Annexure Eight: Geotechnical Report

RILEY CONSULTANTS

COLES PROPERTY PARK LANE: ROLLESTON

GEOTECHNICAL ASSESSMENT FOR SUBDIVISION PLAN CHANGE AND RESOURCE CONSENT

Engineers and Geologists

COLES PROPERTY PARK LANE: ROLLESTON GEOTECHNICAL ASSESSMENT FOR SUBDIVISION RESOURCE CONSENT AND PLAN CHANGE

Report prepared for: Nimbus Group

Report prepared by: Emma Turner, Civil Engineer

E.Turner

Report reviewed by: pp. Don Tate, Director, CPEng

Report Reference: 12891-A

Date: 18 December 2012

Copies to:

Client	2 copies
Riley Consultants Ltd	1 copy

Revision:	Details:	Date:
1.0	Geotechnical Assessment	18 December 2012

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Appendices

COLES PROPERTY LAKE PARK: ROLLESTON GEOTECHNICAL ASSESSMENT FOR SUBDIVISION PLAN CHANGE AND RESOURCE CONSENT

1.0 Introduction

Riley Consultants Ltd (RILEY) has been engaged to undertake a geotechnical investigation at Coles Subdivision, Rolleston, Lots 3 and 4 of DP74253, as outlined in the initial desktop study and proposal dated 2 November 2012 (RILEY ref: R18468-A).

This report details our geotechnical investigations and outlines the level of geotechnical hazard at the site in accordance with "Guidelines for the Geotechnical Investigation and Assessment of Subdivisions in the Canterbury Region" released by the Ministry of Business, Innovation and Employment (MoBIE) September 2012.

This report will be used in support of application for a Resource Consent for Lot 3 and a plan change and subsequent Resource Consent for Lot 4 by the Selwyn District Council (SDC). We understand Lot 3 is to be divided into approximately 170 residential lots and Lot 4 is to be changed to rural residential with 36 lots of approximately 5,000 m^2.

2.0 Regional Geology

The published geological map of the area, (Geology of the Christchurch Area 1:250,000, Brown and Weeber, 1992) indicates that the site is underlain by grey river alluvium.

A review of the Environmental Canterbury (ECan) Wells database showed multiple wells located within 1 km of the proposed subdivision. Material logs available for two of these wells located with the two lots indicates that subsurface materials comprise layers of surficial topsoil and clay to 1.8 m depth underlain by gravel dominated material to at least 30 m depth.

Groundwater information provided in the well logs indicates that groundwater level in the area varies between 10 m and 85 m depth.

A Preliminary Site Investigation Report for the adjacent Park Lane Subdivision (west) was undertaken by E2 Environmental in December 2011. The purpose of this report was to estimate the ground soakage potential of the soils underlying the site. In order to undertake the soakage testing E2 Environmental dug four test pits on the site, two towards the north and two towards the south. The depth of these test pits ranged from 2.2 m to 4.75 m depth, the logs of which were included in the appendices. In summary these test pits encountered 0.2 – 0.4 m of topsoil overlying sandy silt to 1.9 to 2.0 m depth. Sandy gravel was then present to 2.3 to 2.4 m depth overlying gravel and cobbles to the maximum depth of the test pits.

The recommendation that soil characterisation be carried out to 15 m depth recognises that generally liquefaction will not occur below this depth, or if it does is unlikely to be observable at the ground surface. The soil investigation therefore seeks to quantify the liquefaction hazard of the upper 15 m of the soil profile. For this site, this quantification is made largely on the basis of site geology and available borehole data in the area and confirmatory investigations of soil composition via test pits. Available borehole logs in the area indicate dense granular alluvial soils to at least 15 m depth.

5.0 Subsurface Investigations

Subsurface geotechnical investigations were undertaken by RILEY staff (with the assistance of an excavator provided by the Nimbus Group) on 20 November 2012 and comprised:

- Nine test pits (TP1 to TP9) to a maximum depth of 5.2 m
- 15 Scala Penetrometer tests undertaken adjacent to the testpits and at consistent spacing over Lots 3 and 4

The testpits were logged in accordance with the NZGS guidelines (December 2005) and the location of the geotechnical investigations is shown in Appendix A.

The material encountered in the test pit investigations comprised between 200 and 600 mm organic sands (topsoil) underlain by sandy silts and silty sands to a depth of between 0.75 to 2.2 m. Gravels were located below the sand and silt layers to the extent of testing (a maximum of 5.2 m in TP5).

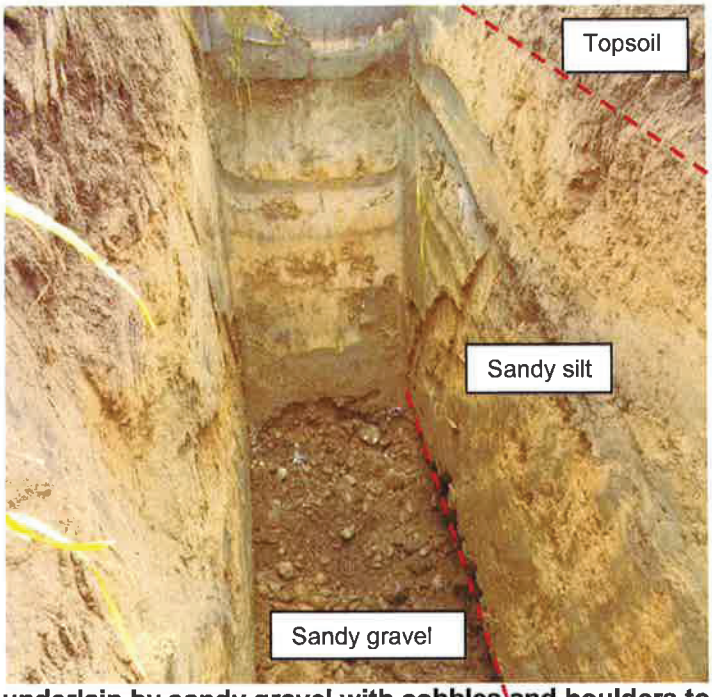

Photo 1: Sandy silt underlain by sandy gravel with cobbles and boulders to 2.0 m depth (TP3)

Groundwater was not encountered in any of the test pits during our investigations. Based on ECAN well logs, groundwater varies between 10 and 85 m depth.

A total of nine Scala penetrometer tests were undertaken at or near existing ground level adjacent to each of the testpits, with an additional six Scala tests undertaken at varied locations across site, to confirm consistency of soil strength.

Soft to firm soils were encountered in the natural soils over the site to approximately 1.8 m depth. Dense to very dense gravels were encountered below this depth to the extent of testing.

The presence of silts and sands in the upper 2.2 m of soil strata underlain by dense gravels is consistent with the geological data for this area and confirmed the expected ground conditions. Regional geological maps indicate the presence of predominantly gravelly soils such as those encountered in the test pits to at least 30 m depth.

6.0 Suitability of Ground for Development

It is desirable for new subdivisions on flat or gently sloping ground to provide building platforms that meet the NZS3604:2011 definition of "good ground", as such building platforms do not require specific engineering design of foundations for residential development. NZS3604:2011 defines the criteria for "good ground" as that which has an ultimate bearing capacity of 300 kPa, and excludes:

- Potentially compressible ground
- Expansive soils
- Ground which could foreseeably experience movement of 25 mm or greater for any reason.

In recent months the Department of Building and Housing (DBH) have included liquefiable soils in the ground conditions for which NZS3604 is not applicable.

On the basis of regional geology, and testpit investigations, the soils on site are considered unlikely to be expansive or compressible. The other criteria for good ground are considered in the following paragraphs.

6.1 Bearing Capacity

NZS3604:2011 provides a Scala penetrometer test criteria whereby if a certain blow count over a measured depth is met, an ultimate bearing capacity of 300 kPa may be assumed (5 blows per 100 mm).

