

GW WILFIELD LTD
Wilfield Subdivision – West Melton

Infrastructure Report

Revision 1

August 2014



DAVIE LOVELL•SMITH

PLANNING SURVEYING ENGINEERING



Shaping the future since 1880

1. INTRODUCTION

The site is located on the southern urban fringe of West Melton on the south side of West Coast Road (SH 73) and east of Weedons Ross Road.

Davie Lovell-Smith (DLS) have held several meetings with Strategic Planners and Infrastructure Engineers at Selwyn District Council (SDC), primarily Murray England with specific regards to servicing the proposal for water supply and sewer. It is the applicant's intention to construct infrastructure that will meet the demands of this project and also compliment the long-term requirements of West Melton. The proposed infrastructure will be integrated into the existing networks and all efforts will be made to ensure that the installations are complimentary to the current assets.

All proposed infrastructure will be designed and constructed in compliance with SDC Standards unless otherwise agreed. All infrastructure works will be designed in detail following subdivision consent and referred back to Council engineers for approval prior to any construction being undertaken on site.

All sites will be serviced for sewage, water supply, telecommunications and power. Stormwater will be discharged to ground on-site. All sites will be earthworked to ensure drainage to the street or natural flow paths. All building platforms will be elevated above secondary flow paths and the 1 in 50 year critical storm event. There is no gas reticulation in this development.

The over-riding feature of the proposal will be the retention of existing stormwater flow across the site. Existing drainage features will be retained and the development will be moulded around them. We understand that the applicant has met with the Council drainage engineers and they have agreed that sites do not need to drain to the roads but can instead drain onto neighbouring sites consistent with the natural contour of the land and the pre-development flow paths on the site.

2. WATER SUPPLY

Abstraction of groundwater from an existing bore on the development site (M35/6201) for irrigation and stock watering is currently consented under Resource Consent CRC010939. Water quality and bore yield testing has been undertaken by Pattle Delamore Partners Limited (PDP), their report is attached as Appendix A.

It is proposed that the development will include the transfer of bore M35/6201 to vest with SDC as a community water supply. Groundwater take consent CRC010939 will be transferred to SDC and the permit altered to a potable public supply. M35/6201 is located outside of the zone of effects of other public water supply wells.

A groundwater quality sample was collected by PDP, and analysed by Hill Laboratories against the Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ 2005). The results indicate water of general good quality with no parameters exceeding Maximum Acceptable Values (MAV) for the protection of human health or the Guideline Values (GV) for aesthetic effects. Full details of the analysis are included in the PDP report at Appendix A.

As discussed further, it is proposed that the future supply from the bore would connect to the West Melton township supply and therefore receive water quality treatment to ensure that DWSNZ 2005 is met.

The current consented maximum abstraction rate from bore M35/6201 under resource consent CRC010939 is 26 L/s.

Flow testing of was undertaken by PDP using a step drawdown test; refer to their report at Appendix A for full details of the methodology and results. Based on the water level conditions during the testing, bore M35/6201 was shown to be capable of yielding 26 L/s over the long-term. Potential yield during a very dry period where the available drawdown is reduced was also calculated. At the lowest assumed water level in M35/6201 the sustainable yield could potentially fall to between 23 and 24 L/s.

PDP have noted that the predictions of low water levels in M35/6201 are uncertain and may not be accurate as they are based on a water level record in a bore 4.5 km distant.

Daily water demand scenarios for average domestic demand, peak demand, and fire demand have been determined for this proposal, and are summarised below.

Proposed lots assumed to require 2.12 m³/lot/day - Assumed flow rate used from previous West Melton development, Preston Downs.

Lots	Volume/day at 2.12cu.m/day	Mean Flow l/s	Peak Flow l/s	
175	371	4.29	30.63	175 Lots
5	10.6	0.12	0.875	5 Inner plain lots
Sum	381.6	4.41	31.51	Total water demand

The Peak flow is calculated from Chart 1, Part 7: Water Supply of the SDC Code of Practice. The chosen flow is 0.175 l/s/connection based on a 180 lot water supply.

Fire Requirements

The water supply will be designed in accordance with SDC specifications and SNZ PAS 4509:2008 New Zealand Fire Service Fire Fighting Water Supplies Code of Practice. The fire fighting water supply classification will be FW2.

Two fire hydrants being used @ 12.5 L/s as per NZS4509

Fire demand = 25 L/s for 1 hour

Maximum Flow Scenario 1

Fire Flow + Mean Demand Flow = 25 + 4.41 = 29.41 L/s

Existing bore max flow = 26 L/s and 2153 m³/day (24.9 L/s average) based on CRC010939

Over run existing bore flow by 3.41 L/s

Over run demand for 1 hour @ 3.41 L/s

Required storage = 12,276 L

If however, the maximum flow from the bore is reduced to 23.5 L/s as outlined by PDP;

Over run existing bore flow by 5.91 L/s

Over run demand for 1 hour @ 5.91 L/s

Required storage = 21,276 L

Maximum Flow Scenario 2

Peak Demand Flow Only = 31.51 L/s

Existing bore max flow = 26 l/s and 2153 m3/day (24.9 L/s average) based on CRC010939

Over run existing bore flow by 5.51 L/s

Over run demand for 1 hour @ 5.51 L/s

Required storage = 19,836 L

If however, the maximum flow from the bore is reduced to 23.5 L/s as outlined by PDP;

Over run existing bore flow by 8.01 L/s

Over run demand for 1 hour @ 8.01 L/s

Required storage = 28,836 L

The worst case scenario is the 1 hour of maximum flow when the groundwater is at a very low level. This scenario requires an additional storage volume of 28,836 L.

Also, we can assume that the system will be connected to the Gainsborough tank farm. Note that the tank farm already provides for fire storage. Assume that there will only be one fire at any one time in either Gainsborough or this development. Therefore storage is only required for the peak flow above that able to be obtained from the on-site bore.

As calculated – 28,836 L

In either calculation, the overrun is relatively minor and for the sake of conservatism - add a 30,000 L tank to the tank farm in Gainsborough or at the bore in Preston Downs.

Further to this and as an added level of conservatism, the connection to the Gainsborough Tank Farm exposes the proposed development to a far greater network and consequently, the Peak Flow calculated from Chart 1, Part 7: Water Supply of the SDC Code of Practice should reduce.

Please refer to the attached proposed indicative water layout plan as Appendix B.

It is proposed that a new uPVC pipe will be laid from bore M35/6201 to the existing tank farm at the Gainsborough subdivision. The tank farm provides for buffer storage for peak usage and fire supplies. As discussed in the previous calculations the additional storage required may be met with an additional 25,000 litre tank. Ideally this tank will be added to the Gainsborough tank farm, however it is noted that SDC do not own the land under the tank farm. If an additional tank is unable to be added to Gainsborough, then the storage will be added to the storage provided in Preston Downs.

Regardless of the location of the additional storage, the flow from the new bore will be directed to the Gainsborough tank farm for treatment and pumping into the domestic supply system. This system will be connected back across West Coast Road in two locations into the Wilfield

development. The pipes under West Coast Road SH 73 will all be pressure mains and will be constructed by drilling, or as agreed with NZTA. NZTA consent for this work is yet to be obtained.

The water supply will be designed in accordance with Council specifications and SNZ PAS 4509:2008, New Zealand Fire Service Fire Fighting Water Supplies Code of Practice. The fire fighting water supply classification will be FW2. Fire hydrants will be placed in accordance with this standard.

It is understood that SDC would like Opus International Consultants Limited to carry out pipe size modelling as part of its overall network analysis to ensure that flow and pressure requirements of the above standards can be met, and appropriate data can be provided to Opus on request. The Wilfield site is down gradient of Gainsborough therefore it is not expected that there will be any difficulties in obtaining suitable flows and pressures.

All sites will be serviced by meters connected to a minimum 50mm ID submain, laid along the frontage of all new streets. Rear sites will be installed with 25mm pipes up the driveways and connected to water meters at the street boundaries.

All watermain construction will be completed to Council standards. All watermain pipes will be uPVC, with submains and lot connections in PE.

The 4 Ha blocks will be supplied via a restrictor and will require the provision of on-site tanks. It is proposed that these tanks will be constructed as part of a future building consent.

3. STORMWATER

As discussed previously, the development will be designed around the retention of existing stormwater flow patterns across the site. Existing drainage features will be retained and the development will be moulded around them. We understand that the applicant has met with SDC drainage engineers and they have agreed that future sites do not need to drain to the roads but can instead drain onto neighbouring sites consistent with the natural contour of the land.

Primary stormwater from the site will be discharged to ground.

Consent or a certificate of compliance for stormwater discharge to ground from the development site will be obtained from Environment Canterbury (ECAN). All consenting from ECAN will be verified by SDC as being suitable for transfer to their ownership.

It is expected that all stormwater will be able to be permitted to discharge to ground without treatment with the exception of stormwater discharge during construction. Stormwater discharge during construction will comply with the Environment Canterbury (ECAN) Erosion and Sediment Control Guidelines. Erosion and Sediment Control Management Plans will be compiled for both ECAN and SDC approval.

Road alignments have been directed along the edge of natural drainage swales. The roads will discharge directly to these natural flow patterns. Soakholes will be constructed in the base of the swales. Although not required by ECAN, this methodology will provide a level of stormwater treatment consistent with Low Impact Design.

This sustainable and environmentally sympathetic approach will also give the development a more interesting natural aspect rather than the usual earthworked and uniform contour associated with modern subdivision.

The natural sloping of the land is from northwest to south east. Runoff from the State Highway will be collected and discharged to ground. Secondary flow paths will be within reserves, roads, and lots.

4. SEWER

All reticulated sewage from West Melton is pumped to Rolleston via an existing pump station at the Gainsborough development to the north of the development site for treatment at The Pines Sewage Treatment Plant. The rising sewer is on a slight down gradient and may empty partially when the pumps are not activated. This emptying provides for some buffer in the rising sewer.

Some investigation has been undertaken to determine the capacity of the existing main pump station at Gainsborough. Peak day pump flow data for Friday 18 April 2014 (Good Friday) has been provided by SDC, and analysis of this data shows that that pumps run for a maximum of 35% of the time during peak flow periods.

We also note the data provided by SDC presents that every alternate pump run is approximately 100 seconds, irrespective of the inflow rate. We are unsure why this pump regime has been selected, however we suggest that if the pump runs were more closely correlated to the sewage inflow rate, then the maximum pump utilisation rate would decrease.

Based on the above findings there seems little need for either pump upgrades or additional storage. The applicant is happy to discuss this further with Council.

The sewer demand for the proposal has been calculated using SDC Code of Practice. Please refer to the calculation below for the peak domestic demands.

Average sewer flow

$$\text{ASF} = 180 \text{ lots} * 220 \text{ l/person/day} * 2.7 \text{ people/lot}$$

$$\text{ASF} = 106,920 \text{ l/day}$$

$$\text{ASF} = 1.24 \text{ l/s}$$

Peak wet weather flow

$$\text{P/A ratio} = 2.5$$

Part 6: Wastewater drainage SDC Code of Practice

$$\text{SPF} = 2$$

Part 6: Wastewater drainage SDC Code of Practice

$$\text{MF} = \text{P/A ratio} * \text{SPF} * \text{ASF}$$

$$\text{MF} = 2 * 2.5 * 1.24$$

$$\text{MF} = 6.2 \text{ l/s}$$

The proposed layout of gravity and pressure sewer infrastructure is attached as Appendix B and is described below.

A pump station serving the development will be located on site to allow the majority of new lots to be serviced with gravity sewer connections. It is proposed that the larger sites at the south of the development site be serviced with individual private pumping mains connections that discharge into the gravity system. Alternatively, the applicant wishes to explore the option of servicing the lots south of the existing power pylons with a low-pressure pumped sewer system if detailed design indicates that a gravity system in this area is not viable or practical.

The pump station and sewer mains will be designed to SDC standards and will be vested in SDC. Provisions will be made for the future developments of small neighbouring blocks of land zoned Rural Residential, in line with the Rural Residential Strategy.

A rising sewer will be laid from the proposed new pump station on the development site to the existing main sewer pump station at the Gainsborough subdivision. This existing pump station is located on land owned by others and it is expected that any issues attached to the proposed additional connection will be resolved by SDC. The rising sewer pipework underneath West Coast Road SH 73 will be constructed by drilling, or as agreed with NZTA. NZTA consent for this work is yet to be obtained.

All proposed gravity sites will be serviced with a 100mm diameter lateral, 600mm into the net area of each new lot. The connection levels will be at a depth to ensure that all building platforms will have gravitational drainage. Sewage flow from the proposed development sites will flow through pipes and manholes to the pump station. All mainline pipes will be 150mm or 225mm uPVC.

It is expected that the flattest gradient of the pipework will be 1 in 300, however every effort will be made to steepen these grades to at least 1 in 200.

All public sewer pipes over private land or reserves will be covered by appropriate easements in favour of SDC. The pump station will be located on its own utility lot to be vested in SDC.

All upsizing of the proposed sewage infrastructure to accommodate sewage emanating from outside of the development will be paid for by SDC.

5. POWER / TELECOMMUNICATIONS / STREET LIGHTS

Power and telecommunications will be provided to all sites to utility company and industry standards. All cables will be placed underground and all kiosks will be constructed on separate individual lots. The kiosk sites will be forwarded to Council for approval following the power design.

Street lights will be provided to the roading and reserves to SDC standards. The applicant will also provide a street light style to SDC for approval.

Full appraisals will proceed once Subdivision Consent has been obtained.

6. ROADING

The internal roads reflect the intentions of the SDC Outline Development Plan.

The proposed subdivision will be serviced with a double road connection from Weedons Ross Road. No upgrades are intended for Weedons Ross Road other than widening at the two intersections. The

widening and splays will provide for a central painted traffic refuge for right turning vehicles into the development.

There will not be any direct connection onto the adjacent State Highway and consequently no consultation with the New Zealand Transport Agency is required in this regard.

