STAGE 3 - SECTION 32

CHAPTER 17

RURAL - CRANFORD BASIN

APPENDIX 2 - CRANFORD BASIN PROPOSED REZONING WASTEWATER REPORT

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Christchurch City Council

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SUBJECT	Cranford Basin Re-zoning – Wastewater Review

1 Introduction

Opus International Consultants was commissioned by Christchurch City Council (CCC) to assess submissions received by CCC requesting rezoning of properties in the Cranford Basin from Rural 3 to Residential Suburban (RS) under the District Plan Review. There were 3 areas of assessment based on the submissions received (refer Table 1). Each of these submissions was assessed for the potential impact to the wastewater network. Consideration was also given to the any constraints (such as connection location and proposed development density) that may restrict the re-zoning.

The data supplied by Christchurch City Council (CCC) for use during the assessment includes:

- Relevant submission numbers.
- Link to the Proposed District Plan, including Planning Maps and all submissions, http://proposeddistrictplan.ccc.govt.nz/PropertySearch/SubmissionSearch.html# (March 2015).
- CCC *Infrastructure Design Guidelines (IDS), Part 6: Wastewater Drainage, v2.2* (Jan 2014). Table 2 and Table 3 were used to calculate average residential, commercial and industrial wastewater flows.

2 Submissions

CCC has received the following plan change submissions from individuals or collectives, as indicated in Table 1 and Figure 1:

Table 1: Details of submissions assessed as part of this report

Submission Site Code	Address / Location	Submission No.	Notified Zone	Requested Zone
Grassmere Site (Site A)	Multiple parcels from 31-65 Grassmere Street and 471&503 Cranford Street	646	Rural 3	RS
Case Site (Site B)	340 Cranford Street	957	Rural 3	RS
Crozier Site (Site C)	60 Croziers Road	324	Rural 3	RS

