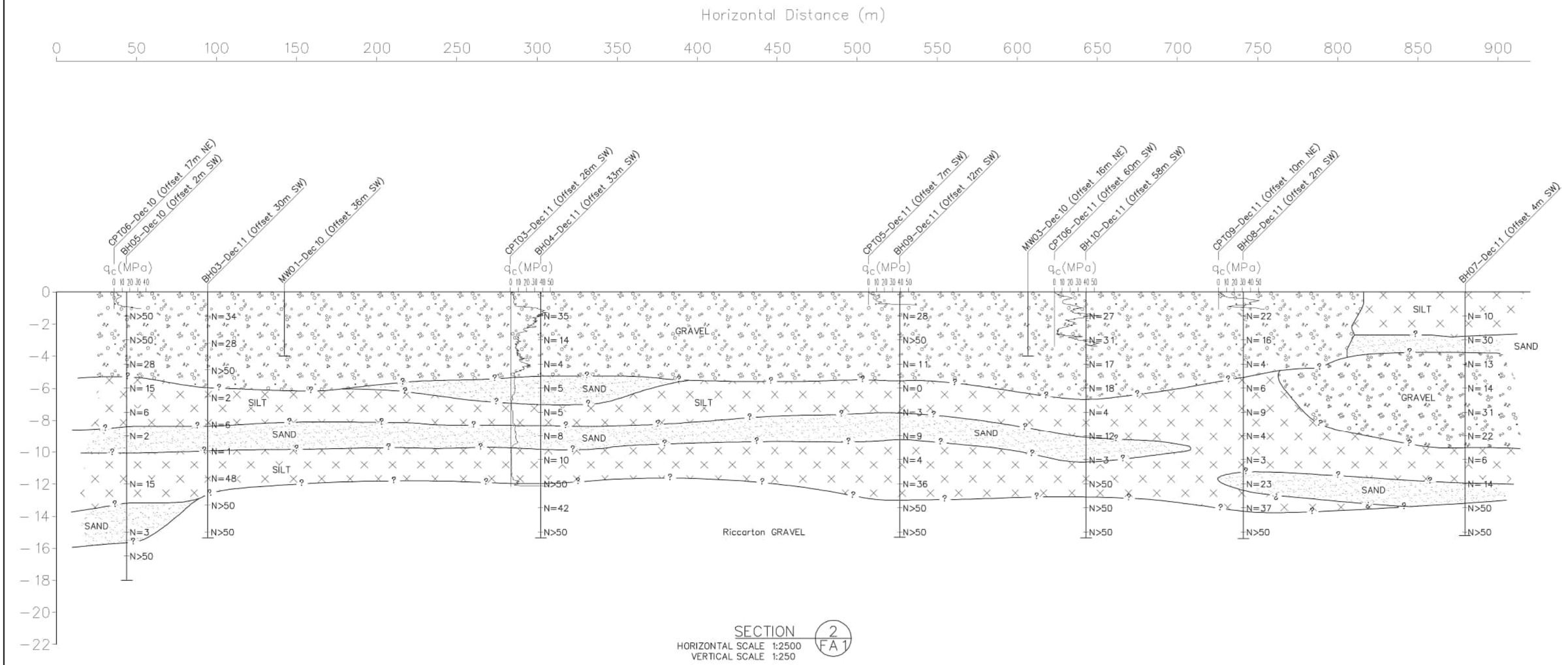
HAYTONS ROAD, WIGRAM
Cross Section 1–1

FIG. No. 51262.012–FA2 REV. 0



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FA1
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VERTICAL SCALE 1:250

A3 SCALE 1:2500
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A3 SCALE 1:250
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FIG. No.	51262.012–FA3	REV. 0

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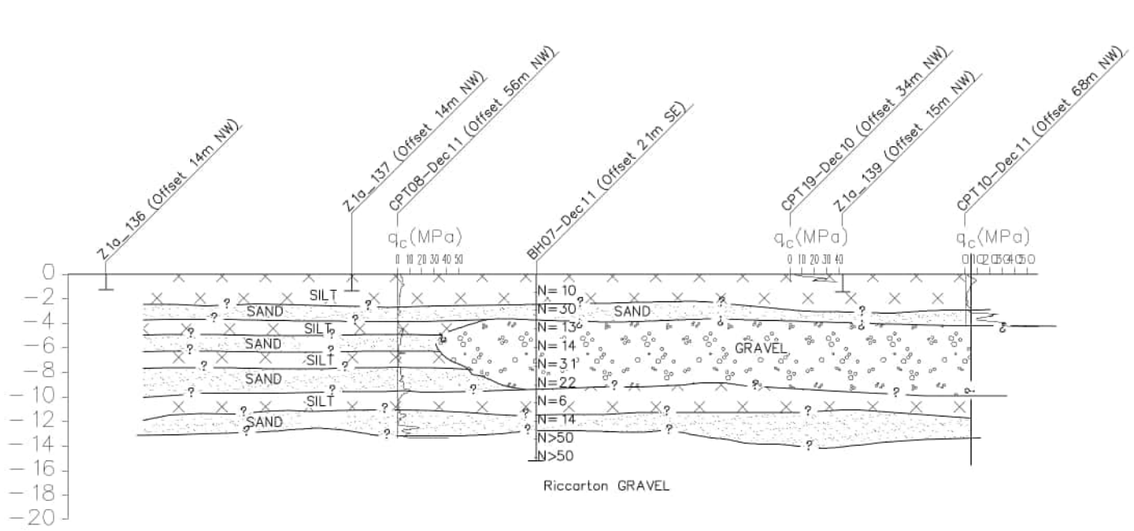
HAYTONS ROAD, WIGRAM
Cross Section 1–1



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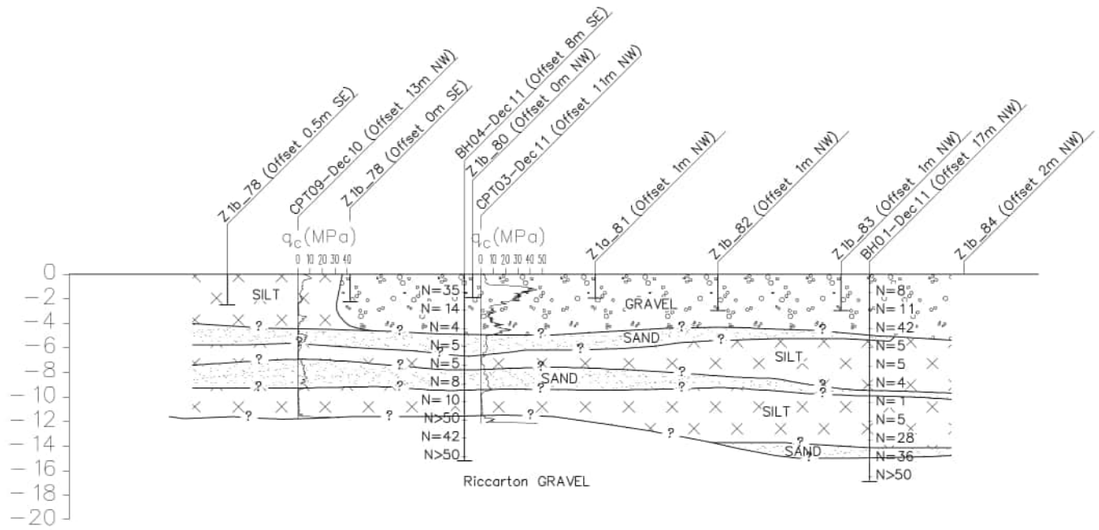

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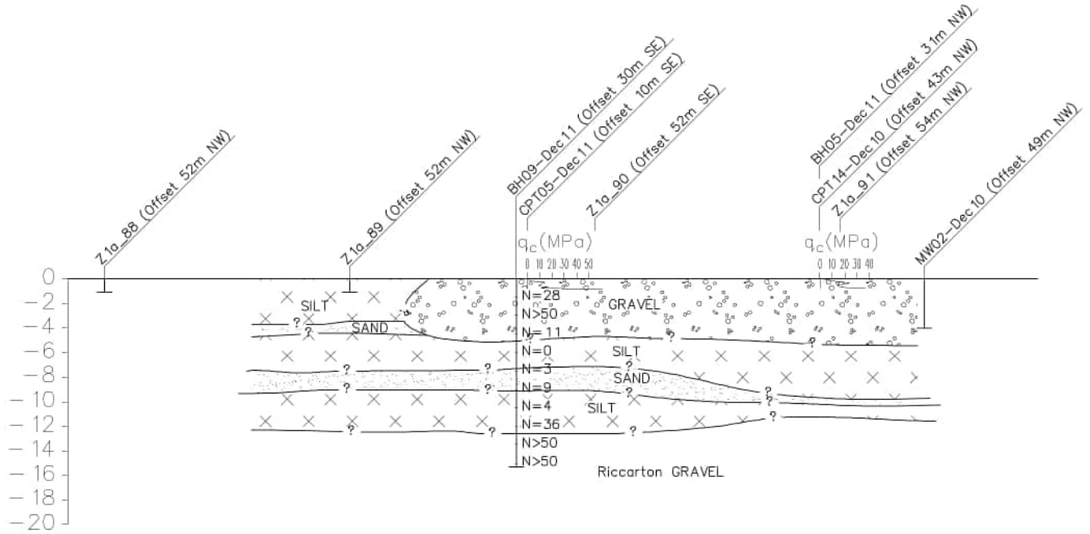

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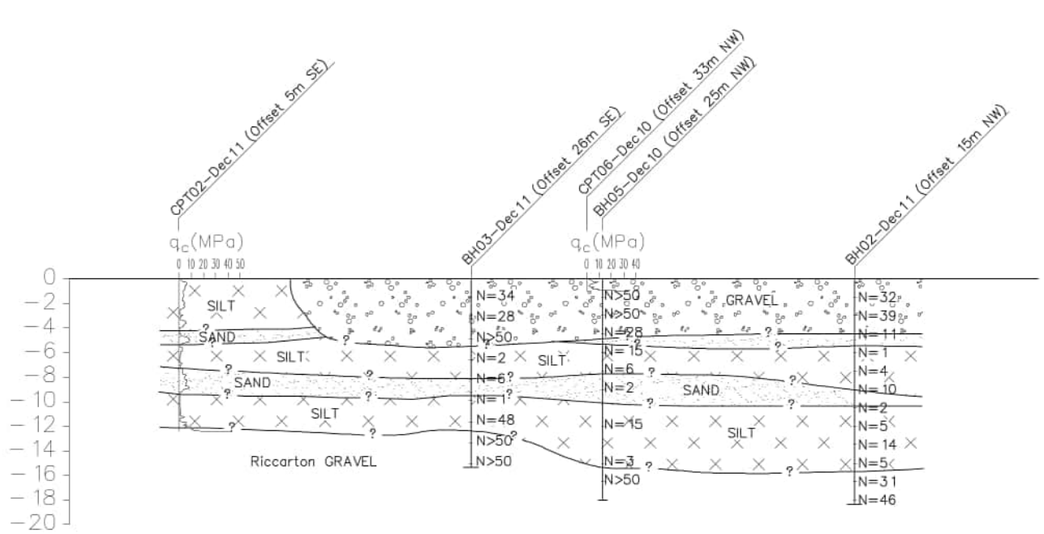

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VERTICAL SCALE 1:500

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A3 SCALE 1:500
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PROJECT No.	51262.012	

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WIGRAM SKIES SUBDIVISION
HAYTONS ROAD, WIGRAM
Cross Section 3–3, 4–4, 5–5, 6–6

FIG. No. 51262.012–FA4
REV. 0

Bore Log

McMILLAN DRILLING SERVICES

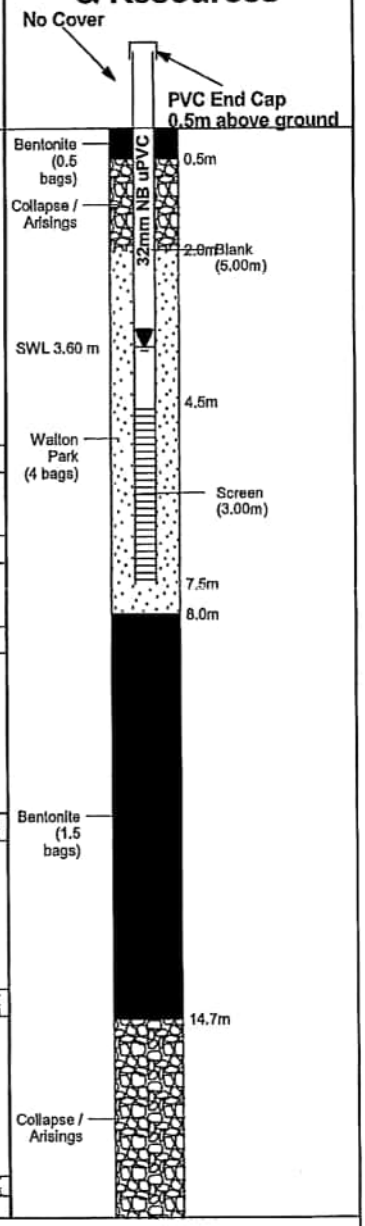
Client:	Tonkin & Taylor Ltd
Project:	Wigram Skies Subdivision
Bore No.:	BH005
Job No.:	8355

Site Location: Old Wigram Airbase
Grid Reference: 2474421 mE, 5739919 mN (NZMG)
Rig Operator: N. Hay
Rig Model and Mounting: CAT 312 - Track, 100mm (AFR)

Date Commenced: 8/12/2010
Date Completed: 9/12/2010
Consent:
Datum: Ground

Description	Depth	Graphic Log	Recovery (25 50 75)	Drill Method and Date	SPT N-Value (uncorrected) (10 20 30 40)	SPT Data (uncorrected)	SAMPLE DEPTH & ID / SAMPLE TYPE
Light brown silty sandy TOPSOIL with trace of gravel; dry	0			AFR - Concentrix			
Grey fine to coarse Sandy fine to very coarse GRAVEL with some cobbles; dry	1					N = 50+ (C) 0.7m 25, 31 / 150 mm Effective Refusal	
- 2.0m, less cobbles, wetter (moist) with depth	2			8/12/2010			
	3			AFR - Concentrix		N = 50+ (C) 2.3m 10, 18 / 12, 10 293 mm Effective Refusal	
	4					N = 28 (C) 3.7m 2, 4 / 7, 7, 7, 7 450 mm	
Grey brown fine Sandy SILT; saturated	5					N = 15 (S) 5.2m 2, 3 / 4, 3, 4, 4 450 mm	5.20m - 5.65m SPT 1
	6						
	7					N = 6 (S) 6.7m 1, 0 / 1, 1, 2, 2 450 mm	6.70m - 7.15m SPT 2
Grey fine SAND with trace to some silt (in lenses); saturated	8					N = 2 (S) 8.2m 1, 1 / 0, 1, 0, 1 450 mm	8.20m - 8.65m SPT 3
	9		100%				
Grey SILT; saturated, plastic	10						
	11						
	12					N = 15 (S) 11.3m 1, 1 / 2, 3, 4, 6 450 mm	11.30m - 11.75m SPT 4
Grey fine SAND; saturated	13						
	14					N = 13 (S) 14.2m 2, 2 / 3, 3, 3, 4 450 mm	14.20m - 14.65m SPT 5
Grey fine to coarse Sandy fine to coarse GRAVEL; saturated	15						
	16						
	17			9/12/2010		N = 50+ (S) 17.3m 4, 8 / 18, 24, 8 325 mm Effective Refusal	17.30m - 17.63m SPT 6
	18						
E.O.H 18.0m							

Installation & Resources



Remarks:
Geotechnical Investigation Borehole BH005

SPT: "Doughnut" trip SPT Hammer #002 used (energy ratio 47.9%)

Additional Resources:

Flush Mounted Toby Box		
	- Standard	ea
	- Environmental	ea
Above Ground Protective Surround		ea
Geotextile Sock		m
Handclear Location		ea
Decontaminate Equipment		ea

120 High Street, Southbridge 7602, Canterbury, New Zealand | ph: (03) 324 2571 fax: +64 3 324 2431 web: www.drilling.co.nz

Report Created: 22/12/2010 10:14:56 a.m.

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-01
Hole Location:

SHEET 1 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 16/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 16/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: CP CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)			100	HQTT					0.5		GW	D	MD				Sandy fine to coarse GRAVEL with trace organics, grey. Medium dense, dry. Gravel is subrounded to subangular. Sand is fine to medium.
									1.0								
				SOLID SPT		9//3/2/1/2 N=8			1.5		ML	M	F				Sandy SILT with some gravel, greyish brown. Firm, moist. Sand is fine to medium. Gravel is fine to coarse, subrounded to subangular.
			86	HQTT					2.0								
									2.5		GW	M	MD				Fine to coarse GRAVEL with trace cobbles, grey. Medium dense, moist. Gravel is subrounded to subangular. Fine content washed away through drilling process. No recovery- 2.85 to 3.9m
				SOLID SPT		12//4/3/2/2 N=11			3.0								
									3.5								
			43	HQTT					4.0								
									4.5				D				No recovery- 4.5 to 4.95m. Becoming dense.
				SOLID SPT		22//13/11/ 10/8 N=42			5								

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-01
Hole Location:

SHEET 2 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 16/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 16/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: CP CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)			10	HQTT					5.5		GW	M	D				No recovery- 5.05 to 6.0m
				SPT		3//1/1/1/2 N=5			6.0		SW	W	L				Fine to medium SAND with trace silt, grey. Loose, wet.
			76	HQTT					6.5		ML	W	S				Sandy SILT, grey. Soft, wet, non plastic. Sand is fine to medium.
									7.0								No recovery- 7.25 to 7.5m
				SPT		1//1/1/1/1 N=5			7.5		ML	W	S				SILT with trace sand and organics, dark grey. Soft, wet, low plasticity. Sand is fine. Contains minor roots.
			100	HQTT					8.0								Contains some roots. Becoming bluish grey. Sand absent.
									8.5								Contains some fine sand. Non plastic. Sand becoming minor.
				SPT		1//0/0/1/3 N=4			9.0		MN	S	S				Sandy SILT, brownish grey. Soft, saturated, non plastic. Sand is fine. Contains trace roots.
			76	HQTT					9.5								
									10								

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-01
Hole Location:

SHEET 3 OF 4

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 16/11/11

HOLE FINISHED: 16/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Mud | LOGGED BY: CP | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)									10.5		SM	W	L				No recovery- 10.25 to 10.5m
											MOL	S	VS				Organic SILT, brownish grey. Very soft, saturated, low plasticity.
			100	SPT		0//0/0/0/1 N=1			11.0								Contains some organics.
				HQTT					11.5								25mm layer of fibrous peat. Non plastic. 25mm layer of fibrous peat. Non plastic.
									12.0				F				
				SPT		3//0/1/1/3 N=5			12.5								
			100	HQTT							ML	W	F				SILT with some sand, bluish grey. Firm, wet. Sand is fine, non plastic.
									13.0								100mm layer fine sand. Low plasticity.
				SPT		6//4/6/8/10 N=28			13.5		MI.	S	VSt				Sandy SILT, dark bluish grey. Very stiff, saturated, non plastic. Sand is fine to medium.
									14.0								Sand becoming minor. Low plasticity.
			62	HQTT							SW	W	MD				Medium to coarse SAND with some gravel, dark grey. Medium dense, wet. Gravel is fine to medium, subrounded to subangular.
RICCARTON GRAVELS (ALLUVIAL)									14.5		GW	W	D				Sandy GRAVEL, yellowish brown. Dense, wet. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. No recovery- 14.6 to 15.0m
									15								

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-01
Hole Location:

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 16/11/11

HOLE FINISHED: 16/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Mud | LOGGED BY: CP | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
RICCARTON GRAVELS				SPT		2//4/5/13/14 N=36			15.5		SM	W	D				Silty SAND, yellowish brown. Dense, wet. Sand is fine to coarse.
			43	HQTT					16.0		GW	W	VD				Fine to coarse GRAVEL with minor sand and trace silt, grey. Very dense, wet. Gravel is subrounded to subangular. Sand is fine to coarse. Majority of fine content washed away through drilling process.
				SOLID SPT		11//10/12/18/10 for 30mm N>50			16.5								
									17.0								End of hole at 16.905mbgl.
									17.5								
									18.0								
									18.5								
									19.0								
									19.5								
									20								

SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-02
Hole Location:

SHEET 1 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 17/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 17/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: GJH CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL			100	HQTT					0.5		SP	D	D				Gravelly, fine SAND, brown. Dense, dry. Gravel is fine to coarse, subrounded. Contains trace rootlets. Contains asphalt pieces. 0.5
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)									1.0		GP	D	D				Medium to coarse GRAVEL, grey. Dense, dry. Subrounded. Fine content washed away during drilling process. 1.0
				SOLID SPT		12//7/7/8/10 N=32			1.5								Trace cobbles. Subrounded. 1.5
			100	HQTT					2.0								2.0
									2.5								2.5 Gravel becoming fine to coarse.
				SOLID SPT		13//10/9/8/12 N=39			3.0								Gravel becoming medium to coarse. 3.0
			81	HQTT					3.5								No recovery- 3.45 to 3.65m 3.5
									4.0								Gravel becoming fine to coarse. 4.0
				SOLID SPT		5//2/3/3/3 N=11			4.5								Trace cobbles. Becoming medium dense. 4.5
									5								

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-02
Hole Location:

SHEET 2 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 17/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 17/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: GJH CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)			100	HQTT					5.5		SP	D	MD				Fine to medium SAND with minor silt and trace gravel, grey. Medium dense, dry. Gravel is coarse, subrounded. Becoming wet.
											ML	W	St				SILT with minor sand and trace gravel, grey. Stiff, wet, low plasticity. Sand is fine. Gravel is fine to coarse, subrounded.
				SPT		0//0/0/0/1 N=1			6.0		ML	S	VS				SILT, grey. Very soft, saturated, low plasticity.
			100	HQTT					6.5								Trace rootlets.
									7.0								10mm bed of fine SAND with some silt.
				SPT		0//0/0/2/2 N=4			7.5				F				Becoming firm. Trace organics. Organics absent.
			100	HQTT					8.0								
									8.5								
				SPT		4//3/3/2/2 N=10			9.0								Sand becoming minor, fine to medium.
									9.5		SM	W	L				Fine to medium SAND with some silt, grey. Loose, wet.
			100	HQTT					10		ML	W	St				SILT with trace sand, grey. Stiff, wet, low plasticity. Sand is fine to medium.

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-02
Hole Location:

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 17/11/11

HOLE FINISHED: 17/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Mud | LOGGED BY: GJH | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)									10.5		SM	W	L				Fine to medium SAND with some silt, grey. Loose, wet.
				SPT		1//0/0/1/1 N=2					ML	W	S				SILT with trace sand, grey. Soft, wet, low plasticity. Sand is fine.
			100	HQTT					11.0								150mm bed of PEAT, dark brown. Fibrous and spongy.
									11.5								300mm bed of organic SILT with some fibrous peat, dark brown.
				SPT		5//1/1/2/1 N=5			12.0								100mm bed of silty, fine SAND. No recovery- 12.0 to 12.3m
			100	HQTT					12.5								Contains minor rootlets. Rootlets absent. With some fine sand.
									13.0								Sand becoming trace.
				SPT		5//3/2/3/6 N=14			13.5				St				Becoming stiff.
			100	HQTT					14.0		SM	W	MD				Silty fine to medium SAND, grey. Medium dense, wet. Sand becoming fine.
									14.5								50mm bed of sandy SILT. Sand is fine to medium.
									15		ML	W	F				SILT with trace sand, grey. Firm, wet, low plasticity. Sand is fine.

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-02
Hole Location:

SHEET 4 OF 4

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 17/11/11

HOLE FINISHED: 17/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Mud | LOGGED BY: GJH | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)				SPT		1//1/1/1/2 N=5					MOL	W	F				Organic SILT, greyish brown. Firm, wet, low plasticity. Contains minor buried roots and wood.
			100	HQTT					15.5		ML	W	F				SILT with minor orgaines, grey mottled brown. Firm, wet, low plasticity. 15.5
									16.0								100mm bed of organic SILT. 16.0
																	200mm bed of buried wood.
RICCARTON GRAVELS (ALLUVIAL)				SPT		13//7/8/5/11 N=31			16.5		GW	W	D				Silty fine to coarse GRAVEL with some sand, grey. Dense, wet. Sand is fine to medium. 16.5
			100	HQTT					17.0								No recovery 16.95 to 17.5m 17.0
									17.5		GP	W	D				Fine to coarse GRAVEL, grey. Dense, wet. Fines content washed away through drilling process. 17.5
																	Trace cobbles.
				SOLID SPT		18//21/18/11 for 45mm N>50			18.0								18.0
									18.5								End of hole at 18.345mbgl. 18.5
									19.0								19.0
									19.5								19.5
									20								

SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.

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BORELOG 51262.012 HAYTON RD.GPJ 30/1/12

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-03
Hole Location:

SHEET 1 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 21/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 22/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Water	LOGGED BY: GJH CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
			100	HAND DUG					0.5		GM		D				Silty GRAVEL with some sand and trace organics, brown. Dense, dry. Gravel is fine to coarse, rounded to subrounded. Sand is fine to coarse.
									1.0								Fine content absent.
				SPT		16//11/10/13/11 N=34			1.5		GP		D				Sandy GRAVEL with some silt, grey. Dense, dry. Gravel is fine to coarse, rounded to subrounded. Sand is fine to coarse. Fine content washed away through drilling process.
			100	HQTT					2.0		GW		D				Fine to coarse GRAVEL with trace sand and trace silt, grey. Dense, dry. Gravel is subrounded.
									2.5				D				COBBLES with some gravel, grey. Dense, dry. Cobbles are subrounded. Gravel is fine to medium, subrounded.
				SPT		16//11/12/11/5 N–28			3.0								
									3.5								No recovery- 3.45 to 3.6m
			90	HQTT					4.0		GW		MD				Fine to coarse GRAVEL, grey. Medium dense, dry. Gravel is rounded to subrounded. With some cobbles.
				SPT		39//23/16/11 for 10mm N>50			4.5				VD				Becoming very dense.
									5								

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-03
Hole Location:

SHEET 2 OF 4

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 21/11/11

HOLE FINISHED: 22/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Water | LOGGED BY: GJH | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

FLUID LOSS | WATER | CORE RECOVERY (%) | METHOD | CASING | TESTS | SAMPLES | R.L. (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MOISTURE / WEATHERING CONDITION | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (mm)

SOIL DESCRIPTION
Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION
Substance: Rock type, particle size, colour, minor components.
Defects: Type, inclination, thickness, roughness, filling.

