Whanganui District Council

Churton Creek (Stage A) Stormwater System Improvements Report

September 2016

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1. Introduction

1.1 Background

As part of the of the Stormwater Masterplanning Roadmap and the Council's intention to develop Integrated Catchment Management Plans, GHD built and validated a 2D stormwater model covering the Churton Creek and Rogers Street/ Heads Road (Stage A) Catchments.

The model was subsequently used to assess the stormwater catchment performance under a range of storms, and identified flooding issues that did not meet Whanganui District Council's(WDC) required level of service. The findings of the assessments are documented in the report, 2D Modelling and Flood Mapping, Stage A Catchment – Churton Creek and Rogers Street, March 2016. InfoWorks ICM software has been used for the modelling.

1.2 Scope of Work

The next phase of the Stormwater Masterplanning Roadmap is to address the issues in the catchment by using the model to assess system improvements to the existing network as well as requirements to address proposed new development in the catchment. Improvements to both the primary and secondary stormwater systems are considered in this work.

Costed improvement works are to be developed to reduce model predicted maximum depth of flooding in urban property to 0.2 m above the surface in a 0.5% AEP (1 in 200 year) 24 hour duration synthetic rainfall event. Some small areas of flooding greater than this depth may be acceptable in private property where the area is undeveloped and/or the cost of resolving the issue deemed too great.

The system deficiencies that exist with the current level of development are to be addressed first. The improvements required to service proposed new development are determined by adding growth projections to the model. The growth projections will be in accordance with those used in the recently delivered wastewater improvement plan. The costs of the resultant system improvements will give WDC a clear indication of the costs associated with proposed development versus the costs associated with resolving existing deficiencies in the system.

This report documents the process undertaken for the system improvement assessment, recommended system improvement works for both the existing network and proposed new development and preliminary cost estimates of the recommended improvement works.

1.3 Limitations

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The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Whanganui District Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimates set out in section 4 *of this report using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.*

The Cost Estimate has been prepared for the purpose of providing indicative costs and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the [works/project] *can or will be undertaken at a cost which is the same or less than the Cost Estimate.*

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

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GHD does not guarantee that the InfoWorks ICM stormwater model is free of computer viruses or other conditions that may damage or interfere with data, hardware or software with which it might be used. Whanganui District Council absolves GHD from any consequence of Whanganui District Council's or other person's use of or reliance on, the InfoWorks ICM stormwater model.

2. Existing Network Issues

The system performance assessment report, 2D Modelling and Flood Mapping, Stage A Catchment – Churton Creek and Rogers Street, March 2016 documents the areas in the catchment where the system is deficient in its ability to convey flows adequately, causing surcharge and/or flooding in the catchment. These deficiencies lead to the development of system improvement options in those areas to ensure the required level of service is achieved.

In addition to Catchment flooding issues caused by deficiencies in the primary and secondary stormwater network, the following observations can be made from the flood maps presented in the Appendix D of the system performance report noted above:

- Substantial flooding is expected in areas adjacent to the Whanganui River. The Gilberd Street/ Heads Road area and parts of Taupo Quay are significantly affected. This is directly influenced by the levels in the Whanganui River.
- The absence of flap gates in both the network and the model may be causing additional flooding in the low-lying areas.

3. System Improvements

3.1 Level of Service

The network improvements are developed to reduce the model predicted maximum depth of flooding in urban property or public facilities to 0.2 m above surface in a 0.5% AEP 24 hour synthetic nested storm event. Some small areas of flooding greater than this depth may be acceptable where the area is undeveloped and/or the cost of resolving the issue is deemed too great.

3.2 Upgrade Concepts

In order to prioritise and size upgrades, consideration must be given to the overland flow paths/ ponding. Spilling/flooding that has the potential to affect buildings should be given priority over spilling/flooding that only presents a nuisance factor. The investigation looks at the flood protection offered by both the primary and secondary systems.

Concepts for network improvements include:

- Upgrade of the primary conveyance systems such as pipes, open channels, pumps etc,;
- Flow attenuation through storage;
- Create or improve secondary overland flow paths clear of private property;
- Flow diversions;
- Measures to stop flow reversal in the primary system.

3.3 Network Improvements to Service Existing Development

The wider catchment problem areas in a 0.5% AEP 24 hour storm are grouped to smaller study areas for investigation as shown in Appendix A considering:

- Ponding depths greater than 0.2 m;
- Potential for ponding to affect buildings or public facilities;
- Historically known problem areas;
- Network connectivity and the potential to isolate problem areas;
- Cost of resolving issues.

Existing development network upgrades are shown in Appendix B. Flood maps showing the flood depths after the network upgrades are in place are shown in Appendix C.

Locating and confirming the need for flap gates is proposed on all river discharges to minimise the flood risk from high river levels.

3.3.1 Study Area 1 (Heads Road Industrial Area)

The existing pipe network surcharges mainly due to the lack of flap gates at the river outfalls causing the area to flood substantially. The flooding extends from the riverbank to Hinau Street. The peak river level assumed at this locality (1 in 4 years) is 2.3 m RL.

Isolated pipe upgrades and earthworks are also required to resolve flooding.

Since the start of this project, WDC has engaged a contractor to build a new swale along Heads Road. This work is not included in the model. The effect the new swale will have on the proposed upgrades in this area should be investigated in the preliminary design phase.

The following upgrade works are proposed (Appendix B Maps B1, B3) :

- Locate and confirm the installation of flap gates on river outfalls to prevent backflow due to high river levels.
- Pipe upgrades to minimise manhole spills/flooding. Pipes are sized to include the flows from the unseparated area.
- Improve the existing overland flow path in the lower section of Gilberd Street to minimise ponding in private property.
- Lower the Landfill Wetland to allow additional flow detention to minimise property flooding in Gilberd St at high river levels

  Groundwater effects and drainage are to be investigated prior to implementing this option.
- Locate flap gates required to prevent backflow to the Hinau Street network

3.3.2 Study Area 2 (Titoki Street and Mosston Road)

Property flooding in Lee Street/ Mosston Road is due to insufficient capacity in the existing drain behind Lee Street/ Mosston Road and the Mosston Road culvert. Flow detention in the Titoki Wetland can be optimised to prevent overland flow into Titoki Street.

The following upgrade works are proposed (Appendix B Maps B1, B2, B4) :

- Bund the Titoki Street side of the Titoki Wetland to prevent property flooding in Titoki Street. An drain is proposed at the toe of the bund to collect the flow from the properties sloping back to the wetland.
- Widen the drain behind Lee Street/ Mosston Road properties to prevent property flooding. These properties drain to the existing swale which has inadequate capacity.
- Construct a side drain on the northern side of Mosston Road to convey additional flows from the Mosston Road culvert to the upgraded Mosston Road pipe network.
- Pipe upgrades to minimise manhole spills/flooding. Pipe upgrades along Mosston Road convey flow from the widened Lee Street/Mosston Road drain and excess overland flow upstream of the Mosston Road culvert.

