



**Geotechnical Report,
Corner of Memorial Avenue
and Russley Road,
Memorial Avenue
Investments Limited**


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1. Introduction

Memorial Avenue Investments Limited is in the process of applying for a plan change to allow the development of a business park on the corner of Russley Road and Memorial Drive. The block of land is approximately 20 hectares in area and is intended to be changed from a rural zoning to a business zoning. To support this application Aurecon has been engaged to undertake a geotechnical investigation to determine the geotechnical suitability of the site for this proposed zone change.

The scope of works undertaken was as follows:

- A detailed desk study considering geological and geotechnical information available for this site, including a review of Environment Canterbury (ECan) borehole and groundwater information;
- A geotechnical investigation comprising 20 test pits across the site.
- A report detailing the investigation and analysis results, as well as providing recommendations on the geotechnical suitability of the site for development.

This work excludes the detailed design of foundation options which would be dealt with at the detailed design stage of the subdivision development.

Our limitations are at the end of this report. This report shall be read as a whole.

2. Site Conditions

2.1 Site description

The site is located on the corner of Russley Road and Memorial Avenue, Christchurch (see Figure 1). The site consists of five blocks of land totalling approximately 20ha. The site is bounded by Russley Road to the west, Memorial Avenue to the north, Avonhead Road to the south and private property to the east. The five blocks of land are legally described as Pt Lot 1, Lots 2, 4 and 5 DP28780, and Lot 1 DP74459 (see Figure 2).

The site is essentially flat and is currently used for pastoral farming activities and is crossed by a series of internal post and wire farm fences. Farm sheds and residential houses within the area of development are located across the site.

2.2 Site Access

The site is accessed via farm gates directly off Russley Road. Internal access is across grassed paddocks and via a network of gates within the internal farm fencing network.

2.3 Vegetation

The site is primarily vegetated with pastoral grass. There are occasional stands of trees and hedges along many parts of the external site boundaries and along internal farm fence lines.

2.4 Drainage

Site drainage consists of natural drainage channels and man made swales. Drainage is inferred to be via the internal drainage network of swales or via direct soakage to the ground.

2.5 Regional Geology

The regional geology of the site is described by Brown et al. (1992) in the 1:25,000 scale map "Geology of the Christchurch Urban Area" as straddling the boundary between "*Alluvial gravel, sand, and silt of historic river flood channels*" and "*Dominantly alluvial sand and silt overbank deposits (spy)*".

The GNS Active Fault System database (GNS, 2011a) indicates that the site is located approximately 16km northeast of the eastern end of the Greendale Fault System. Movement on the Greendale Fault System was responsible for the Magnitude 7.1 Darfield (Canterbury) Earthquake on 4 September 2010. The site is also located approximately 10km north of the epicentre of the Magnitude 6.3 Christchurch Earthquake on 22 February 2011 (GNS, 2011b).

2.6 Liquefaction

No evidence of liquefaction such as sand boils or other surface manifestations were observed on site during investigations or following an inspection of low altitude aerial photographs taken on 24 February 2011 (two days after the Christchurch Earthquake). Tonkin and Taylor (2010) indicated no reported liquefaction within 2km of the site in the September 2010 earthquake.

3. Geotechnical Site Investigation

3.1 General

The objective of the ground investigation was to investigate the overall subsoil and groundwater conditions across the site. Once details of any development are known then site specific investigations will need to be conducted for each proposed building.

The geotechnical investigation comprised the following:

- A review of the available Environment Canterbury GIS database borehole logs.
- Site walk over by a Geotechnical Engineer from Aurecon.
- 20 Test pits excavated by Texco on 4 to 5 May 2011 under supervision by a Geotechnical Engineer from Aurecon.

3.2 Test Pits

The test pits were excavated with a 20t excavator to a maximum depth of 3.5m. They were located to give a reasonable coverage across the site. A geotechnical engineer from Aurecon supervised test pit excavation and logged and photographed the pits. The test locations are shown on Figure 2. Logs from the test pits are presented in Appendix A along with an explanatory sheet outlining the terms and symbols used on the logs.

The soil logging of the test pits was based on observations from the surface and inspection of samples recovered by the excavator bucket. The logging of the soil from the boreholes and test pits was undertaken in accordance with NZ Geotechnical Society's "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes: 2005".

No standpipe piezometers were installed during test pit investigations as the ground water table was not encountered.

