ANNEXURE 6

Water and Wastewater Services Report

Services Report: Potable Water and Sewage
Denwood Plan Change
Denwood Trustees

Report ref:
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Revision 3

aurecon

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0	20th December 2010	Draft Revision for Client Review	LT	LT		
1	20 July 2011	Addendum	BDT	BDT	BDT	BDT
2	08 December 2011	Addendum	BDT	BDT	BDT	BDT
3	13 June 2012	Addendum	BDT	BDT	BDT	BDT

Contents

1. Site Overview

1.1 Introduction

The Denwood Trustees propose re-zoning land at Springs Road, Lincoln from Rural Outer Plains to a Rural-Residential zone to enable development of a rural residential subdivision for approximately 115 lot rural-residential subdivision with an average lot size of around 4,300m^2.

A number of options exist for sewage and potable water infrastructure to service the proposed development.

1.2 Site Description

The site is located just south of the Lincoln University, and is bounded by land rezoned under PC 7 as LZ and B2 to the east, the University to the north (with an unused rail corridor forming the northern boundary), an unnamed stream to the west, and farmland to the south. On the opposite side of Springs Rd, Lincoln Land Developments are developing a significant residential subdivision.

The site is relatively flat with a crest running north-south near the eastern end of the site. The crest is approximately 2 - 3 metres higher than the low points on the western boundary of the site. A drain runs from the university onto the site before turning westwards to the stream on the boundary.

An existing house and associated farm buildings are located near the eastern end of the site.

1.3 Ground Conditions

A full geotechnical investigation has not been undertaken at this site. However, a desktop analysis has been undertaken. This analysis has found that there is a predominance of gravels close to the surface, ground waters were around 4.0m below ground level (however variations are anticipated), and fine grained sediments occurring close to the surface.

The current landowner of the Denwood site expressed the view that the site is generally drier than the LLD site. For further information on ground conditions at this site, refer to the Pattle Delamore Partners report *Feasibility of Stormwater Management for the Proposed Denwood Trustees Development.*

2. Wastewater Reticulation

2.1 Background Information

Lincoln wastewater is currently pumped to a treatment site located to the east of the proposed development. Treatment consists of three aeration tanks, followed by an oxidation pond. Effluent from the oxidation pond is pumped to Christchurch City for further treatment and disposal. As part of the Selwyn District Council's upgrade plans, there are currently some changes to this reticulation, and Lincoln wastewater will ultimately be pumped to Rolleston for final treatment and disposal.

The Selwyn District Council has expressed that they would want to minimise inflow and infiltration of groundwater into the reticulation, therefore alternatives to conventional sewer could be considered. The SDC would also prefer the number of pump stations to be kept to a minimum.

The Living Z and Business 2 zoned land adjacent to the proposed development will need to be serviced by wastewater mains, therefore our proposed solution takes this into consideration.

2.2 Design Flows

Design wastewater flows were calculated using the Selwyn District Council Engineering *Code of Practice*. Predicted flows are presented in Table 1 below. "ASF" denotes Average Sewage Flows, and represents the average daily quantity of wastewater, while "MSF" denotes Maximum Sewage Flows and represents the peak flows from the development.

Table 1 - Sewage Infrastructure Design Parameters

Average Persons per Lot	Estimated Daily Water Usage per Person (L)	Peak / Average Ratio	Infiltration Dilution and Inflow Ratio	Total Number Lots	ASF (m^3/day)	MSF (L/S)
2.7	220	2.5	2	115	68.31	3.95

2.3 Existing Downstream Reticulation

Wastewater mains do not pass this site in Springs Road. The closest sewer main to the proposed development is a 150mm diameter concrete main from the Lincoln University, conveying wastewater to a pump station at the end of Marion Place. The pump station pumps wastewater across the Lincoln Land Development (LLD) site to the treatment facility south of Lincoln. The Selwyn District Council has confirmed that the Lincoln University main is currently operating at or above full capacity.

The Lincoln Land Development (LLD) site will eventually have full wastewater reticulation in close proximity to the Denwood site. The LLD project is being rolled out over several phases however, and may take a number of years before the reticulation is within the vicinity of the Denwood site.