Depth (m)	Core recovery (%)	Method	Tests	Classification symbol	Strength/density classification	Description
5.5	100	HQTT				Becoming trace cobbles. Becoming with some fine to medium sand. Sand is absent.
						Becoming with some cobbles.
6.0		SPT	4//1/0/1/1 N=2		VL	Becoming very loose.
6.5	100	HQTT		ML	S	Cobbles absent. Sandy SILT with minor organics, grey. Soft, moist, no plasticity. Sand is fine to medium. Becoming with minor sand, organics absent, low plasticity.
7.0						Becoming with some fine sand. Becoming sandy.
7.5		SPT	3//2/2/2/2 N=6	SM	L	Silty fine SAND, grey. Loose, wet.
8.0	100	HQTT				
8.5				CL	VS	SILT with minor sand, grey. Very soft, wet, low plasticity. Sand is fine. Sand is absent.
9.0		SPT	0//0/0/0/1 N=1			
9.5	100	HQTT				
10						

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH-03
Hole Location:

SHEET 3 OF 4

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 21/11/11

HOLE FINISHED: 22/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Water | LOGGED BY: GJH | CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
						0//0/0/0/2 N=2			10.5								Fibrous organics Becoming with some organics, fibrous wood, black. 10.5 No recovery- 10.5 to 10.65m
			100	SPT					11.0								250mm layer of organic silt, dark brown. 11.0 Trace rootlets With some fine sand.
				HQTT					11.5								200mm layer of silty SAND, grey. Medium dense, wet. Sand is fine. 11.5
									12.0								No recovery- 12.0 to 12.2m 12.0
				SPT		19//15/16/17/15 N=48			12.5		GW		D				Sandy fine to coarse GRAVEL with some silt, grey brown. Dense, wet. Sand is fine to coarse. No recovery- 12.45 to 12.6m 12.5 Sand and silt absent.
			90	HQTT					13.0								Fine content washed away through drilling process. 13.0
				SPT		60 for 145mm N=50			13.5				VD				Becoming very dense. 13.5 No recovery- 13.645 to 14.45m
			80	HQTT					14.0								14.0
									14.5								Becoming with trace cobbles. 14.5
									15								

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BOREHOLE LOG

BOREHOLE No: BH-03
Hole Location:

SHEET 4 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 21/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 22/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Water	LOGGED BY: GJH CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 10 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
				SPT		18//24/20/6 for 70mm N=50											
									15.5								End of hole at 15.37mbgl.
									16.0								
									16.5								
									17.0								
									17.5								
									18.0								
									18.5								
									19.0								
									19.5								
									20								

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BOREHOLE LOG

BOREHOLE No: BH-04
Hole Location:

SHEET 1 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 23/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 23/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: GJH CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
TOPSOIL			100	HQTT					0.5		ML	D	F				SILT with trace sand and gravel, brown. Firm, dry, low plasticity. Sand is fine. Gravel is medium to coarse, subrounded. Contains trace organics and rootlets.
									1.0								Becoming wet. Trace cobbles.
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)				SPT		13//8/9/8/10 N=35			1.5		GW	W	D				With some sand. Fine to coarse GRAVEL with trace cobbles, grey. Dense, wet. Subrounded. Fine content washed away by drilling process.
			30	HQTT					2.0								No recovery- 1.95 to 2.5m
									2.5								
				SPT		8//3/3/4/4 N=14			3.0				MD				Becoming medium dense.
			100	HQTT					3.5								
									4.0								Gravel becoming medium to coarse.
				SPT		3//1/1/1/1 N=4			4.5				L				Becoming loose.
									5								

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BOREHOLE LOG

BOREHOLE No: BH-04
Hole Location:

SHEET 2 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 23/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 23/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: GJH CHECKED:

GEOLOGICAL	ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)			100	HQTT					5.5								No recovery- 4.95 to 5.3m
																	Gravel becoming fine to coarse. 5.5
				SPT		2//1/1/1/2 N=5			6.0		SM	W	L				6.0 Silty fine to medium SAND, grey. Loose, wet.
			100	HQTT					6.5								6.5
									7.0								7.0
				SPT		2//0/1/2/2 N=5			7.5		ML	W	F				7.5 SILT with trace sand, grey. Firm, wet, low plasticity. Sand is fine.
			100	HQTT					8.0								8.0
									8.5								Becoming sandy SILT. 8.5
				SPT		6//2/3/1/2 N=8			9.0		SM	W	L				9.0 SAND with some silt, grey. Loose, wet.
			100	HQTT					9.5		SM	W	St				9.5 Sandy SILT, grey. Stiff, wet, low plasticity. Sand is fine to medium. Trace organics and rootlets.
									10								

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BOREHOLE LOG

BOREHOLE No: BH-04
Hole Location:

SHEET 3 OF 4

PROJECT: WIGRAM SKIES - ZONE B | LOCATION: HAYTON RD | JOB No: 51262.012

CO-ORDINATES | DRILL TYPE: Rotary | HOLE STARTED: 23/11/11

HOLE FINISHED: 23/11/11

R.L. m | DRILL METHOD: HQTT | DRILLED BY: Perrys Drilling

DATUM | DRILL FLUID: Mud | LOGGED BY: GJH | CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION								
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
YALDHURST MEMEBER OF THE SPRINGSTON FORMATION (ALLUVIAL)								10.5		SM	W	St				Sandy SILT, grey. Stiff, wet, low plasticity. Sand is fine to medium. Trace organics and rootlets.
										OL	W	St				SILT with some organics, grey mottled dark brown. Stiff, wet, low plasticity. Organics are fibrous. 10.5
			100	HQTT		0//4/2/2/2 N=10		11.0								Organics absent. 11.0
								11.5								50mm bed of organic SILT, dark brown. Low plasticity. Contains some organics. 11.5
RICCARTON GRAVELS				SOLID SPT		27//16/24/10 for 10mm N>50		12.0		GW	W	VD				Medium to coarse GRAVEL with some silt and trace cobbles, grey. Very dense, wet. Fine content washed away through drilling process. 12.0
			80	HQTT				12.5								No recovery- 12.45 to 12.65m 12.5
								13.0								Gravel becoming fine to coarse. 13.0
				SOLID SPT		16//11/7/12/12 N=42		13.5				D				Becoming dense. 13.5
			100	HQTT				14.0								14.0
								14.5								14.5
								15								

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BORELOG 51262.012 HAYTON RD.GPJ 30/1/12

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BOREHOLE LOG

BOREHOLE No: BH-04
Hole Location:

SHEET 4 OF 4

PROJECT: WIGRAM SKIES - ZONE B	LOCATION: HAYTON RD	JOB No: 51262.012
CO-ORDINATES	DRILL TYPE: Rotary	HOLE STARTED: 23/11/11
	DRILL METHOD: HQTT	HOLE FINISHED: 23/11/11
R.L. m		DRILLED BY: Perrys Drilling
DATUM	DRILL FLUID: Mud	LOGGED BY: GJH CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
RICCARTON GRAVELS				SOLID SPT		18//20/22/8 for 60mm N>50				GW	W	VD				Fine to coarse GRAVEL with some silt and trace cobbles, grey. Very dense, wet. Fine content washed away through drilling process.
																End of hole at 15.36mbgl.

15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20

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Appendix D : GEOTECHNICAL TEST LOCATIONS PLAN

0 10 30 50 100 150 200 300 Original size mm

0 20 40 60 80 120 160 200 metres

Scale Bar

HAYTON ROAD

TP 30 28.76m GL
TP 29 28.70m GL
1
BH 2 28.65m FL
TP 31 28.79m FL
TP 32 29.00m FL
TP 34 28.59m FL
AVENUE 2
TP 16 28.25m GL
17
TP 10 28.58m FL
TP 9 28.14m GL
BH G 28.12m GL
BH C 28.19m GL
BH A 27.88m GL
16
BH D 28.48m FL
8
TP 7 28.42m FL
15
71
14
TP 11 28.12m FL
BH B 28.61m FL
BH E 28.56m FL
BH F 28.63m FL
TP 15 28.52m FL
TP 13 28.76m FL
BH 4 381322 28.52m FL
BH 6 381322 28.74m FL
BH 7 381322 28.65m FL
BH 3 28.61m FL
13
TP 2 28.13m FL
9
BH 5 381322 28.55m FL
TP 17 28.56m FL
TP 11 28.47m FL
BH 3 381322 28.43m FL
BH 1 381322 28.46m FL
BH 8 381322 28.44 FL
10
BH 9 381322 28.58m FL
11
TP 5 28.29m FL
TP 3 28.00m FL
12
TP 4 28.09m FL
18
TP 18 28.48m FL
TP 20 28.45m FL
BH 10 381322 28.38m FL
BH 2 381322 28.30m FL
LODESTAR
STARK DRIVE
THE RUNWAY
TP 36 28.75m FL
2
TP 35 28.63m FL
TP 19 28.65m FL
4
TP 26 28.45m FL
T&T BH 5 (Dec 2010)
TP 27 28.50m FL
TP 24 28.54m FL
TP 22 28.37m FL
TP 21 28.17m FL
70
BH 4 28.68m FL
3
5
6
7
TP 33 28.42m GL
TP 28 28.51m GL
BH 1 28.45m FL
TP 23 28.30m FL
TP 25 28.48m GL
73

KEY

Borehole Position → BH 1 28.45m FL
BH 10 381322 28.38m FL 15m Depth
Finish Level / Ground Level
Test Pit Position → TP 1 28.12m FL

Sheet 1 of 1 rev: B

Drawing Set 347299 G1

Scale: 1:1500 (A3)
Date: 07/02/2012

Eliot Sinclair
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NZGD 2000 (Post Quake)
Mt Pleasant GD2000

origin of levels
WGI Cors
71 Corsair Drive
RL : 48.29m
datum CDD (Jan 2012)

surveyed WFP
surv. date Feb 2013
designed M A Allan
manager W Paulsen
drawn
checked

initial date
WFP 9/9/13
MSO 11/9/13

no.	amendment
A	TP 20 and Boreholes added
B	Boreholes added for Lots 9, 10 and 16

Geotech Test Locations
Wigram Business Park - Stage 1
For Ngai Tahu Property Ltd.

20 Troup Drive, PO Box 9339, Tower Junction, Christchurch 8149, Phone: 03 379-4014, Fax: 03 365-2449, info@eliotsinclair.co.nz www.eliotsinclair.co.nz

Appendix E : PREVIOUS GEOTECHNICAL INVESTIGATIONS BY ESP

Eliot Sinclair
surveyors | engineers | planners

20 Troup Drive, Tower Junction,
PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	347299
Date Tested	07-Feb-2013
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Lot	1-5 & 8-17
Project No.	

SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

Test Pit @ 5 (Lots 11/12/13)

Hand Auger ☐ Machine Auger ☐ Test Pit ☒

DEPTH [m]	
GL	
0.2	Dark brown Silty TOPSOIL fill
0.4	
0.6	
0.8	Brown Silty Sandy GRAVEL, fill
1.0	
1.2	
1.4	
1.6	
1.8	
2.0	Brown Sandy GRAVEL
2.2	
2.4	
2.6	
2.8	
3.0	Brown Sandy GRAVEL, iron staining
3.2	
3.4	Stop at 3.6m ▽ at 3.5m

DEPTH [m] — Hand Auger ☐ Machine Auger ☐ Test Pit ☐

GL, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4

SITE PLAN (Not to Scale)

North

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Cameron **Date:** 5/6/13

Eliot Sinclair
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20 Troup Drive, Tower Junction,
PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	347299
Date Tested	07-Feb-2013
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SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

DEPTH [m]	Hand Auger	Machine Auger	Test Pit
GL – 3.4	☐	☐	☐

DEPTH [m]	Test Pit @ 10 (Lot 17)	Hand Auger	Machine Auger	Test Pit
GL – 3.4		☐	☐	☒

GL – 0.2: Brown Silty TOPSOIL with gravel and occasional turf

0.2 – 2.6: Dark brown Sandy GRAVEL, fill, some broken bricks & steel bars

2.6 – 3.4: Brown Sandy GRAVEL, damp to wet

Stop at 3.7m

▽ at 3.4m

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Hammond **Date:** 5/6/13

Eliot Sinclair
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Job Number	347299
Date Tested	07-Feb-2013
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Lot	1-5 & 8-17
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SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

Test Pit @ 11 (Lot 9)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	Brown Silty TOPSOIL fill with gravel
0.2	
0.4	
0.6	
0.8	Brown Sandy GRAVEL, fill with some rubbish
1.0	
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	Brown Sandy GRAVEL
2.6	
2.8	▽
3.0	
3.2	
3.4	Stop

Test Pit @ 13 (Lots 9/10/17)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	Brown Silty TOPSOIL fill with gravel
0.2	
0.4	
0.6	Brown fine Sandy GRAVEL, fill
0.8	
1.0	
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	Light grey Sandy GRAVEL
2.6	
2.8	
3.0	
3.2	
3.4	Stop at 3.5m

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Cranmore **Date:** 5/6/13

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Job Number	347299
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SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

Test Pit @ 15 (Lots 9/17)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	Brown Silty TOPSOIL fill with gravel
0.2	
0.4	
0.6	
0.8	Brown Sandy GRAVEL, fill with some minor occasional rubbish (plastic hose, plastic bags)
1.0	
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	Brown Sandy GRAVEL
2.6	
2.8	
3.0	Stop
3.2	
3.4	

Test Pit @ 16 (Lot 17)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	GRAVEL cover
0.2	Brown Silty TOPSOIL fill
0.4	
0.6	
0.8	Brown Sandy GRAVEL, fill with some minor occasional rubbish
1.0	
1.2	
1.4	
1.6	
1.8	
2.0	Brown Sandy GRAVEL
2.2	
2.4	
2.6	
2.8	Brown Sandy GRAVEL, wet ▽
3.0	
3.2	
3.4	Stop

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Aramowicz **Date:** 5/6/13

Eliot Sinclair
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Job Number	347299
Date Tested	07-Feb-2013
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Lot	1-5 & 8-17
Project No.	

SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

Test Pit @ 17 (Lot 9)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	Brown Silty TOPSOIL fill with gravel and turf
0.2	
0.4	Light grey Sandy GRAVEL, fill
0.6	
0.8	
1.0	Brown Sandy GRAVEL, fill
1.2	
1.4	
1.6	
1.8	
2.0	Light grey Sandy GRAVEL, damp to moist
2.2	
2.4	
2.6	
2.8	Dark brown Sandy GRAVEL, moist to wet
3.0	
3.2	▽
3.4	Stop @ 3.5m

Test Pit @ 18 (Lots 9/10)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	Brown Silty TOPSOIL fill with gravel
0.2	
0.4	
0.6	
0.8	
1.0	Brown Sandy GRAVEL, fill with some rubbish
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	Grey Sandy GRAVEL
2.6	
2.8	
3.0	▽
3.2	
3.4	Stop

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Hammond **Date:** 5/6/13

Eliot Sinclair
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20 Troup Drive, Tower Junction,
PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	347299
Date Tested	04-Feb-2013
Page	8 of 17
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Lot	1-5 & 8-17
Project No.	

SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

DEPTH [m]	Hand Auger	Machine Auger	Test Pit
GL – 3.4			

DEPTH [m]	Test Pit @ 20 (Lot 4)	Hand Auger	Machine Auger	Test Pit ⊗
GL – 0.2	Brown Silty TOPSOIL fill with gravel			
0.2 – 1.0				
1.0 – 2.2	Brown Sandy GRAVEL, fill with some minor occasional rubbish (plastic)			
2.2 – 3.4	Brown Sandy GRAVEL, damp to moist			
3.4	Stop @ 3.7m ▽ @ 3.4m			

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Cranwell **Date:** 5/6/13

Eliot Sinclair
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PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number **347299**
Date Tested **04-Feb-2013**

SITE INVESTIGATION RECORD

D.P
Lot **1-5 & 8-17**

Client Ngai Tahu Property Ltd.
Site Stage 1, Hayton Road
Project No.

Test Pit @ 21 (Lot 5)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	
0.2	Light brown Sandy GRAVEL fill
0.4	
0.6	
0.8	
1.0	Brown Sandy GRAVEL, fill over geogrid with some rubble (broken bricks, plastic bags)
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	Dark brown Sandy GRAVEL
2.4	
2.6	
2.8	
3.0	▽
3.2	Stop
3.4	

Test Pit @ 22 (Lot 5)

Hand Auger ☐ Machine Auger ☐ Test Pit ⊗

DEPTH [m]	
GL	
0.2	Brown Sandy GRAVEL fill
0.4	
0.6	
0.8	
1.0	Brown Silty GRAVEL, fill with rubble, plastic bags, rootlets
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	Grey Sandy GRAVEL, iron staining
2.6	
2.8	Stop
3.0	
3.2	
3.4	

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Hammond **Date:** 5/6/13

Eliot Sinclair
surveyors | engineers | planners

20 Troup Drive, Tower Junction,
PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	347299
Date Tested	04-Feb-2013
Page	11 of 17
D.P	
Lot	1-5 & 8-17
Project No.	

SITE INVESTIGATION RECORD

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

DEPTH [m]	Hand Auger	Machine Auger	Test Pit
GL – 3.4	☐	☐	☐

DEPTH [m]	Test Pit @ 26 (Lot 4)	Hand Auger	Machine Auger	Test Pit
GL – 0.4	Grey Sandy GRAVEL, fill	☐	☐	☒
0.4 – 1.0	Brown Sandy GRAVEL, fill with some concrete rubble			
1.0 – 1.4	Grey Sandy GRAVEL			
1.4 – 2.6	Grey Sandy GRAVEL, iron staining, root at 2.2m > 100mm ø			
2.6	Stop			

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Cameron **Date:** 5/6/13

Eliot Sinclair
surveyors | engineers | planners

20 Troup Drive, Tower Junction,
PO Box 9339, Christchurch 8149, NZ
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number **347299**
Date Tested **04-Feb-2013**

SITE INVESTIGATION RECORD

D.P
Lot **1-5 & 8-17**

Client Ngai Tahu Property Ltd.

Site Stage 1, Hayton Road

Project No.

DEPTH [m]	Hand Auger ☐	Machine Auger ☐	Test Pit ☐
GL			
0.2			
0.4			
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			

Test Pit @ 34 (Lots 1/2)

DEPTH [m]	Hand Auger ☐	Machine Auger ☐	Test Pit ⊗
GL			
0.2	Brown Silty TOPSOIL fill, with occasional turf		
0.4			
0.6	Brown Sandy GRAVEL, fill, with some rubbish		
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2	Brown Sandy GRAVEL, some roots @ 2.2m < 100mm Ø		
2.4			
2.6			
2.8			
3.0			
3.2	Stop		
3.4			

SITE PLAN *(Not to Scale)* **North**

Refer to drawing set 347299 G1

COMMENTS

Civil Engineer J. Hamming **Date:** 5/6/13

Bore Log

McMILLAN DRILLING SERVICES

Client: Eliot Sinclair and Partners Ltd

Project: Hayton Road - Stage 1, Christchurch

Bore No.: BH003

Job No.: 11374

Site Location: Hayton Road - Stage 1, Christchurch
Grid Reference: 1564649.31mE, 5178206.4mN (NZTM)
Rig Operator: D. Keown
Rig Model & Mounting: Geoprobe 8140LC

Date Commenced: 05/03/2013
Date Completed: 07/03/2013
Consent: -
Datum: 0m

Description	Method	Drivability (1 2 3 4)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Brown medium Sandy fine to coarse GRAVEL; minor silt, moist, well graded gravel (possibly GRAVEL FILL)	Sonic core drilling		100%	0.5, 1.0, 1.5					Bentonite (4.5 bags)
Silty fine to coarse GRAVEL; some sand, saturated, well graded gravel							N = 27 (C) 1.52m 6, 6 / 7, 6, 7, 7 450mm		
Brown medium Sandy fine to coarse GRAVEL; minor silt, saturated, well graded gravel			100%	2.0, 2.5, 3.0					
-3.04m; some silt with depth							N = 51 (C) 3.04m 5, 9 / 14, 15, 10, 12 450mm		
-4.24m; minor to some cobbles with depth			100%	3.5, 4.0, 4.5					
			80%	5.0, 5.5			N = 41 (C) 4.56m 10, 9 / 7, 8, 14, 12 460mm		
Grey interbedded Silty fine SAND and SILT; saturated, silt is soft to firm, low to medium plasticity and sand is uniformly graded			100%	6.0, 6.5, 7.0			N = 10 (C) 6.08m 1, 2 / 2, 2, 3, 3 450mm		
			100%	7.5, 8.0, 8.5			N = 1 (C) 7.60m 0, 0 / 0, 0, 0, 1 450mm		
				9.0, 9.5, 10.0			N = 9 (C) 9.12m 1, 2 / 2, 2, 2, 3 450mm		

Remarks

Geotechnical Investigation Borehole BH003 with SPT Testing

No Static Water Level Recorded
Samples in Core Boxes
1000 Litres Water Added
Safety Auto Trip Hammer #397 used (energy ratio 102%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	-
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	0.0
Hand Clear Location	ea	
Decontaminate Equipment	ea	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Hole Depth: 18.69m

Created: 12/04/2013 9:42:36 a.m.

Bore Log

McMILLAN DRILLING SERVICES

Client: Eliot Sinclair and Partners Ltd

Project: Hayton Road - Stage 1, Christchurch

Bore No.: BH003

Job No.: 11374

Site Location: Hayton Road - Stage 1, Christchurch
Grid Reference: 1564649.31mE, 5178206.4mN (NZTM)
Rig Operator: D. Keown
Rig Model & Mounting: Geoprobe 8140LC

Date Commenced: 05/03/2013
Date Completed: 07/03/2013
Consent: -
Datum: 0m

Description	Method	Drivability (1 2 3 4)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Grey interbedded Silty fine SAND and SILT; saturated, silt is soft to firm, low to medium plasticity and sand is uniformly graded	Sonic core drilling		100%	11.0			N = 0 (C) 10.64m 0, 0 / 0, 0, 0, 0 450mm		Bentonite (4.5 bags)
Grey SILT; trace rootlets and wood fragments, soft to firm, moist, low to medium plasticity				11.5					
-12.06m - 12.36m; peat lens			100%	12.0			N = 16 (C) 12.16m 1, 2 / 4, 5, 4, 3 450mm		
				12.5					
				13.0					
Grey Silty fine to medium SAND; trace rootlets, wet, well graded sand			100%	13.5					
				14.0			N = 29 (C) 13.68m 4, 7 / 6, 7, 7, 9 450mm		13.9m
Grey fine to coarse Sandy fine to coarse GRAVEL; some silt, wet, well graded sand and gravel			100%	14.5					
				15.0					
				15.5			N = 60+ (C) 15.20m 9, 16 / 20, 15 300mm Effective Refusal		
			100%	16.0					Surrounding ground collapse
				16.5					
-16.72m; no silt with depth				17.0			N = 35 (C) 16.72m 10, 10 / 9, 8, 9, 9 450mm		
-17.04m; trace cobbles with depth			100%	17.5					
				18.0					
				18.5			N = 51 (C) 18.24m 12, 16 / 12, 12, 12, 15 450mm		18.69m

EOH: 18.69m

Remarks

Geotechnical Investigation Borehole BH003 with SPT Testing

No Static Water Level Recorded
Samples in Core Boxes
1000 Litres Water Added
Safety Auto Trip Hammer #397 used (energy ratio 102%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	-
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	0.0
Hand Clear Location	ea	
Decontaminate Equipment	ea	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Hole Depth: 18.69m

Created: 12/04/2013 9:42:36 a.m.

Bore Log

McMILLAN DRILLING SERVICES

Client: Eliot Sinclair and Partners Ltd

Project: Lot 16, Hayton Road, Christchurch

Bore No.: BHG

Job No.: 11802

Site Location: Lot 16, Hayton Road, Christchurch
Grid Reference: 1564661.99mE, 5178286.77mN (NZTM)
Rig Operator: J. Laughton
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 19/03/2013
Date Completed: 20/03/2013
Consent: -
Datum: 0m

Description	Method	Drivability (1 2 3 4)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Yellowish grey fine Sandy fine to coarse GRAVEL; dry, uniformly graded sand and well graded gravel	Sonic core drilling		100%	0.5					Bentonite (1.5 bags)
-0.60m - 1.80m; brownish yellowish grey			100%	1.0			N = 60+ (C) 1.00m 14, 17 / 17, 16, 17 375mm Effective Refusal		
Dark grey fine to medium Sandy fine to medium GRAVEL; trace silt, moist, well graded sand and gravel, less sand and silt with depth			100%	1.5					
				2.0			N = 53 (C) 2.00m 10, 14 / 13, 12, 13, 15 450mm		
				2.5					
				3.0			N = 25 (C) 3.00m 6, 9 / 10, 7, 4, 4 450mm		
				3.5					3.5m
				4.0			N = 37 (C) 4.00m 8, 11 / 11, 11, 8, 7 450mm		
			60%	4.5					
				5.0			N = 15 (C) 5.00m 9, 5 / 5, 4, 3, 3 450mm		
Fine to coarse GRAVEL			50%	5.5					Surrounding ground collapse
				6.0			N = 1 (C) 6.00m 0, 1 / 1, 0, 0, 0 450mm		
Grey SILT; minor sand, trace to minor peat, trace wood fragments and fine gravel			100%	6.5					
-6.60m - 7.20m; no peat or wood				7.0			N = 2 (C) 7.00m 1, 1 / 0, 0, 1, 1 450mm		
-7.20m - 7.80m; some wood, wet, no sand			100%	7.5					

Remarks

Geotechnical Investigation Borehole BHG with SPT Testing

No Static Water Level Recorded
Samples in Core Boxes
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	-
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	0.0
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 15.53m

Created: 10/04/2013 2:06:13 p.m.

Bore Log

McMILLAN DRILLING SERVICES

Client: Eliot Sinclair and Partners Ltd

Project: Lot 16, Hayton Road, Christchurch

Bore No.: BHG

Job No.: 11802

Site Location: Lot 16, Hayton Road, Christchurch
Grid Reference: 1564661.99mE, 5178286.77mN (NZTM)
Rig Operator: J. Laughton
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 19/03/2013
Date Completed: 20/03/2013
Consent: -
Datum: 0m

Description	Method	Drivability (1 2 3 4)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Grey SILT; minor sand, trace to minor peat, trace wood fragments and fine gravel -8.00m: saturated with depth	Sonic core drilling		100%	8.5			N = 8 (C) 8.00m 0, 0 / 1, 2, 2, 3 450mm		Surrounding ground collapse
Grey Silty fine to medium SAND; trace rootlets, saturated, well graded sand				9.0					
Grey SILT; minor fine sand, soft, low plasticity, wet -9.60m - 10.20m; trace wood fragments, soft to firm, medium plasticity			100%	9.5			N = 3 (C) 9.00m 0, 1 / 2, 1, 0, 0 450mm		
-10.20m - 10.30m; peat lens			100%	10.0			N = 5 (C) 10.00m 1, 1 / 1, 1, 2, 1 450mm		10.2m
-10.52m - 11.10m; trace rootlets			100%	10.5			N = 4 (C) 10.52m 0, 1 / 0, 1, 1, 2 450mm		
-11.10m - 11.12m; peat lens, minor wood fragments -11.12m; minor fine sand with depth				11.0					
Grey fine Sandy SILT; soft to firm, wet, low plasticity, low quickness				11.5					
-12.96m - 13.50m; silty fine sand lens			100%	12.0			N = 20 (C) 12.04m 0, 2 / 4, 6, 6, 4 450mm		Bentonite (2.5 bags)
Grey SILT; minor sand, trace rootlets, firm, moist, high plasticity				12.5					
Grey fine to medium Sandy fine to coarse GRAVEL; minor to some silt, saturated, well graded sand and gravel			100%	13.0			N = 13 (C) 13.56m 2, 3 / 4, 3, 3, 3 450mm		14.8m
				13.5					Surrounding ground collapse
				14.0					15.53m
				14.5					
				15.0			N = 55 (C) 15.08m 6, 11 / 13, 12, 14, 16 450mm		
				15.5					

EOH: 15.53m

Remarks

Geotechnical Investigation Borehole BHG with SPT Testing

No Static Water Level Recorded
Samples in Core Boxes
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	-
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	0.0
Hand Clear Location	ea	
Decontaminate Equipment	ea	

Created: 10/04/2013 2:06:13 p.m.