3.3 Environment Canterbury Borehole Logs

A review of the Environment Canterbury GIS System (ECan, 2010) has been undertaken to identify borehole logs within the direct vicinity of the site. The review indicates that four suitable boreholes have been identified. See Figure 2 for the borehole locations and Appendix B for the borehole logs.

Borehole logs describe a layer of soil variously described as "earth", "soil", "topsoil" or "silt" overlying gravels. Water levels were only measured in boreholes M35/1479 and M35/9188 at 7.5m and 6.5m below the ground surface respectively.

4. Engineering Considerations

4.1 General

Memorial Avenue Investments Limited is in the process of applying for a land zoning change for a 20ha block of land on the corner of Memorial Avenue and Russley Road, from its current rural zoning to a business zoning. To assist in this, a geotechnical engineering assessment has been conducted to determine the suitability of the land for development from a geotechnical viewpoint. This is of particular importance in light of the recent Darfield Earthquake in September 2010 and Christchurch Earthquake in February 2011 which resulted in extensive damage due to liquefaction. The details of our assessment, as well as recommendations regarding the suitability of the land for development are discussed in the following sections.

4.2 Geotechnical Ground Model

The results of the site investigation show that the surficial ground layers are fairly consistent with 0.2m to 0.4m of topsoil overlying 0.3m to 2.0m of soft/loose silt, sandy silt and silty sand (loess) which is underlain by sandy gravel and gravel with occasional sand lenses (alluvium) which is inferred to extend approximately 500m below ground level before bedrock is encountered. This is consistent with the nearby boreholes from the Environment Canterbury GIS System (ECan, 2010).

These strata are typical of the Canterbury Plains which have been built up by sandy gravel alluvium washed down rivers such as the Waimakariri and Rakaia rivers from the Southern Alps and subject to wind blown silt deposits, loess, as westerly winds transported fine sediments across the Canterbury Plains. Table 1 presents a generalised subsurface profile, with a summary of the materials encountered and their properties:

Table 1: Generalised Subsurface Profile

Layer	Depth below ground to top of layer	Layer thickness	Description	Consistency
1	0m	0.2m to 0.4m	Topsoil: Dark blackish brown Sandy SILT	Soft
2	0.2m to 0.4m	0.25m to 1.95m	Loess: Light brownish grey SILT, Sandy SILT and Silty fine SAND	Silt: Soft Sand: Loose
3	0.4m to 2.2m	At least 1.3m to 3.1m	Alluvium: Grey to greyish brown GRAVEL and Sandy GRAVEL with occasional sand lenses	Loose to Medium Dense

Also encountered in Test Pit TP15 was 1.1m of fill material. However, this was an isolated case and it is inferred that the majority of the site is as described above.

4.3 Groundwater

No groundwater was encountered during the test pit investigations. This is consistent with the results of the ECan borehole logs which encountered the water table at 6.5m to 7.5m below ground level which is deeper than the maximum depth investigated during test pit investigations.

4.4 Liquefaction Assessment

The three primary factors that contribute to liquefaction potential are:

- Loose uniformly graded soils;
- High ground water table
- Sufficiently high, earthquake induced ground acceleration and sustained shaking.

Each of these is considered below together with our conclusion on the site liquefaction.

a) Soil Grading

Liquefiable soils generally have a Coefficient of Uniformity of less than 5 and a low proportion of soil finer than 75 microns in size (typically less than 5% to 10% but up to 30%). Test logs indicate the ground conditions consist of sandy silt and sandy gravels with occasional sand layers.

Based on the test logs and in-situ test results the silts and fine sands at shallow depths may have a liquefaction potential, however we infer the gravel material will have a Coefficient of Uniformity greater than 5 and therefore may have a low risk of liquefaction.

b) Ground Water

Groundwater was not encountered during our investigations; we infer that groundwater is more than 3.5m below ground level (the extent of our investigation) and so well below the silt and fine sand layers encountered that may be susceptible to liquefaction.

c) Earthquake Intensity and Soil Resistance to Liquefaction

Based on the recent Darfield and Christchurch earthquakes, we infer that the site is susceptible to shaking from nearby faults. Peak horizontal ground accelerations of 0.2g were recorded at the nearby airport in both the September and February earthquakes.

Considering the above factors, we infer that the risk of liquefaction is very low. Furthermore, we observed no liquefaction damage to the site from the recent earthquakes in September 2010 and February 2011.