Roads 1, 2, 3, and the southern cul-de-sac serving the L2A and Inner Plains lots will be 20m wide with 9m carriageways. All other roads will be 18m wide with 8m carriageways. No specific provision will be made for cyclists. Footpaths will be on one side only. Street lighting will be to SDC standards. Kerb and channel to council standards will be adopted but detailed design may create areas where a rural shoulder is used or perhaps a flush kerb only where stormwater can flow directly to roadside swales. All carriageways will be constructed to SDC standards and will be sealed with asphalt. Some cobbling may be included to indicate a change in road hierarchy and to add visual amenity.

Private access and rights of way will be constructed to SDC standards. We note that crossings to individual lots are required however the applicant would like to obtain the right to bond for this portion of the construction in order not to restrict the layout and dwelling position on the created lots.

Provision will be made for future road access to adjacent sites for the purpose of future development. The applicant reserves the right to place point strips across the end of these connections.

All relocations of speed limitations are expected to be undertaken by SDC.

7. EARTHWORKS AND CLEARING

As discussed previously, the ethos of the development relies on the maintenance of natural land form, and therefore will result in only minor earthworks. The earthworks will generally be restricted to the construction of road subgrades and adjustments to the existing overland drainage network.

Existing levels across the majority of sites will be maintained. Specific depths of excavation and fill are not known at this stage as detailed design has not been undertaken. It is estimated at this stage that the total volume of works will be between 40,000 and 60,000m³.

All topsoil will be retained and replaced on the land immediately following bulk earthworks to a depth of up to 400mm. All disturbed topsoil will be re-sown with Council specification grass seed mixes. A balance of cut and fill will be maintained on site and removal of material from site will be minimised. Excess soil may be used in a landscaped acoustic bund along West Coast Road.

Sediment discharge from the development site will be controlled as per Council requirements. The basis of the sediment control will be the ECAN Guidelines and the discharge during construction will be dealt with in association with the overall discharge consent or certificate of compliance.

All dust created on the site will be controlled by water cart or other such approved methods.

All bulk filling will be compacted in accordance with NZS 4431:1989. All fill testing will be carried out by an independent laboratory.

A geotechnical appraisal has been prepared by DLS in support of the application and is attached as Appendix C. This appraisal finds the development site as not being susceptible to earthquake and liquefaction damage, and has determined that the land can be considered to be equivalent to the Ministry of Business, Innovation, and Employment (MBIE) Technical Category 1 (TC1). Based on this assessment no land remediation is required, however the site may still not be considered good ground in terms of NZS 3604. Further testing may be required for future building consent applications for foundations.

Andy Hall
Chartered Professional Engineer
Davie Lovell-Smith Ltd

August 2014

APPENDIX A

Pattle Delamore Partners Report

Pump Testing and Sampling of Bore M35/6201



1 August 2014

Hamish Wheelans
GW Wilfield Limited
PO Box 36-511
Merivale
Christchurch 8146

Dear Hamish

PUMP TESTING AND SAMPLING OF BORE M35/6201

1.0 Introduction

GW Wilfield Limited (GW Wilfield) is proposing a residential subdivision at West Melton on the south side of West Coast Road (SH73) and on the east side of Weedons Ross Road. An existing bore (M35/6201) is located within the area of the proposed subdivision and abstraction of groundwater for the irrigation of crops and pasture is authorised from the bore via resource consent CRC010939. This consent allows for abstraction up to a maximum instantaneous rate of 26 L/s and a daily volume limit of 2,153 m³.

GW Wilfield is ultimately proposing to use the bore for community supply purposes via a transfer and change of conditions to the consent. We also understand that the bore will be linked to the main reticulated community water supply network for West Melton township.

To confirm the yield and water quality of the bore, a step drawdown test was undertaken in M35/6201 and a groundwater quality sample was collected to confirm the potability of the abstracted water. A sample was also collected for groundwater age analysis.

This letter summarises the step drawdown test and provides an estimate of the sustainable yield of M35/6201. In addition, this letter provides a comparison of the groundwater quality results with the health and aesthetic based chemical and biological criteria given in Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ 2005) and some comment is provided with respect to the general condition of the bore and the process involved with transferring and changing the conditions of the consent. The location of M35/6201 and the proposed subdivision is displayed in Figure 1 attached to this letter. Details for M35/6201 including the driller's log from ECan's online wells database in addition to a copy of consent CRC010939 are also attached.

2.0 Step Drawdown Pumping Test

Based on the ECan wellcard, bore M35/6201 was drilled on 23 January 1990 to a depth of 83 m bgl. The bore is reportedly screened between 80 and 83 m bgl and had a static water level of 20.02 m bgl following drilling. The driller's log for the bore shows gravel dominated strata was encountered in the borehole and the screen was installed within strata described as 'free medium to large grey and brown sandy gravels, water bearing'. Overlying strata descriptions include free gravels (likely to be relatively permeable) and claybound gravels (expected to be of lower relative permeability).

A step-drawdown test in M35/6201 was undertaken on 17 July 2014 to establish the performance of the bore and to determine whether the currently consented rate of take of up to 26 L/s is a sustainable yield. The test was carried out between approximately 10:15 am and 2:15 pm and was conducted by East Coast Drilling. Groundwater levels in the pumped bore were measured manually by the drillers with a contact meter. We understand the pumping rate was measured via an electronic flow meter and recorded manually by the drillers during the test. Pre-test measurements of the static water level were measured up to an hour prior to the commencement of the test and the recovery of groundwater levels was measured for an hour after pumping ceased. The length of each step and the average pumping rates are provided in Table 1 below.

Table 1: Summary of Step Drawdown Test in M35/6201					
Pumping Step	Pumping Rate (L/s)	Time at Start of Step (minutes)	Duration of Step (minutes)	Depth to Water at the end of each step (m bgl)	Inferred drawdown at the end of each step (m)
Pre Test	0	-	-	-13.66	0
Step 1	15.2	0	60	-32.96	19.30
Step 2	19.8	60	60	-43.66	30.0
Step 3	23.9	120	60	-53.07	39.41
Step 4	27.6	180	60	-63.87	50.21
Recovery	0	240	60	-14.15	0.49

The depth to water and pumping rate measured in M35/6201 over the testing period is provided in Figure 2. The effects of the four pumping steps are clearly displayed in Figure 2 with abrupt changes in water level at the beginning of each step and a flattening of water levels during the remainder of each pumping step.

Figure 3 attached, shows the measured drawdown in M35/6201 during the pumping test, where the maximum drawdown at the end of the test (i.e. end of Step 4) was 50.21 m.

The water level data from the step-drawdown was analysed using the method developed by Eden and Hazel. Modelled drawdowns were fitted to the measured data using the following equation:

$$s_w = (a + b \log t)Q + CQ^2 + k$$

Where:

- sw is the drawdown in the pumped well (in metres)
- a is the inertia aquifer loss
- b is the time dependant aquifer loss parameter
- t is the duration of the pumping period (in minutes)
- Q is the pumping rate (in m³/min)
- C is the turbulent head loss coefficient

k is a correction factor

From the analysis, the following values for the specific parameters given above which describe the aquifer and well characteristics were calculated.

Parameter	Value	Units
a	10.613	min/m²
b	1.953	min/m²
c	9.83	min²/m⁵
k	-1.585	m

These parameters give the following equation:

$$s_w = (10.613 + 1.953 \log(t)) Q + 9.83Q^2 + (-1.585)$$

The modelled drawdown and recovery is shown together with the measured data in Figure 4. This figure shows that the modelled drawdown is generally a good fit with the measured data.

The results of the step drawdown test can be used to evaluate the potential yield from the pumped bore, which may vary seasonally depending on groundwater level fluctuations. No continuous long-term groundwater level records exist for bore M35/6201 and the closest bore of comparable depth to M35/6201 with long-term groundwater records is bore M35/0933 located approximately 4.5 km north-west of M35/6201. M35/0933 is 55.2 m deep, screened between 46.9 – 55.2 m bgl and has monthly water level records for the period between 10 August 1982 and 23 July 2014. A plot showing the complete groundwater level record from M35/0933 is displayed in Figure 5. The maximum water level recorded in this bore was 92.1 metres above mean sea level on 16 September 2010 and the minimum water level was 78.3 on 19 January 2004. The maximum recorded range of fluctuations in this bore is therefore 13.8 m.

The static groundwater level measured in M35/6201 prior to pumping on the morning of the step-drawdown test was 13.66 m bgl. However, assuming that bore M35/6201 experiences water level fluctuations of similar magnitude to ECan monitoring bore M35/0933, then a conservative low water level would be 27.5 m bgl.

While ECan's wells database indicates that the pump in M35/6201 is located at 58 m bgl, we expect the pump is in fact located much deeper given that the water level in the bore was drawn down to 63.87 m bgl during the last step of the pumping test. Therefore, we have assumed that the pump is located 3 m above the well screen (77 m below ground level).

Based on the assumptions above, the available drawdown in bore M35/6201 based on the water level conditions at the time of the testing is 63.3 m, however during a very dry period there is the potential that the available drawdown could reduce to 49.5 m.

Figure 6 shows the predicted drawdown in the bore based on various rates and periods of pumping. Figure 6 indicates that based on the water level conditions during the testing, bore M35/6201 should be capable of yielding 26 L/s over the long-term. However, if the available drawdown were ever to fall to 49.5 m then longer-term pumping at 26 L/s may not be possible. Figure 6 would suggest that based on the lowest assumed water level in M35/6201 the sustainable yield could potentially fall to between 23 and 24 L/s.

It should be noted however that the predictions of low water levels in M35/6201 are uncertain and may not be accurate as they are based on a water level record in a bore 4.5 km distant.

3.0 Water Quality Sampling

During the step drawdown pumping test, a water quality sample was collected by PDP and sent for analysis by Hill Laboratories. In addition a sample was also collected for water age analysis and sent to GNS for analysis. It is expected that the results from the age sampling will not be received for several months (as is typical of this type of analysis).

The Hill laboratories report is provided in attached to this letter and a summary of the results is provided in Table 2 below.

Table 2: Summary of Water Quality sampling in M35/6201				
Parameter	Value	DWSNZ MAV^a	DWSNZ GV^b	Unit
pH	7.4	-	-	-
Total Alkalinity	48	-	-	g/m3
Free Carbon Dioxide	3.5	-	-	g/m3
Total Hardness	73	-	200	g/m3
Electrical Conductivity (EC)	20.3	-	-	mS/m
Approx Total Dissolved Salts	136	-	-	g/m3
Total Boron	0.024	1.4	-	g/m3
Total Calcium	23	-	-	g/m3
Total Copper	0.003	2	1	g/m3
Total Iron	0.056	-	0.2	g/m3
Total Magnesium	3.8	-	-	g/m3
Total Manganese	0.00163	0.4	0.04	g/m3
Total Potassium	1.23	-	-	g/m3
Total Sodium	9.9	-	200	g/m3
Total Zinc	0.049	-	-	g/m3
Chloride	11.7	-	250	g/m3
Nitrate-N	6.4	11.3	-	g/m3
Sulphate	10.8	-	250	g/m3
Escherichia coli	< 1	<1	-	MPN/100mL
^a - Maximum Acceptable Values from the New Zealand Drinking Water Standards 2005 (Revised 2008) for the protection for human health.				
^b - Guideline Values from the New Zealand Drinking Water Standards 2005 (Revised 2008) for aesthetic effects.				

The results of the groundwater sampling were compared against the DWSNZ 2005 Maximum Acceptable Values (MAV) for the protection of human health and also the Guideline Values (GV) for aesthetic effects. The results indicate water of general good quality with no parameters exceeding the respective MAV or GV values. It should be noted however that the nitrate nitrogen concentration is elevated based on the measured concentration of 6.4 mg/L (approximately half of the MAV).

The initial water quality sampling indicates water quality suitable for potable supply. We understand that any future supply from the bore would connect to the West Melton township supply and receive water treatment to ensure that bacteria is absent from the supply.

4.0 Existing Consent and Required Transfer/Change of Conditions

As mentioned previously, the existing groundwater take consent for bore M35/6201 (CRC010939) is for irrigation use. We understand that the intention is to ultimately change ownership of the bore and change the use to community water supply. We have been informed that the use for community supply is intended to occur in a staged manner while still allowing for irrigation for a limited period of time.

An application to change the conditions of the consent to allow for use as a community supply bore will likely require the following supporting information and assessment:

Justification of the rates and volumes of water required to meet the drinking water demand

Establishment of a community supply protection zone surrounding the bore and assessment of any potential contamination sources within the proposed protection zone

Assessment of any effects on neighbouring land users if the protection zone is established.

Confirmation of a secure well head and the ability to meet water quality requirements of DWSNZ 2005

Figure 1 includes a 100 m zone marked around M35/6201 which represents the size of the required protection zone around the bore. There will likely be a requirement that the adoption of this protection zone does not affect the ability of neighbouring land owners to use their land for specific purposes. However, we note that it appears the protection zone is limited to the an area within the proposed subdivision and therefore there appears to be a low risk of the zone affecting neighbouring properties.

With regard to allocation, the bore occurs within the Selwyn-Waihora Sub-regional area as defined by the proposed Land and Water Regional Plan (pLWRP). Variation 1 of the pLWRP includes policies for the sustainable use of water and improved flow within the Selwyn-Waihora Sub-Regional area. The following policies have the potential to be relevant to proposed changes to resource consent CRC010939:

- 11.4.22 Restrict the transfer of water permits within the Rakaia-Selwyn and Selwyn-Waimakariri water allocation zones to minimise cumulative effects on flows in hill-fed lowland and spring-fed plains rivers from the use of allocated but unused water, by requiring that:
 - (a) Irrigation scheme shareholders within the Irrigation Scheme Area shown on the Planning Maps do not transfer their permits to take and use groundwater; and
 - (b) No permit to take and use groundwater is transferred from down-plains to up-plains; and
 - (c) In all cases 50% of any transferred water is surrendered
- 11.4.23 Only reallocate water to existing resource consent holders at a rate and volume that reflects demonstrated use

With regard to proposed Policy 11.4.22, we understand that the consent will be transferred to a new owner, however the existing bore will continue to provide the supply of water and therefore the water will not be transferred to a different location. This would be the key defence in not surrendering 50% of the existing allocation as required in (c) above. It should be noted that we are unsure whether ECan would interpret the proposal in the same manner.