Appendix F : LIQUEFACTION ANALYSIS

Serviceability Limit State (SLS): M7.5, 0.13g peak horizontal ground acceleration

Eliot Sinclair
surveyors | engineers | planners

Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

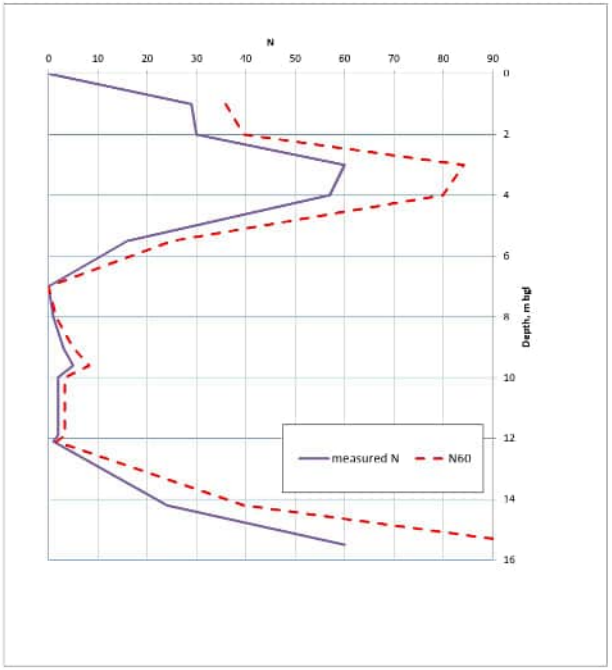
Magnitude scaling factor, MSF = 1.00

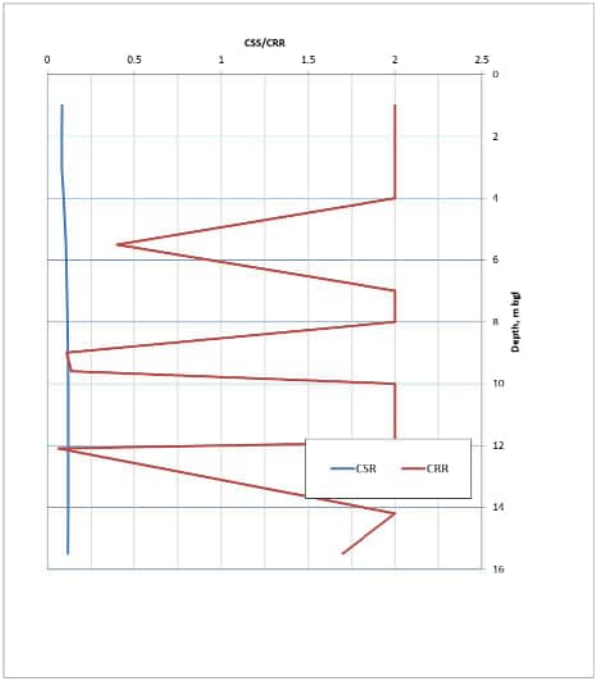
SLS event - (Settlement is limited to the top 10m)

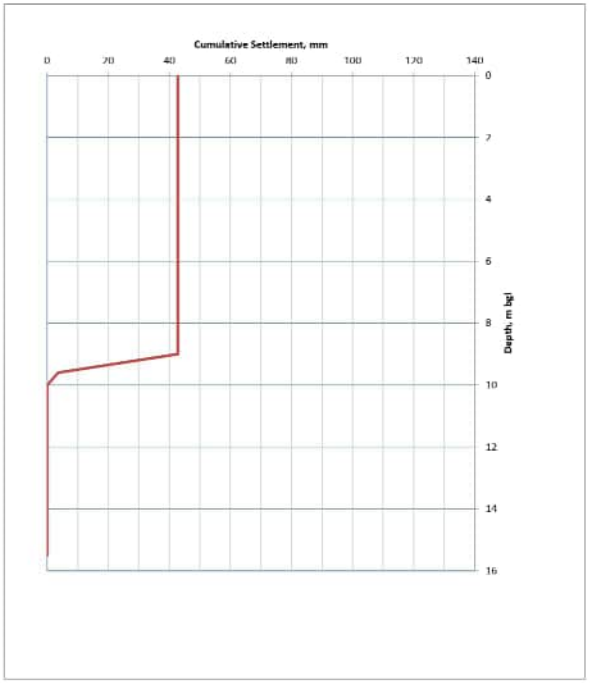
BH001

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification		Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.279		S=	43	
0	0	0																																
1	1.00	29	gravel fill			Unsat	5	99	1.65	1.00	0.75	1.0	35.9	18	18	1.70	61.0	0.0	61.01	1.00	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-2.510	0.000	0.00	0.000	0.000	0	43
2	2.00	30	gravel fill			Unsat	5	99	1.65	1.00	0.80	1.0	39.6	36	36	1.36	54.0	0.0	54.00	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-1.918	0.000	0.00	0.000	0.000	0	43
3	3.00	60	sandy gravel			0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	5.994	0.000	0.00	0.000	0.000	0	43
4	4.00	57	sandy gravel			0	5	99	1.65	1.00	0.85	1.0	79.9	73	63	1.13	90.4	0.0	90.44	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	-5.164	0.000	1.00	0.000	0.000	0	43
5	5.50	16	sandy gravel			0	5	99	1.65	1.00	0.95	1.0	25.1	102	77	1.11	28.0	0.0	27.96	0.96	0.106	1.00	1.05	0.382	0.401	2.00	0.06	0.046	0.000	1.50	0.000	0.000	0	43
6	7.00	0	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	0.0	130	91	1.09	N.A.	n.a.	n.a.	0.94	0.113	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	43
7	8.00	1	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	1.6	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	43
8	9.00	3	silty sand			0	20	99	1.65	1.00	1.00	1.0	5.0	168	109	0.95	4.7	4.5	9.20	0.91	0.118	1.00	0.99	0.113	0.112	0.94	0.50	0.929	0.170	1.00	0.170	0.039	39	43
9	9.60	5	silty sand			0	30	99	1.65	1.00	1.00	1.0	8.3	179	115	0.93	7.7	5.4	13.04	0.90	0.119	1.00	0.99	0.140	0.139	1.16	0.34	0.878	0.015	0.60	0.009	0.006	4	4
10	10.00	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	187	118	0.90	N.A.	n.a.	n.a.	0.90	0.120	1.00	0.95	n.a.	2.000	2.00	0.00	0.000	0.000	0.40	0.000	0.000	0	0
11	11.90	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	223	136	0.83	N.A.	n.a.	n.a.	0.87	0.121	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	1.90	0.000	0.000	0	0
12	12.10	1	sand			0	5	99	1.65	1.00	1.00	1.0	1.7	227	138	0.81	1.3	0.0	1.31	0.87	0.121	1.00	0.98	0.067	0.066	0.54	0.50	0.948	0.500	0.20	0.100	0.078	0	0
13	14.70	24	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	39.6	267	157	0.88	N.A.	n.a.	n.a.	0.83	0.120	1.00	0.87	n.a.	2.000	2.00	0.00	0.000	0.000	2.10	0.000	0.000	0	0
14	15.50	60	sandy gravel			0	5	99	1.65	1.00	1.00	1.0	99.0	292	169	0.87	86.5	0.0	86.48	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-4.794	0.000	1.30	0.000	0.000	0	0







Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

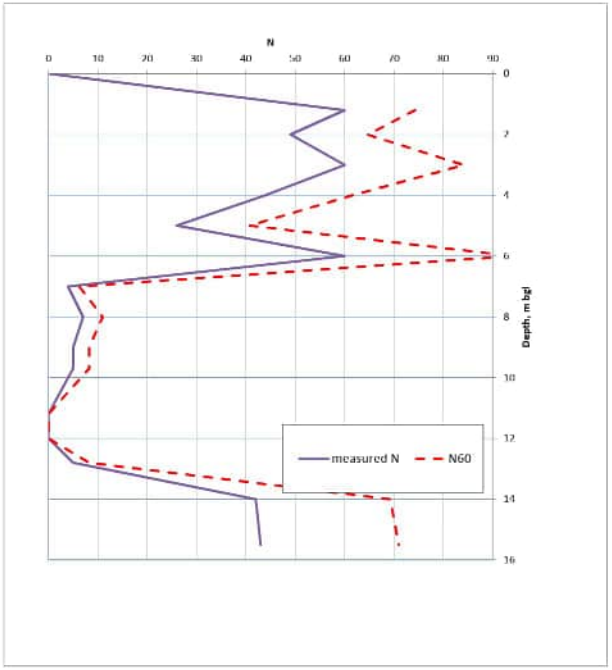
Eliot Sinclair
surveyors | engineers | planners

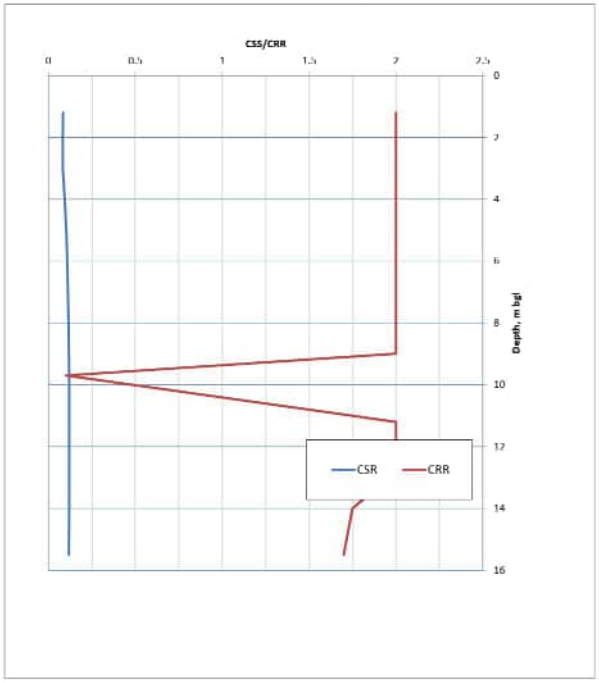
SLS event - (Settlement is limited to the top 10m)

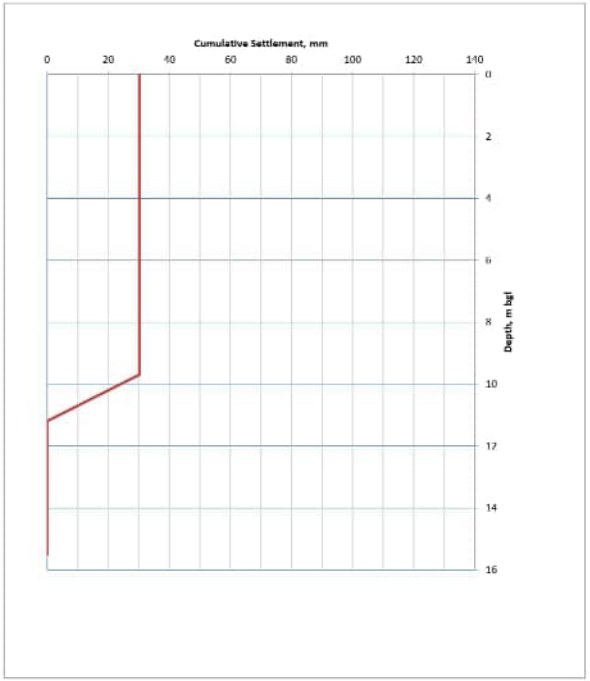
BH002

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.350		S=	30	
0	0	0																															
1	1.20	60	gravel fill		Unsat	5	99	1.65	1.00	0.75	1.0	74.3	22	22	1.50	111.4	0.0	111.42	1.00	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-7.169	0.000	0.00	0.000	0.000	0	30
2	2.00	49	sandy gravel		Unsat	5	99	1.65	1.00	0.80	1.0	64.7	36	36	1.31	84.8	0.0	84.85	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-4.643	0.000	0.00	0.000	0.000	0	30
3	3.00	60	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	-5.994	0.000	0.00	0.000	0.000	0	30
4	4.00	44	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	61.7	73	63	1.13	69.8	0.0	69.82	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	-3.279	0.000	1.00	0.000	0.000	0	30
5	5.00	26	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	40.8	92	72	1.10	44.9	0.0	44.95	0.96	0.103	1.00	1.10	2.000	2.000	2.00	0.00	-1.185	0.000	1.00	0.000	0.000	0	30
6	6.00	60	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	94.1	111	82	1.06	99.5	0.0	99.49	0.95	0.109	1.00	1.06	2.000	2.000	2.00	0.00	-6.019	0.000	1.00	0.000	0.000	0	30
7	7.00	4	wood	clay	Clay	50	99	1.65	1.00	0.95	1.0	6.3	130	91	1.07	N.A.	n.a.	n.a.	0.94	0.113	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
8	8.00	7	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	11.0	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
9	9.00	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	168	109	0.96	N.A.	n.a.	n.a.	0.91	0.118	1.00	0.98	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
10	9.70	5	sand		0	5	99	1.65	1.00	1.00	1.0	8.3	181	116	0.93	7.6	0.0	7.65	0.90	0.119	1.00	0.99	0.102	0.101	0.85	0.50	0.946	0.500	0.70	0.350	0.043	43	30
11	11.20	0	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	210	129	0.82	N.A.	n.a.	n.a.	0.88	0.120	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	0
12	12.00	0	peaty silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	225	137	0.79	N.A.	n.a.	n.a.	0.87	0.121	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
13	12.80	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	240	144	0.82	N.A.	n.a.	n.a.	0.86	0.120	1.00	0.90	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
14	14.00	42	sandy gravel			5	99	1.65	1.00	1.00	1.0	69.3	263	155	0.89	61.9	0.0	61.91	0.84	0.120	1.00	0.87	2.000	1.747	2.00	0.00	-2.587	0.000	1.20	0.000	0.000	0	0
15	15.50	43	sandy gravel		0	5	99	1.65	1.00	1.00	1.0	71.0	292	169	0.87	62.0	0.0	61.98	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-2.593	0.000	1.50	0.000	0.000	0	0







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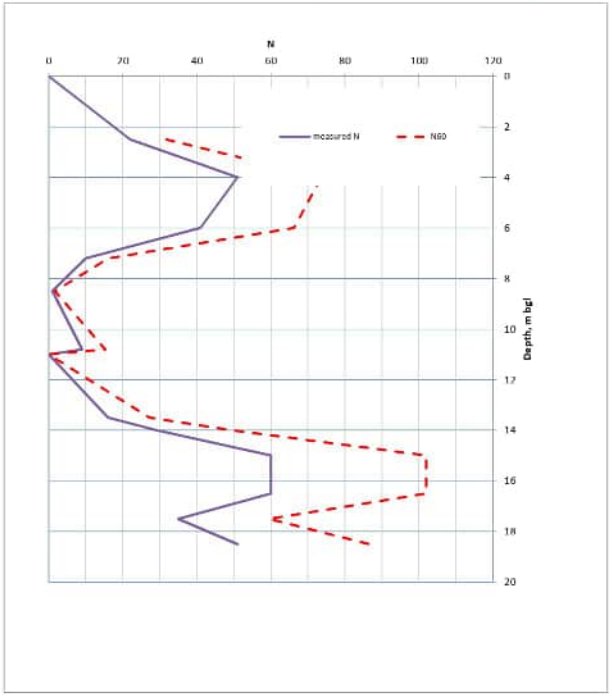
SLS event - (Settlement is limited to the top 10m)

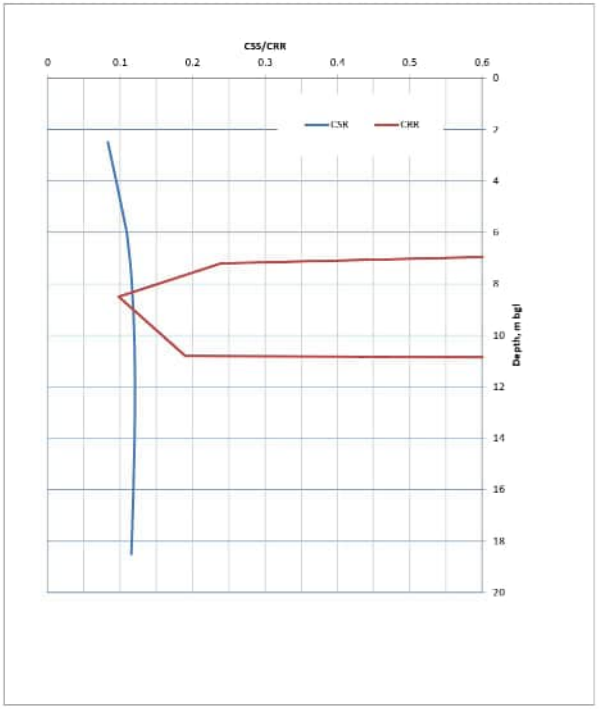
BH003

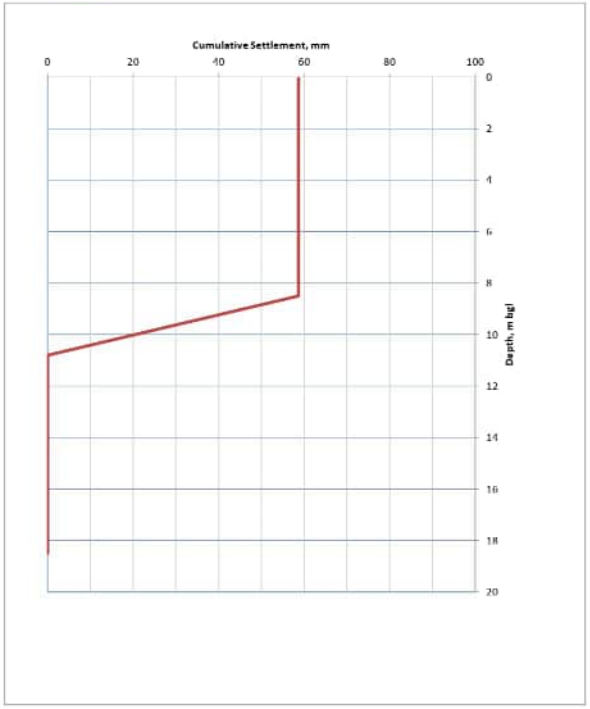
Corner of Lots 8, 11 & 16 - Hayton Road - Stage 1

Input Parameters		Magnitude scaling factor, MSF = 1.00
Atmospheric pressure, Pa kPa	101	
Peak ground acceleration, pga =	0.13	
Earthquake magnitude, M=	7.5	
Water table depth, m =	3.0	
Average γ_T above water table, kN/m3 =	18.0	
Average γ_T below water table, kN/m3 =	19.0	
Borehole diameter (mm)	70	
Requires correction for sample liners (Yes/No)	No	
Rod Lengths (m)	1.5	

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.664		S=	
0	0	0																															
1	2.50	22	sandy gravel		Unsat	5	102	1.70	1.00	0.85	1.0	31.8	45	45	1.33	42.2	0.0	42.22	0.99	0.083	1.00	1.10	2.000	2.000	2.00	0.01	0.973	0.000	0.00	0.000	0.000	0	59
2	4.00	51	sandy gravel		0	5	102	1.70	1.00	0.85	1.0	73.7	73	63	1.13	83.4	0.0	83.38	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	4.506	0.000	1.00	0.000	0.000	0	59
3	6.00	41	sandy gravel		0	5	102	1.70	1.00	0.95	1.0	66.2	111	82	1.06	70.0	0.0	70.05	0.95	0.109	1.00	1.06	2.000	2.000	2.00	0.00	3.799	0.000	2.00	0.000	0.000	0	59
4	7.20	10	silty sand		0	30	102	1.70	1.00	0.95	1.0	16.2	134	93	1.04	16.8	5.4	22.19	0.93	0.114	1.00	1.01	0.236	0.239	2.00	0.12	0.397	0.000	1.20	0.000	0.000	0	59
5	8.50	1	silty sand		0	30	102	1.70	1.00	1.00	1.0	1.7	159	105	0.98	1.7	5.4	7.02	0.92	0.117	1.00	1.00	0.098	0.098	0.83	0.50	0.948	0.500	1.30	0.650	0.045	59	59
6	10.80	9	silty sand		0	30	102	1.70	1.00	1.00	1.0	15.3	202	126	0.90	13.8	5.4	19.13	0.88	0.120	1.00	0.97	0.196	0.190	1.58	0.18	0.563	0.006	2.30	0.014	0.002	0	0
7	11.00	0	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	0.0	206	128	0.83	N.A.	n.a.	n.a.	0.88	0.120	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	0.20	0.000	0.000	0	0
8	13.50	16	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	27.2	254	150	0.86	N.A.	n.a.	n.a.	0.84	0.120	1.00	0.88	n.a.	2.000	2.00	0.00	0.000	0.000	2.50	0.000	0.000	0	0
9	14.00	29	silty sand		0	30	102	1.70	1.00	1.00	1.0	49.3	263	155	0.89	44.0	5.4	49.40	0.84	0.120	1.00	0.87	2.000	1.747	2.00	0.00	1.540	0.000	0.50	0.000	0.000	0	0
10	15.00	60	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	102.0	282	164	0.88	89.7	0.0	89.75	0.82	0.119	1.00	0.86	2.000	1.713	2.00	0.00	5.098	0.000	1.00	0.000	0.000	0	0
11	16.50	60	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	102.0	311	178	0.86	87.9	0.0	87.86	0.80	0.118	1.00	0.83	2.000	1.666	2.00	0.00	4.973	0.000	1.50	0.000	0.000	0	0
12	17.50	35	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	59.5	330	187	0.85	50.6	0.0	50.58	0.79	0.117	1.00	0.82	2.000	1.636	2.00	0.00	1.636	0.000	1.00	0.000	0.000	0	0
13	18.50	51	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	86.7	349	196	0.84	72.8	0.0	72.78	0.77	0.116	1.00	0.80	2.000	1.608	2.00	0.00	3.543	0.000	3.50	0.000	0.000	0	0







Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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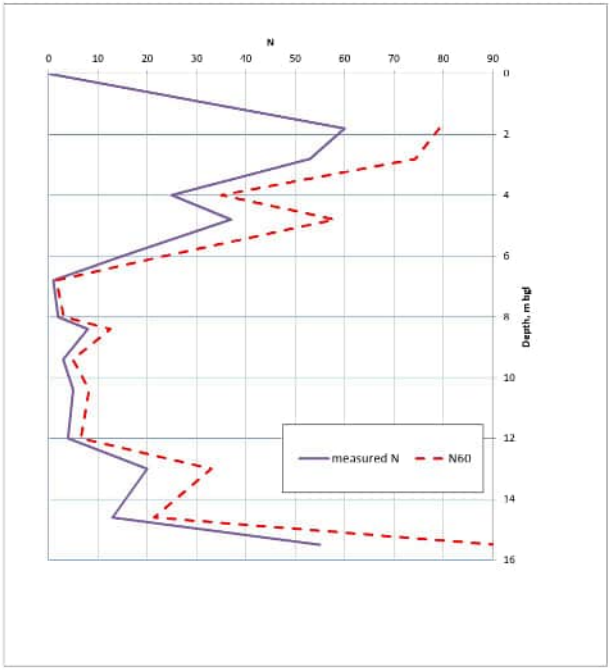
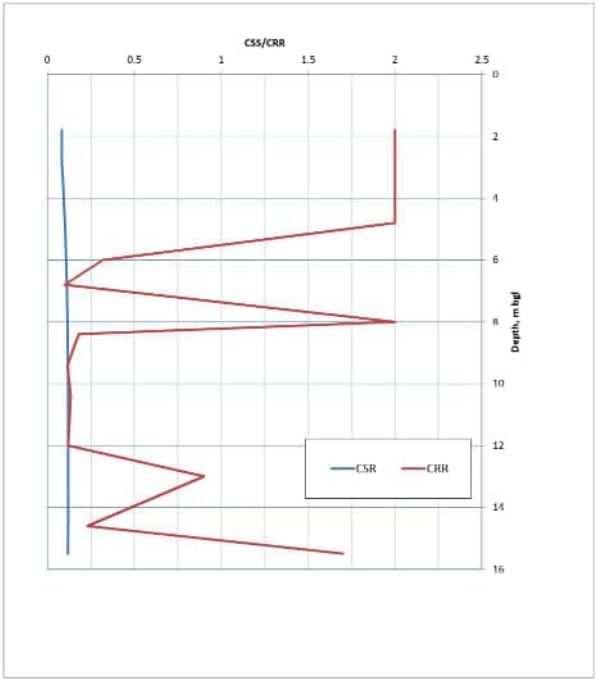
SLS event - (Settlement is limited to the top 10m)