5. Assessment Against RMA

Although the current proposal is for a plan change rather than subdivision, we believe that Section 106 of the Resource Management Act provides an appropriate guide for plan change considerations. Section 106 of the Resource Management Act (RMA) states *inter alia*

1. ... “a consent authority may refuse to grant a 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.”*

Our assessment of the site against the requirements of Section 106 is presented below. A summary is provided in Table 2 with more detail following.

Table 2: Assessment of the Site against the RMA

Hazard	Potential Susceptibility	
	Current (Section 106 1a)	Post Development (Section 106 1b)
Erosion	No erosion observed on site.	Silty soils could be vulnerable to erosion if left unprotected.
Falling Debris	Site is essentially flat so there is no risk of falling debris.	
Slippage	Site is essentially flat so there is no risk of slippage.	
Subsidence	Due to the nature of the soil and the very low risk of liquefaction the risk of subsidence is very low.	Very low risk provided building foundations are properly designed to ensure soils are not over loaded.
Inundation	The risk of inundation from liquefaction is very low. However, a full flood risk assessment is outside the scope of this report.	Provided stormwater discharge is appropriately managed the risk of inundation will not be exacerbated by developing the land.

5.1 Erosion

No erosion was observed on the site. Due to the site being underlain by a layer of silty soil (loess), there exists the potential for erosion and rilling of the sandy soils if vegetation cover is removed for prolonged periods of time, due to both stormwater runoff if it is not discharged in a controlled manner, and from the wind. This susceptibility to erosion of the silty soils can be minimised with appropriate industry standard design measures undertaken during construction.

5.2 Falling Debris and Slippage

The site is essentially flat so there is no risk of falling debris or slippage.

5.3 Subsidence

Due to the nature of the soil on the site the risk of subsidence is very low from both static loads and during seismic loads (i.e. liquefaction – see Section 4.4). Provided that buildings constructed on the site are appropriately founded the risk of subsidence will remain very low.

5.4 Inundation

The risk of liquefaction, and therefore inundation from liquefaction is very low. The overall risk of inundation is inferred to be very low as the soils are relatively free draining and there are no major watercourses nearby. However, a full flood risk assessment has not been carried out. Development of the site may alter the existing drainage patterns of the site. However, provided that stormwater discharge is appropriately dealt with in detailed Civil Engineering design the risk of inundation will not be exacerbated.

5.5 Conclusions

The site is not at risk of erosion, falling debris, subsidence, slippage, or inundation from liquefaction. A flood risk assessment may need to be carried out to confirm whether the site is at risk of inundation from flooding. However, from a geotechnical perspective the site complies with the requirements of Clause 106 1(a).

Provided appropriate engineering design measures are implemented, the man made and natural hazards resulting from the earthworks or general development of the site are unlikely to accelerate, worsen, or result in further material damage to the land. Therefore, in our opinion, the proposed building sites will comply with the requirements of Clause 106 1(b).

Section 106 1(c) is not relevant to a geotechnical appraisal and therefore has not been considered in this report.

In our opinion, under Section 106 1 of the RMA, there are no geotechnical reasons evident at the site to make it unsuitable for development or plan change provided any development is undertaken with appropriate engineering design measures.

5.6 Comparison against 2013 Ministry of Business, Innovation and Employment (MBIE) guidelines.

At the request of Memorial Avenue Investments Limited (MAIL) in August 2013, Aurecon carried out a reassessment of the scope of works, to see whether our previous investigations satisfied the 2012 MBIE guideline requirements for plan change. Our findings are as follows:

- A plan change requires 0.2 to 0.5 deep investigations (CPT, BH, TP) per hectare, with a minimum of 5. The site is 20ha in area, and therefore requires between 5 and 10 investigation points. The investigations undertaken for the 2011 report comprised of 20 test pits up to 3.5m depth, as well as a review of four nearby Environment Canterbury (ECan) well logs.
- The test pits showed topsoil and sandy silt to a depth between 0.5-2.2m (mostly ~1.5m). This was underlain by consistent gravels to termination depth of 3.5m. No groundwater was encountered in any of the test pits.
- The ECan borehole (BH) logs showed similar (simplified) results, and the deepest BH had gravel to termination depth of 24m. Two of the ECan BHs indicated ground water at 6.5 and 7.5m below ground level (bgl).

- Under MBIE guidelines, deep investigations should go to 15m unless there are consistent ground conditions, and liquefaction potential can be determined to be absent, in which case the number or depth of the investigations may be reduced.

