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Racecourse Road Development
Ashburton District Council
28-Jul-2020

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Racecourse Road Development

Concept Assessment Report

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Racecourse Road Development

Concept Assessment Report

Client: Ashburton District Council

Co No.: N/A

Prepared by

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Executive Summary

Ashburton District Council employed the services of AECOM to investigate options for future development of land to the east of Racecourse Road. A high-level, holistic investigation was undertaken to produce a conceptual Structure Plan to provide guidance to property owners.

Planning and Urban Design

Planning and urban design considerations were explored. Two scenarios were investigated considering lot sizes of either 2,000 or 4,000 m^2. The approximate estimated yields of these scenarios are respectively: 555 lots with 15,600 m^2 of green space, or 300 lots with 7950 m^2 of green space. A concept Structure Plan was developed including a road layout to service the proposed lots, a shared pedestrian pathway, and key links to significant adjacent areas.

Geotechnical Desktop Review

A desktop geotechnical review was undertaken. The underlying soils are likely gravels with sand, silt and clay. The hydraulic conductivity is anticipated to be highly variable. Liquefaction potential has been identified as low. Slope stability and lateral spreading are not expected. Geotechnical testing should be undertaken to inform design and construction of stormwater drainage, building foundations and roading infrastructure.

Three Waters Infrastructure

The existing three waters networks were considered in conjunction with proposed infrastructure to service the development.

The existing potable water network was analysed using ADC's Infoworks water supply model. A concept trunk layout was determined to sufficiently service the development via a DN225 main (under peak demand and fire flow conditions). The proposed alignment includes either: connecting the proposed main utilising the adjacent state highway, or detailed design to minimise dead ends north-east of the racecourse. Both alignments are viable and subject to operational and route considerations.

The preferred option to service wastewater requirements should be selected regarding plans for the wider Ashburton wastewater network. Wastewater servicing may be achieved by one of three options:

- A gravity network (DN225 and DN300 mains) discharging via three connections to the adjacent existing network. ADC's ICM wastewater model shows insufficient capacity for this to be feasible under peak loading, unless upgrades are carried out downstream (the extent of which was not investigated here). Feasible locations for connections to the existing network were identified regarding pipeline depth, however network capacity must be improved before this option is considered further.
- Two pump stations servicing the development which discharge to the existing network at one location. Storage in two wet wells of 120 m^3 and 1400 m^3, with limited discharge rates of 10 L/s provides a feasible arrangement to service the development without surcharging the existing or proposed networks.
- A low pressure sewer network. This system offers benefits including: smoothing peak flows, aiding construction staging and providing flexibility for future upstream development. The proposed development would either require; three discharge locations each with maximum loading estimated between 6 – 15 L/s, or one discharge point with flows between 15 – 25 L/s. Spreading the loading over multiple connection points may mitigate the need for additional capacity to be provided in the existing network.

Stormwater devices required to service the development include roadside swales and stormwater detention basins. Swales should be designed in subsequent design stages to provide conveyance of roading runoff during a 1 in 10 year event and site-wide runoff during a 1 in 100 year event. The swales should convey flow to stormwater basins sized for the detention and soakage of the aforementioned events. The design of these devices is subject to finalised roading layouts and location of available land for stormwater basins.

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Abbreviations

AC	Asbestos Cement
ADC	Ashburton District Council
AECOM	AECOM New Zealand Ltd
ARI	Annual Recurrence Interval
CBR	California Bearing Ratio
DI	Ductile Iron
ECan	Environment Canterbury
NZGD	New Zealand Geotechnical Database
PE	Poly-Ethelene
PVC	Poly-Vinyl Chloride
PS	Pump Station
SH1	State Highway 1

1.0 Introduction

1.1 Project Background

Ashburton District Council (ADC) have employed the services of AECOM New Zealand Ltd (AECOM) to investigate options for future development of land to the east of Racecourse Road. A high-level, holistic investigation is required to implement a Structure Plan that will provide guidance to individual property owners when they seek to subdivide or develop in a co-ordinated manner.

The proposed structure plan area constitutes approximately 141 ha of land with 35 separate properties, and 23 unique owners as described in Table 1. The smallest of these is approximately 1,200 m^2, and the largest is 122,729 m^2. There has been a recent subdivision (SUB19/0002) of 174 Racecourse Road (105,698 m^2) approved by ADC to create 22 x 4,000 m^2 residential allotments and a 4,000 m^2 reserve. The area of interest is bounded on the south-west side by Racecourse Road, and on the south-east side by State Highway 1 (SH1). Figure 1 provides an overview of the project area.

Figure 1 **Project Area**

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Table 1 Summary of properties in the Structure Plan Area

Address	Owner	Legal Description	Area (m^2)
102 Racecourse Road	GB and M Trolove	Lot 1 DP 500533	10,521
108 Racecourse Road	GB and M Trolove	Lot 2 DP 500533	97,719
24 Golf Links Road	Ashburton District Council	Lot 1 DP 26365	25,431
198 Racecourse Road	AJ and IM King	Lot 2 DP 486890	4,435
146 Racecourse Road	AJ and CL Hunt	Lot 2 DP 26657	20,220
208 Racecourse Road	SJ Allen and S Giller	Lot 1 DP 26513	20,231
194 Racecourse Road	CA Bond-hood and G E Hood	Lot 1 DP 15884	2,040
	GB and M Trolove	Lot 6 DP 72583	20,226
244 Racecourse Road	DD and JV Askin	Lot 1 DP 26489	4,901
140 Racecourse Road	DJ Williams	Lot 1 DP 72583	20,225
152 Racecourse Road	M G Van der Krogt	Lot 2 DP 491277	6,548
150 Racecourse Road	AJ and GF Rhodes	Lot 1 DP 491277	6,020
154 Racecourse Road	M G Van der Krogt	Lot 3 DP 491277	7,793
218 Racecourse Road	AN and BP Beeston	Lot 1 DP 41519	58,605
	GB and M Trolove	Lot 6 DP 26657	20,225
202 Racecourse Road	FZ and NN Hussein	Lot 1 DP 486890	4,369
	GB and M Trolove	Lot 5 DP 26657	20,224
206 Racecourse Road	MR and RM Amos	Lot 3 DP 486890	30,845
	DD and JV Askin	Lot 1 DP 48202	1,242
	EM McCormick	Lot 5 DP 465347	80,175
	Ashburton District Council	Part RES 1405	15,960
134 Racecourse Road	DJ and EG Luke	Lot 4 DP 72583	81,916
182 Racecourse Road	DW and MJ Bruce	Lot 1 DP 21622	28,305
170 Racecourse Road	A G and D W Smith	Part RS 16478	41,242
234 Racecourse Road	EM McCormick	Lot 6 DP 67784	135338
172 Racecourse Road	EH and TJ Hewson	Lot 1 DP 514448	4,392
188 Racecourse Road	CA Bond-hood and G E Hood	Lot 2 DP 57346	79,990
174 Racecourse Road	EH Hewson, Warnorbill Ltd, TH Williamson	Lot 2 DP 514448	105,698
136 Racecourse Road	DJ and EG Luke	Lot 3 DP 72583	82,538
196 Racecourse Road	Canterbury Safety Ltd	Lot 1 DP 57346	87,372
138 Racecourse Road	DJ and F Peters	Lot 2 DP 72583	83,497
	AG and DW Smith	Part RS 16478	41,365
33 Golf Links Road	RP and SP Bell	Lot 1 DP 527565	3,997
23 Golf Links Road	MA and PV Small	Lot 2 DP 29941	122,729
25 Golf Links Road	RP and SP Bell	Lot 2 DP 527565	36,458
Total			**1,412,792**

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1.2 Project Description

The aim of this investigation is to provide the best outcome for every potential property in the proposed development. This will be achieved by assessing options with a particular focus on the layout and three waters infrastructure.

The scope of work includes:

- Site visit
- Review of existing background information regarding:
    - Planning requirements
    - Three waters infrastructure
    - ADC system preferences
    - ADC models
- Drafting of plans
- Concept assessment report (this Report) including:
    - Subdivision overview exploring high-level details addressing;
        - Planning
        - Urban Design
        - Residential Yield Scenarios
        - Geotechnical Conditions
        - Roading
    - Three Waters Infrastructure Servicing Options
    - Absorption Rate Investigation
- Options workshop
- Delivery of final report

The options developed during this project aim to provide a guide for ADC's approval process when assessing proposed development layouts and projecting collective infrastructure costs.

1.3 Design References and Assumptions

The design standards to be referenced and applied in this project include:

- NZS4404 (2010) Land Development and Subdivision Infrastructure
- ADC Standard Specifications – Construction of Water Supply Pipelines (2018)
- ADC Standard Specifications – Construction of Sewer and Stormwater Pipelines (2018)
- ADC Stormwater Design Guidelines (2018)
- ADC Stormwater Activity Management Plan (2018)
- SNZ PAS 4509 (2003)

General assumptions of this project include:

- The three waters models provided by ADC are complete and up-to-date.
- Property owners are responsible for the on-site disposal of stormwater up to a 1 in 10 yr event.
- Stormwater entering the development from upstream (beyond the project area) is not accounted for as part of this project, due to limits of the existing stormwater model.

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2.0 Subdivision Overview

2.1 Planning Considerations

The Structure Plan Area is currently zoned Residential D Zone in the Ashburton District Plan. Table 2 provides a summary of key requirements relating to subdivision and future development for residential use according to the existing provisions of the Ashburton District Plan. We have given consideration to advice from ADC that a proposed district plan is not due for another two years, but that it may take a different approach to subdivision or land development for residential use, and that the structure plan should consider positive outcomes even where they depart from the current provisions.

Table 2 Ashburton District Plan summary information

Reference	Description	Requirement	Comment
Section 4: Residential Zones			
4.9.1	Residential density	4,000 m^2	4,000 m^2 permitted activity 2,000 m^2 restricted discretionary activity
4.9.2	Building coverage	15%	600m^2 for a 4,000 m^2 lot 300m^2 for a 2,000 m^2 lot
4.9.3	Maximum building height	10 m	-
4.9.4	Recession lines	2.3 m plus angle	-
4.9.5	Setback from streets	10 m	-
4.9.6	Setback from neighbours	6 m	-
4.9.7	Outdoor living space	Nil	Assumes that 15% site coverage will leave sufficient area for outdoor living space.
4.9.12	Flooding	All buildings with a gross floor area greater than 50 m^2 to have a minimum floor height of 150 mm above the 1 in 200 flood event	-
Section 9: Subdivision			
9.8.3	Allotment dimensions	50 m x 50 m minimum rectangle	2,500 m^2 a minimum, otherwise a discretionary activity
9.8.4	Sanitary sewage disposal	All allotments less than 1 hectare in area in the Ashburton Residential D Zone shall be connected to a public or community reticulation and disposal system.	-
9.9.1	Allotment size	4,000 m^2	4,000 m^2 restricted discretionary activity 2,000 m^2 non-complying activity

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Reference	Description	Requirement	Comment
9.9.10	Open Space and Recreation	A contribution calculated as: • 5% of the market value of additional residential lots created • a land area equivalent to 30 m² of land for each additional residential subdivision; or • a combination of the above to the equivalent value/area. Note: Utility lots, including those for stormwater retention purposes, may not be used as part of the open space or recreation reserve contribution.	
Section 10: Transport			
10.9.1	Roading, access and vehicle crossings	All new roads shall be laid out and vested in the Council, in accordance with Standard NZS4404:2010, except where specified. Arterial – urban (>5,000 vpd) minimum 27 m legal width, 15 m carriageway width	
10.9.1 (e)	Cul-de-sac	Turning head 9.5 m radii in Residential zones	-
10.9.2 (c)	Vehicular access	Access to allotments for more than 6 residential units to be by way of road and not private way or access lot.	-
10.9.9	State Highway Access	Any new subdivision or land use requiring direct access to a state highway shall be a restricted discretionary activity.	Golf Links Road to be modified rather than provide other direct access to Rakaia Road (SH1)

Some of the key considerations are that 4,000 m^2 lots are generally provided for in the Residential D Zone, and 2,000 m^2 lots would be a non-complying subdivision, up to 6 lots may be serviced by right of way or access lots, and building coverage of up to 15% is permitted. The consequence of this is that a significant proportion of future development may be occupied by roads, and that generally large residential lots are provided for where the bulk of the lot is not occupied by buildings.

Table 3 provides a brief summary of the existing roading hierarchy adjoining the Structure Plan Area, and key connections to the west of Racecourse Road. This can then be considered in a future road network to provide for connections to existing roads. Golf Links Road is an existing road connection to land in the south-east corner of the Structure Plan Area and the Golf Course. Augmentation of this existing road would provide for the outcomes sought that discourage direct vehicle access from individual properties to SH1.

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Table 3 Ashburton District Council Roading Hierarchy

Road name	Classification	Comment
Rakaia Highway (SH1)	Arterial - urban	Adjoins Structure Plan Area
Racecourse Road	Principal	Adjoins Structure Plan Area
Golf Links Road	Local	Adjoins Rakaia Highway (SH1) and services the Golf Course and properties in the SE corner of the Structure Plan Area
Creek Road	Collector	West of Racecourse Road
Belt Road	Principal	West of Racecourse Road
Allens Road	Collector	West of Racecourse Road
Farm Road	Collector	West of Racecourse Road

2.2 Urban Design

When considering the opportunities and constraints relating to future subdivision within the Structure Plan Area, the site is gently sloping generally from the north-east to south-west, and the surrounding area has been taken into account as shown in Figure 2. A larger Plan is also included in Appendix A

Figure 2 shows that there is existing road access from Golf Links Road to SH1 in the south-east corner of the site and the Main South Railway Line is nearby. Part of the Structure Plan Area also has direct frontage to SH1 but any new access or road is not practical at this location. An upgrade of part of Golf Links Road is the most likely means of providing for future access. Racecourse Road as a Principal Road runs along the western boundary of the Structure Plan Area, and there are a series of existing rights of way (RoW) that service land within the Structure Plan Area, and some further beyond to the east.

There are some water races running through the Structure Plan Area, but the main watercourse in this area is Wakanui Creek that lies approximately 500 m to the south-west running almost parallel to Racecourse Road. Ashburton District Council own land in the north-west corner of the Structure Plan Area (Part RES 1405) that may be a former gravel quarry and as an existing depression, provides an opportunity for a ponding area.

A recent subdivision of 174 Racecourse Road has been approved by Ashburton District Council creating approximately 21 lots (each being 4,000 m^2). A road is proposed to connect to Racecourse Road, and a land to vest as reserve in the centre, this also being approximately 4,000 m^2. This subdivision provides an opportunity for future road connection for land to the south-west but also a constraint to road access for land in the north-east of the Structure Plan Area.

The Structure Plan Area is close to the Ashburton Golf Course and Ashburton Racecourse, which, although private facilities, provide a sense of open space. Beyond there are further parks and sports fields in the surrounding area e.g. Ashburton Domain, Devon Park, Argyle Park, and the A&P Showgrounds. To the south of the railway there is also Drummond and Etheridge Walk which is a strip of land approximately 75 m wide that provides a link between Northpark Road and Company Road.

The following documents prepared by Ashburton District Council provide some guidance on future reserve needs:

- Ashburton District Plan;
- Parks and Open Spaces Activity Management Plan 2018 - 28, December 2019 (the Management Plan); and
- the Open Spaces Strategy 2016 – 2026 (the Strategy)

Between these documents they provide guidance on the reserve contributions required for new development, guiding principles for new reserves/open space, while acknowledging that Ashburton is generally well served by existing open space and recreation facilities.

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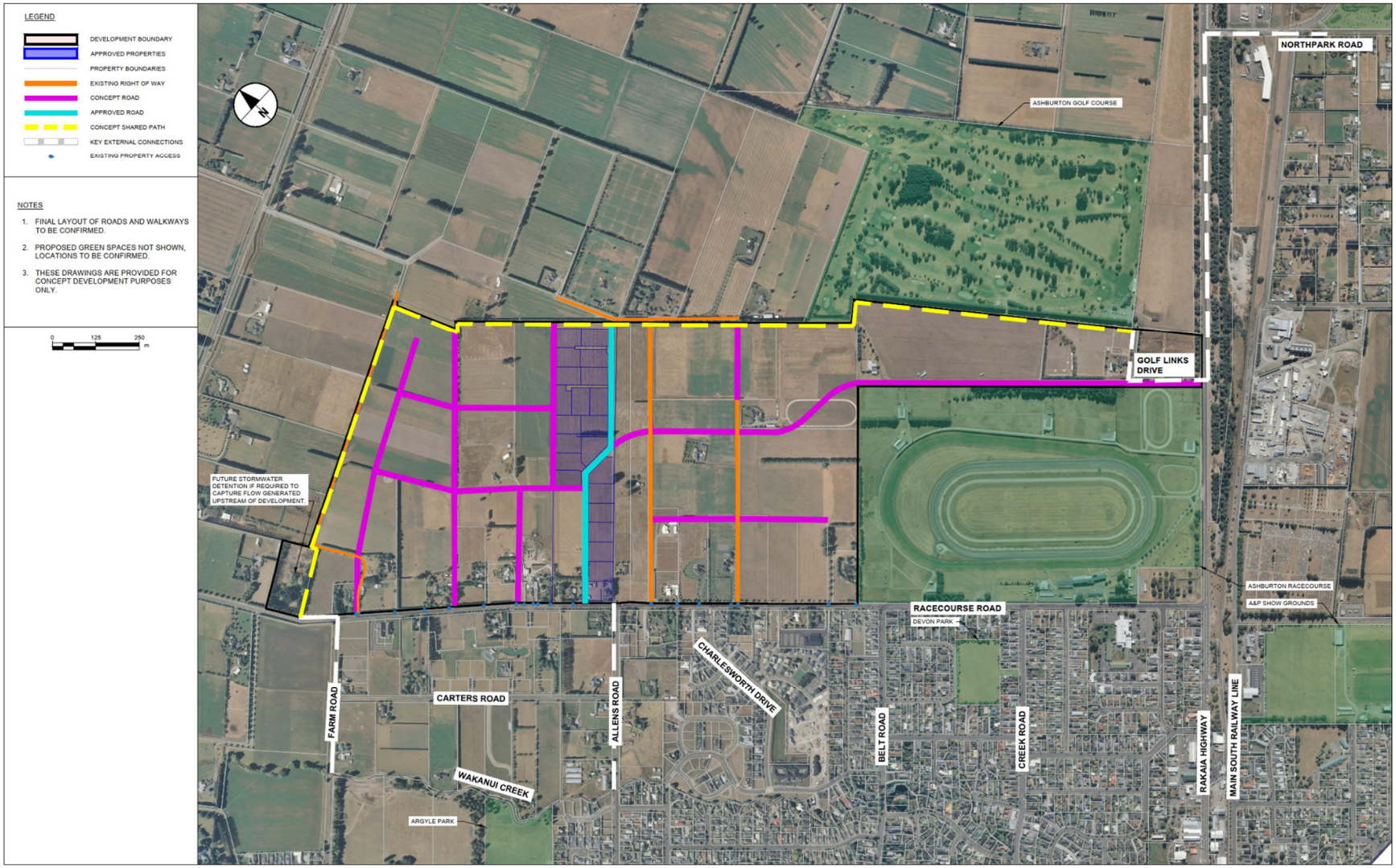

Figure 2 Opportunities and constraints

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The distribution of existing reserves and open space and the location of the Structure Plan Area at the edge of the township means that the preference is for future development to provide for a shared pedestrian/cycle route (and potentially horses) around the perimeter of the site that provides for links to Wakanui Creek, Farm Road, Racecourse Road, the Drummond and Etheridge Walk, and key open space/recreation destinations in the immediate area. This opportunity is shown as a 3 km link in Figure 2 (10 m wide = 30,000 m^2).

To provide for co-ordinated development for road access and servicing, it is important that the structure plan provides for multiple connections to Racecourse Road at appropriately spaced intervals, and a suitable connection to a cross route along Farm Road and other Collector Roads along Racecourse Road to reduce a dependency on access to SH1 either through Golf Links Road or Racecourse Road. It is also preferable to provide some alternative north-south routes within the Structure Plan Area itself. The series of existing RoW provide an opportunity for conversion to roads if supported by requirements of a future Structure Plan. An exception would be the northernmost RoW, which if upgraded to a road, may put pressure on the land to the north for future redevelopment that is not desirable so as to maintain a transition from the urban area, to the rural area beyond. This has formed the basis of assumptions for developing the suggested roading framework for the Structure Plan Area.

Given the number of separate properties within the Structure Plan Area that are all generally equally suitable for stormwater drainage and detention, when providing for up to 9ha of stormwater detention it is not necessary to require a single or few consolidated areas within the Structure Plan Area since a requirement could be to distribute it on a pro-rata basis with overland flow paths and connection to the swale systems of future roads. Such a distributed system could still achieve the necessary stormwater management as each site is developed in the future. It would also avoid the burden of providing for stormwater detention on one specific property or a few properties that would not be equitable. The former quarry site could provide for ongoing overland flow and drainage for land to the north.

2.3 Residential Yield Scenarios

ADC has specified two lot sizing scenarios to consider:

a. Scenario A is for 2,000 m^3 lots. This requires provision of public open space with a minimum of 30 m^2 for each additional residential lot. There are 35 existing allotments, and some are already smaller than, or equivalent to, this minimum area, so the additional lots are estimated to be 520 lots, and 555 lots total.

b. Scenario B is for 4,000 m^3 lots. This requires provision of public open space with a minimum of 30 m^2 for each additional residential lot. There are 35 existing allotments, and some are already smaller than, or equivalent to, this minimum area, so the additional lots are estimated to be 265 lots, and 300 lots total.

Refer to Table 4 for a comparison of the scenarios assuming approximately 3,500 m of Principal or Collector Roads are built at a width of 20 m (as per NZS4404, Table 3.2 – Figure E3), and a further 6,000m of local roads.

Table 4 Scenario Summary

	Scenario A	Scenario B	Unit
Lot area	2,000	4,000	m^2
Public open space required	15,600	7,950	m^2
Total lot yield	555	300	#

The size and location of existing properties has been taken into account for their potential for redevelopment and that there would be losses of 13% to 25% for utility reserves, roading, access, and recreation reserves when creating 4,000m^2 lots, and those losses would generally be higher from 20% to 24% when creating 2,000 m^2 lots to allow for the additional road and access requirements.

Simon Newberry at FordBaker Valuation Ltd has considered the design scenarios (A and B) as a registered valuer in relation to likely absorption rates (refer to Appendix B). The FordBaker report considered property information, existing land ownership, historical sales information, population

growth data and forecasts, and online databases to understand the likely rate of sales if 555 lots of 2,000m^2 (Scenario A) or 300 lots of 4,000m^2 (Scenario B) were released to the Ashburton market.