With respect to proposed Policy 11.4.23, we are unsure if there is any use data available from the existing bore, however it would appear that this policy would allow ECan to re-allocate only the amount that has been used in the past.

PUMP TESTING AND SAMPLING OF BORE M35/6201

At present there is no annual volume on the consent, however ECan have likely calculated an estimated annual volume for allocation purposes. Any new consent will include an annual volume limit that will need to be justified and does not exceed the existing estimated allocation.

The existing consent also includes water level trigger conditions which restrict the use of the bore during periods when groundwater levels are low. It is likely that these conditions will remain on any modified consent.

5.0 Current Condition of Bore M35/6201

We have spoken with East Coast Drilling regarding the condition of bore M35/6201. It should be noted that it is difficult to confirm the condition of the bore casing and screen without dismantling the bore and conducting a down hole inspection. However, based on the water quality results and the performance of the bore during the step drawdown pumping test, it appears that the bore casing and screen are in generally good condition. In addition, while we have not carried out a detailed well head inspection and it is possible that the wellhead is not currently secure as per DWSNZ 2005, the PDP representative who collected the water sample from the bore commented that the well headworks appeared to be in good condition.

We trust the information in this letter meets your requirements. Please do not hesitate to contact us if you have any questions.

Kind Regards,

PATTLE DELAMORE PARTNERS LIMITED

A handwritten signature in black ink, appearing to read 'Ryan Nicol', is written over a light grey circular stamp.

Ryan Nicol



SOURCE: GOOGLE EARTH
IMAGE TAKEN ON 30/08/2014

FIGURE 1 : BORE LOCATION AND PROPOSED COMMUNITY SUPPLY PROTECTION ZONE

SCALE : 1:10,000
0 50 100 200 300
Meters

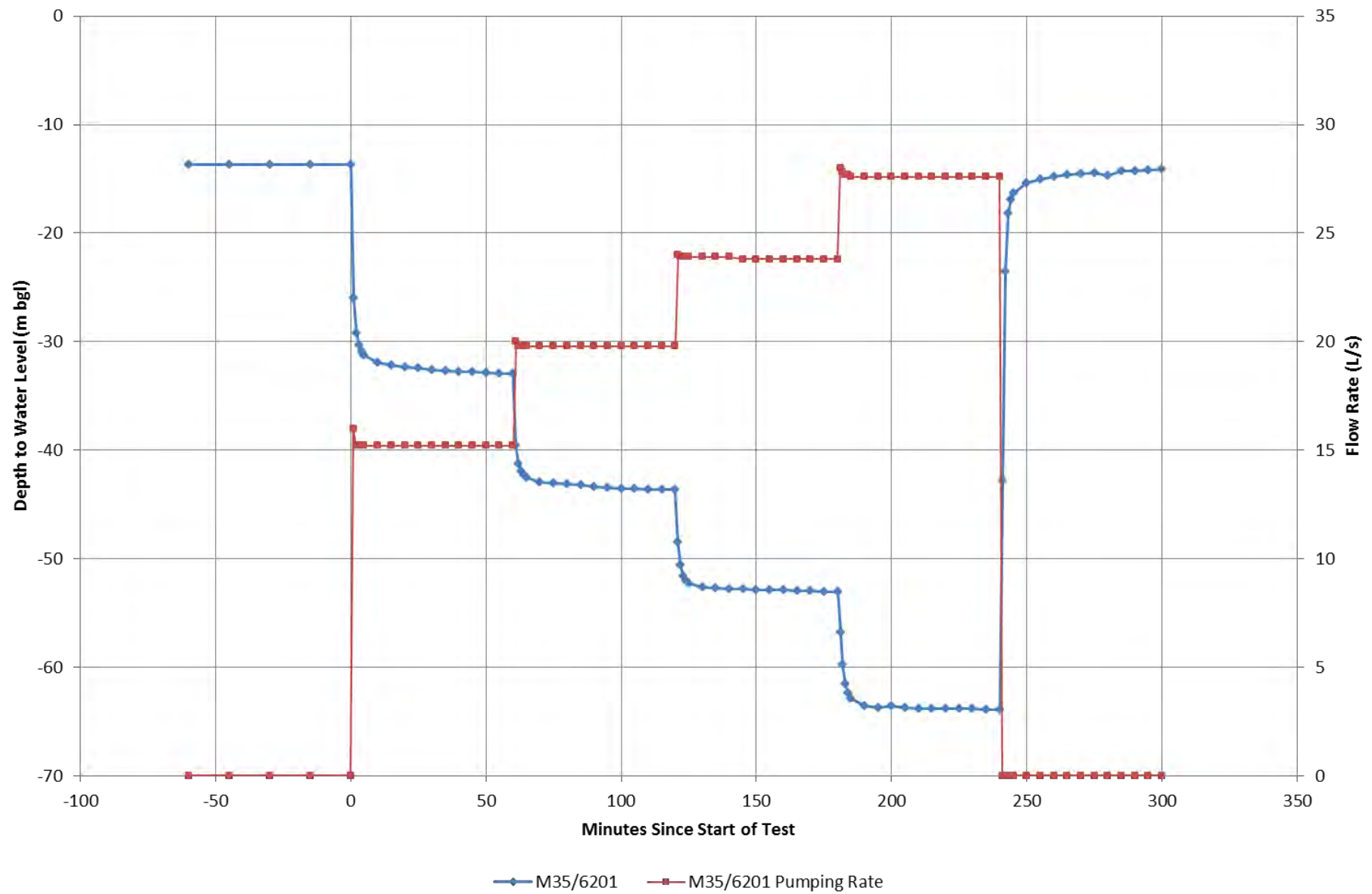


Figure 2: Plot of depth to water and pumping rates during the step drawdown pumping test in M35/6201 on 17 July 2014

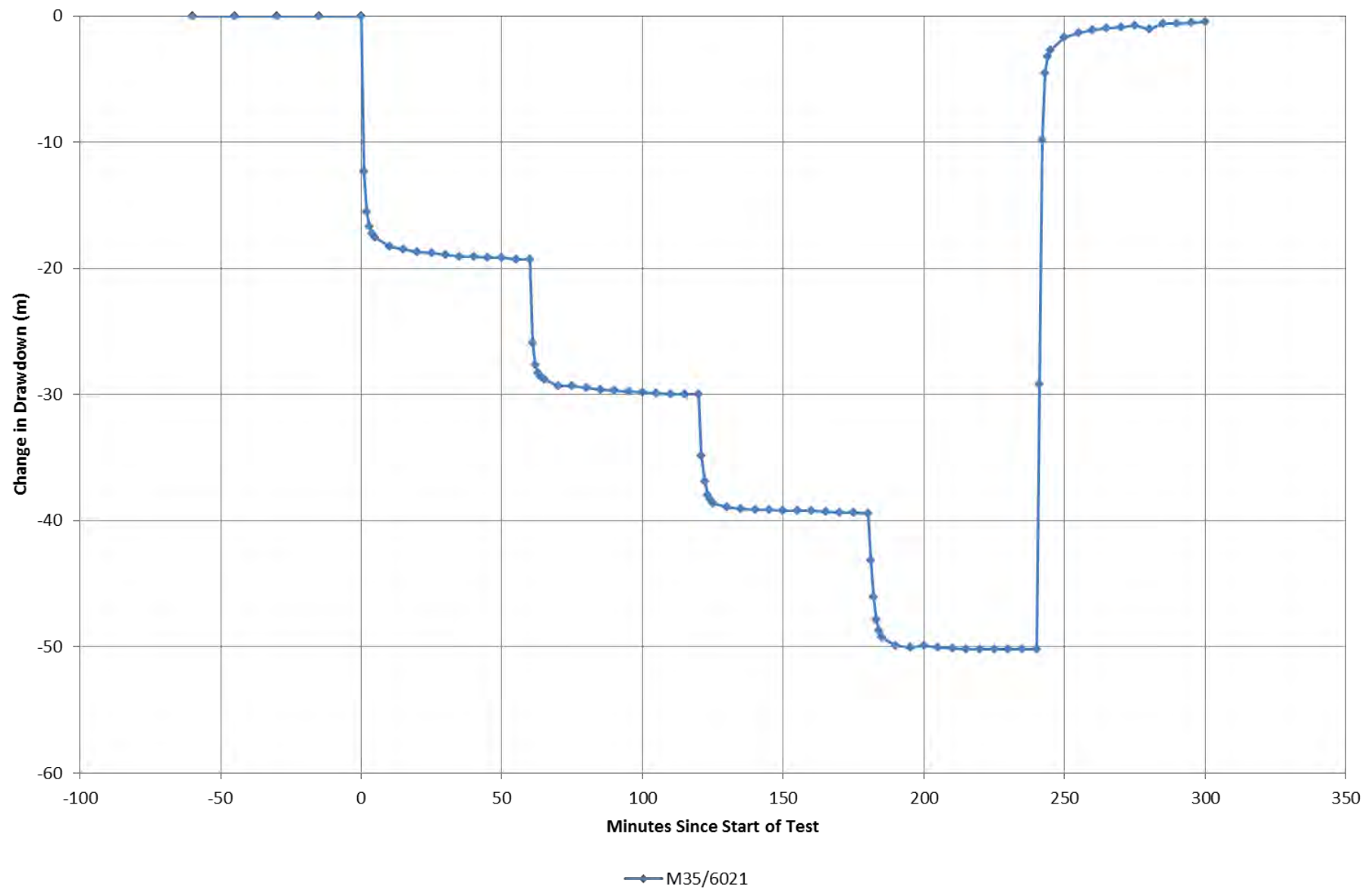


Figure 3: Measured drawdown in pumped bore during the step-drawdown pumping test in M35/6201

