Infrastructure Report
160 Bangor Road, Darfield
Private Plan Change for
Mrs GM Logan

FINAL REPORT

9 February 2015

Client:	Mrs GM Logan
Document Type:	Infrastructure Servicing Report
Document Number:	053-2014 Mrs Logan - 160 Bangor Road
Prepared by:	Victor Mthamo
Signature:	
Date:	9 February 2015

Contact
Email – victor.mthamo@reeftide.co.nz
Phone +64-27 6736006

Preface

1. Introduction

Mrs GM Logan ("the Applicant") is seeking a change to the Selwyn District Council Plan to facilitate a proposal for residential development at 160 Bangor Road in Darfield. The land is currently zoned Living Deferred under the Selwyn District Plan and the applicant seeks to have the deferment lifted to allow future subdivision.

This report assess the infrastructure requirements and availability and makes recommendations for the proposed plan change.

2. Potable Water Supply

2.1. Available Capacity and Plan Change Area Requirements

The Council has confirmed that there is capacity to service the plan change area. However, Council would prefer to *"see all sections above 2000 m^3 on restrictors (2m^3/day)"*.

From Council's feedback there is no reason why the development should not proceed based on a restricted water supply system.

If this option is pursued the flow to the development will be 3 L/s over 24 hours in order to supply each property with the 2,000 L/day that Council has suggested.

The applicants, however, notes that the average water demand in Darfield is 2,137 L/day. As the proposed lots are larger than the typical section in Darfield, the applicant requests an average allowance of 2,200 L/day.

A common 45 m^3 storage tank will be required to meet the New Zealand Fire Services Firefighting Water Supplies Code of Practice. An alternative to this is for individual property owners to have on-property tanks to meet their own fire requirements.

A restricted water supply could be achieved with pipe sizes of less than PN80 in diameter.

3. Stormwater Collection, Conveyance, Treatment and Discharge

3.1. Developed Site Stormwater

The primary stormwater system will be designed and constructed to handle at least the 2% AEP flows.

3.1.1. Primary Stormwater

Roof stormwater is considered to be "clean' requiring no treatment and will therefore be discharged directly to ground via standard soakpits.

Driveway runoff will be directed to the grassed/landscaped areas adjacent to the driveways and discharged the ground.

Road runoff will be directed to the road side swales for treatment and discharged to ground via soakage pits.

3.1.2. Secondary Flows

Secondary flows from the individual lots will flow towards the main roads where it will flow towards the roadside swales i.e. away from the building platforms to prevent flooding as discussed earlier.

3.2. Construction Stormwater

Earthworks involve the general clearance of vegetation and topsoil stripping, followed by general recontouring to provide the basis for the layout of the lots and infrastructure. This will be confirmed when the subdivision layouts have been defined.

3.3. Stormwater Discharge Consents

Stormwater discharge consents will be sought from Environment Canterbury at the subdivision stage.

3.4. Summary

The proposed system will be consistent with Selwyn District Council's requirements.

4. Wastewater Servicing

4.1. Existing Situation

The township of Darfield has no reticulated wastewater system. Individual properties are served by on-site wastewater treatment and discharge systems. Selwyn District Council was approached for its thoughts on a sewer system for the plan change area. There are no plans to implement a reticulated system in the short to medium term and rather *"Council has established a working party to determine Darfield's future sewer management strategy. For now assume septic tanks with the potential for a centralised system"*

4.2. Summary of the Preferred Wastewater Systems

The proposed wastewater treatment and dispersal system will consist of ***Individual On-site Aearated Treatment and Discharge Systems on Each Lot***. This will consist of the following:

- Primary treatment of raw wastewater via individual at-source sedimentation tanks and a coarse filter system;
- Secondary treatment of wastewater via an aerated treatment system on each lot; and,
- Land treatment via sub-surface drip irrigation at a maximum application rate of 5 mm/day over an area of 390 m^2 for each lot.

5. Power Supply and Telecommunications

5.1. Power Supply

A written request was sent Orion New Zealand Limited seeking confirmation of the feasibility of providing power to the plan change area. Orion were able to confirm that they can service the plan change area.

5.2. Telecommunications

Written confirmation was sought from Chorus, Vodafone and Enable New Zealand.

Vodafone and Enable confirmed that they did not cover the township of Darfield.

Chorus were able to confirm that the site can be serviced.

6. Conclusion

This report has assessed the engineering infrastructure requirements for the proposed Logan Plan Change area. The analysis has demonstrated that the plan change area is serviceable for Water, Stormwater and Wastewater, Power and Telecommunications.

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[1] http://www.selwyn.govt.nz/__data/assets/pdf_file/0006/78819/5WatersAMP-pt2-web.pdf

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1 Introduction and Project Objectives

1.1 Project Background and Proposed Development

Mrs GM Logan ("the Applicant") is seeking a change to the Selwyn District Council Plan to facilitate a proposal for residential development at 160 Bangor Road in Darfield. The land is currently zoned Living Deferred under the Selwyn District Plan and the applicant seeks to have the deferment lifted to allow future subdivision.

It is expected that the development area will yield up to 130 lots, with a mix of three lot sizes - being 0.3 ha, 1.0 ha and 1.8 ha. **Appendix A** shows the Outline Development Plan for the project site.

1.2 Purpose of the Report

Mrs GM Logan has engaged Reeftide Environmental & Projects Limited (Reeftide) to scope the infrastructure requirements in support of the proposed Private Plan Change at 160 Bangor Road in Darfield.

This infrastructure servicing report covers the following;

- Potable Water Supply;
- Stormwater;
- Sewerage;
- Power Supply/Electricity Network; and,
- Telecommunications Network.

Roading, Site Contamination and Geotechnical work are only referenced within this report. Detailed information relating to these infrastructure topics are the subject of more detailed reports by others. These include;

- Roading and Traffic by Avanzar; and,
- Site Contamination Assessment by URS Limited.

1.3 Selwyn District Council's 5-Waters Strategic Focus

In August 2009, Selwyn District Council released its Five Waters Strategy document which had its "vision for the future for Community Water Supplies, Wastewater, Waterraces, Land Drainage and Stormwater".

In assessing the infrastructural options for the Logan Plan Change, Reeftide has taken into account the initiatives described in the strategic document. These include:

- Governance issues on who manages the water resources infrastructure and SDC's role;
- Using design parameters that are acceptable to SDC to ensure a consistent and cohesive approach to water allocation, design and management;
- Accounting for supply security and water quality;
- Adoption of the seven sustainability principles in assessing different options;
- Incorporation of the effects of Climate Change by using the rainfall data adopted by SDC for stormwater design; and,
- The Drinking Water Standards 2005/08 and The Health (Drinking Water) Amendment Act 2007.

1.4 Structure of the Report

This detailed design report is structured as follows:

Section 1: Introduces the Project and outlines the objectives and structure of the report.

Section 2: Provides a detailed description of the site focusing on matters that are relevant for the engineering services proposed in this report.

Section 3: Discusses Potable Water Supply.

Section 4: Discusses Stormwater Collection, Conveyance, Treatment and Discharge.

Section 5: Discusses Wastewater Servicing.

Section 6: Power Supply and Telecommunications.

Section 7: Consultation.

Section 8: Conclusions.

2 Description of the Site

2.1 Site Description and Location

The project site is located at 160 Bangor Road in Darfield. This is on a parcel of land legally described as Section 2 SO438579 which is at or about Map Reference Topo50 BX22:2603-8524. The land parcel has an areal extent of approximately 126.39 ha. The land parcel is within Selwyn District Council and its Valuation Number is 2420008202. The site location is shown in Figures 2.1(a) -2.1(b).

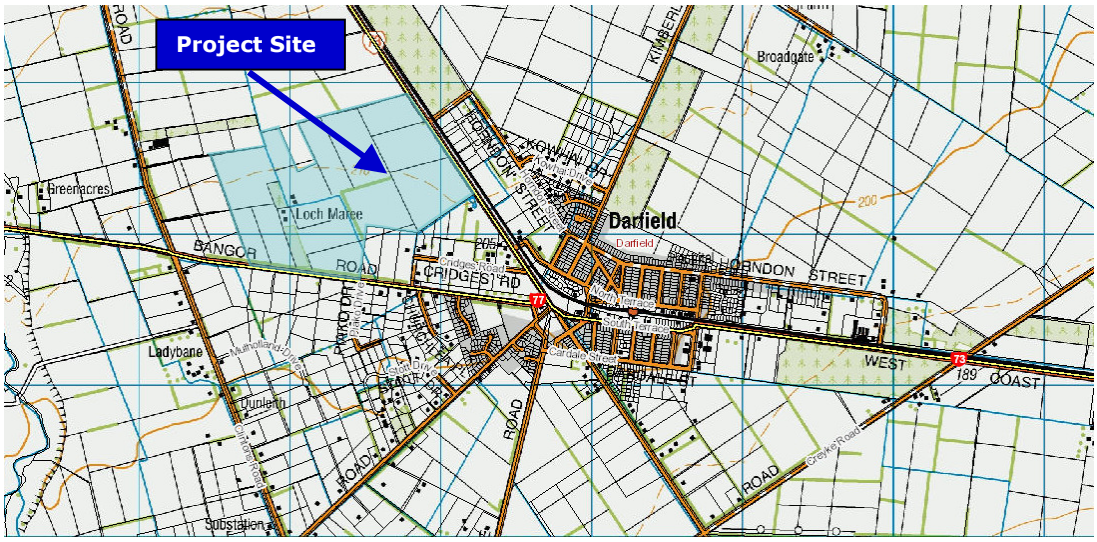


Figure 2.1(a) – Location of the Site

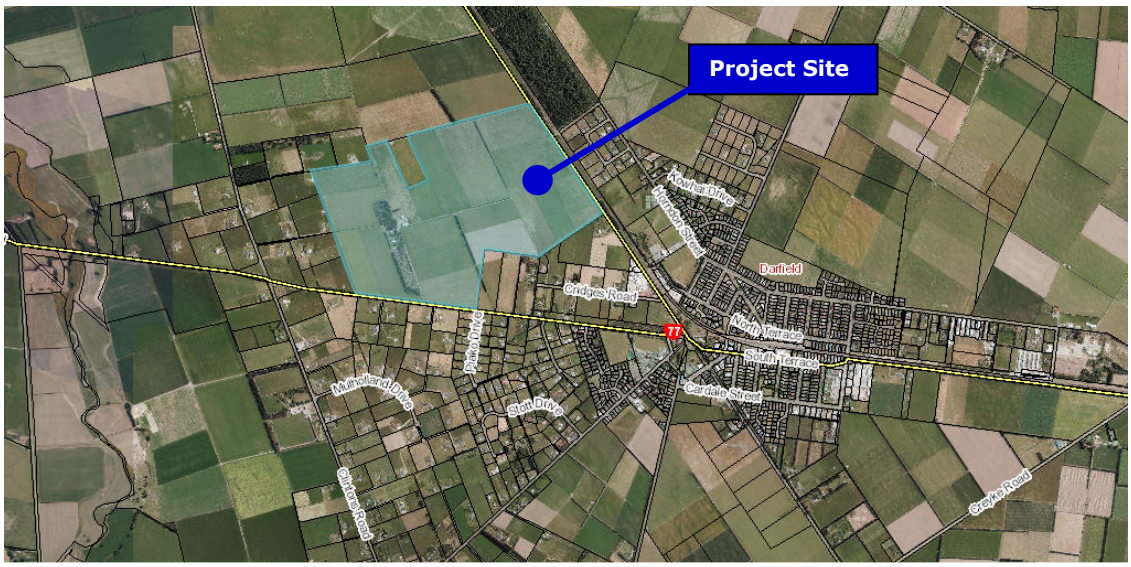


Figure 2.1(b) – Location of the Site

2.2 Landuse

2.2.1 At 160 Bangor Road

The site has been primarily a sheep farm for at least the last 20 years. The 126 ha block is divided and fenced into manageable paddocks, with laneways, mature shelter belts and small forestry blocks. Improvements include implement shed/barn, various useful utility sheds, existing dwelling and ancillary outbuildings.

2.2.2 Surrounding Properties and Landuse

The surrounding properties are residential lots, lifestyle blocks and sheep farms nearby.

2.3 Topography

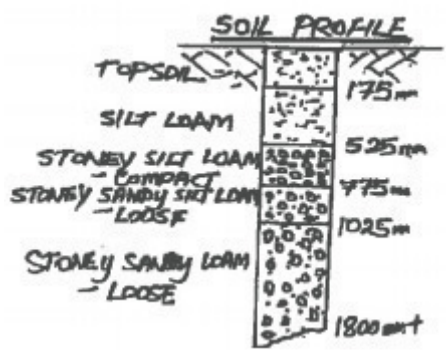
The site is generally flat (0.5-1% slope north to south). There are some minor undulations within the site but these are not significant enough to impact infrastructural provision and layouts. The site elevation is approximately around 200-205 m above sea level.