Key findings of that report are:

- population growth forecast for 2021 to 2026 is 1.27% (and it was 3.31% in the previous 5 year period);
- district-wide sales in the Ashburton District from 2015 to 2019 were a total of 549 sales;
- estimated sales of 2,000m^2 lots is an average of 1 to 1.5 sections per month that would equate to a development period of 37 years; and
- estimated sales of 4,000m^2 lots is an average of 4 to 6 sections per year that would equate to a development period of 60 years.

In summary, the 2,000m^2 lots are considered more likely to be sold than 4,000m^2 lots, historical rates of sales for comparable properties is slow, and population growth is also forecast to be low (1.27% over a five year period from 2021 to 2026).

2.4 Geotechnical Desktop Review

2.4.1 Geological Setting

The published 1:250,000 scale geological map of the Christchurch area (Forsyth, Barrell, & Jongens, 2008) indicates that the near surface geology comprises Quaternary age brownish-grey river alluvium and reworked glacial outwash deposits of the Canterbury Plains. This sedimentary sequence is thick, and comprises gravel, sand, silt and clays, forming strata deposited during glacial and interglacial cycles. The Ashburton River is located 2.7 km south-west from the proposed site and dissects the township, flowing south-east towards the eastern coastline.

2.4.2 Existing Geotechnical Data

The New Zealand Geotechnical Database (NZGD) has been reviewed for geotechnical and geological information in the area surrounding the site. Due to the extensive volume of data available within the vicinity of the site, a setback distance of approximately 400 m was adopted to capture the nearest geotechnical information to the site.

Sixteen (16) geotechnical investigations have been considered for this assessment to provide reliable geological information. This information is summarised in Table 5 and related records are presented in Appendix C.

Table 5 Summary of near-site Geotechnical Investigation Data

Investigation Reference	Source	Investigation Type	Depth (m bgl)	GW (m bgl)	Date Drilled	Proximity to Site (m)
BH_71673	Davis Ogilvie Partners	Borehole	6.0	1.45[1]	26/08/2010	350 SW
TP_76263		Test Pit	2.6	2.3	25/02/2013	95 SW
TP_76264			2.4	2.3	28/02/2013	95 SW
TP_76262			2.4	2.2	28/02/2013	110 SW
TP_76265			2.4	2.3	28/02/2013	110 SW
TP_76261			2.2	2.05	28/02/2013	140 SW
TP_76266			2.6	2.5	28/02/2013	140 SW
HA-DCP_76253		Hand auger / Scala Penetrometer	1.0	-	25/03/2011	200 SW
HA-DCP_76252			1.0	-	25/03/2011	215 SW
HA-DCP_76254			1.0	-	25/03/2011	190 SW

[1] 50 L water added during drilling process.

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Investigation Reference	Source	Investigation Type	Depth (m bgl)	GW (m bgl)	Date Drilled	Proximity to Site (m)
HA-DCP_76255			1.0	-	25/03/2011	230 SW
HA-DCP_76256			1.0	-	25/03/2011	245 SW
HA-DCP_76257			1.0	-	25/03/2011	225 SW
HA-DCP_76258			1.0	-	25/03/2011	275 SW
HA-DCP_76259			1.0	-	25/03/2011	240 SW
HA-DCP_76251			1.0	--	25/03/2011	230 SW

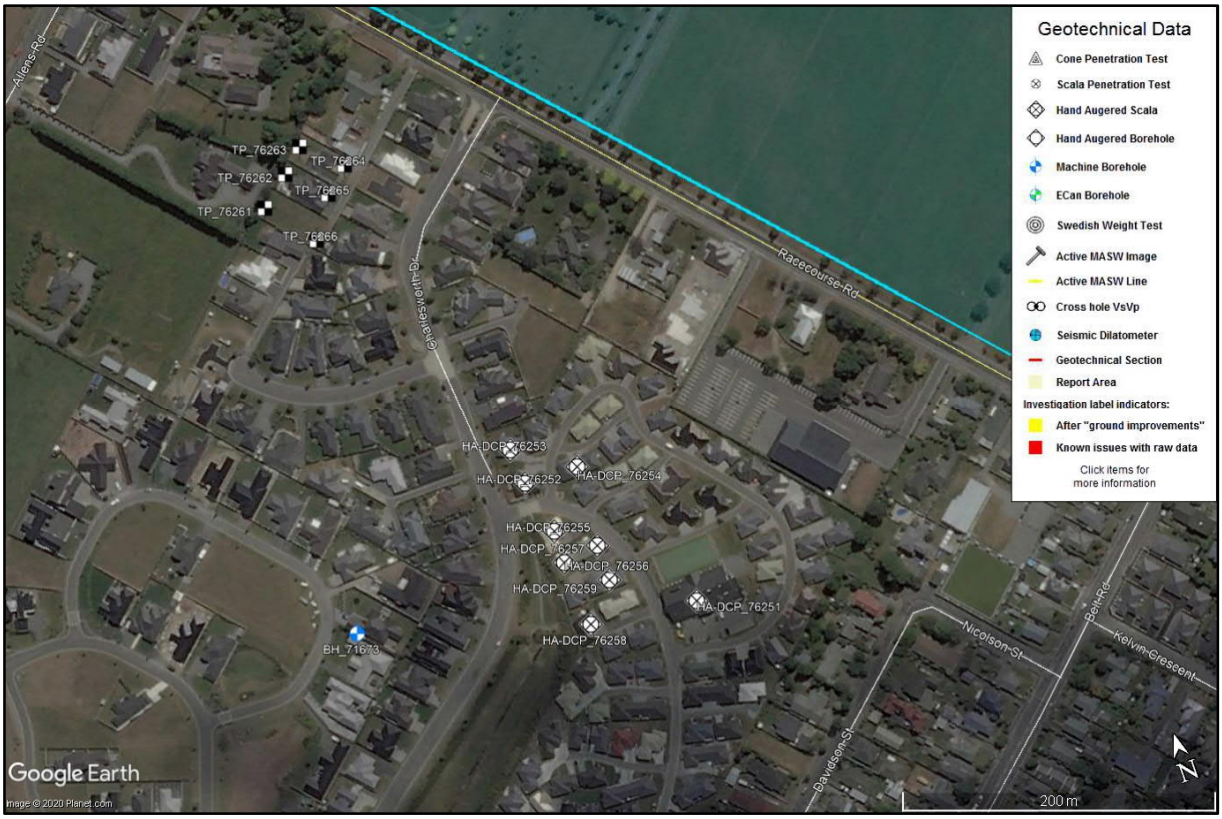

Figure 3 Location of the nearby NZGD geotechnical investigations (approx. 600 south-west of Ashburton Racecourse)

2.4.2.1 Site geology / ground conditions

Based on the site history, geological map and the available geotechnical investigation data, the likely ground conditions beneath the site have been interpreted. Table 6 below summarises the interpreted geological profile for the site in the absence of structural offsets and discontinuities.

Table 6 Interpreted Site Geology

Geological Unit	Depth to top (m bgl)	Thickness (m)	Soil Type	Scala Penetrometer (kpa)
Topsoil	0	0.2 – 0.5	Organic SILT	0-900
	0.1 – 0.5	0.3 – 2.0	SILT to clayey SILT	350-1300

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Geological Unit	Depth to top (m bgl)	Thickness (m)	Soil Type	Scala Penetrometer (kpa)
Late Quaternary alluvium / colluvium	0.4 – 0.8	0.2 – 0.6	Silty Gravels with clay to Gravelly SILT with clay	700-1600
	0.8 – 2.3	Unknown	Sandy GRAVEL, with some silt and clay	-

The yielded ranges given from Scala Penetrometer testing are indicative of the soil bearing pressure with respect to depth, which can be used as an approximation for the California Bearing Ratio (CBR).

2.4.2.2 Groundwater

Groundwater was encountered between 2.05 m and 2.50 m based on the nearby geotechnical investigations.

The groundwater level in BH_71673 was recorded at 1.45 m. This water level is expected to be elevated due to the addition of fluid during drilling and is considered not a true representation of the groundwater table at the site. Gravels are expected to have a higher permeability than soils with higher fractions of fine-grained cohesive material.

The Environment Canterbury (ECan) Well Database was also reviewed to provide additional detail about the groundwater regime at the site. Five active well sites were identified within the vicinity of the proposed site as shown in Figure 4 and summarised in Table 7.

Table 7 ECAN Well Database

Investigation Reference	Date Drilled	Depth (m bgl)	Aquifer Type	Specific Capacity (l/s/m)	Initial Water Level (m bgl)
L37/0403	25/11/1966	37.79	Semi-confined	6.31	11.58
L37/0245	30/01/1973	22.25	Semi-confined	0.27	6.70
L37/0186	10/01/1971	31.70	Semi-confined	1.04	11.98
K37/0275	16/11/1967	22.86	Semi-confined	2.40	5.69
L37/2257	N/A	15.00	N/A	N/A	N/A

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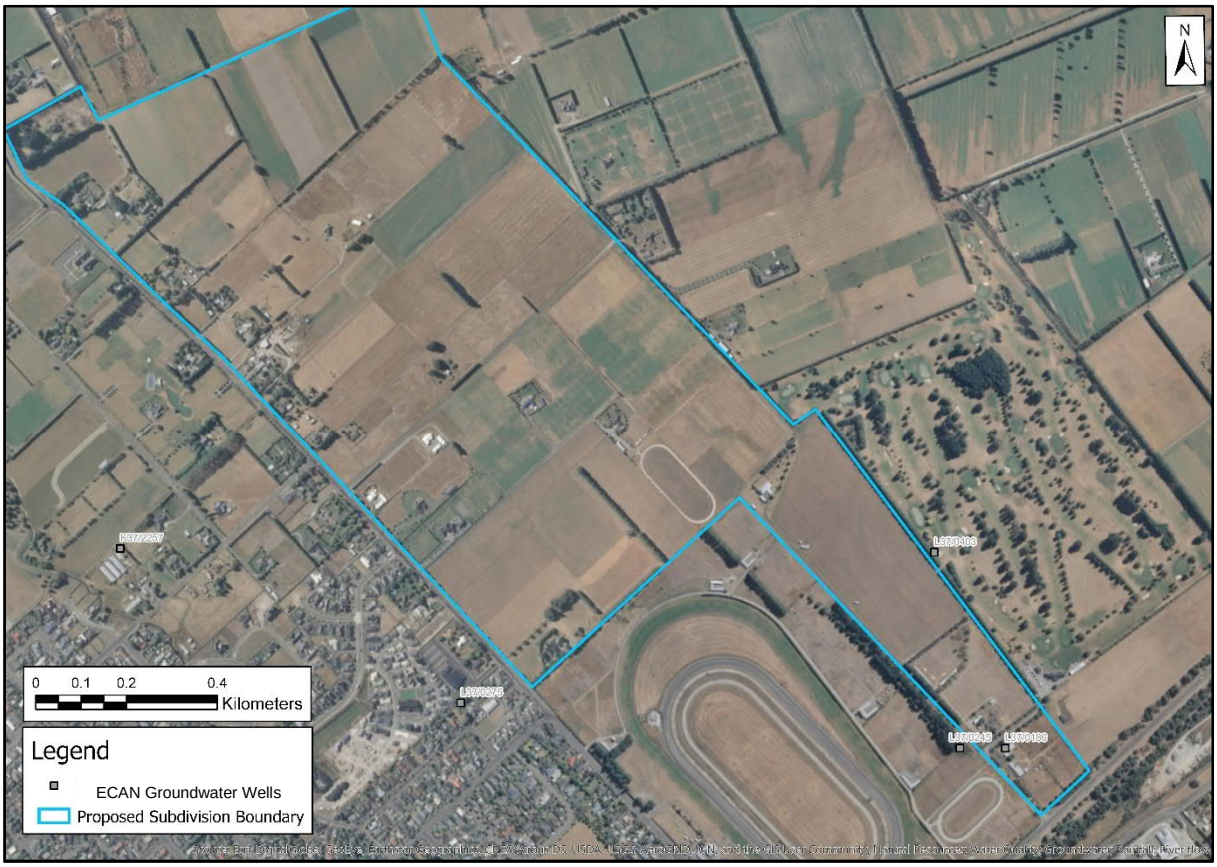

Figure 4 ECAN Well Database map for Ashburton District

Water levels at L37/0403 have been observed to fluctuate between 7.00 m and 14.07 m bgl since the well was installed. No additional monitoring observations were recorded on the database.

It should be noted that groundwater levels at the site may vary depending on rainfall and recharge from the Ashburton River.

2.4.3 Geotechnical Hazards

2.4.3.1 Faulting

The nearest active fault is the Montalto Fault which is approximately 35 km north-west of the site (GNS Science, 2020). No fault details of the Montalto Fault are available on the GNS Active Faults Database.

2.4.3.2 Slope Stability

The site has a gentle slope grade (<1%) to the south-east. Due to the relatively flat topography of the site and the surrounding area, slope stability is not considered to be a risk.

2.4.3.3 Liquefaction

Liquefaction is the term given to describe the loss of soil strength experienced when saturated sand and low plasticity silts are subjected to dynamic earthquake loading. The following soils are generally considered to be susceptible to liquefaction:

a. Young (typically Holocene age) alluvial sediments (typically fluvial deposits laid down in a low energy environment) or man-made fills

b. Poorly consolidated/compacted sands and sandy silts

c. Areas with a high groundwater level

The ground conditions at the site comprise cohesive silt with some clay underlain by silty gravels and low cohesive sandy gravels. According the liquefaction potential map (Yetton & McCahon, 2002) for

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the Ashburton District, the site has been identified as being low risk. Given the anticipated geological conditions at the site and the published Engineering Lifelines report for Ashburton, we consider the risk of liquefaction to be low.

2.4.3.4 Lateral Spreading

Lateral spreading will only occur if both a shallow liquefiable layer exists, and sloping ground or an unsupported free face is within the vicinity of the site. Based on the negligible slope grade in any direction, the absence of an unsupported free face and low-risk of liquefaction, the risk of lateral spreading is expected to be low.

2.4.4 Geotechnical Summary

Based on the existing data available, AECOM can provide the following details on the geotechnical conditions for the site:

- The continuity of the soils underlying the site are expected to be spatially heterogeneous, consisting of gravels with variable amounts of sand, silt and clay;
- The hydraulic conductivity is anticipated to be highly variable where semi-confining layers are present which may affect the transmissivity and level of groundwater locally;
- Liquefaction potential for the proposed site has been identified as low; and
- Slope stability and lateral spreading are not expected to be an issue for the proposed subdivision.

AECOM recommend geotechnical testing be completed in preparation for design and construction of stormwater drainage, building foundations and roading infrastructure as a requirement for quality control. The suitability of the material for development will be determined based on the results collected from a site-specific geotechnical assessment.

3.0 Three Waters Infrastructure

3.1 Potable Water

3.1.1 Existing Network and Constraints

The existing adjacent potable water network is comprised primarily of polyvinyl chloride (PVC) and asbestos cement (AC) pipe on Racecourse Rd and Creek Rd. Refer to Figure 5 for an overview of the existing potable water network adjacent to the proposed development.

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Figure 5 Existing Potable Water Network

The following considerations guide watermain design for this subdivision:

- A looped main should service the new subdivision as per the requirements of NZS4404 (2010) Section 6.3.8.3. A looped main ensures that water remains fresh and sustains pressure from multiple directions. This increases network resilience and assists in maintaining the supply pressure during high demand.
- SH1 (Main South Rd) bounds the south-east side of the development and should be avoided if possible.
- Feasible sizing and connection points to the existing network must be explored using the potable water supply model provided by ADC. The conclusions drawn from the model are explored in Section 3.1.2.2.

3.1.2 Potable Water Supply Trunk Main Concepts

3.1.2.1 Alignment

Alignment of the water supply mains within the development, should be finalised in conjunction with the detailed roading layout. Factors to be considered include:

- Mains should be situated on the side of main roads that has the greatest number of connections to ‘branching’ roads.
- Looping mains should be provided where practical.
- Rider mains should be designed for ‘all lots not fronted by the principal main’ (NZS4404, Section 6.3.8.2).

External to the development, alignment of the water supply mains should consider the tie-in capacity (refer Section 3.1.2.2) and the cost of construction or upgrade through existing areas.

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The potential alignment of a trunk main on SH1 introduces additional items to be managed including traffic management, additional consents, and constraints on infrastructure within State Highway corridors.

Refer to Figure 6 for a schematic of the proposed water supply alignment. This is based on the current proposed roading overview and only shows a high level, trunk alignment. Secondary and rider mains will be able to be designed when further roading detail is developed, therefore are not shown.

Figure 6 Potable Water Trunk Arrangement

The alignment on SH1 would provide a full looped supply through the development, however this may equally be achieved by secondary mains looped back via branched roads. Further consideration of the SH1 alignment should include communication with NZTA regarding feasibility of construction and ownership.

If the alignment on SH1 is not pursued, detailed design should seek to minimise dead ends in the trunk main servicing lots north-east of the racecourse via rider main loops or flushing hydrants.

Both alignments are viable and subject to operational and route considerations.

3.1.2.2 Water Supply Modelling

ADC's ICM water supply model shows that the current network is able to service the new properties via a new DN225 trunk main within the proposed development.

The following ICM InfoWorks model set-up from ADC was used[2]:

- Network: "Current Network_Calibration#2".
- Control: "Current Control_Calibration#2".
- Demand Diagram: "Demand Diagrams – Peak Day".

[2] Note that ADC had advised the use of 'Current Network' and 'Current Control', however these had validation errors therefore were not used.

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It should be noted that no ground surface was included in the model therefore the elevation was assumed to be flat, similar to the existing node profile.

The proposed water supply arrangement was tested against the level of service requirements as per NZS4404 and fire flow requirements as per SNZ PAS 4509, as follows:

- Operational pressure range: 25 – 80 m
- Operational velocity: 0.5 – 2.0 m/s
- Fire flow minimum pressure: 10 m at hydrant
- Maximum hydrant flow: 35 L/s

The existing model was amended by adding a DN225 ring main through the proposed development. The ring main was connected to the existing network at the proposed development entrance, and the intersection of SH1 and Racecourse Rd. The supply pressure remained above 37 m within the development at peak demand.

The fire flow scenario was tested with the following parameters:

- Hydrants within the development were represented by nodes with downstream valves and infinite reservoirs (InfoWorks does not allow fire flow testing of multiple hydrants simultaneously). This arrangement has been used and verified during prior projects. When compared to the in-built fire flow availability function in InfoWorks which tests one hydrant at a time, the same results are achieved.
- Three 80 mm hydrants were tested along the proposed DN225 ring main with a loss coefficient of 12 for a Spring Hydrant Valve (based on supplier information).
- Needle valves were used in the model as they provide the closest representation of the losses through a hydrant valve available in the model. The k value was set to 12 based on supplier information.
- The fire flow run was based on a peak hour of 7:30pm based on the demand diagram of this study area. This represents the worst-case scenario as the lowest pressure occurs at peak demand time.

The modelled fire flow scenario showed that the minimum network pressure remained above the required 10 m. The lowest pressure experienced within the development was 23 m during peak demand and a fire flow event with three hydrants open.

It should be noted that the adjacent area (between Farm Rd and Allens Rd, Racecourse Rd and Harrison St) experienced a minimum pressure of approximately 20 m when all three hydrants are in use within the development. While this pressure drop is lower that the permitted operational pressure range, it is acceptable in the fire flow scenario.

It should also be noted that under the fire flow scenario, there is one DN150 main downstream of a local supply pump which experiences a velocity of 2.8 m/s (located at the intersection of Middle Rd and Bathurst St, Pump ID: ALLENTON1_US.ALLENTON1_DS.1). This is above the recommended velocity maximum of 2.0 m/s in NZS4404. This pump outlet may require upsizing to reduce this velocity, or upgrades undertaken for the pump itself.

3.1.3 Potable Water Summary

The existing network was determined to be adequately sized to service the proposed development via a DN225 trunk main layout. Providing an alignment on SH1 would provide a full looped supply through the development, however this may equally be achieved by secondary mains looped back via branched roads. Both alignments are viable and subject to operational and route considerations.

Refer to Appendix C for a high-level overview plan of the proposed potable water layout.

3.2 Wastewater

Options have been investigated to service the proposed development's wastewater system that consider the following:

- Methods of wastewater discharge into the existing network.
- Network alignments within the development.

The options presented cover both aspects. Final details should be confirmed in later design stages in consideration with surrounding ADC wastewater projects. Considerations should include development staging and upgrades to the surrounding wastewater network.

3.2.1 Pipe Sizing

ADC's existing ICM wastewater model was used to determine pipe sizes to service the maximum density of the proposed development. Feasible alignments, discharge locations, and conceptual depths of mains within the development have been investigated and are described in Section 3.2.2.

The model accounts for stormwater ingress to the system in a 2-hour duration (2-hour) 1 in 10 year (10-year) Annual Recurrence Event (ARI), with allowance for climate change. Various design rainfall durations (30 mins, 1 hr, 2 hr and 6 hr) that were provided by ADC. The critical storm duration was established as the event which caused the widest spread of manhole overflows and system surcharge. This was compared with calculation as per Ashburton's Stormwater Design Guidelines Section 4.2.

The wastewater flows from the development have been assessed based on the following parameters from the NZ Standard for Land Development and Subdivision (NZS4404:2010):

- Number of occupants: 3.5 persons per lot
- Minimum lot area: 2,000 m^2
- Area required for green space, roading, etc: 20 m^2 per person

Table 8 presents the breakdown of area, lots and populations calculated based on the above parameters. NZS4404 states an average dry weather flow of 180 to 250 litres per day per person. An existing wastewater profile with per capita flow of 230 litres/person/day from sub-catchments adjacent to the development area was adopted for the assessment.

Table 8 Model assessment values used within the modelling, based on NZS4404:2010

Catchment	Area (m^2)	Maximum lots	Population	Wastewater flow (L/day)
WW Catchment 1	765,385	352	1,232	283,360
WW Catchment 2	187,706	86	301	69,230
WW Catchment 3	162,201	74	259	59,570
WW Catchment 4	321,118	148	518	119,140

Note: The modelled pipe sizes are adequate assuming the existing downstream network capacity issues are resolved, or discharge from the development is managed via storage as discussed in subsequent sections. All adjacent wastewater pipes on Racecourse Rd are DN150. The recommended pipe sizes are shown in Figure 7.