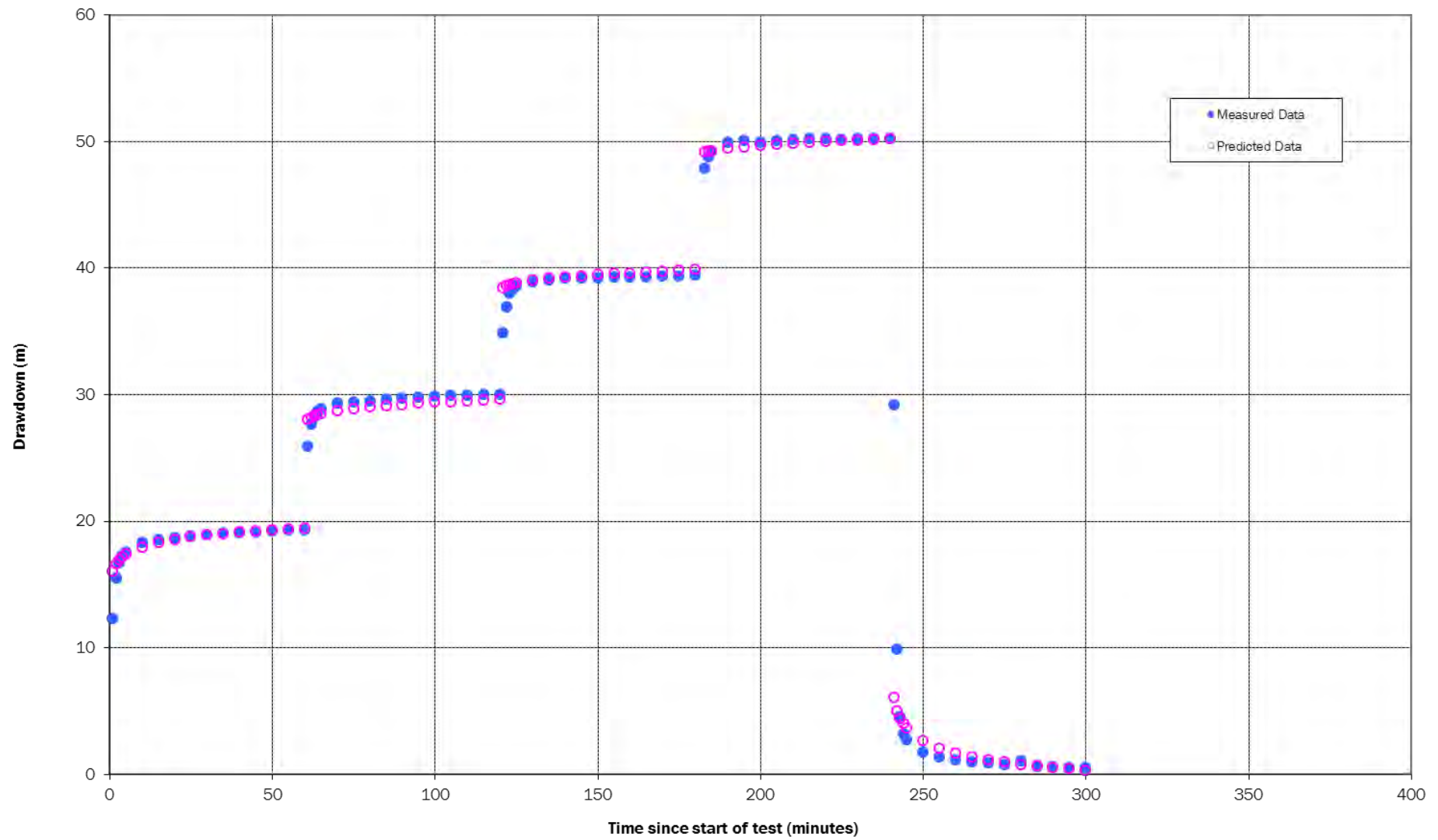


Figure 4: Modelled and measured drawdown from the step drawdown test in M35/6201

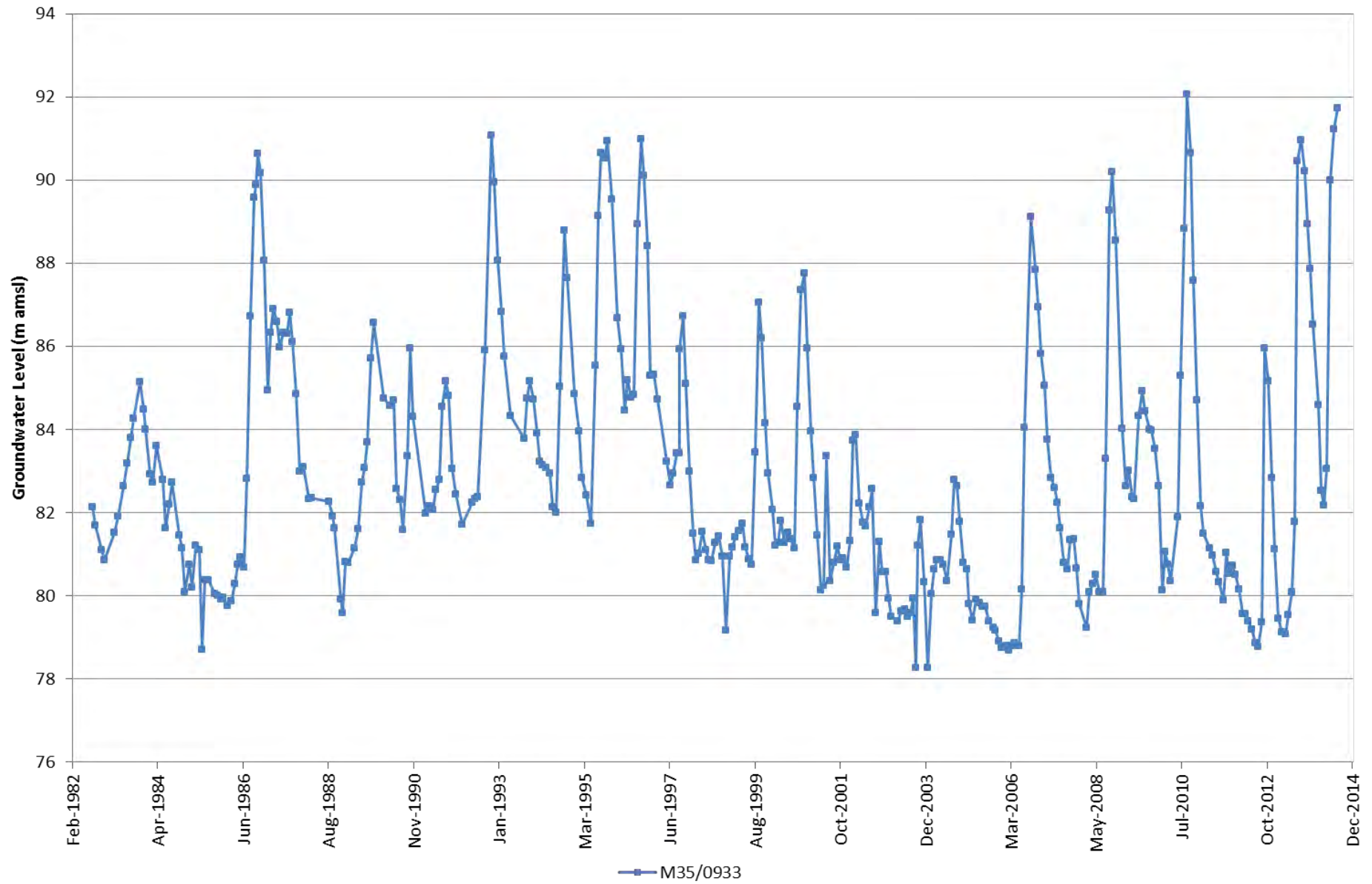


Figure 5: Long term water levels in ECan monitoring bore M35/6201

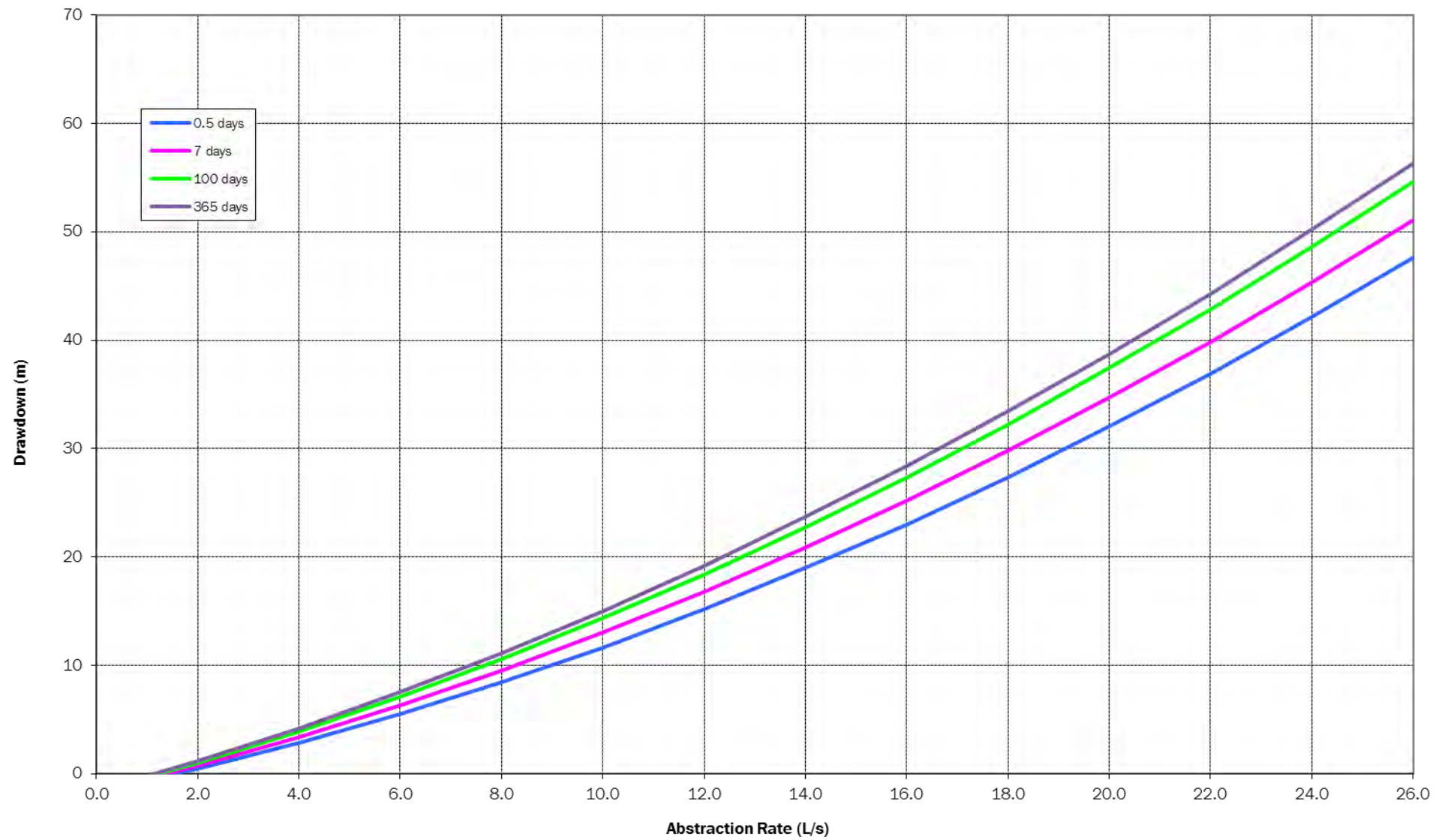


Figure 6: Predicted drawdown at different pumping rates for M35/6201

Bore or Well No: M35/6201

Well Name:

Owner: Messrs G R & R W Wilson



Street of Well: Weedons Ross rd

File No: CO6C/02184

Locality: WEST MELTON

Allocation Zone: Selwyn-Waimakariri

NZGM Grid Reference: M35:59873-41650 QAR 2

NZGM X-Y: 2459873 - 5741650

Location Description:

Uses: Irrigation

ECan Monitoring:

Well Status: Active (exist, present)

Drill Date: 23 Jan 1990

Water Level Count: 3

Well Depth: 83.00m -GL

Strata Layers: 9

Initial Water Depth: -20.20m -MP

Aquifer Tests: 1

Diameter: 220mm

Isotope Data: 1

Yield/Drawdown Tests: 4

Measuring Point Ait: 83.06m MSD QAR 1

Highest GW Level: 20.35m below MP

GL Around Well: -0.18m -MP

Lowest GW Level: 20.44m below MP

MP Description: ToC

First Reading: 17 Jan 1990

Last Reading: 18 Jan 1990

Driller: McMillan Drilling Group

Calc. Min. GWL: -31.00m -MP

Drilling Method: Rotary/Percussion

Last Updated: 08 Nov 2013

Casing Material: STEEL

Last Field Check: 10 Apr 2003

Pump Type: Submersible

Screens:

Yield: 23 l/s

Screen Type: Stainless steel

Drawdown: 33 m

Top GL: 80.00m

Specific Capacity: 0.88 l/s/m

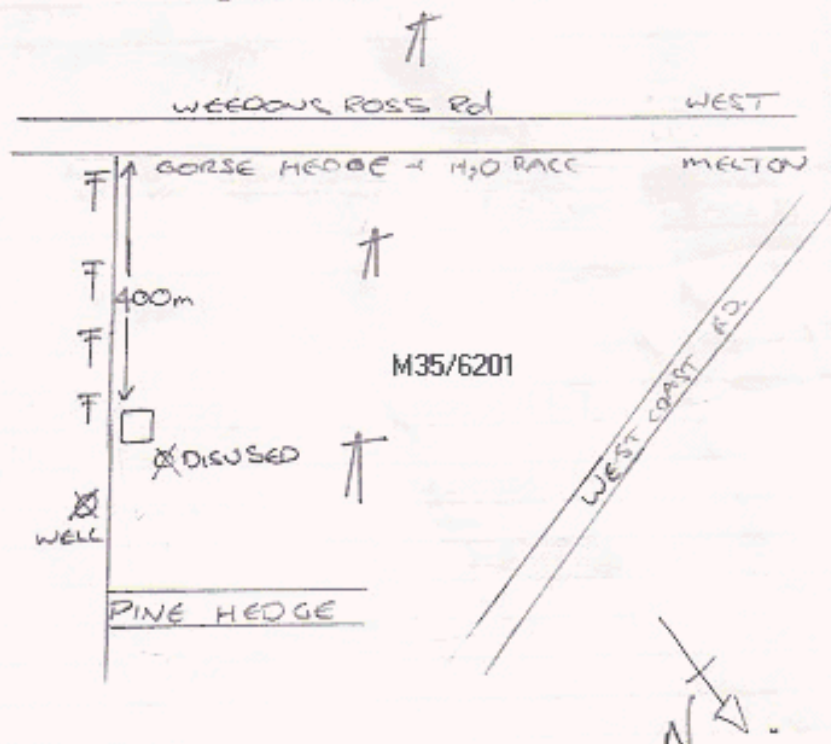
Bottom GL: 83.00m

Aquifer Type: Unknown

Aquifer Name: Linwood Gravel

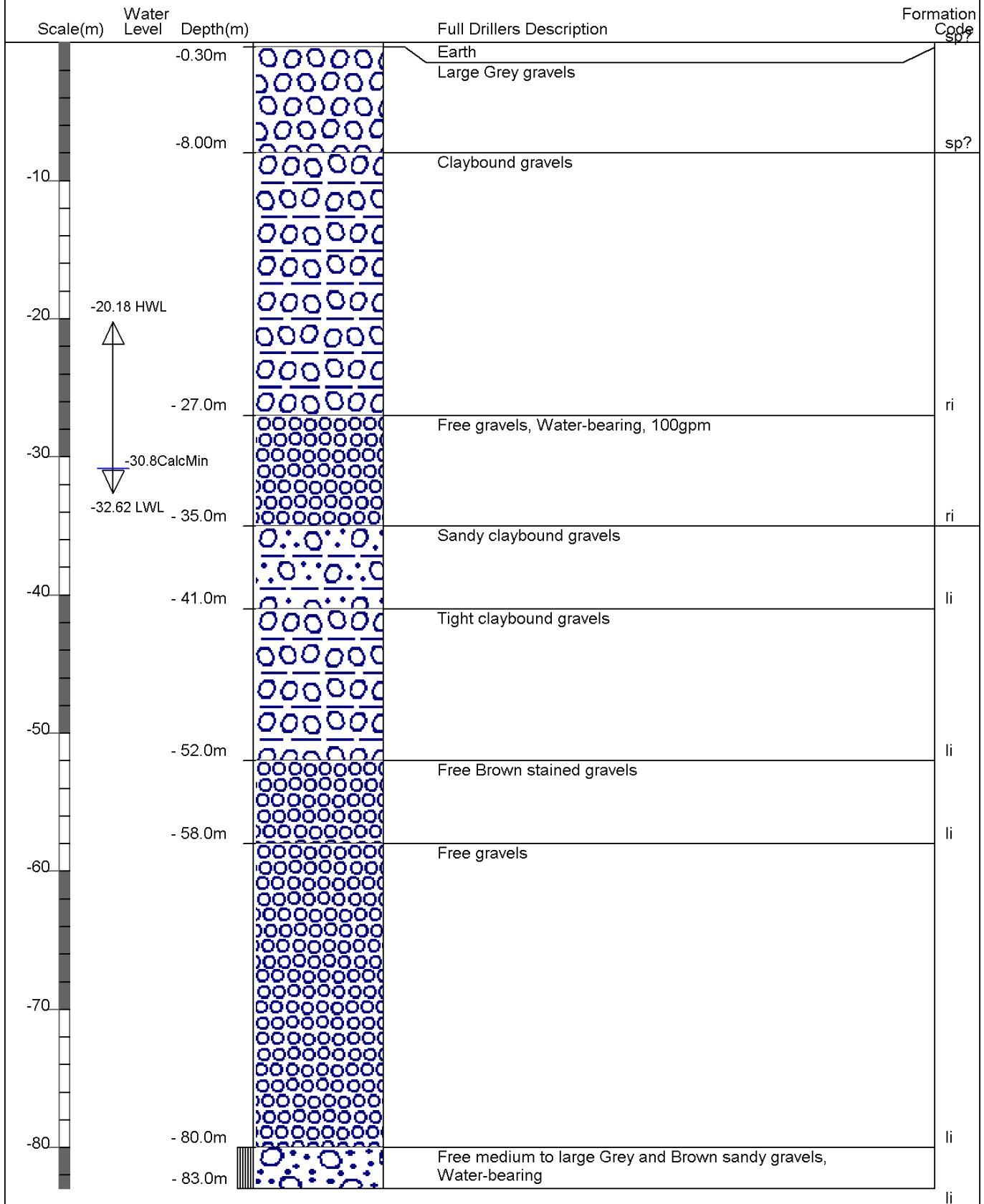
Date	Comments
	PUMP TEST CRC 24 HRS - copy in file WE1C/0015
08 Jan 2001	Additional information added from aquifertest report NCCB Jan. 1990 by PF Callander. (including some water levels) Pump set at 58m
28 Jan 2003	Owners house is on West Coast rd, access to paddock and well is off Weedons Ross rd. Powerlines to well so easy to spot. LE thought they measured this for Piezometric Survey. Actually measured M35/0976. Jamie 25/5/04
16 Jul 2003	Was a well sunk to 83 m nearby (other side of fence).
03 Feb 2009	Routine monitoring visit undertaken. Flow rate measured at 20 L/s

Note: HOUSE ON LEFT SIDE OF
WEST C ROAD, RED BRICK,
MOUNTAIN SIDE OF TOWN.