2.4 Soils

The Landcare Research S-Maps GIS describes the soils within the site as predominantly Lismore Shallow Silty Loams (90%) with the balance of the soils being moderately deep Templetons. Table 2.1 is an extract of the S-Maps soil characterisation for the site.

Table 2.1 – Characterisation of the Soils at 160 Bangor Road (Source: Landcare Research S-Maps)

Soils	Lismore shallow silty loam (90%), Templeton moderately deep silty loam (10%)
Dominant soil texture	Silty
Dominant soil drainage	Well drained
Dominant soil depth	Shallow (20-45 cm)
ECAN soil group	Light
Avg. PAW 30cm	59.00
Avg. PAW 60cm	86.00
Avg. PAW 1m	102.00
Confidence	Moderate
Major Relevant Soil Feature(S)	This soil is shallow (<45 cm to gravel), with a low to average water retention capacity. It is well drained with a moderately permeable subsoil. The top soil hydraulic conductivities are >$3.5x10^{-5}$ m/s and minimum infiltration is 126 mm based on data from consented discharges in and around the area taken from the Environment Canterbury GIS system. At greater than 0.5 m below the ground level, the infiltration rates to >600 mm/hr. Beneath the topsoil, there are no significant limitations to root growth.

2.5 Surface Water

The nearest large water body is the Hawkins River which is approximately 2 km west of the project site. The Waimakariri River is at least 8 km north east of the site.

A water race enters the property from its northern boundary and exits on the southern boundary. Another water race enters the site from the south-eastern boundary of the property and runs west towards the centre of the block before draining to the southern boundary. The water races are used to provide stockwater. They have never been used for irrigation.

The water races are not part of the Canterbury Plains Enhancement Scheme and will therefore will not require piping. They will be retained purely for aesthetic purposes.

The site has not been identified as a flood area in the regional and district planning maps.

2.6 Groundwater

2.6.1 Groundwater Levels

The land within the project site sits on unconfined/semi-confined groundwater aquifers, with a low watertable. Figure 2.2 has been extracted from the Environment Canterbury GIS system and it shows the groundwater wells close to the project area.

The highest groundwater level in the wells in and around the site ranges from 106 – 150 m below the ground level average based on data on the ECan GIS system. Table 2.2 below shows some of the groundwater levels for some of the wells shown in Figure 2.2.

Table 2.2 – Details of Some of the Existing Wells Close to the Site

Well No	Well Owner	Distance (m) And Direction	Depth (m)	Highest Water Level (m)
L35/0277	R Logan	0 m. Within the Plan Change area	265	106
L35/0276	RM Stewart		28	N/A
L35/0980	SDC	30 m N from the nearest boundary	247	150
BX22/0006	SDC		245	135

N/A – Not available

2.6.2 Groundwater Flow Direction

The ECan GIS also shows that groundwater flows through the site in a general south easterly direction as can be seen from the piezometric contours in Figure 2.2.

2.7 Climate

Table 2.3 presents the climatic data for the project site. This has been taken from Darfield Station Number 4836.

Table 2.3 – Monthly Rainfall Data – Darfield Station Number 4836 (1970-2013)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	58	56	64	60	68	73	73	81	57	70	59	68
Evaporation	128	97	76	42	25	14	16	27	50	76	99	120

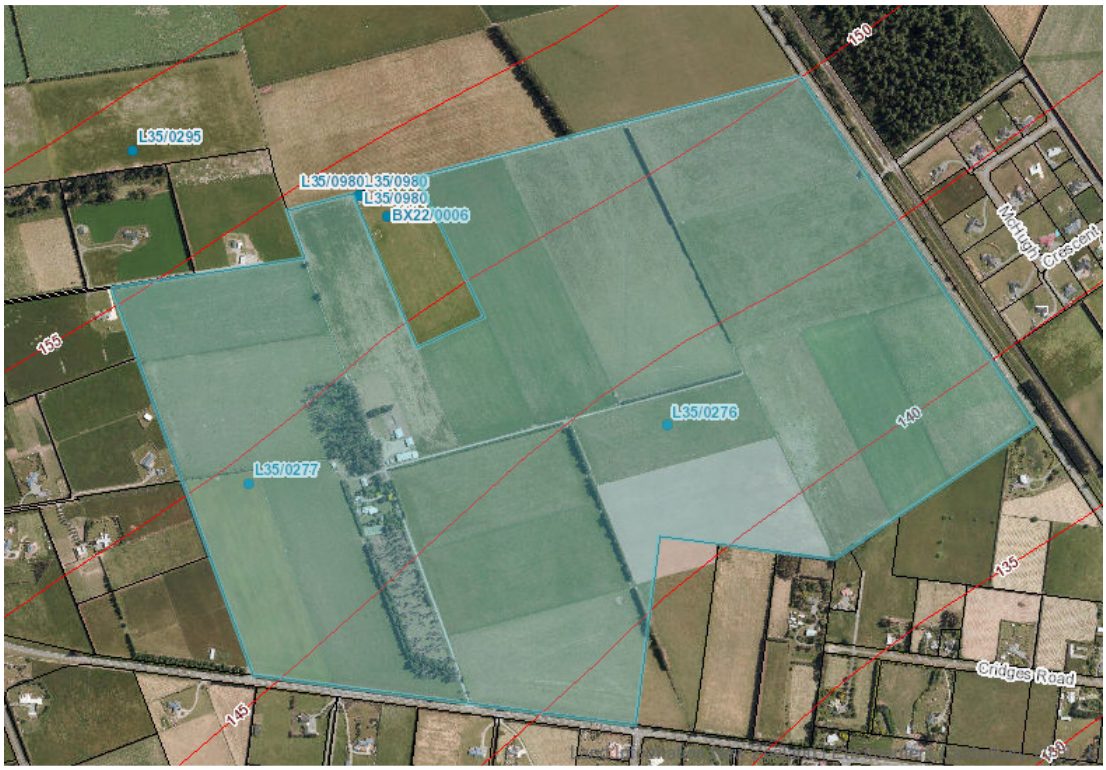


Figure 2.2 – Location of Wells Close to the Project Site

2.8 Rainfall Data

Selwyn District Council has produced a rainfall study specific to the Selwyn District. Environment Canterbury's Principal Hazards Analyst (Mr Tony Oliver) carried out a comparison of SDC's rainfall analysis with NIWA's HIRDS 3. It was noted that there is good agreement between the two studies for shorter duration rainfall events but the SDC rainfall was 10-15% lower for longer duration events.

For the purposes of the engineering assessment, the site's mean rainfall data used in this analysis has been derived from HIRDS 3. A climate change factor of 16% is proposed to be added to any future infrastructure designed using rainfall depths derived from HIRDS 3. Table 2.4 below provides a summary of the rainfall intensities for various durations.

Table 2.4 - Rainfall Intensities (mm/hr)

		Rainfall Durations									
					1hr	2hr	6hr	12hr	24hr	48hr	72hr
		10	**20**	**30**	**60**	**120**	**360**	**720**	**1440**	**2880**	**4320**
period /years	**2**	22.2	17.4	15	11.5	8.2	4.8	3.4	2.4	1.4	1.1
	10	40.2	30.9	26.6	20.6	14.2	7.9	5.4	3.7	2.2	1.6

	Rainfall Durations										
					1hr	2hr	6hr	12hr	24hr	48hr	72hr
		10	**20**	**30**	**60**	**120**	**360**	**720**	**1440**	**2880**	**4320**
	20	49.8	38.7	33.2	25.8	17.6	9.5	6.5	4.4	2.6	1.9
	50	66.6	51.6	44.4	34.3	23	12.2	8.2	5.5	3.3	2.4

3 Potable Water Supply

3.1 General

The following sections describe the options assessments carried out for supplying potable water to the proposed plan change area. It includes the following:

- A description of the existing water supply and current demand estimates in Darfield;
- An estimate of the water demand by the fully developed plan change area; and,
- Potable water supply recommendations.

3.2 Existing Water Supply Situation

The property has two existing bores L35/0276 and L35/0277. The two bores are not consented. According to the ECan GIS L35/0276 has a yield of 20 L/s.

The Council holds consent (CRC143985) from Environment Canterbury to abstraction of up to 83 litres per day from bores L35/0980 and BX22/0006 with a volume not exceeding 6,000 cubic metres per day". Potable water supply to the Logan property comes from the Council bores. A copy of the consent is presented in **Appendix B**.

3.3 Existing Demand

3.3.1 Potable Water

The existing water infrastructure location and pipework is shown in Figure 3.1 below. The infrastructure consists of two equipped wells, a reservoir and a booster pump station at the reservoir, power supply and a back-up generator.

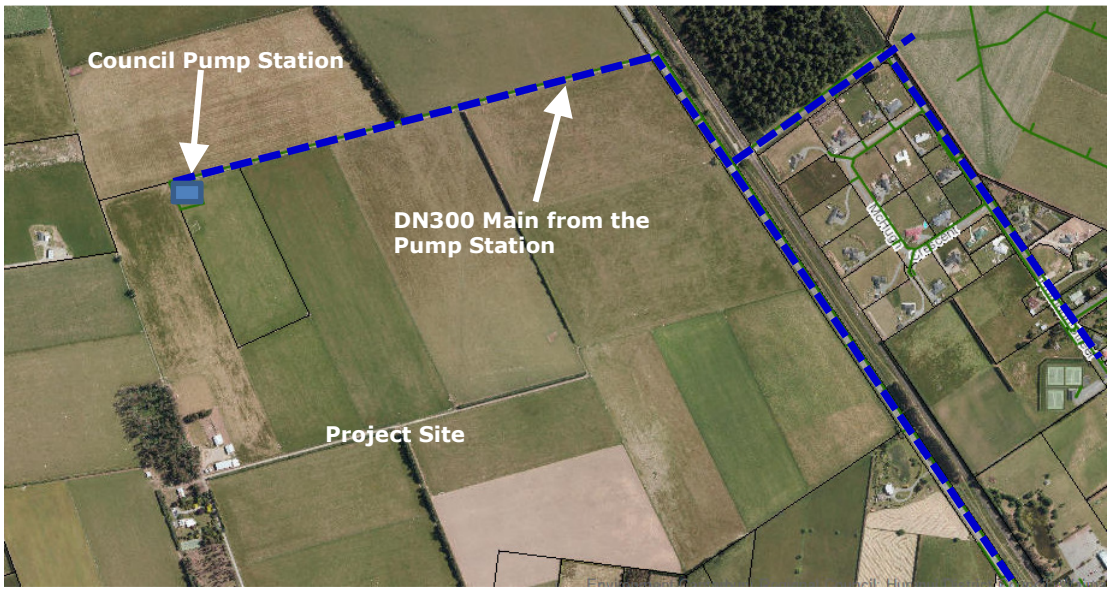


Figure 3.1 – Existing Water Supply Infrastructure

Figure 3.2 below shows the potable water demand in Darfield over a two week period in October 2014[2]. Figure 3.2 shows that consumption ranged between 1,405 Litres/connection and 2,673 Litres/connection. The average consumption over the period was 2,137 L/connection/day.