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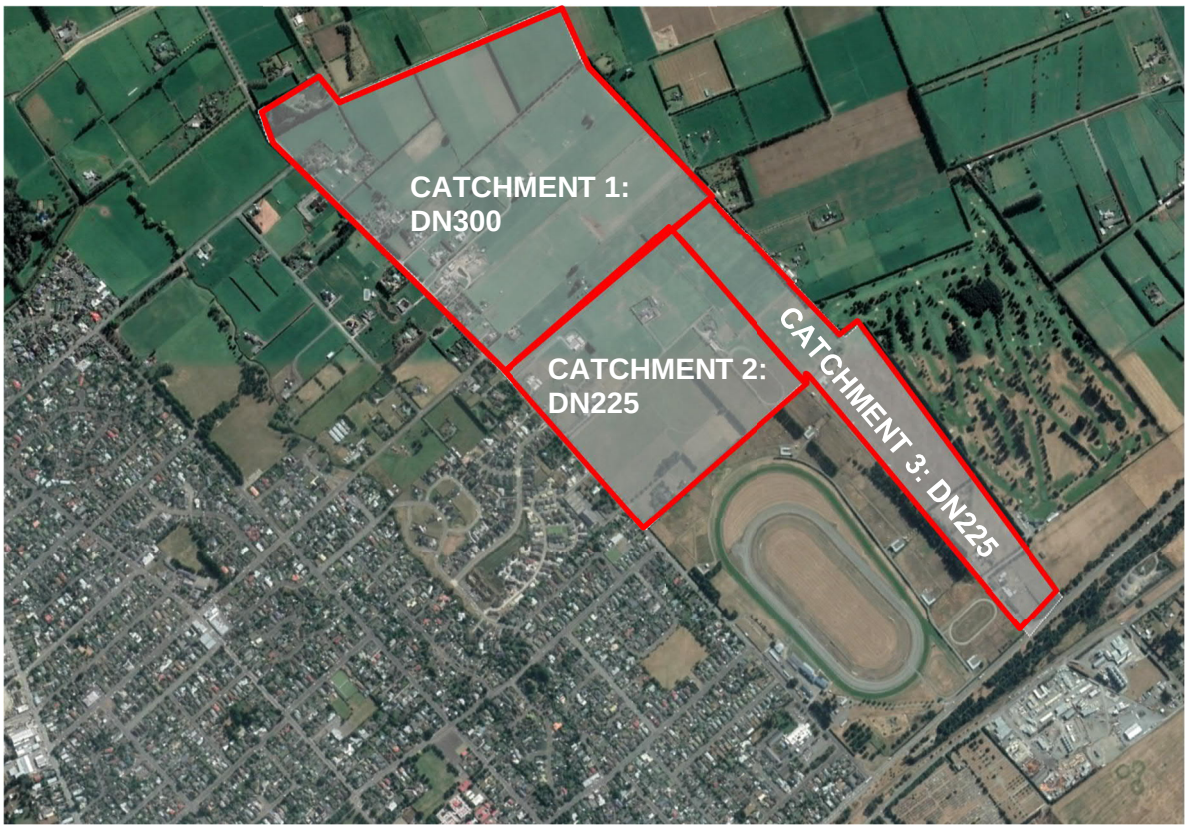

Figure 7 Trunk wastewater pipe sizes required within the development

3.2.2 Wastewater Network Options

Network alignments within the development have been explored based on the proposed roading layout. The exact layouts considering branched street connections to the network should be determined in subsequent design phases.

Gravity-driven wastewater networks service Ashburton at present. A number of existing pump stations transport the flow due to the flat and spread-out geography of the township. The network discharges to a wastewater treatment plant south of the central township.

Three wastewater networks have been investigated as follows:

- Gravity only
- Gravity with two pump stations
- Low-pressure sewer

The following design assumptions have been used to determine the network layouts:

- Minimum pipeline grades as per NZS4404, 2010 Table 5.4.
- Laterals to service the furthest point of properties in each catchment have been estimated in accordance with NZS4404, 2010 Table 5.4. Only the trunk mains have been shown. Local mains and property connections will be determined once a detailed property plan has been developed.
- Minimum cover requirements used are in accordance with ADC Sewer Standard Specifications Clause 3.1.7 (0.8 m cover for pipelines).
- Flows from the development as discussed in the previous section.

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3.2.2.1 Option 1 – Gravity only (downstream network upgrades required)

It was determined that wastewater flows from the development cannot discharge to local reticulation without upgrades to the existing network. Either network storage with controlled discharge, or improvements to downstream network capacity are required for this option.

Points in the existing network adjacent to the development (north of SH1) were identified where there is some spare capacity. All are insufficient to service the peak flow from the development. The additional flow resulted in surcharging of the existing wastewater network when modelled. Any connection to the existing network in the vicinity of the development will require downstream upgrades.

The closest connection point that could accommodate the flows from the development is located on William Street, 3.3 km south west of the development (node ASH2004WWMH2765). An extensive gravity network extension would be required to connect the development at this point.

Alignment of a gravity network within the development may operate as per Figure 8 and as follows:

- The western main (DN300) discharges to the central main (DN300), which drains towards Racecourse Rd. At Racecourse Rd the depth of the central main is 3.5 m.
- A secondary central main (DN225) is required to service the mid-properties. This has been aligned on two existing right of ways. This discharges at a depth of 2.0 m to Racecourse Rd.
- The eastern main (DN225) drains to SH1, then south-west on SH1 to the intersection with Racecourse Rd. This reaches a depth of 1.4 m.

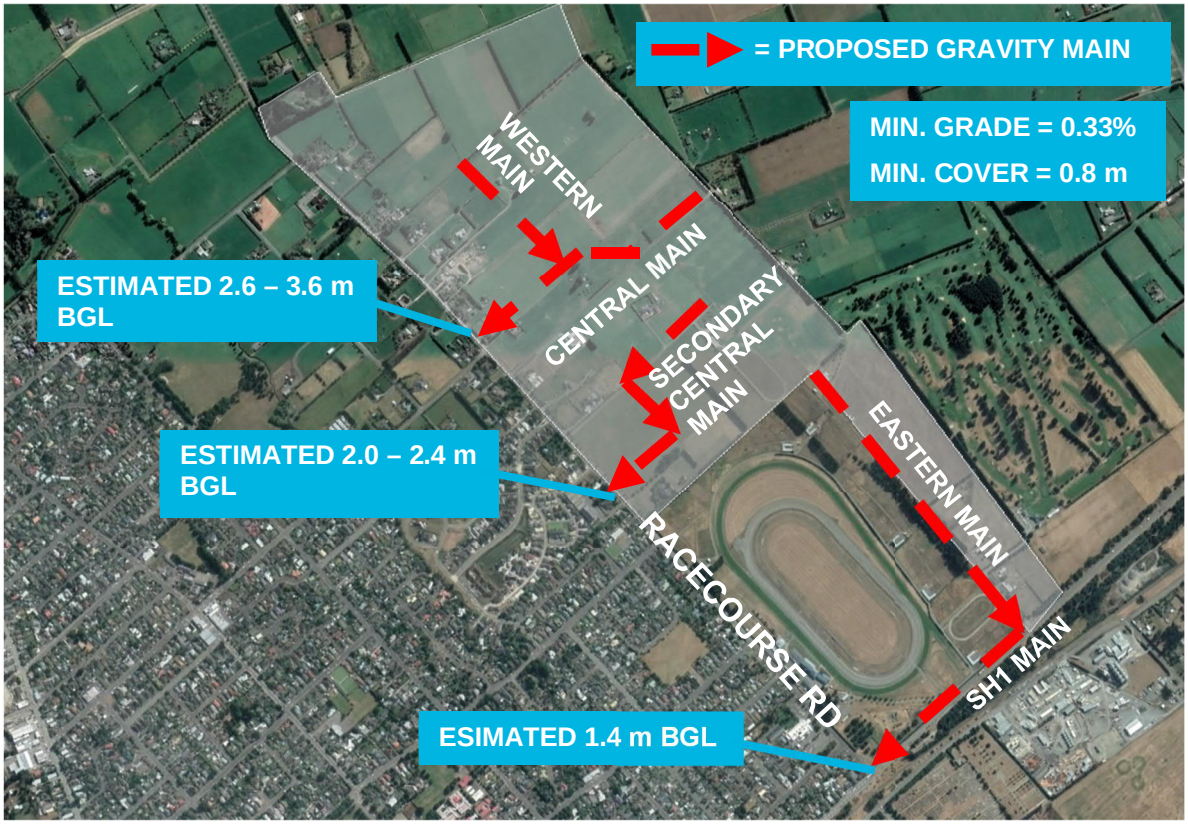

Figure 8 Wastewater Network Option 1 – Gravity fed layout with main on SH1

This layout provides construction staging advantages which may assist the development's growth.

A preliminary assessment of pipeline depth was undertaken. It was found that gravity pipeline connections to adjacent existing DN150 wastewater pipes may be possible provided that network capacity is improved. Central mains 1 and 2 could connect at the intersection of Racecourse Rd and Creek Rd. Alternatively, these mains could connect at the intersection of Russel Ave and Somerset Grove. The SH1 main could connect to the existing DN150 pipe at the intersection of Racecourse Rd

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and SH1 (Rakaia Highway). Depth and capacity will need to be confirmed through more detailed investigation of the existing network and preliminary design of the development network.

3.2.2.2 Option 2 - Pump stations (no downstream upgrade required)

Regulating discharges in association with wastewater storage allows controlled loading to the existing network. This allows peak flows to be smoothed and prevents the existing downstream network from surcharging. Pump stations are also required to lift wastewater into the existing network, as was established in Option 1.

For this reason, two pump stations (1 and 2 as per Figure 9) were modelled within the development as follows:

- A gravity line (DN225) services approximately two thirds of the eastern main draining towards SH1.
- The remaining one third of the eastern main (DN225) is gravity fed away from SH1, against the natural grade to a depth of approximately 5.5 m.
- Where these two sections of the eastern main meet, pump station 1 (PS1) feeds this flow via a rising main to the central main.
- The western main (DN300) drains to the central main (DN300) which discharges to Racecourse Rd at a depth of approximately 3.6 m. Here, a second pump station (PS2) is required.
- The volume storage depth at PS2 (see Table 9) is constrained by the proposed rising main outfall connection into the existing network on Middle Road (node ASH2007WWMH0465). The diameter of the proposed raising main is 225 mm to tie into the existing network.
- The proposed and existing wastewater infrastructure does not surcharge with wet wells at both pump stations and pump rates as identified in Table 9.

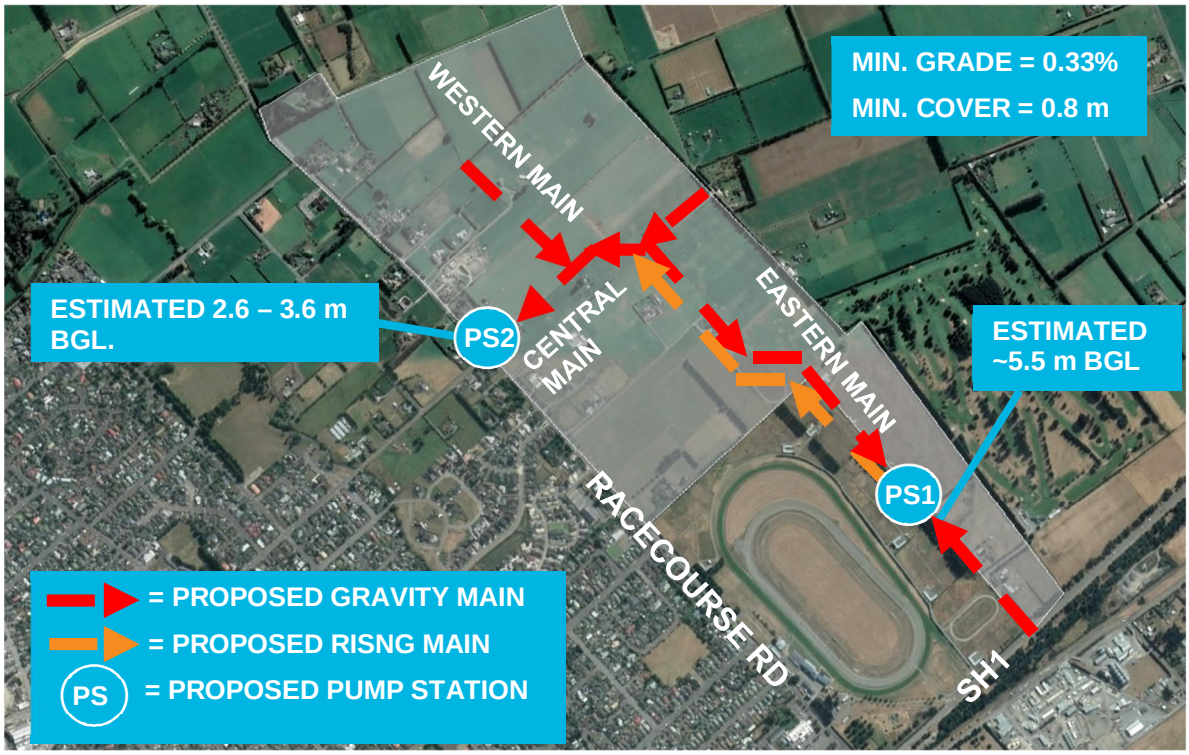

Figure 9 Wastewater Network Option 2 – Gravity fed layout with a pump station within development

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Table 9 WW Pump Station Details

Pump station	Storage volume (m^3)	Pump Rate (L/s)
PS1	120	10
PS2	1,400	10

The volume of the indicative wet well at PS2 (see Table 9) is constrained by the proposed rising main outfall connection into the existing network on Middle Road (node ASH2007WWMH0465). The diameter of the proposed raising main is 225 mm.

The wet well storage volumes and pump rates as identified in Table 9 prevent the proposed and existing wastewater infrastructure from surcharging.

It should be noted that alternative discharge locations may be considered to optimise the discharge, storage and pump size (as related to rising main length and diameter) for PS2. Such detail should be assessed in a preliminary design phase and will not affect the internal development pipe layout, or PS1.

Beyond the scope of this project, a new pump station is proposed by ADC near the Allens Rd / Wakanui Creek intersection. The potential integration of this Allens Rd proposed pump station and PS2 should be investigated further in the subsequent design phases. It may be feasible to use one pump station to serve both the Racecourse Road and Carters Road developments. The investigation of the interaction between both developments are beyond the scope of this project.

3.2.2.3 Option 3 – Low Pressure Sewer

An alternative to the 'traditional' gravity wastewater network is a low-pressure sewer. This is a relatively modern technology within New Zealand. Pressure sewers are growing in popularity and have been implemented in regions surrounding Ashburton, including Christchurch City, Selwyn District and the Waimakariri district.

Low pressure sewer networks are comprised of small grinder pumps and storage tanks on each property. These individual systems grind and transfer wastewater to the wider network via small diameter PE pipework. Each pump is automatically activated with control set points to optimise the operation of the overall network. The service provided to property owners is essentially the same as a traditional sewer network in the sense that day-to-day operation is not a property owner's responsibility.

The total flows from the catchments outlined in Figure 7 are shown in Table 10. This shows discharge rates to the existing network similar to that provided by pump stations as outlined in the previous section.

Table 10 Pressure sewer pump rates

Catchment	Number of lots / grinder pump cores connected	Maximum daily grinder pump cores operating simultaneously[3]	Maximum Flow Generated by Catchment (L/s)	
			Pump Rate 0.6 L/s	Pump Rate 1 L/s
1	352	15	9	15
2	160	10	6	10
3	148	10	6	10
Total (i.e. all catchments discharge to one location)	660	25	15	25

Catchments may discharge to the network in multiple locations potentially mitigating the need for upgrades to the existing system. The model identified locations with spare capacity which may be investigated as discharge points if this option is pursued.

[3] E/One Low Pressure Sewer Systems Using Environment One Grinder Pumps, Table 3, pg 14.

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Benefits of pressure sewers include:

- Smoothing and control of peak flows which eases downstream network pressures (i.e. conveyance and treatment processes). This may reduce the exacerbating of existing network capacity issues.
- Straight-forward construction staging of the wastewater network.
- Flexibility of pipeline alignment due to less reliance on network grades.
- Reduction of pipeline depth, therefore reducing construction / maintenance costs.
- Flexibility of future connection for upstream developments.
- Provision and maintenance costs of the pressure sewer infrastructure on private properties may either be the responsibility of the property owner, or publicly owned by the Council. Nationally, Council ownership is the most common however Waimakariri and Selwyn District Councils both use the private ownership model[4].

Limitations of pressure sewers for this application include:

- Lack of similar infrastructure within Ashburton; new systems require additional training and equipment for maintenance staff and operators.
- Reliance on electricity (although it should be noted that pump stations are similarly reliant).
- Initial design must be thorough to ensure wastewater does not become septic. Design must ensure control systems and pipelines are correctly specified.

Rural properties beyond the project area considered may be developed in Ashburton requiring similar wastewater infrastructure. If additional development is being planned for the next few decades, then benefits of approving a pressure sewer wastewater network should be considered in relation to the entire district, not only the project area considered here.

3.2.2.4 Wastewater Network Summary

The preferred option to service the proposed development's wastewater requirements should be selected in relation to plans for the wider Ashburton wastewater network. If the network is to undergo significant upgrades, then discharge controls may not be required. If not, then pump stations with storage or a low-pressure sewer would be required to limit peak discharges.

Refer to Appendix D for high-level plans outlining wastewater options 1 and 2.

3.3 Stormwater

This investigation considers runoff generated within the proposed development; from the proposed roading (1 in 10-year ARI), and from the wider developed development (1 in 100-year ARI).

This concept design excludes the following:

- Conveyance of overland flow generated to the north of the development. A flood model is recommended to estimate the flow generated which may impact the proposed development. Design may be required to either capture and dispose of this runoff prior to it entering the development, or dedicated paths designed for flow through.
- Alignments of conveyance systems within the development. Flow paths will be dependent on finalised roading and geometry design.
- Private soakage systems for localised disposal of runoff generated during 1 in 10-year ARI events. These will be the responsibility of individual property owners.

[4] Pressure Sewer National Guidelines, Water New Zealand (2020). Available online: https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=4249

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3.3.1 Existing Network and Constraints

The existing stormwater management in the vicinity of the project area are largely localised solutions. These include minimal piped conveyance systems, stormwater storage basins, discharges to Wakanui Creek, and private soakage. Some existing stormwater considerations are outlined in Figure 10.

Figure 10 Stormwater Considerations Relevant to Project Area

According to ADC's Stormwater Activity Management Plan (2018), there is little capacity in the existing stormwater network. Therefore, new developments are generally required to provide infrastructure to manage their own stormwater.

In accordance with ADC's Stormwater Design Guidelines (2018) Table 5.1, stormwater systems in the proposed developments require the following capacity:

- Primary system: 10-year ARI event (ADC residential area)
- System without an overland flow path: 100-year ARI event

Discharge to ground is ADC's preferred method of stormwater management for new developments. Geotechnical review (refer Section 2.4) indicates the existing ground has good to moderate soakage capability. Discharge via soakage is thought to be a viable solution and should be confirmed via future detailed geotechnical investigations.

3.3.2 Primary System – Swales

Road-side swales are recommended to convey runoff from roads during a 1 in 10-year event. The swales would discharge to detention basins for soakage (to be confirmed). The proposed primary stormwater system assumes flow generated from private properties within the development are discharged to private soakage.

A typical swale detail from NZS4404, 2010 Figure 3.6 (A) is shown below (note that the drawing notes are not included here):

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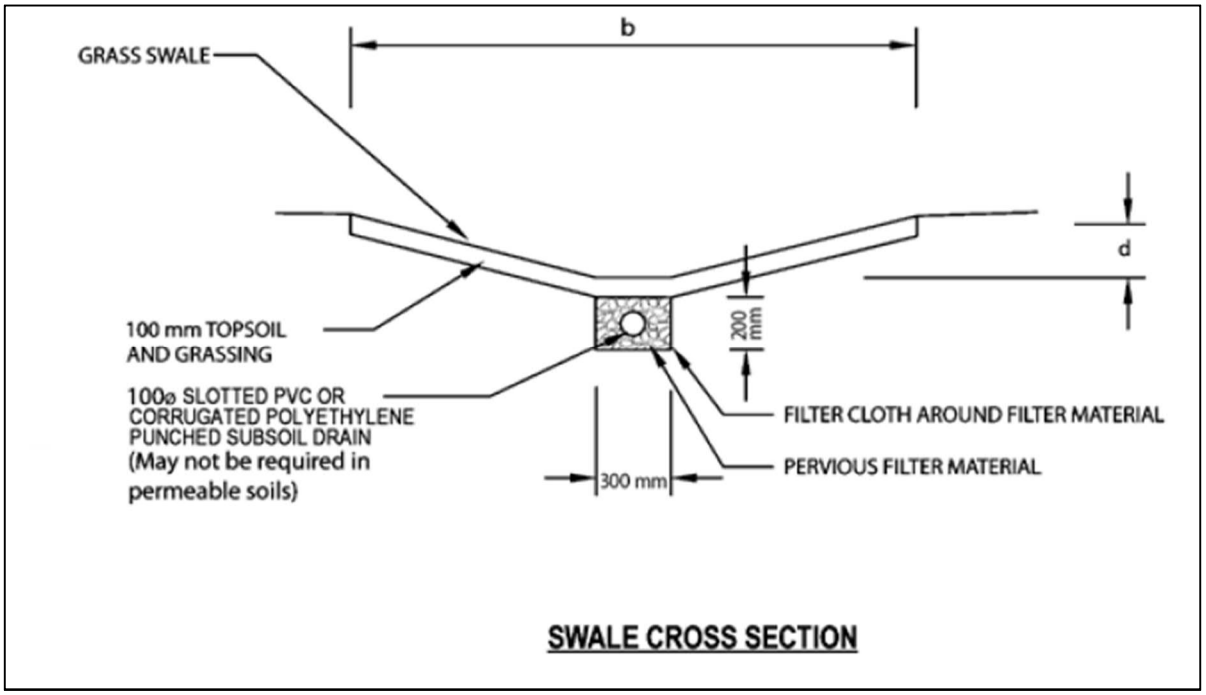

Figure 11 Typical Swale Detail, NZS4404, 2010

The swale width (b as per figure above), will be required to be approximately 2 m wide either side of the roads. The layout and finalised sizing for conveyance cannot be designed without confirmed locations for stormwater storage/detention basins.

3.3.3 Secondary System – Detention Basins (100-year ARI)

In the absence of a secondary flow path, runoff must be stored within the development and discharged to ground. This prevents flooding properties within the proposed development, as well as the existing properties south of the development. This is a requirement of ADC's Stormwater Design Guidelines (2018) Table 5.1, as there is no secondary flow path available beyond the development boundary.

Property owners are responsible for on-site storage and disposal of runoff generated by their developments during a 1 in 10-year event. However, for a 1 in 100-year event public infrastructure must convey and dispose of the runoff that is generated.

Due to the high-level nature of this investigation, conveyance of runoff generated during a 1 in 100-year event cannot be designed. The geometric surface developed in subsequent design phases will be required to direct flow either into; the roadside swales as discussed in Section 3.3.2, or alternative flow routes yet to be determined.