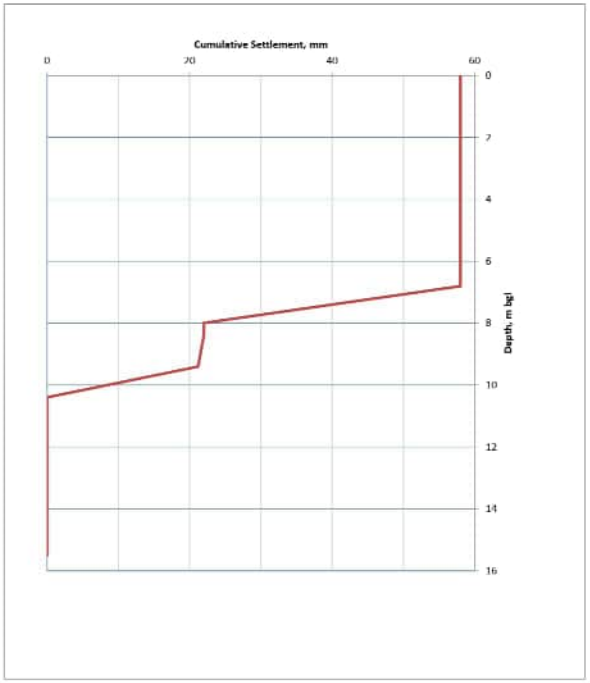
BH-G

370177 - Lot 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.521		S=	58	
0	0	0																															
1	1.80	60	sandy gravel		Unsat	5	99	1.65	1.00	0.80	1.0	79.2	32	32	1.35	106.8	0.0	106.82	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	6.723	0.000	0.00	0.000	0.000	0	58
2	2.80	53	sandy gravel		Unsat	5	99	1.65	1.00	0.85	1.0	74.3	50	50	1.20	89.3	0.0	89.25	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	-5.052	0.000	0.00	0.000	0.000	0	58
3	4.00	25	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	35.1	73	63	1.17	40.9	0.0	40.92	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.01	0.874	0.000	1.00	0.000	0.000	0	58
4	4.80	37	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	58.0	88	71	1.10	63.7	0.0	63.74	0.96	0.102	1.00	1.10	2.000	2.000	2.00	0.00	-2.746	0.000	0.80	0.000	0.000	0	58
5	6.00	15	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	23.5	111	82	1.09	25.7	0.0	25.68	0.95	0.109	1.00	1.04	0.307	0.318	2.00	0.08	0.190	0.000	1.20	0.000	0.000	0	58
6	6.80	1	sandy silt		0	30	99	1.65	1.00	0.95	1.0	1.6	126	89	1.09	1.7	5.4	7.07	0.94	0.113	1.00	1.01	0.099	0.100	0.89	0.50	0.948	0.500	0.80	0.400	0.045	36	58
7	8.00	2	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	3.1	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.20	0.000	0.000	0	22
8	8.40	8	sandy silt		0	30	99	1.65	1.00	0.95	1.0	12.5	157	104	0.99	12.4	5.4	17.74	0.92	0.117	1.00	1.00	0.181	0.181	1.54	0.20	0.632	0.007	0.40	0.003	0.002	1	22
9	9.40	3	silty sand		0	30	99	1.65	1.00	1.00	1.0	5.0	176	113	0.93	4.6	5.4	9.99	0.90	0.119	1.00	0.99	0.118	0.117	0.98	0.47	0.914	0.045	1.00	0.045	0.021	21	21
10	10.40	5	sandy silt		0	30	99	1.65	1.00	1.00	1.0	8.3	195	122	0.90	7.4	5.4	12.78	0.89	0.120	1.00	0.98	0.138	0.136	1.13	0.35	0.837	0.017	1.00	0.017	0.007	0	0
11	12.00	4	sandy silt		0	30	99	1.65	1.00	1.00	1.0	6.6	225	137	0.84	5.5	5.4	10.89	0.87	0.121	1.00	0.97	0.124	0.121	1.00	0.43	0.893	0.034	1.60	0.055	0.015	0	0
12	13.00	20	sandy silt		0	30	99	1.65	1.00	1.00	1.0	33.0	244	146	0.88	29.1	5.4	34.45	0.85	0.120	1.00	0.91	0.992	0.900	2.00	0.02	-0.397	0.000	1.00	0.000	0.000	0	0
13	14.60	13	sandy silt		0	30	99	1.65	1.00	1.00	1.0	21.5	274	161	0.82	17.6	5.4	22.95	0.83	0.120	1.00	0.93	0.248	0.231	1.93	0.11	0.354	0.001	1.60	0.002	0.000	0	0
14	15.50	55	sandy gravel		0	5	99	1.65	1.00	1.00	1.0	90.8	292	169	0.87	79.3	0.0	79.27	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-4.130	0.000	0.90	0.000	0.000	0	0







Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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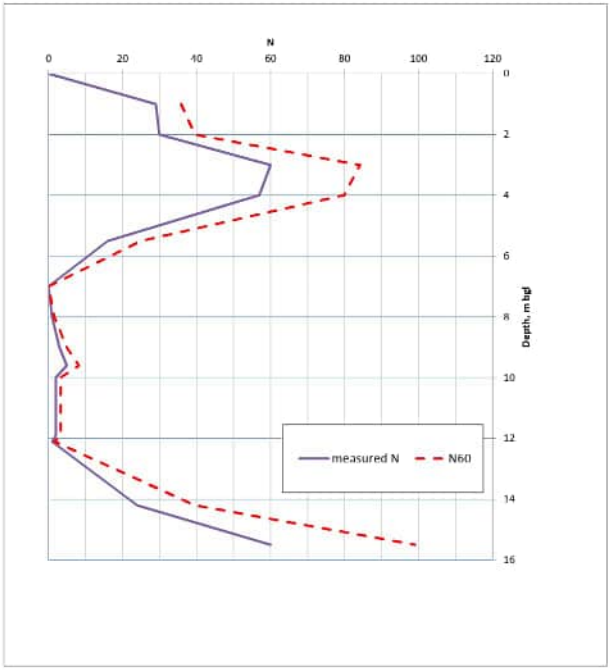
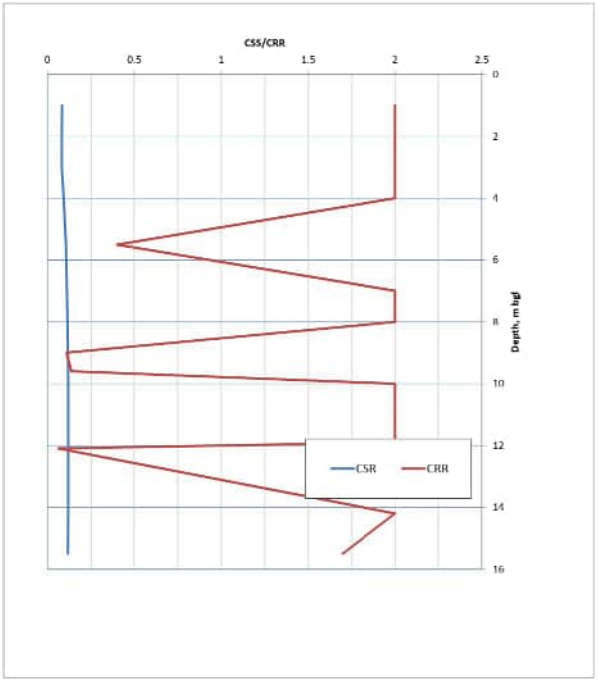
SLS event - (Settlement along full investigated depth)

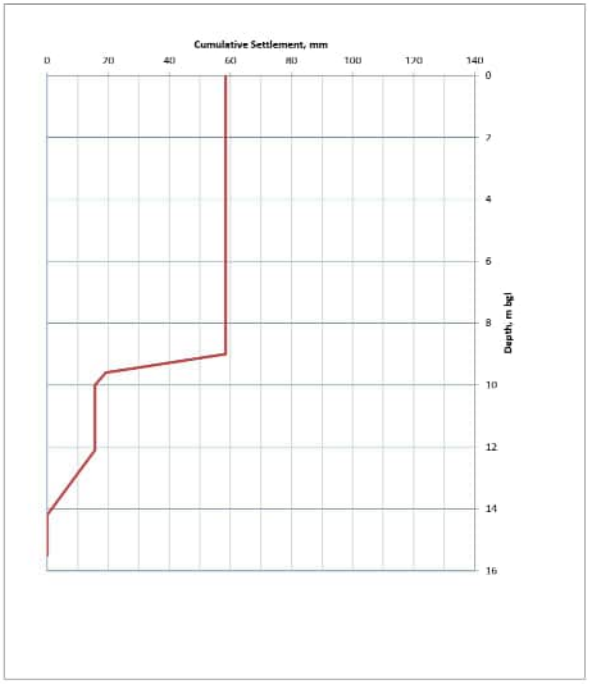
BH001

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification		Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.279		S=	58	
0	0	0																															
1	1.00	29	gravel fill			Unsat	5	99	1.65	1.00	0.75	1.0	35.9	18	18	1.70	61.0	0.0	61.01	1.00	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-2.510	0.000	0.00	0.000	0.000	0	58
2	2.00	30	gravel fill			Unsat	5	99	1.65	1.00	0.80	1.0	39.6	36	36	1.36	54.0	0.0	54.00	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-1.918	0.000	0.00	0.000	0.000	0	58
3	3.00	60	sandy gravel			0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	5.994	0.000	0.00	0.000	0.000	0	58
4	4.00	57	sandy gravel			0	5	99	1.65	1.00	0.85	1.0	79.9	73	63	1.13	90.4	0.0	90.44	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	-5.164	0.000	1.00	0.000	0.000	0	58
5	5.50	16	sandy gravel			0	5	99	1.65	1.00	0.95	1.0	25.1	102	77	1.11	28.0	0.0	27.96	0.96	0.106	1.00	1.05	0.382	0.401	2.00	0.06	0.046	0.000	1.50	0.000	0.000	0	58
6	7.00	0	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	0.0	130	91	1.09	N.A.	n.a.	n.a.	0.94	0.113	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	58
7	8.00	1	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	1.6	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	58
8	9.00	3	silty sand			0	20	99	1.65	1.00	1.00	1.0	5.0	168	109	0.95	4.7	4.5	9.20	0.91	0.118	1.00	0.99	0.113	0.112	0.94	0.50	0.929	0.170	1.00	0.170	0.039	39	58
9	9.60	5	silty sand			0	30	99	1.65	1.00	1.00	1.0	8.3	179	115	0.93	7.7	5.4	13.04	0.90	0.119	1.00	0.99	0.140	0.139	1.16	0.34	0.828	0.015	0.60	0.009	0.006	4	19
10	10.00	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	187	118	0.90	N.A.	n.a.	n.a.	0.90	0.120	1.00	0.95	n.a.	2.000	2.00	0.00	0.000	0.000	0.40	0.000	0.000	0	16
11	11.90	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	223	136	0.83	N.A.	n.a.	n.a.	0.87	0.121	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	1.90	0.000	0.000	0	16
12	12.10	1	sand			0	5	99	1.65	1.00	1.00	1.0	1.7	227	138	0.81	1.3	0.0	1.34	0.87	0.121	1.00	0.98	0.067	0.066	0.54	0.50	0.948	0.500	0.20	0.100	0.078	16	16
13	14.70	24	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	39.6	267	157	0.88	N.A.	n.a.	n.a.	0.83	0.120	1.00	0.87	n.a.	2.000	2.00	0.00	0.000	0.000	2.10	0.000	0.000	0	0
14	15.50	60	sandy gravel			0	5	99	1.65	1.00	1.00	1.0	99.0	292	169	0.87	86.5	0.0	86.48	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-4.794	0.000	1.30	0.000	0.000	0	0







Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

Eliot Sinclair
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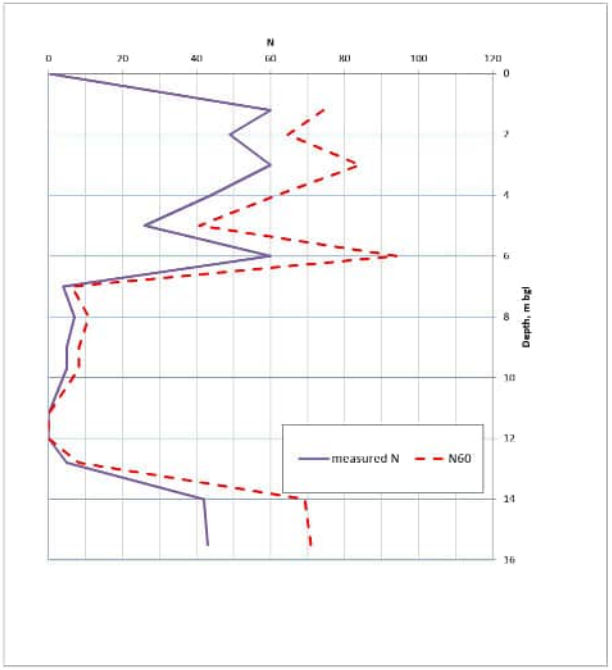
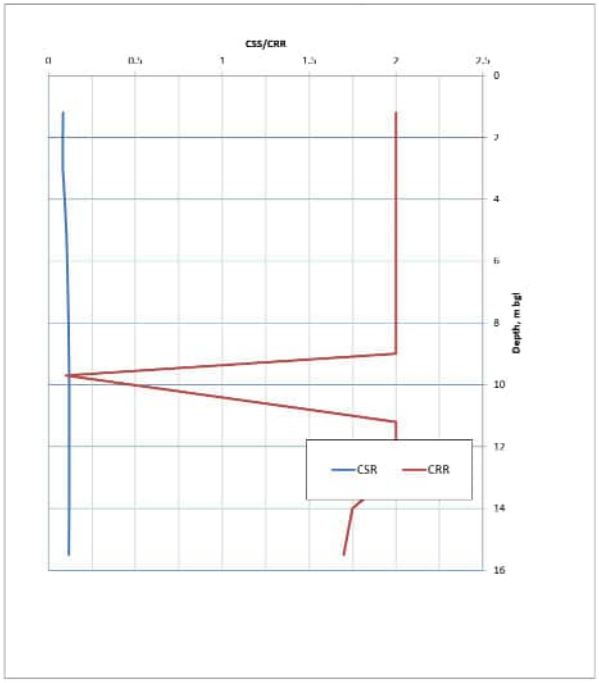
SLS event - (Settlement along full investigated depth)

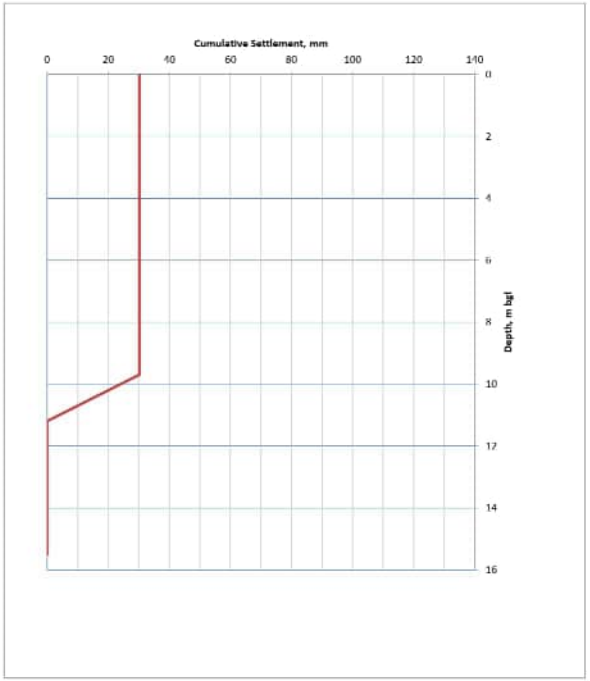
BH002

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.350		S=	30	
0	0	0																															
1	1.20	60	gravel fill		Unsat	5	99	1.65	1.00	0.75	1.0	74.3	22	22	1.50	111.4	0.0	111.42	1.00	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-7.169	0.000	0.00	0.000	0.000	0	30
2	2.00	49	sandy gravel		Unsat	5	99	1.65	1.00	0.80	1.0	64.7	36	36	1.31	84.8	0.0	84.85	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	-4.643	0.000	0.00	0.000	0.000	0	30
3	3.00	60	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	-5.994	0.000	0.00	0.000	0.000	0	30
4	4.00	44	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	61.7	73	63	1.13	69.8	0.0	69.82	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	-3.279	0.000	1.00	0.000	0.000	0	30
5	5.00	26	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	40.8	92	72	1.10	44.9	0.0	44.95	0.96	0.103	1.00	1.10	2.000	2.000	2.00	0.00	-1.185	0.000	1.00	0.000	0.000	0	30
6	6.00	60	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	94.1	111	82	1.06	99.5	0.0	99.49	0.95	0.109	1.00	1.06	2.000	2.000	2.00	0.00	-6.019	0.000	1.00	0.000	0.000	0	30
7	7.00	4	wood	clay	Clay	50	99	1.65	1.00	0.95	1.0	6.3	130	91	1.07	N.A.	n.a.	n.a.	0.94	0.113	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
8	8.00	7	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	11.0	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
9	9.00	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	168	109	0.96	N.A.	n.a.	n.a.	0.91	0.118	1.00	0.98	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
10	9.70	5	sand		0	5	99	1.65	1.00	1.00	1.0	8.3	181	116	0.93	7.6	0.0	7.65	0.90	0.119	1.00	0.99	0.102	0.101	0.85	0.50	0.946	0.500	0.70	0.350	0.043	43	30
11	11.20	0	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	210	129	0.82	N.A.	n.a.	n.a.	0.88	0.120	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	0
12	12.00	0	peaty silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	225	137	0.79	N.A.	n.a.	n.a.	0.87	0.121	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
13	12.80	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	240	144	0.82	N.A.	n.a.	n.a.	0.86	0.120	1.00	0.90	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
14	14.00	42	sandy gravel		0	5	99	1.65	1.00	1.00	1.0	69.3	263	155	0.89	61.9	0.0	61.91	0.84	0.120	1.00	0.87	2.000	1.747	2.00	0.00	-2.587	0.000	1.20	0.000	0.000	0	0
15	15.50	43	sandy gravel		0	5	99	1.65	1.00	1.00	1.0	71.0	292	169	0.87	62.0	0.0	61.98	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-2.593	0.000	1.50	0.000	0.000	0	0







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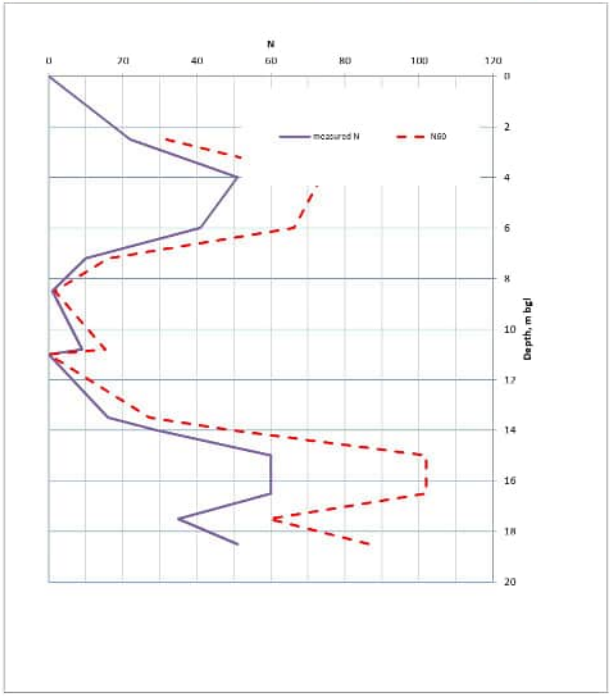
SLS event - (Settlement along full investigated depth)

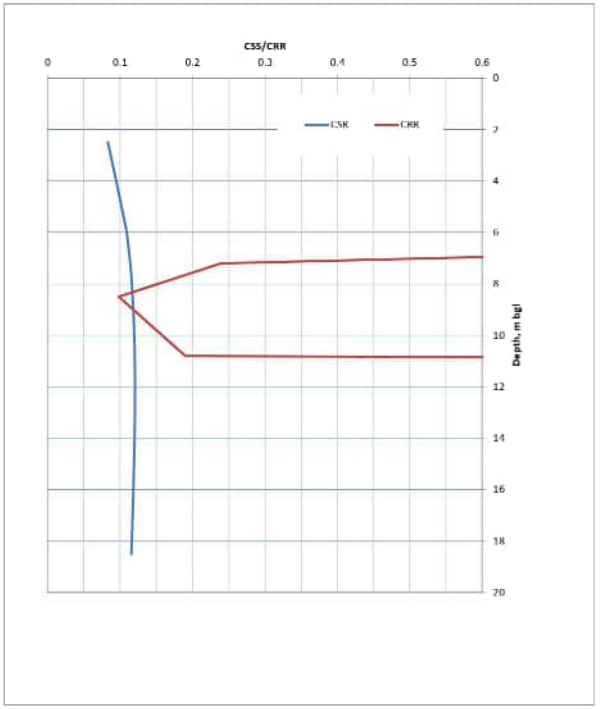
BH003

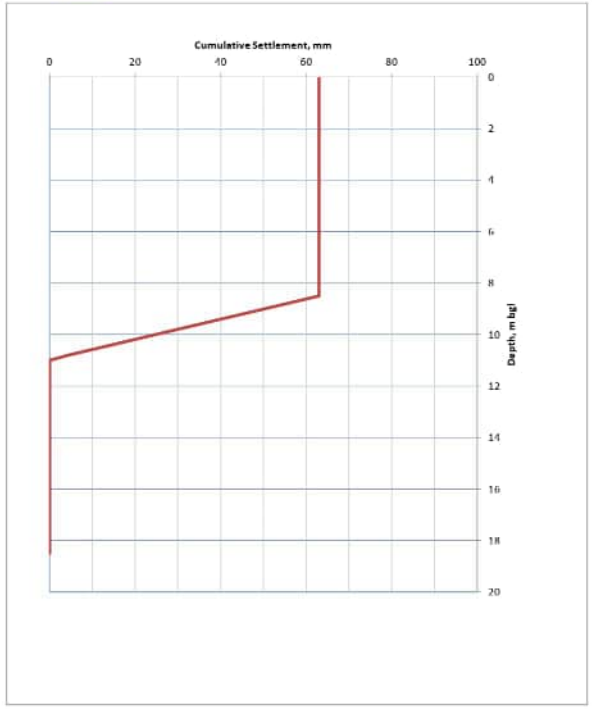
Corner of Lots 8, 11 & 16 - Hayton Road - Stage 1

Input Parameters		Magnitude scaling factor, MSF = 1.00
Atmospheric pressure, Pa kPa	101	
Peak ground acceleration, pga =	0.13	
Earthquake magnitude, M=	7.5	
Water table depth, m =	3.0	
Average γ_T above water table, kN/m3 =	18.0	
Average γ_T below water table, kN/m3 =	19.0	
Borehole diameter (mm)	70	
Requires correction for sample liners (Yes/No)	No	
Rod Lengths (m)	1.5	

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.664		S=	
0	0	0																															
1	2.50	22	sandy gravel		Unsat	5	102	1.70	1.00	0.85	1.0	31.8	45	45	1.33	42.2	0.0	42.22	0.99	0.083	1.00	1.10	2.000	2.000	2.00	0.01	0.973	0.000	0.00	0.000	0.000	0	63
2	4.00	51	sandy gravel		0	5	102	1.70	1.00	0.85	1.0	73.7	73	63	1.13	83.4	0.0	83.38	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.00	4.506	0.000	1.00	0.000	0.000	0	63
3	6.00	41	sandy gravel		0	5	102	1.70	1.00	0.95	1.0	66.2	111	82	1.06	70.0	0.0	70.05	0.95	0.109	1.00	1.06	2.000	2.000	2.00	0.00	3.799	0.000	2.00	0.000	0.000	0	63
4	7.20	10	silty sand		0	30	102	1.70	1.00	0.95	1.0	16.2	134	93	1.04	16.8	5.4	22.19	0.93	0.114	1.00	1.01	0.236	0.239	2.00	0.12	0.397	0.000	1.20	0.000	0.000	0	63
5	8.50	1	silty sand		0	30	102	1.70	1.00	1.00	1.0	1.7	159	105	0.98	1.7	5.4	7.02	0.92	0.117	1.00	1.00	0.098	0.098	0.83	0.50	0.948	0.500	1.30	0.650	0.045	58	63
6	10.80	9	silty sand		0	30	102	1.70	1.00	1.00	1.0	15.3	202	126	0.90	13.8	5.4	19.13	0.88	0.120	1.00	0.97	0.196	0.190	1.58	0.18	0.563	0.006	2.30	0.014	0.002	4	4
7	11.00	0	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	0.0	206	128	0.83	N.A.	n.a.	n.a.	0.88	0.120	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	0.20	0.000	0.000	0	0
8	13.50	16	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	27.2	254	150	0.86	N.A.	n.a.	n.a.	0.84	0.120	1.00	0.88	n.a.	2.000	2.00	0.00	0.000	0.000	2.50	0.000	0.000	0	0
9	14.00	29	silty sand		0	30	102	1.70	1.00	1.00	1.0	49.3	263	155	0.89	44.0	5.4	49.40	0.84	0.120	1.00	0.87	2.000	1.747	2.00	0.00	1.540	0.000	0.50	0.000	0.000	0	0
10	15.00	60	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	102.0	282	164	0.88	89.7	0.0	89.75	0.82	0.119	1.00	0.86	2.000	1.713	2.00	0.00	5.098	0.000	1.00	0.000	0.000	0	0
11	16.50	60	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	102.0	311	178	0.86	87.9	0.0	87.86	0.80	0.118	1.00	0.83	2.000	1.666	2.00	0.00	4.973	0.000	1.50	0.000	0.000	0	0
12	17.50	35	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	59.5	330	187	0.85	50.6	0.0	50.58	0.79	0.117	1.00	0.82	2.000	1.636	2.00	0.00	1.636	0.000	1.00	0.000	0.000	0	0
13	18.50	51	sandy gravel		0	5	102	1.70	1.00	1.00	1.0	86.7	349	196	0.84	72.8	0.0	72.78	0.77	0.116	1.00	0.80	2.000	1.608	2.00	0.00	3.543	0.000	3.50	0.000	0.000	0	0







Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.13
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

Eliot Sinclair
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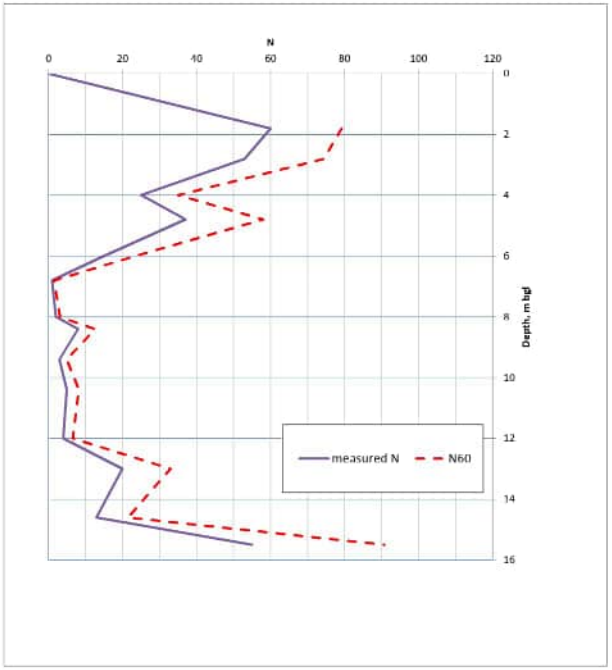
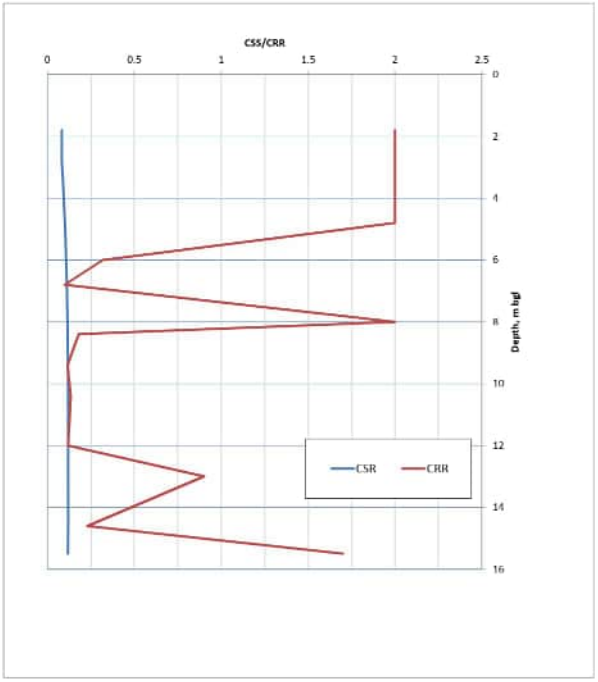
SLS event - (Settlement along full investigated depth)