[2] http://www.selwyn.govt.nz/__data/assets/pdf_file/0006/78819/5WatersAMP-pt2-web.pdf

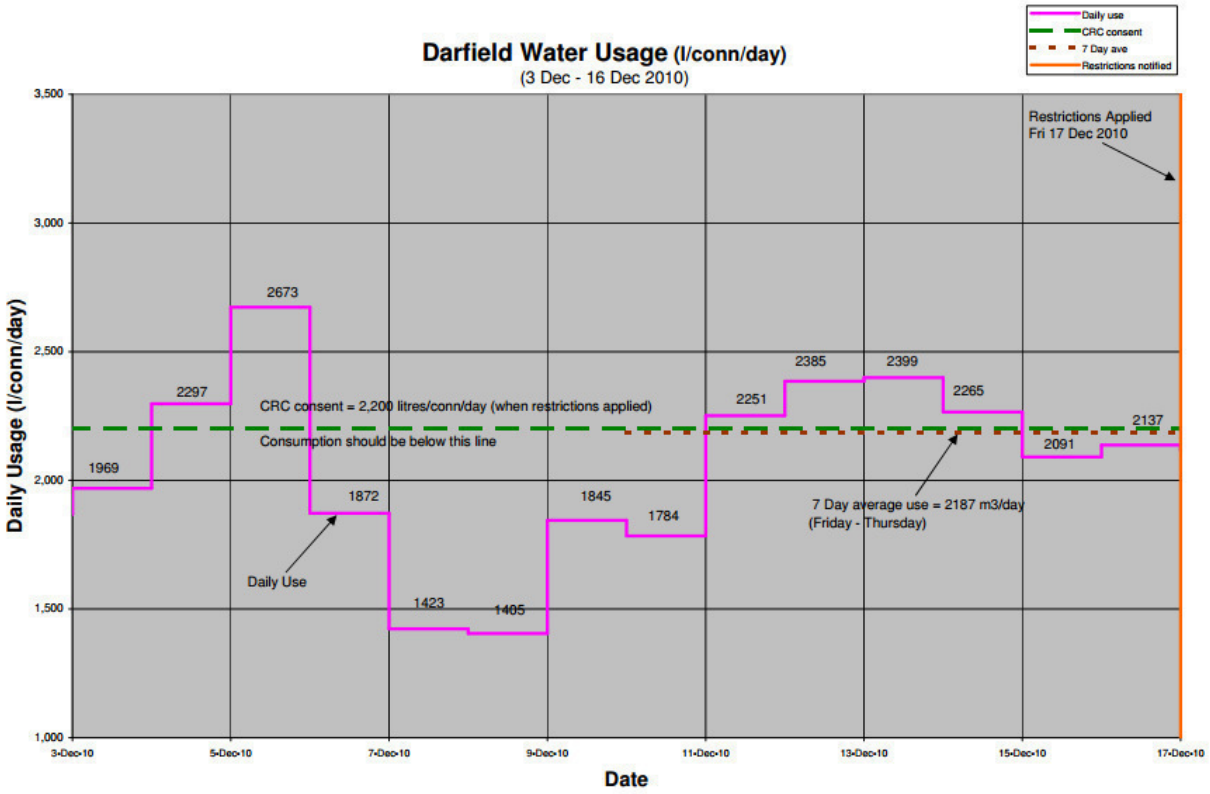


Figure 3.2 – Darfield Water Usage during October 2010 (Source – Selwyn District Council[5]

Other Council records[3] provide the average daily consumption per capita. This data, extracted from the Council's asset Management Plan, is presented in Figure 3.3. Figure 3.3 shows that the per capita consumption is 575 L/day.

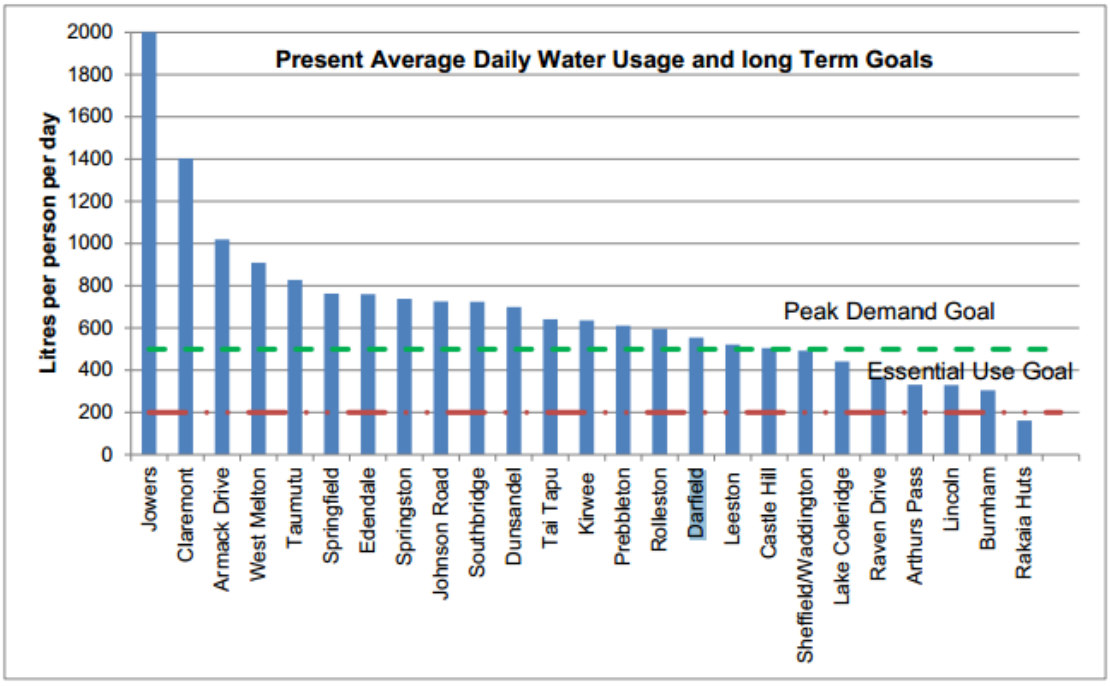


Figure 3.3 – Present Average Daily Water Usage in Selwyn District Council[4]

[3]https://www.selwyn.govt.nz/__data/assets/pdf_file/0009/38727/Darfield-Restrictions-Graph-3-16Dec10.pdf

Part 7 of SDC's Engineering Code of Practice[5] suggests that water supplies should be designed based on peak flow of 0.15 L/s/connection. However, Chart 1 in the code shows that for the proposed 130 lots the peak design flow would need to be approximately 0.18 L/s/connection.

3.3.2 Firefighting

SDC[2] asset management plan classifies Darfield within what the Council calls Group A Fire Code Suitability Assessment. Figure 3.4 below shows the current firefighting capabilities of the Darfield water supply.

Water Supply	Summary	Suggested Target	Comments
Darfield	Can meet FW2 Can nearly meet FW3	Living Zones – FW2 Business Zones - FW3	Need to review in light of reconfigured supply using new groundwater source

Figure 3.4 - Group A Fire Code Suitability Assessment[6] for Darfield

3.4 Selwyn District Council's Preference

Reeftide presented the plan change proposal to SDC Engineering staff. Mr Murray England (Asset Manager – Water Services) provided advice on Council's preferred water supply arrangements. In an email dated 11 December 2014 (**Appendix C**) Mr England advised that *"We would like to see all sections above 2000m^3 on restrictors (2m^3/day). A new connection from our reservoir site will be required to form a ring main. As part of the development Council would like to change the easement for the access to our reservoir site into free hold land. Provision needs to be made along this access way strip for a further well"*

3.5 Estimation of Potable Water Requirements for the Plan Change Area

The proposed plan change will result in a yield of up to 130 new lots. As highlighted above there are three scenarios for assessing potable water requirements. These are summarised below as:

- Scenario 1 – Current average demand per person in Darfield is 575 L/day;
- Scenario 2 - Current average demand per connection is 2,137 L/day;
- Scenario 3 – Assuming a restricted water supply of 2,000 L/connection/day. This scenario is in line with the suggested allocation by the Council.

Table 3.1 below presents the expected average and peak potable water demands for the three scenarios. The peak flows for Scenarios 1 and 2 are based on SDC's Infrastructure Design Code which suggests a peak design flow of 0.175 L/s/connection based on Chart 1 of the Code.

Table 3.1 – Potable Water Demand Estimates

Scenario	Assumed No of Occupants	Total Demand Per Lot	Total for the Plan Change Area (m^3/day)	Average Daily Flow (L/s)	Peak Flow (L/s)
1	4 per Lot	2,300	299	3.5	22.8
2		2,137	277.81	3.2	22.8
3		2,000	260	3.0	3.0

[4]https://www.selwyn.govt.nz/__data/assets/pdf_file/0009/38727/Darfield-Restrictions-Graph-3-16Dec10.pdf
[5] https://www.selwyn.govt.nz/__data/assets/pdf_file/0013/35401/Part-7-Water-Supply.pdf
[6] http://www.selwyn.govt.nz/__data/assets/pdf_file/0006/78819/5WatersAMP-pt2-web.pdf

3.6 Fire Fighting Requirements

Although the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS4509:2008) is a discretionary standard, it is generally accepted as being a *de facto* obligation. It is intended for the proposed development to meet the firefighting standards.

According to the SNZ PAS4509:2008, *"all structures with a sprinkler system installed to an approved Standard" will have fire water classification number FW2. Single family homes without sprinklers are classified FW2*". As the proposed plan change area will have single family homes, the fire water requirements for the development should be based on FW2 which requires reticulated water supply systems to have one hydrant no more than 135 m away from a building and an additional hydrant within 270 m of that same building, with both hydrants providing at least 12.5 L/s, or for non-reticulated water supplies a storage volume of 45 m^3 would be required.

An alternative to the use of a common storage facility is for fire fighting water to be supplied by on-site storage tanks located on each property in the case of restricted water supplies.

3.7 Summary of Water Demands

As discussed above, the peak potable flow requirements for the area will either be 22.8 L/s or 3.0 L/s depending on whether the supply is an on-demand or a restricted supply restricted at 2,000 L/day per property.

Table 3.2 below provides the total peak predicted water demand for the three scenarios i.e. the on-demand (Scenarios 1 and 2) and the restricted supply (Scenario 3) and firefighting requirements.

Table 3.2 – Potable Water Demand Estimates

Scenario	Type of Supply	Average Daily Flow (L/s)	Peak Potable Flow (L/s)	Fire Fighting	Total Peak Demand (L/s)[a]
1	On-demand	3.5	22.8	25 L/s	36.4
2	On-demand	3.2	22.8	25 L/s	36.4
3	Restricted at 2 m^3/day	3.0	3	45 m^3 storage	3.0

a – Full Pressure Flow for the Development = Fire Fighting + 50% of the Peak Potable Flow

3.8 Comments on Council's Preferences

The 2,000 L/day that Council has proposed on a restricted supply is comparable to the average water use in Darfield which is 2,137 L/day as presented earlier. Reeftide proposes on-going discussions with Council with the view to changing from the suggested restricted supply to an on-demand supply. The proposed change would have the following benefits:

- It would provide a typical on-demand water supply system which would be consistent with a quality residential subdivision such as one that is expected on the site.
- An on-demand supply would remove the need for on-property water storage tanks or a communal storage tank for fire-fighting. The disadvantage with a second reservoir is that a set of pumps would be required increasing the O&M costs for the water supply whether it is Council owned or privately owned.
- It would enable a more efficient reticulation which could also be linked with the existing infrastructure across Bangor Road thus providing improved security of supply into the township. With a restricted supply there is no reason for a

developer to install larger pipework from the reservoir into the subdivision unless Council contributes for the extra overs i.e. costs above the development's minimum requirements for a restricted supply.

If an on-demand supply is not feasible for the Council in the short to medium term, Reeftide proposes a restricted supply limit of 2,200 L given that the proposed lot sizes are larger than the average section size in Darfield.

3.9 Summary of the Water Supply Options

From Council's feedback there is no reason why the development should not proceed based on water supply availability albeit as a restricted supply.

3.9.1 Restricted Supply

If this option is pursued the flow to the development will be 3 L/s over 24 hours in order to supply each property with the 2,000 L/day that Council has suggested or 3.3 L/s if Reeftide's proposal of 2,200 L/connection/day is granted.

A common 45 m^3 storage tank will be required to meet the New Zealand Fire Services Firefighting Water Supplies Code of Practice. The storage can be provided using PE tanks, timber tanks, concrete tanks or steel tanks. PE tanks are more cost effective and are recommended.

A restricted water supply could be achieved with pipe sizes of less than PN80 in diameter. This means that the Council's suggestion of a ring main will not be possible unless Council pays for the extra overs for a larger pipe.

3.9.2 On-Demand Supply

An on-demand supply would be preferable. An on-demand supply would improve the security of supply to other parts of the township.

4 Stormwater Conveyance, Treatment and Discharge

4.1 General

The site is a greenfield site and, therefore, there is no existing stormwater network. It is proposed to treat and dispose of stormwater onsite using Low Impact Design (LID) or Sustainable Urban Drainage (SUD) approaches. LID approaches are discussed in detail in publications such as the Waterways, Wetlands and Drainage Guide (CCC, 2003), the On-site Stormwater Management Guideline (NZWERF, 2004) and the Low Impact Design Manual for the Auckland Region TP124. The following are examples of LID approaches:

- Fewer allotments with more open spaces.
- Reduction of the total impervious area within the development.
- Use of vegetative swales. Stormwater from hardstanding areas is directed to swales.
- Infiltration trenches can be used instead of swales provided the soils are well drained. Infiltration trenches can reduce the peak flows as they have storage capabilities.
- Infiltration basins.
- Soakage chambers. These allow the discharge of stormwater into the land.
- Detention Pond. These store water to attenuate the peak flows.

This section of the report discusses the proposed stormwater collection, conveyance, treatment and discharge. The design considerations for the stormwater management system is preliminary at this stage, and will be subject to both ECan and SDC approval during the resource consenting at or just before the subdivision consenting. The basic concept of the proposed stormwater system were presented to Mr Murray England of SDC and some feedback was received which has been incorporated into the proposals presented below.

4.2 Construction Stormwater

The District Plan rules require a resource consent application for earthworks as part of the subdivision consent application.