Scala penetrometer (SP) results indicate that moderate to high strength soils exist beneath the topsoil to the extent of testing. The materials have a geotechnical ultimate bearing capacity of above 200 kPa immediately below the topsoil. A geotechnical ultimate bearing capacity of 300 kPa is available at and below approximately 1.8 m consistently across site.

The sands and silts above 1.8 m across site do not meet the bearing capacity criteria for "good ground" according to NZS3604:2011.

6.2 Ground Movement/Liquefaction

The key consideration for ground movement is the potential for seismically induced liquefaction resulting in settlement or lateral movement. Liquefaction may occur in loose silts and sands beneath groundwater level. The susceptibility of such soils to liquefy depends on their density and particle size distribution.

Dense granular soils are not liquefiable (Youd et al, 1996 & 1998), and the density of the granular soils (below the sandy silt layer) within the test pits has been confirmed to be high via Scala penetrometer testing. Similar soils in Canterbury have generally performed well under recent seismic loading. No land damage is observable, and no ejected sands or lateral spreading was reported across the site as a result of the recent Christchurch earthquakes.

A deeper groundwater profile of 10 to 85 m was indicated by the regional well logs, therefore at least a 10 m thick non-liquefiable cap exists over any potentially liquefiable sand or silt strata, and therefore these shallow layers are not considered a significant risk to the development. Furthermore, if liquefiable lenses exist below this depth, it is unlikely that any evidence of liquefaction induced densification of the lenses would be observed at ground surface.

The Department of Building and Housing (DBH) has provided a guidance document whereby land is placed into one of three technical categories with the following liquefaction deformation limits. These limits are reproduced in Table 2.

Table 2: Liquefaction Deformation Limits and House Foundation Implications

Technical Category	Liquefaction Deformation Limits				Likely Implications for House Foundations (subject to individual assessment)
	Vertical		Lateral Spread		
	SLS	ULS	SLS	ULS	
TC1	15 mm	25 mm	Nil	Nil	Standard 3604-like foundations[1] with tied slabs[2]
TC2	50 mm	100 mm	50 mm	100 mm	DBH enhanced foundation solutions (Section 5.2)
TC3	>50 mm	>100 mm	>50 mm	>100 mm	Site specific measures – piles or ground improvement

1. Provided the shallow investigation determines the site is 'good ground' (As defined by NZS 3604:2011)
2. Note that certain foundation details included in NZS 3604 are precluded from use in Canterbury (refer to: http://www.dbh.govt.nz/information-sheet-seismicity-changes)

Based on the 1.0 m non-liquefiable cap, site geology and past ECAN boreholes in the area the risk of surface manifestation of liquefaction in a SLS event is considered to be low.

In terms of the DBH guidelines, we consider that the subject site is likely to be similar to those sites that fall into the technical category TC1.

7.0 Foundation Development Options

The subsurface data obtained at the site to date indicates that the subsoils do not meet the bearing capacity requirements for 'good ground', (as defined by NZS 3604:2011).Therefore any proposed houses developed at this site will require specifically designed foundations as part of the building consent, once the subdivision is formed.

In terms of the DBH guidelines, where the ultimate bearing capacity meets the 200 kPa requirement either enhanced slab TC2 solutions or other specific engineering design is applicable. At a conceptual level, enhanced house foundation solutions could comprise the following:

- A concrete slab foundation built over a compacted granular fill raft;
- Shallow driven timber piles;
- A thickened slab foundation over the existing site soils.

Further investigations will be required at the time of individual building development as outlined in the DBH guidelines. It is noted that test pits create weaker areas in the ground and foundations should be located clear of test zones or should take this into consideration during design.

Alternatively, wide scale soil improvement of the upper soil profile (subject to design) could be undertaken to allow for the construction of standard foundations in accordance with NZS 3604:2011, (with the modifications outlined in Building Code Acceptable Solutions B1/VM1, B1/AS1 and B1/AS3).

7.1 Further Development Considerations

Roads

Roads are not subject to the same design criteria as foundations; however subgrade layers are required to provide appropriate strength and stiffness for pavement design. Following removal of the topsoil (200 - 600 mm), the representative CBR value for the silty soils encountered on site (derived from Scala penetrometer testing) is 2.0.

Earthworks

During development of the site, RILEY recommends that appropriate stormwater and erosion controls be implemented. These are likely to involve the use of silt fences, hay bales and similar devices to intercept soil runoff and improve the quality of the stormwater discharged. Any exposed surfaces shall be topsoiled and grassed as soon as practicable to limit soil erosion.

8.0 RMA Considerations

Section 106 of the RMA states that a "consent authority may refuse to grant subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that:

a) *the land in respect of which a consent is sought, or any structure on the land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; or*

b) *any subsequent use that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; or*

c) *sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.*

No evidence of erosion, falling debris, or slippage was observed during our site visit walkover for this site based on its relatively flat topography. Due to the uniform nature of the soils encountered in our testpit excavations, and the absence of any noticeable surface expressions, subsidence is not considered to be a geotechnical risk. Based on the topographical setting, the lack of evidence of overland flows and the dry soils encountered, the site is unlikely to be subject to inundation.

Any future development of this site will likely involve the removal of the surface vegetation and topsoil for extended periods of time. Exposure of the stripped ground surface to rainfall will potentially cause erosion and rilling of the site soils. Damage can be minimised by staging the earthworks (to retain vegetated areas) and the use of appropriate mitigation measures as described in section 7.1.

Access to the site is presently off Main South Road (SH 1) and is likely to be enhanced with the development of adjacent subdivisions.

9.0 Conclusions

1. Geotechnical investigations have been completed and a typical soil profile for the site identified, which corresponds well to the regional geological setting from published data.
2. Ground conditions in the test locations do not meet the minimum requirements of NZS3604:2011 for standard shallow foundations and therefore house foundations require specific investigation and design. Indications based on investigations to date are that enhanced slab TC2 solutions or other specific design is applicable.
3. The potential for seismically induced liquefaction has been assessed from the test pit investigations.
   - Liquefaction is a negligible risk in soils to 10.0 m depth above the water table.
   - Liquefaction in soils below 10 m depth may potentially occur within saturated sand or silt lenses that may be present over this depth. However, it is unlikely that liquefaction of these lenses will cause any surface disruption or observable settlement and therefore they are not considered a significant risk to the development.
4. In terms of the DBH guidelines, we consider that the subject site is likely to be similar to those sites that fall into the technical category, TC1.
5. The proposed development will generally comply with the intent of section 106 of the RMA provided that appropriate engineering measures are undertaken to protect the existing site soils during subdivision development.
6. Inspections of ground conditions during the construction phase should be undertaken in accordance with accepted practice. RILEY shall be informed if there are any changes from the conditions described in this report.

10.0 Limitation

This report has been prepared solely for the benefit of the Nimbus Group as our client with respect to the brief, and the Selwyn District Council in processing the subdivision consent for the land area. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Recommendations and opinions in this report are based on data from limited test positions. The nature and continuity of subsoil conditions away from the test positions are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.

11.0 References

Youd, T.L. et al, 1996 and 1998, *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction resistance of soils*. Journal of Geotechnical and Geoenvironmental Engineering, October 2001.