For the Memorial Ave investigation, we consider that the guidelines have been met. There is a high density of consistent test pits, none of which encountered ground water. Though the upper silts may be potentially liquefiable, there was no liquefaction observed on the site or anywhere within a 2km radius, likely due to the deep ground water level. In our opinion therefore no further works at the site would be required to support the plan change application.

6. References

Brown, L. J.; Weeber, J. H. (1992) *Geology of the Christchurch urban area*. Scale 1:25,000. Institute of Geological and Nuclear Sciences geological map 1. 1 sheet + 104p. Institute of Geological a Nuclear Sciences Limited, Lower Hutt, New Zealand.

ECan, (2010). <http://arcims.ecan.govt.nz/ecanmapping/>

GNS, (2010)a. <http://maps.gns.cri.nz/website/af/viewer.htm>

GNS, (2010)b. <http://www.gns.cri.nz/Home/News-and-Events/Media-Releases/Most-damaging-quake-since-1931/Canterbury-quake>

NZSG, (2005). *Guidelines for the Classification and Field Description of Soils and Rocks in Engineering*. NZ Geotechnical Society Inc, Wellington, New Zealand.

Tonkin and Taylor, (2010), *Darfield Earthquake 4 September 2010 Geotechnical Land Damage Assessment Report – Stage 1 Report*, Earthquake Commission (EQC)

MBIE, (2012) Repairing and rebuilding houses affected by the Canterbury earthquakes.

7. Limitations

We have prepared this report in accordance with the brief as provided. The contents of the report are for the sole use of Memorial Avenue Investments Limited and no responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without our prior review and agreement.

The recommendations in this report are based on data collected at specific locations with limited site coverage. Only a finite amount of information has been collected to meet the specific financial and technical requirements of the Memorial Avenue Investments Limited's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgment and it must be appreciated that actual conditions could vary from the assumed model.

Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay.

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Figures

Figure 1 – Site Location Plan

Figure 2 – Site Investigation Location Plan





Appendix A

Test Pit Logs





Appendix B

ECan Borehole Logs





Figures

Figure 1 – Site Location Plan

Figure 2 – Site Investigation Location Plan





Appendix A

Test Pit Logs



Test Pit Number: TP01



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563615m
Easting: 5184268m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description							
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments	
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil	
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess	
				GW	Sandy GRAVEL: Grey, fine to course, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		L		Alluvium	
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine.		F		Loess	
				ML	Sandy GRAVEL: Grey, fine to course, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		L		Alluvium	
		4.0	5.0			End of Test Pit at 3.2m depth (Sidewalls collapsing)				

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP02



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563557m
Easting: 5184155m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description							
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments	
	Ex	0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil	
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess	
									Slightly plastic, grey. Sand is medium.	M
					GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles. Localised iron staining.	D	MD		Alluvium
					End of Test Pit at 3.5m depth (Target depth)					

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP03



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563522m
Easting: 5184060m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-


Test Pit Number: TP04



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563730m
Easting: 5184178m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div>1.0</div><div></div><div>2.0</div><div></div><div>3.0</div><div></div><div>4.0</div><div></div><div>5.0</div></div>		ML	Sandy SILT: Slightly plastic, dark brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
				GW	GRAVEL: Brown grey, fine to course, rounded, slightly to moderately weathered. Some sand, fine to medium. Trace of cobbles.		L		Alluvium
					Sandy GRAVEL: Grey, fine to course, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.				
					End of Test Pit at 2.7m depth (Pit sidewalls collapsing)				

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP05



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563689m
Easting: 5184083m
Elevation: n/a

Sheet: 1 of 1

Excavation					Soil Description				
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex			ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, brown grey. Sand is fine. Occasional rootlets.		St		Loess
				GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		Alluvium
					End of Test Pit at 3.5m depth (Target depth)				

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP06



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563649m
Easting: 5183984m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP07



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563647m
Easting: 5183878m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
				GW	Sandy GRAVEL: Brown grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		Alluvium
			4.0			End of Test Pit at 3.5m depth (Target depth)			
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP08



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563591m
Easting: 5183759m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-


Test Pit Number: TP09



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563825m
Easting: 5184099m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brownish grey, sand is fine. Occasional rootlets.		St		Loess
				GW	Sandy GRAVEL: Grey, fine to course, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		L		Alluvium
						End of Test Pit at 3.2m depth (Pit sidewalls collapsing)			
		4.0							
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-