3.3.3 Study Area 3 (Alma Road)

Property flooding in Alma Road is due to insufficient existing pipe capacities.

The following upgrade works are proposed to minimise manhole spills/ flooding in Alma Street (Appendix B Map B9):

- Pipe upgrade along Alma Road including a new diversion via Dustin Street to Kawatiri Avenue.

3.3.4 Study Area 4 (Smithfield Road and Konini Street)

Pipe capacity issues along Smithfield Road and Konini Street cause flooding in adjacent private properties.

The following upgrade works are proposed (Appendix B Maps B7, B9) :

- Pipe upgrades along Smithfield Road and Konini Street to minimise manhole spills/ flooding

3.3.5 Study Area 5 (Gonville Avenue)

Property flooding in Gonville Avenue is due to pipe capacity issues in the existing Gonville Avenue system.

The following upgrade works are proposed (Appendix B Map B10) :

- Upgrade of the pipe system in Gonville Avenue downstream of Tawa Street to minimise manhole spills/flooding

3.3.6 Study Area 6 (Springvale)

Significant overland flows are expected from the northern rural area discharging via the Montgomery Road drain connecting to the Springvale pipe network at Downes Avenue. The Springvale pipe network is of insufficient capacity to convey these flows. The overland flow paths mainly follow the road carriageways down to Parsons Street where significant ponding is initiated. Significant flooding is predicted south of Parsons Street to Ingestre Street. To minimise the flood risk in this area, substantial upgrade works are required.

Springvale Swale

An investigation was carried out to assess the benefits of the proposed Springvale Swale for reducing flood risk in the urban area. One of the intended benefits of the proposed Springvale Swale was to divert the existing swale flows that enter the pipe network away from the Parsons Street main flood risk area.

The assessment shows that there is minimal benefit from the proposed swale for reducing the existing flood risk in the urban area, showing similar ponding depths with and without the proposed swale. Therefore, the proposed Springvale swale is not of benefit at present but will be required when the Springvale Growth area is developed, as detailed in Section 4.0.

Also note that the Mosston Road currently dams the overland flow from the rural area causing flooding on the west side. This area is zoned rural and therefore has not been addressed.

Tayforth Road Culvert

The ponding area behind the Tayforth Road culvert to be formalised.

Montgomery Road Drain/Bund

The Montgomery Road drain collects rural flows from the northern catchment as well as flows from the small urban pipe network to the west of Great North Road. The current drain capacity does not meet the required level of service.

The following upgrade works are proposed (Appendix B Map B6) :

- A bund across the drain with an associated culvert outlet to reduce the rate of flow in the drain downstream of the bund.

Springvale Park

The existing Springvale Park area is proposed to be used as a major flow detention facility to minimise the significant private property flooding south of Parsons Street to Ingestre Street. Lowering the Carlton Avenue side of the park and a bund at the London Street side of the park with other minor upgrade works would substantially minimise the flood risk in this area.

The following upgrade works are proposed (Appendix B Map B8) :

- Lower the Carlton Avenue side of Springvale Park to retain flood flows and reduce flood risk to the south

Groundwater effects and drainage are to be investigated prior to implementing this option.

- A bund along the London Street side of Springvale Park to retain flood flows and reduce flood risk to the south
- New overflow pipe connections from the existing Parsons Street stormwater system to Springvale Park providing flow diversion into the Springvale Park detention facility
- A pipe diversion from Parsons Street to the existing system in Grey Street
- A swale drain along the Parsons Street side of Springvale Park to improve the overland flow path and collect flows from the northern side of Parsons Street and minimise flood risk to those properties
- Lower a section at the Grey Street end of the Parsons Street road carriageway to improve the overland flow path to the proposed swale drain
- Locate flap valves as appropriate to prevent private property flooding due to backflow from the surcharged pipes
- A minor pipe upgrade adjacent to Avon Place to minimise manhole spills/flooding

Pipe Upgrades

Deficient pipe capacities are causing private property flooding in Hadfield Crescent and lower Grey Street even after the flood risk from the upstream catchment is removed.

The following upgrade works are proposed (Appendix B Map B11) :

- Upgrade the existing pipe system along Hadfield Crescent to minimise manhole spills/flooding
- Re-grade and upgrade a section of the pipe system in Selwyn Crescent to convey flows to the Grey Street system
- Upgrade the pipe system in Grey Street from Selwyn Crescent to Ingestre Street to minimise manhole spills/flooding

3.3.7 Study Area 7 (Heads Road / Cemetery)

Flooding in the Heads Road/Cemetery area is caused by pipe capacity issues in the Heads Road pipe system.

The following upgrade works are proposed (Appendix B Map B13) :

- Upgrade the system along Heads Road to the River to minimise manhole spills/flooding

3.3.8 Study Area 8 (Taupo Quay, near Pacific Place)

Existing pipes surcharge mainly due to the absence of a flap valve at the river outfall causing the area to flood substantially. A minor pipe upgrade is also required to resolve flooding.

The following upgrade works are proposed (Appendix B Map B13):

- Locate and confirm installation of a flap valve on the River outfall to prevent backflow due to high river levels
- Upgrade a short section of pipe to minimise manhole spills/flooding.

3.3.9 Study Area 9 (Hospital Carpark and Heads Road)

Hospital carpark flooding and minor property flooding in the vicinity is caused by pipe capacity issues in the pipe system along Carlton Avenue/ Heads Road.

The following upgrade works are proposed (Appendix B Map B12):

- Upgrade the pipe system along Carlton Avenue/ Heads Road to minimise manhole spills/flooding

3.3.10 Study Area 10 (Totara Street)

Totara Street private property flooding is due to pipe capacity issues in the pipe system along Akepiro Place/ Totara Street.

The following upgrade works are proposed (Appendix B Map B5):

- A pipe system upgrade along Akepiro Place/ Totara Street to minimise manhole spills/flooding

3.3.11 Study Area 11 (Nikau Street)

Private property flooding in Nikau Street is due to under capacity pipes along Nikau Street and backwater from the Totara Street pipe system.

The following upgrade works are proposed (Appendix B Map B5):

- A pipe system upgrade along Nikau Street to minimise manhole spills/ flooding.
- Install a check valve at the Nikau Street/ Totara Street intersection to prevent backflow to Nikau Street.