APPENDIX A

Site Plan

LEGEND

SP1 — SCALA PENETROMETER TEST LOCATION

TP1 — TEST PIT LOCATION

SCALE 1: 5000

0 50 100 150 200 300 (m)

NOTES:-

1. PHOTO SOURCED FROM GOOGLE EARTH (7th FEB 2011).
2. ORIGINAL SCALE A3

REV	DESCRIPTION	BY	DATE
1	CPT ADDED	HN	17.12.12
0	FIRST ISSUE		

DESIGN ET | CHECKED
DRAWN HN | CHECKED
DATE DRAWN 18 DEC 2012

APPROVED FOR ISSUE:
DATE: / /

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TITLE

NIMBUS GROUP

COLES PROPERTY, PARK LANE

GEOTECHNICAL INVESTIGATION SITE LOCATION PLAN

CADFILE 12891-01
SCALES (A3) AS SHOWN
DRAWING No. 12891-01
REV. 1

APPENDIX B

Test Pit Logs

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Fax: +643 3794403

TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP1

Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	4.20 m	1 of 1

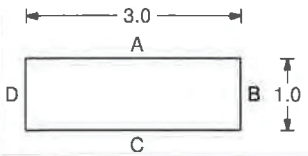
Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil / Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.75	0.25	Fine to medium SAND with some silt, dark brown with trace rootlets. Loose; moist. (TOPSOIL)							No. 1 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 1, 1, 1, 1, 2, 2, 2, 1, 2, 1, 1, 2, 14, 15
	1	Fine to medium SAND with trace to minor silt, grading to greyish brown SILT with some sand at 0.6 m., trace roots and local clay-rich lenses, light yellowish brown. Loose to medium dense; moist; clay rich lenses light greyish brown with pale orange spotting. (Q1a ALLUVIUM)							
+48.15	1.85								
	2	Fine to coarse GRAVEL with minor sand and silt and trace cobbles and boulders at depth, brown. Very dense; moist. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
	3								
	4								
+45.80	4.20								
	5	EOH @ 4.20 m							

SKETCH:

MAP

0 m
10 m
20 m
1:1,000

Shoring/Support: None
Stability:



- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

RILEY AGS 3_1 NZ LIB 13.GLB Log: RILEY TP COLESPROPERTY GINT LOG.GPJ DWG41574.GDW 11/22/2012 13:10 Produced by gINT Professional

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Engineers and Geologists

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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP2

Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	2.20 m	1 of 1

Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil / Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.70	0.30	Fine to medium silty SAND, dark brown with trace rootlets and roots. Loose; moist. (TOPSOIL)							No. 1 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1, 1, 2, 2, 2, 1, 1, 3, 4, 2, 2, 1, 1, 1, 2, 4, 7, 15
	1	Fine to medium silty SAND and sandy SILT thinly bedded with trace roots, light yellowish brown. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+48.45	1.55								
	2	Fine to coarse sandy GRAVEL with minor cobbles and boulders at depth, brown. Very dense; moist; gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
+47.80	2.20								
		EOH @ 2.20 m							
	3								
	4								
	5								

SKETCH:

MAP

N

0m 10m 20m

1:1,000

Shoring/Support: None
Stability:

5.0
A
D B 1.0
C

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
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- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP3

Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	2.00 m	1 of 1

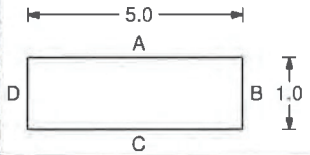
Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil / Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.80	0.20	Fine to medium silty SAND, dark brown with trace roollets. Loose; moist. (TOPSOIL)							No. 1 1, 1, 1, 2, 1, 1, 1, 2, 2, 3, 2, 3, 2, 1, 1, 2, 2, 3, 1, 1, 2, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 5, 15
	1	Fine to medium sandy SILT thinly bedded with trace roots and local clay-rich lenses, light yellowish brown. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+48.35	1.65								
+48.00	2.00	Fine to coarse sandy GRAVEL with trace cobbles and boulders at depth, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
		EOH @ 2.00 m							
	3								
	4								
	5								

SKETCH:

MAP

1:1,000

Shoring/Support: None
Stability:



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- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP4

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	5.00 m	1 of 1

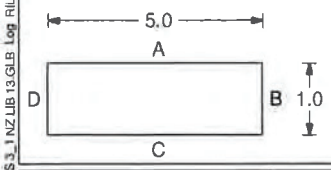
Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength Soil / Rock	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.80	0.20	Fine to medium silty SAND, dark brown with trace rootlets. Loose; moist. (TOPSOIL)							No. 1 1, 2, 1, 2, 1, 2, 1, 1, 1, 2, 2, 4, 3, 3, 2, 2, 3, 3, 3, 2, 2, 1, 1, 1, 1, 2, 2, 2, 3, 2, 1, 1, 1, 1, 2, 2, 3, 3, 6, 15
	1	Fine to medium sandy SILT thinly bedded with trace roots and local clay-rich lenses, light yellowish brown. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+48.35	1.65								
+48.00	2.00	Fine to coarse sandy GRAVEL with trace cobbles and boulders at depth, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
	3								
	4								
	5	EOH @ 5.00 m							

SKETCH:

MAP

0 m
10 m
20 m
1:1,000

Shoring/Support: None
Stability:



- Small Disturbed Sample
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GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

TEST PIT LOG

Riley Consultants Limited
395 Madras Street
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Tel: +643 3794402
Fax: +643 3794403

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP5

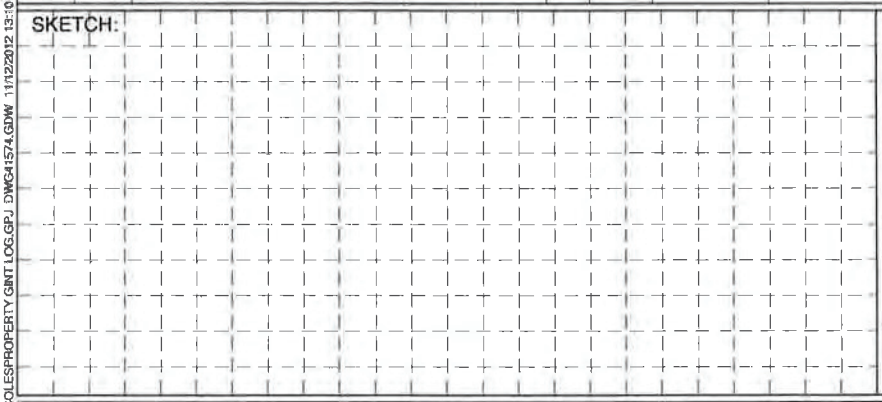
Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	1.45 m	1 of 1

Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength Soil / Rock	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.60	0.40	Fine to medium silty SAND, dark brown with trace rootlets. Loose; moist. (TOPSOIL)							
+49.25	0.75	Fine to medium sandy SILT thinly bedded with trace roots and local clay-rich lenses, light yellowish brown. CClay rich lenses light greyish brown with pale orange spotting. Loose to medium dense; moist. (Q1a ALLUVIUM)							
	1	0.45 m Grades to contain no roots.							
		Fine to coarse GRAVEL with minor sand and silt and trace cobbles and boulders at depth, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
	2								
	3								
	4								
	5								
+44.80	5.20								
		EOH @ 1.45 m							

No. 1
1, 1, 2,
2, 2, 3,
2, 2, 2,
3, 2, 3,
3, 5, 3,
2, 2, 2,
2, 1, 2,
2, 4, 3,
3, 3, 2,
1, 3, 15

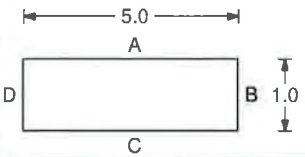
SKETCH:



MAP

1:1,000

Shoring/Support: None
Stability:



- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants Limited
395 Madras Street
Christchurch 8013
Tel: +643 3794402
Fax: +643 3794403

TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP6

Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	5.00 m	1 of 1

Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil / Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.70	0.30	Fine to medium SAND with some silt, dark brown with trace rootlets. Loose; moist. (TOPSOIL)							
	1	Fine to medium silty SAND with local clay-rich lenses, light yellowish brown. Clay rich lenses light greyish brown with pale orange spotting. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+47.80	2.20								
	3	Fine to coarse GRAVEL with minor sand and silt and trace cobbles and boulders at depth, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. (Q1a ALLUVIUM)							
	4								
+45.00	5.00								
	5	EOH @ 5.00 m							