Test Pit Number: TP10



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563801m
Easting: 5184010m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex			ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
			ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.	F			Loess	
		1.0							
		2.0		GW	Sandy GRAVEL: Grey, fine to course, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		Alluvium
		3.0							
		4.0			End of Test Pit at 3.5m depth (Target depth)				
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP11



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 04/05/11
Northing: 1563772m
Easting: 5183921m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div>0.0</div><div></div><div>0.5</div><div></div><div>1.0</div><div></div><div>1.5</div><div></div><div>2.0</div><div></div><div>2.5</div><div></div><div>3.0</div><div></div><div>3.5</div><div></div><div>4.0</div><div></div><div>4.5</div><div></div><div>5.0</div></div>	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-


Test Pit Number: TP12



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563751m
Easting: 5183833m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
				GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		Alluvium
			4.0			End of Test Pit at 3.5m depth (Target depth)			
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP13



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563779m
Easting: 5183760m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div>1.0</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div>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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP14



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563689m
Easting: 5183717m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
				SP	SAND: Grey, fine to medium. Minor silt. Localised iron staining. Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		L		Alluvium
				GW			MD		
			2.0						
		3.0							
		4.0			End of Test Pit at 3.5m depth (Target depth)				
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP15



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563893m
Easting: 5184030m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP16



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563877m
Easting: 5183890m
Elevation: n/a

Sheet: 1 of 1

Excavation					Soil Description				
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
					As above	M			
		2.0		GW	Sandy GRAVEL: Brown grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.	D	MD		Alluvium
		4.0			End of Test Pit at 3.5m depth (Target depth)				
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-





Test Pit Number: TP17



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563866m
Easting: 5183801m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	<div><div></div><div>1.0</div><div></div></div>		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets.		F		Loess
				SP	SAND: Grey, fine to medium. Some silt. Localised iron staining.		L		Alluvium
				GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		
		<div><div></div><div>4.0</div><div></div></div>			End of Test Pit at 3.5m depth (Target depth)				
		<div><div></div><div>5.0</div><div></div></div>							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

Test Pit Number: TP18



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563892m
Easting: 5183689m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex			ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				ML	Sandy SILT: Non-plastic, light brown grey. Sand is fine. Occasional rootlets. Localised iron staining.		F		Loess
				GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles.		MD		Alluvium
					End of Test Pit at 3.5m depth (Target depth)				

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-

aurecon

Sheet: 1 of 1

5.0

1: Pit dimensions 0.6m wide by 2.5m long
2: Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
3:

Test Pit Number: TP20



Client: Memorial Avenue Investments Limited
Project: Cnr Memorial Avenue and Russley Road
Project Number: 221228
Logged By: Richard Heritage
Checked By: Richard Sabiston

Test Pit Location: See Location Plan
Date: 05/05/11
Northing: 1563971m
Easting: 5183797m
Elevation: n/a

Sheet: 1 of 1

Excavation			Soil Description						
Groundwater	Method	Depth	Graphic Log	Classification	Description of Soil: (Soil type: plasticity, colour, other components)	Moisture Content	Consistency	Samples and tests	Additional Comments
	Ex	1.0		ML	Sandy SILT: Slightly plastic, dark black brown. Sand is fine. Abundant rootlets.	D	S		Topsoil
				SM	Silty SAND: Grey, fine.		L		Loess
				SM	Silty SAND: Grey, fine to medium. Localised Iron Staining.	M			Alluvium
				GW	Sandy GRAVEL: Grey, fine to coarse, rounded, slightly to moderately weathered. Sand is fine to medium. Trace of cobbles. Localised iron staining.	D			
		4.0			End of Test Pit at 3.5m depth (Target depth)				
		5.0							

Remarks:

- Pit dimensions 0.6m wide by 2.5m long
- Co-ordinates are accurate to +/-5m and are in NZGD2000 NZTM.
-