Borelog for well M35/6201

Gridref: M35:59873-41650 Accuracy : 2 (1=best, 4=worst)
 Ground Level Altitude : 82.88 +MSD
 Driller : McMillan Water Wells Ltd
 Drill Method : Rotary/Percussion
 Drill Depth : -83m Drill Date : 23/01/1990



Record Number: CRC010939
Record Type: Renewal
Permit Type: Water Permit
Record Holder: Messrs G R & R W Wilson
Record Status: Issued - Active
File Number: CO6C/02184
Previous Record(s): CRC890411
Next Record(s):
Location: Weedons Ross Road, WEST MELTON
Description: to take and use water



Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz
www.ecan.govt.nz

Key Dates:

Event	Date
Commencement Date	28 Jul 2004
Given Effect To	22 Jan 2009
Lapses	30 Sep 2009
Expires	28 Jul 2039

Workflow (Only shows if workflow has open tasks):

Task Name	Task Status	Task Status Date
-----------	-------------	------------------

Conditions:

No	Text
1	Water shall only be taken from bore M35/6201, 220 millimetres diameter and 83 metres deep, at or about map reference NZMS 260 M35:5987-4165, at a rate not exceeding 26 litres per second, with a volume not exceeding 2,153 cubic metres in any one day.
2	<p>a. The volume of water taken in terms of this permit from bore M35/6201 shall not exceed 1,436 cubic metres in any one day whenever the standing water level in bore M35/5696 (at or about map reference NZMS 260 M35:595-415) is lower than 28.2 metres below ground level (55.78 metres above mean sea level).</p> <p>b. The volume of water taken in terms of this permit from bore M35/6201 shall not exceed 718 cubic metres in any one day whenever the standing water level in bore M35/5696 (at or about map reference NZMS 260 M35:595-415) is lower than 28.7 metres below ground level (55.28 metres above mean sea level).</p> <p>PROVIDED THAT Whenever the Canterbury Regional Council, in consultation with the Water Users Committee representing all water users who are subject to this condition, has determined upon a water sharing regime which limits the total daily abstraction from the resource in accordance with the limits set out in these conditions, then the taking of water in accordance with that determination shall be deemed to be in compliance with parts (a) and (b) of this condition.</p> <p>c. The taking of water in terms of this permit from bore M35/6201 shall cease whenever the standing water level in bore M35/5696 (at or about map reference NZMS 260 M35:595-415) is lower than 29.1 metres below ground level (54.88 metres above mean sea level).</p>
3	Water shall be used only for irrigation of crops and pasture as described in the application, on the area of land shown in attached plan CRC010939.

4	<p>The consent holder shall, within 12 months of the commencement of this consent, install, or provide for the installation of:</p> <ol style="list-style-type: none"> an easily accessible straight pipe, of a length at least 15 times the diameter of the pipe, or a water flow measurement device which will measure the rate at which water is taken to within an accuracy of plus or minus five percent, <p>as part of the pump outlet plumbing or within the mainline distribution system.</p>
5	<p>The consent holder shall take all practicable steps to:</p> <ol style="list-style-type: none"> ensure that the volume of water used for irrigation does not exceed that required for the soil to reach field capacity; and avoid leakage from pipes and structures; and avoid the use of water onto non-productive land such as impermeable surfaces and river or stream riparian strips.
6	<ol style="list-style-type: none"> The irrigation system used in association with taking water from bore M35/6201 shall not be used to distribute effluent, fertiliser or any other added contaminant, unless a reduced pressure zone backflow preventer is installed within the pump outlet plumbing or within the mainline to prevent the backflow of water into the bore. The backflow preventer shall be tested within one month of its installation and annually thereafter by a suitably qualified person. A test report shall be provided to the Canterbury Regional Council within two weeks of each inspection.
7	<p>If required by notice in writing by the Canterbury Regional Council</p> <ol style="list-style-type: none"> a water flow measurement and recording device that will measure the volume at which water is taken to within an accuracy of plus or minus five percent, shall be installed as part of the pump outlet plumbing or within the mainline distribution system; and the measuring and recording device shall be used to measure the volume of water abstracted per specified time interval. The volume shall be recorded either electronically or in a log kept for that purpose. The measuring and recording device and the records of abstraction shall be available for inspection on request by the Canterbury Regional Council for at least 12 months from the date of recording; and the measuring and recording device shall be installed and maintained throughout the duration of the consent in accordance with the manufacturer's instructions, if any.
8	<p>The Canterbury Regional Council may, once per year, on any of the last five working days of May or October, serve notice of its intention to review the conditions of this consent for the purposes of dealing with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage.</p>
9	<p>The lapsing date for the purposes of section 125 shall be 30 September 2009.</p>



ANALYSIS REPORT

Page 1 of 2

Client:	Pattle Delamore Partners Limited	Lab No:	1300276	SPv1
Contact:	C Steffens C/- Pattle Delamore Partners Limited PO Box 389 CHRISTCHURCH 8140	Date Registered:	17-Jul-2014	
		Date Reported:	24-Jul-2014	
		Quote No:		
		Order No:		
		Client Reference:	C03109500	
		Submitted By:	B Munro	

Sample Type: Aqueous

Sample Name:	M35/6201 17-Jul-2014 1:45 pm				
Lab Number:	1300276.1				
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL	< 1	-	-	-
Routine Water Profile					
pH	pH Units	7.4	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	48	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	3.5	-	-	-
Total Hardness	g/m ³ as CaCO ₃	73	-	-	-
Electrical Conductivity (EC)	mS/m	20.3	-	-	-
Electrical Conductivity (EC)	µS/cm	203	-	-	-
Approx Total Dissolved Salts	g/m ³	136	-	-	-
Total Boron	g/m ³	0.024	-	-	-
Total Calcium	g/m ³	23	-	-	-
Total Copper	g/m ³	0.0030	-	-	-
Total Iron	g/m ³	0.056	-	-	-
Total Magnesium	g/m ³	3.8	-	-	-
Total Manganese	g/m ³	0.00163	-	-	-
Total Potassium	g/m ³	1.23	-	-	-
Total Sodium	g/m ³	9.9	-	-	-
Total Zinc	g/m ³	0.049	-	-	-
Chloride	g/m ³	11.7	-	-	-
Nitrate-N	g/m ³	6.4	-	-	-
Sulphate	g/m ³	10.8	-	-	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter. Performed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch.	-	1
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1
pH	pH meter. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 4500-H ⁺ B 22 nd ed. 2012.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 22 nd ed. 2012.	1.0 g/m ³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0053 g/m ³	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.053 g/m ³	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.021 g/m ³	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.021 g/m ³	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.053 g/m ³	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.021 g/m ³	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1
Chloride	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B 22 nd ed. 2012.	0.5 g/m ³	1
Nitrate-N	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B 22 nd ed. 2012.	0.05 g/m ³	1
Sulphate	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B 22 nd ed. 2012.	0.5 g/m ³	1
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours), or Colilert 18 (Incubated at 35°C for 18 hours), Analysed at Hill Laboratories - Microbiology; 101c Waterloo Road, Hornby, Christchurch. APHA 9223 B, 22 nd ed. 2012, MIMM 11.A1.1, LAS Official test 1.1.1, 1.8.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

APPENDIX B

Proposed Infrastructure Plans



AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION
R1	13.08.14	LAYOUT AMENDED.

- NOTES :
- 1) Areas and dimensions are approximate only and are subject to final survey and deposit of plans.
 - 2) Service easements to be created as required.
 - 3) This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.

- Gravity Sewer
— Rising Sewer

	NAME	SIGNED	DATE
DESIGNED BY	MARK THOMSON		
CHECKED BY	ANDY HALL		



DAVIE LOVELL•SMITH

PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140, New Zealand
Telephone: 03 379-0793 E-mail: office@dis.co.nz

JOB TITLE:

Development Plan
Wilson & Gillman Wheelans

SHEET TITLE:

Proposed Sewer

DRAWING STATUS

For Consent

SCALE : 1:2500@A1
1:5000@A3

DATE : August 2014

CAD FILE :	SHEET No:	REVISION :
J:\18130\ENG\C18130\PROPOSED INFRASTRUCTURE_R1.dwg		
DRAWING No :	SHEET No:	
C.18130	E04.0	R1



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION
R1	13.08.14	LAYOUT AMENDED.

NOTES :

1)

Areas and dimensions are approximate only and are subject to final survey and deposit of plans.

2)

Service easements to be created as required.

3)

This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.

Rising Main

Mains

	NAME	SIGNED	DATE
DESIGNED BY	MARK THOMSON		
CHECKED BY	ANDY HALL		

DAVIE LOVELL•SMITH

PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 E-mail: office@dls.co.nz

JOB TITLE:

Development Plan
Wilson & Gillman Wheelans

SHEET TITLE:

Proposed Water Supply

DRAWING STATUS

For Consent

SCALE : 1:2500@A1
1:5000@A3

DATE : August 2014

CAD FILE : J:\18130\ENG\C18130\PROPOSED INFRASTRUCTURE_R1.dwg

REVISION :

DRAWING No : C.18130

SHEET No: E05.0

R1

APPENDIX C

Davie Lovell-Smith Geotechnical Appraisal

GEOTECHNICAL APPRAISAL

Wilfield Subdivision

Weedons Ross Road – West Melton

August 2014

REPORT

CONTENTS

Introduction.....	3
Geographical Work Area	3
Site Location	3
Site Description	3
Geotechnical Assessment	4
Desktop Study	4
DLS Site Investigation	4
Earthquake Risk.....	5
Liquefaction Risk	5
Definition of Good Ground	5
Department of Building and Housing Guidelines	6
Conclusion	6

APPENDICES

- APPENDIX A – Location of Test across the Site
- APPENDIX B – Borelog detail of Tests
- APPENDIX C – Environment Canterbury Well data
- APPENDIX D – University of Canterbury Trace of the Greendale Fault

Introduction

As part of the proposed Wilfield subdivision in West Melton, Davie Lovell-Smith has been engaged to undertake a geotechnical site appraisal. This is required to assess the suitability of the ground conditions across the site for development and to fulfill the recent council requirements on the assessment of liquefaction risk in Canterbury.

A recent site investigation was conducted involving 32 test pits, 7 of which were conducted using a drilling rig while 25 were completed using a hand auger. A borelog was recorded at each test pit to a depth where the gravel horizon was found. Scalar penetrometers were also conducted at each test pit to calculate the strength of the soil. See Appendix A for test locations and Appendix B for the Borelog details with associated scala readings.

Canterbury Regional Council (ECan) borelog data has also been used to estimate the groundwater level under the site. This has been downloaded from the Online ECan GIS site. The Ecan borelog and location is attached in Appendix C.

Geographical Work Area

West section – Eyre shallow sandy loam

South section – Templeton moderately deep fine sandy loam and air shallows

East section – Eyre shallow and stony sandy loam

North east section – Templeton deep sandy loam on sand

Site Location

The site is located at 690 Weedons Ross Rd, West Melton. The total area of the site is approximately 92.2364 ha and is proposed to be zoned as residential.

Site Description

Wilson and Gillman Wheelans Ltd plan to develop a subdivision into 180 residential lots. The area of land is bounded by West Coast Road to the north, Weedons Ross Road to the west and agricultural pastoral land to the East and South.

The site is generally flat pastoral land. The outer boundaries of the proposed site all have some type of fencing. The site also contains a number of tree lines on the outer boundaries.

The site comprises the following lots: Lot 1 D.P.391578, Lot 2 D.P.391578, S.O.8333 R.S.37783, and S.O.8404 R.S.37879.

Geotechnical Assessment

Geotechnical data has been obtained from the following sources: Environment of Canterbury (ECan) Borelogs and Davie Lovell-Smith site visits.

Desktop Study

ECan borelog data has been obtained from the online ECan GIS system and is attached in full detail in Appendix C of this report. The borelog data identified from the sites identified is listed below:

- Borelog M35/0976 – Topsoil to a depth of 0.3 m, Yellow clay to a depth of 0.6 m, Grey and brown sandy gravels to a depth of 53.3 m. The HWL was identified to be 20.2 m below ground level.
- Borelog M35/6201 – Topsoil to a depth of 0.3 m, large grey gravels to a depth of 8 m, clay bound gravels to a depth of 27 m, free water-bearing gravels to a depth of 35.0 m, a mixture of claybound gravels to a depth of 52.0 m and a mixture of free gravel to a depth of 83.0 m. The HWL was identified to be 20.18 m below ground level.