Earthworks involve the general clearance of vegetation and topsoil stripping, followed by general recontouring to provide the basis for the layout of the lots and infrastructure. Therefore, earthwork volumes will be largely dependent on the location of housing sites and the road alignments. As these have yet to be finalised, earthworks volumes have not been calculated and this will be done at the subdivision stage.

Reeftide does not envisage significant alterations to the site's topography, and it is expected that all excess cut material (if any) will be placed as engineered fill in designated areas such as low-lying road footprints, space around dwellings, driveways, etc. It is intended to balance cut and fill on the site.

All design drawings and specifications will be prepared with reference to the SDC and ECan's 2007 Erosion and Sediment Control Guidelines (ESCG). This will be done at the subdivision stage.

The construction stormwater management plan will be based on the principles stated in the ESCG:

- Separate clean and dirty water;
- Control run on water;

- Protect the land surface from erosion;
- Prevent sediment from leaving the site.

As this is a relatively flat site it is most unlikely that any water will run on to the site.

4.3 Primary Stormwater Treatment and Management from the Developed Site

The primary stormwater system will be designed and constructed to handle at least the 2% AEP flows. At the detailed design stage the possibility of handling a 1% AEP storm should be investigated as the soil permeability is high.

4.3.1 Individual Lots Stormwater Management

As there is no detailed subdivision plan at this stage that would provide a figure for average areas, this section on stormwater treatment and disposal on an individual lot will be confined to the descriptive concepts. A description of the stormwater management measures follows for each of the runoff sources is provided below:

Earthworks within lots will result in both primary and secondary stormwater draining naturally away from habitable floors. Primary stormwater flows will also be prevented from entering neighbouring properties. The final design of the overland flowpaths will be confirmed once earthworks have been finalised during detailed design.

Roof Water

Roof stormwater may contain small amounts of sediment and some faecal coliforms from birds but the levels are generally very low. Roof stormwater is therefore considered to be "clean' requiring no treatment and will therefore be discharged directly to ground via standard soakpits (an example of which is shown in Figure 4.1 below) or rapid infiltration sumps dug deep enough to ensure high infiltration rates.

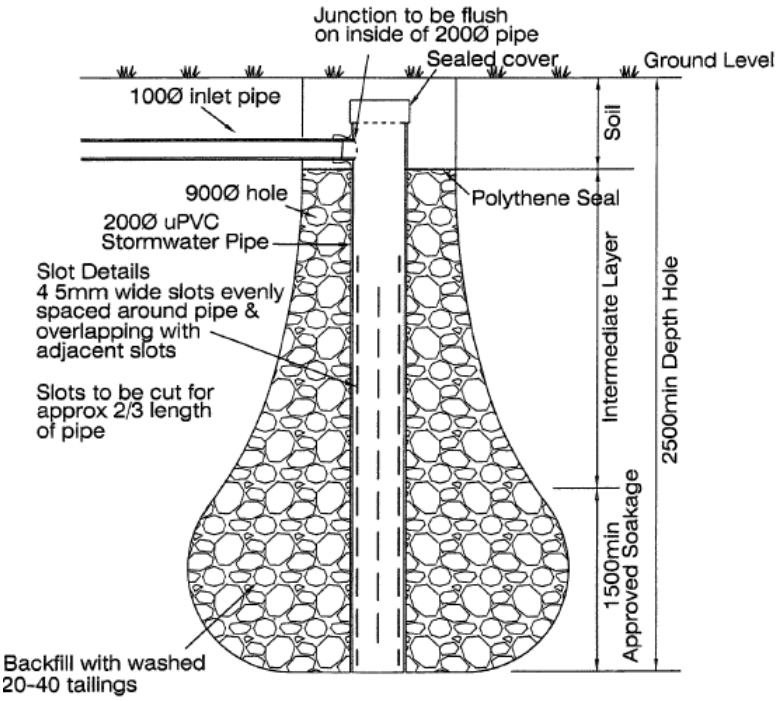


Figure 4.1 – Standard Roof Soakpit.

The roof soakpits would be designed and constructed in accordance with the New Zealand Building Code Verification Method E1/VM1 to collect, treat and dispose of stormwater from the contributing catchments.

Driveway Stormwater

Driveway runoff will be directed to the grassed/landscaped areas adjacent to the driveways and discharged the ground. The post development proportion of driveways catchments is expected to be proportionally smaller given the large size of the sections proposed with the plan change. Driveway types will be optional and will include gravel driveways especially on the larger sections which will reduce the post development runoff. The landscaping will generally be graded towards the roads to ensure that runoff from high rainfall events above the design levels are drained to the roads where it will be treated discharged as shown in the conceptual drawing in Figure 4.2 below.

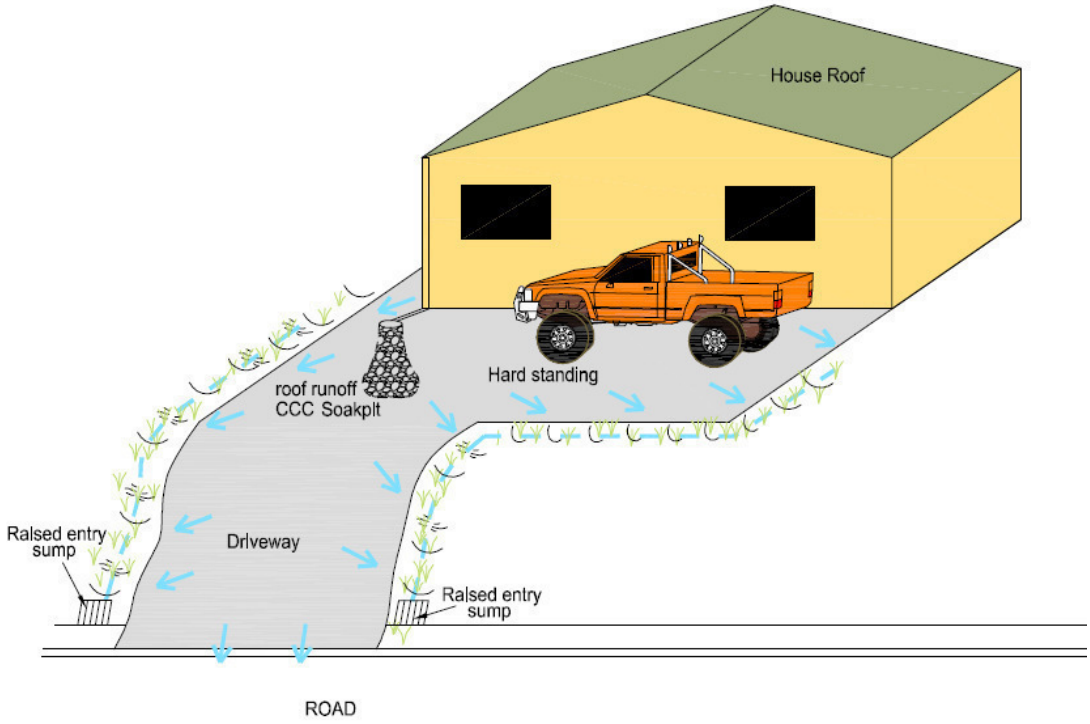


Figure 4.2 – Conceptual Representation of the On-Lot Stormwater Management

4.3.2 Road Stormwater Management

Road runoff will be directed to the road side swales for treatment and discharged to ground via soakage pits. This could also be via kerb and channel should kerb & channel be included in the subdivision designs in which case the stormwater will be conveyed into the swales via sumps and also discharged into the ground via soakpits.

Swale Layout

Typically, the road design will be such that a central crown with the carriageway sloping away to a stormwater system on one or both sides of the road. Stormwater runoff from the roads is collected in wide, shallow, grassed open channels (swales), which provide treatment of the stormwater, and discharge to the ground (Figures 4.3 and 4.4).

Where the roadside swales are on both sides of the road, for the water quality event, contributing areas will be calculated based on runoff from half the road width, (i.e. with swales on both sides of the road, runoff to the crown of the road is included for each swale). The contributing area includes adjoining land from which the swale

may receive runoff such as parts of the private driveways. These details will be confirmed at the subdivision stage when the layouts of the lots have been finalised.

Figure 4.3 shows the typical swale cross sections where there is no kerb & channel. Figure 4.4 shows examples of similar installations.

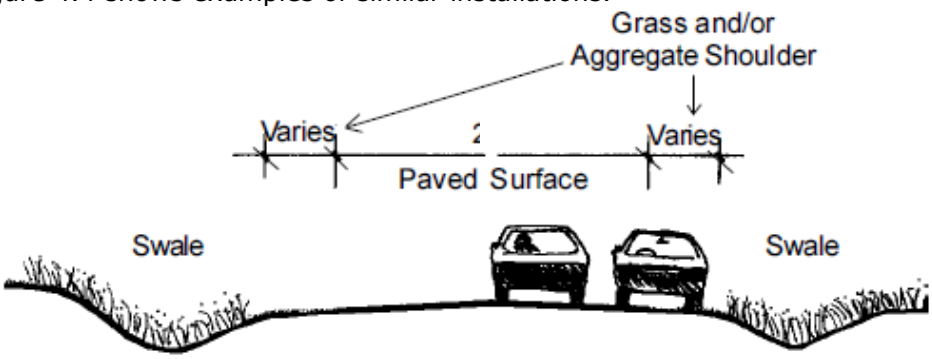


Figure 4.3(a) – Typical Double Roadside Swales

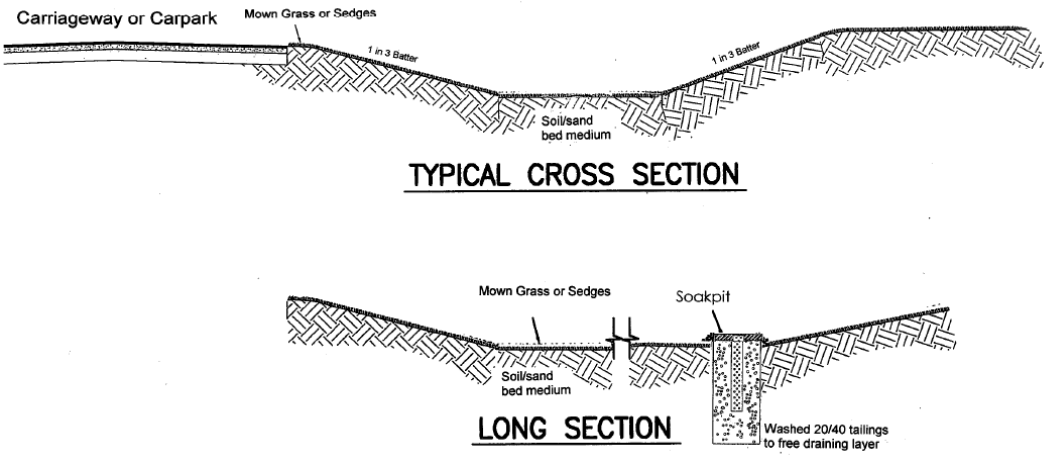


Figure 4.3(b) – Typical Swale and Soakpit Cross Sections

Figure 4.4(a) – Example of Installed Swales

Figure 4.4(b) – Example of Installed Swales

Swale Design

The water quality volume will be calculated as 1/3 of the 2-year 24-hour storm event, as specified by ARC TP10 or calculated using a 25 mm event for consistency with the requirements of the SDC's 'first flush' specification (Chapter 5 of the Code of Practice Section 5.12.9).

As required by the SDC Code of Practice (Chapter 5 Section 5.12.10), "*Where the discharge of stormwater is to ground, the system should be designed for total detention" (combination of storage and overflow soakage) of the 2% AEP critical duration storm event".* The stormwater vegetative swales will at the very least be designed to provide conveyance of the 50-year with ponding up on to the road. As discussed in Section 2 above, the groundwater at 106 m below the ground level is sufficiently deep for a soakage system to be effective. It is proposed that swales will have a minimum length of 30 m and a maximum length of 250 – 300 m. As the capacity of the road side swales is exceeded, the secondary flows will then flow overland on the road networks towards Bangor Road to prevent flooding within the subdivision. A higher standard (i.e. 100-year or 1% AEP) should be considered at the detailed design and consenting stage. This standard should be achievable given the depth to groundwater and the high infiltration rates of the soils especially below 0.5 m below the ground level.

The HIRDS 3 rainfall data that will be applied at the detailed design stage is provided in Section 2 and includes a climate change factor of 16%.