Tests — No. 1:
1, 1, 2,
1, 2, 1,
1, 1, 1,
1, 1, 1,
1, 1, 1,
1, 1, 1,
1, 1, 1,
1, 1, 1,
1, 2, 1,
2, 2, 1,
1, 2, 2,
1, 2, 2,
2, 2, 2, 3

SKETCH:

MAP

0 m
10 m
20 m
1:1,000

Shoring/Support: None
Stability:

5.0
A
D
B
1.0
C

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

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Christchurch 8013
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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP7

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	4.50 m	1 of 1

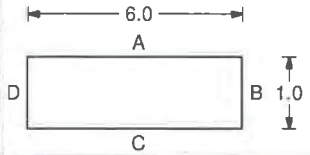
Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength Soil / Rock	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.40	0.60	Fine to medium silty SAND, dark brown with trace medium subrounded gravel, rootlets and roots. Loose; moist. (TOPSOIL)							No, 1 1, 2, 1, 1, 1, 1, 1, 1, 2, 2, 1, 2, 2, 3, 1, 2, 2, 2, 2, 2, 3, 6, 3, 7, 12, 5, 7, 15
+47.90	2.10	Fine to medium SAND with minor silt and trace roots, light brown. Deeper at North end of pit, local gravel lens at 1.1 m. Loose to medium dense; moist. (Q1a ALLUVIUM)							
		Fine to coarse sandy GRAVEL with minor cobbles, brown. Gravel, subangular to subrounded, strong, slighlly weathered greywacke sandstone. Contains obvoius layering and local gravelly sand lenses. (Q1a ALLUVIUM)							
+45.00	5.00								
		EOH @ 4.50 m							

SKETCH:

MAP

0 m
10 m
20 m
1:1,000

Shoring/Support: None
Stability:



- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

RILEY AGS 3_1 NZ LIB 13.GLB Log RILEY TP COLESPROPERTY GINT LOG.GPJ DWG41574.GDW 11/12/2012 13:10 Produced by gINT Professional

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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP8

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

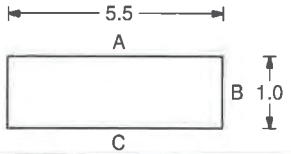
Client:	Hole Depth:	Sheet:
Nimbus Group	5.00 m	1 of 1

Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil / Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.75	0.25	Fine to medium silty SAND, dark brown with trace rootlets and roots. Loose; moist. (TOPSOIL)							
		Fine to medium SAND with minor silt and trace roots, light brown. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+49.00	1.00	Fine to coarse sandy GRAVEL with minor cobbles, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. Contains obvoius layering and some sand lenses. Loose; moist. (Q1a ALLUVIUM)							No. 1 2, 2, 3, 3, 2, 2, 1, 4, 6, 8, 7, 5, 4, 5, 6, 5, 4, 3, 2, 4, 6, 5, 4, 5, 16
	2								
	3								
	4								
+45.00	5.00								
		EOH @ 5.00 m							

SKETCH:

MAP

Shoring/Support: None
Stability:



- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

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Christchurch 8013
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TEST PIT LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	TP9

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Hole Depth:	Sheet:
Nimbus Group	1.70 m	1 of 1

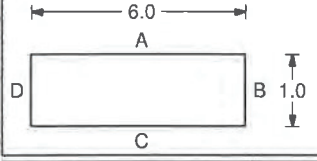
Elevation (m LINZ)	Depth (m)	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Weathering	Field Strength (Soil | Rock)	Defect Description (type, orientation, spacing, roughness, persistence aperture, infilling etc)	Groundwater	Samples	Tests
+50.00									
+49.80	0.20	Fine to medium silty SAND, dark brown with trace rootlets and roots. Loose; moist. (TOPSOIL)							No. 1 2, 2, 3, 2, 2, 3, 2, 2, 3, 2, 2, 2, 2, 1, 1, 2, 2, 2, 2, 2, 1, 2, 2, 1, 2, 3, 1, 2, 2, 2, 3, 2, 10, 15
	1	Fine to medium silty SAND silt and trace roots, light brown. Loose to medium dense; moist. (Q1a ALLUVIUM)							
+48.40	1.60								
+48.20	1.80	Fine to coarse sandy GRAVEL with minor cobbles, brown. Gravel, subangular to subrounded, strong, slightly weathered greywacke sandstone. Loose to medium dense; moist. (Q1a ALLUVIUM)							
	2	EOH @ 1.70 m							
	3								
	4								
	5								

SKETCH:

MAP

1:1,000

Shoring/Support: None
Stability:



- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Permeability Test
- Clegg Hammer; test repetitions (IV)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Scala Penetrometer - blows/50mm

GROUNDWATER [X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

PIT TERMINATED DUE TO:
[X] Target depth [ ] Collapse
[ ] Refusal [ ] Machine limit

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:50	Contractor:	Rig/Plant Used: Machine Excavator (14 tonne)	Logged by: 39	Checked by: AvD

APPENDIX C

Scala Penetrometer Logs

RILEY CONSULTANTS Engineers and Geologists
Riley Consultants Limited
395 Madras Street
Christchurch 8013
Tel: +643 3794402
Fax: +643 3794403

SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP1

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.60 m	1 of 1

Elevation (m LINZ): +50.00

Depth (m): 1, 2

Descriptive Strength Term (inferred from in-situ penetration test)

Legend

Weathering: RSW, CW, HW, MW, SW, UW

Field Strength — Soil: VSVL, VSoft, Soft, FirmD, StiffD, VStiffD, Hard; Rock: VW, MS, SS, VSS

Scala Penetrometer (blows / 50 mm): 0 3 6 9 12 15

Fluid & Water

Samples

Tests

Instrument/ Backfill

Tests
No. 1
1, 2, 1,
2, 1, 2,
1, 3, 2,
2, 3, 2,
1, 2, 1,
2, 2, 2,
2, 2, 1,
2, 1, 1,
2, 1, 1,
2, 1, 1,
1, 1, 2,
11, 15

SKETCH:

MAP

N

0 m
1 km
2 km
1:1,000

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

RILEY AGS 3_1 NZ LIB 13.GLB Log RILEY SCALA LOG COLESPROPERTY GINT LOG.GPJ DWG36164.GDW 11/12/2012 13:09 Produced by gINT Professional