A new treatment plant is to be constructed at Rolleston and will receive wastewater from Lincoln. A new trunk rising main will be constructed which will convey wastewater from the existing treatment facility to Rolleston. It is possible the trunk main will be passing within close proximity of the site. While it is technically possible to pump directly into this wastewater main, it would require high pressure pumps in the Denwood site. The Selwyn District Council has stated they would prefer all of Lincoln's wastewater to drain to the Lincoln treatment site for buffering and monitoring purposes, prior to being pumped to the new Rolleston facility.

2.4 Options for Disposal and Conveyance from Site

Options for servicing the site for wastewater include disposal within the site or discharging to the Selwyn District Council sewerage network. Due to the topography of the area, discharging to the SDC network would require a pumping station.

On-Site Treatment and Disposal

On-site treatment and disposal is theoretically possible on each individual property or in a communally located disposal field. However, individual on-site disposal would not be desirable due to the number of lots proposed, and issues that could arise from separation distances between boundaries and other disposal fields. A communal disposal field would use a large area. Further ground investigations would be required if this option was to be explored further.

Pump Wastewater to SDC Network

A new pump station near the western end of site could pump wastewater to the Lincoln town reticulation. The Living Z and Business 2 land adjacent to the site will also require a pump station at Springs Road, and the sewage from this site could also be pumped to this pump station before being sent through to the treatment plant.

There are several options available for the alignment of the rising main conveying wastewater to the SDC network. These are shown on the plans in Appendix A, and are summarised as follows:

1. Discharge directly into the Marion Place Pump Station;
    1.1. Upgrading the wastewater gravity pipe from the Lincoln University into the Marion Place Pump Station and discharge into the gravity pipe;
    1.2. Discharge directly into the Lincoln reticulation in the intersection of Gerald St and Marion Place,
2. Discharge into any future proposed LLD reticulation.

The above options are further discussed as follows:

1 A new rising main from the Denwood site could be constructed all the way to the Marion Place Pump Station. The available capacity at Marion Place to accept additional flows from this site has not been fully assessed. Two possible alternative pipeline routes conveying wastewater to the Marion Place Pump Station are described below:

1.1 The Lincoln University gravity main to the Marion Place pump station is conveyed over private land owned by Lincoln University and Ngai Tahu Properties. The rising main would discharge into this main. This would require the main to be upgraded, and the existing easement on this land may need to be modified or extended. The Selwyn District council is open to the possibility of upgrading the Lincoln University pipe; however more consultation will be needed to confirm the feasibility of this option.

1.2 To discharge into the Lincoln network at the intersection of Gerald St and Marion Place, the rising main would be routed up Springs Rd to the roundabout at the intersection with Gerald St. The main would then travel eastwards down Gerald St to the sewer network. As the main could be in the road reserve the whole way, obtaining permission for land use should not cause issues. The route is approximately 1.5 km long. As potable water may potentially need to be connected around this area, trenching could be shared to reduce costs.

2 Once the LLD site is developed, the shortest route for wastewater discharge from the Denwood site would be into the LLD reticulation. For this option to be feasible, the Denwood site would need to be developed after works on the LLD site are well advanced, as the proposed LLD roading and reticulation layouts are subject to change. These would have to be established for the rising main route to be finalised. However, the western part of the LLD site will not be

developed immediately, therefore discharging into the LLD reticulation is not viable in the short term.

2.5 Options for Reticulation within Site

A pump station is required to pump from this site to the SDC network. The following subsections outline the alternatives for connecting to this pump station.

2.5.1 Gravity Reticulation and New Pump Stations

A conventional gravity reticulation could be installed to service the development.. If the gravity reticulation follows the natural topography of the land, a pump station is required at the low point

By having a pump station in the south-west corner of the development, trench depths could be kept to around two metres deep, keeping most of the reticulation above groundwater and the potential for inflow and infiltration will be reduced.

2.5.2 Vacuum Sewer System

A vacuum sewer system consists of a central vacuum pump station that creates a vacuum in the pipe network. A series of valve pits collect wastewater from the residential dwelling and propel the wastewater to the central pump station, from where the wastewater is conveyed to the treatment plant.