3.4 Network Improvements to Service Proposed Growth Areas

The following key growth areas are proposed as part of the Whanganui District Council's District Plan:

- Mill Road Industrial growth area
- Springvale growth area
- Otamatea growth area

Maps of these growth areas are presented in Appendix D.

The following hydrological factors have been used for the proposed new development as per discussions with WDC:

- Mill Road Industrial growth area – Entire development area to have 100% impervious surface.
- Springvale growth area – Hydrologically neutral or runoff from the new development area maintained at 'existing' levels.
- Otamatea growth area - Hydrologically neutral or runoff from the new development area maintained at 'existing' levels.

The network improvements proposed are the key infrastructure required to manage the 0.5% AEP 24 hour storm and the flooding risk to private property based on maximum ponding depths of less than 0.2 m. Stormwater collection networks required within the developments have not been addressed.

System improvement works proposed due to growth areas are presented in Appendix D. Flood maps showing the flood depths after the network upgrades are in place are shown in Appendix E.

3.4.1 Mill Road Industrial Growth Area

The stormwater flows from the 110 ha Mill Road industrial area are proposed to be serviced by upgraded swales, a bund across the swales for flow detention and the Mosston Road pipe system with some other minor upgrades.

The following additional upgrade works are proposed:

- Wide deep swales to convey increased flows to the Mosston Road pipe system
- A bund across the swale and associated culvert outlet to limit flows into the Mosston Road pipe system and Mosston Road culvert
- Lowering the existing ground surface in the vicinity of the swales to form a detention area for peak flow reduction purposes

  Groundwater effects and drainage are to be investigated prior to implementing this option.
- Upgrade and regrade the Mosston Road pipe system to convey increased flows to the River
- Side drains around the boundary of the development area to collect and convey overland flows from outside the development to the upgraded swales
- Connect the outlet pipe from the Titoki Wetland to the Mosston Road pipe system

3.4.2 Springvale Growth Area

The proposed 97 ha Springvale development is intended to be hydrologically neutral or stormwater flows maintained at 'existing' levels. If this criterion is applied across the growth area, the peak flows from the development will be maintained at pre-development levels.

The following upgrade works are proposed:

- The growth area flows are proposed to be conveyed via the proposed Springvale Swale which is planned to discharge to the Titoki Wetland. The proposed 15 m x 1.2 m sizing of the swale to be optimised in the detail design stage to ensure a corridor width that is adaptive and provides a degree of resilience to future changes in the Springvale Growth Area.

3.4.3 Otamatea Growth Area

The proposed 161 ha Otamatea development is intended to be hydrologically neutral or stormwater flows maintained at 'existing' levels. If this criterion is applied across the growth area, the peak flows from the development will be maintained at pre-development levels.

Part of the Otamatea development area north of Great North Road will be discharged to stormwater Catchment D and is therefore excluded.

The following upgrade works are proposed:

- Attenuated flows from the growth area are to be piped to the Sandcroft Drive detention pond
- Re-shape and formalise Sandcroft Drive detention area to retain catchment flows.
- Install an outlet pipe system from the Sandcroft Drive pond to connect to the Montgomery Road drain

4. System Improvements Costing

Cost estimates for the upgrade works have been developed based on the standard unit rates from recent infrastructure projects. The rates exclude GST and include a 20% contingency margin.

Tables 1, 2 and 3 show a cost summary for existing development only, both existing and proposed growth, and proposed growth only scenarios. The detailed cost estimate is presented in Appendix F.

Table 1 Existing Development Only Costing

Study Area	Description	Cost
All	Locate and Confirm Check Valves on River Discharges	$ 60,000
1	Heads Road Industrial Area	$ 6,640,800
2	Titoki Street and Mosston Road	$ 1,230,000
3	Alma Road	$ 252,000
4	Smithfield Road and Konini Street	$ 1,250,400
5	Gonville Avenue	$ 531,600
6	Springvale	$ 2,907,600
7	Heads Road / Cemetery	$ 472,800
8	Taupo Quay, near Pacific Place	$ 43,200
9	Hospital Carpark and Heads Road	$ 252,000
10	Totara Street	$ 446,400
11	Nikau Street	$ 154,800
	Total Cost to Service Existing Development Only (Excl. GST)	**$14,241,600**

Table 2 Existing Development and Proposed Growth Costing

Study Area	Description	Cost
All	Locate and Confirm Check Valves on River Discharges	$ 60,000
1	Heads Road Industrial Area	$ 6,640,800
2	Titoki Street and Mosston Road	$ 1,230,000
3	Alma Road	$ 252,000
4	Smithfield Road and Konini Street	$ 1,250,400
5	Gonville Avenue	$ 531,600
6	Springvale	$ 2,907,600
7	Heads Road / Cemetery	$ 472,800
8	Taupo Quay, near Pacific Place	$ 43,200
9	Hospital Carpark and Heads Road	$ 252,000
10	Totara Street	$ 446,400
11	Nikau Street	$ 154,800
	Mill Road Industrial Growth Area	$ 4,888,800 *
	Springvale Growth Area	$ 822,000
	Otamatea Growth Area	$ 769,200
	Total Cost to Service Existing and Proposed Growth (Excl. GST)	**$20,721,600**

* Any pre-growth upgrade costs are removed when upsizing the same upgrade for post-growth

Table 3 Proposed Growth Only Costing

Study Area	Description	Cost
	Mill Road Industrial Growth Area	$ 5,881,200
	Springvale Growth Area	$ 822,000
	Otamatea Growth Area	$ 769,200
	Total Cost to Service Proposed Growth Only (Excl. GST)	**$ 7,472,400**

5. Conclusions

- Improvements are proposed to the existing stormwater network to reduce the predicted maximum depth of flooding in urban property and public facilities to a maximum of 0.2 m above surface in a 0.5% AEP 24 hour nested design storm event.
- Network upgrades proposed for the primary and secondary stormwater networks, required to service the existing development, are detailed in Section 3.3 and Appendix B. The estimated cost of the improvement works is $14.2 million.
- Network upgrades proposed for the primary and secondary stormwater networks, to service proposed growth areas, are detailed in Section 3.4 and Appendix D. The estimated cost of the improvement works is $7.5 million. Stormwater collection networks required within the developments have not been costed.
- The total estimated cost of the improvement works to service the existing and proposed developments is $20.7 million.