The borelog data provides similar results across the area. Both boreholes have 300 mm topsoil before transitioning into deep layers of either sandy or claybound gravel to a depth of at least 50m. The average depth to the groundwater table identified from the available ECan data was found to be 20.19 m (B.G.L).

DLS Site Investigation

The site investigations show a Topsoil layer of 300 mm in depth. This is underlain by a layer of sand and silt that reach down to a maximum depth of 900 mm. This is followed by a layer of sandy gravels.

These soil horizons follow the maximum depth where the layers are found. Most of the pit locations revealed much smaller layers of silt with sandy gravel occurring closer to the surface; see Appendix A for test pit locations and Appendix C for full test pit detail.

Some test pits revealed damp soil near the end of the bore holes. Water was also found at one test pit at a depth of 3.5 m. This indicates that there is perched ground water on the site.

Correlation between the test pits and ECan borelog data show a gravel horizon from 300 mm depth to depths exceeding 20 m. This is complementary to the ECan data which shows thin topsoil followed by gravel horizons.

Earthquake Risk

A review of the GNS Active Faults Database indicates that the Greendale fault is approximately 5500m off the southern end of the proposed development. Please refer to the attached University of Canterbury trace of the Greendale Fault in Appendix D which depicts the location of the proposed site in relation to this phenomenon.

With reference to the GNS publication “Planning for Development of Land on or Close to Active Faults” a fault avoidance zone of 20 metres either side of the known fault trace or likely fault rupture zone. This is to limit the risk of intense deformation or secondary ruptures in the near vicinity of structures. To our knowledge there is no fault trace on the site but this will be reviewed during the earthworks program.

This site has some earthquake potential due to the close proximity of the fault. Subsequently structural consideration towards seismic activity is recommended in respect to development of buildings on this site.

Liquefaction Risk

For a soil to have liquefactive potential it needs to meet specific moisture and grading criteria. Essentially the soil needs to be a saturated sand or silt. The soil found on this site does not display any of these liquefactive properties. The groundwater is very deep. Existing borelogs have this measured between 20.18 and 20.2 m below ground level. From the test pits bored by DLS most of the soil displayed damp features, including one test pit where water was struck at a depth of 3.5 m which suggests that there is perched water on the site. However, as the test pits revealed silts to a maximum of 0.9 m, there is a low chance of having saturated silt on the site. As a result, the site has a low liquefaction potential.

Appendix E shows the area of low geotechnical risk according to the Selwyn district council. The site location is well within the boundaries, this confirms that there is a very low chance of liquefaction occurring at this site.

Definition of Good Ground

Foundation soils, according to the New Zealand Standard NZS3604:2011 require that the following criteria must be met:

- No buried services under the footings.
- No evidence of land instability.
- No uncontrolled land filling.
- No buried topsoil, soft peat, very soft clay, soft clay or expansive clay.

In addition to this, the soils must meet at least one of the following:

- a) Meet a soil bearing capacity of 300 kPa as detailed in the testing requirements in NZS3604.
- b) Inspection of existing structures, council records, local history and geological data shows no evidence of erosion or land instability.
- c) Geotechnical completion report in accordance with NZS4404 identifies good ground.

Under normal circumstances, the option a) would be applied. However, this testing regime does have some prerequisite requirements. For this testing to be applied, the location of the future buildings foundations need to be determined and the tests carried out in those locations. Also the number of tests to be performed is a function of the building size. Clearly, at the time of subdivision, the proposed buildings have not been designed and the testing criteria cannot be met. For these reasons, under usual circumstances, the proving of good ground for bearing capacity is undertaken in association with a building consent application.

During the construction of the site, the earthworks will be carried out in accordance with NZS4431:1989. This NZS4431 certification relates to the filling on the site but does not test the insitu soils. The insitu soils may require testing in accordance with NZS3604 at the time of Building Consent Application.

Department of Building and Housing Guidelines

Utilising the “Revised guidance on repairing and rebuilding house affected by the Canterbury Earthquake Sequence” and the CERA technical Categories Map the Weedons Ross Road site is classified as TC1 – future land damage from liquefaction is unlikely. You can use standard foundations for concrete slabs or timber floors. An engineer should be engaged to determine the appropriate solution for the property, based on a site-specific investigation.

Conclusion

We believe that the geotechnical data obtained via the ECan borelogs combined with DLS borelogs indicate that the ground conditions over the site are consistent and of acceptable quality for residential development. Findings show:

- The depth to the groundwater is approximated to be 20.19 m; this in association with the insitu gravel horizons provides for a low liquefactive potential. Conditions are consistent with other geotechnical investigations in the Rolleston area and typically, a Technical Category 1 can be safely assumed.
- The proximity of the Greendale Fault should be taken into account when the design of building foundations and structures are undertaken and the guidance issued in the DBH guidelines followed

- The assessment of the site being good ground can be assessed once construction and earthworks is complete, as a part of the Building Consent process using NZS3604.

Andy Hall

CPEng, BE (Hons)

APPENDIX A

Davie Lovell-Smith Test Hole Locations



AMENDMENTS :


AMENDMENT	DATE	DESCRIPTION

NOTES :

1) Areas and dimensions are approximate only and are subject to final survey and deposit of plans.

2) Service easements to be created as required.

3) This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.



DAVIE LOVELL • SMITH

PLANNING SURVEYING ENGINEERING

79 Cambridge Terrace
Telephone: 03 379-0793

P O Box 579
Fax: 03 379-5664

Christchurch 8140, New Zealand
E-mail: office@dls.co.nz

JOB TITLE:

G W Wilfield Limited
Gillman Wheelans

SHEET TITLE:

Test Pit Locations

DRAWING STATUS:

For Approval

SCALE: 1:2500@A1
1:5000@A3

DATE: June 2014

CAD FILE: J:\18130\ENG\Geotech Report\C18130.TPLD1



DRAWING No: SHEET No:


C.18130 TPL.01


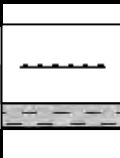
R1


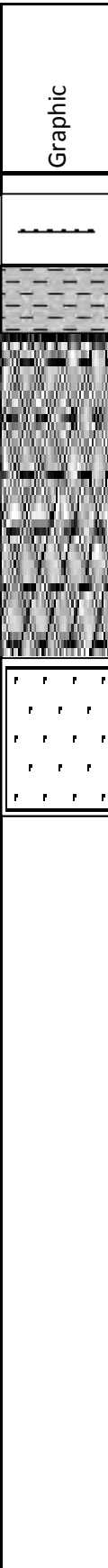
APPENDIX B




Davie Lovell-Smith Borelog Detail – November 2012



	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP001		
Client: Gillman Wheelans	<div>Graphic</div> 	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
<div>topsoil</div> <div>silt</div> <div>damp silt</div> <div>End of Bore Log (Gravel hit)</div>		0.00				
				1	1.00	75.00
				1	1.67	125.00
				3	2.33	175.00
				3	3.00	225.00
		0.50		3	2.67	200.00
				2	5.00	375.00
				10	6.00	450.00
		0.70				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				
		4.50				
		5.00				
		5.50				
		6.00				



	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP002		
Client: Gillman Wheelans	<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
<div>topsoil</div> <div>silt</div> <div>Sandy Gravel</div>		0.00				
				1	1.00	75.00
				1	1.67	125.00
				3	2.33	175.00
				3	3.00	225.00
		0.50		3	2.67	200.00
				2	5.00	375.00
		0.70		10	6.00	450.00
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				
		4.50				
		5.00				
		5.50				
		6.00				



	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP003		
Client: Gillman Wheelans	<div>Graphic</div> 	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
<div>topsoil</div> <div>silt</div> <div>End of Bore Log (Gravel hit)</div>		0.00				
				1	1.00	75.00
				1	1.33	100.00
				2	1.67	125.00
				2	2.33	175.00
		0.50		3	5.00	375.00
				10	6.50	487.50
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				
		4.50				
		5.00				
		5.50				
		6.00				



	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP004		
Client: Gillman Wheelans	Graphic 	Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil silt Sandy Gravel Damp Sandy Gravel		0.00				
				1	1.00	75.00
				1	1.67	125.00
				3	2.33	175.00
				3	3.00	225.00
		0.50		3	2.67	200.00
				2	5.00	375.00
				10	6.00	450.00
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				
		4.50				
		5.00				
		5.50				
		6.00				


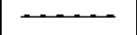

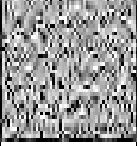
 DAVID LONVILL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP005		
Client: Gillman Wheelans	Graphic  	Depth (m) 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil					1	75.00
					1	75.00
silt					1	100.00
					2	325.00
End of Bore Log (Gravel hit)				10	6.00	450.00




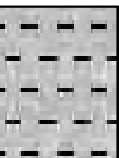

 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130		
	Project: Lot 862				SPT No: TP006		
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Topsoil</div> <div>End of Bore Log (Gravel hit)</div>			0.00		<div>1</div> <div>2</div>	<div>1.50</div> <div>1.50</div>	<div>112.50</div> <div>112.50</div>
							
			0.20				
			0.50				
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				


 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130						
	Project: Lot 862				SPT No: TP007						
Client: Gillman Wheelans	<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>					
Date: 27/06/2014											
Location: Wilfeild Sub Devision											
Logged By: Nic Brooker											
Description of Soils.											
<div>topsoil</div> <div>End of Bore Log (Gravel hit)</div>	<div></div>	0.00									
	<div></div>										
	<div></div>	0.15					1	1.00	75.00		
							0.50	1	1.33	100.00	
								2	1.50	112.50	
							1.00				
								1.50			
									2.00		
									2.50		
								3.00			
								3.50			
								4.00			




 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130			
	Project: Lot 862			SPT No: TP008			
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>topsoil</div> <div>End of Bore Log (Gravel hit)</div>		<div></div>	0.00				
		<div></div>			1	1.50	112.50
		<div></div>			2	2.67	200.00
				0.15	5	5.67	425.00
				0.50	10	7.50	562.50
				1.00			
				1.50			
				2.00			
				2.50			
	3.00						
	3.50						
	4.00						



 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP009		
Client: Gillman Wheelans	<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
topsoil End of Bore Log (Gravel hit)		0.00				
					1	75.00
					1	100.00
					2	125.00
		0.30			2	150.00
		0.50			2	225.00
					5	262.50
		1.00				
		1.50				
		2.00				
		2.50				
	3.00					
	3.50					
	4.00					




 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP010		
Client: Gillman Wheelans	Graphic	Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
topsoil		0.00				
				0.5	0.50	37.50
silt				0.5	0.67	50.00
				1	1.17	87.50
				2	1.67	125.00
		0.50		2	2.67	200.00
damp silt				4	2.67	200.00
				2	3.00	225.00
				3	2.67	200.00
		0.80		3	2.67	200.00
End of Bore Log (Gravel hit)		1.00		2	3.33	250.00
				5	3.67	275.00
				4	4.00	300.00
				3	3.50	262.50
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				



 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130			
	Project: Lot 862			SPT No: TP011			
Client: Gillman Wheelans			Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
			0.00				
topsoil					2	2.00	150.00
					2	2.00	150.00
silt			0.50		2	1.67	125.00
					1	1.67	125.00
					2	2.00	150.00
Coarse silt					3	3.33	250.00
					5	4.00	300.00
End of Bore Log (Gravel hit)			0.75				
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
			3.50				
			4.00				



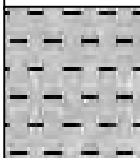

 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP012		
Client: Gillman Wheelans	Graphic	Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
topsoil End of Bore Log (Gravel hit)		0.00		1	1.00	75.00
		0.15				
		0.50				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				


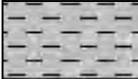
 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP013		
Client: Gillman Wheelans	Graphic  	Depth (m) 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
topsoil						
				1	1.00	75.00
				1	1.00	75.00
				1	1.33	100.00
silt				2	1.67	125.00
End of Bore Log (Gravel hit)				2	2.00	150.00


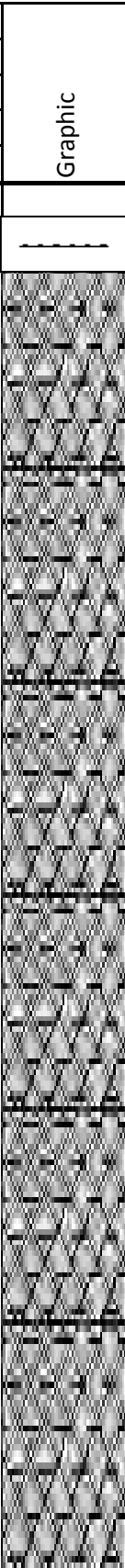
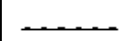
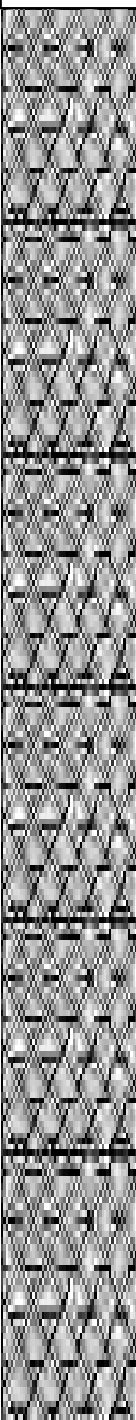
 <small>DAVID LOVELL-SMITH</small>	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP014		
Client: Gillman Wheelans	<div>Graphic</div> 	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
<div>Topsoil</div> <div>End of Bore Log (Gravel hit)</div>		0.00				
				1	1.50	112.50
				2	2.00	150.00
		0.20		3	2.50	187.50
		0.50				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				