A vacuum sewer system may have the benefit of keeping more of the network above the groundwater level, and may save trenching costs due to the ability to have narrower and shallower pipes than a conventional gravity system. Drawbacks of the system would be the need for such a system to have trained operators who are familiar with the technology.

2.5.3 Pressure Reticulation with Proprietary Macerating Pump Stations

Proprietary pump stations for each individual lot could be used to pump wastewater to the new pump station in the east of the site. A pressurised reticulation would have the benefit of keeping the wastewater pipes relatively shallow, therefore reducing the potential for infiltration.

The need for each lot owner to be responsible for a pump station may be viewed as a negative by prospective purchasers and would likely affect the property values..

2.6 STEP System

A Septic Tank Effluent Pumped (STEP) system consists of individual primary treatment, with the treated effluent pumped into a pressurised on-site reticulation network. This would remove solids from the wastewater and remove the need for macerating pumps, as well as reducing the treatment load at the wastewater treatment plant.

Having individual septic tanks places the responsibility for operation and maintenance with the property owners. With this number of properties, this could eventually lead to environmental problems if any tanks were neglected. Also, as commercially available septic tanks typically range in depth from 1.6m to 2.7m, installing septic tanks may penetrate the confined groundwater layer. This would have the potential to cause buoyancy problems with the tanks.

As the wastewater will receive some treatment at the Lincoln aeration tanks and oxidation ponds, and further treatment at the proposed new Rolleston Treatment Plant, on-site septic tanks are not considered necessary.

2.7 Wastewater Options Summary

Based on available information, the most feasible option for wastewater servicing of the development is to have a conventional gravity wastewater network, draining to a new pump station in the south-

west and of the development. This would then be pumped to the nearest available part of the SDC network (i.e. Marion St Pump Station).

A vacuum system or a pressure reticulation does not present itself as a superior option.

3. Potable Water Supply

3.1 Background Information

The water supply for Lincoln is currently provided by three bores. Water is sourced from secure aquifers, which means that no treatment is required prior to distribution of the water within the reticulation network.

The maximum consented output for the three existing Lincoln bores is 35 L/sec for the West Belt bore, 36 L/sec for Kildare Terrace and 9 L/sec for Cole Street (Mill Stream). Variable speed pumps are used with the West Belt and Kildare bores to meet the daily fluctuations in water demand. Therefore there is a theoretical maximum of 80 L/s available to this water supply.

We have also been advised that the greatest water demand previously recorded within Lincoln was 48 L/s, which occurred during February 2008. This suggests that there is significant capacity (up to 32 L/s) remaining within the existing system.

Other residential developments in Lincoln will put more demands on the existing Lincoln water supply and more capacity in the network will be required at some stage, most likely through the provision of a new bore.

The Selwyn District Council has accepted development contributions from other developments in the area to go towards the costs of developing a new source, and has indicated this approach could be satisfactory for the Denwood site.

3.2 Design Flows

Table 2 provides the predicted water demand for two scenarios; a full pressure supply, and a restricted supply with storage on-site. These scenarios are discussed in further detail in the following section.

Flow per property is obtained from Chart 2, Part 7 of the CCC Infrastructure Design Standard. Fire fighting flow is obtained from the New Zealand Fire Service *Firefighting Water Supplies Code of Practice,* for a fire water classification FW2.

Table 2: Predicted Potable Water Demand

Type of Supply	Flow per Property	Fire Fighting	Peak Intensities Water Demand
Full Pressure	0.2 L/sec	25 L/sec flow	36.5 L/sec‡
Restricted	3 m^3/day	45 m^3 storage	3.99 L/sec

3.3 Existing Water Supplies and Reticulation

The Lincoln Township reticulation extends down Gerald St to the intersection with Marion Place with a 150mm main, approximately 1.5km from the gate to the Denwood site. Beyond Marion Place towards Lincoln University, businesses (Crop and Food etc) and the University are supplied by privately owned bores. Refer to the Water and Wastewater Servicing Options plan in Appendix A for further details.