6. Recommendations

- The proposed list of system improvement works be included in WDC's long term capital works programme and in the intended catchment management plan for the Churton Creek (Stage A) catchment.
- Prioritisation of upgrades to be followed by a floor level survey in the identified flood risk areas to assess the extent of flood risk to habitable floors.
- Locating and confirming flap valves on river discharges in low lying areas should be given priority, which will substantially reduce the flooding resulting from river levels.
- Consideration of a bulk detention system in each growth area that is intended to be 'hydraulically neutral', to prevent the risk of higher than intended discharges into the stormwater network.
- Whether to upgrade or replace a pipeline was based on existing pipe size, age and location. The duplication or replacement decision could be based on future CCTV inspections. This will impact on costs as pipe replacement costs could be considerably different to pipe duplication costs.

Appendices

Appendix A – Study Areas (Existing Development)

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	Study Boundary
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	MH Levels Assumed
0.3 - 0.5	> 100 m3			Catchment Boundary
> 0.5				

Paper Size A3

0 90 180 360 540 720

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Existing 0.5% AEP Flood Depth Study Areas

Job Number	51-34131
Revision	A
Date	23 Sep 2016

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Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 3531801 **E** palmmail@ghd.com **W** www.ghd.com

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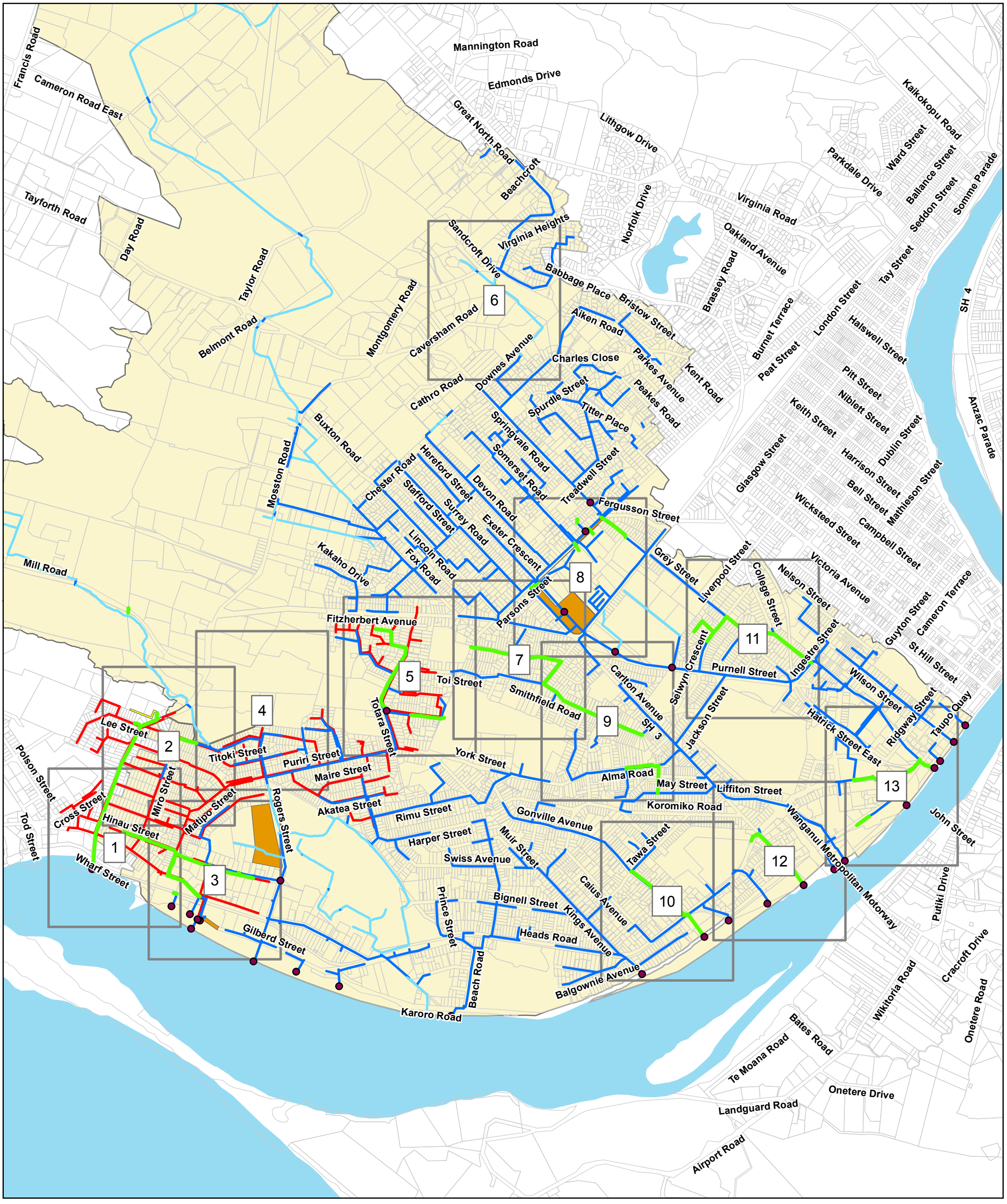
Data source: WDC: Cadastre, Roads, Asset data; GHD: Catchments, Model results. Created by:chaegoda

Appendix B – Network Improvements (Existing Development)



LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

Overview Map

Paper Size A3

0 100 200 400 600 800

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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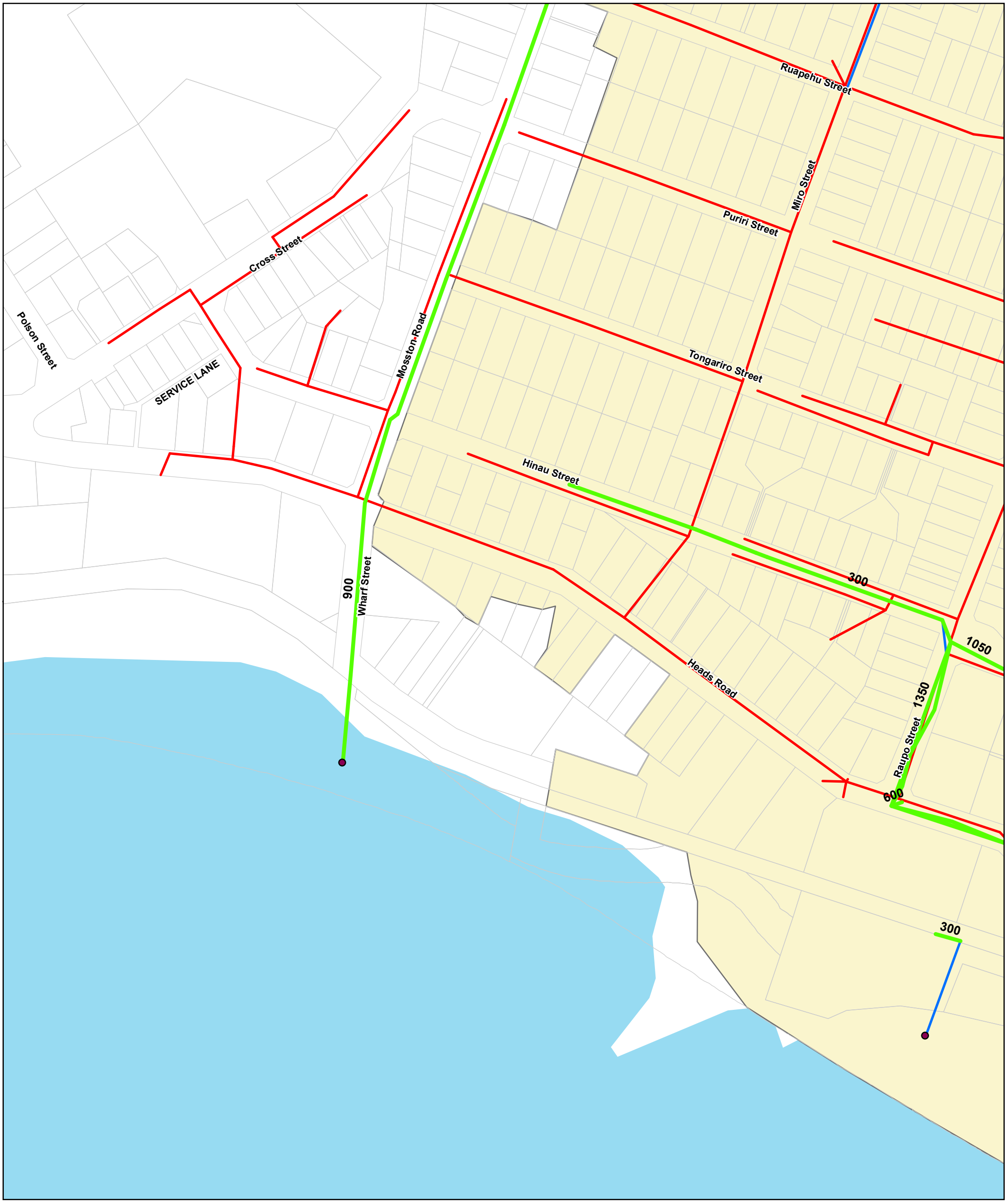

LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B1

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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Job Number	51-34131
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Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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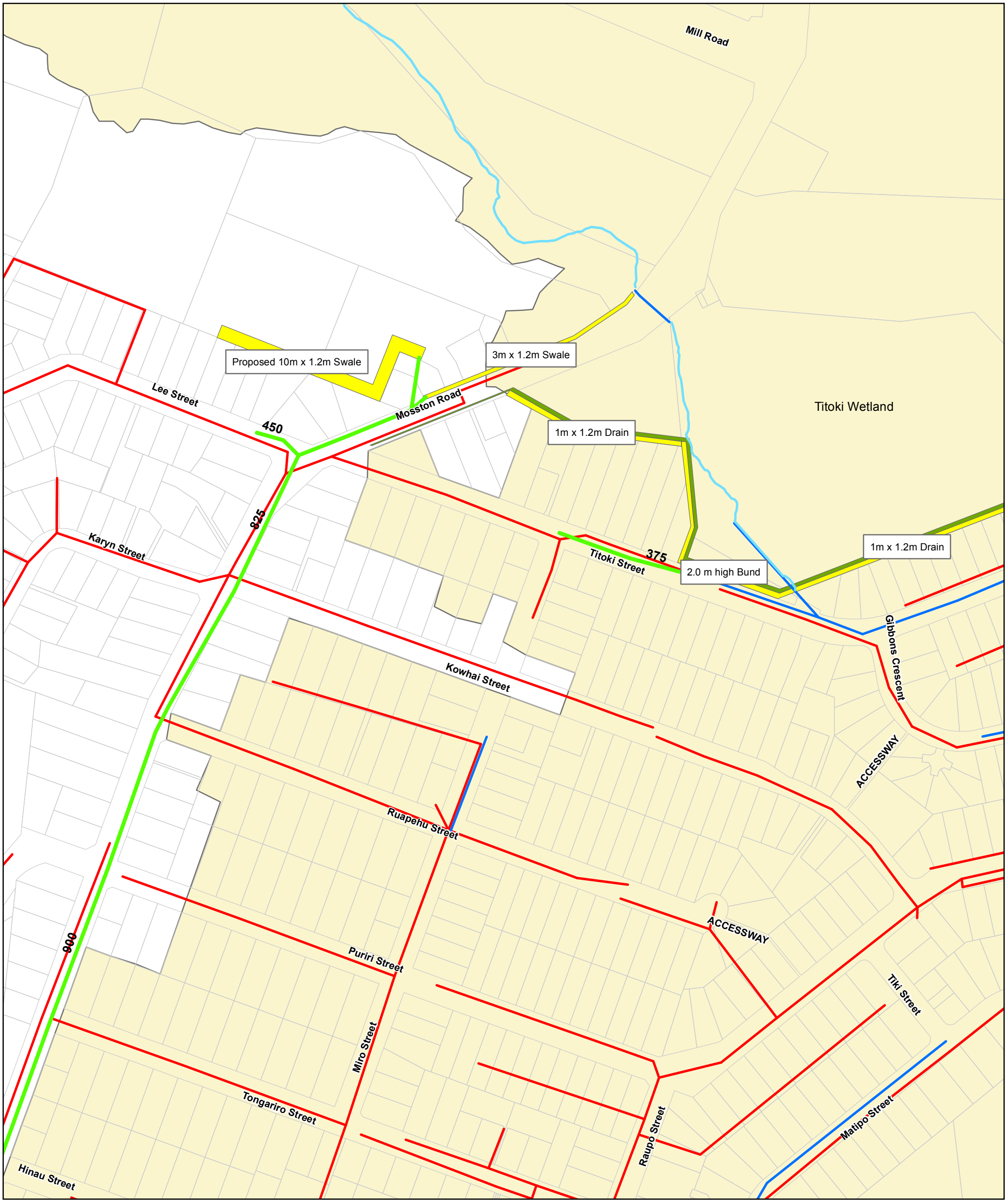