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants Limited
395 Madras Street
Christchurch 8013
Tel: +643 3794402
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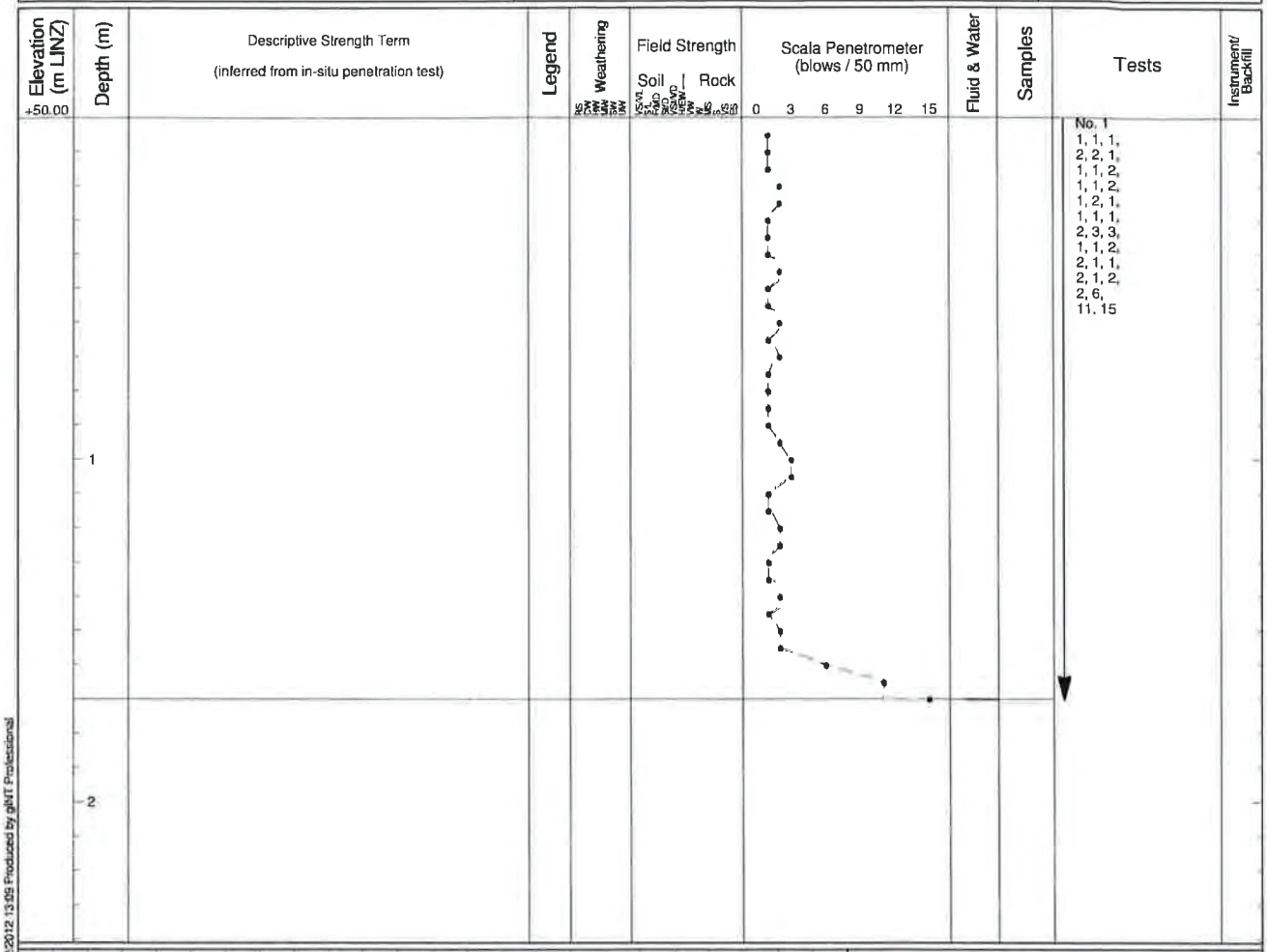
SCALA LOG

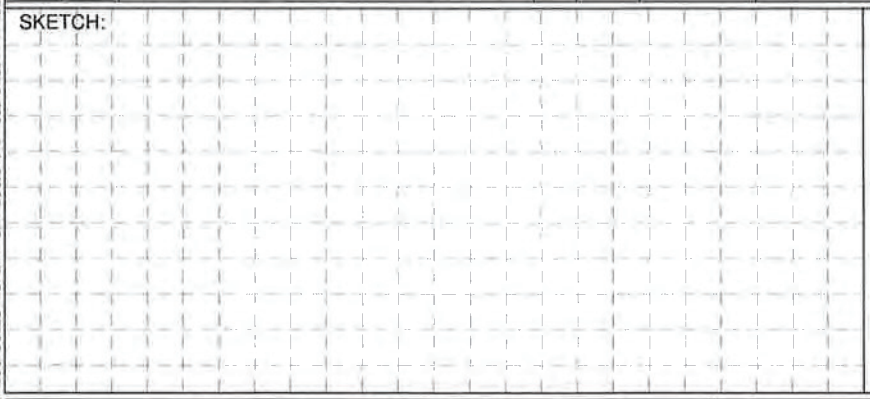
Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP2

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

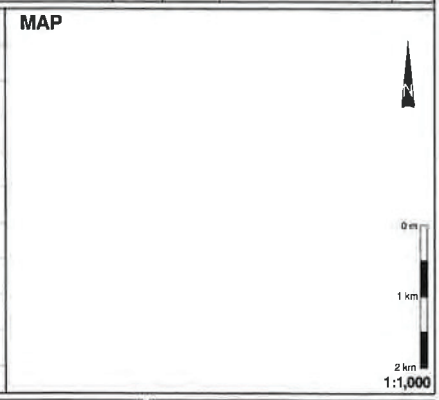
Client:	Test Depth:	Sheet:
Nimbus Group	1.70 m	1 of 1



SKETCH:



MAP



Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ..)
- Water Rise (1st, 2nd ..) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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Christchurch 8013
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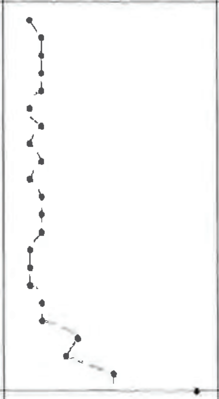
SCALA LOG

Project: Coles Property - Park Lane	Location: Rolleston, Canterbury	Hole position: Refer to site plan	No.: **SP3**
Job No.: 12891	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ): 50.00	Co-Ordinates (NZTM2000):
Client: Nimbus Group	Test Depth: 1.10 m		Sheet: 1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength (Soil / Rock)	Scala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	0 – 1.10					0 3 6 9 12 15			No. 1 1, 2, 2, 2, 2, 1, 2, 1, 2, 1, 2, 2, 2, 1, 1, 1, 2, 2, 5, 4, 8, 15	



SKETCH:

MAP

1:1,000

Explanations:
Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered
Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:
[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks
1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