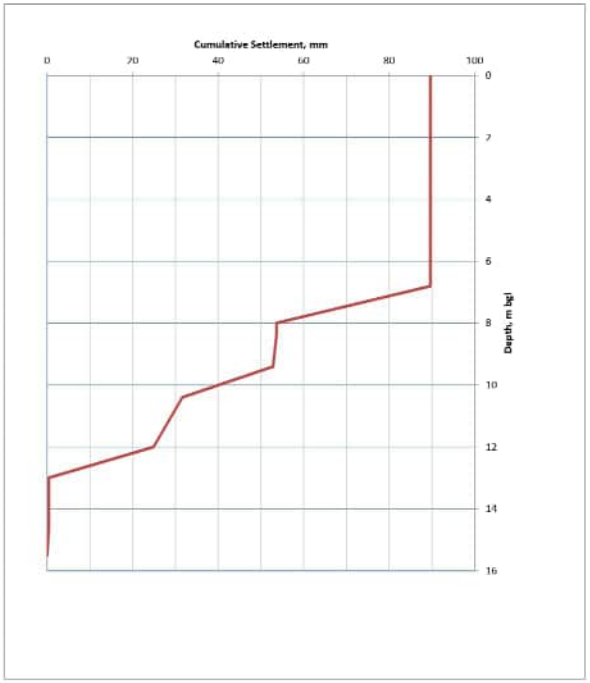
BH-G

370177 - Lot 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.521		S=	90	
0	0	0																															
1	1.80	60	sandy gravel		Unsat	5	99	1.65	1.00	0.80	1.0	79.2	32	32	1.35	106.8	0.0	106.82	0.99	0.084	1.00	1.10	2.000	2.000	2.00	0.00	6.723	0.000	0.00	0.000	0.000	0	90
2	2.80	53	sandy gravel		Unsat	5	99	1.65	1.00	0.85	1.0	74.3	50	50	1.20	89.3	0.0	89.25	0.98	0.083	1.00	1.10	2.000	2.000	2.00	0.00	-5.052	0.000	0.00	0.000	0.000	0	90
3	4.00	25	sandy gravel		0	5	99	1.65	1.00	0.85	1.0	35.1	73	63	1.17	40.9	0.0	40.92	0.97	0.095	1.00	1.10	2.000	2.000	2.00	0.01	0.874	0.000	1.00	0.000	0.000	0	90
4	4.80	37	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	58.0	88	71	1.10	63.7	0.0	63.74	0.96	0.102	1.00	1.10	2.000	2.000	2.00	0.00	-2.746	0.000	0.80	0.000	0.000	0	90
5	6.00	15	sandy gravel		0	5	99	1.65	1.00	0.95	1.0	23.5	111	82	1.09	25.7	0.0	25.68	0.95	0.109	1.00	1.04	0.307	0.318	2.00	0.08	0.190	0.000	1.20	0.000	0.000	0	90
6	6.80	1	sandy silt		0	30	99	1.65	1.00	0.95	1.0	1.6	126	89	1.09	1.7	5.4	7.07	0.94	0.113	1.00	1.01	0.099	0.100	0.89	0.50	0.948	0.500	0.80	0.400	0.045	36	90
7	8.00	2	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	3.1	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.116	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.20	0.000	0.000	0	54
8	8.40	8	sandy silt		0	30	99	1.65	1.00	0.95	1.0	12.5	157	104	0.99	12.4	5.4	17.74	0.92	0.117	1.00	1.00	0.181	0.181	1.54	0.20	0.632	0.007	0.40	0.003	0.002	1	54
9	9.40	3	silty sand		0	30	99	1.65	1.00	1.00	1.0	5.0	176	113	0.93	4.6	5.4	9.99	0.90	0.119	1.00	0.99	0.118	0.117	0.98	0.47	0.914	0.045	1.00	0.045	0.021	21	53
10	10.40	5	sandy silt		0	30	99	1.65	1.00	1.00	1.0	8.3	195	122	0.90	7.4	5.4	12.78	0.89	0.120	1.00	0.98	0.138	0.136	1.13	0.35	0.837	0.017	1.00	0.017	0.007	7	32
11	12.00	4	sandy silt		0	30	99	1.65	1.00	1.00	1.0	6.6	225	137	0.84	5.5	5.4	10.89	0.87	0.121	1.00	0.97	0.124	0.121	1.00	0.43	0.893	0.034	1.60	0.055	0.015	24	25
12	13.00	20	sandy silt		0	30	99	1.65	1.00	1.00	1.0	33.0	244	146	0.88	29.1	5.4	34.45	0.85	0.120	1.00	0.91	0.992	0.900	2.00	0.02	-0.397	0.000	1.00	0.000	0.000	0	0
13	14.60	13	sandy silt		0	30	99	1.65	1.00	1.00	1.0	21.5	274	161	0.82	17.6	5.4	22.95	0.83	0.120	1.00	0.93	0.248	0.231	1.93	0.11	0.354	0.001	1.60	0.002	0.000	0	0
14	15.50	55	sandy gravel		0	5	99	1.65	1.00	1.00	1.0	90.8	292	169	0.87	79.3	0.0	79.27	0.82	0.119	1.00	0.85	2.000	1.697	2.00	0.00	-4.130	0.000	0.90	0.000	0.000	0	0







Ultimate Limit State (ULS): M7.5, 0.35g peak horizontal ground acceleration

Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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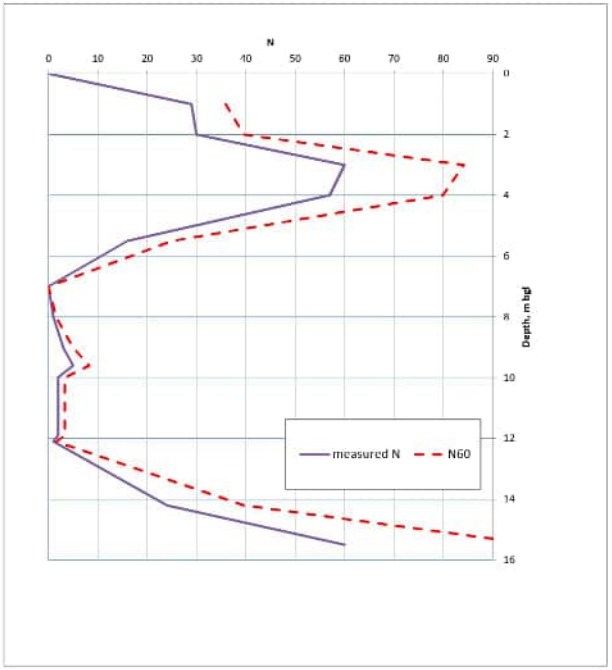
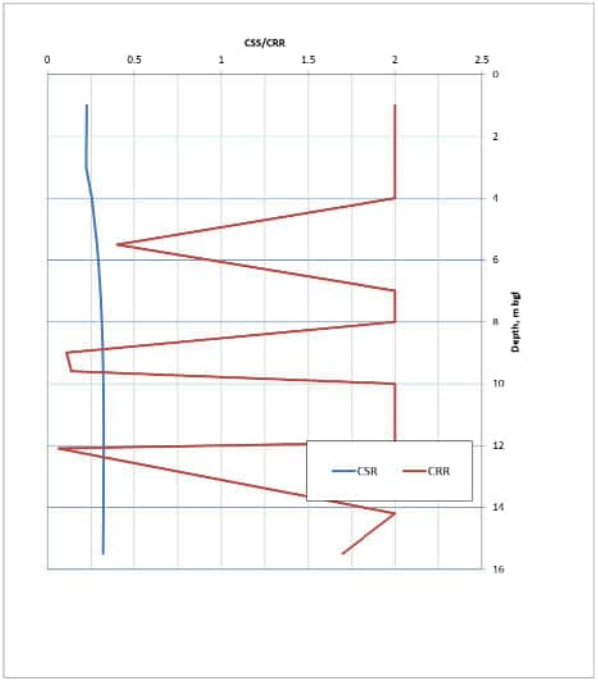
ULS event - (Settlement is limited to the top 10m)

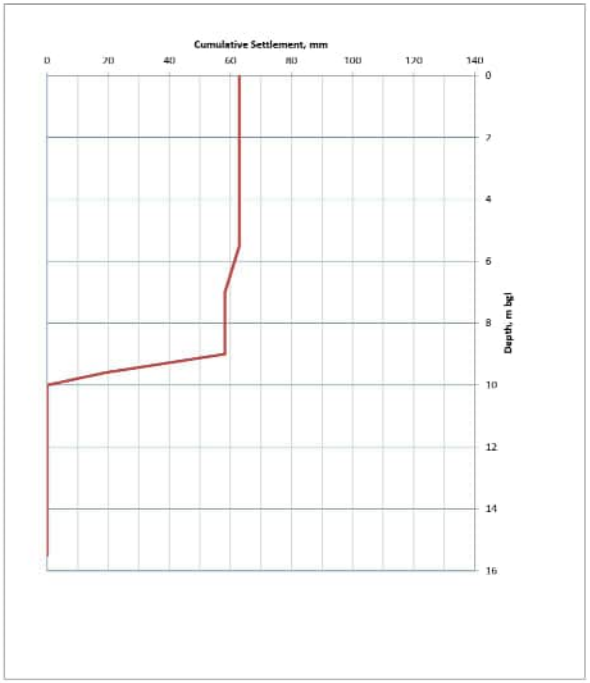
BH001

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.826		S=	63	
0	0	0																															
1	1.00	29	gravel fill	0	Unsat	5	99	1.65	1.00	0.75	1.0	35.9	18	18	1.70	61.0	0.0	61.01	1.00	0.227	1.00	1.10	2.000	2.000	2.00	0.00	-2.510	0.000	0.00	0.000	0.000	0	63
2	2.00	30	gravel fill	0	Unsat	5	99	1.65	1.00	0.80	1.0	39.6	36	36	1.36	54.0	0.0	54.00	0.99	0.225	1.00	1.10	2.000	2.000	2.00	0.00	-1.918	0.000	0.00	0.000	0.000	0	63
3	3.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.223	1.00	1.10	2.000	2.000	2.00	0.00	5.994	0.000	0.00	0.000	0.000	0	63
4	4.00	57	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	79.9	73	63	1.13	90.4	0.0	90.44	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-5.164	0.000	1.00	0.000	0.000	0	63
5	5.50	16	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	25.1	102	77	1.11	28.0	0.0	27.96	0.96	0.287	1.00	1.05	0.382	0.401	1.40	0.06	0.046	0.015	1.50	0.022	0.003	5	63
6	7.00	0	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	0.0	130	91	1.09	N.A.	n.a.	n.a.	0.94	0.305	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	58
7	8.00	1	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	1.6	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	58
8	9.00	3	silty sand	0	0	20	99	1.65	1.00	1.00	1.0	5.0	168	109	0.95	4.7	4.5	9.20	0.91	0.319	1.00	0.99	0.113	0.112	0.35	0.50	0.929	0.500	1.00	0.500	0.039	39	58
9	9.60	5	silty sand	0	0	30	99	1.65	1.00	1.00	1.0	8.3	179	115	0.93	7.7	5.4	13.04	0.90	0.321	1.00	0.99	0.140	0.139	0.43	0.34	0.878	0.340	0.60	0.704	0.037	19	19
10	10.00	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	187	118	0.90	N.A.	n.a.	n.a.	0.90	0.322	1.00	0.99	n.a.	2.000	2.00	0.00	0.000	0.000	0.40	0.000	0.000	0	0
11	11.90	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	223	136	0.83	N.A.	n.a.	n.a.	0.87	0.325	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	1.90	0.000	0.000	0	0
12	12.10	1	sand	0	0	5	99	1.65	1.00	1.00	1.0	1.7	227	138	0.81	1.3	0.0	1.31	0.87	0.325	1.00	0.98	0.067	0.066	0.20	0.50	0.948	0.500	0.20	0.100	0.078	0	0
13	14.70	24	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	39.6	267	157	0.88	N.A.	n.a.	n.a.	0.83	0.323	1.00	0.87	n.a.	2.000	2.00	0.00	0.000	0.000	2.10	0.000	0.000	0	0
14	15.50	60	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	99.0	292	169	0.87	86.5	0.0	86.48	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-4.794	0.000	1.30	0.000	0.000	0	0







Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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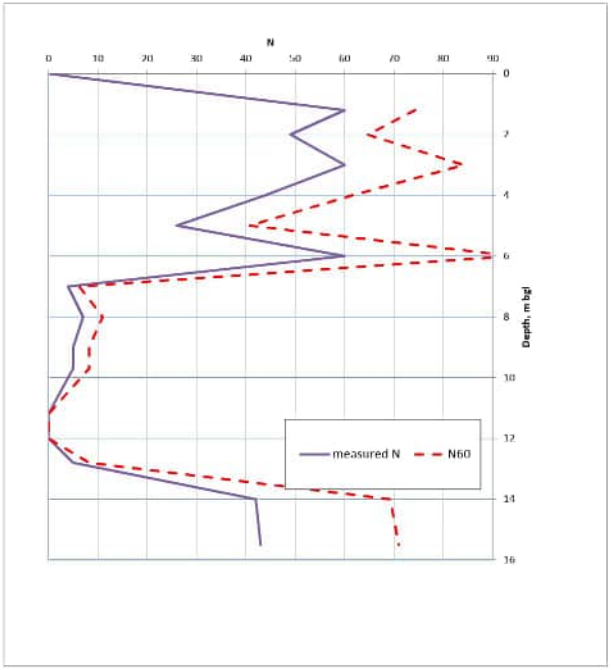
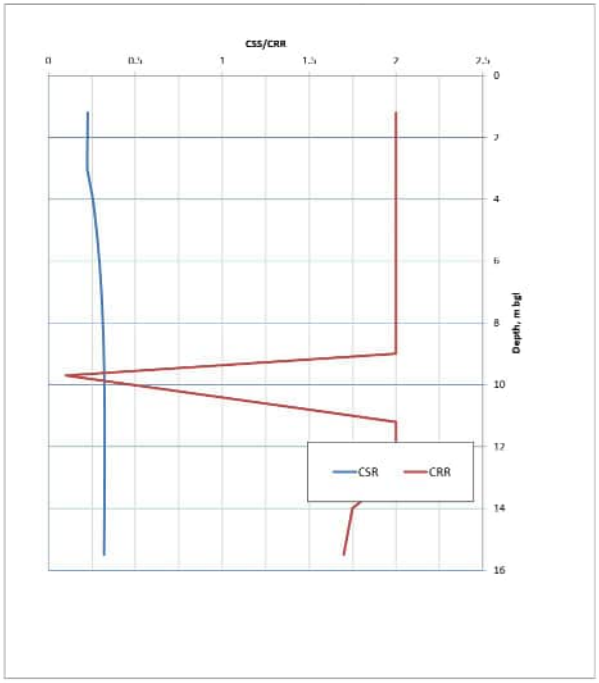
ULS event - (Settlement is limited to the top 10m)

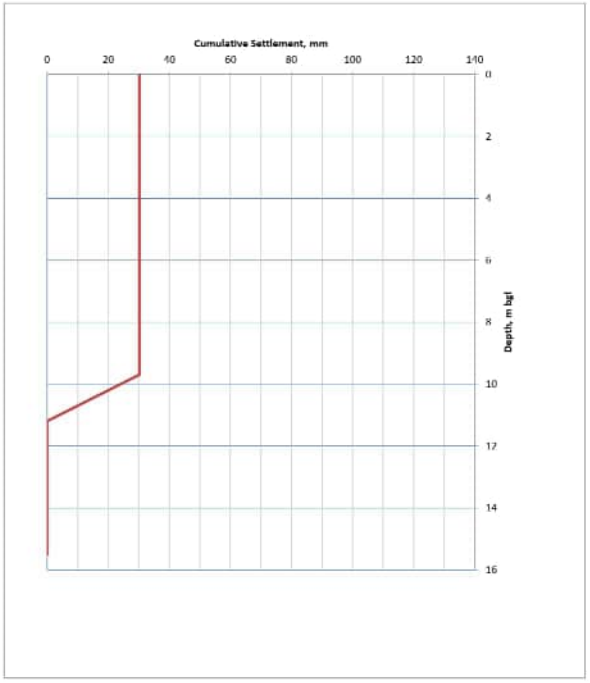
BH002

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.350		S=	30	
0	0	0																															
1	1.20	60	gravel fill	0	Unsat	5	99	1.65	1.00	0.75	1.0	74.3	22	22	1.50	111.4	0.0	111.42	1.00	0.227	1.00	1.10	2.000	2.000	2.00	0.00	-7.169	0.000	0.00	0.000	0.000	0	30
2	2.00	49	sandy gravel	0	Unsat	5	99	1.65	1.00	0.80	1.0	64.7	36	36	1.31	84.8	0.0	84.85	0.99	0.225	1.00	1.10	2.000	2.000	2.00	0.00	-4.643	0.000	0.00	0.000	0.000	0	30
3	3.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.223	1.00	1.10	2.000	2.000	2.00	0.00	-5.994	0.000	0.00	0.000	0.000	0	30
4	4.00	44	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	61.7	73	63	1.13	69.8	0.0	69.82	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-3.279	0.000	1.00	0.000	0.000	0	30
5	5.00	26	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	40.8	92	72	1.10	44.9	0.0	44.95	0.96	0.278	1.00	1.10	2.000	2.000	2.00	0.00	-1.185	0.000	1.00	0.000	0.000	0	30
6	6.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	94.1	111	82	1.06	99.5	0.0	99.49	0.95	0.294	1.00	1.06	2.000	2.000	2.00	0.00	-6.019	0.000	1.00	0.000	0.000	0	30
7	7.00	4	wood	clay	Clay	50	99	1.65	1.00	0.95	1.0	6.3	130	91	1.07	N.A.	n.a.	n.a.	0.94	0.305	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
8	8.00	7	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	11.0	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
9	9.00	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	168	109	0.96	N.A.	n.a.	n.a.	0.91	0.319	1.00	0.98	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
10	9.70	5	sand	0	0	5	99	1.65	1.00	1.00	1.0	8.3	181	116	0.93	7.6	0.0	7.65	0.90	0.321	1.00	0.99	0.102	0.101	0.31	0.50	0.946	0.500	0.70	0.350	0.043	43	30
11	11.20	0	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	210	129	0.82	N.A.	n.a.	n.a.	0.88	0.324	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	0
12	12.00	0	peaty silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	225	137	0.79	N.A.	n.a.	n.a.	0.87	0.325	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
13	12.80	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	240	144	0.87	N.A.	n.a.	n.a.	0.86	0.324	1.00	0.90	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
14	14.00	42	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	69.3	263	155	0.89	61.9	0.0	61.91	0.84	0.323	1.00	0.87	2.000	1.747	2.00	0.00	-2.587	0.000	1.20	0.000	0.000	0	0
15	15.50	43	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	71.0	292	169	0.87	62.0	0.0	61.98	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-2.593	0.000	1.50	0.000	0.000	0	0







Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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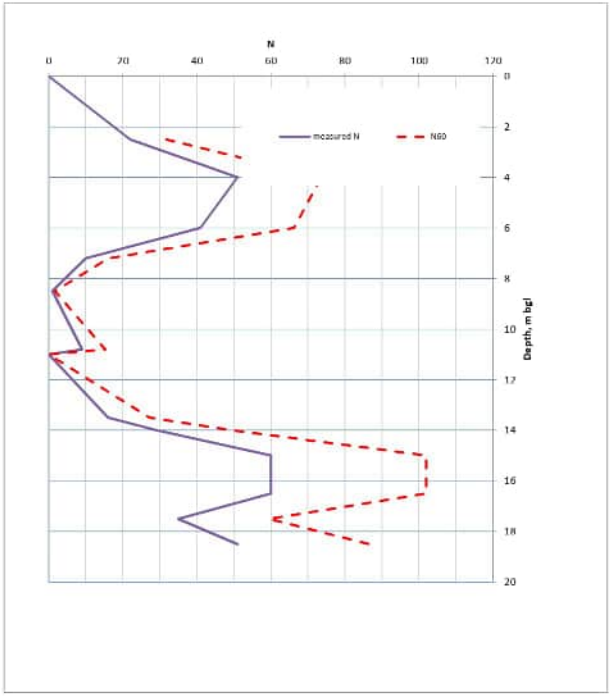
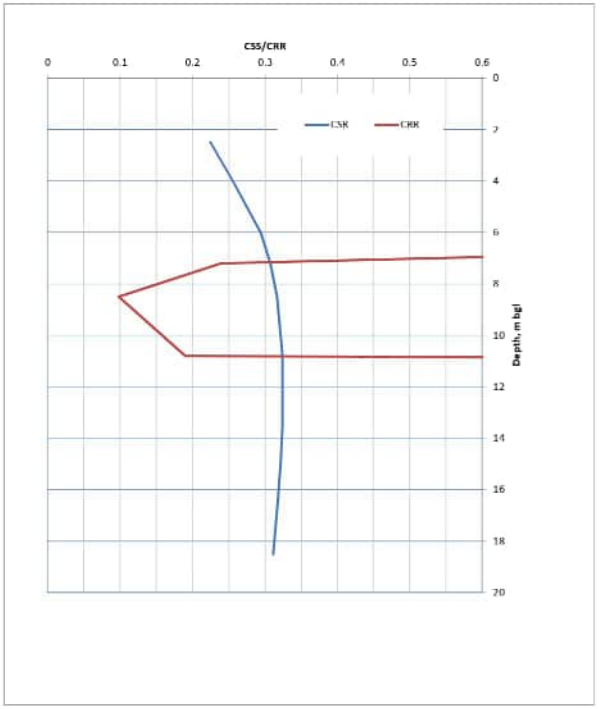
ULS event - (Settlement is limited to the top 10m)

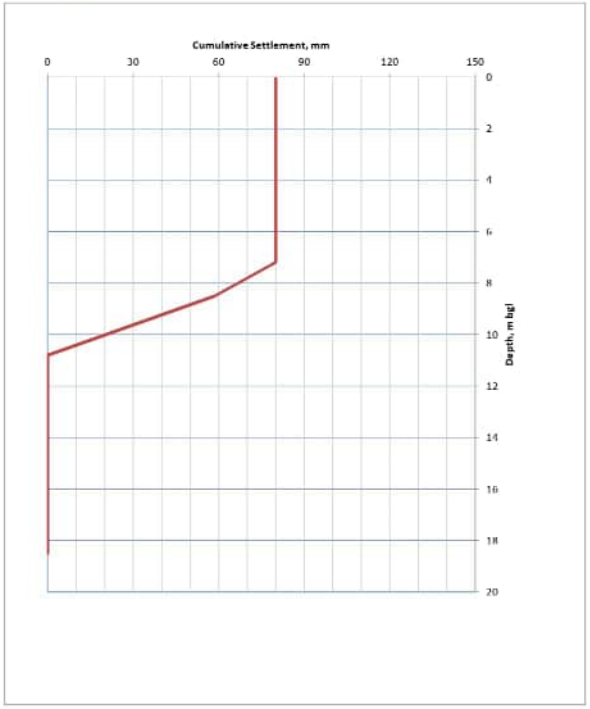
BH003

Corner of Lots 8, 11 & 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	1.134		S=	80	
0	0	0																															
1	2.50	22	sandy gravel	0	Unsat	5	102	1.70	1.00	0.85	1.0	31.8	45	45	1.33	42.2	0.0	42.22	0.99	0.224	1.00	1.10	2.000	2.000	2.00	0.01	-0.973	0.000	0.00	0.000	0.000	0	80
2	4.00	51	sandy gravel	0	0	5	102	1.70	1.00	0.85	1.0	73.7	73	63	1.13	83.4	0.0	83.38	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-4.506	0.000	0.00	0.000	0.000	0	80
3	6.00	41	sandy gravel	0	0	5	102	1.70	1.00	0.95	1.0	66.2	111	82	1.06	70.0	0.0	70.05	0.95	0.294	1.00	1.06	2.000	2.000	2.00	0.00	-3.799	0.000	0.00	0.000	0.000	0	80
4	7.20	10	silty sand	0	0	30	102	1.70	1.00	0.95	1.0	16.2	134	93	1.04	16.8	5.4	22.19	0.93	0.307	1.00	1.01	0.236	0.239	0.78	0.12	0.397	0.068	1.20	0.081	0.018	21	80
5	8.50	1	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	1.7	159	105	0.98	1.7	5.4	7.02	0.92	0.316	1.00	1.00	0.098	0.098	0.31	0.50	0.948	0.500	1.30	0.650	0.045	58	59
6	10.80	9	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	15.3	202	126	0.90	13.8	5.4	19.13	0.88	0.324	1.00	0.97	0.196	0.190	0.59	0.18	0.563	0.175	2.30	0.403	0.074	0	0
7	11.00	0	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	0.0	206	128	0.83	N.A.	n.a.	n.a.	0.88	0.324	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	0.20	0.000	0.000	0	0
8	13.50	16	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	27.2	254	150	0.86	N.A.	n.a.	n.a.	0.84	0.324	1.00	0.88	n.a.	2.000	2.00	0.00	0.000	0.000	2.50	0.000	0.000	0	0
9	14.00	29	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	49.3	263	155	0.89	44.0	5.4	49.40	0.84	0.323	1.00	0.87	2.000	1.747	2.00	0.00	1.540	0.000	0.50	0.000	0.000	0	0
10	15.00	60	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	102.0	282	164	0.88	89.7	0.0	89.75	0.87	0.321	1.00	0.86	2.000	1.713	2.00	0.00	5.098	0.000	1.00	0.000	0.000	0	0
11	16.50	60	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	102.0	311	178	0.86	87.9	0.0	87.86	0.80	0.317	1.00	0.83	2.000	1.666	2.00	0.00	4.923	0.000	1.50	0.000	0.000	0	0
12	17.50	35	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	59.5	330	187	0.85	50.6	0.0	50.58	0.79	0.314	1.00	0.82	2.000	1.636	2.00	0.00	1.636	0.000	1.00	0.000	0.000	0	0
13	18.50	51	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	86.7	349	196	0.84	72.8	0.0	72.78	0.77	0.311	1.00	0.80	2.000	1.608	2.00	0.00	3.543	0.000	2.00	0.000	0.000	0	0