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B2

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B3

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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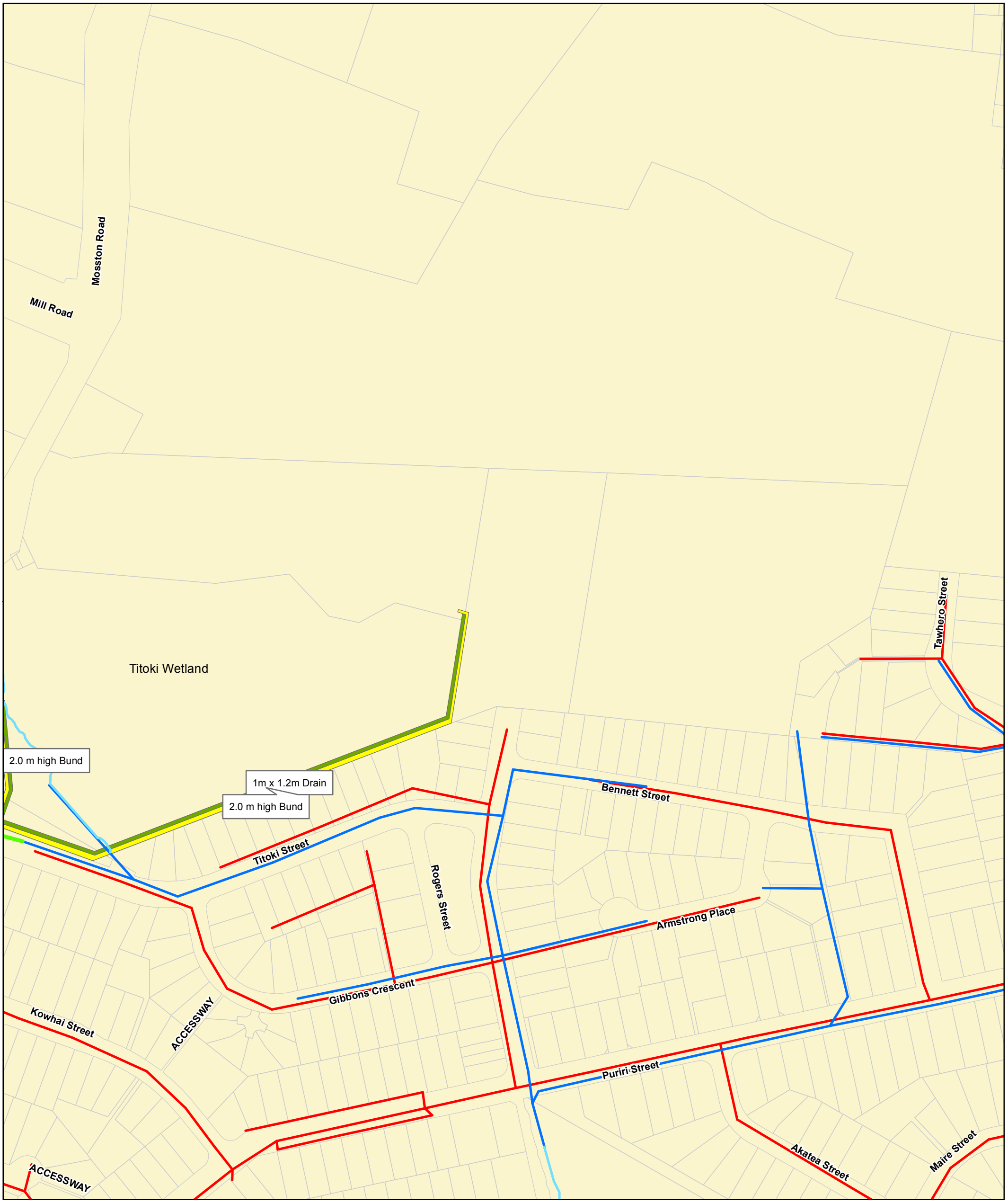

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B4

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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Poutama Place
Kakaho Drive
Oxford Road
ACCESSWAY
Fox Road
Lindsey Crescent
ACCESSWAY
Fitzherbert Avenue
St Helens Place
Karamu Street
450
Akepiro Place
Parsons Street
600
Patete Place
525
Toi Street
Broadhead Avenue
600
Nikau Street
525
Banks Place
Totara Street
Mahoe Place
Puriri Street
York Street

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B5

Paper Size A3
0 12.5 25 50 75 100
Metres
Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

GHD

WHANGANUI DISTRICT COUNCIL
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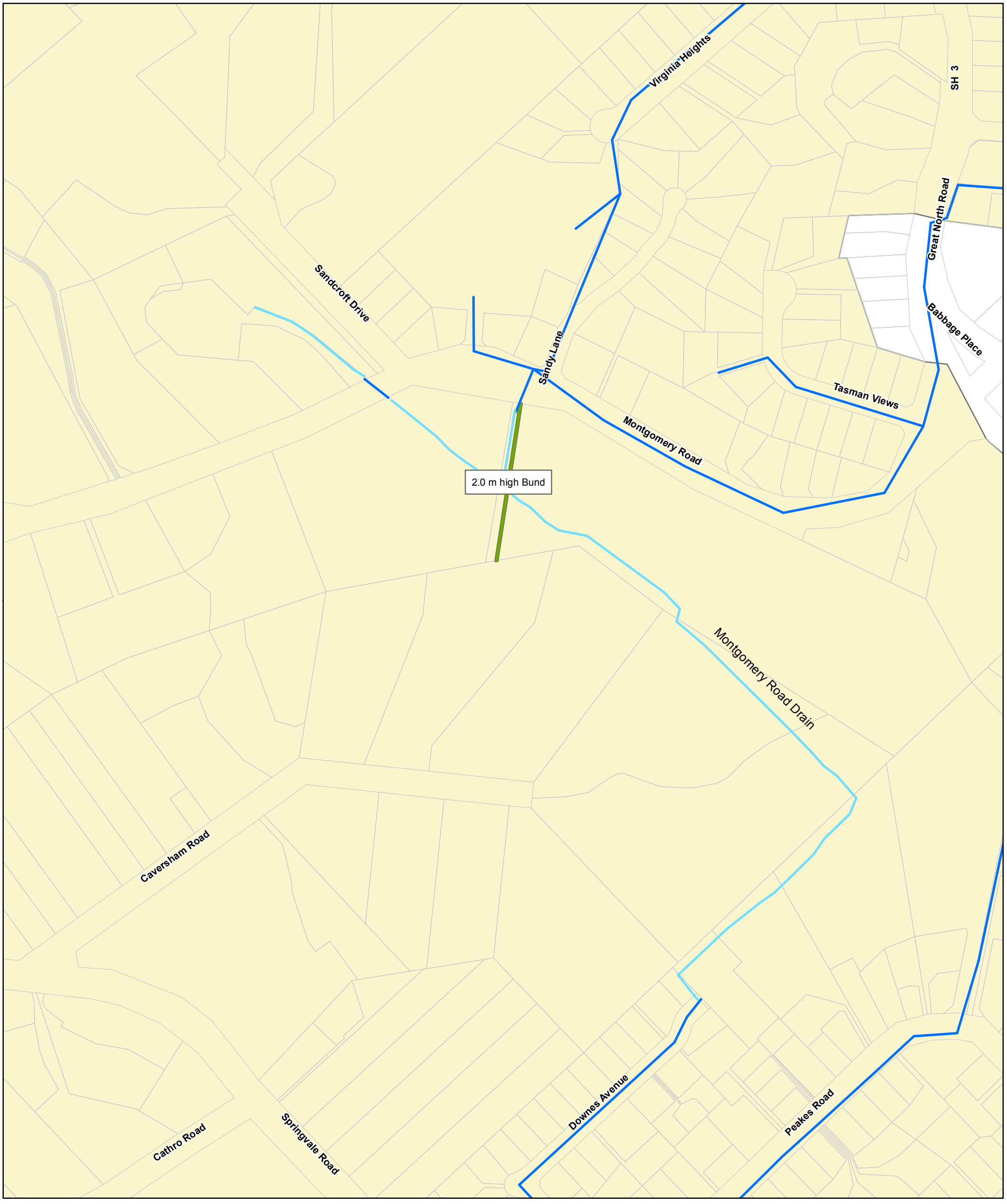