The stormwater detention volume has been calculated conservatively assuming no loss of water via infiltration to ground due to the following:

- Soakage rates will be dependent on detention infrastructure used (consider whether it is; planted, grassed, compacted earth, specialised drainage media, etc). Subsequent design phases should investigate the groundwater levels and infiltration rates within the development to calculate approximate detention times achieved.
- Groundwater levels will rise during a 1 in 100-year ARI event reducing the hydraulic grade available to drive soakage to ground. This effect will be exacerbated by the ground level having been lowered to create a storage basin.

Therefore, this assumption provides a conservative calculation of the detention area required which should be reconsidered in future design phases. The design parameters used to determine the stormwater detention volume are shown in Table 11.

Table 11 Stormwater storage basin design parameters

Parameter	Symbol	Value	Unit
Coefficient impervious (dependent on lot sizing scenario, refer to Appendix C for a breakdown of estimated land use percentages)	C	0.48 – 0.52	-
Rainfall depth (24-hour, 100-year, ADC Stormwater Design Guidelines, Table 3.3)		152.2	mm
Area contributing	A_{TOTAL}	1,438,411	m^2
Depth of storage	D	1	m

For the 2000 m^2 lot size scenario, assuming 22 % of the development is required for roading, a total of 11.4 ha is required (7.9 % of the total development) to provide stormwater detention for a 24 hour, 1 in 100-year ARI event.

For the 4000 m^2 lot size scenario, assuming 15 % of the development is required for roading a total of 10.5 ha is required (7.3 % of the total development) to provide stormwater detention for a 24-hour, 1 in 100-year ARI event.

The location and number of basins, to achieve the areas stated above, has not been considered at this stage. The locations may be fully or partly integrated into reserve requirements and will also be affected by road layouts, and development staging across multiple landowners.

3.3.4 Stormwater Summary

Stormwater devices required to service the development include roadside swales and stormwater detention basins. Swales should be designed in subsequent design stages to provide conveyance of roading runoff during a 1 in 10 yr ARI event and site-wide runoff during a 1 in 100 yr ARI event. The swales should convey the stormwater to the detention basins, which should be sized for the detention and soakage of the aforementioned events. The design of these devices is subject to finalised roading layouts and available land for stormwater basins.

Refer to Appendix for a high-level plan showing key stormwater considerations.

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4.0 Limitations

AECOM Consulting Services (NZ) Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Ashburton District Council and only those third parties who have been authorised in writing by AECOM to rely on this Report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated 23rd of January 2020.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared between January – May 2020 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This Report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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Except as specifically stated in this section, AECOM does not authorise the use of this Report by any third party.

It is the responsibility of third parties to independently make inquiries or seek advice in relation to their requirements and proposed use of the site.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Structure Plan

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- APPROVED PROPERTIES
- PROPERTY BOUNDARIES
- EXISTING RIGHT OF WAY
- CONCEPT ROAD
- APPROVED ROAD
- CONCEPT SHARED PATH
- KEY EXTERNAL CONNECTIONS
- EXISTING PROPERTY ACCESS

NOTES

1. FINAL LAYOUT OF ROADS AND WALKWAYS TO BE CONFIRMED.
2. PROPOSED GREEN SPACES NOT SHOWN, LOCATIONS TO BE CONFIRMED.
3. THESE DRAWINGS ARE PROVIDED FOR CONCEPT DEVELOPMENT PURPOSES ONLY.

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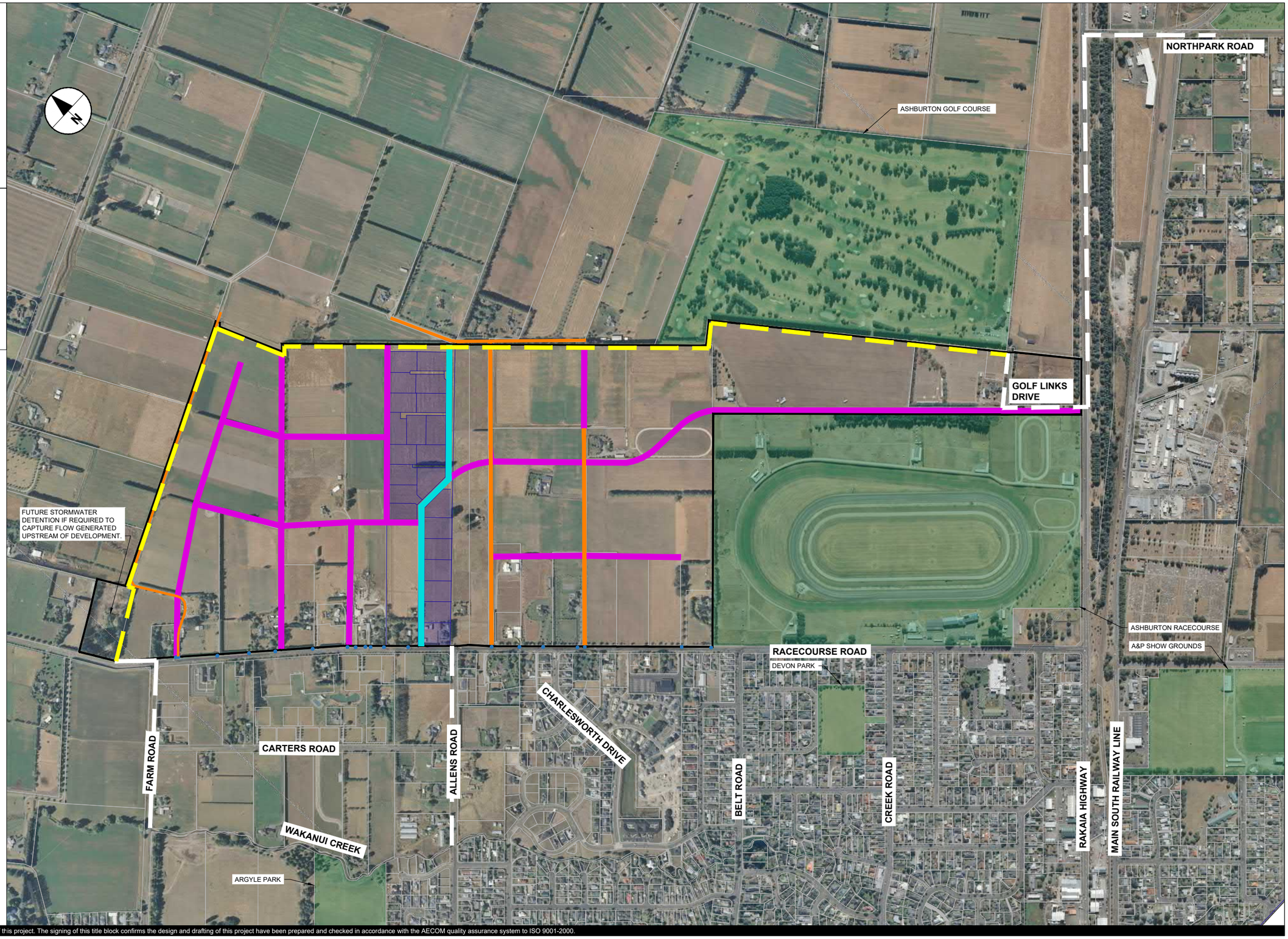

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PROJECT

ASHBURTON - RACECOURSE ROAD

CLIENT

Ashburton DISTRICT COUNCIL

5 Baring Square W
Ashburton
7700

ISSUE/REVISION		
A	15/05/2020	CONCEPT FOR COMMENT
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60624586

SHEET TITLE

STRUCTURE PLAN

SHEET NUMBER

60624586-SHT-CI-0010

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Appendix B

Section Absorption Rates Report

fordbaker valuation

Property Valuers and Advisors

FordBaker Valuation Limited
Level 3, 48 Fitzgerald Avenue
PO Box 43, Christchurch 8140
New Zealand
Tel: +64 3 379 7830
Fax: +64 3 366 6520
Email: fordbaker@fordbaker.co.nz
www.fordbaker.co.nz

16 July 2020

Associate Director - Transportation
AECOM
PO Box 710
CHRISTCHURCH 8140

ATTENTION: DAVID ANGUS

Dear Sir

RE: SECTION ABSORPTION RATES, GOLF LINKS DRIVE AND 102 - 244 RACECOURSE ROAD, ASHBURTON

This report has been prepared by Simon Newberry, B Com (VPM), FPINZ, FNZIV, Registered Valuer, who has been in private practice since 1987 together with Millie McLean, Bachelor of Land and Property Management, both working as Valuers primarily in the Canterbury Province.

We refer to your instruction to provide consultancy advice in relation to likely absorption rates for the proposed Racecourse Road Development Concept zoned Residential D under the Ashburton District Plan.

DOCUMENTATION

We have been provided with the following documentation:

- ADC Assets Team-Project Brief (SD-PB105)
- Racecourse Road Aerial Photos
- Racecourse Road Development-Concept Assessment Report (AECOM)
- Various email correspondence from Ben Petch (Principal Planner) and David Angus (Associate Director - Transportation), AECOM

In addition to the above, we have used and relied on the following sources of information:

- Property-Guru information
- PropertySmarts (Headway Systems Limited)
- Ashburton District Council (https://www.ashburtondc.govt.nz)
- Environment Canterbury (www.ecan.govt.nz)
- FordBaker Valuation Limited sales and database information
- Client information as provided by Ben Petch and David Angus of AECOM
- Property Search Canterbury Maps (https://propertysearch.canterburymaps.govt.nz/
- QuickMap (Custom Software Limited)
- Google Maps (www.google.co.nz/maps)
- Real estate agents, negotiators, consultants and websites
- Registered Valuers (internal and external)

INSTRUCTION/PROJECT SCOPE

Our deliverable and output, instructed by David Angus of AECOM is as follows:

- The consultant shall undertake an assessment of absorption rates for the land under the Residential D zoning under 2 residential density scenarios, namely 2,000 m² sections comprising 555 lots with 15,600 m² of green space and of 4,000 m² sections comprising 300 lots with 7,950 m² of green space. We have assumed that the zone will be varied to allow 2,000 m² sites as a Controlled Activity (currently this is a Non-Complying Activity under the Residential D zoning of the Ashburton District Plan)

EXTENT OF INVESTIGATIONS

- Visual roadside inspection of the site on 3 July 2020
- Reviewed Documentation
- Collation of Sales Evidence from 2010 but primarily focusing on the period from 2015 to the current date
- Reviewed Ashburton District Council website and District Plan
- Reviewed Racecourse Road Development: Concept Assessment Report

OBSERVATIONS

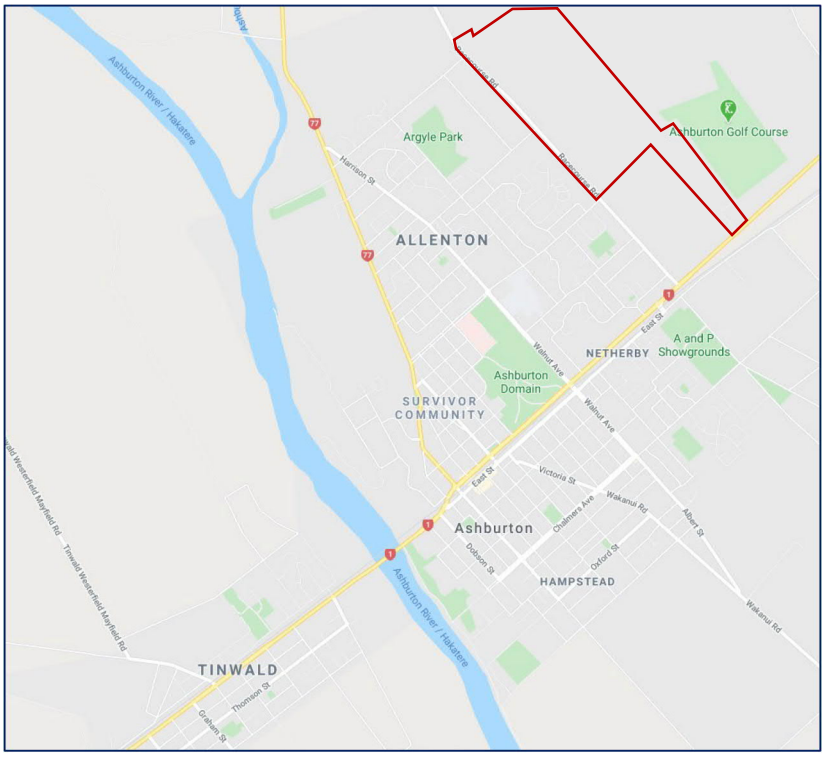
- The overall development concept has the potential for a range of piecemeal, non integrated or synergetic subdivisions
- No allowance for commercial land/neighbourhood shopping centre
- Subdivision at 174 Racecourse Road being passively advertised by signboard only
- The Ashburton District Long Term Plan 2015 – 2025 states that Ashburton Urban population projections (based on Statistics NZ projections) increasing as follows:

	2016	2021	2026
Population	19,340	19,980	20,233
Increase		640	253
Percentage Increase		3.31%	1.27%
Increase in Households (2.5 residents)		256 houses	101 houses

LOCATION

The Racecourse Road Development Concept comprises 35 individual sites, some of which are in common ownership, extensively being located to the north eastern side of Racecourse Road and with frontage to State Highway 1 and Golf Links Drive being north and east of Ashburton Racecourse and extending up to and slightly beyond the Racecourse Road intersection with Farm Road, within the suburb of Allenton at Ashburton.

We display the land's location in the following map:



Source: www.google.co.nz/maps

RESOURCE MANAGEMENT

The collection of sites are held within the Residential D (Low Density) zone of the Ashburton District Council.

The 'Low Density Residential' zone covers areas adjoining the towns of Ashburton (Kapuka), Methven and Rakaia and a number of the smaller villages. The zones are concentrated in close proximity to the towns in order to encourage energy conservation and to enable convenient access to the employment, services and facilities in those towns.

The zone provides for very low-density residential opportunities in association with these towns as an alternative to the suburban living areas typical of the District.

The purpose of the zone is to maintain very low-density residential areas with ample open space, tree and garden plantings and with minimal adverse environmental effects experienced by residents. However, rural productive activities are likely to remain a common use of land in the zone and an integral part of the rural-residential interface.

ASHBURTON SUBDIVISIONS

Over the past 10 years there have been a number of subdivisions developed in and around Ashburton. The expansion of Ashburton has seen several of these being developed to the south west side of Racecourse Road within named subdivisions. We now discuss the selling rate history of several of these and other Ashburton subdivisions as follows:

Lochlea

Created within a former small holding/lifestyle property, this comprised a 58 residential site development together with retirement lifestyle village. The subdivision was developed in stages and typically comprised residential sections between 600 m² and 900 m². Titles in the first stage were issued in March 2012 with a limited number of pre-sales. In all there have been 58 sales that we are aware of occurring between August 2010 (pre title) through to November 2018. Our breakdown of volume of sales on an annual basis is as follows:

Year	No of Sales	Average Area
2010	1 sale	1308 m²
2011	1 sale	604 m²
2012	19 sales	814 m²
2013	11 sales	783 m²
2014	9 sales	769 m²
2015	11 sales	700 m²
2016	1 sale	633 m²
2017	1 sale	912 m²
2018	4 sales	802 m²

In addition, there were 4 sales on Racecourse Road of land areas between 984 m² and 1785 m² of which one was sold in September 2015 and the remaining 3 sold between June and August 2018.

Turton Green

Comprising a 42 site subdivision with section sizes between 753 m² and 1298 m² that was developed in 2 stages. This development adjoins Lochlea with section sales occurring on an annual basis as follows:

Year	No of Sales	Average Area
2014	17 sales	1011 m²
2015	6 sales	975 m²
2016	3 sales	1159 m²
2017	4 sales	934 m²
2018	1 sale	894 m²
2019	4 sales	988 m²

Carters Estate

To comprise 25 residential lots arranged primarily in clusters of 4 with access off either Racecourse or Carters Road with the rear sites serviced by a private access lanes. Each lot is approximately 2000 m² in size and in addition there the use of a tennis court, pavilion and a couple of pitch and putt holes.

Limited sales only have occurred with only 5 sections having now sold into private ownership and the developer currently has 10 sites available in the current stages with a further 10 sites yet to be developed.

This development has been ongoing since 2012 with one sale occurring in that year, two sales occurred in each of 2015 and 2016. These sections have sold at between $350,000 and $450,000 and the remaining developed sites are currently being advertised from $380,000. This unique development is at a significantly higher price point for the Ashburton residential sales market.

Allens Place

Comprising a 15 site subdivision developed around 2014 with section sizes ranging from 625 m² up to 1290 m². A breakdown of the timing of this section sales is as follows:

Year	No of Sales	Average Area
2014	5 sales	900 m²
2015	2 sales	995 m²
2016	1 sale	903 m²
2017	0 sales	
2018	5 sales	840 m²
2019	0 sales	
2020	1 sale	1001 m²

In addition, there is a subdivision at the Allens Road intersection with Racecourse Road with one site of 4540 m² selling in 2014, the balance of sites were of standard residential sections between 835 m² and 1270 m². The breakdown of the timing of the section sales in this subdivision is as follows:

Year	No of Sales	Average Area
2014	1 sale	4540 m²
2015	1 sale	835 m²
2016	1 sale	886 m²
2017	1 sale	1023 m²
2018	1 sale	866 m²
2019	3 sales	1250 m²

Newland Sections

Zoned Residential D, the sites have a minimum site area of 4000 m². Sales have been relatively slow going and these can be illustrated on an annual basis as follows:

Year	No of Sales	Average Area
2015	4 sales	7523 m²
2016	2 sales	4616 m²
2017	3 sales	4532 m²
2018	3 sales	4916 m²
2019	1 sale	4000 m²
2020	0 sales	

Kelburn Estate

Located to the western fringe of Tinwald, is Kelburn Estate which comprises a rural residential subdivision with section sizes exceeding 4000 m². Its sales uptake has been intermittent with 19 sales occurring from 2011 through to 2019. This indicates approximately 2 sales per annum and there has been relatively even spread and this can be shown as follows:

Year	No of Sales	Average Area
2011	1 sale	4390 m²
2012	2 sales	4155 m²
2013	2 sales	4958 m²
2014	5 sales	4205 m²
2015	2 sales	4015 m²
2016	1 sale	4011 m²
2017	2 sale	4103 m²
2018	2 sales	4056 m²
2019	2 sales	5230 m²

Furthermore, Malcolm Tarbotton undertook a standard residential subdivision directly opposite (also known as Kelburn), comprising 26 sections and there have been 14 sales that occurred from 2014 of sections ranging in size from 689 m² up to around 1000 m² excluding any accessways. A breakdown of the sales can be illustrated as follows:

Year	No of Sales	Average Area
2014	1 sale	1002 m²
2015	0 sales	
2016	2 sales	1038 m²
2017	1 sale	1037 m²
2018	2 sales	749 m²
2019	5 sales	781 m²
2020	3 sales	749 m²

Oaklea

Again, located within Tinwald and comprising some 89 sections ranging in size from 680 m² to 1379 m² including the access way. Titles were initially issued from March 2014 and a breakdown of the annual sales can be shown as follows:

Year	No of Sales	Average Area
2014	12 sales	912 m²
2015	16 sales	915 m²
2016	9 sales	851 m²
2017	7 sales	854 m²
2018	7 sales	826 m²
2019	13 sales	828 m²
2020	3 sales	885 m²

Lake Hood

Contained within a 173 hectare park as a combined recreational and residential development and having been developed progressively since the early 2000's. There are 2 classes of property comprising residential sections up to 1500 m² and rural residential and lifestyle sections from 4500 m² up to 4.173 hectares.

If we concentrate on vacant land sales of parcels between 4500 m² and 2 hectares, the annual sales can be illustrated as follows:

Year	No of Sales	Average Area
2013	1 sale	9230 m²
2014	4 sales	14178 m²
2015	7 sales	8586 m²
2016	8 sales	9122 m²
2017	3 sales	8601 m²
2018	2 sales	6664 m²
2019	1 sale	5131 m²

Methven

There are 3 subdivisions within the township of Methven that have section sizes exceeding 1000 m². Thyme Stream comprises a rural residential subdivision featuring sites exceeding 4000 m² and comprising 16 allotments of which 9 have sold. Of the sales 8 occurred in 2018 and 1 only in 2019 with the developer still holding 7 sections.

Timaru and Selwyn District

In order to understand the balance of sales and their absorption rate we have considered subdivisions and section sales within the surrounding Territorial Authority districts of Timaru and Selwyn. It has become evident that the locational attributes of various properties are significantly important to the purchasers especially when they compare lifestyle, affordability, proximity to the central township and the semirural environment and outlook. Other factors that will influence purchasers will include the availability of services or the cost of providing them themselves.

We note surrounding the Selwyn townships of Rolleston, Lincoln, Prebbleton and West Melton that there are a number of rural residential sections available and which are still being met with moderate demand levels.

We anticipate and note that for a direct comparison of residential sales within a new subdivision when compared with rural residential sections exceeding 1500 m² but less than 1.5 hectares at Rolleston there are the following statistics:

Year	No of Sales	
	<1500 m²	>1500 m²
2015	524 sales	11 sales
2016	461 sales	18 sales
2017	379 sales	14 sales
2018	386 sales	3 sales
2019	342 sales	12 sales
2020	73 sales	6 sales

This would indicate an average of 34 regular residential section sales per rural residential section sold. This is one example and Rolleston (like most fringe Christchurch locations) is experiencing significant population growth and expansion.

ABSORPTION RATES

If we are to consider the absorption rates achieved for sections of 1000 m² or greater at Ashburton (including those section sales at Lake Hood) the evidence produces the following year on year statistics:

	No of Sales			
Year	Ashburton	Tinwald	Lake Hood	Totals
2015	19 sales	5 sales	14 sales	38 sales
2016	16 sales	5 sales	17 sales	38 sales
2017	11 sales	5 sales	5 sales	21 sales
2018	8 sales	2 sales	9 sales	19 sales
2019	9 sales	4 sales	2 sales	15 sales
2020	1 sale	1 sale	1 sale	3 sales
Totals	**64 sales**	**22 sales**	**48 sales**	**134 sales**

On average between 2015 and 2019 there have been 26 sales per annum of sections with land areas between 1000 m² and 1 hectare. Furthermore, if we look at the districtwide (Ashburton District Council catchment) all section sales up to 1 hectare in size, there are on average 110 sales per annum (based on years 2015 to 2019) these can be illustrated as follows:

Districtwide Sales	
2015	164 sales
2016	104 sales
2017	85 sales
2018	94 sales
2019	102 sales
2020	21 sales
Totals	**570 sales**

Therefore, the resident populations appetite for land is being mirrored to some degree by population growth statistics.

RACECOURSE ROAD DEVELOPMENT ABSORPTION RATES

Having reviewed the number of sales that occur year on year within Ashburton including Tinwald and Lake Hood we acknowledge that likely absorption rates of larger sections will be marginally better than dormant.