‡ Full pressure flows for the total development are the sum of the fire fighting requirements and half of the peak flow for the development of 23 L/sec.

The proposed Lincoln Land Developments subdivision will be connected to the Lincoln Township reticulation and will eventually extend over to Springs Rd. As the development is to be constructed in stages over a number of years, it could be some time before the reticulation comes within close proximity of Springs Rd.

3.4 Source Options

Water can be supplied to the development from either re-developing the two existing bores on site, or by connecting into the potable water mains in Lincoln Township.

Source from Existing Bores on Site

The two existing wells on site (M36/1414 and M36/1415 on Environment Canterbury's bore register) could be used to supply water for the development. A search of Environment Canterbury's online GIS system found the bores to be drilled to a depth of 20 metres. At this depth, the wells would not be classified as a secure water source.

Source from Lincoln Township Supply

The 150mm main could be extended down Springs Rd from Ellesmere Junction Rd to service the proposed development, as well as the adjacent Living Z and Business 2 zoned land adjacent to the site. Refer to the water main routes on the Water and Wastewater Servicing Options Plan, Appendix A.

The site could alternatively be connected into the Lincoln Land Development reticulation. However as it could be some time until the Lincoln Dairy Block development reaches Springs Rd, the Denwood site would need to be developed after the LLD site works are completed. The road layout for the LLD is not yet finalised, and the roading connection to Springs Rd may be subject to change.

3.5 Reticulation and Supply Options

Restricted Supply

A restricted supply would require a flow-restricted supply of $3m^3$ per day per property. On-site storage would be required to provide at least two days' worth of storage. The New Zealand Fire Service *Firefighting Water Supplies Code of Practice* requires $45m^3$ of storage within 90 metres of a dwelling. There are several options for providing this storage volume.

A restricted water supply could be achieved with pipe sizes up to 50mm in diameter.

Full Pressure Supply

A full pressure water supply would be required to supply peak and fire fighting flows as presented in Table 2, through a conventional reticulated pressure pipe network.

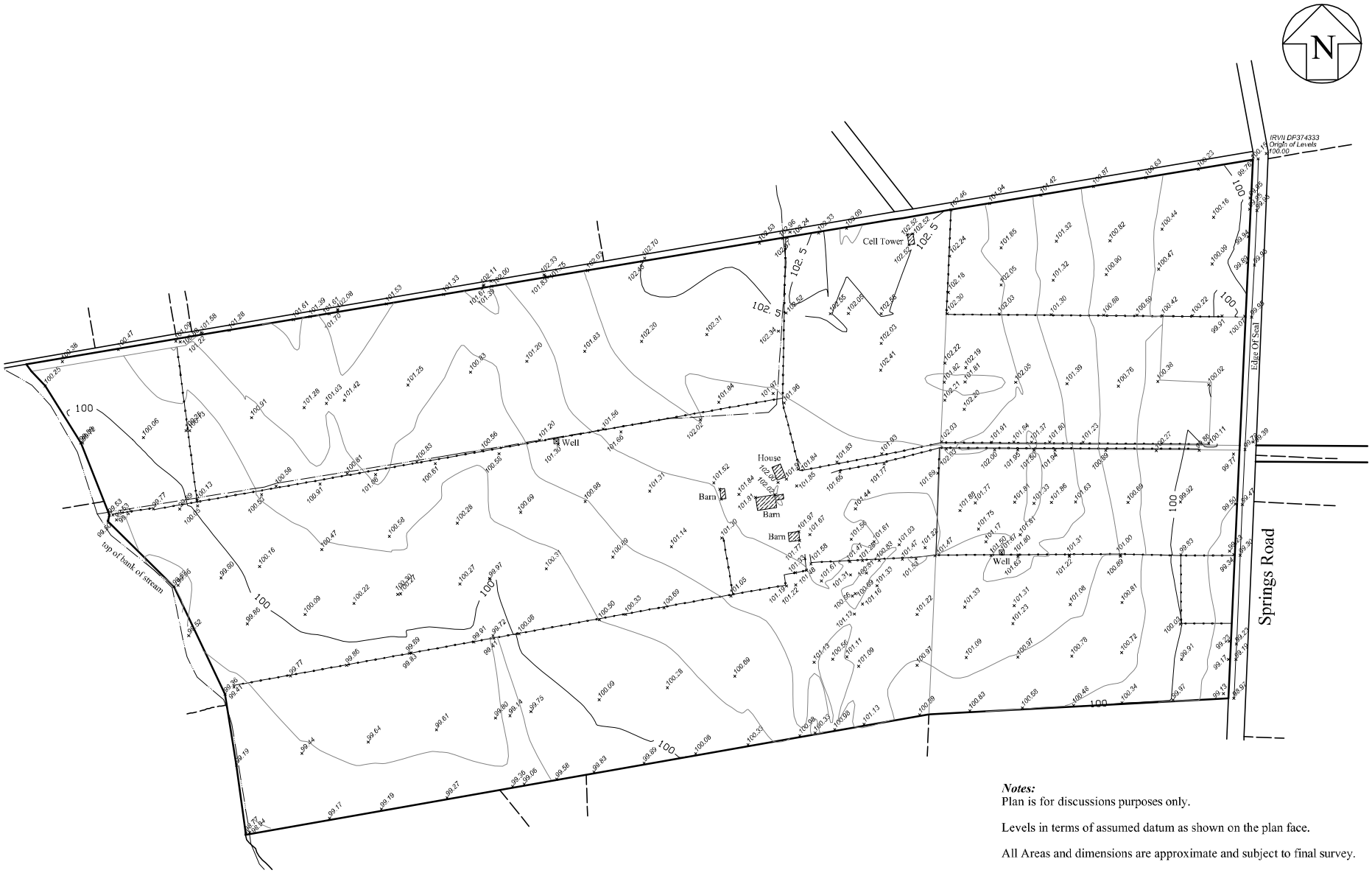
The firefighting code of practice requires hydrants within 135 metres of each dwelling, plus a second hydrant within 270 metres. A full pressure supply will require pipe sizes up to 150mm in diameter.