RILEY CONSULTANTS Engineers and Geologists
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395 Madras Street
Christchurch 8013
Tel: +643 3794402
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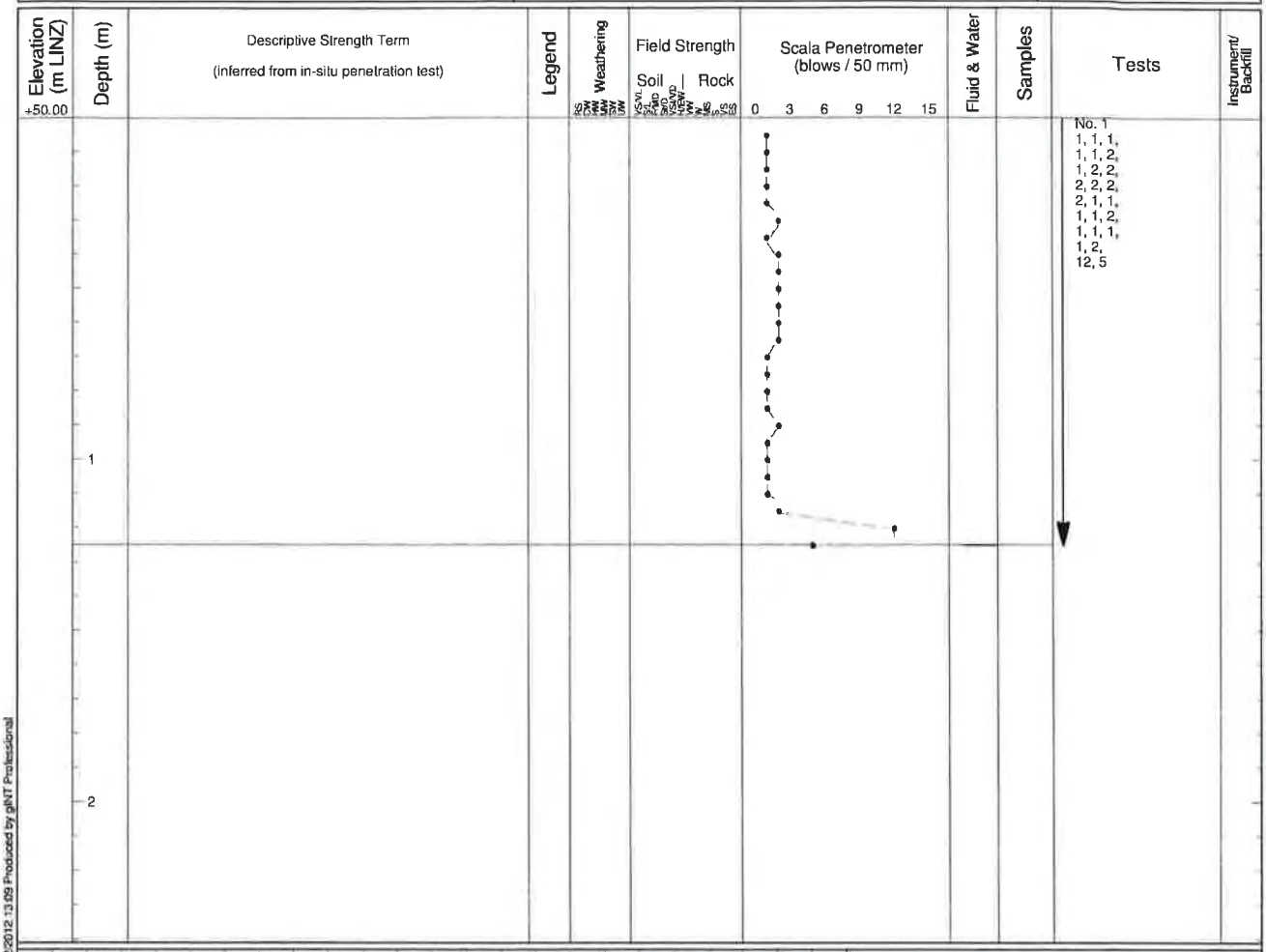
SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP4

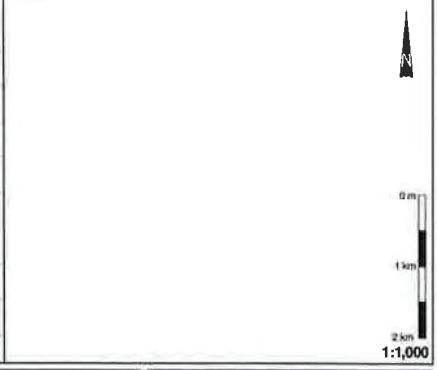
Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.25 m	1 of 1



SKETCH:

MAP



Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP5

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.50 m	1 of 1

Elevation (m LINZ) +50.00 | Depth (m) | Descriptive Strength Term (inferred from in-situ penetration test) | Legend | Weathering | Field Strength Soil — Rock | Scala Penetrometer (blows / 50 mm) 0 3 6 9 12 15 | Fluid & Water | Samples | Tests | Instrument/ Backfill

1
2

Tests — No. 1
1, 2, 1,
2, 2, 3,
2, 2, 2,
3, 2, 2,
1, 1, 1,
1, 1, 1,
1, 1, 1,
2, 2, 2,
3, 3, 2,
3, 12,
15

SKETCH:

MAP

N

0 m
1 km
2 km
1:1,000

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ..) & Rise Time (min's.)

Groundwater:

[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP6

Job No.:	Start Date:	Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12	20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.40 m	1 of 1

Elevation (m LINZ) +50.00 | Depth (m) | Descriptive Strength Term (inferred from in-situ penetration test) | Legend | Weathering | Field Strength Soil | Rock | Scala Penetrometer (blows / 50 mm) 0 3 6 9 12 15 | Fluid & Water | Samples | Tests | Instrument/ Backfill

Tests: No. 1
1, 1, 1,
1, 1, 1,
1, 2, 2,
2, 1, 1,
1, 2, 1,
2, 3, 2,
2, 1, 1,
2, 2, 4,
3, 2, 6,
15

SKETCH:

MAP

0 m
1 km
2 km
1:1,000

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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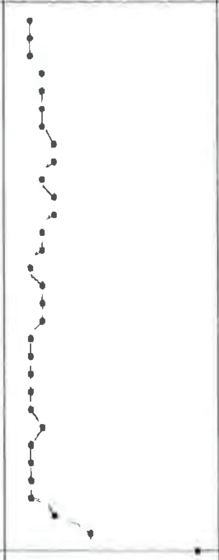
SCALA LOG

Project: Coles Property - Park Lane	Location: Rolleston, Canterbury	Hole position: Refer to site plan	No.: SP7
Job No.: 12891	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ): 50.00	Co-Ordinates (NZTM2000):
Client: Nimbus Group	Test Depth: 1.55 m		Sheet: 1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength Soil | Rock	Scala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	1 2			RS CW HW MW SW UW	VS/VL S/L F/MD St/D VSt/VD H EW VW W MS S VS ES				No. 1 1, 1, 1, 2, 2, 2, 2, 3, 3, 2, 3, 3, 2, 2, 1, 2, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 3, 6, 15	

SKETCH:

MAP

Explanations:
Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered
Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:
[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks
1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP8

Job No.:	Start Date:	Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12	20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.60 m	1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength (Soil / Rock)	Scala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	1					0 3 6 9 12 15			No. 1 1, 0, 1, 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1, 2, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 2, 4, 15	
	2									

SKETCH:

MAP

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ..)
- Water Rise (1st, 2nd ..) & Rise Time (min's.)

Groundwater:

[X] None

[ ] Rods wet below

HOLE TERMINATED DUE TO:

[ ] Target depth [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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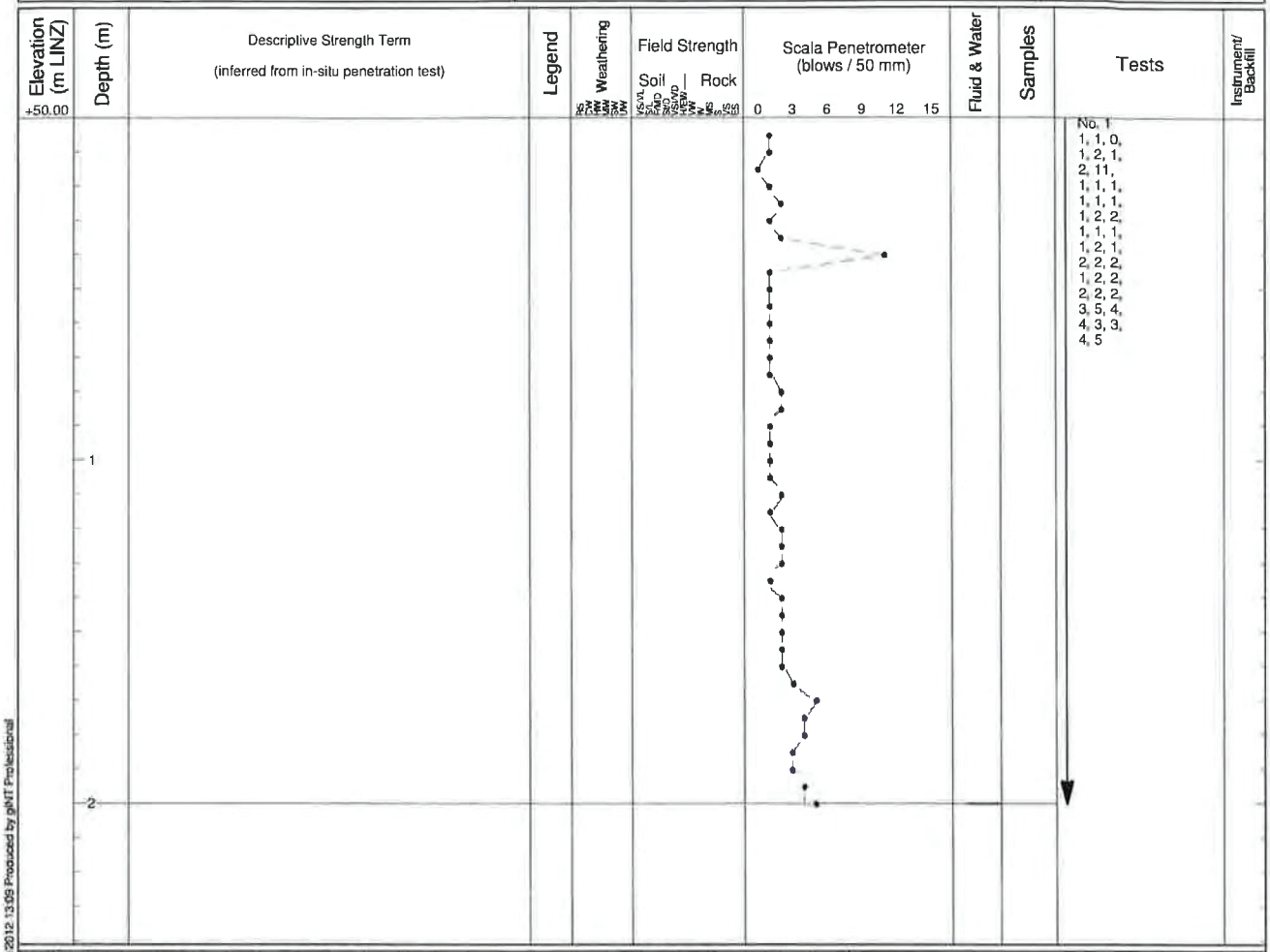
SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP9