We must acknowledge that any development of this land is likely to be slow given that not all owners of land in this area will have a desire to undertake a subdivision given the likely upfront payments required to fund the development costs to be associated with it before a return can be realised (starting at title issue). Clearly the Council have a Structure Plan that includes not only roading patterns but also will provide the individual owners with access to services.

We also note that within this specific area that there have been 11 property transactions which includes two smaller vacant land parcels between 4000 m² and 4371 m² since 2015.

Our focus in determining absorption rates, we must assume that a realistic pricing model will be adopted by the developer and that there are no discounts or inflated prices that would distort our conclusions. We are also mindful that transactions of property do not follow a linear path and they can oscillate following property cycles whilst recognising a particular location.

Under normal circumstances we consider that the proposed subdivision of 172-174 Racecourse Road will be viewed by others with trepidation and its success or failure will provide guidance or create a barrier when observed by the other property owners in this block. Clearly and typically subdivisions are considered on their individual merits and what is successful for some may not be able to be repeated by others.

In undertaking our assessment, we have considered that the 3 Waters Services will be available to each owner/developer at a point where they can incorporate them into their development.

Without significant population growth, but acknowledging existing further development of subdivisions we assess absorption rates for the subject land on the following basis:

Under subdivision of 2000 m² sections which would indicate a yield of 555 lots, we would consider that between 1 and 1.5 sections per month on average would sell thereby indicating that between 12 and 18 section sales per annum could be achieved. Therefore, on average if we adopt 15 sections per annum, this would, therefore, indicate a development period of around 37 years based on a linear projection.

The Residential D zone allows for 4000 m² sites to be developed as of right however the absorption rate will be significantly decreased and it is likely that between 4 and 6 sales per year would occur under normal conditions (refer Newland and Kelburn sales). Therefore, on average we have allowed for 5 sections to sell per year thereby indicating a 60 year development period.

CONCLUSIONS

Subdivision of large sections within Ashburton, whether they be 2000 m² or 4000 m² will require a long-term commitment from property owners.

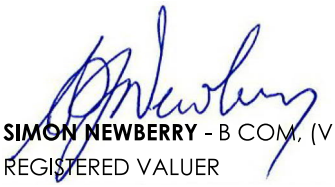
Some properties have been purchased presumably with a view that the owner can enjoy the lifestyle that a smallholding brings on the fringe of the township rather than become embroiled in the long-term commitment that a land subdivision development is likely to take.

For example if the property at 172-174 Racecourse Road is a sell down period of 4 years based on our assessed average section absorption rate and if there is a nine-month development period then there is an extreme if not onerous holding cost that may negatively impact on the developer's ability to achieve a profitable outcome.

Accordingly, we assess the annual absorption rates under the current market conditions at 15 sections and 5 sections per annum respectively for 2000 m² and 4000 m² section sizes.

We trust that this report is satisfactory for your purposes, however, should you wish to discuss it or require any further information, please do not hesitate to contact the writer.

Yours faithfully
FORDBAKER VALUATION LIMITED



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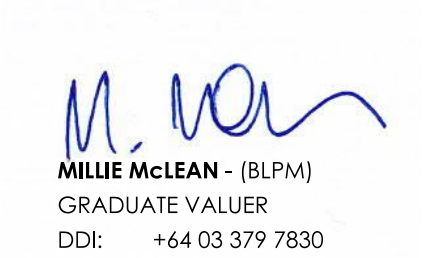
Involvement: Inspection
Valuation Calculation
Report Preparation



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Involvement: Inspection
Valuation Calculation
Report Preparation

Appendix C

Geotechnical Bore Logs

Bore Log

McMILLAN DRILLING SERVICES

Client: Davis Ogilvie Partners

Project: Turton St, Ashburton

Bore No.: MW002

Job No.: 7925

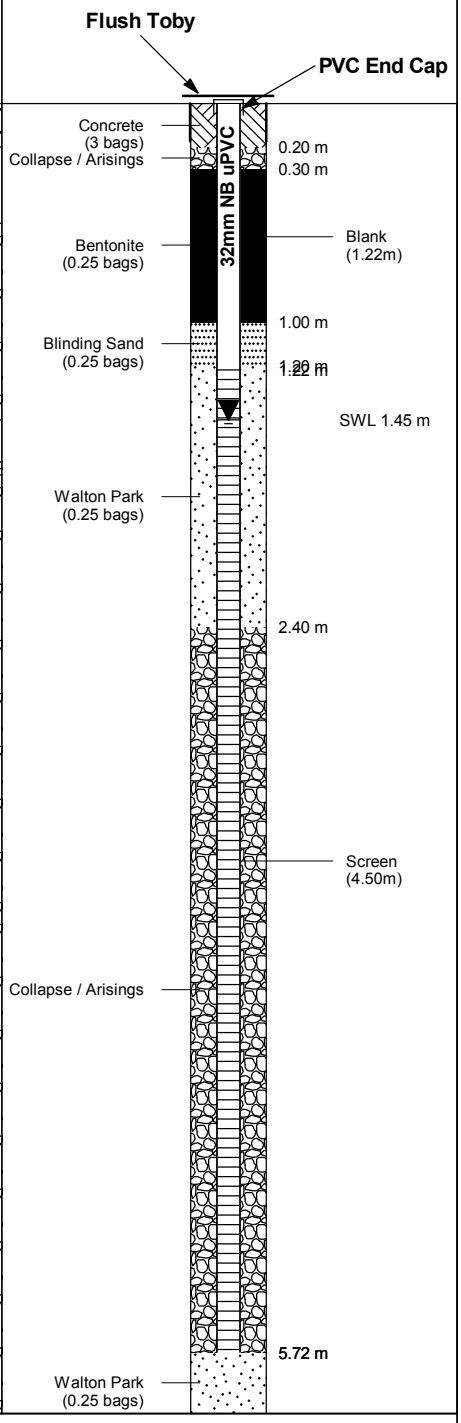
Site Location: Lot 1 55412 (North east corner), Ashburton
Grid Reference: mE, mN (NZMG)
Rig Operator: N. Barnes
Rig Model and Mounting: 9700 D - Truck, 70mm (DT)

Date Commenced: 26/08/2010
Date Completed: 26/08/2010
Consent: CRC103769-K37/3528
Datum: Ground

Description	Method	Drivability (1 2 3 4)	Recovery (25 50 75)	Depth (m)	Graphic Log
Dark brown organic silty TOPSOIL; moist, soft, becoming yellow brown mottled with depth (cultivated)				0	
Light grey, mottled yellow brown and orange SILT with minor fine sand; moist, firm, light grey and orange gammation and iron stained weathering, slight to low plasticity			65%		
Grey, mottled yellow brown and orange silty fine to medium GRAVEL with some fine to coarse sand; moist to wet, iron stained weathering, medium to tightly packed, rounded to subrounded gravel			90%	1	
Reddish brown fine to medium gravelly fine to medium SAND with trace of silt; moist to wet, subrounded gravel					
Reddish yellow brown fine to coarse sandy fine to coarse GRAVEL with minor to some silt, wet to saturated, sub rounded gravel			90%	2	
- 1.9m, saturated, less silt (minor), coarser sand (predominantly coarse) with depth					
- 2.4m, silt content varies from "silty" to "minor" with silty lenses up to 100mm thick			85%	3	
- 3.6m, "clean" gravel (no sand or silt) in 100mm lense					
- 3.7m, very tightly packed and grading slightly coarser with depth			65%	4	
				5	
			85%	6	

E.O.H 6.0m

Installation & Resources



Remarks:
Monitoring Well 002 (K37/3528)
50 litres water added.

Additional Resources:

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

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

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

NZGD ID: BH_71673

Report Created: 27/08/2010 11:38:42 a.m.

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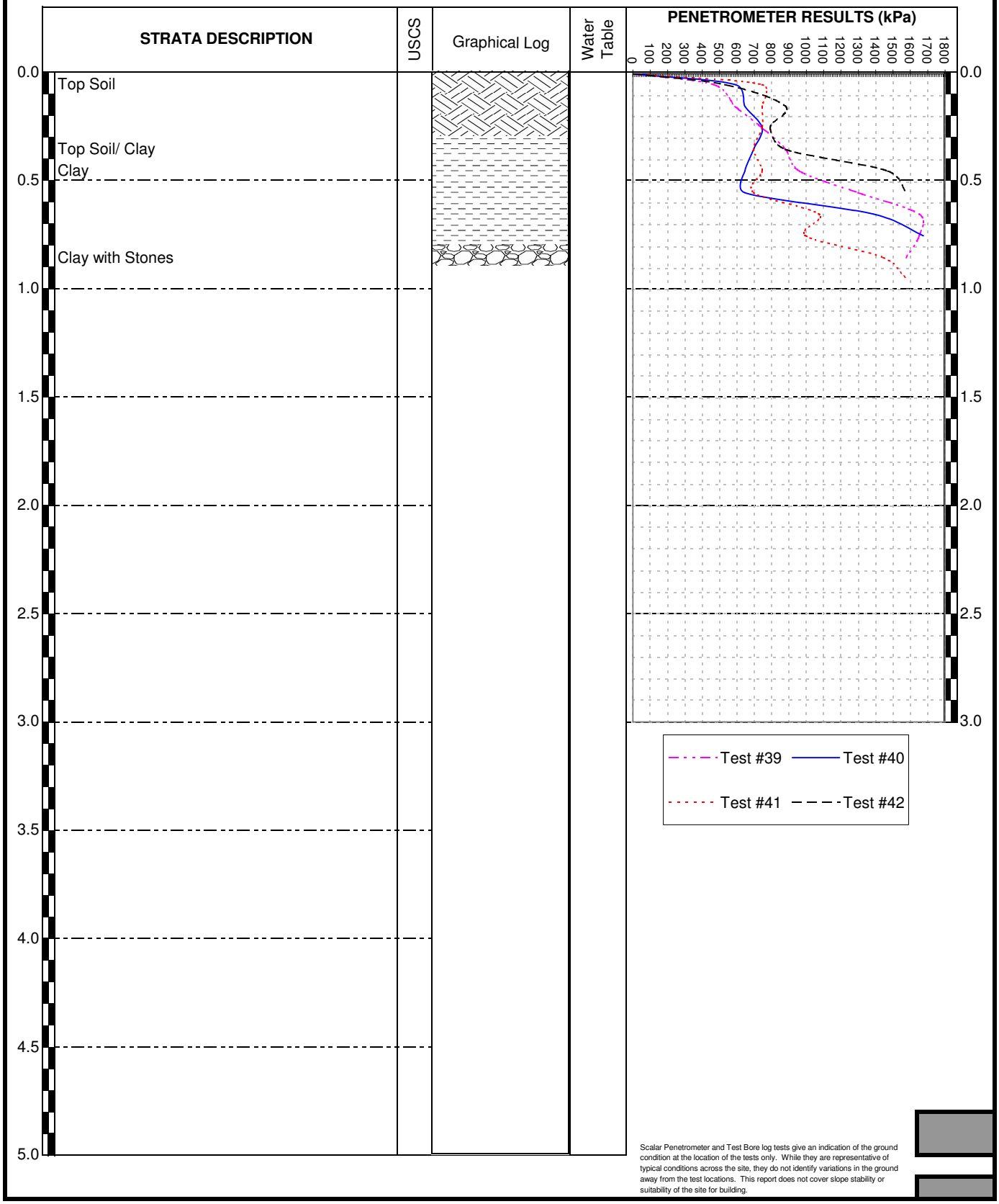
Davis Ogilvie
Professional Services

BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P1-10

Project:	Lochlea, Racecourse Road	Date:	23/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Auger 1	Equipment:	Hand Auger/ Penetrometer



Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This report does not cover slope stability or suitability of the site for building.

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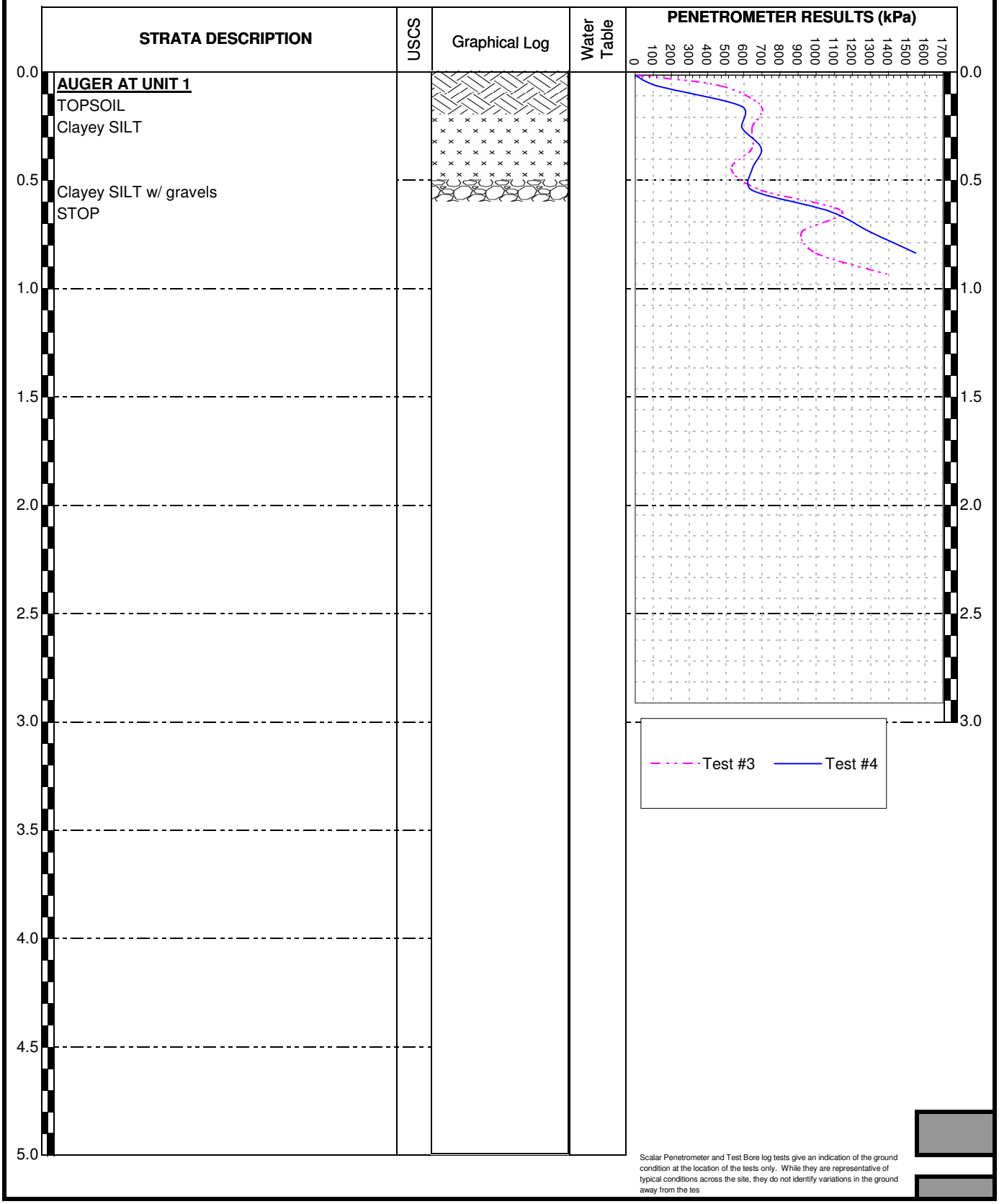
BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P3,4

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 1	Equipment:	Hand Auger/ Penetrometer



Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the tes

NZGD ID: HA-DCP_76252

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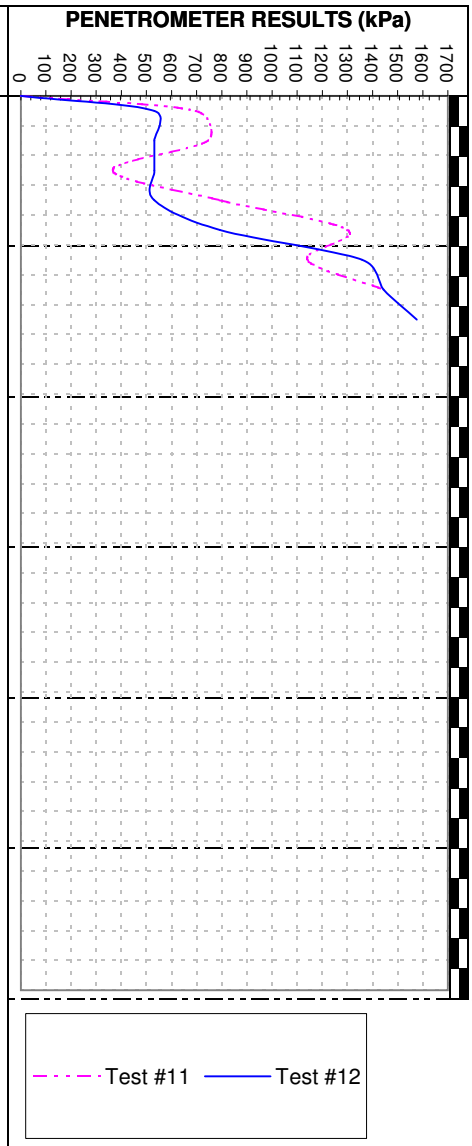
BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P11,12

Project:	Lochlea, Racecourse Road	Date:	27/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 2	Equipment:	Hand Auger/ Penetrometer

STRATA DESCRIPTION	USCS	Graphical Log	Water Table
AUGER AT UNIT 2 TOPSOIL Clayey SILT			
Clayey SILT w/ gravels STOP			



0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the tes

NZGD ID: HA-DCP_76253

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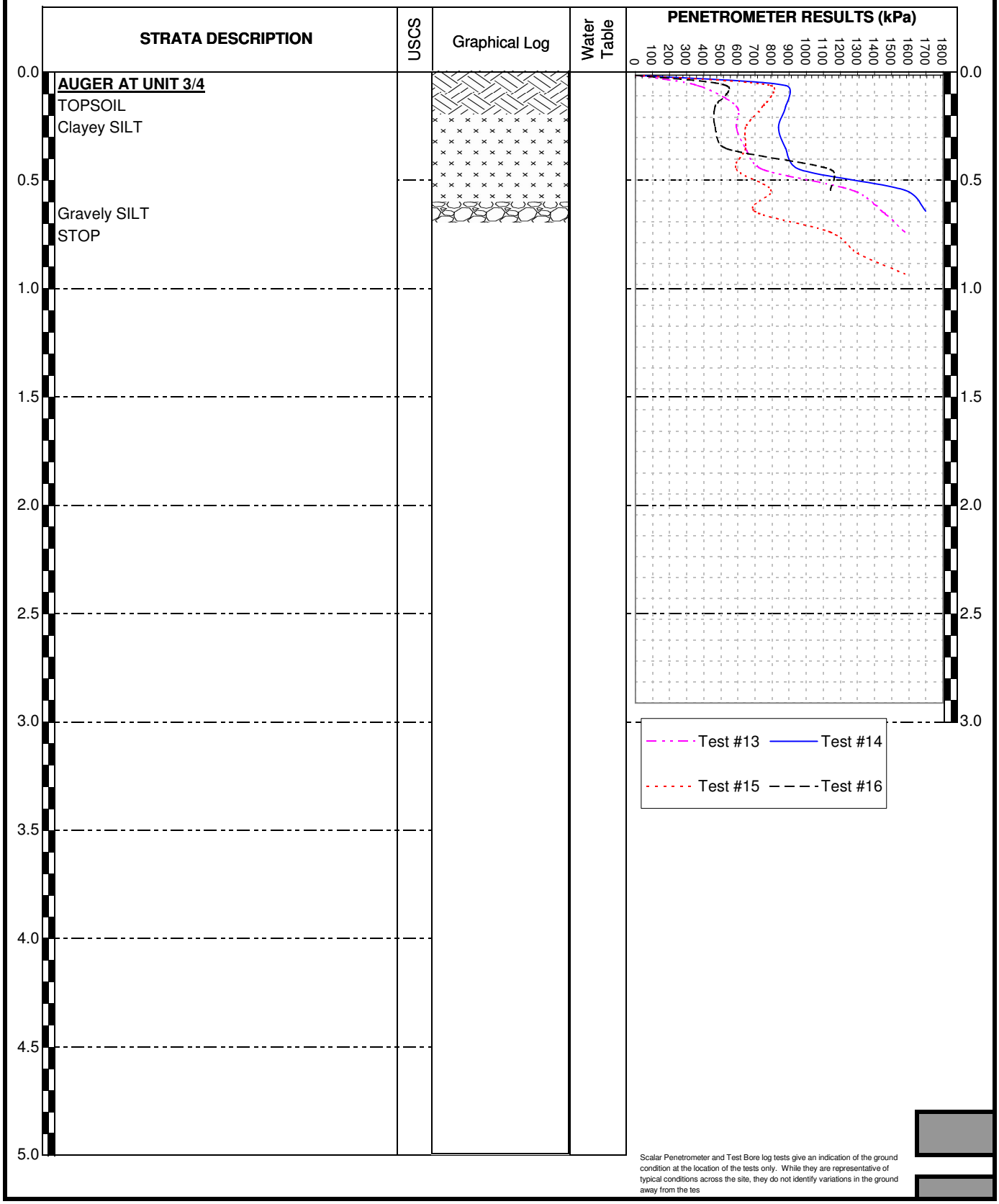
BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P13-14

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 3/4	Equipment:	Hand Auger/ Penetrometer