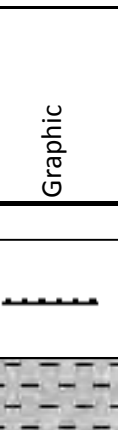
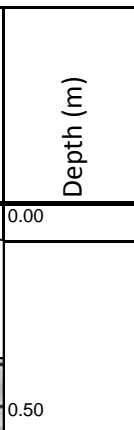
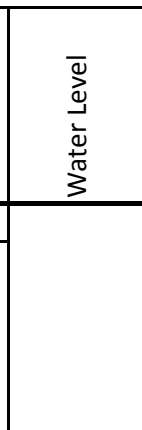
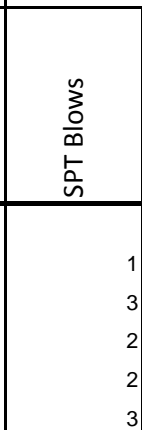
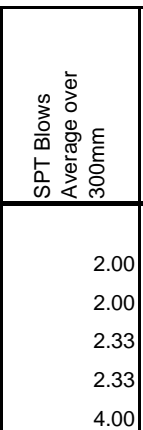
 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP015		
Client: Gillman Wheelans	Graphic	Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil Silt End of Bore Log (Gravel hit)		0.00				
				1	1.00	75.00
				1	1.33	100.00
				2	1.50	112.50
		0.30				
		0.50				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				


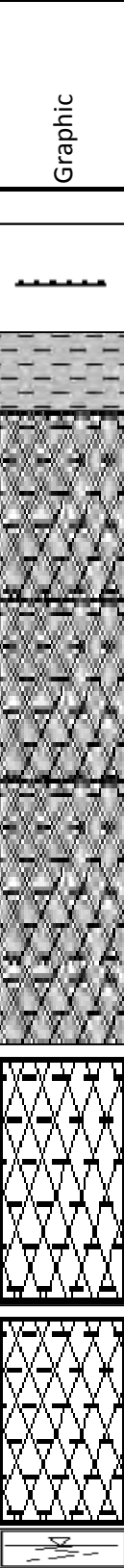


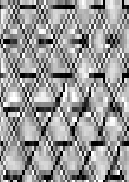
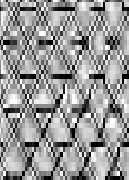
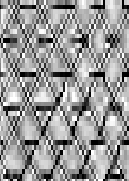
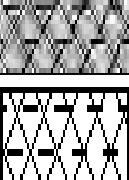
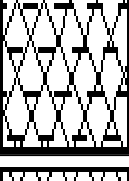
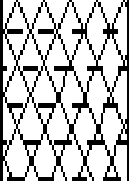

 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP016		
Client: Gillman Wheelans	Graphic 	Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil End of Bore Log (Gravel hit)		0.00				
				0.5	0.50	37.50
				0.5	0.50	37.50
		0.20				
		0.50				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				




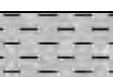
 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130			
	Project: Lot 862			SPT No: TP017			
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Topsiol</div> <div>Silt</div> <div>Sand</div> <div>End of Bore Log (Gravel hit)</div>			0.00				
					1	1.00	75.00
					1	1.00	75.00
					1	1.33	100.00
					2	1.33	100.00
				0.50	1	1.67	125.00
					2	2.00	150.00
					3	2.67	200.00
					3	3.67	275.00
					5	4.00	300.00
			1.00				
			1.50				
			2.00				
	2.50						
	3.00						
	3.50						
	4.00						


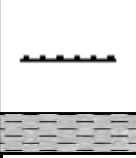
 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP018		
Client: Gillman Wheelans		Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil Silt End of Bore Log (Gravel hit)		0.00				
				1	1.00	75.00
				1	1.00	75.00
				1	1.00	75.00
				1	1.33	100.00
		0.50		2	3.33	250.00
		0.50		7	4.50	337.50
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				



 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130					
	Project: Lot 862			SPT No: TP019					
Client: Gillman Wheelans		Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)			
Date: 27/06/2014									
Location: Wilfeild Sub Devision									
Logged By: Nic Brooker									
Description of Soils.									
Topsoil		0.00							
									
	0.15	1					1.50	112.50	
		2					1.50	112.50	
Sandy Gravel		0.50							
		1.00							
		1.50							
		2.00							
		2.50							
		3.00							
		3.50							
		4.00							




 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130			
	Project: Lot 862			SPT No: TP020			
Client: Gillman Wheelans							
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
Topsoil			0.00				
					1	2.00	150.00
					3	2.00	150.00
					2	2.33	175.00
Silt					2	2.33	175.00
			0.50		3	4.00	300.00
End of Bore Log (Gravel hit)			0.50		7	5.00	375.00
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
			3.50				
			4.00				



 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP021		
Client: Gillman Wheelans		Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Scala Penetrometer Log		0.00				
Topsoil				0.5	0.50	37.50
				0.5	0.67	50.00
				1	2.50	187.50
Silt		0.50		6	3.50	262.50
		1.00				
		1.50				
Sandy Gravel		2.00				
		2.50				
		3.00				
Wet Sandy Gravel		3.50				
Water table @ 3.5m						
End of Bore Log		4.00				
(Water table prevented further boring)						



 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130			
	Project: Lot 862			SPT No: TP022			
Client: Gillman Wheelans			Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
Topsoil			0.00				
					1	1.00	75.00
					1	1.00	75.00
					1	1.33	100.00
Silt			0.50		2	2.33	175.00
					4	2.67	200.00
End of Bore Log (Gravel hit)					2	3.00	225.00
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
			3.50				
			4.00				


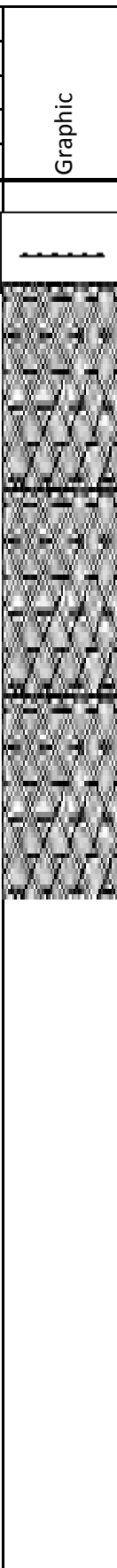

 <small>DAVE LOVELL-SMITH</small>	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP023		
Client: Gillman Wheelans	<div>Graphic</div> 	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
<div>Topsoil</div> <div>Silt</div> <div>End of Bore log (Gravel hit)</div>		0.00				
				1	1.00	75.00
				1	1.33	100.00
				2	1.50	112.50
		0.50				
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				


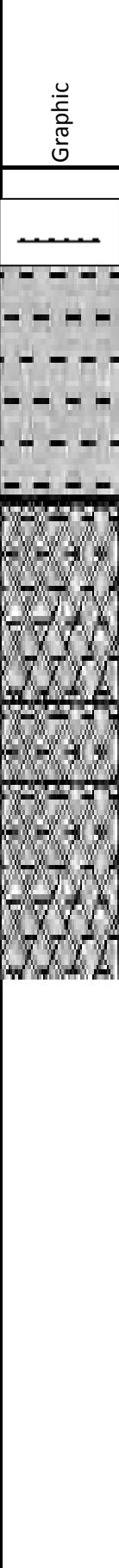
 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130		
	Project: Lot 862				SPT No: TP024		
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Gravelly topsoil</div> <div>End of Bore Log (Gravel hit)</div>			0.00		<div>1</div> <div>2</div>	<div>1.50</div> <div>1.50</div>	<div>112.50</div> <div>112.50</div>
							
			0.50				
			1.00				
			1.50				
			2.00				
			2.50				
3.00							
3.50							
4.00							


 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130		
	Project: Lot 862				SPT No: TP025		
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Topsoil</div> <div>silt</div> <div>End of Bore log (Gravel hit)</div>			0.00				
					1	1.00	75.00
					1	2.00	150.00
					4	2.50	187.50
			0.50				
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
			3.50				
			4.00				


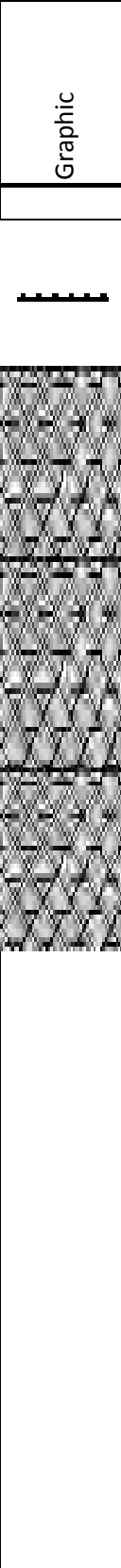
 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130		
	Project: Lot 862				SPT No: TP026		
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Topsoil</div> <div>End of Bore log (Gravel hit)</div>			0.00		<div>1</div> <div>2</div> <div>3</div>	<div>1.50</div> <div>2.00</div> <div>2.50</div>	<div>112.50</div> <div>150.00</div> <div>187.50</div>
							
			0.50				
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
	3.50						
	4.00						


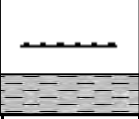
 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130						
	Project: Lot 862			SPT No: TP027						
Client: Gillman Wheelans	<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>				
Date: 27/06/2014										
Location: Wilfeild Sub Devision										
Logged By: Nic Brooker										
Description of Soils.										
<div>Topsoil</div> <div>End of Bore log (Gravel hit)</div>		0.00								
								1	1.00	75.00
								1	1.00	75.00
								1	1.33	100.00
								2	1.33	100.00
		0.50						1	3.67	275.00
								8	4.50	337.50
		1.00								
		1.50								
		2.00								
		2.50								
	3.00									
	3.50									
	4.00									

 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130									
	Project: Lot 862			SPT No: TP028									
Client: Gillman Wheelans			Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)						
Date: 27/06/2014													
Location: Wilfeild Sub Devision													
Logged By: Nic Brooker													
Description of Soils.													
Topsoil			0.00		1	1.00	75.00						
								1	1.33	100.00			
											2	1.50	112.50
			0.50										
			1.00										
			1.50										
			2.00										
			2.50										
			3.00										
			3.50										
Sandy Gravel			4.00										

 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP029		
Client: Gillman Wheelans		Depth (m)	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil		0.00				
				1	1.00	75.00
				1	1.33	100.00
				2	1.33	100.00
				1	1.67	125.00
		0.50		2	2.00	150.00
				3	3.00	225.00
				4	3.00	225.00
				2	2.67	200.00
				2	3.00	225.00
		1.00		5	4.00	300.00
				5	5.00	375.00
Sandy Gravel						
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				
		4.00				

 DAVID LOVELL-SMITH	Scala Penetrometer Log				Job No: 18130		
	Project: Lot 862				SPT No: TP030		
Client: Gillman Wheelans		<div>Graphic</div>	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014							
Location: Wilfeild Sub Devision							
Logged By: Nic Brooker							
Description of Soils.							
<div>Topsoil</div> <div>End of Bore log (Gravel hit)</div>		<div></div>	0.00				
		<div><div></div></div>					
		<div></div>					
			0.50				
			1.00				
			1.50				
			2.00				
			2.50				
			3.00				
	3.50						
	4.00						

 <small>DAVID LOVELL-SMITH</small>		Scala Penetrometer Log			Job No: 18130	
Project: Lot 862					SPT No: TP031	
Client: Gillman Wheelans	<div>Graphic</div> 	<div>Depth (m)</div>	<div>Water Level</div>	<div>SPT Blows</div>	<div>SPT Blows Average over 300mm</div>	<div>Soil Strength to NZS3604:1999 (kPa)</div>
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil		0.00				
				1	1.00	75.00
				1	1.00	75.00
				1	1.67	125.00
				3	4.33	325.00
Sandy Gravel		0.50		9	8.00	600.00
				12	10.50	787.50
		1.00				
		1.50				
		2.00				
		2.50				
		3.00				
		3.50				

 DAVID LOVELL-SMITH	Scala Penetrometer Log			Job No: 18130		
	Project: Lot 862			SPT No: TP032		
Client: Gillman Wheelans	Graphic 	Depth (m) 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50	Water Level	SPT Blows	SPT Blows Average over 300mm	Soil Strength to NZS3604:1999 (kPa)
Date: 27/06/2014						
Location: Wilfeild Sub Devision						
Logged By: Nic Brooker						
Description of Soils.						
Topsoil					2	225.00
					4	350.00
Silt					8	725.00
End of Bore log (Gravel hit)					17	937.50

APPENDIX C

ECan Borehole data



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

1)

Areas and dimensions are approximate only and are subject to final survey and deposit of plans.

2)

Service easements to be created as required.

3)

This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.