Table 4.1 below provides the range of parameters that would be applied to the design of the swales:

Table 4.1 – Swale Water Quality Design Parameters

Parameter	Criteria	Source/Comment
Longitudinal slope	Typically 0.5% to 1% Minimum 0.3%	Can be 0.3% which is flatter than standard
Maximum velocity	0.8 m/s	NZTA[a]
Design vegetation height	100 – 150 mm	NZTA[a]

Parameter	Criteria	Source/Comment
Typical water depth above vegetation	Should not exceed design vegetation height under the treatment design storm	NZTA[a]
Bottom width	0.6 – 2.0 m	NZTA[a]
Hydraulic residence time	≥ 9 minutes	NZTA[a]
Maximum catchment area served	4 ha	NZTA[a]
Minimum length	30 m	NZWERF
Maximum Length	250 - 300 m	NZWERF
Side slope	1 V : 4 H on road side.	NZWERF

a -NZTA Stormwater Treatment Standard for State Highway Infrastructure, May 2010

4.4 Stormwater Attenuation

This initial assessment indicates that the stormwater can effectively treat and discharge the stormwater via soakage. Details of the flows and volumes will be finalised at the detailed design stage when the developed hardstanding areas are known. While attenuation is not likely to be required, provision has been made in the ODP for a stormwater attenuation basin.

4.5 Secondary Flows from the Developed Site

Secondary flows from the individual lots will flow towards the main roads where it will flow towards the roadside swales i.e. away from the building platforms to prevent flooding as discussed earlier.

In addition to the above, the secondary flow paths will be designed and constructed in accordance with the recommendations in the Chapter 5 of the SDC Code.

4.6 Design Stormwater Runoff Flows and Volumes

The total size of the catchment is 126 ha. The exact developed areas will not be known until the subdivision stage. This means the catchment cannot realistically be split into stormwater catchments and subcatchments until at that stage and at that time the detailed modelling will be carried out.

The HIRDS 3 design rainfall figures presented in Section 2 will be used in conjunction with the United States Soil Conservation Service (SCS) method to establish the peak runoff rate from the plan change area.

It is expected that the peak discharge for the critical duration event will be established using the unit hydrograph method, as specified in SDC Code of Practice and taken from the Waterways, Wetlands and Drainage Guide (CCC, 2003).

4.7 Stormwater Contaminants

As the development of this land will include the creation of new hardstanding areas and internal roads, contaminant sources from these areas must be considered. The runoff from this development is likely to contain the following potential contaminants:

Suspended Solids

This is derived from road surfaces where by-products from vehicle wear and tear and combustion accumulate.

Pathogens
Pathogens are disease causing bacteria and viruses in urban stormwater, usually derived from animal faeces and endemic sources such as soil. Stormwater pathogens are mostly consumed by other organisms within the upper layers of the soil and are therefore not regarded as a significant contaminant.

Litter
Litter in stormwater is often referred to as gross pollution. It has a high visual and amenity impact, but only limited effect on public health and ecological standards. It will easily be removed from the proposed stormwater infrastructure and it is not a significant soil contaminant.

Hydrocarbons and Oils (THP/Oils)
These are typically associated with vehicle use (e.g. oil leaks) although spills of hydrocarbon products from other sources can occur. They may be in the form of a free slick, oil droplets, and oil emulsion and in solution or absorbed to sediments. These contaminants are usually readily visible and thus can be easily removed from sumps, and swales as part of a maintenance programme.

Other Toxic Organics
A variety of other toxic organic substances are occasionally present in stormwater. These typically originate from garden or agricultural chemicals such as weed killers or pesticides.

Toxic and Heavy Metals
A variety of trace metal compounds are carried by stormwater in both solid and dissolved forms. The most commonly measured metals of concern are zinc, copper and chromium (mostly associated with vehicles and roads). Metals are predominantly in the solid state and the can be removed from the sumps and swales.

Heavy metals are discharged by vehicle traffic from sources such as tyres and brake linings. However, given the low volumes of traffic as a result of the low housing densities proposed levels of metals within the discharge are likely to be low and are unlikely to affect groundwater quality.

Nutrients
These are usually from animals and from exhaust fumes. As the site will now be an urban development, nutrient contaminants from animals are not anticipated to be a significant contaminant type.

In addition to the above contaminants, stormwater discharges have other physical and chemical effects that can have potential direct adverse effects on groundwater quality. These include changes to pH, dissolved oxygen, alkalinity, hardness and conductivity. However, as the groundwater is over 106 m below the discharge points the effect on groundwater will be minimal.

Table 4.2 shows a possible range of selected site annual contaminant loadings derived from the results of surveys of a variety of urban catchments by Williamson (1993)[7]. Two scenarios are presented in Table 4.2, the first assumes that the full 126 ha area will contribute to the contaminating loading. The second assumes that 20% (25.2 ha) will be developed. Assuming a 20% contribution from the catchment is conservative for a low density subdivision such as one envisaged by this plan change.

[7] Williamson RB (1993) *Urban Runoff Data Book Water Quality Centre Publication No. 20*

Table 4.2 - Predicted Annual Site Contaminant Loadings

Contaminant	TSS	TP	TN	BOD	Zn	Cu	TPH/Oil
Urban Loadings kg/ha							
Lower	60	0.4	2.5	12	0.25	0.02	4
Mean	375	0.8	8	20	0.75	0.09	
Upper	1750	1.6	11	33	2	0.2	20
Total Site Loading (kg) from the 126 ha							
Lower	7,560	50	315	1,512	32	3	504
Mean	47,250	101	1,008	2,520	95	11	
Upper	220,500	202	1,386	4,158	252	25	2,520
Total Site Loading Kg - 20% of the 126 ha (25.2 ha) is Developed							
Lower	1,512	10	63	302	6	1	101
Mean	9,450	20	202	504	19	2	-
Upper	44,100	40	277	832	50	5	504

4.8 Stormwater Treatment Efficiency

4.8.1 Contaminant Removal

Table 4.3 summarises the expected performances of the proposed stormwater treatment technologies. This mix of qualitative and quantitative information is sourced from Auckland Regional Council's TP10 and monitoring data from the Auckland Harbour Bridge and CCC Waterways Guide.

Table 4.3– Stormwater Treatment Technology Performance Effectiveness

Treatment Device	TSS (%)	TPH/ Oil (%)	Metals (%)	BOD (%)	Zn (%)	Cu (%)	Faecal Coliforms (%)	Total Nitrogen (%)
Sumps	up to 58	NA	NA	NA	NA	NA	NA	N/A
Swale (ARC[1])	75-90	75	75	75	46	58	75	75
Swale (WWDG)	20 – 60	>55	20 - 60	20 - 40	NA	NA	20 – 40	20-40

1 - Auckland Regional Council Technical Publication No. 10

It is important to note that while the sumps and infiltration through the soil profile will provide some additional treatment these have not been included in the assessment of the removal rates of the contaminants in the table above.

4.8.2 Expected Runoff Quality

As API (1989)[8] report that within unsaturated strata, residual hydrocarbons can be retained on gravel at a volume of around 2.5 to 10 litres per m^3 of gravels, the beds of swales thus providing a high capability of TPH/oil contaminant removal.

The risk to soil from hardstand runoff in residential areas is considered to be low due to the low levels of vehicle movement and parking being a low density area. The runoff from roofs may contain small amounts of suspended sediment and bird droppings but is considered to be relatively uncontaminated.

The runoff from roading is likely to contain a higher content of road borne contaminants because traffic volumes will be relatively higher than in the areas of private residences. The soil contamination risk in these latter areas is appropriately

[8] Newell, C.J., L.P. Hopkins, and P.B. Bedient. Ground Water, Vol. 28, No. 5, Sept./Oct. 1990. pp. 703-714.
API, 1989. Hydrogeologic Data Base for Groundwater Modeling, API Publication No. 4476, Washington, D.C.

mitigated by the operation and maintenance of the proposed stormwater management strategy.

The ARC performance rates in Table 4.3 are generally widely accepted and when they are applied to the contaminant loadings in Table 4.2 this gives an indication of the remaining contaminants and these are presented in Table 4.4.

Table 4.4 – Residual Contaminants Post Treatment in the Swales

Contaminant	TSS	TP	TN	BOD	Zn	Cu	TPH/Oil
Urban Loadings kg/ha							
Lower	15	0.1	0.625	3	0.135	0.0084	1
Mean	93.75	0.2	2	5	0.405	0.0378	0
Upper	437.5	0.4	2.75	8.25	1.08	0.084	5
Site Loading (kg) from the 126 ha							
Lower	1,890	13	79	378	17	1	126
Mean	11,813	25	252	630	51	5	-
Upper	55,125	50	347	1,040	136	11	630
Site Loading Kg - 20% of the 126 ha (25.2 ha) is Developed							
Lower	378	3	16	76	3	0	25
Mean	2,363	5	50	126	10	1	-
Upper	11,025	10	69	208	27	2	126

As highlighted earlier, the sumps and the soil after infiltration will provide some additional treatment.

As a significant proportion of key contaminants of urban stormwater (hydrocarbons and metals especially) are adsorbed to the suspended sediment loading and to a lesser extent the grass surfacing, they will mostly be removed leaving a filtered largely soluble loading mainly to soak into the substrate.

The silt loam/gravel nature of the substrate above the groundwater has considerable contaminant filtering and adsorptive properties. This means that it is likely that although there will be a residual build-up of contaminants in the substrate it is likely to migrate only a very short distance from the swale surface before being adsorbed by media.

As the intervening layers of sandy loams and gravels are at least 106 m above the groundwater surface the topsoil and substrate will provide effective retention of contaminants. This limited accumulation of residual contaminants in the substrate will have no more than a minor adverse environmental effect.

This shows that a high degree of confidence can be placed in the proposed treatment system.

4.8.3 Operation and Maintenance

For the stormwater management system to achieve the anticipated treatment efficiencies, an operation and maintenance regime has to be implemented. As a minimum, the following items will be necessary on a regular basis:

- Mowing of the swales to maintain appropriate grass height of between 50-150 mm; and,
- Inspections and cleaning as necessary to remove accumulated litter in the sumps and swales.

4.9 Discharge Consents

Stormwater discharge consents will be sought from Environment Canterbury at the subdivision stage.

The stormwater consent application(s) will provide an assessment of environmental effects and one of the considerations will be ensuring setback distances are met from the wastewater system and the existing water races.

4.10 Ownership of the Stormwater Infrastructure

Sumps and master traps on private land will be maintained by the property owner or occupier. They will need to be maintained by the removal of sediments regularly if the units are found to be filling more quickly than expected.

For infrastructure on public land, the issue of ownership and management of the infrastructure has not been discussed with Council. It is however, anticipated that all infrastructure within public land will be vested with Council. This applies to all the stormwater infrastructure outside the individual lot boundaries. As discussed in the previous sections, the infrastructure will be designed and constructed to meet all Council standards.

4.11 Summary

The proposed stormwater infrastructure concepts are based on the best practices. The system will be able to cope with stormwater from the developed sites and appropriate secondary flow paths can be provided.

The proposed system would be consistent with Selwyn District Council's requirements as articulated in an email from Mr Murray England (**Appendix C**) which stated that *"Stormwater is disposed to ground. Generally sump to soakhole (depending on ECan requirements). Otherwise pre-treatment by shallow swales. Reticulation designed for 10 year event with overland flow and disposal of stormwater onsite up to the 50 year event in line with ECan requirements"*

5 Wastewater Servicing

5.1 Existing Infrastructure

The township of Darfield has no reticulated wastewater system. Individual properties are served by on-site wastewater treatment and discharge systems.

This section of the report assesses the wastewater servicing options for the proposed plan change area.

5.2 Wastewater Servicing Options

A number of wastewater treatment and dispersal options are available in New Zealand. These systems typically consist of treatment, storage, and effluent disposal to provide a complete solution. Below are some of the ways that domestic wastewater is dealt with:

- **Option 1** - Discharging to a Council's sewer;
- **Option 2** - Individual on-site treatment and dispersal within each lot;
- **Option 3** - On-site collection/storage and transported off site for treatment and disposal/discharge; and,
- **Option 4** - Community treatment plant and central dispersal. Also called decentralised wastewater system.

As highlighted above, Darfield does not have a reticulated public wastewater system. There are no plans to implement a reticulated system in the short to medium term. In an email (**Appendix C**) the Council's Assets Manager (Water Services) Mr Murray England advised that *"Council has established a working party to determine Darfield's future sewer management strategy. For now assume septic tanks with the potential for a centralised system"*

In the absence of definite long term plans for an integrated network and based on discussions with Council on preferred options this discounts a discharge to a Council network (Option 1) as a short to medium term option.

Table 5.1 below provides a summary of the combination of the sub-options available from among the remaining options (Options 2-4) when discharge to a Council reticulation system is discounted.