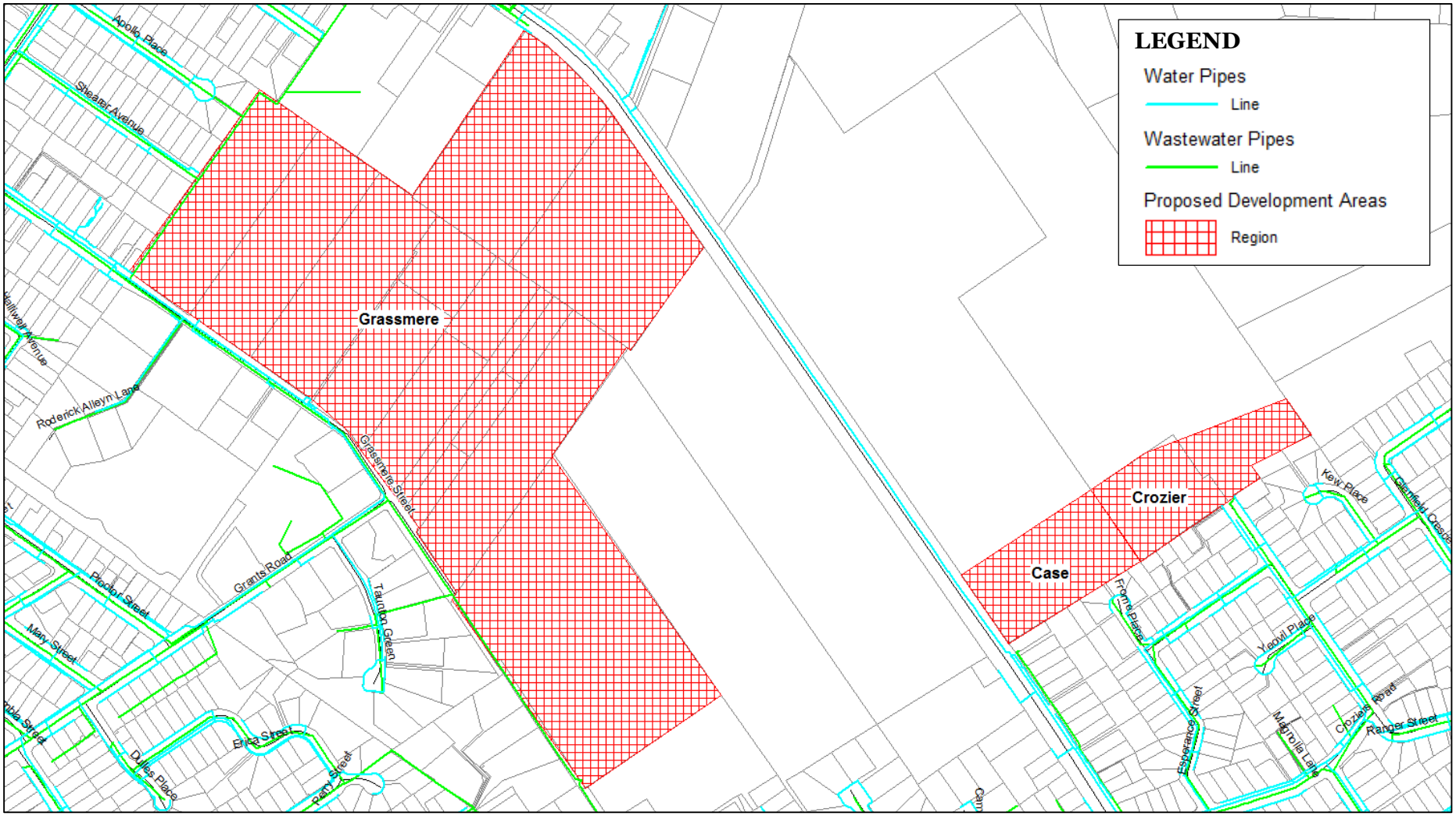

Figure 1: Properties requesting District Plan zone change from Rural 3 to Residential Suburban

3 Assessment Approach

In order to assess the impact of the proposed submissions on the wastewater network, the following methodology was undertaken:

1. Each submission was reviewed to detail the exact area of concern and to confirm what the submission was seeking.
2. Using the Zone Name Conversion table supplied by CCC, the Operative District Plan zoning, the Proposed District Plan zoning (Notified zone) and the zoning sought by the submission was confirmed.
3. An assessment of predicted flows from the proposed re-zone was then conducted. Maximum flows (MF) were calculated for the zoning sought by the submission. The IDS unit design flows (reproduced below in Table 2) were used for this calculation.
4. The Case and Crozier sites (Sites B and C) were assessed based on the proposed development area and the re-zoning sought of Residential Suburban, this zone is equivalent to L1 in the Operative District Plan.
5. The Grassmere site (Site A) was assessed using 3 re-zoning scenarios, the 3 scenarios have a range of population densities and were undertaken to assess if there should be any constraints applied to the density of the proposed development:
   - Scenario 1 - assuming a similar housing density to the Residential Suburban Peat Constraint Zone or L1B in the Operative Plan
   - Scenario 2 - assuming a similar housing density to the Residential Suburban Zone or L1 in the Operative Plan
   - Scenario 3 - assuming a similar housing density to the Residential Medium Density Zone or L3 in the Operative Plan
6. An assessment of predicted flows from the proposed re-zone was then conducted. Maximum flows (MF) were calculated for the zoning sought by the submission. The IDS unit design flows (reproduced below in Table 2) were used for this calculation.
7. Based on the calculated MFs, an assessment of the likely impact on the network was undertaken. To assess the impact on the network, the trunk network into which the flow discharges was examined for capacity and overflow (manhole or constructed) issues.
8. In order to quantify the extent of the impact on the network, as a worst case scenario the MF was added as a constant flow into the network at the proposed connection point during a wet weather flow (WWF) model run. Overflow results were analysed.
9. Investigation was conducted into the network downstream of the proposed re-zone areas, with both SCIRT rebuild and CCC proposed capital upgrades taken into account. This was in order to provide an indication of any constraints to the development.