Total Area : 92.2364ha

Comprised in: C.F.R's.367736, CB11A/748 & CB549/209



DAVIE LOVELL • SMITH

PLANNING SURVEYING ENGINEERING

79 Cambridge Terrace P O Box 679 Christchurch 8140, New Zealand
Telephone: 03 379-0793 Fax: 03 379-5664 E-mail: office@dls.co.nz

JOB TITLE:

Development Plan
Gillman Wheelans

SHEET TITLE:

ECan Borehole Locations

DRAWING STATUS

For Engineering Approval

SCALE: 1:2500@A1
1:5000@A3

DATE: April 2014

CAD FILE : J:\18130\ENG\Geotech Report\C18130.EBHL01.dwg

DRAWING No : SHEET No :

C.18130. EBHL.01

RO

Borelog for well M35/0976

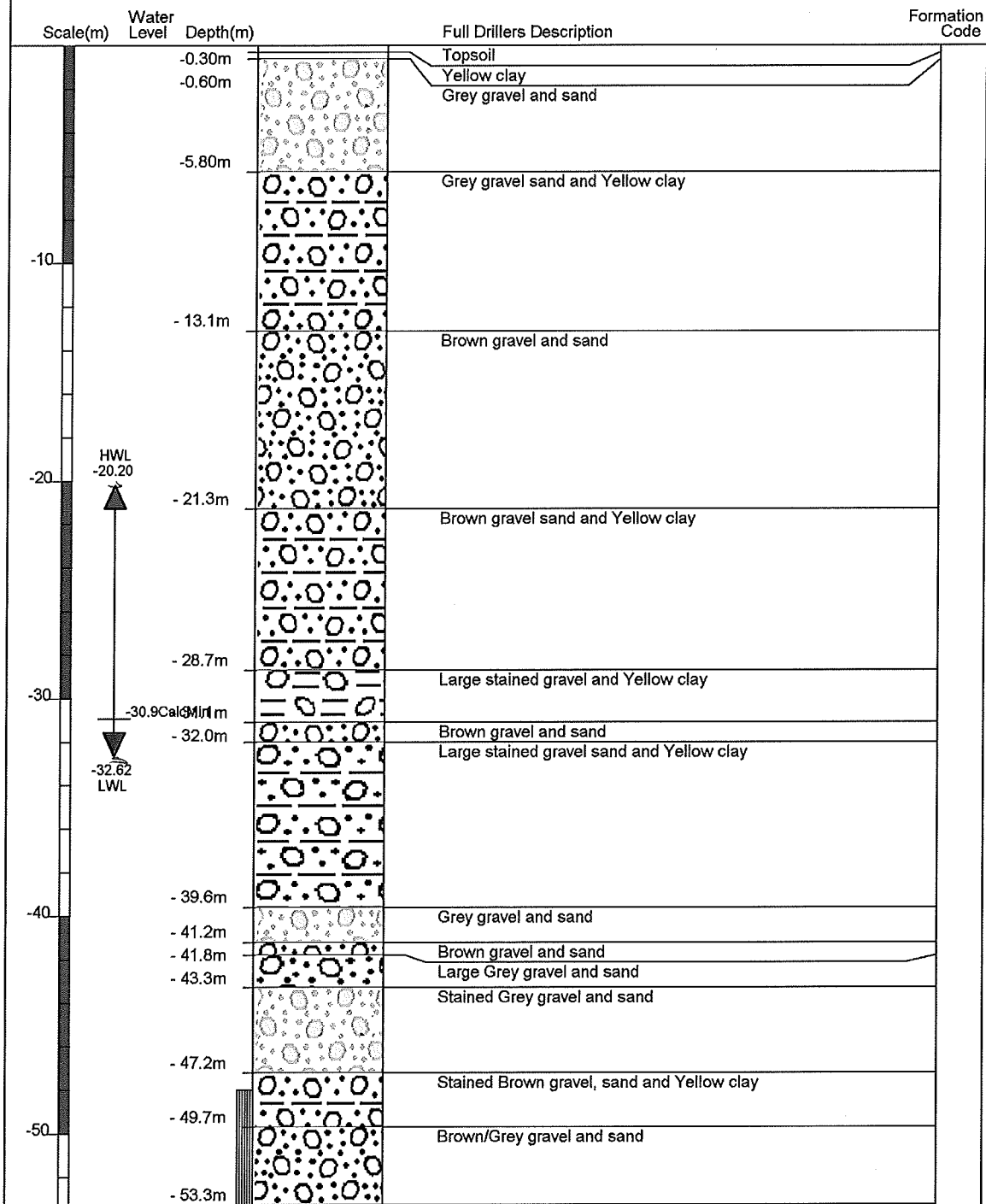
Gridref: M35:59877-41639 Accuracy : 2 (1=high, 5=low)

Ground Level Altitude : 82.66 +MSD

Driller : A M Bisley & Co

Drill Method : Cable Tool

Drill Depth : -53.29m Drill Date : 30/06/1971



Borelog for well M35/6201

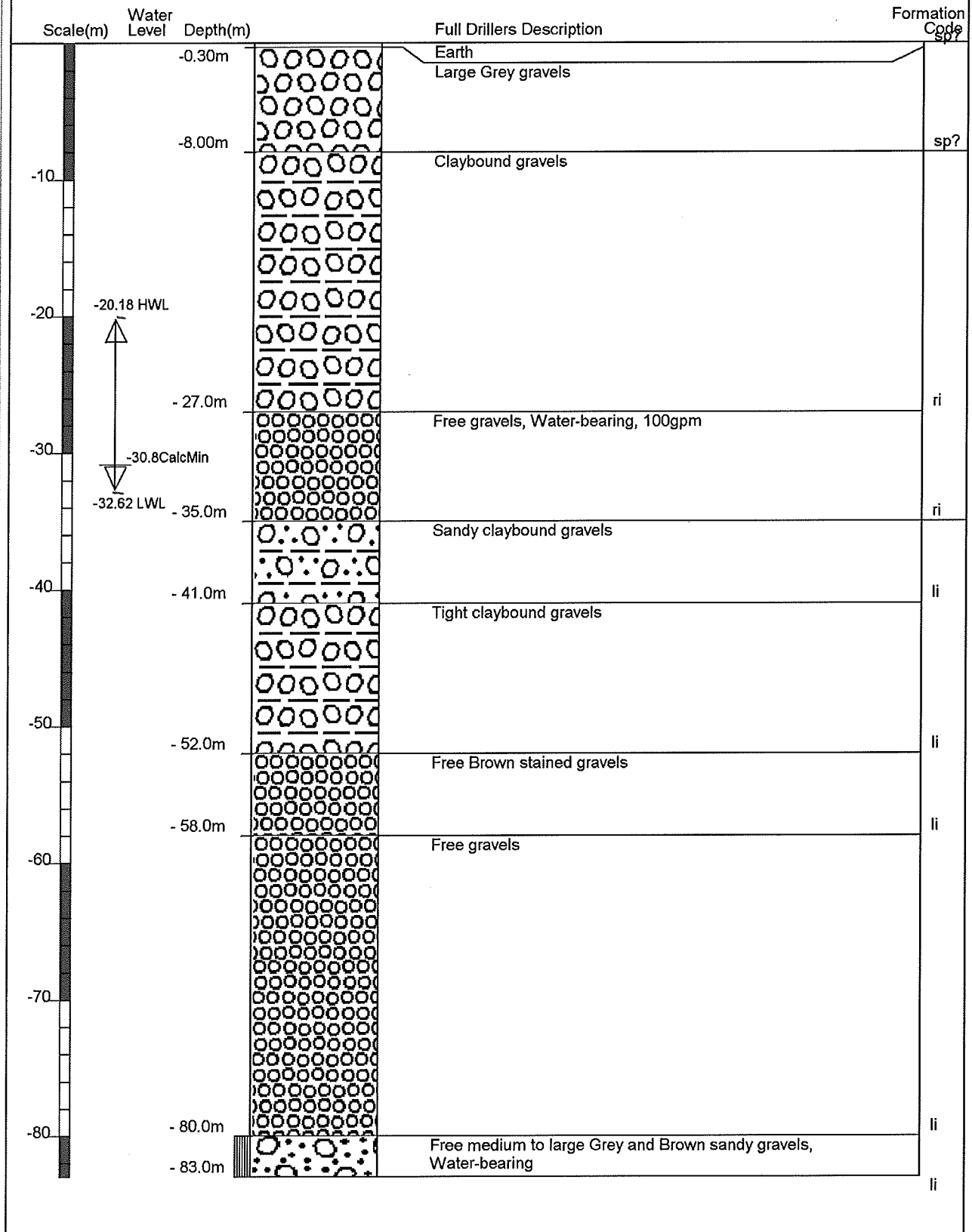
Gridref: M35:59873-41650 Accuracy : 2 (1=best, 4=worst)

Ground Level Altitude : 82.88 +MSD

Driller : McMillan Water Wells Ltd

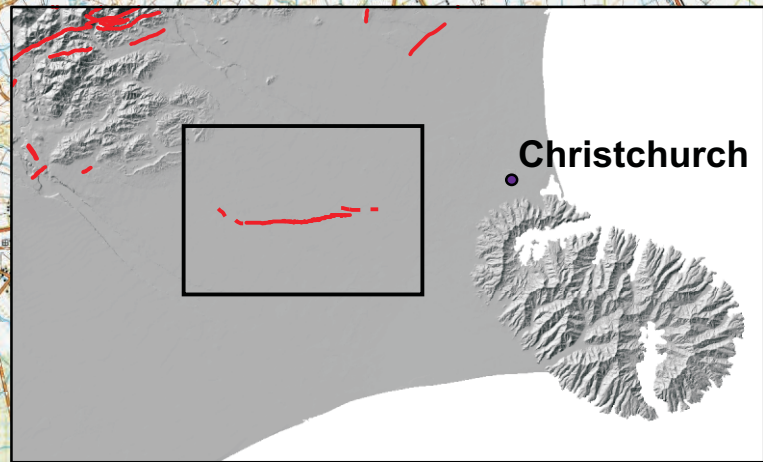
Drill Method : Rotary/Percussion

Drill Depth : -83m Drill Date : 23/01/1990

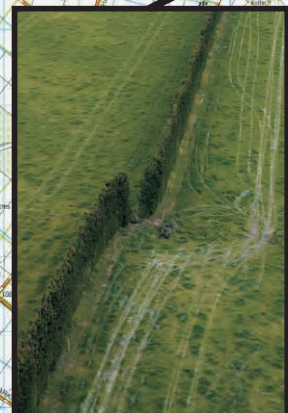
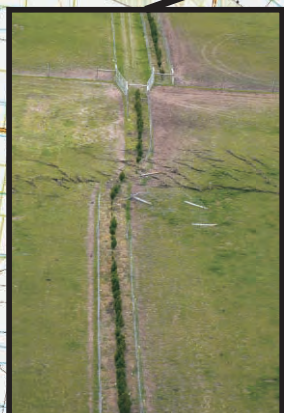
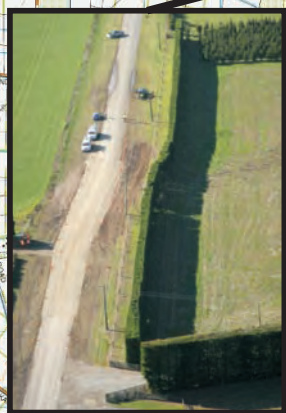


APPENDIX D

University of Canterbury Trace of the Greendale Fault



UC
UNIVERSITY OF
CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

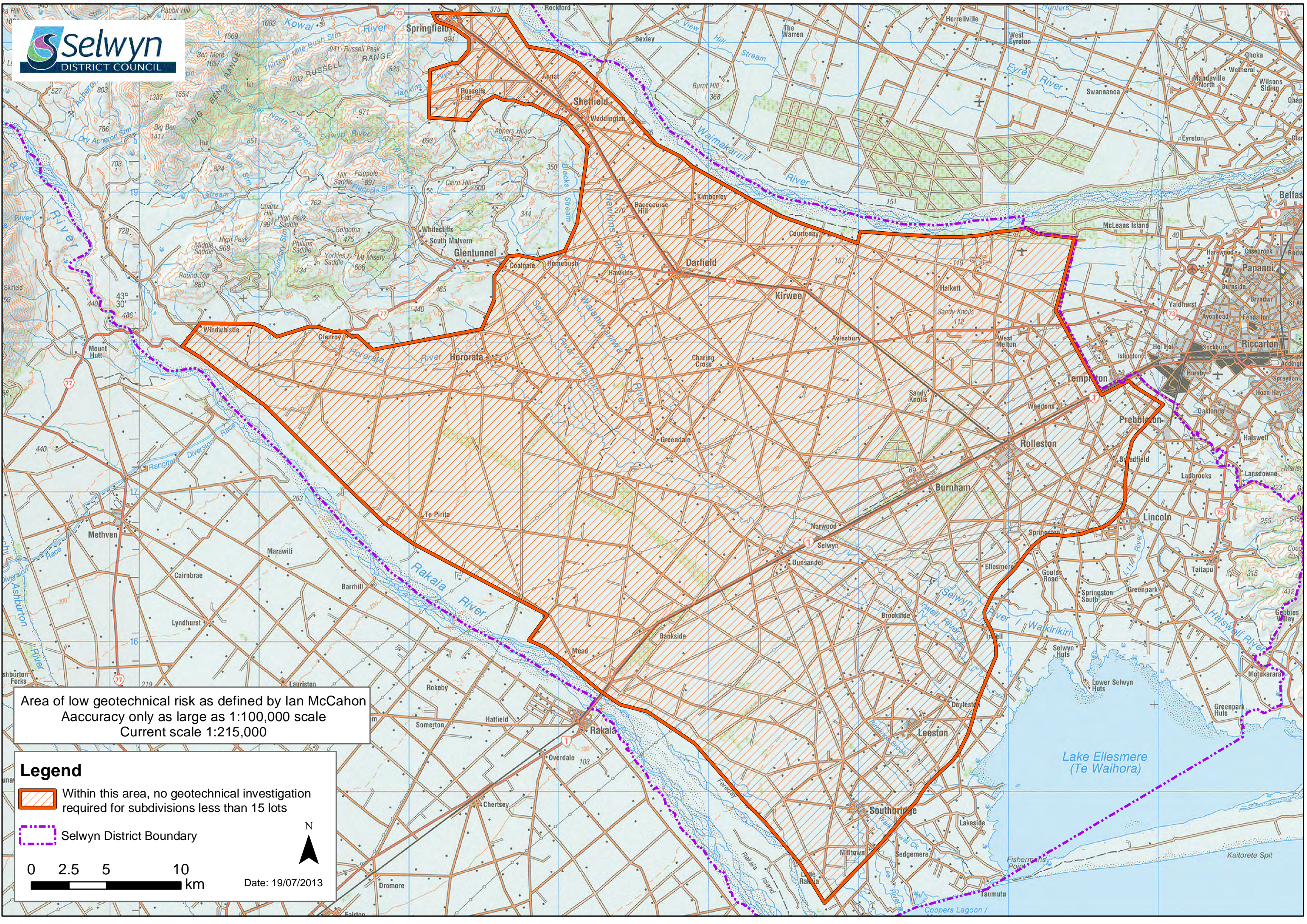


0 5 km





APPENDIX E

Selwyn District Council map of areas with low geotechnical risk



Area of low geotechnical risk as defined by Ian McCahon
Accuracy only as large as 1:100,000 scale
Current scale 1:215,000

Legend

-  Within this area, no geotechnical investigation required for subdivisions less than 15 lots
-  Selwyn District Boundary

0 2.5 5 10 km

Date: 19/07/2013