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Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

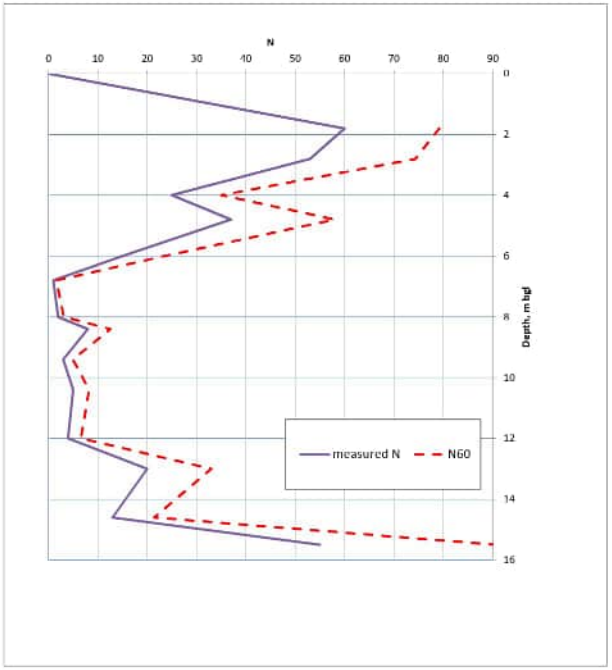
Magnitude scaling factor, MSF = 1.00

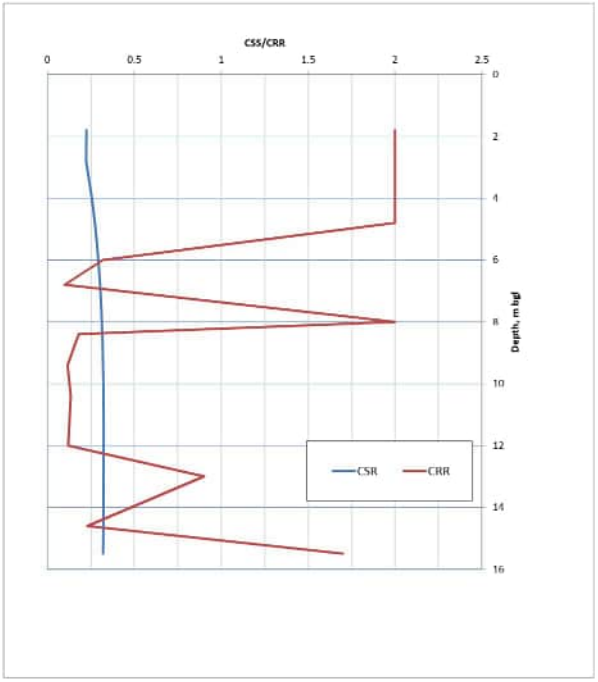
ULS event - (Settlement is limited to the top 10m)

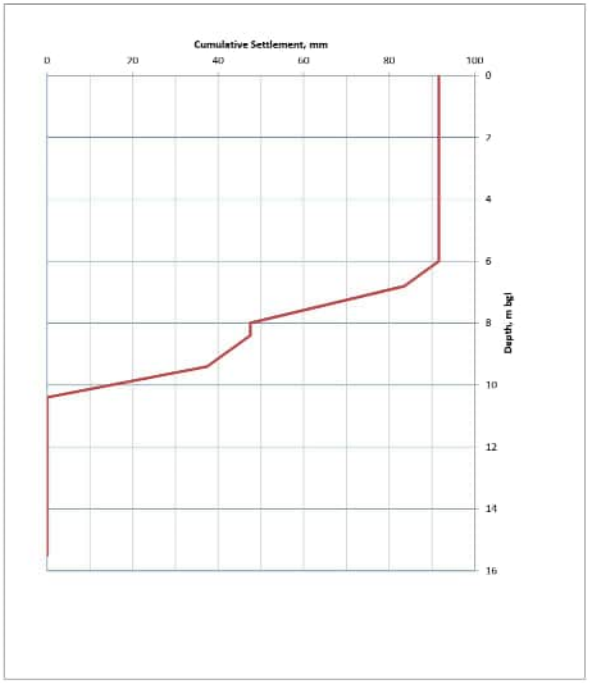
BH-G

370177 - Lot 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	2.154		S=	92	
0	0	0																															
1	1.80	60	sandy gravel	0	Unsat	5	99	1.65	1.00	0.80	1.0	79.2	32	32	1.35	106.8	0.0	106.82	0.99	0.226	1.00	1.10	2.000	2.000	2.00	0.00	6.723	0.000	0.00	0.000	0.000	0	92
2	2.80	53	sandy gravel	0	Unsat	5	99	1.65	1.00	0.85	1.0	74.3	50	50	1.20	89.3	0.0	89.25	0.98	0.224	1.00	1.10	2.000	2.000	2.00	0.00	-5.052	0.000	0.00	0.000	0.000	0	92
3	4.00	25	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	35.1	73	63	1.17	40.9	0.0	40.92	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.01	0.874	0.000	1.00	0.000	0.000	0	92
4	4.80	37	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	58.0	88	71	1.10	63.7	0.0	63.74	0.96	0.274	1.00	1.10	2.000	2.000	2.00	0.00	-2.746	0.000	0.80	0.000	0.000	0	92
5	6.00	15	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	23.5	111	87	1.09	25.7	0.0	25.68	0.95	0.294	1.00	1.04	0.307	0.318	1.08	0.08	0.190	0.029	1.20	0.035	0.007	8	92
6	6.80	1	sandy silt	0	0	30	99	1.65	1.00	0.95	1.0	1.6	126	89	1.09	1.7	5.4	7.07	0.94	0.303	1.00	1.01	0.099	0.100	0.33	0.50	0.948	0.500	0.80	0.400	0.045	36	84
7	8.00	2	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	3.1	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.20	0.000	0.000	0	48
8	8.40	8	sandy silt	0	0	30	99	1.65	1.00	0.95	1.0	12.5	157	104	0.99	12.4	5.4	17.74	0.92	0.316	1.00	1.00	0.181	0.181	0.57	0.20	0.632	0.204	0.40	0.082	0.025	10	48
9	9.40	3	silty sand	0	0	30	99	1.65	1.00	1.00	1.0	5.0	176	113	0.93	4.6	5.4	9.99	0.90	0.320	1.00	0.99	0.118	0.117	0.36	0.47	0.914	0.474	1.00	0.474	0.037	37	37
10	10.40	5	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	8.3	195	122	0.90	7.4	5.4	12.78	0.89	0.323	1.00	0.98	0.138	0.136	0.42	0.35	0.837	0.350	1.00	0.350	0.032	0	0
11	12.00	4	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	6.6	225	137	0.84	5.5	5.4	10.89	0.87	0.325	1.00	0.97	0.124	0.121	0.37	0.43	0.893	0.429	1.60	0.687	0.036	0	0
12	13.00	20	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	33.0	244	146	0.88	29.1	5.4	34.45	0.85	0.324	1.00	0.91	0.992	0.900	2.00	0.02	-0.397	0.000	1.00	0.000	0.000	0	0
13	14.60	13	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	21.5	274	161	0.82	17.6	5.4	22.95	0.83	0.322	1.00	0.93	0.248	0.231	0.72	0.11	0.354	0.080	1.60	0.127	0.020	0	0
14	15.50	55	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	90.8	292	169	0.87	79.3	0.0	79.27	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-4.130	0.000	0.90	0.000	0.000	0	0







Input Parameters

Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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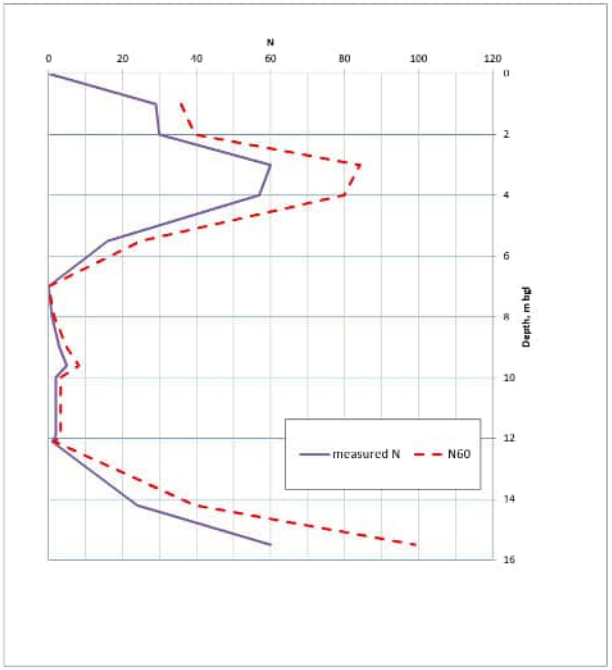
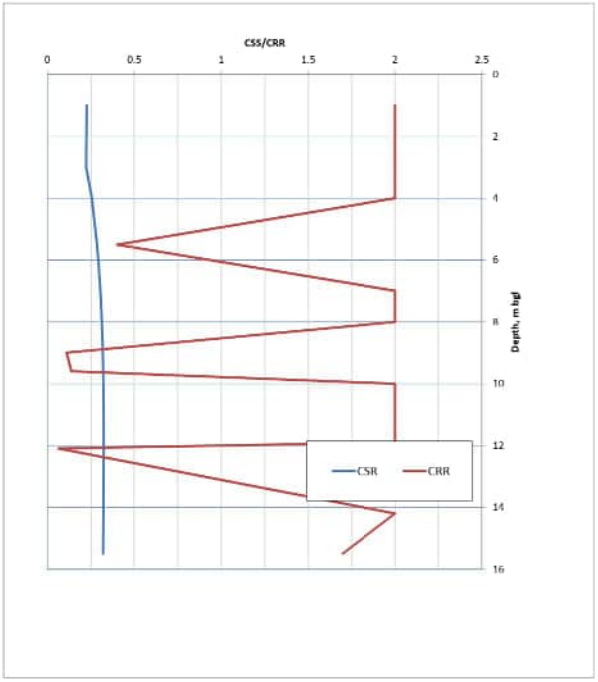
ULS event - (Settlement along full investigated depth)

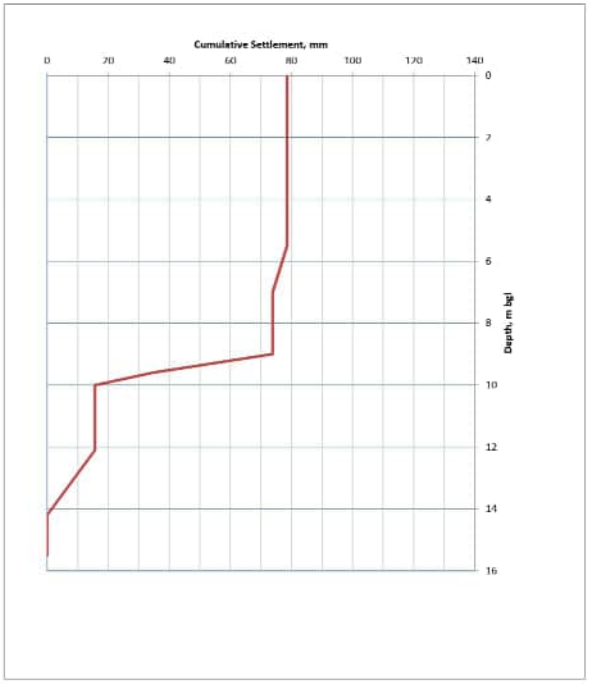
BH001

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.826	S=	79	
0	0	0																															
1	1.00	29	gravel fill	0	Unsat	5	99	1.65	1.00	0.75	1.0	35.9	18	18	1.70	61.0	0.0	61.01	1.00	0.227	1.00	1.10	2.000	2.000	2.00	0.00	-2.510	0.000	0.00	0.000	0.000	0	79
2	2.00	30	gravel fill	0	Unsat	5	99	1.65	1.00	0.80	1.0	39.6	36	36	1.36	54.0	0.0	54.00	0.99	0.225	1.00	1.10	2.000	2.000	2.00	0.00	-1.918	0.000	0.00	0.000	0.000	0	79
3	3.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.223	1.00	1.10	2.000	2.000	2.00	0.00	5.994	0.000	0.00	0.000	0.000	0	79
4	4.00	57	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	79.9	73	63	1.13	90.4	0.0	90.44	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-5.164	0.000	1.00	0.000	0.000	0	79
5	5.50	16	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	25.1	102	77	1.11	28.0	0.0	27.96	0.96	0.287	1.00	1.05	0.382	0.401	1.40	0.06	0.046	0.015	1.50	0.022	0.003	5	79
6	7.00	0	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	0.0	130	91	1.09	N.A.	n.a.	n.a.	0.94	0.305	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	74
7	8.00	1	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	1.6	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	74
8	9.00	3	silty sand	0	0	20	99	1.65	1.00	1.00	1.0	5.0	168	109	0.95	4.7	4.5	9.20	0.91	0.319	1.00	0.99	0.113	0.112	0.35	0.50	0.929	0.500	1.00	0.500	0.039	39	74
9	9.60	5	silty sand	0	0	30	99	1.65	1.00	1.00	1.0	8.3	179	115	0.93	7.7	5.4	13.04	0.90	0.321	1.00	0.99	0.140	0.139	0.43	0.34	0.828	0.340	0.60	0.204	0.032	19	35
10	10.00	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	187	118	0.90	N.A.	n.a.	n.a.	0.90	0.322	1.00	0.95	n.a.	2.000	2.00	0.00	0.000	0.000	0.40	0.000	0.000	0	16
11	11.90	2	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	3.3	223	136	0.83	N.A.	n.a.	n.a.	0.87	0.325	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	1.90	0.000	0.000	0	16
12	12.10	1	sand	0	0	5	99	1.65	1.00	1.00	1.0	1.7	227	138	0.81	1.3	0.0	1.31	0.87	0.325	1.00	0.98	0.067	0.066	0.20	0.50	0.948	0.500	0.20	0.100	0.078	16	16
13	14.20	24	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	39.6	267	157	0.88	N.A.	n.a.	n.a.	0.83	0.323	1.00	0.87	n.a.	2.000	2.00	0.00	0.000	0.000	2.10	0.000	0.000	0	0
14	15.50	60	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	99.0	292	169	0.87	86.5	0.0	86.48	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-4.794	0.000	1.30	0.000	0.000	0	0







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Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

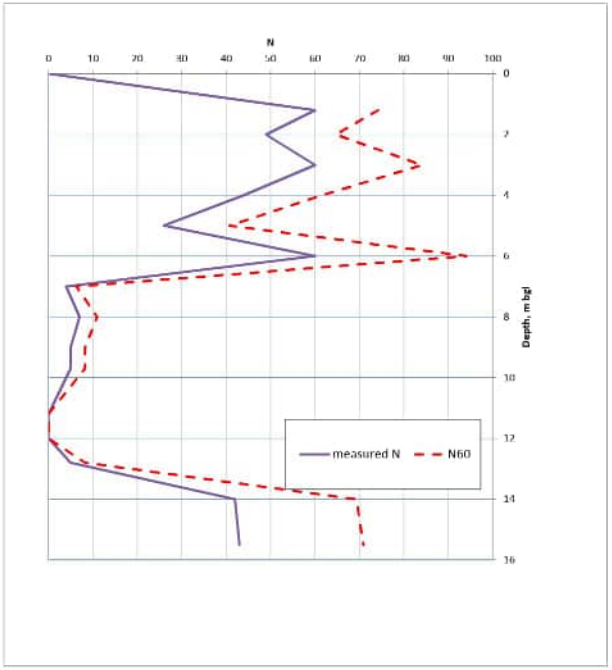
Magnitude scaling factor, MSF = 1.00

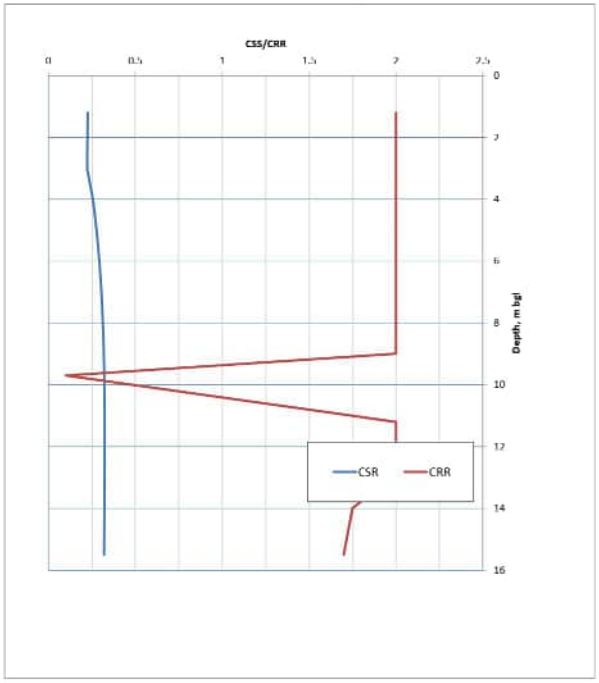
ULS event - (Settlement along full investigated depth)

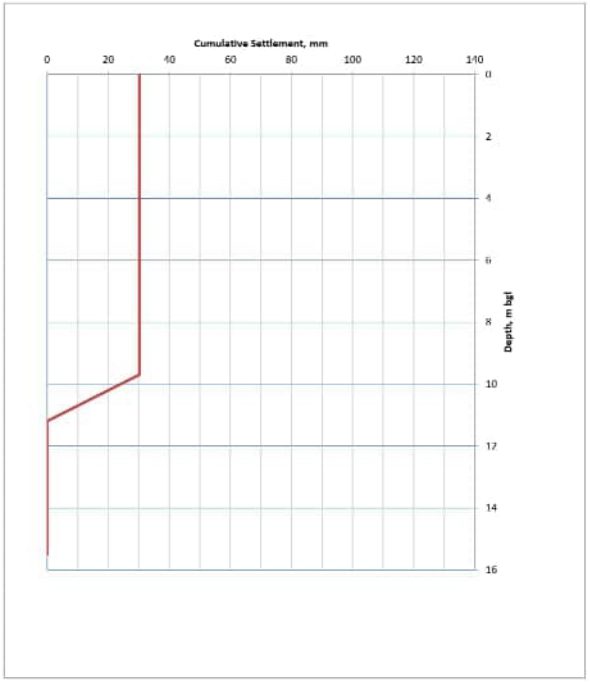
BH002

381322 - Lots 9 & 10 - Wigram Business Park

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	0.350		S=	30	
0	0	0																															
1	1.20	60	gravel fill	0	Unsat	5	99	1.65	1.00	0.75	1.0	74.3	22	22	1.50	111.4	0.0	111.42	1.00	0.227	1.00	1.10	2.000	2.000	2.00	0.00	-7.169	0.000	0.00	0.000	0.000	0	30
2	2.00	49	sandy gravel	0	Unsat	5	99	1.65	1.00	0.80	1.0	64.7	36	36	1.31	84.8	0.0	84.85	0.99	0.225	1.00	1.10	2.000	2.000	2.00	0.00	-4.643	0.000	0.00	0.000	0.000	0	30
3	3.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	84.2	54	54	1.18	99.2	0.0	99.22	0.98	0.223	1.00	1.10	2.000	2.000	2.00	0.00	-5.994	0.000	0.00	0.000	0.000	0	30
4	4.00	44	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	61.7	73	63	1.13	69.8	0.0	69.82	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-3.279	0.000	1.00	0.000	0.000	0	30
5	5.00	26	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	40.8	92	72	1.10	44.9	0.0	44.95	0.96	0.278	1.00	1.10	2.000	2.000	2.00	0.00	-1.185	0.000	1.00	0.000	0.000	0	30
6	6.00	60	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	94.1	111	82	1.06	99.5	0.0	99.49	0.95	0.294	1.00	1.06	2.000	2.000	2.00	0.00	-6.019	0.000	1.00	0.000	0.000	0	30
7	7.00	4	wood	clay	Clay	50	99	1.65	1.00	0.95	1.0	6.3	130	91	1.07	N.A.	n.a.	n.a.	0.94	0.305	1.00	1.03	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
8	8.00	7	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	11.0	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
9	9.00	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	168	109	0.96	N.A.	n.a.	n.a.	0.91	0.319	1.00	0.98	n.a.	2.000	2.00	0.00	0.000	0.000	1.00	0.000	0.000	0	30
10	9.70	5	sand	0	0	5	99	1.65	1.00	1.00	1.0	8.3	181	116	0.93	7.6	0.0	7.65	0.90	0.321	1.00	0.99	0.102	0.101	0.31	0.50	0.946	0.500	0.70	0.350	0.043	43	30
11	11.20	0	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	210	129	0.82	N.A.	n.a.	n.a.	0.88	0.324	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	1.50	0.000	0.000	0	0
12	12.00	0	peaty silt	silt	clay	50	99	1.65	1.00	1.00	1.0	0.0	225	137	0.79	N.A.	n.a.	n.a.	0.87	0.325	1.00	0.91	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
13	12.80	5	silt	silt	clay	50	99	1.65	1.00	1.00	1.0	8.3	240	144	0.82	N.A.	n.a.	n.a.	0.86	0.324	1.00	0.90	n.a.	2.000	2.00	0.00	0.000	0.000	0.80	0.000	0.000	0	0
14	14.00	42	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	69.3	263	155	0.89	61.9	0.0	61.91	0.84	0.323	1.00	0.87	2.000	1.747	2.00	0.00	-2.587	0.000	1.20	0.000	0.000	0	0
15	15.50	43	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	71.0	292	169	0.87	62.0	0.0	61.98	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-2.593	0.000	1.50	0.000	0.000	0	0







Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

Magnitude scaling factor, MSF = 1.00

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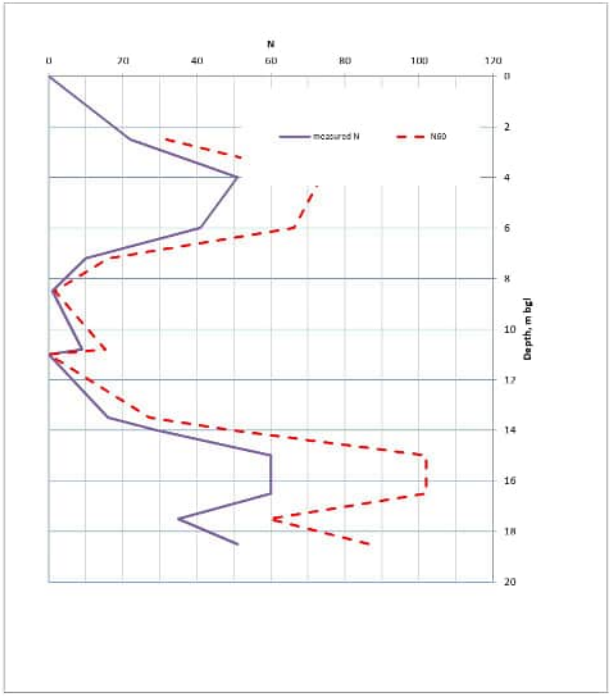
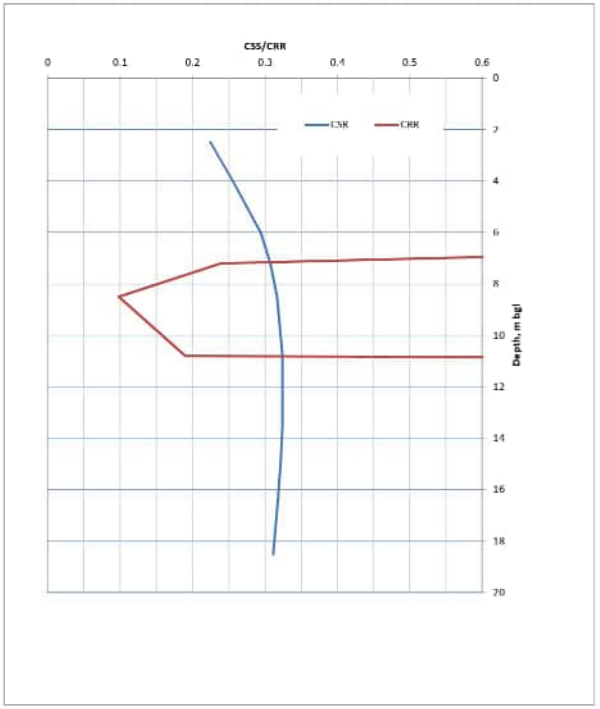
ULS event - (Settlement along full investigated depth)