3.6 Water Options Summary

The most practical option for servicing the proposed development with potable water is to extend the 150mm main down Ellesmere Junction Rd/Gerald St to the Springs Road roundabout, then down Springs Rd to the proposed development. This would also be able to service any development in the Living Z and Business 2 zoned land adjacent to the site. The main would then be able to be connected into the Lincoln Land Developments water reticulation once that main comes within proximity of Springs Rd to increase the resilience of the system.

The connecting water mains will need to have adequate capacity for a full pressure supply for the LZ and B2 land. Therefore, a full pressure supply for the Denwood site can practically be achieved as an extension to this requirement.

Appendix A:
Water and Wastewater Servicing Options Plan



Notes:
Plan is for discussions purposes only.

Levels in terms of assumed datum as shown on the plan face.

All Areas and dimensions are approximate and subject to final survey.

Rev	Date	By	Amendments
A	08/10/09	ADC	Proposed Road/Eng Alignment

Outline Development Plan - Springs Road Lincoln

Lots 1 & 4 DP 12928, Lots 1 & 2 DP 54824 & Lots 1 & 2 DP 26815

Springs Road Lincoln, Total Area 83.49120ha

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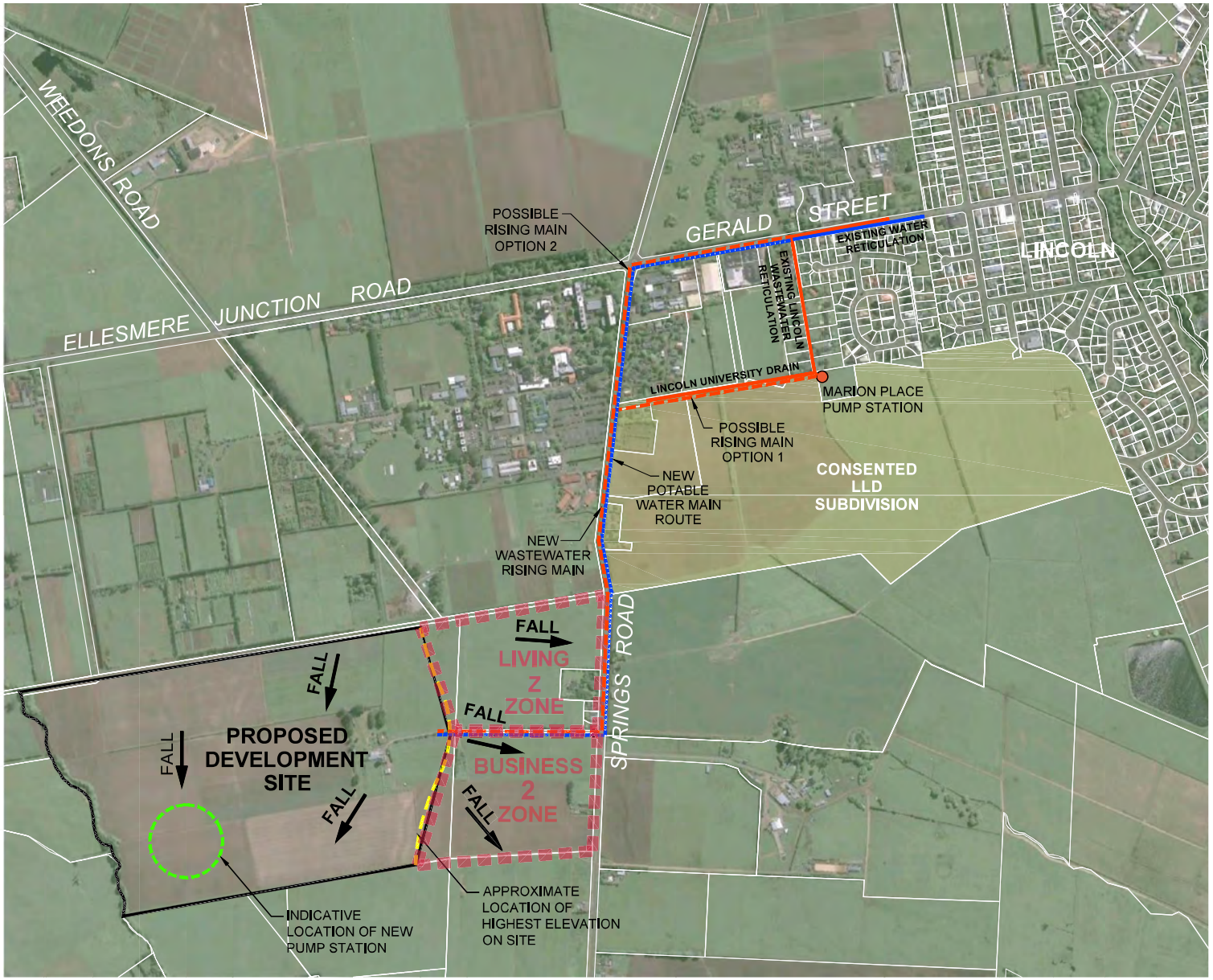
Scale	Job Ref
1 : 3000	9132/01
Date	**Sheet** / **Revision**
Oct 2009	1 of 1 / A / A2



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NORTH

LEGEND

- EXISTING WASTEWATER RETICULATION
- POSSIBLE WASTEWATER RETICULATION
- EXISTING POTABLE WATER RETICULATION
- POSSIBLE POTABLE WATER ROUTE
- EXISTING PUMP STATION
- PROPOSED PUMP STATION
- PROPOSED SDC ZONE BOUNDARY

No.	Date	Revision Details	Drn.	Ver.	App.
B	08.12.11	AREA AMENDED	BDT	BDT	BDT
A	17.12.10	ISSUE	RD	LT	CHT

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Project:

DENWOOD PLAN CHANGE SPRINGS ROAD LINCOLN

Drawing Title:

WATER & WASTEWATER SERVICING OPTIONS

Drawn	RD	Date	
Designed	LT		
Verified	LT	Scale	1:10 000
Approved	CHT	Sheet Size	A3
Project No.	210740	Drawing No.	C 01
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