Table 5.1 – Wastewater Servicing Sub-Options

OPTIONS	REMARKS
2.1 Install conventional or alternate septic systems on each lot	• Applicable only in low-density areas with adequate soil conditions. • The plan change area and hence all lots will have suitable conditions for the installation of a conventional septic system. However, the fluent quality is not as high as that from aerated systems.
2.2 Install enhanced systems such as packaged sewage treatment on each lot followed by drain field or drip systems	• Can be applicable in areas with marginal soil conditions where it is not economical to install a conventional septic system • Would be suitable in the plan change area. The systems produce better quality effluent than ordinary septic tanks (Option 2.1)

3.1 Communal or cluster effluent collection and transporting to a treatment and discharge centre similar	• No a sustainable long term solution as this would be expensive and impractical. Therefore, this option is not considered any further.
4.1 Small communal sewage systems serving a cluster of houses with discharge to a drain field or drip systems	• May be a good option for some small developments that cannot be economically connected to a central sewage system. • May be expensive and impractical when the subdivision is carried out over a long period of time. • Can be modularised and the installation is staged as the subdivision develops. • Can make integration to any future Council reticulation easier as the local pipe network will have already been established.
4.2 Communal sewage system for an entire community with an advanced sewage treatment plant followed discharge to land via drip systems, rapid infiltration, spray irrigation to land or similar	• May be a good option for some small developments that cannot be economically connected to a central sewage system. • May be expensive and impractical when the subdivision is carried out over a long period of time. • Can be modularised and the installation is staged as the subdivision develops. • Can make integration to any future Council reticulation easier as the local pipe network will have already been established.

Key considerations in deciding the best option depends on a number of factors, all of which have to be considered. These include:

- Size of the site and the discharge volumes generated;
- Distance to an off-site treatment/discharge location;
- Availability of sufficient area for a wastewater treatment plant and the available options for dispersal/disposal; and,
- Availability of sufficient area for land dispersal/disposal.

Of the five sub-options presented in Table 5.1 three options are really feasible and these are:

Individual On-site Systems

Each property has its own treatment and discharge system.

Community Collection Systems.

This is also called a decentralised sewerage system. It comprises small diameter reticulation to a local treatment plant. For a small diameter reticulation system to be viable an on-lot pretreatment system is required to either remove grease and bulk solids, or to macerate them such that they will pass through the collection system without causing blockage.

Each lot will have a STEP system which will comprise a large water-tight interceptor tanks with effluent filter and a gravity discharge via a 32mm PE pipeline to a boundary box connection at the boundary of each Lot.

Small Community (cluster) Collection Systems
This is similar to the community collection system above except lots that are close to each other are clustered and share a common collection and treatment and discharge

system. Thus rather than one large communal system, a cluster of 2 or more such systems may be established.

5.3 Wastewater Treatment Options

5.3.1 For Individual On-Site Systems

Septic Systems

These are septic tanks with discharge trenches. These septic systems provide sewage treatment in a two-step process:

- Step 1 – Treatment in Septic Tank:
  - Large particles are settled out (Solids removal protects drain field); and,
  - The organic waste starts to break down in the absence of oxygen, an anaerobic environment.
- Step 2 – Treatment in the drain field:
  - Bacteria in the soil further break down the organic waste in the presence of oxygen;
  - Harmful bacteria are removed
  - Odorous gases are removed

A septic system needs both a properly installed septic tank and a drain field in order to provide adequate treatment of the sewage. Installations that have a leaching pit or a dry well instead of a drain field do not provide the second step in sewage treatment. As a result, partially treated sewage can potentially contaminate groundwater.

Most the existing systems in Darfield are septic systems. The level of water treatment is not as high as that of the more modern systems.

Aerated Wastewater Systems

Aerated water treatment systems (AWTS) and advanced sewage treatment systems (ASTS) are secondary treatment systems, that is, they involve both anaerobic and aerobic (with oxygen) treatment to a higher level than a primary treatment system, resulting in effluent that is suitable for garden (excluding fruit and vegetables) and landscape irrigation. At the highest level of treatment (from ASTS), the treated effluent can be used in non-potable situations such as toilet flushing, vehicle washing and firefighting. Table 5.2 below shows the steps involved in a typical AWTS.

Table 5.2 – Stages in a AWTS

Stage	Type of treatment	Process
Chamber 1	Anaerobic	Settlement of solids and anaerobic decomposition
Chamber 2	Aeration	Effluent passes through filter to aeration chamber Pumped in air creates turbulence and aerates effluent The chamber may incorporate a bioreactor to give additional bacterial treatment
Chamber 3	Clarification	Effluent passes through second, finer filter to clarification chamber Fine sludge particles settle and are pumped back to the first chamber
Chamber 4	Pump	A submersible pump distributes treated effluent to the disposal field

The sedimentation tank (Chamber 1) can capture approximately 90% of the grease commonly found in domestic wastewater. Amino acids and proteins are broken down and the effluent is generally anaerobically stabilised ensuring a more uniform quality in the effluent conveyed to the secondary treatment plant and a low level of sludge accumulation.

Typical sedimentation tanks have a capacity of at least 4.5 m^3 for individual dwellings. This equates to at least 24 hours of storage depending on the size of the dwelling(s) being served by the tank. Larger sizes can be specified for longer storage.

As a guide, sludge in the sedimentation tanks builds-up at a rate of 0.08 m^3/person/year and will need to be pumped out on average every 10 -15 years.

These systems are now common and most companies that supply septic tank systems also manufacture variations of the AWTS.

5.3.2 Small Community Cluster Systems and Communal Systems

A number of treatment systems are available for the small cluster and community on-site option. These included the following:

- Recirculating Textile Packed Bed Reactors (rtPBR);
- Membrane Bioreactor (MBR);
- Submerged Aerated System (SAF);
- Trickling Filters; and,
- Sequence Batch Reactors (SBRs).

Of the systems listed above, the two leading secondary treatment systems are the rtPBR and MBR. These two treatment systems are well established in New Zealand, give high quality effluent and function well under fluctuating loads. These systems are commonly used for community on-site wastewater where a high level of treatment, nitrogen reduction and the removal of pathogens are important considerations.

5.4 Wastewater Conveyance

5.4.1 For Individual On-Site Systems

From the treatment system the wastewater is pumped and conveyed to the discharge area via small diameter pipe. For individual lots this will be within the property boundaries.

5.4.2 Small Community Cluster Systems and Communal Systems

Flows from the individual private tanks are pumped to the treatment plant where they are treated and discharged.

The infrastructure on public roads is usually vested with Council which then operates and maintains it as public assets. The infrastructure within the property boundaries is owned by the landowners.

5.5 Wastewater Discharge Options

Post treatment the treated effluent is disposed using a number of possible discharge to land options available. These are:

- Infiltration trenches;
- Infiltration and evaporation beds;
- Mounds;
- Surface irrigation methods; and,
- Subsurface drip irrigation.

Tables K1 and K2 in AS/NZS 1547:2012 summarise common site and soil constraints and provides guidance on the suitability of land application systems. Table 3.3 below is a modified extract from Tables K1 and K2.

Table 5.3 - Summary of Common Site and Soil Constraints (modified extract of Tables K1 & K2 A/NZS1547:2012)

Land Application System	Slope (%)	Soil Depth (m)	Soil Category Number	Comments – Suitability of System at the Applicants Site
Infiltration Trenches	<25%	> 1.2	1 - 4	No soil and groundwater issues to require this option
Infiltration beds and evaporation beds	< 5%	> 1.2	4 - 6	No soil and groundwater issues to require this option
Mounds	<15%	Not Important	1 - 4	No soil and groundwater issues to require this option
Surface irrigation systems	< 6%	> 0.4	Any	Surface irrigation is not as reliable as surface drip and would require an additional disinfection step.
Subsurface drip irrigation	<25%	> 0.4	Any	This system is considered preferable, subsurface irrigation is more ideal than those discussed above providing a higher degree of nutrient and bacterial treatment.

While the Plan Change area would be suitable for all discharge systems, Reeftide recommends the use of drip systems as these have a low application rate and will provide further treatment thus providing additional mitigation to any real or perceived potential groundwater contamination.

5.6 Wastewater Flows

Flows generated from properties are estimated using the equivalent population or number of bedrooms being served. The flow estimates from the two methods are discussed below.

5.6.1 Flows Based on Population

The projected number of lots for the area is 130. It is also assumed that the average occupancy per household will be 5 people.

Table 5.4 summarises the estimated wastewater flows from the individual lots and the plan change area as a whole.

Table 5.4 – Wastewater Flow Estimates Based on Population Estimates

Parameter	Value
Residents per Lot	5[a]
Population	650
Flow per Person	200 L/person/day[b]
Flow Generated Per Property	1,000 L
Total Flow Generated within the Plan Change Area	130,000 L or 130 m^3

Notes:

a) Peak occupancy of 5 persons has been used based on TP58 guidelines, Table 6.1 and AS/NZS 1547.

b) Design flow allowances are based on standard household fixtures and assuming borewater supply, AS/NZS 1547.

5.6.2 Flows Based on Bedroom Numbers

The AS/NZS:1547-2012 also allows the wastewater flows to be estimated using the number of bedrooms. Table J1 of the AS/NZS:1547 has been extracted and is presented below as Figure 5.1.

TABLE J1
ALL-WASTE SEPTIC TANK OPERATIONAL CAPACITIES

Population equivalent (persons)	Number of bedrooms	Design flow (L/day)	Tank capacity (L)
1 – 5	1 – 3	1000	3000
6 – 7	4	1000 – 1400	3500
8	5	1400 – 1600	4000
9 – 10	6	1600 – 2000	4500

Figure 5.1 – Flow Estimates Based on the Number of Bedrooms (Extracted from AS/NZS:1547)

It is most likely that the average number of bedrooms for the dwellings within the plan change area will be 3-5. This is based on trends observed in the township of Darfield. In estimating the wastewater flows it has been assumed that the properties will have 4 bedrooms.

Table 5.5 below provides the wastewater flow estimates.

Table 5.5 – Wastewater Flow Estimates Based on Bedroom Numbers

Parameter	Value
Number of Lots	130
Number of Bedrooms//Dwelling	4
Flow per Dwelling per day	1,400 L[a]
Total Flow Generated within the Plan Change Area per Day	182,000 L or 182 m^3

a) The higher rate of 1,400 L is recommended which provides some conservatism.

5.6.3 Summary of Flows

There are two possible design flow values for the wastewater treatment and discharge system as discussed above. Reeftide recommends the use of the "bedroom numbers" method which is more realistic and also more conservative thus allowing for a wider range of variation on the assumed design parameters.

In summary, the maximum flows generated from each lot will be 1.4 m^3 and the total flow generated from the plan change area will be 182 m^3.

5.7 Wastewater Quality

5.7.1 Wastewater Source and Characterisation

The wastewater produced by the households will primarily come from:

- Kitchens.
- Sanitary appliances.

These wastewaters are basically domestic waters which are biodegradable. Table 5.6 below provides the expected wastewater quality before and after treatment.

Table 5.6 - Expected Raw Wastewater and Treated Effluent

Parameter	Unit	Raw Wastewater Value[b]	Value after AWTS or rtPBR System [a]	Value after MBR [a]
BOD_5	g m^{-3}	< 450	<5 – 15	<5
TSS	g m^{-3}	< 350	< 15	< 5
Total-N	g m^{-3}	< 80	1 – 25	
Total-P	g m^{-3}	40 – 100	5 – 25	10
Grease	g m^{-3}	10 – 30	12	
FC	cfu 100 mL^{-1}	-	8	

Parameter	Unit	Raw Wastewater Value[b]	Value after AWTS or rtPBR System [a]	Value after MBR [a]
FC following UV		10^6 - 10^{10}	< 10^2	< 1

a – from Manufacturer's literature.
b – from Rotorua trials (Scholes, 2006)

5.8 Estimated Hydraulic Loading Rates

The AS/NZS1547:2012 Standard contains guidelines for the evaluation of soil properties with respect to land application of treated effluent. Table 5.2 of the AS/NZS1547:2012 gives the recommended Design Irrigation/Loading Rates (DIR/DLR) for different soil categories. For the soil types and textures observed within the land treatment area, Table 5.7 shows that the site's soils (at below 0.50 m) fall in Categories 1-2.

Table 5.7 - Extract of Table 5.2 from AS/NZS1547:2012 – DIR/DLR for Different Soil Categories, Soil Textures and Structures

Soil Category	Soil Texture	Soil Structure	Indicative Permeability (Ksat) m/day	Drip and Spray Irrigation (mm/day)
1	Gravels and sand	Structureless/massive	>3.0	5
2	Sandy Loams	Weakly structured massive	1.4 – 3.0	5
3	Loams	High – weakly structured massive	0.5 – 3.0	4
4	Clay Loams	Massive – Highly/moderately structured	0.12 – 0.5	3.5

Category 1 and 2 soils have a DIR of 5 mm/day. This should be adopted for the Plan Change area design.

The total flows generated from the site have been estimated in Section 5.6.2. Table 5.8 below shows the net Land Treatment Area (LTA) estimates for both individual on-site systems and for the wider plan change areas if a communal system were to be implemented.