Table 2: IDS unit design flows based on Operative and Proposed District Plans

Proposed District Plan Code	Operative District Plan Code	Population Density (p/ha)	Unit ASF (L/s/ha)	Unit MF (L/s/ha)
Residential Suburban Peat Constriant Zone	L1B	14	0.04	0.2
Residential Suburban (RS)	L1	35	0.09	0.45
Residential Medium Density (RMD)	L3	100	0.25	1.25

4 Assumptions, Uncertainties and Limitations

- The existing SCIRT Christchurch City wastewater model (Current Model) is presently the best available and is suitable for this re-zoning assessment.
- The Current Model is a trunk main model, meaning that most pipes <DN225 are not included in the model. In addition the subcatchments modelled are quite often large and are not split by each manhole in the model.
- Peak wet weather flow (PWWF) is peak flows during a design rainfall event; the 3yr, 24hr duration event. The flow from the existing areas was calibrated for wet weather in 2011 and re-calibrated for dry weather in 2013/14.
- The current population is the 2012 post-earthquake projected population which was based on the 2006 Census data. The model has not yet been updated with the 2013 Census data.
- The Post-SCIRT rebuild model is a work in progress at SCIRT, however the Current Model used for this modelling does not contain all the rebuilt catchments that have completed construction as not all as-built data is available.
- Where suitable, comments have been made regarding the impact of possible SCIRT rebuild work and/or CCC upgrades on the network.

5 Results

Table 3 outlines a summary of the calculated flows from the proposed re-zone based on the IDS unit design flows.

Table 3: Wastewater results for submission requests for re-zoning land

Submission Site Code	Address/ location	Scenario Number	Scenario Modelled - Zoning sought	Area of Zone Change (ha)	Increase in flow due to re-zone, IDS ASF (L/s)	Increase in flow due to re-zone, IDS MF (L/s)	Impact	Comment on Impact
A	Multiple land parcels located at: 471 & 503 Cranford Street, 31, 37 - 45A Grassmere Street, 57, 63 - 65 Grassmere Street	1	Residential Suburban Peat Constriant Zone (L1B)	29.1	1.2	5.8	Moderate	Moderate increase in volume lost at Grassmere overflow during WWF
		2	Residential Suburban (L1)		2.6	13.1	Moderate	Moderate increase in volume lost at Grassmere overflow during WWF
		3	Residential Medium Density (L3)		7.3	36.4	Major	Significant increase in volume lost at Grassmere overflow during WWF
B	340 Cranford St	n/a	Residential Suburban	1.9	0.2	0.9	Moderate	One additional manhole overflow during PWWF and increased number of manholes with freeboard issues.
C	60 Croziers Road	n/a	Residential Suburban	2.6	0.2	1.2	Moderate	One additional manhole overflow during PWWF and increased number of manholes with freeboard issues.

5.1 Grassmere Site (Site A)

The development at the Grassmere Site covers a large area and is bound by Cranford Street to the east and Grassmere Street to the west. The Northern Relief is aligned down the north and western boundaries of the proposed re-zoning site, and increases in size from a DN750 to DN900 in this section. In order to quantify the effect the re-zoning is likely to have on the wastewater network, the MF from each of the 3 scenarios has been added to the model as a constant flow. The entire flow has been added in at a manhole on Grassmere Street (refer Figure 2).

The Northern Relief is a large trunk main that collects and conveys flow from the north and west of Christchurch to PS1, a terminal pump station which discharges to the Christchurch Wastewater Treatment Plant. Located on the Northern Relief just at the south-west boundary of the Grassmere re-zone site is the Grassmere overflow (PS1/21). The Northern Relief is currently predicted to run surcharged during WWF, with known areas downstream to result in manhole overflows, as well as constructed overflows operating during wet weather events. Previous modelling by CCC/Opus indicated that due to the surcharging in the Northern Relief, the Grassmere overflow was predicted to operate annually, with the Current model therefore predicting it to overflow during the design rainfall event.

The addition of the MF from the re-zoning of Site A exacerbates the current issue in the Northern Relief. While in scenario 1 the increase of 5.8L/s is only an approximate 2% increase in flow in comparsion to the 321 L/s PWWF in the Northern Relief at this point, essentially any increase just adds directly to the volume lost at the Grassmere overflow. Table 4 compares the increase in volume lost out of the Grassmere overflow during each of the scenario runs.