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B6

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
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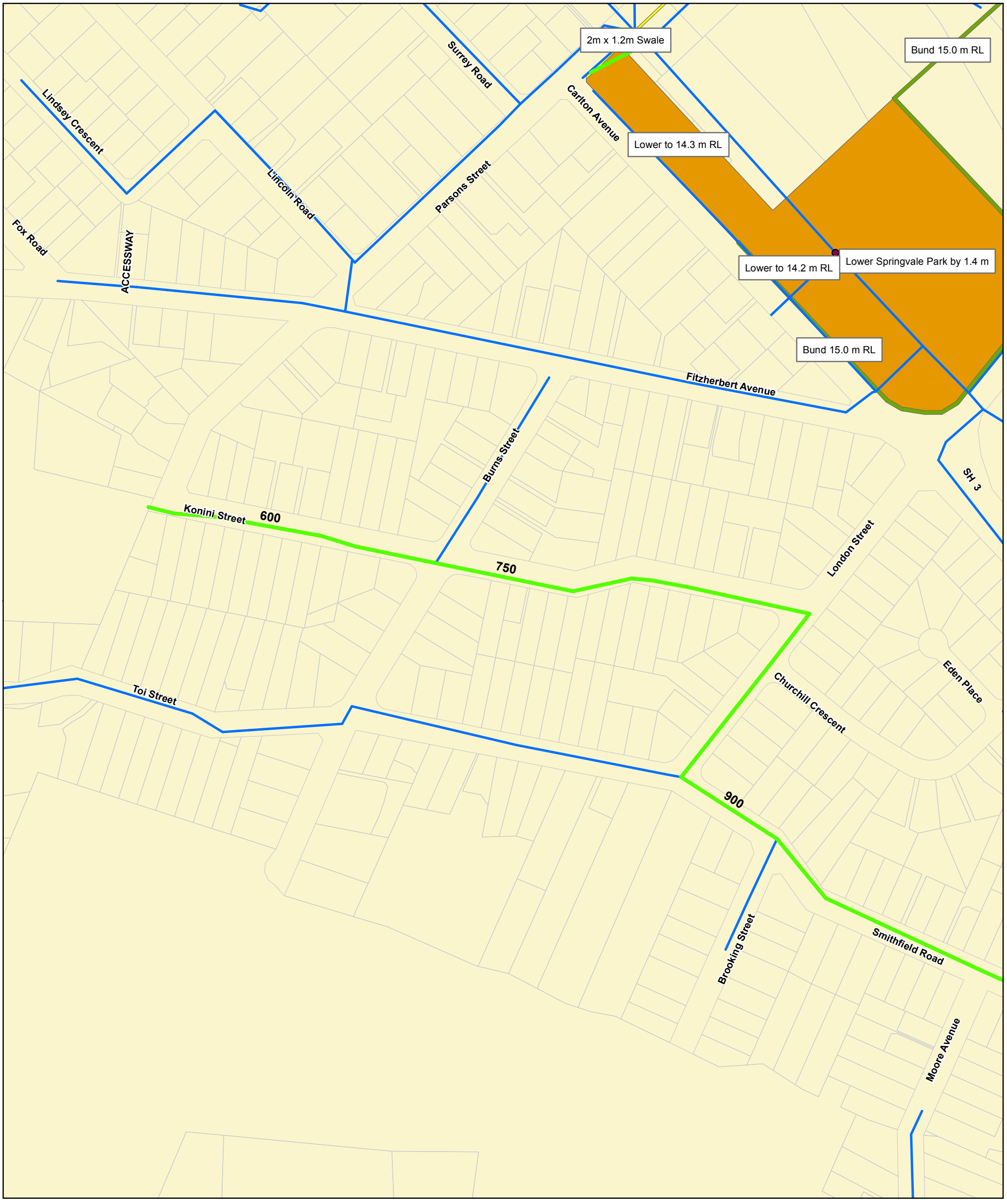

LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B7

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

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Revision	A
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LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B8