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NZGD ID: HA-DCP_76254

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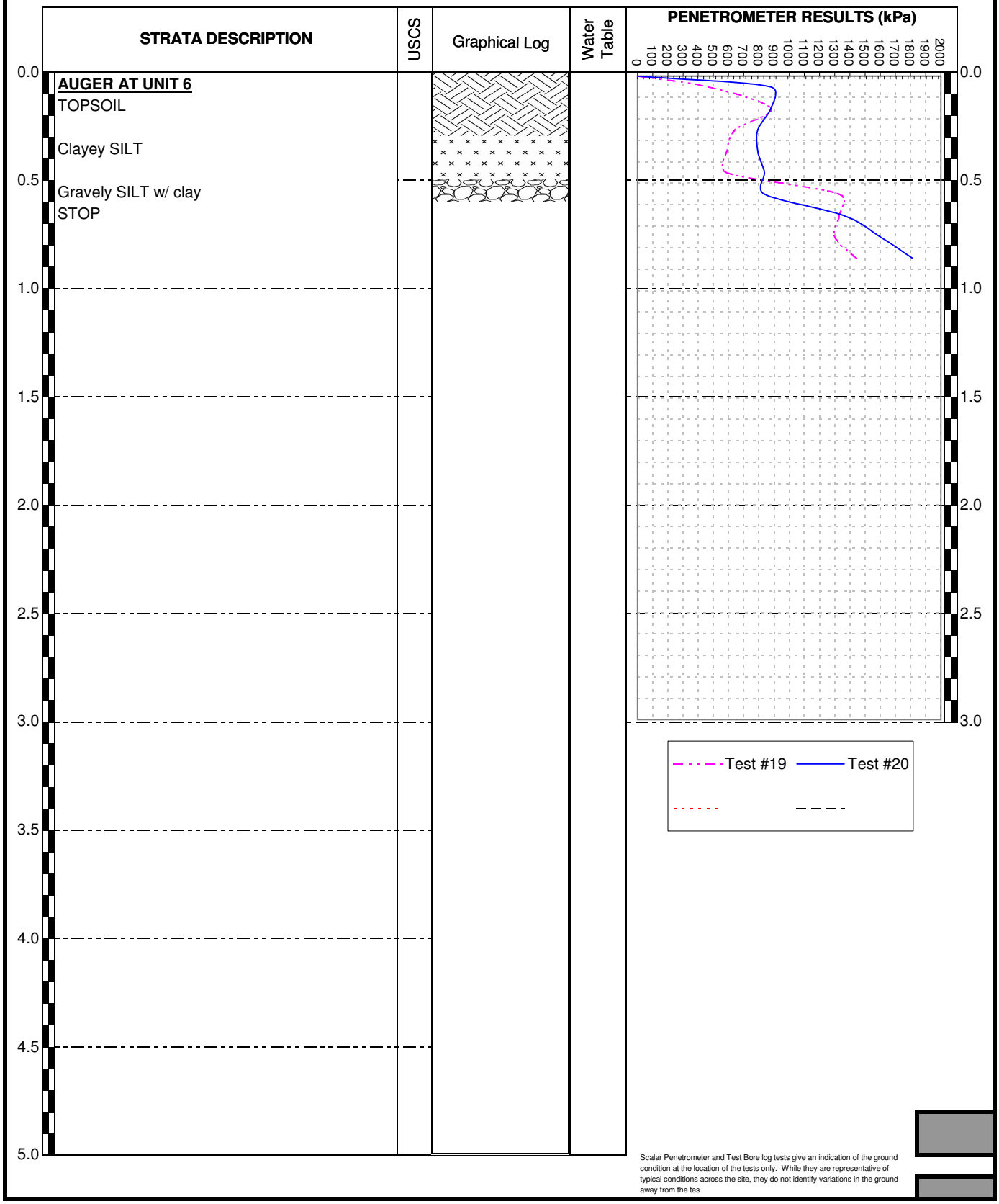
Job No. 26188
Test(s): P19,20

BORE LOG / SCALA PENETROMETER RESULTS

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 6	Equipment:	Hand Auger/ Penetrometer



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NZGD ID: HA-DCP_76255

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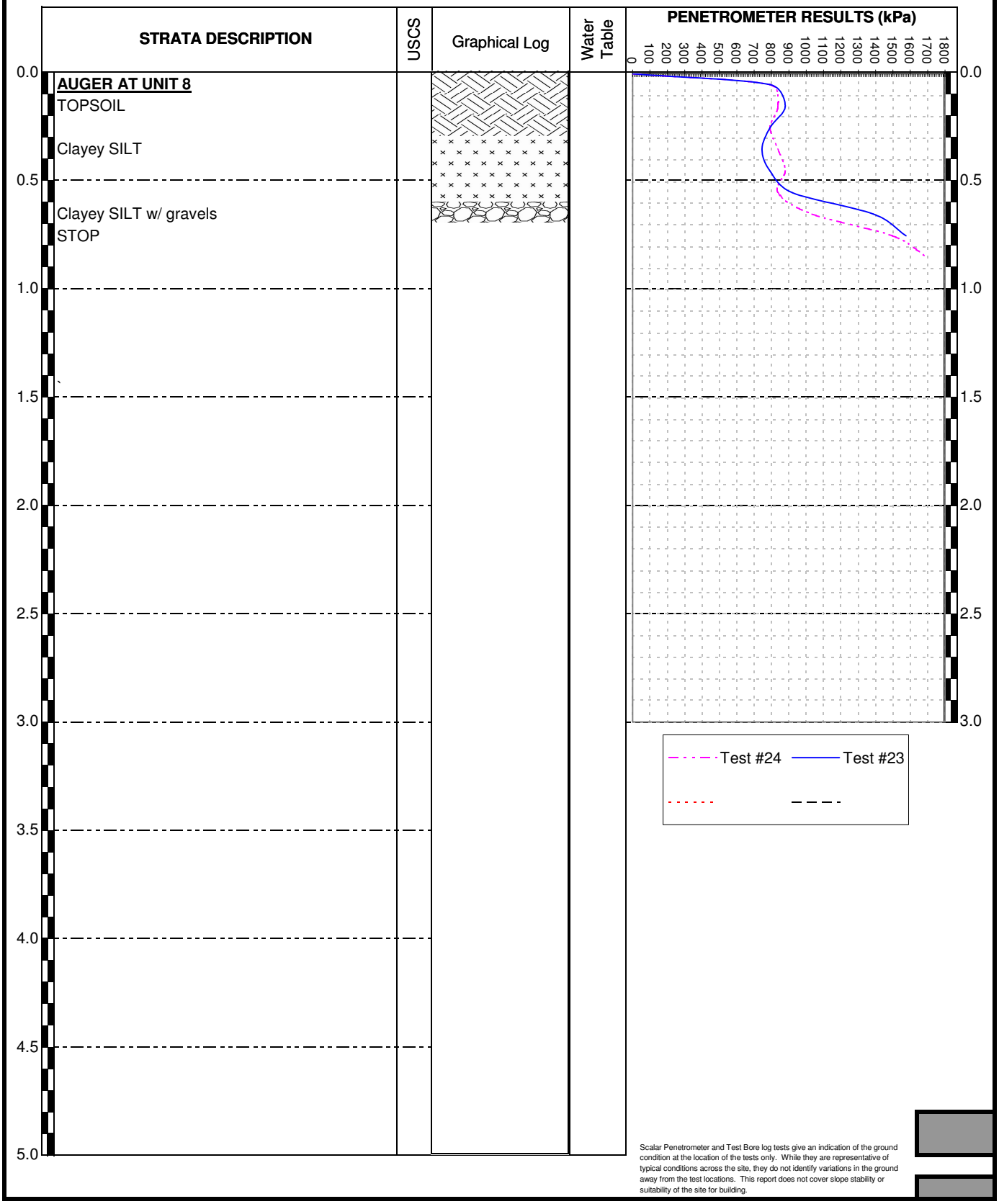
BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P23,24

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 8	Equipment:	Hand Auger/ Penetrometer



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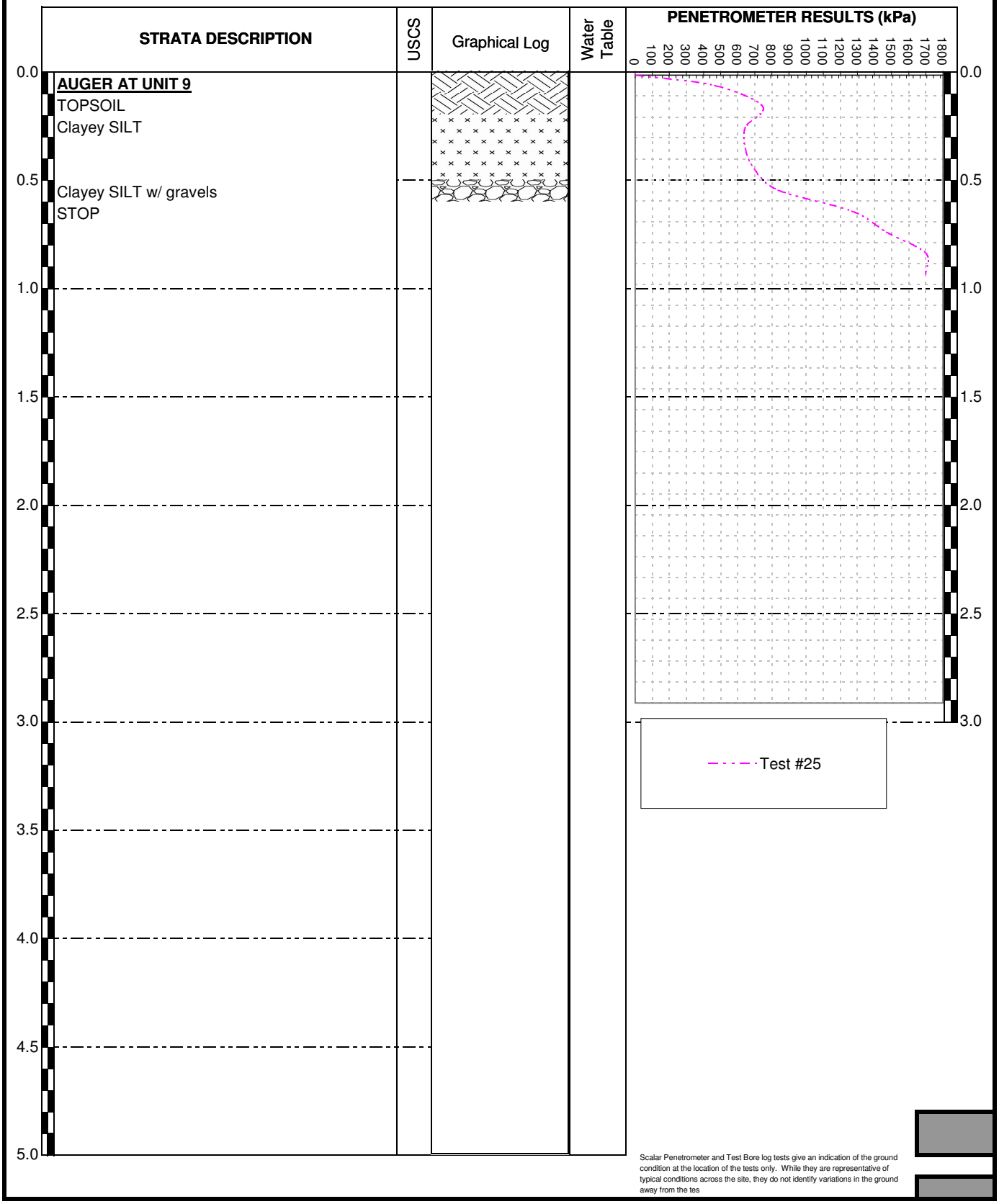
Job No. 26188
Test(s): P25

BORE LOG / SCALA PENETROMETER RESULTS

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 9	Equipment:	Hand Auger/ Penetrometer



Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the tes

NZGD ID: HA-DCP_76257

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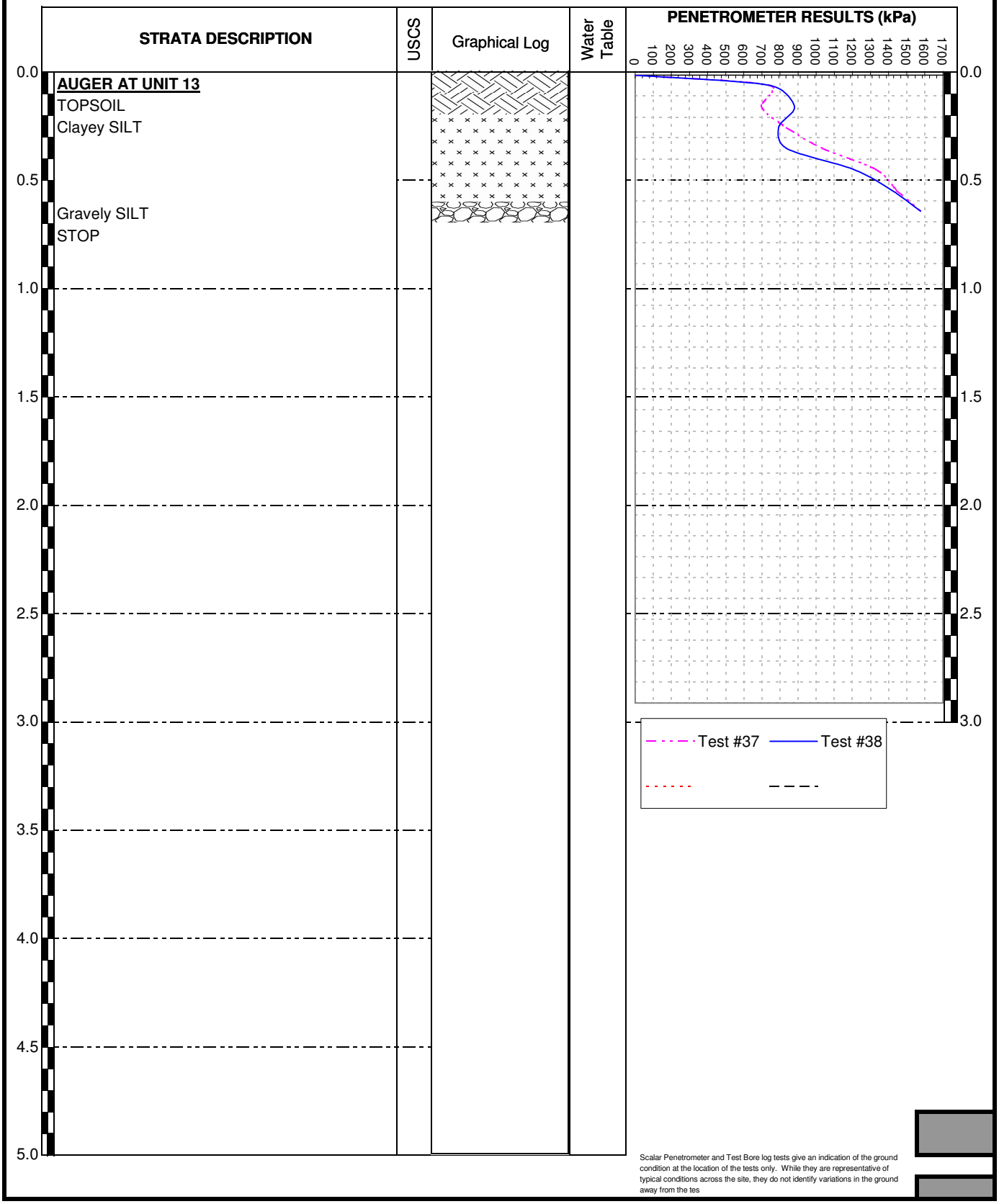
e admin@dop.co.nz w www.dop.co.nz

Davis Ogilvie
Professional Services

BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P37,38

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 13	Equipment:	Hand Auger/ Penetrometer



Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the tes

NZGD ID: HA-DCP_76258

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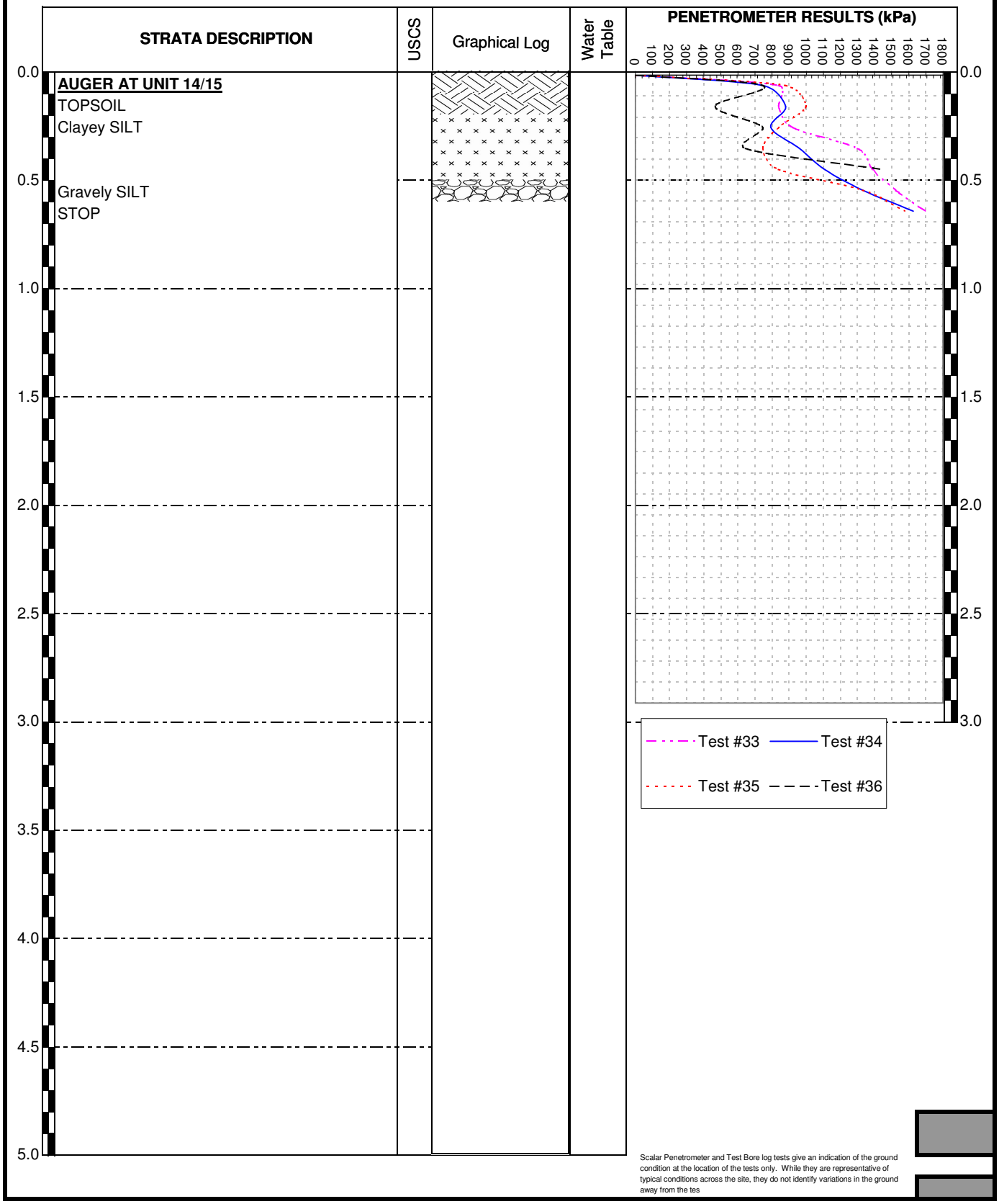
BORE LOG / SCALA PENETROMETER RESULTS

Job No. 26188
Test(s): P33-36

Project:	Lochlea, Racecourse Road	Date:	25/03/2011
Client:		Time:	10:00 a.m.
Test Location:	Refer to attached site plan	Field Staff:	Timaru
Notes:	Unit 14/15	Equipment:	Hand Auger/ Penetrometer



Scalar Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the tes

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Engineering Log - Test Pit

Test Pit No. TP01
Sheet 1 of 1
Project No. 26796

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: 28/02/2013
Date Completed: 28/02/2013
Logged By: CSB
Checked By: DW

Northing: 5,140,474.17
Easting: 1,499,822.82
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information						Excavation Information				
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
			0.20	TS TS	OL	Silty TOPSOIL; light brown. Dry.	D	F		
			0.40		ML	SILT some clay; light brown. Dry, stiff, low plasticity, friable/sensitive.	D	St-VSt		
			0.60							
			0.80		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, dense - very dense, gravels well graded round - subround greywacke, up to 150mm	D	D-VD		
			1.00		GW	Fine - medium sandy fine to coarse GRAVEL, some silt, some clay, some cobbles; medium - dark brown. Moist. Fines - low plasticity, low cohesion, gravel round - subround greywacke, cobbles upto 150 mm diam.	D	D-VD		
			1.20							
			1.40							
			1.60							
			1.80							
	2.05m		2.00		GW	At 2.05 m becomes saturated.	S	D-VD		
			2.20							

EOH: 2.2 m
Termination:
Notes:

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Engineering Log - Test Pit

Test Pit No. *TP02*
Sheet *1 of 1*
Project No. *26796*

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: *28/02/2013*
Date Completed: *28/02/2013*
Logged By: *CSB*
Checked By: *DW*

Northing: 5,140,494.48
Easting: 1,499,843.17
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information						Excavation Information				
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
				TS	OL	Silty TOPSOIL; light brown. Dry.	D	F		
			0.20		ML	SILT some clay; light brown. Dry, stiff, low plasticity, friable/sensitive.	D	St		
			0.40							
			0.60		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, dense - very dense, gravels well graded round - subround greywacke, up to 150mm diam.	D	D-VD		
			0.80							
			1.00		GM	Silty fine - coarse GRAVEL and COBBLES some clay; light brown. Dry, dense - very dense, gravels well graded, round - subround greywacke, up to 150mm diam.	D	D-VD		
			1.20							
			1.40							
			1.60							
			1.80							
			2.00							
	2.20m		2.20		GM	At 2.2 m becomes saturated.	S	D-VD		
			2.40							

EOH: 2.4 m
Termination:
Notes:

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Engineering Log - Test Pit

Test Pit No. *TP03*
Sheet *1 of 1*
Project No. *26796*

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: *25/02/2013*
Date Completed: *28/02/2013*
Logged By: *CSB*
Checked By: *DW*

Northing: 5,140,510.63
Easting: 1,499,860.92
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information						Excavation Information				
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
			0.20	TS TS	OL	Silty TOPSOIL; light brown. Dry.		F		
			0.40		ML	SILT some clay; medium brown. Dry, stiff, low plasticity, friable/sensitive.	D	St		
			0.60							
			0.80		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, dense - very dense, gravels well graded, round - subround greywacke, up to 150mm diam.	D	D-VD		
			1.00							
			1.20							
			1.40							
			1.60							
			1.80							
			2.00							
			2.20			0.1 m thick band of stained gravel; dark brown - black.	D	D-VD		
	2.30m		2.40		GM	Silty, clayey fine - coarse GRAVEL and COBBLES some clay; light brown. Wet - saturated, dense - very dense, gravels well graded round - subround greywacke, up to 150mm diam. Some lobes of clay rich sandy fines. At 2.4 becomes saturated.	W-S	D-VD		
			2.60		GM		S	D-VD		

EOH: 2.6 m
Termination:
Notes:

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Engineering Log - Test Pit

Test Pit No. *TP04*
Sheet *1 of 1*
Project No. *26796*

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: *28/02/2013*
Date Completed: *28/02/2013*
Logged By: *CSB*
Checked By: *DW*

Northing: 5,140,486.94
Easting: 1,499,880.81
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information						Excavation Information				
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
			0.20	TS TS	OL	Silty TOPSOIL; light brown. Dry.	D	F		
			0.40		ML	SILT some clay; light brown. Dry, stiff, low plasticity, friable/sensitive.	D	VS		
			0.60		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, dense - very dense, gravels well graded, round - subround greywacke, up to 150mm diam.	D	D-VD		
			0.80							
			1.00			Silty, sandy, fine - medium GRAVEL some clay, some cobbles; light brown. Dry, dense - very dense, gravels well graded round - subround greywacke, up to 150mm diam.				
			1.20							
			1.40							
			1.60		GW		D	D-VD		
			1.80							
			2.00							
			2.20							
	2.30m ▼		2.40		GW	At 2.3 becomes saturated.	S	D-VD		