Table 4: Results from scenario runs for Site A

Submission Site Code	Model Scenario	Volume lost at Grassmere overflow (m^3)	% Change from Current model
A	Base Model	598	-
	Scenario 1	686	115%
	Scenario 2	835	140%
	Scenario 3	1383	231%

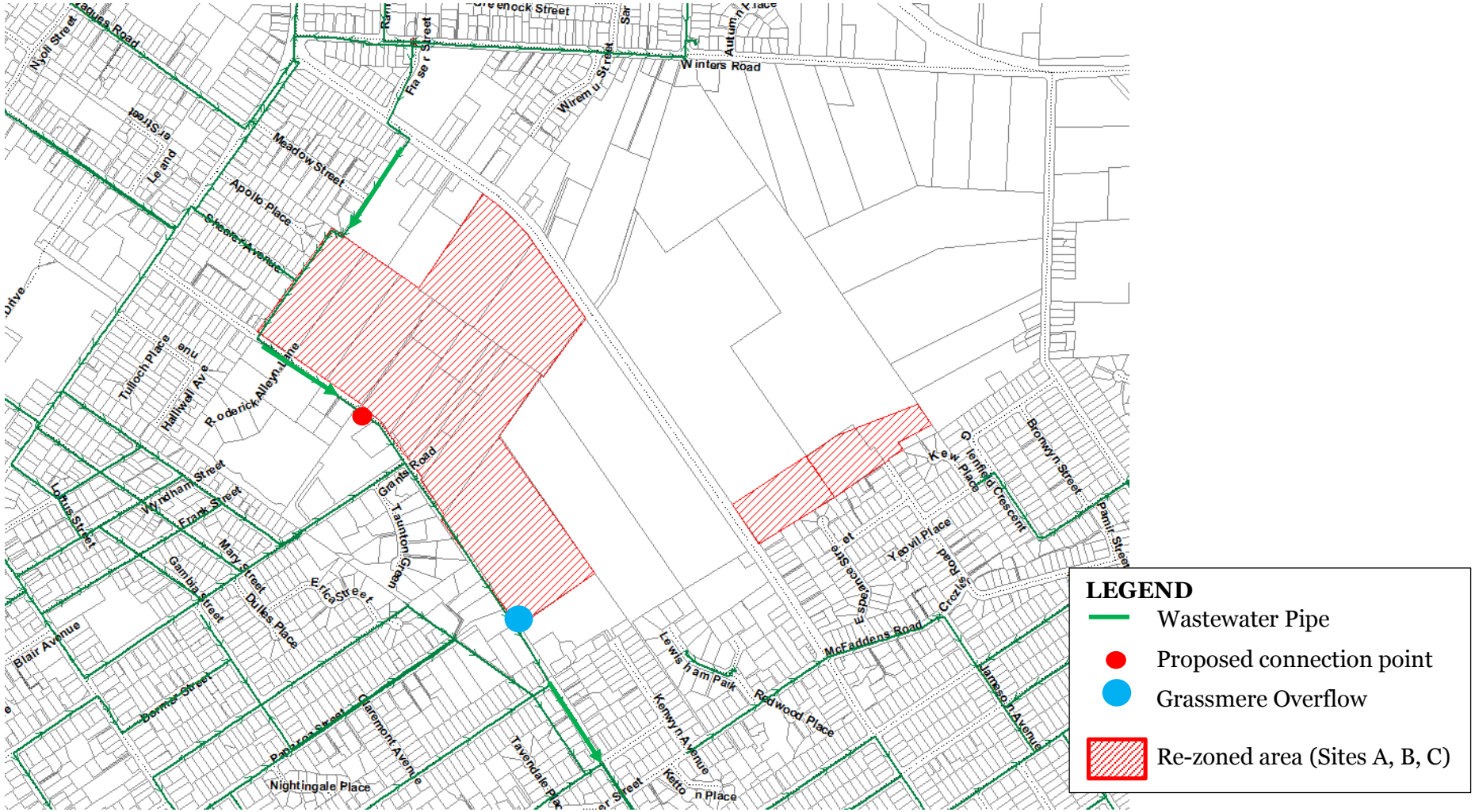

Figure 2: Map showing Site A connection points and details

5.2 Case and Crozier Sites (Sites B and C)

The two developments at Site B and C are able to connect into the DN150 local reticulation on Fromes Place and Croziers Road, refer Figure 3 The DN150 from Fromes Place directs flow to the newly built PS118 (SCIRT) and then discharges to the gravity network feeding PS6.The DN150 on Croziers Road connects into the gravity network feeding PS6.