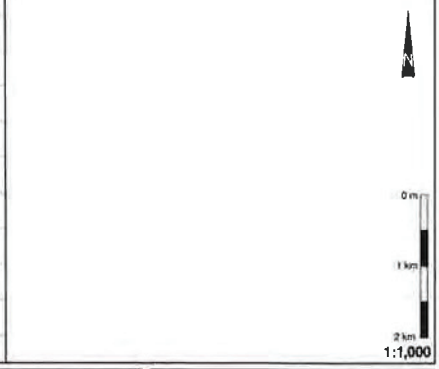
Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	2.00 m	1 of 1



SKETCH:

MAP



Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:

- [X] Target depth
- [ ] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP10

Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	0.55 m	1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength (Soil | Rock)	Scala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00						0 3 6 9 12 15			No. 1 1, 0, 1, 2, 2, 2, 2, 2, 3, 7, 15	
	1									
	2									

SKETCH:

MAP

1:1,000

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

[X] None

[ ] Rods wet below

HOLE TERMINATED DUE TO:

[ ] Target depth [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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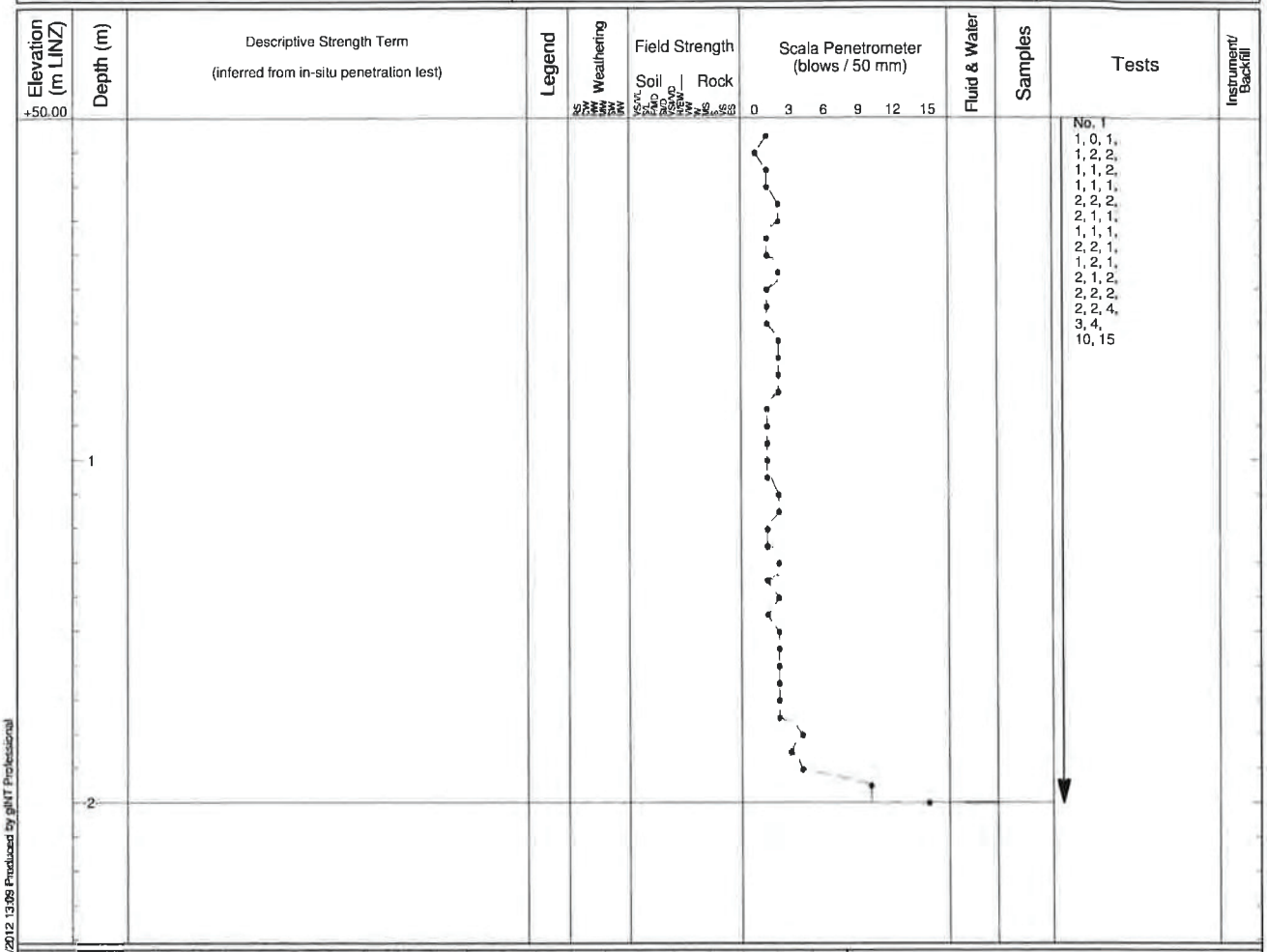
SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP11

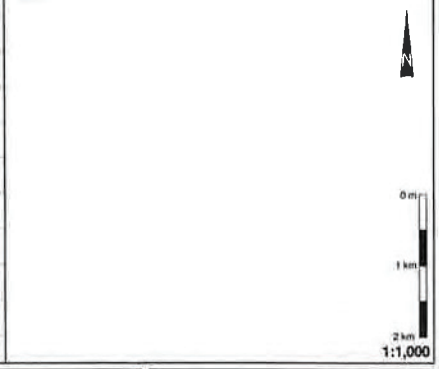
Job No.:	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891		50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	2.00 m	1 of 1



SKETCH:

MAP



Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd...)
- Water Rise (1st, 2nd...) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:

- [X] Target depth
- [ ] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project: Coles Property - Park Lane	Location: Rolleston, Canterbury	Hole position: Refer to site plan	No.: **SP12**
Job No.: 12891	Start Date: 20-11-12 Finish Date: 20-11-12	Ground Level (m LINZ): 50.00	Co-Ordinates (NZTM2000):
Client: Nimbus Group	Test Depth: 1.45 m		Sheet: 1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength Soil / Rock	Scala Penetrometer (blows / 50 mm) 0 3 6 9 12 15	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	1 2								No. 1 1, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 1, 2, 1, 1, 1, 2, 2, 1, 3, 2, 2, 1, 2, 10, 15	

SKETCH:

MAP

1:1,000

Explanations:
Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered
Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ..) & Rise Time (min's.)