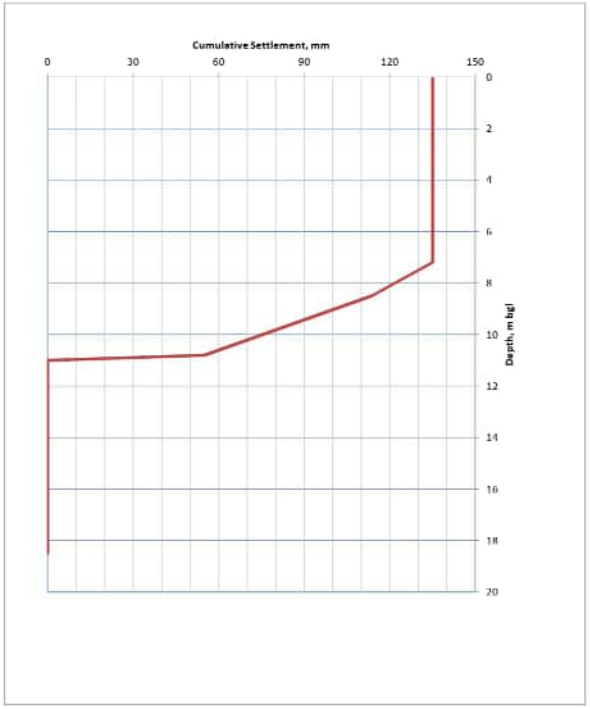
BH003

Corner of Lots 8, 11 & 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	1.134		S=	135	
0	0	0																															
1	2.50	22	sandy gravel	0	Unsat	5	102	1.70	1.00	0.85	1.0	31.8	45	45	1.33	42.2	0.0	42.22	0.99	0.224	1.00	1.10	2.000	2.000	2.00	0.01	-0.973	0.000	0.00	0.000	0.000	0	135
2	4.00	51	sandy gravel	0	0	5	102	1.70	1.00	0.85	1.0	73.7	73	63	1.13	83.4	0.0	83.38	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.00	-4.506	0.000	0.00	0.000	0.000	0	135
3	6.00	41	sandy gravel	0	0	5	102	1.70	1.00	0.95	1.0	66.2	111	82	1.06	70.0	0.0	70.05	0.95	0.294	1.00	1.06	2.000	2.000	2.00	0.00	-3.799	0.000	0.00	0.000	0.000	0	135
4	7.20	10	silty sand	0	0	30	102	1.70	1.00	0.95	1.0	16.2	134	93	1.04	16.8	5.4	22.19	0.93	0.307	1.00	1.01	0.236	0.239	0.78	0.12	0.397	0.068	1.20	0.081	0.018	21	135
5	8.50	1	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	1.7	159	105	0.98	1.7	5.4	7.02	0.92	0.316	1.00	1.00	0.098	0.098	0.31	0.50	0.948	0.500	1.30	0.650	0.045	58	114
6	10.80	9	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	15.3	202	126	0.90	13.8	5.4	19.13	0.88	0.324	1.00	0.97	0.196	0.190	0.59	0.18	0.563	0.175	2.30	0.403	0.024	55	55
7	11.00	0	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	0.0	206	128	0.83	N.A.	n.a.	n.a.	0.88	0.324	1.00	0.93	n.a.	2.000	2.00	0.00	0.000	0.000	0.20	0.000	0.000	0	0
8	13.50	16	silt	silt	clay	50	102	1.70	1.00	1.00	1.0	27.2	254	150	0.86	N.A.	n.a.	n.a.	0.84	0.324	1.00	0.88	n.a.	2.000	2.00	0.00	0.000	0.000	2.50	0.000	0.000	0	0
9	14.00	29	silty sand	0	0	30	102	1.70	1.00	1.00	1.0	49.3	263	155	0.89	44.0	5.4	49.40	0.84	0.323	1.00	0.87	2.000	1.747	2.00	0.00	1.540	0.000	0.50	0.000	0.000	0	0
10	15.00	60	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	102.0	282	164	0.88	89.7	0.0	89.75	0.87	0.321	1.00	0.86	2.000	1.713	2.00	0.00	5.098	0.000	1.00	0.000	0.000	0	0
11	16.50	60	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	102.0	311	178	0.86	87.9	0.0	87.86	0.80	0.317	1.00	0.83	2.000	1.666	2.00	0.00	4.923	0.000	1.50	0.000	0.000	0	0
12	17.50	35	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	59.5	330	187	0.85	50.6	0.0	50.58	0.79	0.314	1.00	0.82	2.000	1.636	2.00	0.00	1.636	0.000	1.00	0.000	0.000	0	0
13	18.50	51	sandy gravel	0	0	5	102	1.70	1.00	1.00	1.0	86.7	349	196	0.84	72.8	0.0	72.78	0.77	0.311	1.00	0.80	2.000	1.608	2.00	0.00	3.543	0.000	2.00	0.000	0.000	0	0







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Input Parameters	
Atmospheric pressure, Pa kPa	101
Peak ground acceleration, pga =	0.35
Earthquake magnitude, M=	7.5
Water table depth, m =	3.0
Average γ_T above water table, kN/m3 =	18.0
Average γ_T below water table, kN/m3 =	19.0
Borehole diameter (mm)	70
Requires correction for sample liners (Yes/No)	No
Rod Lengths (m)	1.5

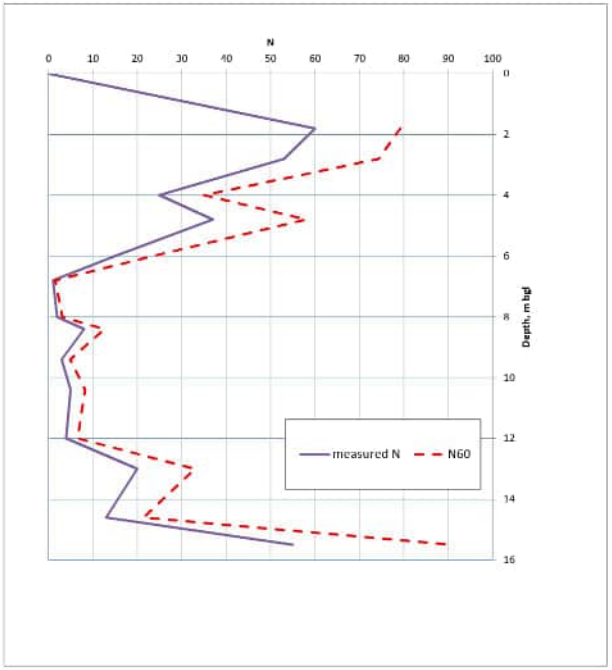
Magnitude scaling factor, MSF = 1.00

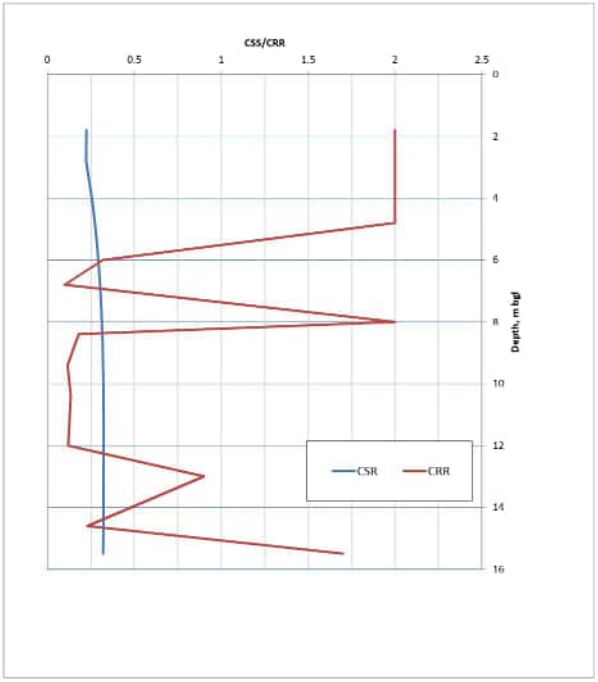
ULS event - (Settlement along full investigated depth)

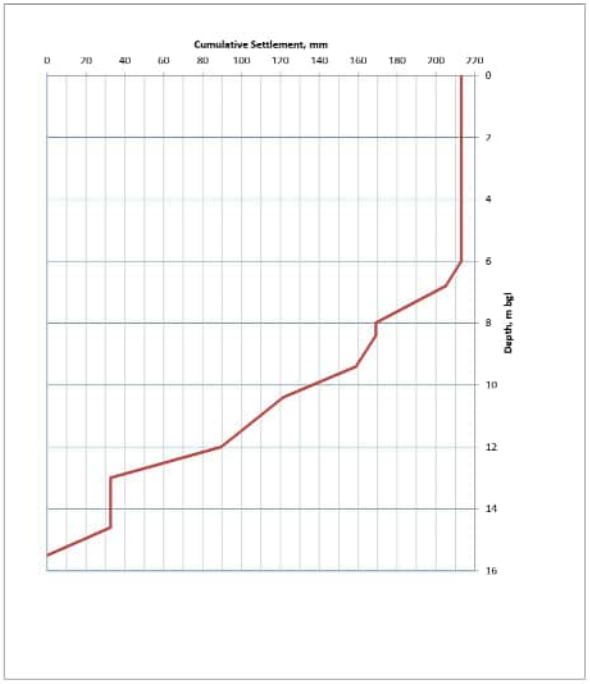
BH-G

370177 - Lot 16 - Hayton Road - Stage 1

SPT sample number	Depth to bottom of layer (m)	measured N	Description	Soil Classification	Flag "Clay" "Unsat" "Unreliable"	Fines Content (%)	Energy Ratio (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	Stress reduction coeff, r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	FOS	Limiting shear strain, γ_{lim}	F_α	Max shear strain, γ_{max}	ΔH_{liq} (m)	ΔLDI (m)	Vertical reconsolidation strain, ε_v	Settlement, ΔS_1 (mm)	Cumulative settlement, ΣS (mm)
																													ΣLDI=	2.154		S=	213	
0	0	0																															
1	1.80	60	sandy gravel	0	Unsat	5	99	1.65	1.00	0.80	1.0	79.2	32	32	1.35	106.8	0.0	106.82	0.99	0.226	1.00	1.10	2.000	2.000	2.00	0.00	6.723	0.000	0.00	0.000	0.000	0	213
2	2.80	53	sandy gravel	0	Unsat	5	99	1.65	1.00	0.85	1.0	74.3	50	50	1.20	89.3	0.0	89.25	0.98	0.224	1.00	1.10	2.000	2.000	2.00	0.00	-5.052	0.000	0.00	0.000	0.000	0	213
3	4.00	25	sandy gravel	0	0	5	99	1.65	1.00	0.85	1.0	35.1	73	63	1.17	40.9	0.0	40.92	0.97	0.255	1.00	1.10	2.000	2.000	2.00	0.01	0.874	0.000	1.00	0.000	0.000	0	213
4	4.80	37	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	58.0	88	71	1.10	63.7	0.0	63.74	0.96	0.274	1.00	1.10	2.000	2.000	2.00	0.00	-2.746	0.000	0.80	0.000	0.000	0	213
5	6.00	15	sandy gravel	0	0	5	99	1.65	1.00	0.95	1.0	23.5	111	87	1.09	25.7	0.0	25.68	0.95	0.294	1.00	1.04	0.307	0.318	1.08	0.08	0.190	0.029	1.20	0.035	0.007	8	213
6	6.80	1	sandy silt	0	0	30	99	1.65	1.00	0.95	1.0	1.6	126	89	1.09	1.7	5.4	7.07	0.94	0.303	1.00	1.01	0.099	0.100	0.33	0.50	0.948	0.500	0.80	0.400	0.045	36	205
7	8.00	2	silt	silt	clay	50	99	1.65	1.00	0.95	1.0	3.1	149	100	1.01	N.A.	n.a.	n.a.	0.92	0.313	1.00	1.00	n.a.	2.000	2.00	0.00	0.000	0.000	1.20	0.000	0.000	0	169
8	8.40	8	sandy silt	0	0	30	99	1.65	1.00	0.95	1.0	12.5	157	104	0.99	12.4	5.4	17.74	0.92	0.316	1.00	1.00	0.181	0.181	0.57	0.20	0.632	0.204	0.40	0.082	0.025	10	169
9	9.40	3	silty sand	0	0	30	99	1.65	1.00	1.00	1.0	5.0	176	113	0.93	4.6	5.4	9.99	0.90	0.320	1.00	0.99	0.118	0.117	0.36	0.47	0.914	0.474	1.00	0.474	0.037	37	159
10	10.40	5	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	8.3	195	122	0.90	7.4	5.4	12.78	0.89	0.323	1.00	0.98	0.138	0.136	0.42	0.35	0.837	0.350	1.00	0.350	0.032	32	122
11	12.00	4	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	6.6	225	137	0.84	5.5	5.4	10.89	0.87	0.325	1.00	0.97	0.124	0.121	0.37	0.43	0.893	0.429	1.60	0.687	0.036	57	89
12	13.00	20	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	33.0	244	146	0.88	29.1	5.4	34.45	0.85	0.324	1.00	0.91	0.992	0.900	2.00	0.02	-0.397	0.000	1.00	0.000	0.000	0	33
13	14.60	13	sandy silt	0	0	30	99	1.65	1.00	1.00	1.0	21.5	274	161	0.82	17.6	5.4	22.95	0.83	0.322	1.00	0.93	0.248	0.231	0.72	0.11	0.354	0.080	1.60	0.127	0.020	33	33
14	15.50	55	sandy gravel	0	0	5	99	1.65	1.00	1.00	1.0	90.8	292	169	0.87	79.3	0.0	79.27	0.82	0.320	1.00	0.85	2.000	1.697	2.00	0.00	-4.130	0.000	0.90	0.000	0.000	0	0







GEOTECHNICAL FACTUAL REPORT

Lots 9 & 10, Wigram Business Park, Stage 1

For Stark Drive LP

25 September 2013

Eliot Sinclair

surveyors | engineers | planners

GEOTECHNICAL FACTUAL REPORT

Lots 9 & 10, Wigram Business Park, Stage 1

Eliot Sinclair
surveyors | engineers | planners

20 Troup Drive, Tower Junction | PO Box 9339
Christchurch 8149 | New Zealand | 03 379 4014

Prepared by:	Firas A. Salman Civil/Geotechnical Engineer	PhD, MSc, BSc, GIPENZ
Reviewed and approved for release by:	John Aramowicz Associate, Senior Civil/Geotechnical Engineer	BE(Hons), MIPENZ (1008112), CPEng, IntPE(NZ)

Date:	25 September 2013	
Reference:	381322_13259092456_Letter_jta.docx	
Status:	FINAL	
Distribution:	1 Original	Stark Drive LP
	File copy	Eliot Sinclair

Limitations: This report has been prepared according to the instructions from Stark Drive LP, for the particular objectives described in the report. The information contained in the report should not be used by anyone else or for any other purposes unless specifically authorised in writing by Eliot Sinclair.

Table of Contents

1. INTRODUCTION

Eliot Sinclair were engaged by Stark Drive LP to undertake a geotechnical investigation of Lots 9 & 10, Wigram Business Park, Stage 1 and prepare a geotechnical factual report.

2. SCOPE OF WORK

The scope of work for this geotechnical investigation was;

- Arrange for two deep boreholes with standard penetration testing (SPT) at 1m vertical intervals to 10m depth, and then 1.5m vertical intervals to the 15m target depth,
- Arrange for eight shallow boreholes with standard penetration testing (SPT) at 1m vertical intervals to the 4m target depth,
- Preparation of Geotechnical Factual Report.

3. DISCLAIMER

This Geotechnical Factual Report outlines the results of the recent shallow and deep testing.

Whilst every care was taken during our investigation of the subsurface conditions, there may be subsoil strata and features that were not detected.

This report has been prepared for the benefit of Stark Drive LP and the Christchurch City Council, in accordance with the Scope of Work.

No liability is accepted by Eliot Sinclair or any employee of Eliot Sinclair with respect to the use of this report by any other party, for any other purpose other than outlined in the Scope of Work.

4. SITE DESCRIPTION

4.1. Location

The site is located at the north corner of the former Wigram Airfield.

The site is described as Lots 9 & 10 and is located at the central part of Wigram Business Park Subdivision, Stage 1, and is bounded by Strak Drive to the west, Lodestar Avenue to the north, and undeveloped industrial lots on all other sides. Refer to Appendix A.

4.2. Topography

The site comprises flat topography.

4.3. Watercourses

The nearest watercourse, Paparua Stream, is located around 100m southwest of the site. Paparua Stream has its invert around 3m below surrounding ground level.

The former open drain adjacent to Hayton Road has now been piped and backfilled over.

5. SITE SPECIFIC INVESTIGATION

Two deep boreholes (to 15m target depth) and eight shallow boreholes (to 4m target depth) with standard penetration testing (SPT) at 1m centres to 10m depth, followed by 1.5m centres to 15m depth, were undertaken across the site near the corners of the proposed buildings.

Refer to Appendix B for test locations plan and Appendix C for site investigation results.

Appendix A : WIGRAM BUSINESS PARK – STAGE 1 PLAN

0 10 30 50 100 150 200 300

Original size mm

Pilkington Way

Vickerys Road

Hayton Road

Parkhouse Drive

Lodestar Avenue

Stark Drive

The Runway

Paparua Stream Diversion

Lot 1

Lot 2

Lot 3

Lot 4

Lot 5

Lot 6

Lot 7

Lot 8

Lot 9

Lot 10

Lot 11

Lot 12

Lot 13

Lot 14

Lot 15

Lot 16

Lot 17

0 40 80 120 160 240 320 400 metres

Scale Bar

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Unit 4, 502 Wairakei Road, PO Box 4597, Christchurch 8140, Phone: 03 379-4014, Fax: 03 365-2449, info@eliotsinclair.co.nz www.eliotsinclair.co.nz

Sheet 1 of 1 rev:

Drawing Set 347299 M4

PLOT PN 180228

Scale: 1:2000 (A3)
Date: 28/03/2013

NZGD 2000 (Post Quake)
Mt Pleasant GD2000

origin of levels
WIG1 Cors
Wigram Control Tower
71 Corsair Drive
RL : 48.29m
datum CDD (Jan 2012)

surveyed

surv. date

designed M A Allan
manager
drawn W Paulsen
checked

initial date

amendment

no.

Stage 1 Boundaries
Wigram Business Park
For Ngai Tahu Property Ltd.

[plotted: Thursday, March 28, 2013 12:21:34] [computer operator: wfp] [Project: G:\Jobs\99\993399\12d\surv\EW\SH\GEOTECH STAGE HAYTON\GEOTECH STAGE HAYTON]

Appendix B : GEOTECHNICAL TEST LOCATIONS PLAN

0 10 30 50 100 150 200 300 Original size mm

LODESTAR AVENUE

6m boundary setback

TP 10
28.58m FL

TP 15
28.52m FL

TP 13
28.76m FL

BH 4
381322
28.52m FL

unit 7

unit 8

unit 9

unit 10

TP 17
28.56m FL

BH 5
381322
28.55m FL

BH 6
381322
28.74m FL

BH 7
381322
28.65m FL

Lot 9
DP 457595

Lot 10
DP 457595

unit 1

TP 11
28.47m FL

BH 3
381322
28.43m FL

unit 2

unit 3

bike stand 1

unit 4

BH 1
381322
28.46m FL

unit 5

unit 6

BH 8
381322
28.44 FL

bike stand 2

unit 11

unit 12

unit 13

BH 9
381322
28.58m FL

TP 18
28.48m FL

TP 20
28.45m FL

BH 10
381322
28.38m FL

BH 2
381322
28.30m FL

STARK DRIVE

TP 26
28.45m FL

Sheet 1 of 1

Drawing Set 381322 G1
PLOT G1 130913

Scale: 1:500 (A3)
Date: 13/09/2013

NZGD 2000
Mount Pleasant 2000

origin of levels

datum CDD Jan 2012

surveyed

surv date

designed F Salman
manager J Aramowicz
drawn F Nicholls
checked

initial date

amendment

no.

Eliot Sinclair
surveyors | engineers | planners

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GEOTECH TEST LOCATIONS
WIGRAM BUSINESS PARK - STAGE 1
LOTS 9 & 10 DP 457595
FOR STARK DRIVE LP

[plotted: Wednesday, September 25, 2013 09:53:53] [computer operator: fjn] [Project: G:\Jobs\38\381322\12d\SURVEY\TOPO\381322 Lots 9 and 10 Wigram Business Park Geotech\381322 Lots 9 and 10 Wigram Business Park Geotech]

Appendix C : SITE INVESTIGATION RESULTS

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH001

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564212.8mE, 5177905.31mN (NZTM)
Rig Operator: D. Berger
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 06/09/2013
Date Completed: 06/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to coarse GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel, occasional silt interbeds up to 50mm thick	Sonic core drilling	1 2 3 4 5	25 50 75 20% 100%	0.5 1.0 1.5 2.0		10 20 30 40 50	N = 29 (C) 1.00m 7, 7 / 6, 6, 10, 7 450mm		Bentonite (1.5 bags)
Yellowish grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel -2.00m - 4.00m; minor to some cobbles -4.00m; trace to minor silt with depth			100%	2.5 3.0 3.5 4.0 4.5 5.0			N = 30 (C) 2.00m 2, 4 / 4, 6, 10, 10 450mm N = 60+ (C) 3.00m 10, 15 / 15, 14, 13, 15 430mm Effective Refusal N = 57 (C) 4.00m 10, 15 / 15, 14, 13, 15 450mm N = 16 (C) 5.00m 10, 9 / 7, 6, 2, 1 450mm		3m Surrounding ground collapse
Grey SILT; trace rootlets and wood fragments, very soft, saturated, moderately plasticity, rare fine silty sand lenses up to 50 mm thick -5.60m - 7.00m; soft			100%	5.5 6.0 6.5			N = 0 (S) 6.00m 0, 0 / 0, 0, 0, 0 450mm		
Brown SILT; trace fine to coarse sand, trace wood fragments and peat, soft to firm, moist, high plasticity			100%	7.0 7.5			N = 1 (S) 7.00m 1, 0 / 0, 0, 0, 1 450mm	7.00 - 7.04m, SPTLS, 1	
Grey SILT; some fine sand, soft to firm, moist, low plasticity									

Remarks

Geotechnical Investigation Borehole BH001 with SPT Testing

Static Water Levels:
-0.00m @ Casing depth of 9.00m
1200 Litres Water Added
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	19.5
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 15.52m

Created: 11/09/2013 9:01:12 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH001

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564212.8mE, 5177905.31mN (NZTM)
Rig Operator: D. Berger
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 06/09/2013
Date Completed: 06/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability (1 2 3 4 5)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Silty fine SAND; moist, well graded sand, high quickness	Sonic core drilling		100%	8.5			N = 3 (S) 8.00m 1, 0 / 0, 0, 1, 2 450mm	8.00 - 8.04m, SPTLS, 2	Surrounding ground collapse
				9.0			N = 5 (S) 9.00m 1, 2 / 2, 1, 1, 1 450mm	9.00 - 9.36m, SPTLS, 3	
Fine to medium grey SAND; moist, uniformly graded sand Grey SILT; soft to firm, moist, moderate plasticity			100%	9.5					
				10.0					
				10.5					10.5m
-10.62m; trace rootlets, wood fragments and peat with depth			100%	11.0			N = 2 (S) 10.52m 1, 0 / 1, 0, 1, 0 450mm	10.52 - 10.97m, SPTLS, 4	Bentonite (1.5 bags)
-11.00m - 11.15m; peat lens									
-11.45m - 11.50m; peat lens				11.5					
Fine SAND, some silt, moist, uniformly graded sand Grey SILT; firm, moist, high plasticity				12.0					12m
			100%	12.5			N = 1 (S) 12.04m 0, 0 / 0, 0, 0, 1 450mm	12.04 - 12.49m, SPTLS, 5	
				13.0					
-13.30m; some sand with depth, low plasticity with depth				13.5					
							N = 24 (S) 13.56m 2, 5 / 5, 5, 7, 7 450mm	13.56 - 14.01m, SPTLS, 6	Surrounding ground collapse
Fine to Coarse Sandy fine to medium GRAVEL; some silt, moist, well graded sand and gravel			100%	14.0					
				14.5					
				15.0					
				15.5			N = 60+ (C) 15.08m 14, 16 / 16, 16, 15, 13 440mm Effective Refusal		15.52m

EOH: 15.52m

Remarks

Geotechnical Investigation Borehole BH001 with SPT Testing

Static Water Levels:
-0.00m @ Casing depth of 9.00m
1200 Litres Water Added
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	19.5
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

Created: 11/09/2013 9:01:12 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH002

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564259.19mE, 5177787.04mN (NZTM)
Rig Operator: D. Berger
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 09/09/2013
Date Completed: 09/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown fine to coarse Sandy Silty fine to coarse GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel	Sonic core drilling	1 2 3 4 5	25 50 75	0.5		10 20 30 40 50			Bentonite (4 bags)
Whitish grey fine Sandy fine to coarse GRAVEL; moist, well graded sand and gravel			100%	1.0			N = 60 (C) 1.00m 15, 17 / 16, 15, 14, 15 450mm		
Fine to coarse GRAVEL; minor to some cobbles, moist, well graded gravel			100%	1.5					
Yellowish grey fine to coarse Sandy fine to medium GRAVEL; minor to some silt, saturated, well graded sand and gravel			100%	2.0			N = 49 (C) 2.00m 10, 11 / 10, 13, 13, 13 450mm		
-3.00m - 3.20m; fine to coarse gravel lens -3.20m - 4.00m; rare cobbles			100%	2.5					
				3.0			N = 60+ (C) 3.00m 9, 13 / 20, 14, 15, 11 435mm Effective Refusal		3m
-4.00m - 4.30m; fine to coarse gravel lens -4.30m - 5.00m; no silt, rare cobbles and fine to coarse gravel			100%	3.5					
				4.0			N = 44 (C) 4.00m 10, 17 / 13, 11, 10, 10 450mm		
-5.00m; trace silt and fine to coarse gravel with depth			100%	4.5					
			65%	5.0			N = 26 (C) 5.00m 7, 5 / 6, 7, 6, 7 450mm		Surrounding ground collapse
Dark reddish brown WOOD; partially decayed			20%	5.5					
				6.0			N = 60+ (S) 6.00m 2, 1 / 1 150mm Effective Refusal	6.00 - 6.13m, SPTLS, 1	
Grey SILT; soft, saturated, moderate plasticity				6.5					
-7.40m - 7.46m; woody silt lens			100%	7.0			N = 4 (S) 7.00m 2, 1 / 1, 1, 1, 1 450mm		
-7.70m - 7.75m; trace to minor wood fragments				7.5					

Remarks

Geotechnical Investigation Borehole BH002 with SPT Testing

No Static Water Level Recorded
1100 Litres Water Added
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	19.5
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

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Hole Depth: 15.53m

Created: 11/09/2013 9:01:32 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH002

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564259.19mE, 5177787.04mN (NZTM)
Rig Operator: D. Berger
Rig Model & Mounting: Geoprobe 8140LS

Date Commenced: 09/09/2013
Date Completed: 09/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability (1–6)	Recovery (25–75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10–50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Grey SILT; soft, saturated, moderate plasticity	Sonic core drilling		100%	8.5			N = 7 (S) 8.00m 0, 1 / 1, 2, 3, 1 450mm	8.00 - 8.45m, SPTLS, 2	Surrounding ground collapse
Fine grey SAND; saturated, uniformly graded sand			100%	9.0			N = 5 (S) 9.00m 0, 1 / 1, 1, 1, 2 450mm	9.00 - 9.36m, SPTLS, 3	
Grey SILT; very soft, saturated, moderate plasticity			100%	9.5 10.0					
Dark brown PEAT; saturated, fibrous			100%	10.5			N = 0 (S) 10.52m 0, 0 / 0, 0, 0, 0 450mm	10.52 - 10.97m, SPTLS, 4	
Dark purplish brown mottled grey Peaty SILT; soft to firm, saturated, moderate plasticity				11.0 11.5					
Dark brown PEAT; saturated, fibrous									
Dark purplish brown mottled grey Peaty SILT; soft to firm, saturated, moderate plasticity									
Grey SILT; very soft, saturated, moderate plasticity, becoming firm and low plasticity with depth			100%	12.0 12.5			N = 0 (S) 12.04m 0, 0 / 0, 0, 0, 0 450mm	12.04 - 12.40m, SPTLS, 5	
Fine grey SAND; saturated, uniformly graded sand				13.0					
Grey Silty fine to coarse GRAVEL; some fine to coarse sand, saturated, well graded gravel				13.5			N = 42 (C) 13.56m 4, 7 / 10, 9, 11, 12 450mm		
-13.24m; yellow brown with depth			85%	14.0 14.5					
				15.0			N = 43 (C) 15.08m 6, 10 / 10, 11, 11, 11 450mm		15.53m

EOH: 15.53m

Remarks

Geotechnical Investigation Borehole BH002 with SPT Testing

No Static Water Level Recorded
1100 Litres Water Added
Safety Auto Trip Hammer #368 used (energy ratio 99%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	19.5
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Created: 11/09/2013 9:01:32 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH003