The flows from the re-zoned area are not predicted to result in any negative impact on the network during dry weather flow (DWF). In wet weather, while the re-zoned area is predicted to only have a reasonably small MF, due to the size of the reticulation it is entering and existing surcharging issues, this small increase is predicted to result in an increased number of manholes with freeboard issues in the network during PWWF. One additional manhole is now predicted to overflow.

It is the pipework in the PS6 catchment (rather than PS6) which is predicted to have capacity issues during DWF. The pipework immediately upstream of PS6 on Harrison Street (WwPipe65 and WwPipe15151 which is the inlet into PS6) are predicted to have the greatest capacity issues due to pipe size and grade. An additional scenario was run to assess if upsizing (from DN375 to DN525) and re-grading this pipework in the model reduces surcharging and overflow issues in the network. Table 5 outlines the results from this scenario run in comparison to both the base model (with no re-zoning of Site B & C) and also with the re-zoned areas included.

Table 5: Results from additional scenarios run for Site B and C

Model Scenario	Manhole overflow volume lost (m^3) in PS6 catchment	No of manholes overflowing	No of manholes with <0.3m freeboard
Base Model	11	2	17
With Site B & C re-zoned	56	3	19
With Site B & C re-zoned and PS6 inlet upsized and regraded	4	1	13

The results indicate that upsizing and re-grading WwPipe65 and WwPipe15151 resolve the additional manhole overflow and freeboard issues caused by the addition of flows from the re-zoning. The SCIRT project encompassing the PS6 catchment is still in the detailed design phase at SCIRT. It is recommended that CCC investigate if any upgrades to these pipes are programmed as part of the SCIRT work and if this is not the case then any upgrades to this pipework should be included as a constraint to re-zoning and development