EOH: 2.4 m
Termination:
Notes:

NZGD ID: TP_76264

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Engineering Log - Test Pit

Test Pit No. *TP05*
Sheet *1 of 1*
Project No. *26796*

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: *28/02/2013*
Date Completed: *28/02/2013*
Logged By: *CSB*
Checked By: *DW*

Northing: 5,140,471.18
Easting: 1,499,860.15
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information						Excavation Information				
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
			0.20	TS TS	OL	Silty TOPSOIL; light brown. Dry.	D	F		
			0.40		ML	SILT some clay; light brown. Dry, stiff, low plasticity, friable/sensitive.	D	St		
			0.60 0.80 1.00		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, dense - very dense, gravels well graded round - subround greywacke, up to 150mm diam.	D	D-VD		
	2.30m		1.20 1.40 1.60 1.80 2.00 2.20		GM	Fine - medium sandy fine to coarse GRAVEL, some silt, some clay, some cobbles; medium - dark brown. Moist. Fines - low plasticity, low cohesion, gravel round - subround greywacke, cobbles upto 150 mm diam.	D	D-VD		
			2.40		GM	At 2.3 m becomes saturated.	S	D		

EOH: 2.4 m
Termination:
Notes:

NZGD ID: TP_76265

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Engineering Log - Test Pit

Test Pit No. TP06
Sheet 1 of 1
Project No. 26796

Client: GW and HJ Menzies

Project: 149 Racecourse Road, Ashburton

Test Pit Location: REFER TO SITE PLAN

Date Started: 28/02/2013
Date Completed: 28/02/2013
Logged By: CSB
Checked By: DW

Northing: 5,140,451.53
Easting: 1,499,839.08
Datum: NZGD 2000
RL Surface: 106.00

Excavation Information				Excavation Information						
Material	Water	Notes, samples, tests etc	Depth (m)	Graphic Log	Classification Symbol	Material Soil - soil type, colour, structure, grading, bedding, plasticity, sensitivity; Secondary and minor components Rock - colour, fabric, rock type; discontinuities; additional information	Moisture Condition	Consistency / Density Index	Shear Vane (Dial Readings kPa)	Scala 5 10 15
			0.00	TS	OL	Silty TOPSOIL; light brown. Dry.	D	F		
			0.20		ML	SILT some clay; light brown. Dry, stiff, low plasticity, friable/sensitive.	D	St		
			0.40							
			0.60		GW	Silty fine - coarse GRAVEL and COBBLES some fine sand and some clay; light brown. Dry, very dense, gravels well graded round - subround greywacke, up to 150mm diam.	D	VD		
			0.80							
			1.00							
			1.20							
			1.40							
			1.60							
			1.80		GC	Fine - medium sandy fine to coarse GRAVEL, some silt, some clay, some cobbles; medium brown. Moist. Fines - low plasticity, low cohesion, gravel, round - subround greywacke, cobbles upto 150 mm diam.	D	D-VD		
			2.00							
			2.20		GC	At 2.2 m becomes moist.	M	D-VD		
	2.50m		2.40							
			2.60		GC	At 2.5 m becomes saturated.	S	D-VD		

EOH: 2.6 m
Termination:
Notes:

NZGD ID: TP_76266

Appendix D

Potable Water Plan

ISO A1 594mm x 841mm

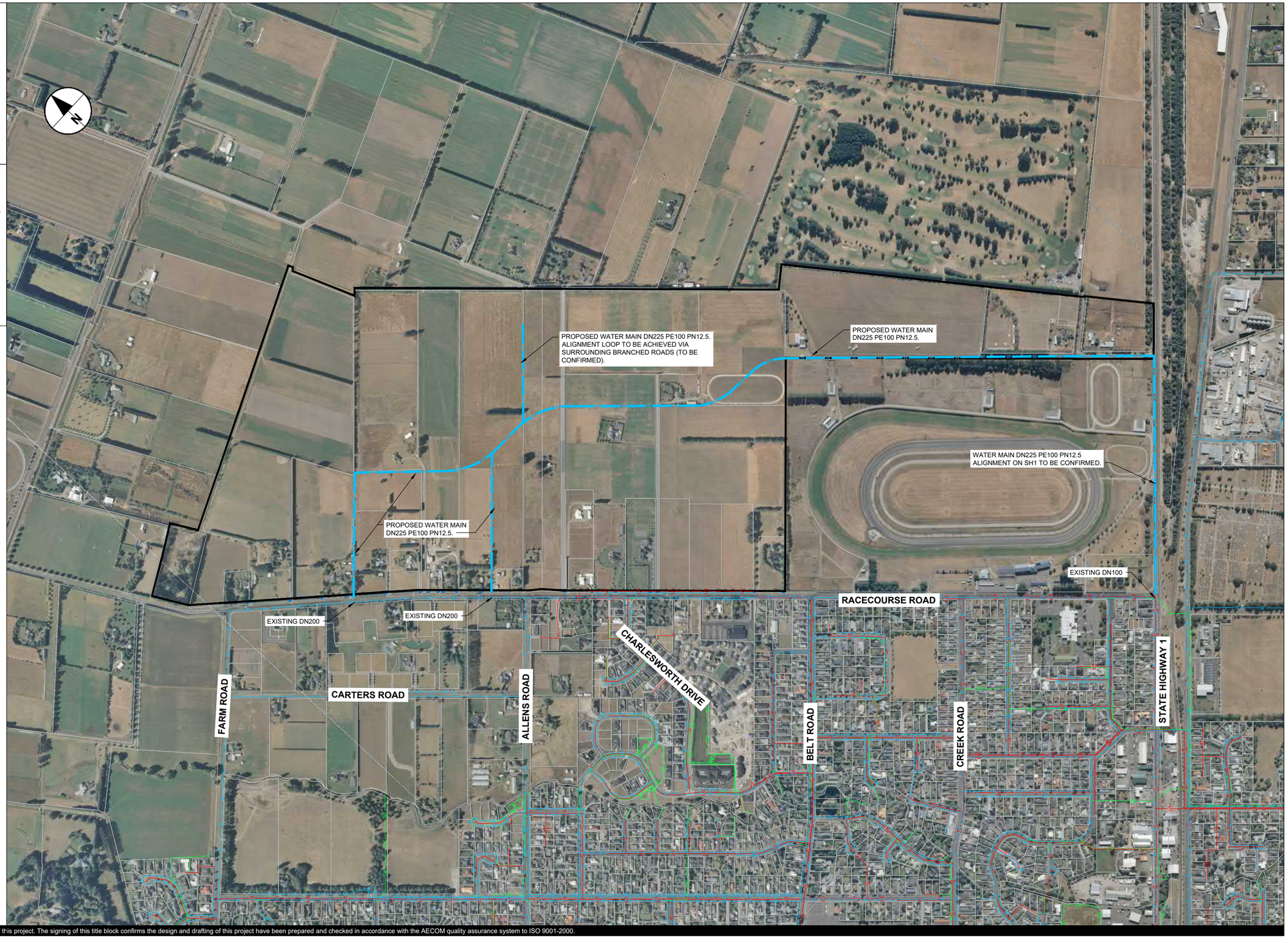
LEGEND

- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT WATER SUPPLY
- DEVELOPMENT BOUNDARY

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 125 250 m



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CLIENT

Ashburton DISTRICT COUNCIL

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

TRUNK WATER SUPPLY PLAN OVERVIEW

SHEET NUMBER

60624586-SHT-CI-0200

Appendix E

Wastewater Plan and Sections

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 125 250 m

THIS OPTION IS NOT CURRENTLY VIABLE DUE TO EXISTING NETWORK CAPACITY. FUTURE INVESTIGATION WILL BE REQUIRED REGARDING THE FEASIBILITY OF UPGRADING THE EXISTING NETWORK.

WESTERN MAIN:
DISCHARGES TO CENTRAL MAIN.
ESTIMATED 2.2 - 2.4 m BGL.

CENTRAL MAIN:
ESTIMATED 2.6 - 3.6 m BGL.

SECONDARY CENTRAL MAIN:
ESTIMATED 2.0 - 2.4 m BGL.

EASTERN MAIN:
ESTIMATED 1.4 - 2.3 m BGL.

SH1 MAIN:
ESTIMATED 1.4 m BGL.

FEASIBLE DEPTH FOR DISCHARGE OF CENTRAL MAINS 1 AND 2.
EXISTING INVERT: 98.443.
LIMITED BY EXISTING CAPACITY.

FEASIBLE DEPTH FOR DISCHARGE OF SH1 MAIN.
EXISTING INVERT: 96.623.
LIMITED BY EXISTING CAPACITY.

ALTERNATIVE DISCHARGE POINT FOR CENTRAL MAINS 1 AND 2.
EXISTING INVERT: 97.150.
LIMITED BY EXISTING CAPACITY.

STATE HIGHWAY 1
RACECOURSE ROAD
CHARLESWORTH DRIVE
FARM ROAD
CARTERS ROAD
ALLENS ROAD
BELT ROAD
CREEK ROAD

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER GRAVITY NETWORK OVERVIEW

SHEET NUMBER

60624586-SHT-CI-0100

ISO A1 594mm x 841mm

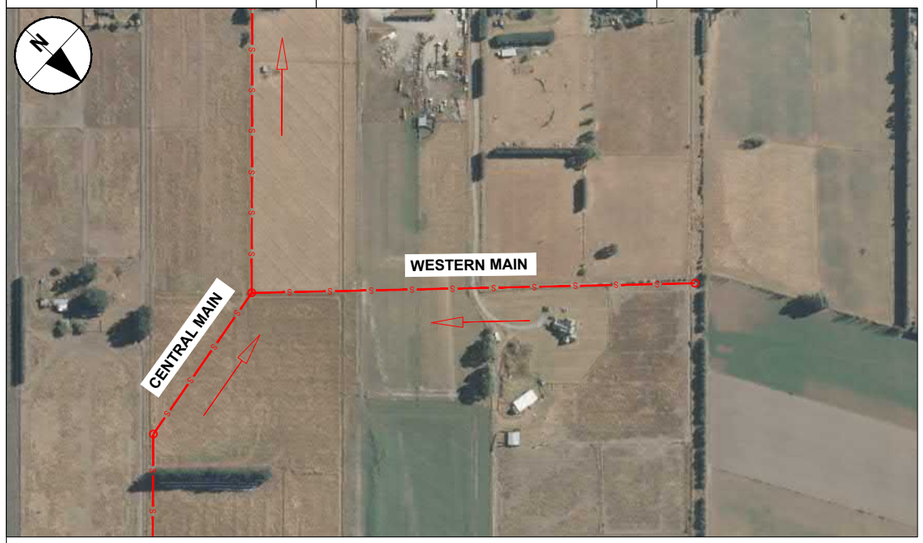
LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER

NOTES

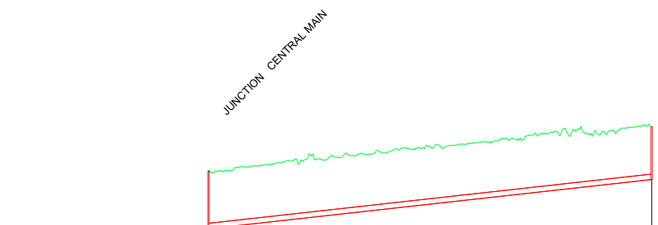
1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 62.5 125 m



PLAN: WESTERN MAIN, GRAVITY OPTION

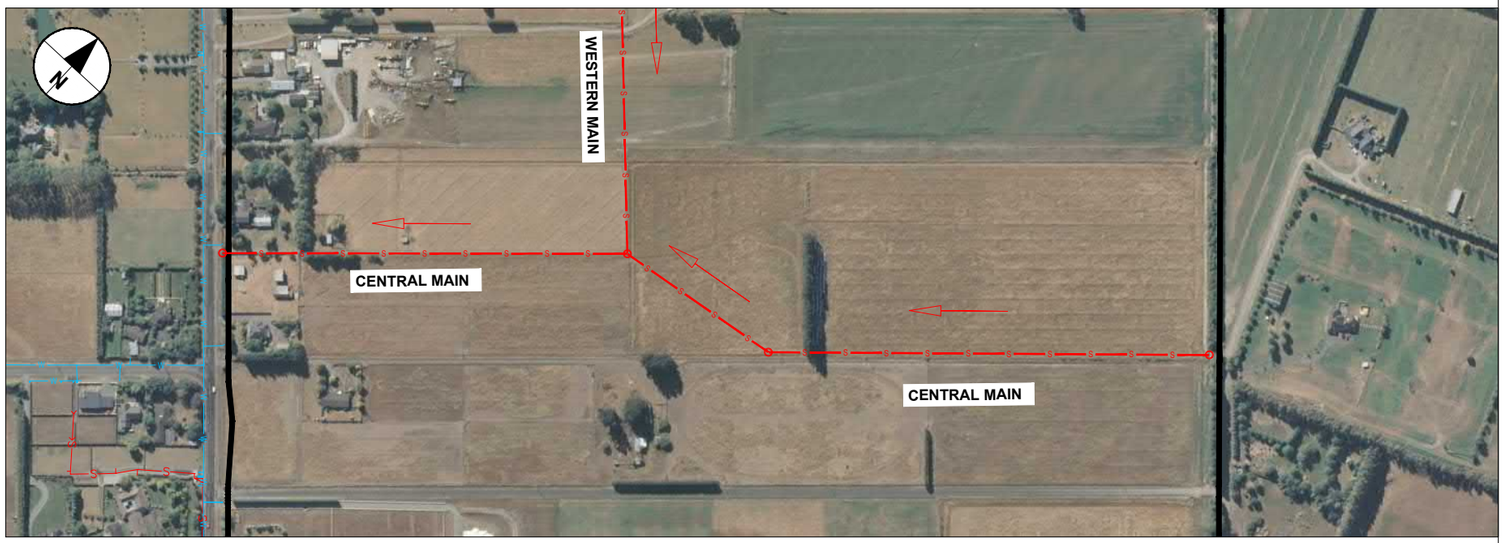
Scale 1:2500 m



PIPE GRADE		1 in 181	
DATUM R.L		100.000	
DEPTH TO INVERT	3.326	2.340	2.157
R.L. OF INVERT	103.787	104.774	106.771
CHAINAGE		0.000	361.445

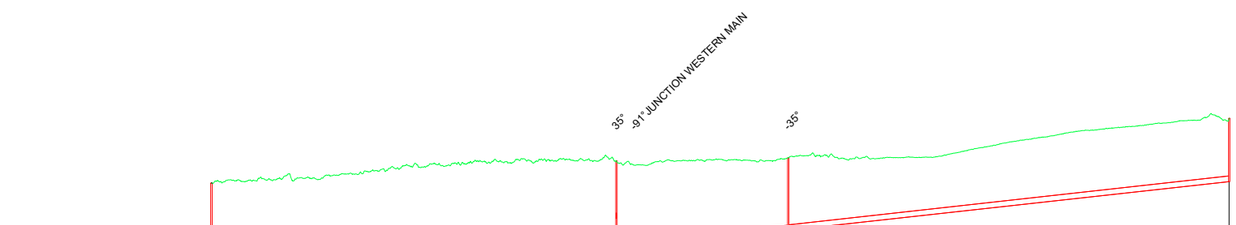
LONG SECTION: WESTERN MAIN, GRAVITY OPTION

Scale 1:2500 H, 1:125 V



PLAN: CENTRAL MAIN, GRAVITY OPTION

Scale 1:2500 m



PIPE GRADE		1 in 303		1 in 303		1 in 181
DATUM R.L		99.000				
DEPTH TO INVERT	3.518	3.518	3.326	3.306	2.973	2.953	2.574
R.L. OF INVERT	102.697	102.697	103.787	103.807	104.270	104.290	106.275
CHAINAGE	0.000	0.000	330.240	0.000	140.197	0.000	359.441

LONG SECTION: CENTRAL MAIN, GRAVITY OPTION

Scale 1:2500 H, 1:125 V

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER GRAVITY NETWORK SECTIONS 1 OF 4

SHEET NUMBER

60624586-SHT-CI-0101

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER

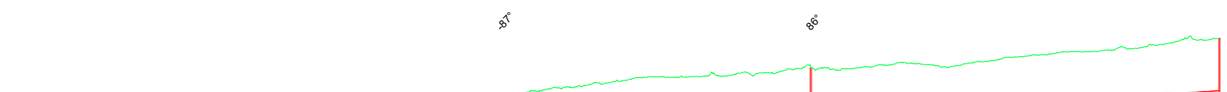
NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 62.5 125 m

PLAN: SECOND CENTRAL MAIN, GRAVITY OPTION

Scale 1:2500 m



PIPE GRADE		1 in 303			1 in 303			1 in 303			
DATUM R.L	97.000										
DEPTH TO INVERT	2.044	2.044		1.945	1.925		2.271	2.251			2.348
R.L. OF INVERT	100.958	100.958		101.737	101.757		102.591	102.611			103.710
CHAINAGE	0.000		236.065	0.000		252.461	0.000		333.129		

LONG SECTION: SECOND CENTRAL MAIN, GRAVITY OPTION

Scale 1:2500 H, 1:125 V

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I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER GRAVITY NETWORK SECTIONS 2 OF 4

SHEET NUMBER

60624586-SHT-CI-0102

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- W — W — EXISTING WATER SUPPLY
- SW — SW — EXISTING STORMWATER
- S — S — EXISTING SEWER
- S — S — CONCEPT SEWER

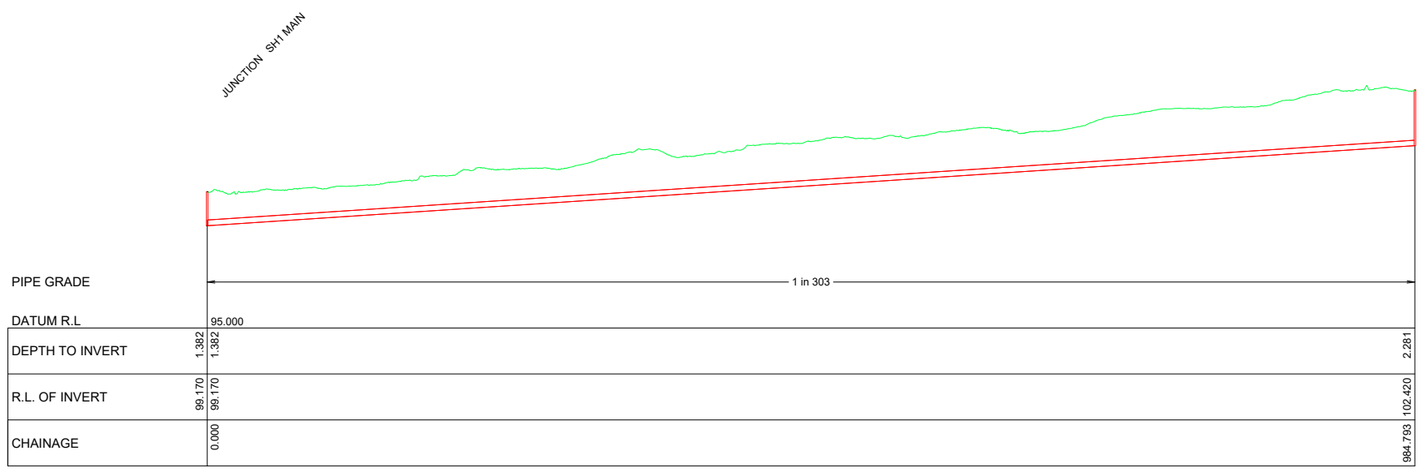
NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 62.5 125 m

PLAN: EASTERN MAIN, GRAVITY OPTION

Scale 1:2500 m



LONG SECTION: EASTERN MAIN, GRAVITY OPTION

Scale 1:2500 H, 1:125 V

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PROJECT

ASHBURTON - RACECOURSE ROAD

CLIENT

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5 Baring Square W
Ashburton
7700

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER GRAVITY NETWORK SECTIONS 3 OF 4

SHEET NUMBER

60624586-SHT-CI-0103

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
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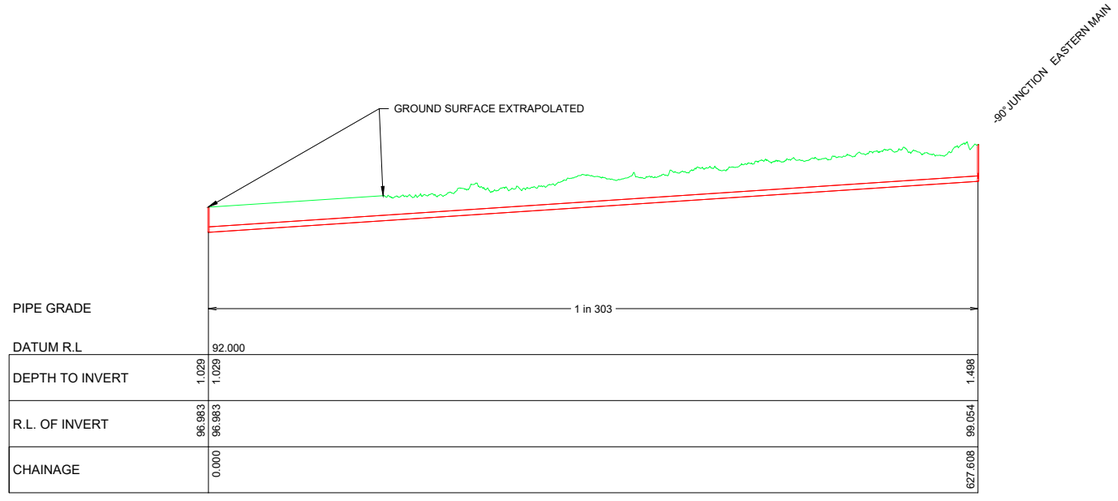
0 62.5 125 m

PLAN: EASTERN MAIN, GRAVITY OPTION

Scale 1:2500 m



LONG SECTION: EASTERN MAIN, GRAVITY OPTION

Scale 1:2500 H, 1:125 V

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER GRAVITY NETWORK SECTIONS 4 OF 4

SHEET NUMBER

60624586-SHT-CI-0104

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER
- CONCEPT RISING MAIN

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
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0 125 250 m

EASTERN MAIN:
GRAVITY MAIN DISCHARGES FLOW TO PUMP STATION 1.
ESTIMATED 1.6 - 2.3 m BGL.

MAIN FROM SH1:
GRAVITY MAIN DISCHARGES TO PUMP STATION 1.
ESTIMATED 1.1 - 5.5. m BGL.