Table 5.8 - LTA Estimates

Parameter	Individual Site	Whole Plan Change Area
Flows (m^3/d)	1.4	182
Peak DIR (mm/day)	5.0	5
Net LTA Required (ha)	**0.028**	**3.64**

Therefore, based on hydraulic loading 280 m^2 will be required on each lot for the discharge area or 3.64 ha for the whole plan change area if a communal system were to be implemented.

5.9 Nutrient Loading Rates

In estimating the nutrient loading, the following conservative assumptions have been made:

- Nitrogen concentration of the treated wastewater is 15 g/m^3 (Table 5.6).
- The peak flows estimated occur every day all year round.

Table 5.9 summarises these calculations.

Table 5.9 - Nitrogen Loading Rates

Scenario	Flow (m^3/day)	Area (ha)	Total N Loading Kg/ha/yr
Individual Lot	1.4	0.039	197
Communal (i.e. total N over the PC Area)	182	5	199

Table 5.9 shows that the LTA area would need to be increased to at least 390 m^2 for each individual lot or to 5 ha for a communal system if the nitrogen loading is to be kept below 200 kg N/ha/year. The increased area results in an application depth of only 3.6 mm/day.

5.10 Irrigation System

5.10.1 Irrigation Design Details

As discussed above, drip irrigation will be used to disperse the treated effluent to land.

The dripline will be spaced 1 m apart and the drippers will be 0.6 m apart. The dripline will be placed approximately 150 - 200 mm below the ground surface to protect public health and to minimise risk of frost damage to the irrigation system.

This means that each individual lot system will require only 390 of drip line.

5.10.2 Irrigation Design Details

The setback clearances distances from wells, water races and property boundaries will be provided in compliance with Natural Resources Regional Plan and the Proposed Land and Water Plan.

5.11 Operation and Maintenance

For the system to operate successfully, appropriate operation and maintenance requirements will need to be adhered to. It is envisaged that a suite of resource consent conditions will stipulate the basic maintenance requirements.

5.12 Summary of the Preferred Wastewater System

The proposed wastewater treatment and dispersal system will consist of ***Individual On-site Treatment and Discharge Systems on Each Lot***. This will consist of the following:

- Primary treatment of raw wastewater via individual at-source sedimentation tanks and a coarse filter system;
- Secondary treatment of wastewater via an aerated treatment system on each lot; and,
- Land treatment via sub-surface drip irrigation at a maximum application rate of 5 mm/day over an area of 390 m^2.

The preferred treatment and dispersal system will provide:

- High quality treated wastewater;
- Reasonably consistent effluent quality throughout the year;
- Low annual operating costs;
- Likely to meet the expectations of future regulatory changes;
- Low maintenance requirements; and,
- Ease of operation.

5.13 Resource Consents

A global consent for the discharge of treated human effluent to land should be sought from Environment Canterbury at or before the subdivision stage. There is always the option to allow individual lot owners to seek their own consents at building consent stage.

6 Power Supply and Telecommunications

6.1 Power Supply

A written request was sent Orion New Zealand Limited seeking confirmation of the feasibility of providing power to the plan change area. Orion's confirmed that the area could be supplied with infrastructure for power supply. Orion's response provided in **Appendix D**.

6.2 Telecommunications

It is important that contemporary homes are provided with telecommunications infrastructure capable of supporting a wide range of capabilities including multiple phone lines, broadband internet, and the potential for future technologies such as cable television.

Such infrastructure has over recent years become standard installation in subdivisions, and will be the case within the plan change area.

Written confirmation was sought from Chorus, Vodafone and Enable New Zealand.

Vodafone and Enable confirmed that they did not cover the township of Darfield.

Chorus were able to confirm that the area can be serviced. A copy of Chorus' response is presented in **Appendix D**.

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7 Consultation

7.1 Selwyn District Council

As discussed in the preceding sections, Reeftide's Victor Mthamo presented the project concepts to the Council during a meeting with Mr Mathew Abraham (Water Engineer) on 24 November 2014. The project concepts and servicing options were discussed with Mr Abraham. This was followed up with some email correspondence. A formal response was received from Mr Murray England and this is appended in **Appendix C**.

7.2 Darfield Residents

A Drop-In Session was organised by the project planners (Avanzar) on behalf of Mrs GM Logan to provide an opportunity for interested parties including neighbours to come and ask questions about the project and for them to provide some comments on the proposal. The Preliminary Outline Development Plan was presented to those who attended. The meeting was held on 10 December 2014.

There were no specific issues raised with regards to any of the servicing matters. However, a few people were interested to know when the Council was going to put in a reticulated sewer system.

8 Conclusions

This report has assessed the engineering infrastructure requirements for the proposed Logan Plan Change area. The analysis has demonstrated that the plan change area is serviceable for Water, Stormwater and Wastewater, Power and Telecommunications.

It has been demonstrated that the proposed water, stormwater and wastewater infrastructure is technically feasible and can be designed, installed and operated to meet the high standards envisaged by the applicant for the plan change and by Selwyn District Council. Detailed designs will be confirmed at the subdivision phases of the development or when resource consents for the stormwater and wastewater discharges systems are sought.

Appendix A Outline Development Plan

Outline Development Plan

(part of) Area 5
Bangor Road, Darfield

Appendix B Selwyn District Council Water Consents

Record Number: CRC143985
Record Type: Change in Conditions
Permit Type: Water Permit
Record Holder: Selwyn District Council
Record Status: Issued - Inactive
File Number: CRC143985
Previous Record(s): CRC093539.1
Next Record(s):
Location: Bangor Road, DARFIELD
Description: To take and use groundwater for the purposes of community supply.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Key Dates:

Event	Date
Change Takes Effect Date	28 Mar 2014
Lapses	31 Dec 2015
Expires	16 Nov 2045

Workflow (Only shows if workflow has open tasks):

Task Name	Task Status	Task Status Date
Record Lodgement	Completed - Ready for s88	23 Dec 2013
Complete s88 Check	Completed - Accept Application	17 Jan 2014
Audit Application	Completed	24 Mar 2014
Complete Recommendation	Completed - No Peer/App Review	24 Mar 2014
Make Notification Decision	Completed - Non Notified	26 Mar 2014
Notify and Issue Final Decision	Completed - NonNtfd Grant	28 Mar 2014
Make Non Notified Final Decision	Completed	26 Mar 2014
Finalise Application	Completed	28 Mar 2014
Manage Objection Period	In Objection Period	
Manage Objection Period	In Process - Objection Period	

Conditions:

No	Text
1	Water may be taken only from: a. Bore L35/0980, 400 millimetres diameter, 246.5 metres deep, and screened between 191.5 and 245.5 meters below ground level, at or about map reference NZMS 260 L35:35927-47315; and b. Bore BX22/0006, 300 millimetres diameter and 245 metres deep, and screened between 189 and 243 metres below ground level, at or about map reference Topo50 BX22: 25995-85660.
2	a. Water may be taken from bore L35/0980 and BX22/0006 at a combined rate not exceeding 83 litres per second, with a volume not exceeding 6,000 cubic metres per day and not exceeding the maximum annual volume calculated in accordance with Condition (2)(b). b. The maximum annual volume for the 12 month period from 1 July to the following 30 June, shall be determined annually in June prior to the 12 month period, using the following formula: Maximum annual volume = estimate of the population to be provided with the water supply for the 12 month period x 227.3 cubic metres (Note: 227.3 = (365 days x 0.519 cubic metres per person) +20%).

	c. The population estimate for the purpose of (b) shall be an objective best estimate of the population that will be provided with water from the Darfield Public Water Supply over the 12 month period, 1 July – 30 June, calculated by applying the most recent and relevant Statistics New Zealand data, including the Statistics New Zealand average household size estimate for the district, number of serviced properties, building permit information and other relevant information provided that where the consent holder is a local authority as defined in the Local Government Act 2002 that has within the preceding three years formally adopted a population projection that estimates the population that will be provided with water from the Darfield Public Water Supply then that projection may be used as the estimate of population for the purpose of (b). d. The Darfield population estimate shall be certified by the consent holder's directors, chief executive or most senior person responsible for water supply, as being an objective best estimate that has been undertaken in accordance with Condition (2)(c), provided that where the consent holder is a local authority as defined in the Local Government Act 2002, certification of the formally adopted population projection is not required. e. The calculated maximum annual volume, including all the information used to undertake that calculation, and the certification shall be provided to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, before 1 July each year.
3	Water shall only be used for community drinking water supply purposes.
4	The combined total daily amount of water abstracted for the Darfield water supply via resource consent CRC991423 or CRC960148 and this resource consent CRC143985 shall not exceed 7344 cubic metres per day.
5	a. The consent holder shall within three months of the commencement of this consent in consultation with the Selwyn District Council prepare a water use demand management plan that sets out the measures the consent holder will take to reduce water usage under this consent during periods of low groundwater levels and submit the plan to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager. b. Static groundwater levels in any of: i. bore L35/0171; or ii. bore L35/0163; or iii. where a correlation report has been submitted in accordance with (c), bore L35/0806; shall be monitored at least monthly from 1 September to 31 March inclusive each year by a person with at least a tertiary science or engineering qualification that required the equivalent of at least one year of full-time study, a National Certificate in Water Treatment (Site Operator), a National Diploma in Drinking Water - Water Treatment (Site Technician) or an equivalent qualification. Note: monthly groundwater level monitoring data from any of these bores undertaken by the Canterbury Regional Council and obtained by the consent holder would constitute compliance with this condition. If the Canterbury Regional Council ceases monitoring of the bore, the consent holder would have to undertake monitoring. c. Where: i. static groundwater levels (depth below ground level) have been measured at least monthly in each of bores L35/0163, L35/0171 and L36/0092 and have been measured at least weekly in bore L35/0806 for a continuous period of 3 years and 6 months commencing 1 January and a correlation between the measurements in L35/0806 and each of the

other bores has been made and a determination has been made as to the measurements in which of bores L35/0163, L35/0171 or L36/0092 provides the best correlation with the measured static groundwater levels in bore L35/0806; and

ii. the correlation between the static groundwater levels in bore L35/0806 and in the bore that provides the best correlation with bore L35/0806 has been used to identify a groundwater level in bore L35/0806 that corresponds to the lowest water level below ground level measured in the bore that provides the best correlation with bore L35/0806 over the 3 year six month period of continuous monitoring ("the trigger level");
a report may be submitted to Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager setting out the measurements taken and correlations made and identifying the water level in bore L35/0806 below ground level that corresponds to the lowest recorded water level in the bore that is shown to have the best correlation with bore L35/0806 ("the trigger level").

d.

i. Where monitoring of the groundwater level in bore L35/0171 is undertaken in accordance with Condition (5)(b)(i) during the period 1 September to 31 March and measurements taken show that the water level has dropped below 47 metres below ground level, the water demand management plan shall be implemented as soon as possible after the consent holder is aware of that event, and continue until the groundwater level in bore L35/0171 rises up to less than 47 metres below ground level or until 31 March, whichever occurs first, or

ii. Where monitoring of the groundwater level in bore L35/0163 is undertaken in accordance with Condition (5)(b)(ii) during the period 1 September to 31 March and measurements taken show that the water level has dropped below 83.8 metres below ground level, the water demand management plan shall be implemented as soon as possible after the consent holder is aware of that event, and continue until the groundwater level in bore L35/0163 rises up to less than 83.8 metres below ground level or until 31 March, whichever occurs first; or

iii. Where monitoring of the groundwater level in bore L35/0806 is undertaken in accordance with Condition (5)(b)(iii) during the period 1 September to 31 March and measurements taken show that the water level has dropped below the trigger level identified in reports submitted in accordance with (5)(c), the water demand management plan shall be implemented as soon as possible after the consent holder is aware of that event, and continue until the groundwater level in L35/0806 rises above the trigger level or until 31 March, whichever occurs first.

e. The consent holder shall use its best endeavours to implement the water demand management plan and take all reasonable measures to ensure that there is compliance with the plan by water users.

f. If at any time there is monitoring of water levels under this condition in any bore that has not been monitored over the same period by the Canterbury Regional Council the consent holder shall provide all groundwater level data to the Canterbury Regional Council on request and shall provide a report annually on or about 30 April each year that details the results of groundwater level monitoring undertaken in the preceding seven months, the qualifications and experience of the person who undertook the monitoring and the measures taken to ensure the accuracy and representativeness of the reported groundwater levels.

g. Every year that the water demand management plan is implemented an annual report shall be provided to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, by 30 April following each implementation. That report shall include: the groundwater level data from any bore monitored during the monitoring period in accordance with (b), water usage data during that period and the actions taken to implement the water demand

	management plan.
6	a. The consent holder shall, within 12 months of the commencement of this consent: a. install and maintain throughout the duration of this consent a water metering device that is capable of measuring the rate and volume of water taken to an accuracy of not less than ±5%; and which is suitable for use with an electronic recording device; and b. install and maintain throughout the duration of this consent a tamper-proof electronic recording device such as a data logger that records or logs the pulse totals at hourly intervals and has the capacity to hold at least one years water use data; and c. the water measuring and recording devices shall be made immediately available to the Canterbury Regional Council upon request for the purposes of inspection and/or data retrieval. d. All reasonable measures shall be taken to ensure that the water metering and recording devices are fully functional at all times. a. The consent holder shall provide to the Canterbury Regional Council, at least on an annual basis or upon reasonable request, auditable recorded water usage data in a CSV format specified by Canterbury Regional Council that demonstrates compliance with Condition (2) of this consent. b. The consent holder shall: i. have the accuracy of the measuring device installed in accordance with Condition (6)(a) verified by a Chartered Professional Engineer (CPEng) or by a person who has relevant experience and/or a relevant qualification, that demonstrates that they have an appropriate level of knowledge about the calibration of water meters within 24 months of commencement of consent, and at five yearly intervals thereafter; and ii. provide the details of the qualifications and/or experience of the verifier and results of this verification to the Canterbury Regional Council within one month of the results being received by the consent holder.
7	a. The consent holder shall submit a copy of its Standard Operating Procedures relating to the management of the water supply system to the Canterbury Regional Council within 12 months of commencement of this consent. The procedures shall be reviewed on at least a five yearly basis thereafter and a further copy provided to the Canterbury Regional Council as soon as reasonably possible after any review of procedures; and b. The Standard Operating Procedures shall include but not be limited to information that demonstrates compliance with Condition (6)(a) of this consent; and c. The installation and maintenance of the devices installed in accordance with Condition (6)(a) shall be carried out in accordance with the Standard Operating Procedures.
8	The Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, shall be informed in writing within five working days of the first exercise of this consent.