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564201.28mE, 5177932.03mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 03/09/2013
Date Completed: 03/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to coarse GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel, occasional silt interbeds up to 50mm thick	Dual tube	1 2 3 4 5	25 50 75	0.5		10 20 30 40 50	N = 21 (C) 1.00m 6, 7 / 5, 5, 5, 6 450mm		Bentonite (0.5 bags)
			100%	1.0					
			60%	1.5					
				2.0			N = 54 (C) 2.00m 3, 3 / 5, 9, 21, 19 450mm		2.4m
			75%	2.5					
Grey fine to coarse Sandy fine to medium GRAVEL; moist, well graded sand and gravel				3.0			N = 60+ (C) 3.00m 15, 13 / 16 225mm Effective Refusal		Surrounding ground collapse
			100%	3.5					
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel				4.0			N = 41 (C) 4.00m 13, 14 / 12, 10, 9, 10 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH003 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	1.5
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

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Hole Depth: 4.45m

Created: 11/09/2013 9:01:41 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH004

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564230.49mE, 5177917.97mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 03/09/2013
Date Completed: 03/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to medium GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel, occasional silt interbeds up to 50 mm thick	Dual tube	1 2 3 4 5	25 50 75	0.5		10 20 30 40 50	N = 60+ (C) 1.00m 8, 19 150mm Effective Refusal		Bentonite (0.5 bags)
			100%	1.0					
Grey fine to coarse Sandy fine to coarse GRAVEL; moist, well graded sand and gravel			80%	1.5					
				2.0			N = 60+ (C) 2.00m 18, 19 150mm Effective Refusal		
			90%	2.5					
Grey fine to coarse Sandy fine to medium GRAVEL; trace silt, saturated, well graded sand and gravel				3.0			N = 48 (C) 3.00m 12, 14 / 13, 12, 11, 12 450mm		3m
			90%	3.5					Surrounding ground collapse
				4.0			N = 37 (C) 4.00m 13, 11 / 11, 8, 9, 9 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH004 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	6
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 4.45m

Created: 11/09/2013 9:01:49 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH005

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564243.04mE, 5177886.59mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 03/09/2013
Date Completed: 03/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to medium GRAVEL FILL; moist, well graded sand and gravel, occasional silt interbeds up to 50mm thick	Dual tube	1 2 3 4 5	25 50 75	0.5		10 20 30 40 50	N = 31 (C) 1.00m 7, 5 / 5, 8, 9, 9 450mm		Bentonite (0.5 bags)
			100%	1.0					
Grey fine to coarse Sandy fine to coarse GRAVEL; trace cobbles, moist, well graded sand and gravel			100%	1.5					
				2.0			N = 60+ (C) 2.00m 29 75mm Effective Refusal		
			80%	2.5					
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel				3.0					3m
			100%	3.5			N = 60+ (C) 3.00m 17, 18 150mm Effective Refusal		Surrounding ground collapse
				4.0			N = 20 (C) 4.00m 7, 5 / 4, 4, 6, 6 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH005 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	6
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 4.45m

Created: 11/09/2013 9:01:57 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH006

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564284.81mE, 5177844.44mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 04/09/2013
Date Completed: 04/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability (1 2 3 4 5)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to medium GRAVEL FILL; trace brick fragments, moist, well graded gravel, occasional silt lenses up to 50 mm thick	Dual tube		80%	0.5			N = 28 (C) 1.00m 7, 7 / 7, 7, 7, 7 450mm		Bentonite (0.5 bags)
			80%	1.0					
Grey fine to coarse Sandy fine to medium GRAVEL; moist, well graded sand and gravel				1.5			N = 60+ (C) 2.00m 25 75mm Effective Refusal		
			90%	2.0					
Fine to medium grey GRAVEL; saturated, well graded gravel				2.5			N = 45 (C) 3.00m 17, 13 / 14, 11, 10, 10 450mm		2.6m
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel			80%	3.0					Surrounding ground collapse
				3.5					
				4.0			N = 49 (C) 4.00m 14, 13 / 14, 12, 12, 11 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH006 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	6
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 4.45m

Created: 11/09/2013 9:02:06 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH007

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564301.47mE, 5177816.67mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 04/09/2013
Date Completed: 05/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability (1 2 3 4 5)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to coarse GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel, occasional silt lenses up to 50 mm thick	Dual tube		90%	0.5			N = 5 (C) 1.00m 1, 2 / 2, 1, 1, 1 450mm		Bentonite (0.5 bags)
Yellow brown fine to coarse Sandy fine to medium GRAVEL; moist, well graded sand and gravel			90%	1.0					
-2.00m - 2.50m; white fine sandy fine gravel lens			60%	1.5			N = 60+ (C) 2.00m 18, 17 / 18 225mm Effective Refusal		
Fine grey GRAVEL; wet, uniformly graded gravel			75%	2.0					
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel				2.5			N = 44 (C) 3.00m 14, 13 / 11, 12, 11, 10 450mm		3.2m
				3.0					Surrounding ground collapse
				3.5					
				4.0			N = 18 (C) 4.00m 5, 4 / 4, 4, 5, 5 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH007 with SPT Testing

Static Water Levels:
-2.60m @ Casing depth of 4.00m
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	6
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

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Hole Depth: 4.45m

Created: 11/09/2013 9:02:13 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH008

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564228.03mE, 5177870.08mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 03/09/2013
Date Completed: 03/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to medium GRAVEL FILL; trace brick fragments, moist, well graded sand and gravel, occasional silt interbeds up to 50mm thick	Dual tube	1 2 3 4 5	25 50 75	0.5		10 20 30 40 50	N = 35 (C) 1.00m 5, 6 / 8, 7, 9, 11 450mm		Bentonite (0.5 bags)
			90%	1.0					
Grey fine to coarse Sandy fine to medium GRAVEL; moist, well graded sand and gravel			100%	1.5					
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, moist, well graded sand and gravel			80%	2.0			N = 60+ (C) 2.00m 20 75mm Effective Refusal		2.5m
-3.70m; saturated with depth			100%	2.5					Surrounding ground collapse
				3.0			N = 31 (C) 3.00m 6, 6 / 6, 6, 8, 11 450mm		
				3.5					
				4.0			N = 22 (C) 4.00m 9, 7 / 6, 5, 5, 6 450mm		4.45m

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH008 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	6
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Hole Depth: 4.45m

Created: 11/09/2013 9:02:21 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH009

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564251.47mE, 5177850.99mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 04/09/2013
Date Completed: 04/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability	Recovery	Depth	Graphic Log	SPT N-value (Uncorrected)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown Silty fine to coarse Sandy fine to medium GRAVEL FILL; trace wood fragments and brick fragments, moist, well graded sand and gravel, occasional silt lenses up to 50 mm thick	Dual tube	1 2 3 4 5	25 50 75	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		10 20 30 40 50	N = 22 (C) 1.00m 5, 5 / 5, 6, 5, 6 450mm N = 60+ (C) 2.00m 14, 18 150mm Effective Refusal N = 9 (C) 3.00m 4, 3 / 3, 3, 2, 1 450mm N = 26 (C) 4.00m 11, 7 / 9, 7, 5, 5 450mm		Bentonite (0.5 bags) 3m Surrounding ground collapse 4.45m
Yellow brown fine to coarse Sandy fine to GRAVEL; trace silt and cobbles, wet, well graded sand and gravel									
Fine to coarse grey GRAVEL; trace fine to coarse sand and silt, saturated, well graded gravel									

EOH: 4.45m

Remarks

Geotechnical Investigation Borehole BH009 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	6
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	
Above Ground Protective Surround	ea	
Geotextile Sock	m	-
Hand Clear Location	ea	
Decontaminate Equipment	ea	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Hole Depth: 4.45m

Created: 11/09/2013 9:02:29 a.m.

Bore Log

McMILLAN Drilling GROUP

Client: Eliot Sinclair and Partners Ltd

Project: Lot 9 & 10, Wigram Business Park

Bore No.: BH010

Job No.: 12634

Site Location: The Runway, Christchurch
Grid Reference: 1564239.25mE, 5177817.11mN (NZTM)
Rig Operator: Z. Luxton
Rig Model & Mounting: 9700 - D; Truck

Date Commenced: 04/09/2013
Date Completed: 04/09/2013
Consent: BH381322
Datum: Ground

Description	Method	Drivability (1 2 3 4 5)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	SPT Data (Uncorrected)	Samples	Installation & Resources
Dark brown interbedded Silty fine GRAVEL and fine Gravelly SILT; moist, gravel is uniformly graded and silt is firm, low plasticity	Dual tube	1	90%	0.5					Bentonite (0.2 bags)
		2	100%	1.0			N = 22 (C) 1.00m 6, 5 / 6, 5, 6, 5 450mm		
		3		1.5					
			80%	2.0			N = 37 (C) 2.00m 4, 5 / 8, 9, 10, 10 450mm		
Yellow brown fine to coarse Sandy fine to medium GRAVEL; moist, well graded sand and gravel				2.5					3m
Grey fine to coarse Sandy fine to coarse GRAVEL; trace silt, saturated, well graded sand and gravel			90%	3.0			N = 60+ (C) 3.00m 14, 16 / 20 225mm Effective Refusal		Surrounding ground collapse
		4		3.5					
				4.0			N = 30 (C) 4.00m 10, 8 / 6, 6, 9, 9 450mm		4.45m
EOH: 4.45m									

Remarks

Geotechnical Investigation Borehole BH010 with SPT Testing

No Static Water Level Recorded
Safety Auto Trip Hammer #398 used (energy ratio 82.9%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

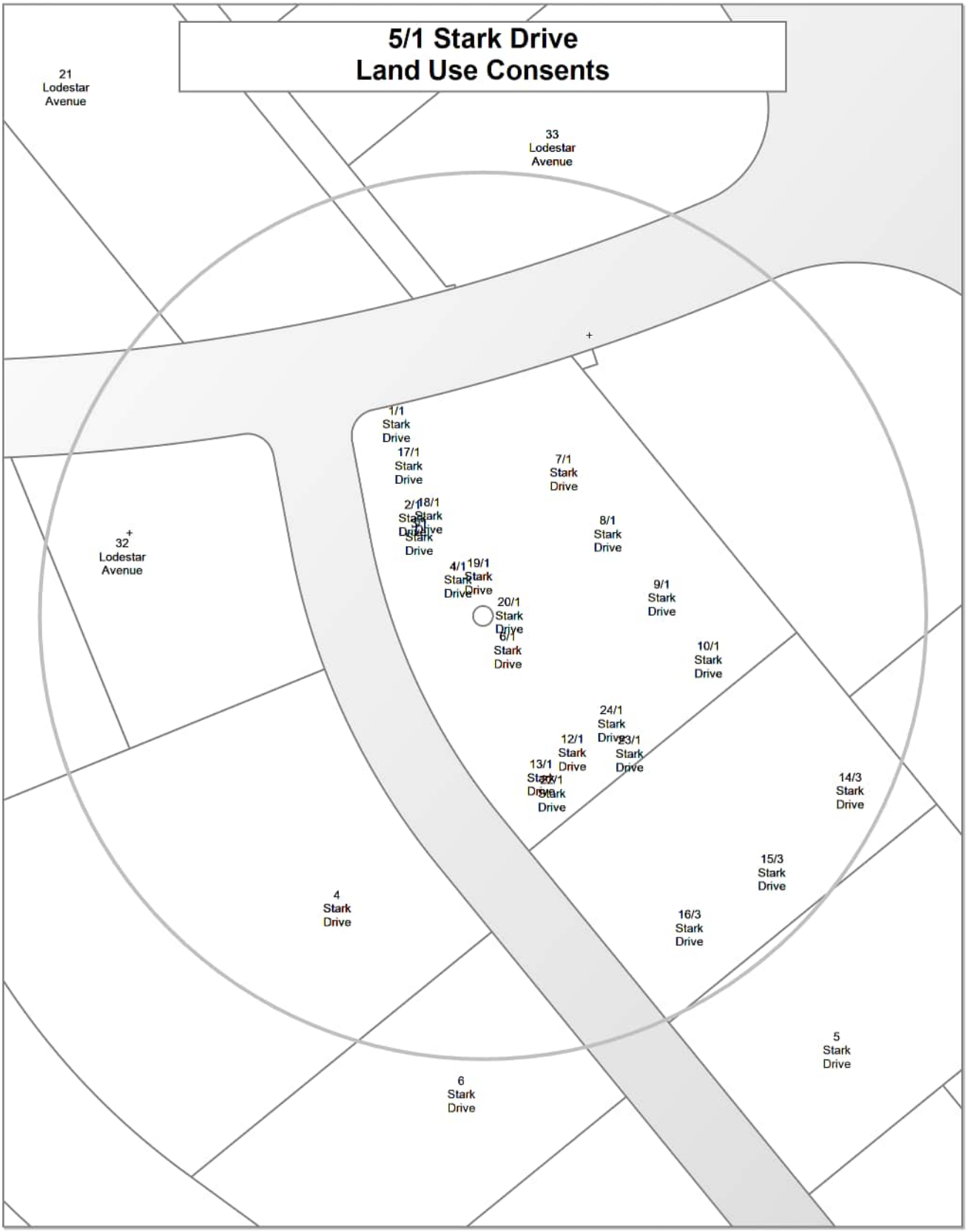
Additional Resources:

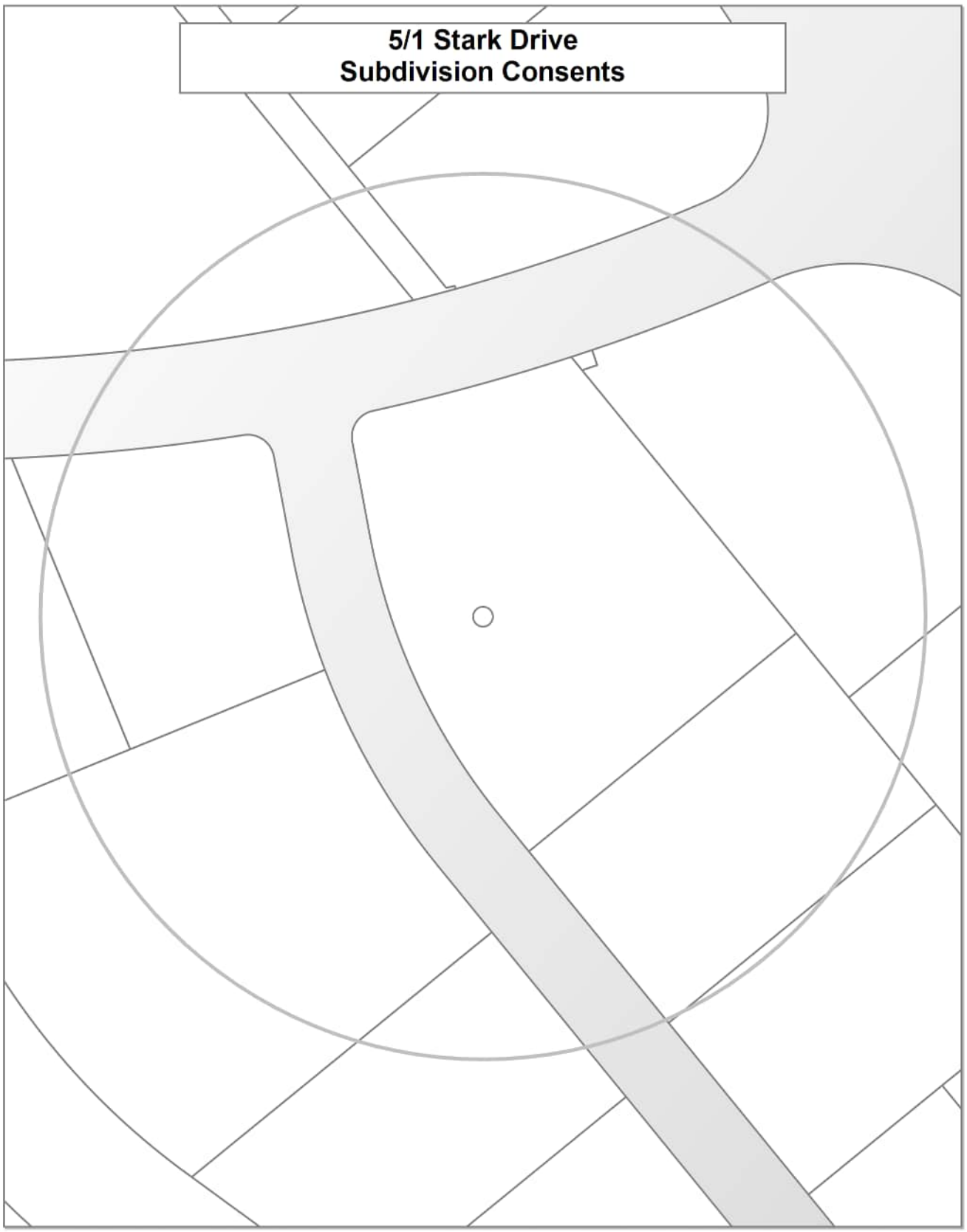
Plastic Liner	**m**	6
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Hole Depth: 4.45m

Created: 11/09/2013 9:02:36 a.m.


5/1 Stark Drive
Land Use Consents
21 Lodestar Avenue
33 Lodestar Avenue
32 Lodestar Avenue
1/1 Stark Drive
17/1 Stark Drive
7/1 Stark Drive
18/1 Stark Drive
8/1 Stark Drive
19/1 Stark Drive
4/1 Stark Drive
9/1 Stark Drive
20/1 Stark Drive
6/1 Stark Drive
10/1 Stark Drive
24/1 Stark Drive
12/1 Stark Drive
23/1 Stark Drive
13/1 Stark Drive
14/3 Stark Drive
15/3 Stark Drive
4 Stark Drive
16/3 Stark Drive
5 Stark Drive
6 Stark Drive


5/1 Stark Drive
Subdivision Consents

Land Use Resource Consents within 100 metres of 5/1 Stark Drive

Note:This list does not include subdivision Consents and Certificates of Compliance issued under the Resource Management Act.

1/1 Stark Drive

RMA/2013/1097

Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743

Processing complete

Applied 19/06/2013

Decision issued 15/08/2013

Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

10/1 Stark Drive

RMA/2013/1097

Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743

Processing complete

Applied 19/06/2013

Decision issued 15/08/2013

Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

110 Hayton Road

RMA/2017/1930

Establishment of an industrial activity on the application site

Processing complete

Applied 18/08/2017

Decision issued 05/12/2017

Granted 04/12/2017

RMA/2024/718

Earthworks for extension of existing facility

Processing complete

Applied 18/03/2024

Decision issued 10/04/2024

Granted 09/04/2024

112 Hayton Road

RMA/2014/2921

Commercial Building that is to contain a warehouse, a trade showroom and ancillary offices - Historical Reference RMA92027620

Processing complete

Applied 05/11/2014

Decision issued 12/12/2014

Granted 12/12/2014

RMA/2014/3237

Warehouse and Office Development - landscaping& traffic - Historical Reference RMA92027940

Processing complete

Applied 04/12/2014

Decision issued 20/01/2015

Granted 19/01/2015

RMA/2014/585

NEW BREWERY, WAREHOUSE AND ASSORTED RETAIL ACTIVITY s.88 REJECTION - Historical Reference RMA92025207

Withdrawn

Applied 13/03/2014

112A Hayton Road

RMA/2014/2921

Commercial Building that is to contain a warehouse, a trade showroom and ancillary offices - Historical Reference RMA92027620

Processing complete

Applied 05/11/2014

Decision issued 12/12/2014

Granted 12/12/2014

RMA/2014/3237

Warehouse and Office Development - landscaping& traffic - Historical Reference RMA92027940

Processing complete

Applied 04/12/2014

Decision issued 20/01/2015

Granted 19/01/2015

RMA/2014/585

NEW BREWERY, WAREHOUSE AND ASSORTED RETAIL ACTIVITY s.88 REJECTION - Historical Reference RMA92025207

Withdrawn

Applied 13/03/2014

114 Hayton Road

RMA/2015/1826

Commercial building and associated parking - Historical Reference RMA92030113

Processing complete

Applied 07/07/2015

Decision issued 14/08/2015

Granted 14/08/2015

116 Hayton Road

RMA/2013/866

Warehouse - Historical Reference RMA92022498

Processing complete

Applied 16/05/2013

Decision issued 21/05/2013

Granted 21/05/2013

12/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

13/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

14/3 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

15/3 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

16/3 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

17/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

18/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

19 Lodestar Avenue

RMA/2015/45
Commercial Building that contains a warehouse, and ancillary offices - Historical Reference RMA92028203
Processing complete
Applied 05/01/2015
Decision issued 27/03/2015
Granted 27/03/2015

RMA/2016/2289
Right of Way
Processing complete
Applied 19/08/2016
Certificate issued 31/01/2017
Certificate issued 26/01/2017
Decision issued 07/09/2016
Granted 06/09/2016

RMA/2021/126
Earthworks associated with new warehouse and trade supply activity
Processing complete
Applied 25/01/2021
Decision issued 18/02/2021
Granted 18/02/2021

19/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

2/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

20/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

21 Lodestar Avenue

RMA/2015/3602
Industrial/warehouse/office building - Historical Reference RMA92032024
Processing complete
Applied 23/12/2015
Decision issued 16/02/2016
Granted 16/02/2016

RMA/2015/45
Commercial Building that contains a warehouse, and ancillary offices - Historical Reference RMA92028203
Processing complete
Applied 05/01/2015
Decision issued 27/03/2015
Granted 27/03/2015

22/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

23/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

24/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

3/1 Stark Drive

RMA/2013/1097

Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743

Processing complete

Applied 19/06/2013

Decision issued 15/08/2013

Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

30 Lodestar Avenue

RMA/2013/1612

Office and Warehouse Building - Historical Reference RMA92023297

Processing complete

Applied 15/08/2013

Decision issued 12/09/2013

Granted 12/09/2013

32 Lodestar Avenue

RMA/2013/1586

To erect an 1859m2 commercial building, with ancillary offices and to provide associated parking areas and landscaping - Historical Reference RMA92023269

Processing complete

Applied 12/08/2013

Decision issued 24/10/2013

Granted 23/10/2013

Granted 23/10/2013

Decision issued 24/10/2013

33 Lodestar Avenue

RMA/2014/2921

Commercial Building that is to contain a warehouse, a trade showroom and ancillary offices - Historical Reference RMA92027620

Processing complete

Applied 05/11/2014

Decision issued 12/12/2014

Granted 12/12/2014

RMA/2014/3237

Warehouse and Office Development - landscaping& traffic - Historical Reference RMA92027940

Processing complete

Applied 04/12/2014

Decision issued 20/01/2015

Granted 19/01/2015

RMA/2014/585

NEW BREWERY, WAREHOUSE AND ASSORTED RETAIL ACTIVITY s.88 REJECTION - Historical Reference RMA92025207

Withdrawn

Applied 13/03/2014

RMA/2018/193

To construct, operate and maintain a service station (with two car washes), with associated signage and landscaping. Consent under the NES is also sought for associated earthworks in a site that exceeds soil contamination standards

Processing complete

Applied 30/01/2018

Decision issued 15/06/2018

Granted 15/06/2018

RMA/2024/2621

Construct and operate a food outlet store on fuel station forecourt

Processing complete

Applied 10/09/2024

Decision issued 01/11/2024

Granted 01/11/2024

4 Stark Drive

RMA/2015/2222

Warehouse and attached office building - Historical Reference RMA92030534

Processing complete

Applied 13/08/2015

Decision issued 01/09/2015

Granted 01/09/2015

RMA/2015/2362

Soil disturbance associated with site preparation and ground improvement works for a new office & warehouse development - Historical Reference RMA92030693

Processing complete

Applied 26/08/2015

Decision issued 24/09/2015

Granted 23/09/2015

RMA/2025/282

Contaminated soil removal and ground improvement works/ construction of 4 new warehouse units with offices

Processing complete

Applied 07/02/2025

Decision issued 10/03/2025

Granted 03/03/2025

4/1 Stark Drive

RMA/2013/1097

Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743

Processing complete

Applied 19/06/2013

Decision issued 15/08/2013

Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

5 Stark Drive

RMA/2013/2195

Warehouse, Offices and Showroom - Historical Reference RMA92023912

Processing complete

Applied 21/10/2013

Decision issued 21/11/2013

Granted 20/11/2013

6 Stark Drive

RMA/2013/2324

To erect a commercial building containin an 1800m2 warehouse, and an ancillary office - Historical Reference RMA92024044

Processing complete

Applied 05/11/2013

Decision issued 30/01/2014

Granted 30/01/2014

6/1 Stark Drive

RMA/2013/1097

Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743

Processing complete

Applied 19/06/2013

Decision issued 15/08/2013

Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

7/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

8/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264
"Within scope" changes to RMA92022743 - Historical Reference RMA92024869
Processing complete
Applied 10/02/2014
Decision issued 20/02/2014
Granted 20/02/2014

9/1 Stark Drive

RMA/2013/1097
Develop 15-20 Mixed Use Tenancies - Historical Reference RMA92022743
Processing complete
Applied 19/06/2013
Decision issued 15/08/2013
Granted 15/08/2013

RMA/2014/264

"Within scope" changes to RMA92022743 - Historical Reference RMA92024869

Processing complete

Applied 10/02/2014

Decision issued 20/02/2014

Granted 20/02/2014

Data Quality Statement

Land Use Consents

All resource consents are shown for sites that have been labelled with an address. For sites that have been labelled with a cross (+) no resource consents have been found. Sites that have no label have not been checked for resource consents. This will be particularly noticeable on the margins of the search radius. If there are such sites and you would like them included in the check, please ask for the LIM spatial query to be rerun accordingly. This will be done free of charge although there may be a short delay. Resource consents which are on land occupied by roads, railways or rivers are not, and currently cannot be displayed, either on the map or in the list. Resource consents that relate to land that has since been subdivided, will be shown in the list, but not on the map. They will be under the address of the land as it was at the time the resource consent was applied for. Resource consents that are listed as Non-notified and are current, may in fact be notified resource consents that have not yet been through the notification process. If in doubt. Please phone (03)941 8999.

The term “resource consents” in this context means land use consents. Subdivision consents and certificates of compliance are excluded.

Subdivision Consents

All subdivision consents are shown for the sites that have been labelled with consent details. For Sites that have been labelled with a cross (+) no records have been found. Sites that have no label have not been checked for subdivision consents. This will be particularly noticeable on the margins of the search radius. If there are such sites and you would like them included in the check, please ask for the LIM spatial query to be rerun accordingly. This will be done free of charge although there may be a short delay.

The term “subdivision consents” in this context means a resource consent application to subdivide land. Non subdivision land use resource consents and certificates of compliance are excluded.

This report will only record those subdivision applications which have not been completed i.e once a subdivision has been given effect to and the new lots/properties have been established the application which created those lots will not be shown

All subdivision consent information is contained on the map and no separate list is supplied