PUMP STATION 1
STORAGE: 120 m^3.
FLOW RESTRICTED TO 10 L/s UNLESS NETWORK UPGRADES UNDERTAKEN.
LOCATION INDICATIVE.

WESTERN MAIN:
DISCHARGES TO CENTRAL MAIN.
ESTIMATED 2.2 - 2.4 m BGL.

RISING MAIN:
DISCHARGES FLOW FROM PUMP STATION 1 TO THE CENTRAL MAIN.
FLOW DIRECTION OPPOSITE TO GRADE. ESTIMATED 0.6 - 3 m BGL.

CENTRAL MAIN:
ESTIMATED 2.6 - 3.6 m BGL.

PUMP STATION 2
STORAGE: 1400 m^3.
FLOW RESTRICTED TO 10 L/s UNLESS NETWORK UPGRADES UNDERTAKEN.

APPROXIMATE LOCATION OF ADC'S PROPOSED PUMP STATION (OUTSIDE PROJECT SCOPE)

PROPOSED DISCHARGE POINT FROM PUMP STATION 2.

STATE HIGHWAY 1
RACECOURSE ROAD
CHARLESWORTH DRIVE
FARM ROAD
CARTERS ROAD
ALLENS ROAD
BELT ROAD
CREEK ROAD

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A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER WITH PUMP STATIONS OVERVIEW

SHEET NUMBER

60624586-SHT-CI-0105

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER
- CONCEPT RISING MAIN

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
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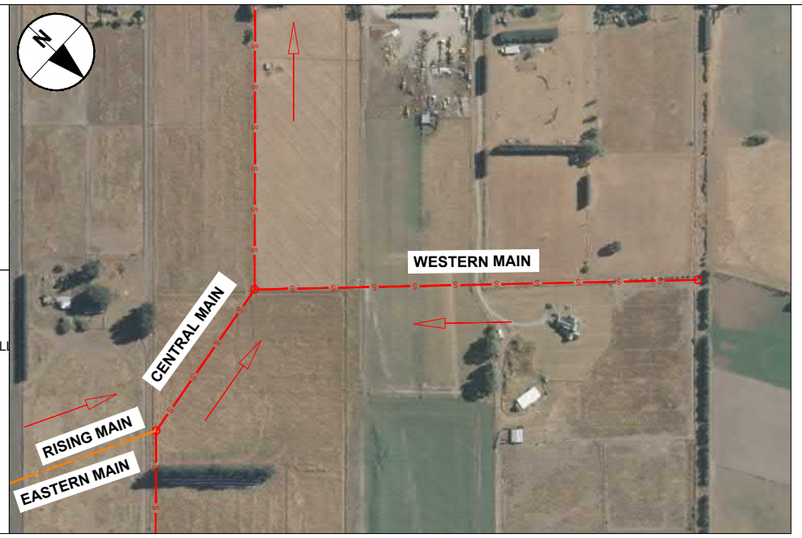
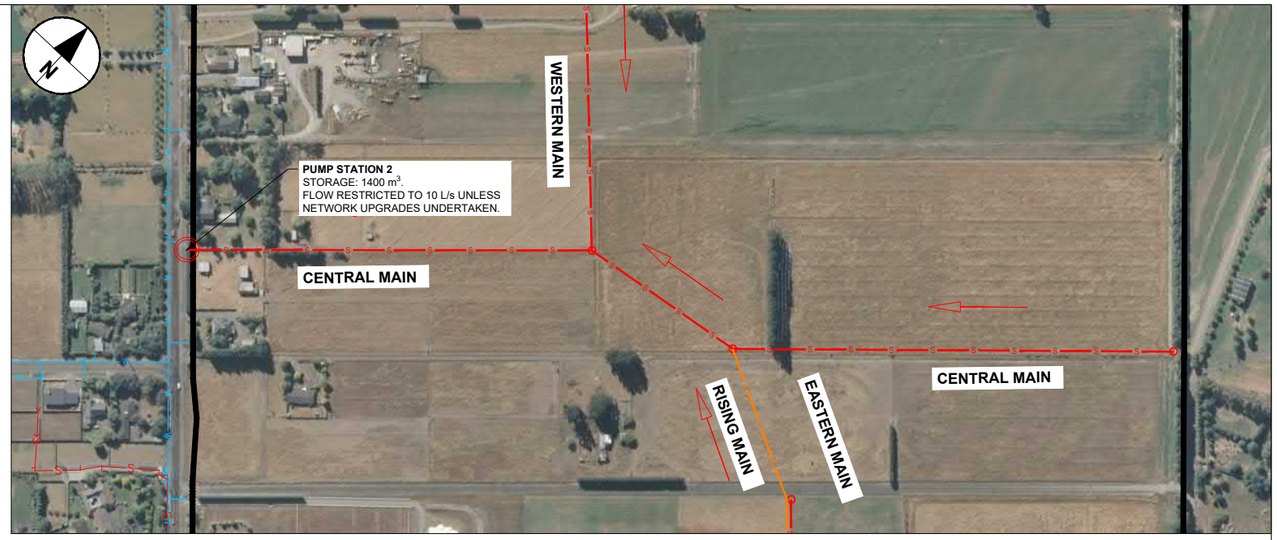


0 125 250 m

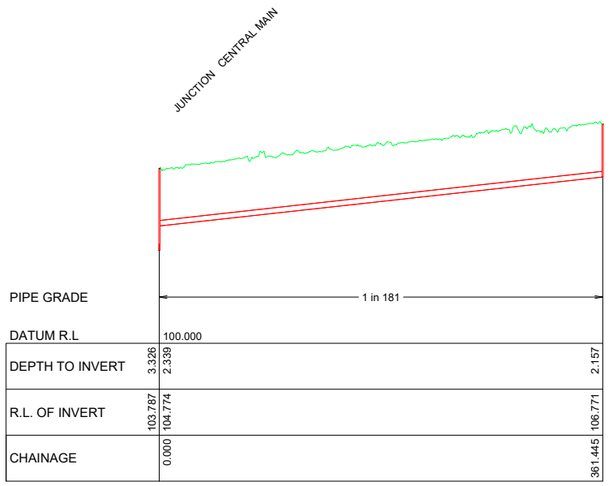
PLAN: WESTERN MAIN, PUMP STATION LAYOUT

Scale 1:2500 m



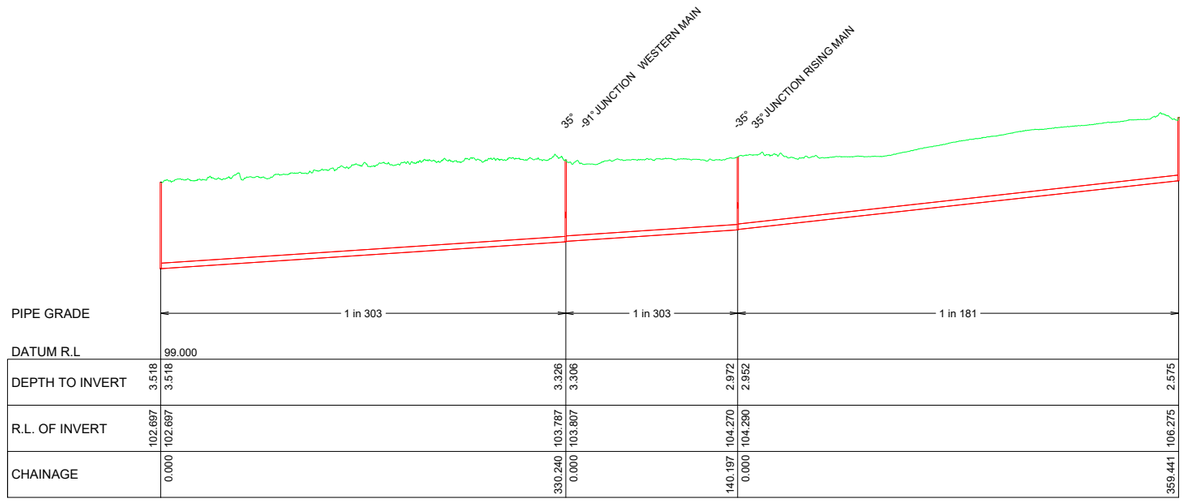
PLAN: CENTRAL MAIN, PUMP STATION LAYOUT

Scale 1:2500 m



LONG SECTION: WESTERN MAIN, PUMP STATION LAYOUT

Scale 1:2500 H, 1:125 V



LONG SECTION: CENTRAL MAIN, PUMP STATION LAYOUT

Scale 1:2500 H, 1:125 V

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER WITH PUMP STATIONS SECTIONS 1 OF 4

SHEET NUMBER

60624586-SHT-CI-0106

ISO A1 594mm x 841mm

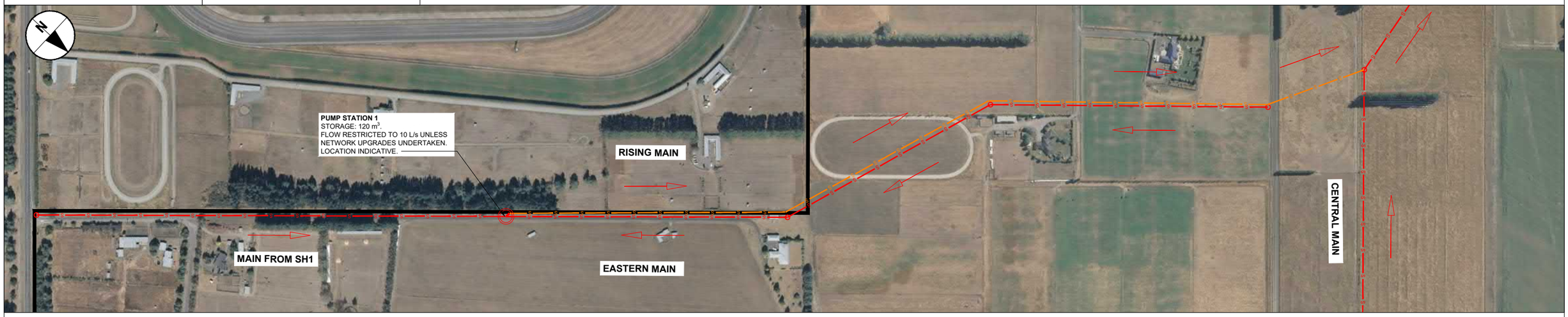
LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER
- CONCEPT RISING MAIN

NOTES

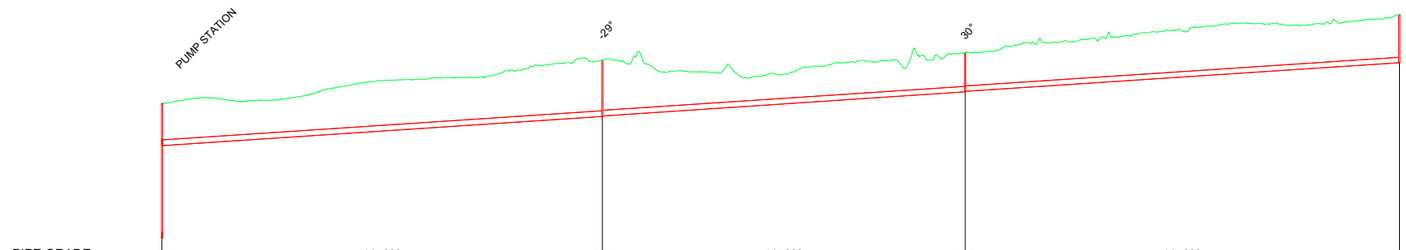
1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
2. DETAILED LOCAL RETICULATION LAYOUT TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. THE CONCEPTS PRESENTED HERE ARE BASED ON CURRENT INFORMATION AVAILABLE. FURTHER INVESTIGATION SHOULD BE CARRIED OUT.

0 62.5 125 m



PLAN: EASTERN MAIN, PUMP STATION LAYOUT

Scale 1:2500 m



PIPE GRADE		1 in 303										1 in 303										1 in 303	
DATUM R.L	95.000																						
DEPTH TO INVERT	1.669	1.704									2.297	2.277									1.593	1.573	1.947
R.L. OF INVERT	101.306	101.271									102.456	102.476									103.453	103.473	104.641
CHAINAGE	0.000										358.992	0.000									295.966	0.000	353.997

LONG SECTION: EASTERN MAIN, PUMP STATION LAYOUT

Scale 1:2500 H, 1:125 V

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PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER WITH PUMP STATIONS SECTIONS 2 OF 4

SHEET NUMBER

60624586-SHT-CI-0107

ISO A1 594mm x 841mm

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- CONCEPT SEWER
- CONCEPT RISING MAIN

NOTES

1. FINAL SIZING, DEPTHS AND LAYOUT OF ALL MAINS AND STRUCTURES TO BE CONFIRMED.
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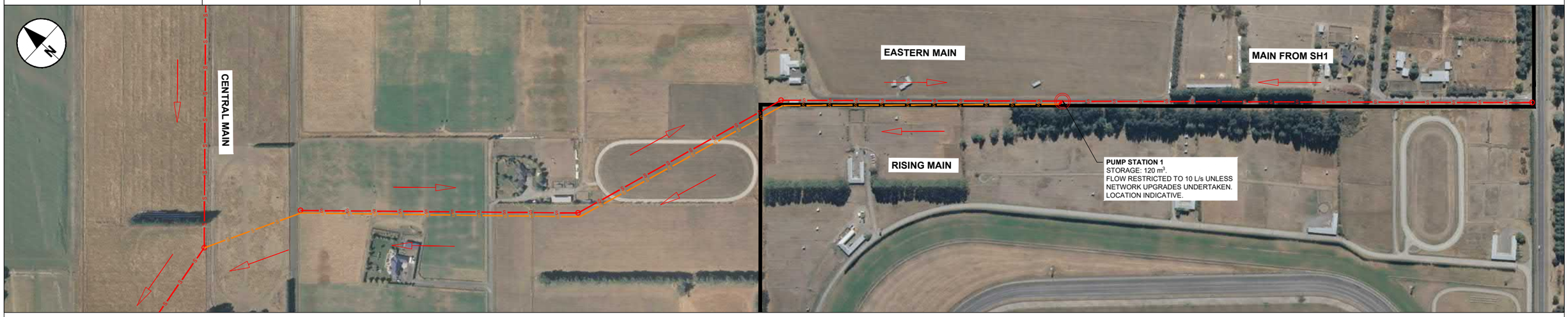
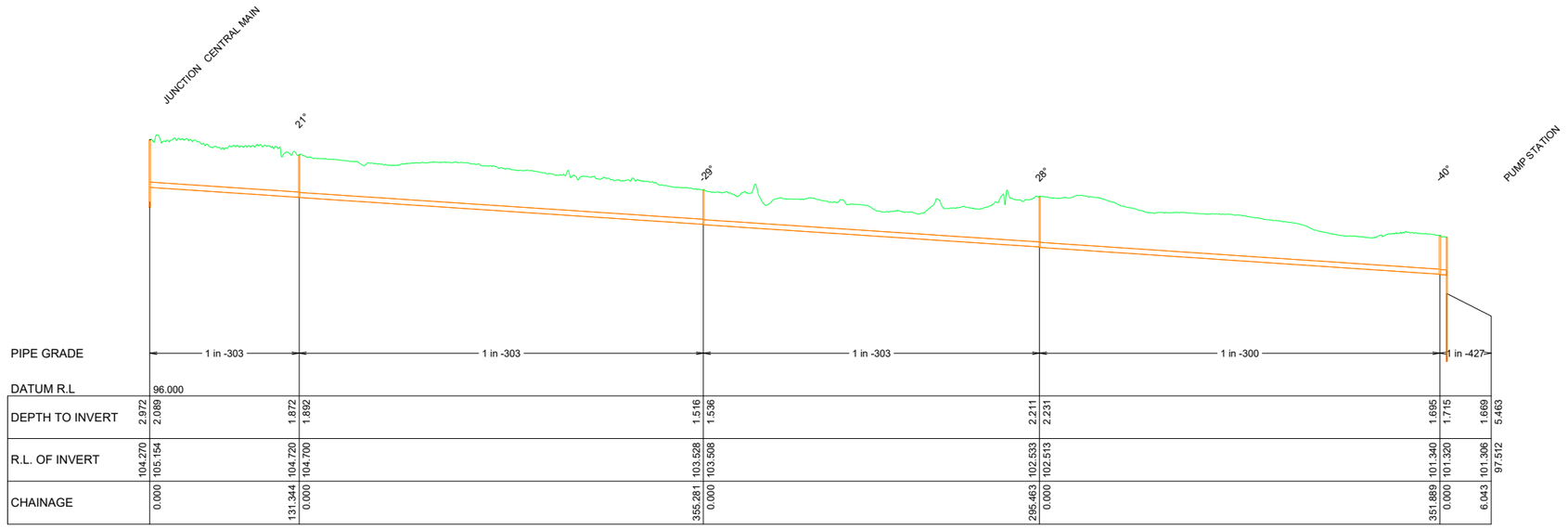


PLAN: RISING MAIN, PUMP STATION LAYOUT

Scale 1:2500 m



PIPE GRADE		1 in -303				1 in -303				1 in -303				1 in -300				1 in -427			
DATUM R.L	96.000																				
DEPTH TO INVERT	2.972	2.089			1.872	1.892			1.516	1.536			2.211	2.231			1.695	1.715		1.669	5.463
R.L. OF INVERT	104.270	105.154			104.720	104.700			103.528	103.508			102.533	102.513			101.340	101.320		101.306	97.512
CHAINAGE	0.000				131.344	0.000			355.281	0.000			295.463	0.000			351.889	0.000		6.043	

LONG SECTION: RISING MAIN, PUMP STATION LAYOUT

Scale 1:2500 H, 1:125 V

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PROJECT NUMBER

60624586

SHEET TITLE

WASTEWATER WITH PUMP STATIONS SECTIONS 3 OF 4

SHEET NUMBER

60624586-SHT-CI-0108

DRAFT

Appendix F

Stormwater Plan

ISO A1 594mm x 841mm

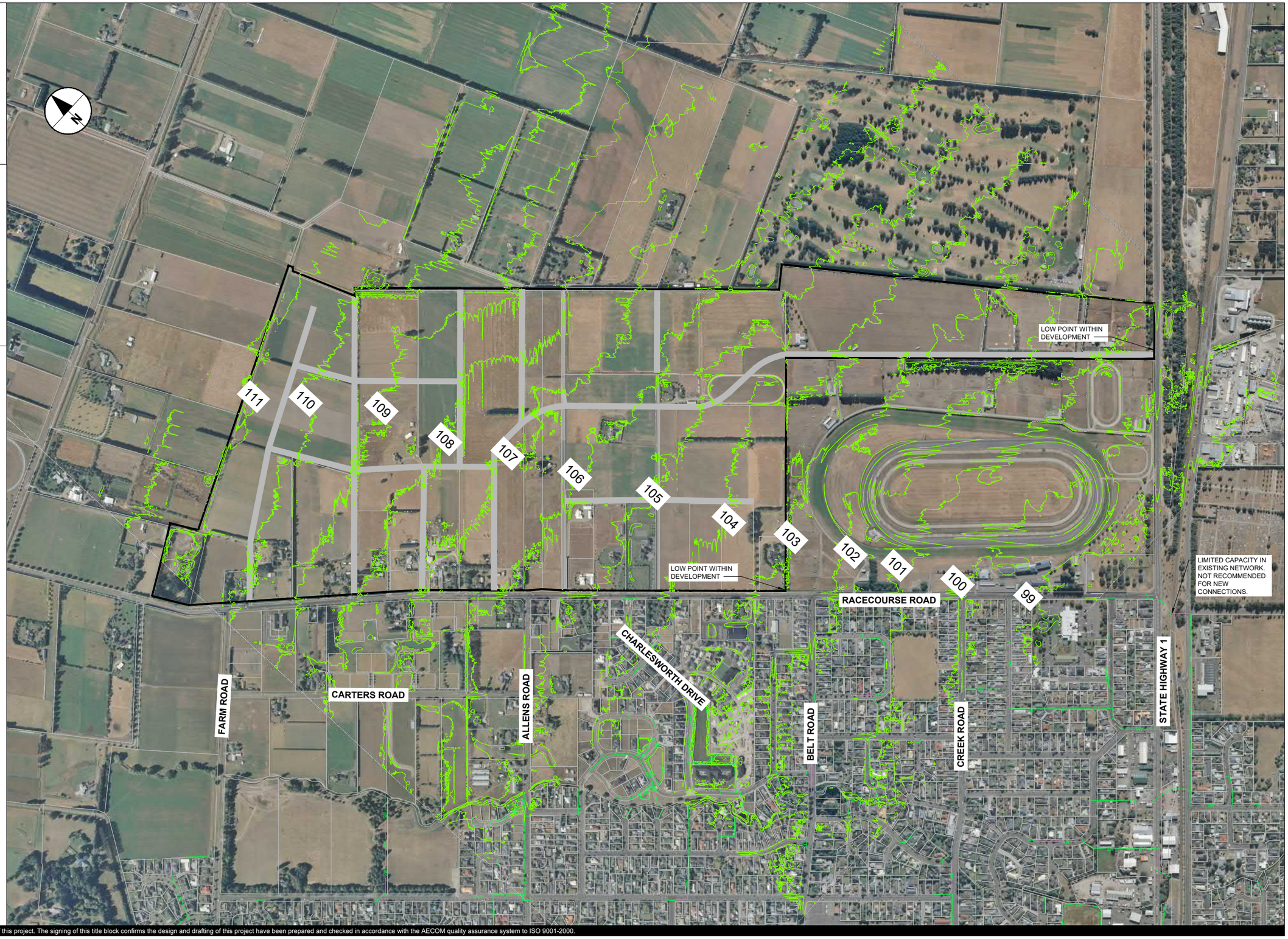
LEGEND

- EXISTING WATER SUPPLY
- EXISTING STORMWATER
- EXISTING SEWER
- EXISTING CONTOURS
- DEVELOPMENT BOUNDARY
- CONCEPT ROAD

NOTES

1. ALL CONCEPT MAIN ROADS REQUIRE SWALES TO CONVEY RUNOFF TO STORMWATER BASINS.
2. STORMWATER BASINS ARE REQUIRED WITH DEPTH OF 1 m AND A COMBINED AREA OF 10.5 - 11.4 ha (DEPENDENT ON DEVELOPMENT DENSITY). STORMWATER BASIN LOCATIONS TO BE CONFIRMED SUBJECT TO ROAD LAYOUTS AND STAGING.
3. OVERLAND FLOW ENTERING THE DEVELOPMENT FROM UPSTREAM IS YET TO BE QUANTIFIED. ADDITIONAL CONVEYANCE AND SOAKAGE AREAS MAY BE REQUIRED.

0 125 250 m



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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	15/05/2020	CONCEPT FOR COMMENT

PROJECT NUMBER

60624586

SHEET TITLE

STORMWATER PLAN OVERVIEW

SHEET NUMBER

60624586-SHT-CI-0300