9	a. The consent holder shall take all reasonable measures to avoid leakage from pipes and structures forming part of the reticulation system associated with the abstraction; and b. If the resource consent is held by a person other than a local authority under the Local Government Act 2002, then the consent holder shall also take all reasonable measures to avoid the application of water onto impermeable surfaces.
10	a. Within three months of the first exercise of this consent, a backflow prevention system that prevents contaminants entering bores L35/0980 and BX22/0006 shall be installed and maintained. b. Within one month of the installation of the backflow prevention system, a certificate signed by a Chartered professional engineer (CPEng) that certifies that a backflow prevention system has been installed in compliance with Condition (10)(a) of this consent shall be provided to the Canterbury Regional Council Attention: RMA Compliance and Enforcement Manager. c. An annual inspection shall be carried out of the backflow prevention system to ensure that it is operating correctly and a certificate, signed by a Chartered professional engineer (CPEng) within one month of the inspection that certifies that the backflow prevention system is operating in compliance with Condition (10)(a) of this consent, shall be provided on request to the Canterbury Regional Council Attention: RMA Compliance and Enforcement Manager.
11	The Canterbury Regional Council may, once per year, on any of the last five working day of May or November, serve notice of its intention to review the conditions of this consent for the purpose of a. dealing with any adverse effect on the environment which may arise from the exercise of the consent and which is appropriate to deal with at a later stage, or b. changing the water use reduction management plan requirements, including the trigger control requirements, if Condition (5) becomes ineffective.
12	The lapsing date for the purpose of section 125 shall be 31 December 2015.

Appendix C Correspondence with Selwyn District Council Officers

Victor Mthamo

From: Murray England <Murray.England@selwyn.govt.nz>
Sent: Thursday, 11 December 2014 10:54 p.m.
To: reeftide@gmail.com
Cc: Mathew Abraham
Subject: RE: PROPOSED PLAN CHANGE - 160 Bangor Road - Darfield

Hi Victor,

Some initial comments below for your consideration.

Water

We would like to see all section above 2000m3 on restrictors (2m3/day).

A new connection from our reservoir site will be required to form a ring main.

As part of the development Council would like to change the easement for the access to our reservoir site into free hold land. Provision needs to be made along this access way strip for a further well.

Sewer

Council has established a working party to determine Darfield's future sewer management strategy. For now assume septic tanks with the potential for a centralised system.

Stormwater,

Stormwater is disposed to ground. Generally sump to soakhole (depending on ECan requirements). Otherwise pre-treatment by shallow swales. Reticulation designed for 10 year event with overland flow and disposal of stormwater onsite up to the 50 year event in line with ECan requirements.

Kind regards

Murray England

Asset Manager – Water Services
DDI 347 2972

From: Victor Mthamo [mailto:reeftide@gmail.com]
Sent: Tuesday, 25 November 2014 8:57 p.m.
To: Mathew Abraham
Subject: RE: PROPOSED PLAN CHANGE - 160 Bangor Road - Darfield

Hi Mathew,
Good to meet you yesterday.

Mathew, the following is a summary of my take from yesterday's meeting:

- Water Supply – there is sufficient capacity in the water pump station behind 160 Bangor Road to supply the proposed 130-140 lots. The proposal is able to tee-off the main from the pump station.
- Wastewater – SDC has no plans for a community wastewater treatment system in the short to medium term. All proposal for subdivisions would need their own individual systems. SDC has no objection to the proposed individual onsite wastewater discharge systems for each lot for the plan change.

As I mentioned, the applicant will seek consents from Environment Canterbury for the stormwater and on-site wastewater discharges.

Mathew, I wonder if you are able to confirm the above. Please feel free to add anything that I may have missed.

Kind Regards,

Victor

From: Victor Mthamo [mailto:reeftide@gmail.com]
Sent: Thursday, 20 November 2014 5:09 p.m.
To: mathew.abraham@selwyn.govt.nz
Subject: PROPOSED PLAN CHANGE - 160 Bangor Road - Darfield

Hi Mathew,

Good talking too you just now.

I am looking at the servicing options (Water, Waste and Stormwater) for the proposed Plan Change for 160 Bangor Road in Darfield.

The proposal is still at an early stage and the final lot yields are being determined but it will likely be in the order of 100-140 lots.

Water Supply
I am seeking confirmation that potable and firefighting water can be supplied from the existing wells, pump station and reservoir behind the property. The demand is yet to be estimated but it would be based on the normal SDC requirements for potable residential water supply and a firefighting system designed to the New Zealand Fire Service standard. If SDC has a known demand rate (L/s/lot) for the Darfield area for similar sized lots (1,000 – 4,000m2) we could work with that. Happy to discuss the details.

Wastewater
The wastewater system will be on-site treatment and discharge systems. Resource consents will be sought from ECan. I was wondering if SDC has any issues with such a proposal. It is anticipated that each property will have its own treatment and discharge system that will be privately owned as is the case within the wider Darfield area.

Stormwater
A stormwater system that will collect, treat, attenuate (if needed) and discharge stormwater to the ground will be developed. Consents will be sought from ECan.
Does SDC have any special considerations that we should take into account in the design and operation of the system?

Summary
Mathew, would appreciate confirmation on the above for water supply, wastewater and stormwater. Happy to come around tomorrow (Friday) or early next week to discuss.

Kind Regards,

Victor Mthamo (CPEng, IntPE)
Principal Consultant
Reeftide Environmental and Projects
Phone - 027 673 6006
Email – victor.mthamo@reeftide.co.nz; reeftide@gmail.com

Selwyn District Council, 2 Norman Kirk Drive, Rolleston 7614; Post: PO Box 90, Rolleston 7643, Christchurch
Phone: (03) 347-2800 or (03) 318-8338, Fax: (03) 347-2799
www.selwyn.govt.nz | m.selwyn.govt.nz | www.selwynlibrary.co.nz

Appendix D Correspondence with Chorus and Orion

26th January 2015 **ES249696**

Reeftide Environmental and Projects

Victor Mthamo
Principal Consultant

victor.mthamo@reeftide.co.nz

Dear Sir,

Proposed sub-division connection to the Orion network

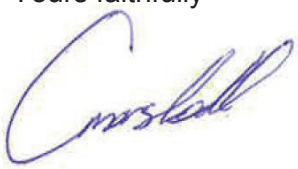
Appellation Sec 2 SO 438579, 160 Bangor Rd, Darfield

I refer to your letter and the above named property(s). I have investigated your request and comment as follows;

1. There is no specific connections available for this sub division; however,
2. A connection could be available with alteration to the Orion network.
3. There will be costs associated in providing the connection(s). These costs will be the responsibility of the property owner, not Orion.
4. To comply with Orion's network security conditions an alternative feed from adjoining developments may also be required.
5. This type of work would be a typical design build project. If you decide to proceed; have your designer forward their proposal to Orion for approval. Orion will forward Terms and Conditions for acceptance.
6. The terms and conditions presented to the applicant will encompass Orion's policies and practices current at the time.

Please don't hesitate to contact me on (03) 363 9722 if you have any questions, or email me at craig.marshall@oriongroup.co.nz.

Yours faithfully



Craig Marshall

The Subdivision Group
55 Shands Rd, Hornby 8042
PO Box 1374, Chrischurch 8140
Telephone: (03) 339 3402
Facsimile: (03) 338 0133
Email: tsg@chorus.co.nz

Chorus

Sub Div Ref: DRF26656
Your Ref: Dev Ref

9 February 2015

The Developer
c/- Reeftide Environmental and Projects

Attn: Victor Mthamo

Dear Sir/Madam

Fibre Reticulation Offer Letter

RE: Subdivision: DRF: 160 Bangor Road, Darfield - 130 lots (ABF)

Subdivision Location: DRF: 160 Bangor Road, Darfield

Thank you for your enquiry and scheme plan for the above subdivision. This letter is to confirm that Chorus will install Fibre to the Premises (FTTP) reticulation for the subdivision.

Fibre reticulation will enable the delivery of high bandwidth internet connections for new multi-media services, internet-based applications and phone services. This is why Chorus is currently laying thousands of kilometres of fibre optic cable to bring ultra-fast broadband to more than 800,000 homes and businesses across New Zealand.

Important information about premises wiring

It is important for you to know that the wiring requirements for premises in a subdivision connected by fibre are different from the requirements for connecting to the traditional copper network. Premises wiring is the responsibility of the homeowner. Any new homes built in the subdivision should be installed with telecommunications cabling that complies with the Telecommunications Carriers' Forum's Premises Wiring Code. Information about this code and wiring requirements is available on our website at chorus.co.nz/wiring

Failing to install telecommunications wiring that meets the standard in the Code may mean services will not function as expected within the home. It is therefore important that information about wiring requirements and service delivery is passed on to your electricians, builders and potential property owners for this subdivision.

If the developer wishes to reticulate the subdivision and install connection points on the boundaries prior to selling sections, they'll need to commit to a Chorus Subdivision Reticulation Agreement and pay the required subdivision fees. The ballpark figure to reticulate this 130 lot development in fibre is $290,000.00 (GST exclusive). This quote is valid for three months from the date of this letter.

NOTE: The above is a ballpark figure only.

The charge is a contribution to Chorus' total costs to extend its network and infrastructure to the lots in the supplied plan. Chorus' costs include network design, supply of telecommunications specific materials and supervising installation.

The quote above also assumes that the Developer, or their nominated contractor, will supply and reinstate trenches, and install Chorus plant within the subdivided.

Payment option

The subdivision charge can be split into two payments. The first payment will be a contribution to the cost of the network design, with the second payment covering the balance of the reticulation charges.

Please note that early payment of the Chorus network design fee payment will be required as the Chorus network design details need to be integrated with the overall civil engineering planning. The lead time for material ordering will be 12 weeks, after the total reticulation fee balance has been paid.

Easements
In any areas where Chorus Network is not installed in public road reserve vested to the Local Council, the subdivider is to ensure that a legal easement is registered over the route and Network in favour of Chorus New Zealand Limited. The easement should provide for an "easement in gross for Telecommunications purposes". Chorus has standard forms for easements transfer where an easement is being granted to Chorus as part of the requirements associated with the depositing of a subdivisional plan

Please note this includes service lead-in pipes and cable extending from the main network cabling into Right of Ways

Information relating to Street Names and Addresses

Please note that there are now multiple service providers who can potentially connect into communications networks in new subdivision areas. In order for connection requests to proceed without delays, accurate street address and numbering that aligns with Council plans needs to be recorded in the network providers data base.

This is particularly important for multiple dwelling units, campus developments or retirement villages that use both street addresses and unit numbering

Most subdivision developments at design stage start without Council registered road names and contain allotment numbers through the early build phase of the project. At build completion, the road names and the street address information is often available to developers before the final survey plans are sent for registration

It's vital that this information gets recorded in the Chorus network data base to ensure that connection requests to the network are completed successfully. The information can be provided back into the Chorus system via our Service Company staff who have provided the network designs for the subdivision area

I hope that this information assists with your enquiry and look forward to hearing from you in due course if a Reticulation Agreement is required.

Yours faithfully

Nuncy Maposa
Sub Division Specialist