Groundwater:
[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal

Remarks
1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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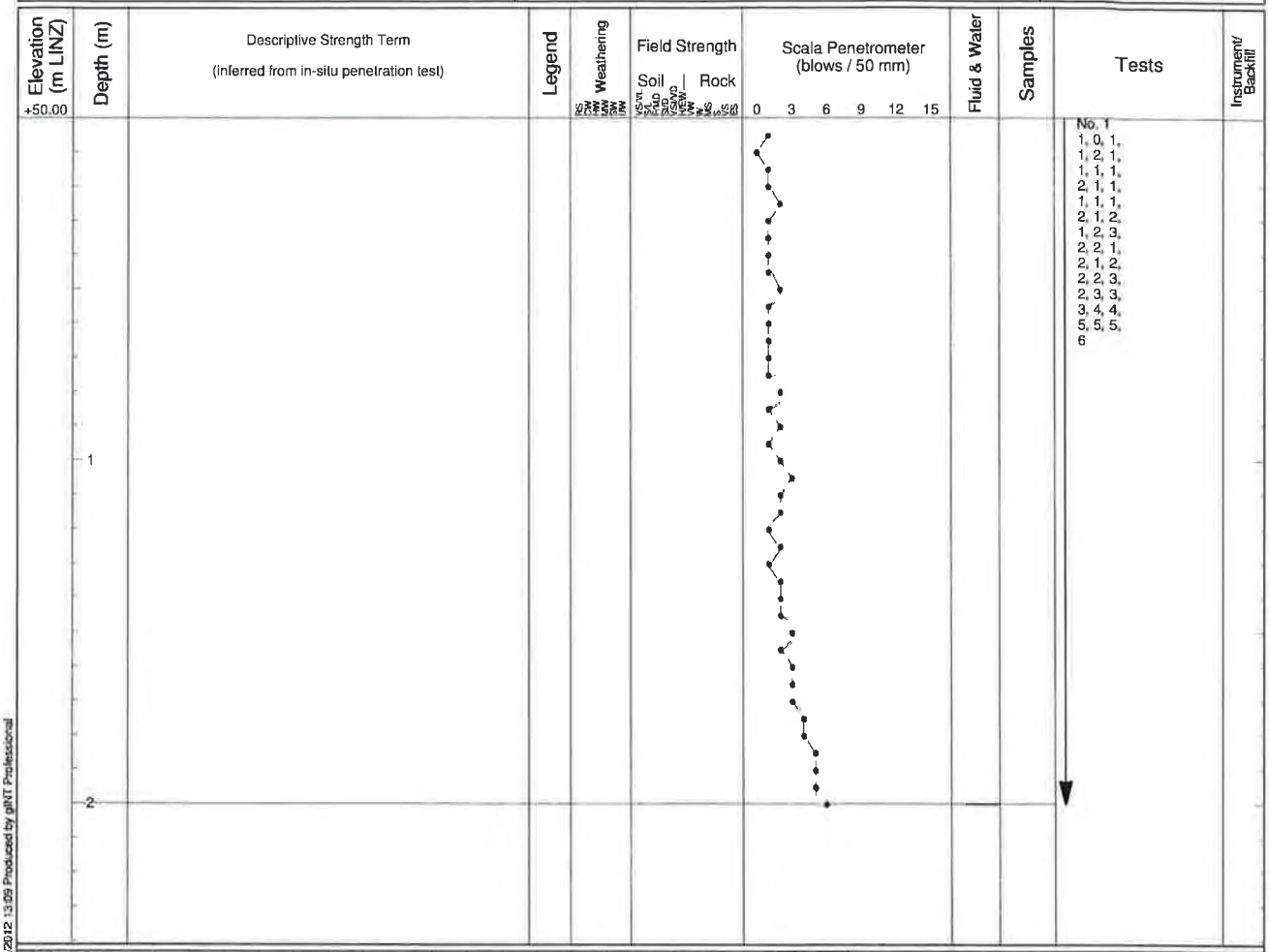
SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	**SP13**

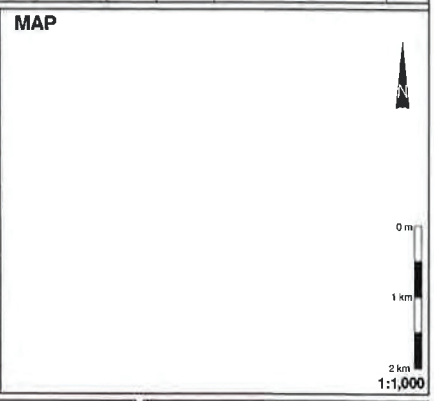
Job No.:	Start Date: / Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12 / 20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	2.00 m	1 of 1



SKETCH:

MAP



Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:

- [X] Target depth
- [ ] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Location:	Hole position:	No.:
Coles Property - Park Lane	Rolleston, Canterbury	Refer to site plan	SP14

Job No.:	Start Date:	Finish Date:	Ground Level (m LINZ):	Co-Ordinates (NZTM2000):
12891	20-11-12	20-11-12	50.00	

Client:	Test Depth:	Sheet:
Nimbus Group	1.95 m	1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength (Soil / Rock)	Scala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00						0 3 6 9 12 15				
	1								No. 1 1, 0, 1, 1, 1, 2, 2, 1, 2, 1, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1, 1, 2, 1, 2, 2, 1, 2, 1, 2, 2, 3, 2, 1, 1, 1, 2, 4, 5, 15	
	2									

SKETCH:

MAP

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample

- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) & Rise Time (min's.)

Groundwater:

- [X] None
- [ ] Rods wet below

HOLE TERMINATED DUE TO:
- [ ] Target depth
- [X] Refusal

Remarks

1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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SCALA LOG

Project:	Coles Property - Park Lane
Location:	Rolleston, Canterbury
Hole position:	Refer to site plan
No.:	SP15
Job No.:	12891
Start Date:	20-11-12
Finish Date:	20-11-12
Ground Level (m LINZ):	50.00
Co-Ordinates (NZTM2000):	
Client:	Nimbus Group
Test Depth:	2.00 m
Sheet:	1 of 1

Elevation (m LINZ)	Depth (m)	Descriptive Strength Term (inferred from in-situ penetration test)	Legend	Weathering	Field Strength Soil / Rock	Scala Penetrometer (blows / 50 mm) 0 3 6 9 12 15	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	0 – 2								No. 1 2, 2, 2, 2, 3, 3, 4, 4, 4, 3, 3, 3, 3, 4, 4, 3, 3, 4, 3, 3, 4, 4, 5, 6, 5, 5, 4, 4, 4, 4, 5, 4, 6, 6, 6, 6, 5, 6, 5, 5	

SKETCH:

MAP

1:1,000

Explanations:
Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered
Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer: blows/50mm
- Permeability Test
- Clegg Hammer: impact value (test repetitions)
- Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ..) & Rise Time (min's.)

Groundwater:
[X] None
[ ] Rods wet below

HOLE TERMINATED DUE TO:
[X] Target depth [ ] Refusal

Remarks
1. Ground level and coordinates are approximate and subject to survey confirmation.

All dimensions in metres Scale 1:20	Contractor:	Rig/Plant Used: Scala Penetrometer	Logged by: 39	Checked by: AvD

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