Appendix B

ECan Borehole Logs



Borelog for well M35/12257

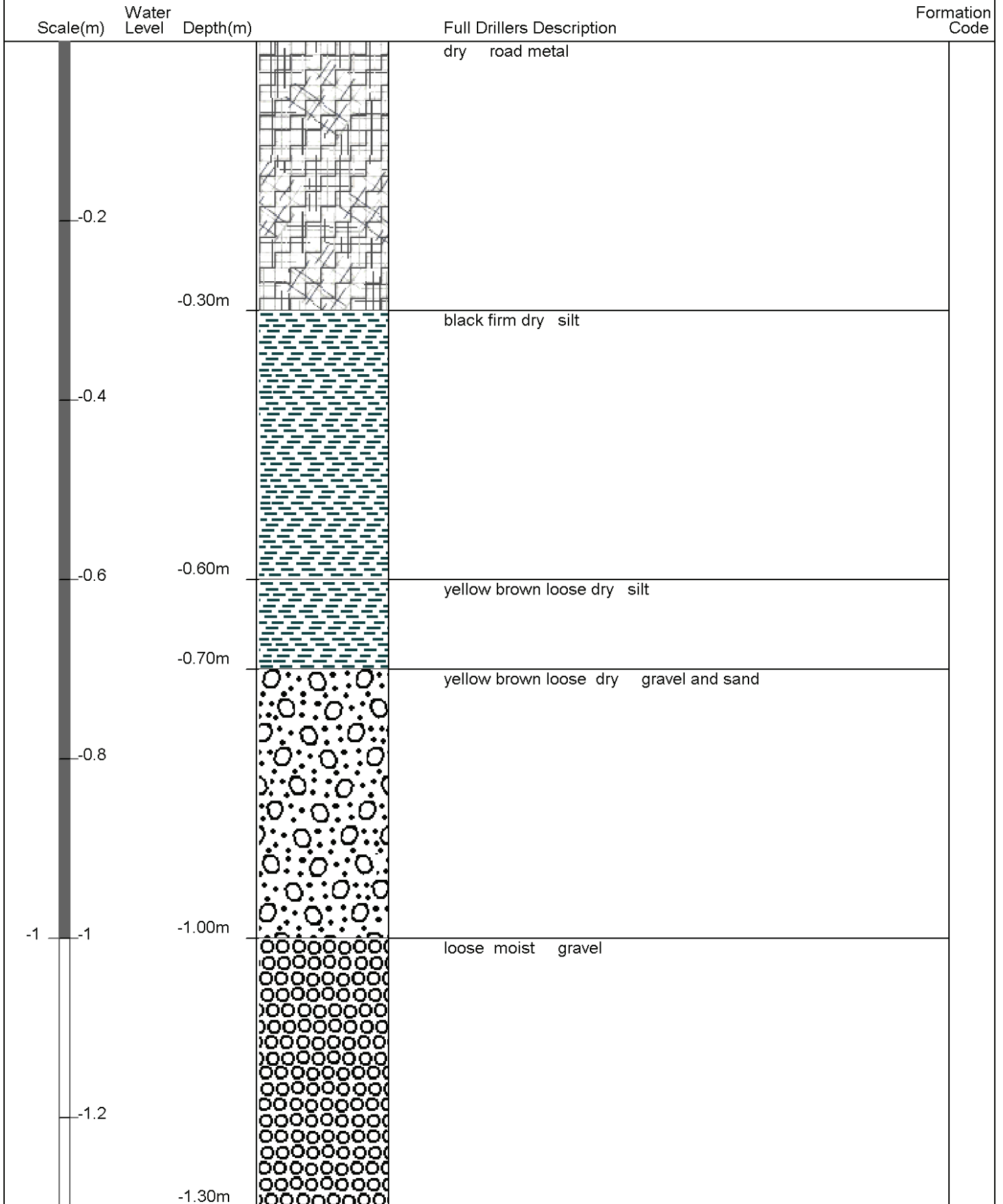
Gridref: M35:73964-45177 Accuracy : 3 (1=high, 5=low)

Ground Level Altitude : 23 +MSD

Well name : CCC BorelogID 299

Drill Method : Not Recorded

Drill Depth : -1.3m Drill Date : 8/05/1975



Borelog for well M35/1479

Gridref: M35:734-455 Accuracy : 4 (1=best, 4=worst)

Ground Level Altitude : 27.4 +MSD

Driller : J W Horne (& Co)

Drill Method : Driven Pipe

Drill Depth : -18.29m Drill Date : 1/07/1968



Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
			Topsoil	
		-1.50m		sp?
			Shingle and clay, brown	
-5				
	-7.3CalcMin			
-10				
-15				
		- 18.3m		sp-ri