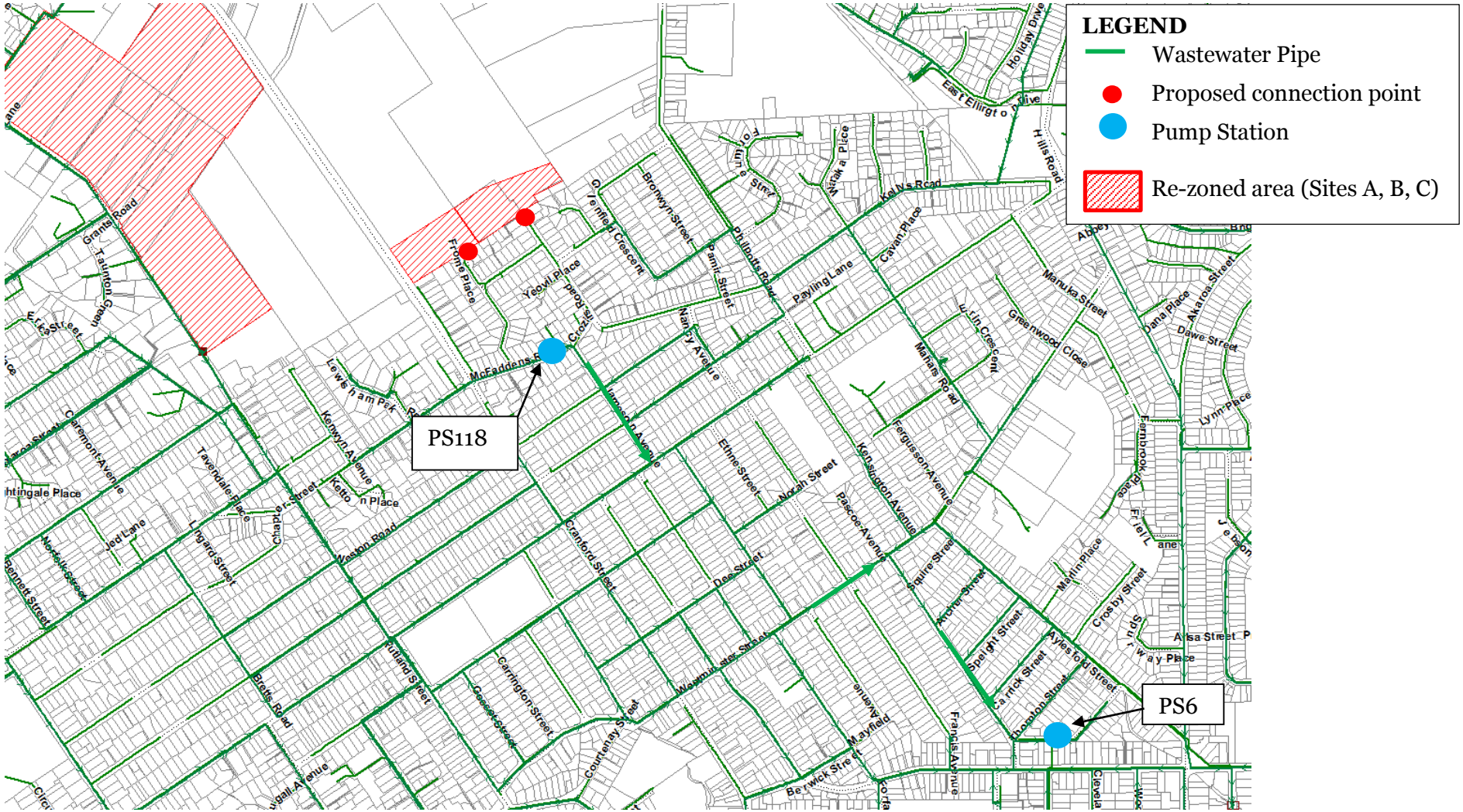

Figure 3: Map showing Site B & C connection points and details from PS6 catchment

6 Results Discussion

6.1 Grassmere Site (Site A)

- As the Northern Relief currently surcharges during wet weather events, there are both CCC and SCIRT upgrades proposed, currently under construction or have been built, to help reduce these issues (including the Wairakei Diversion, Fendalton Duplication, upgrades to the Northern Relief and rebuild of the River Road constructed overflow).
- CCC also propose to undertake substantial capital upgrade of the Grassmere overflow in the future. This upgrade is proposed to help resolve the issue of the current overflow to Dudley Creek and also to allow for growth in northern Christchurch. Issues and options for this upgrade have been identified by CCC.
- The re-zoning of site A in the Cranford Basin is predicted to exacerbate any current overflow issues at the Grassmere overflow. If the development of this site can be restricted until after proposed upgrades at Grassmere overflow occur, the impact of the addition of these flows to the network will be minimal, with the main impact then being on what volumes to account for during design of the proposed upgrades.
- As the re-zoned site in Cranford Basin is likely to have a high groundwater table, it is recommended that consideration be given to a pressure or vaccum wastewater system, rather than gravity. This type of system is also likely to mitigate any backwater effect that might occur from connecting to the surcharged Northern Relief via a gravity network.

Constraints on Re-zoning

- Consideration should be given to constraining the timing of any potential development to be in line with or following on from the timing of proposed upgrades at the Grassmere overflow. If the development of the re-zoned area occurs prior to the upgrades, the volume lost at the Grassmere overflow during wet weather is predicted to increase.

- Due to the likelihood that there is a high groundwater table at site A, it is recommended that a pressure or vacuum wastewater system be considered rather than gravity.

- A system that is able to attenuate flows during wet weather should be considered. To reduce any increase in overflow volume lost from the network, attenuating WWF from the new developments until after PWWF passes in the network is necessary.