Borelog for well M35/9188

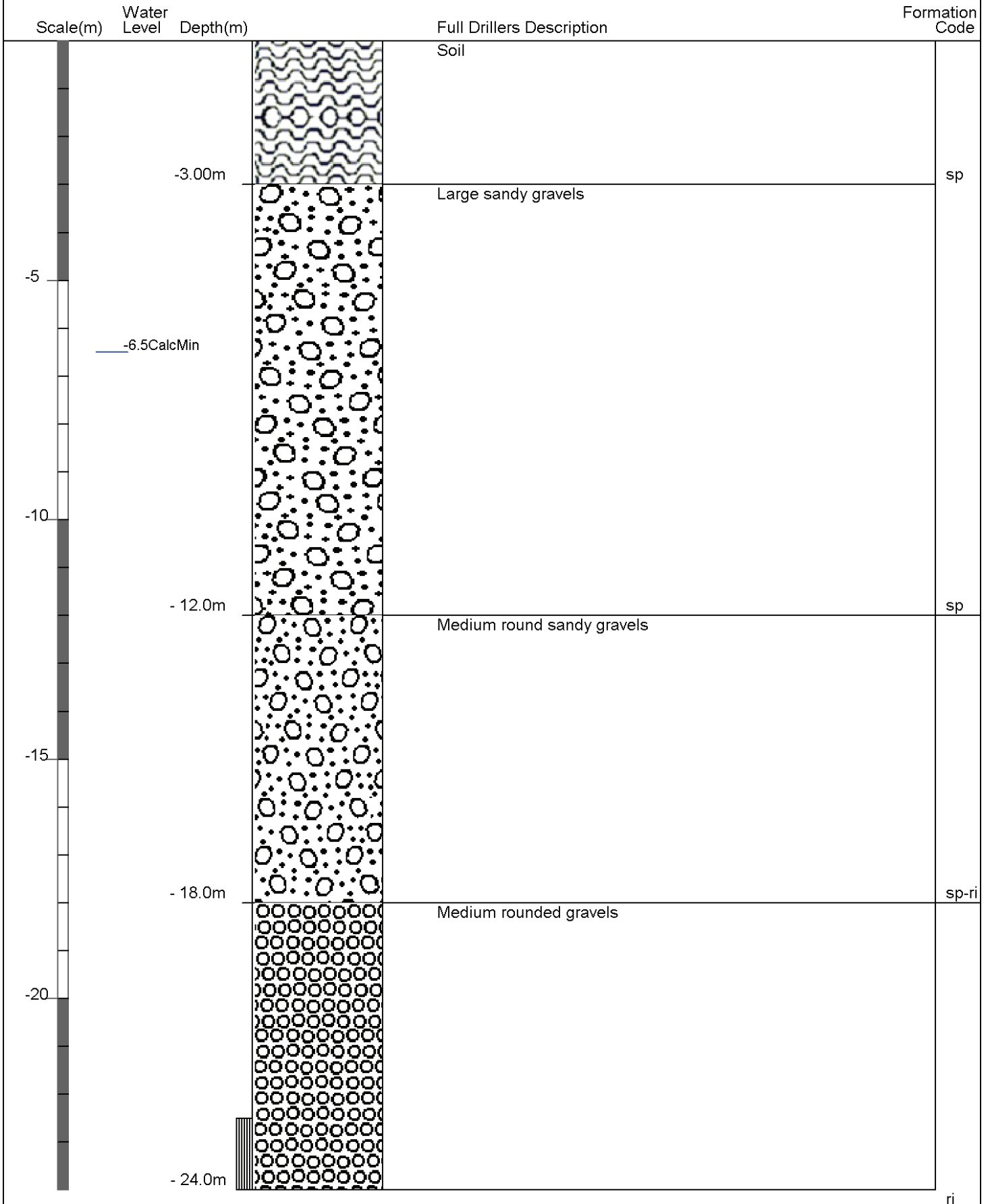
Gridref: M35:7358-4554 Accuracy : 4 (1=high, 5=low)

Ground Level Altitude : 26.9 +MSD

Driller : East Coast Drilling

Drill Method : Rotary/Percussion

Drill Depth : -24m Drill Date : 16/09/2002



Borelog for well M35/11537

Gridref: M35:73439-45632 Accuracy : 2 (1=high, 5=low)

Ground Level Altitude : 29 +MSD

Driller : McMillan Water Wells Ltd

Drill Method : Rotary/Percussion

Drill Depth : -10.7m Drill Date : 30/10/2006