6.2 Case and Crozier Sites (Sites B and C)

- The Current model predicts that the PS6 catchment has high infiltration and inflow, resulting in a surcharged network during the design wet weather event. PS6 itself does not appear to have capacity issues, however, there are capacity issues identified within the catchment reticulation serving PS6.
- Pipework immediately upstream of PS6 on Harrison Street (WwPipe65 and WwPipe15151 which is the inlet into PS6) are predicted to have the greatest capacity issues due to pipe size and grade.
- In the PS6 catchment, stormwater inflow from vented manholes is a known contributer to surcharging issues during WWF. This area contains the Flockton Basin and in this

area and elsewhere in the catchment, water is known to pond during wet weather events and enter the wastewater network through manhole vents. CCC area currently working on a trial to block vented manholes in areas that pond to determine the impact this has on restricting stormwater inflow to the wastewater network.

- High groundwater levels in the north-west of the PS6 catchment also results in some of the pipes being below groundwater, hence infiltration is known to be an issue.
- The Current model does not have any SCIRT rebuild changes to the network, including those in the catchment immediately downstream of these connections (particularly PS118 at the intersection of McFaddens Road and Jameson Ave). However, current information received to date, has identified that the SCIRT rebuild in the greater PS6 catchment is not proposed to make any major connectivity or configuration changes to the network, and no major upgrades are proposed. Repairs on some pipework, in addition to some lining, is expected.
- Any reduction in I&I from repairs, lining or blocking inflow, will be unknown until work is complete and additional flow monitoring undertaken, this is only expected to occur sometime in 2017.

Constraints on Re-zoning

It is likely that the changes to the PS6 catchment network outlined in this discussion may reduce flows entering, and therefore surcharging in the network, mitigating the need for stringent restrictions to flows from any re-zoning.

However, until this is confirmed, it is suggested that the following constraints be applied to any development proposed as part of re-zoning of Site B and C:

- No development to occur prior to CCC undertaking further assessment to determine if pipe upgrades are required immediately upstream of PS6 (refer results for specific pipes) and allowing for the implementation of these upgrades to take place if required.

- Due to infiltration issues in the current network from a high groundwater table it is recommended that a pressure or vacuum wastewater system be considered rather than gravity.

- A system that is able to attenuate flows during wet weather should be considered. To avoid the risk of manhole overflows (and freeboard issues), attenuating WWF from the new developments until after PWWF passes in the network is necessary.

7 Conclusions and Recommendations

Development of any of the re-zone areas proposed by the submissions assessed for this report, are predicted to result in moderate or major impacts to the performance of the wastewater network, if unmitigated. The impacts predicted include increases to volume lost from manhole or constructed overflows.

We have assessed that Site A would connect into the Northern Relief, which is aligned along the north and western boundary of the proposed site. However, the Northern Relief is currently predicted to be heavily surcharged during WWF, and the Grassmere overflow downstream is predicted to overflow. Any addition in flow into the Northern Relief has a corresponding increase in volume lost out the Grassmere overflow. Selection of alternative connection points

is unlikely to significantly alter these conclusions due to the current status of the network issues in the area and the proximity to the Grassmere overflow location.

Re-zone Sites B and C are able to connect into existing reticulation in the PS6 catchment. However, due to surcharging in this catchment during WWF, any increase in flows during wet weather results in an additional manhole overflow and freeboard issues.

The following is an outline of the recommended constraints to the re-zoning of the 3 sites located within the Cranford Basin:

- For the Grassmere site (Site A), consideration should be given to the timing of any potential development to be in line with or following on from the timing of proposed upgrades at the Grassmere overflow. If the development of the re-zoned area occurs prior to the upgrades, the volume lost at the Grassmere overflow during wet weather is predicted to increase.

- For the Case and Crozier sites (Sites B and C), it is recommended that no development occur prior to CCC undertaking further assessment to determine if pipe upgrades are required immediately upstream of PS6 (refer results for specific pipes) and allowing for the implementation of these upgrades to take place if required.

- For all re-zoned sites it is recommended that a pressure or vacuum wastewater system be considered rather than gravity.

- For all re-zoned sites a system that is able to attenuate flows during wet weather should be considered. To avoid the risk of overflow and freeboard issues, attenuating WWF from the new developments until after PWWF passes in the network is necessary.