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

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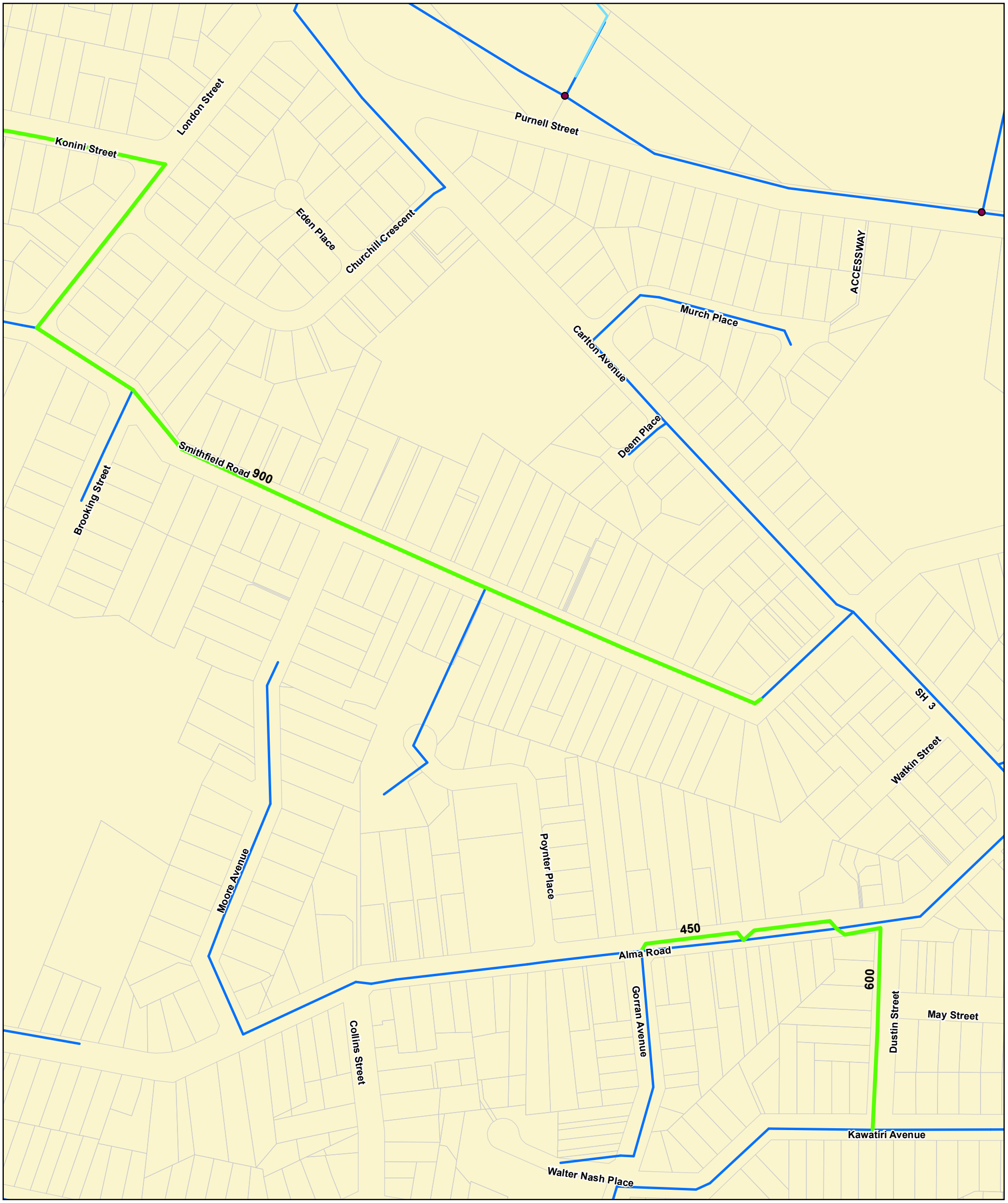

LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe
- Open Channels
- Stormwater Pipe Upgrades
- Wastewater Pipe
- Catchment Boundary

B9

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
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Rata Street
Tawa Street
Gonville Avenue
675
Caius Avenue
Cavell Place
Taupo Quay
Heads Road
975
Kings Avenue
Bedford Avenue
Balgownie Avenue

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B10

Paper Size A3
0 12.5 25 50 75 100
Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
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Whanganui District Council

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Revision	A
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Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale
- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B11

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

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Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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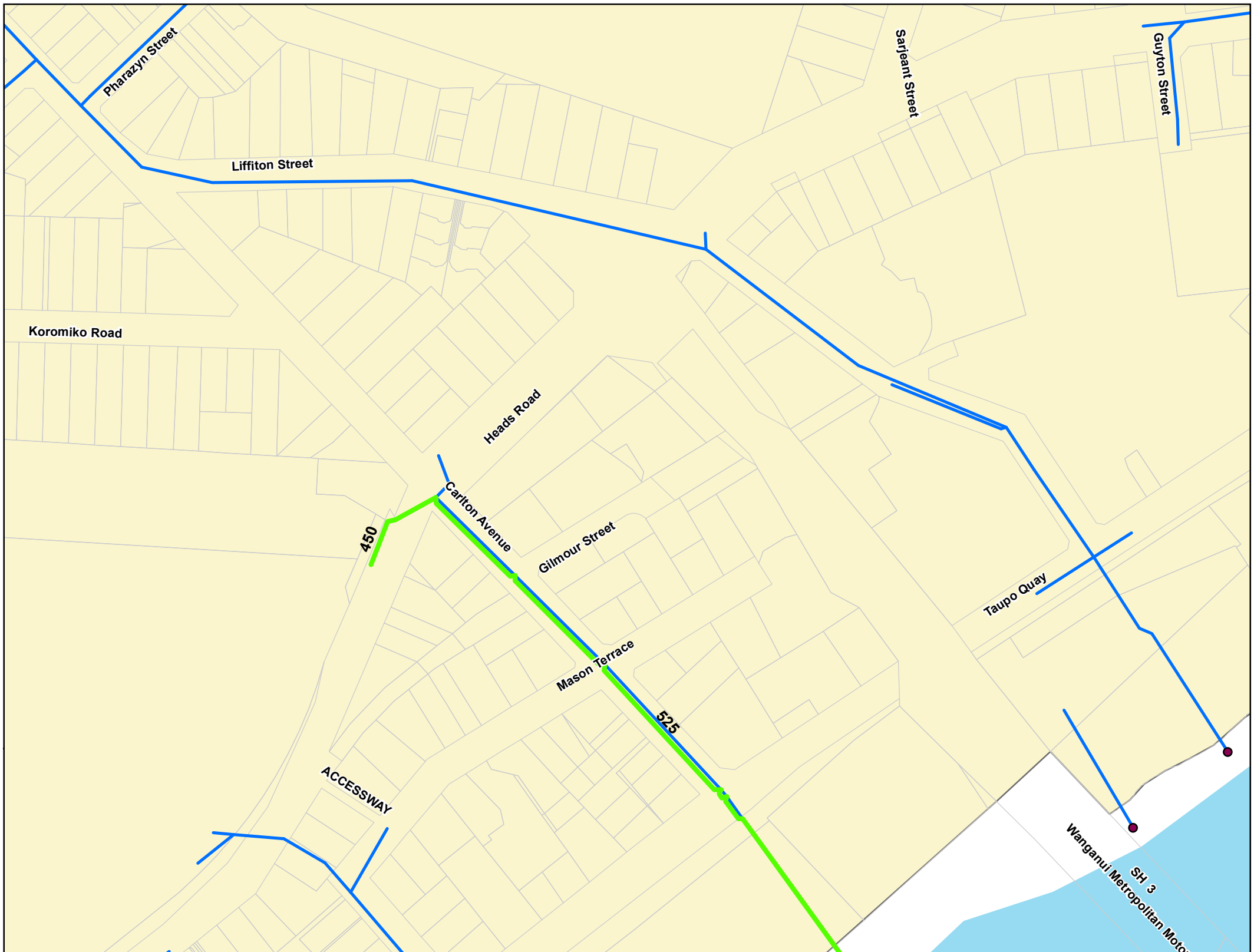

LEGEND

Proposed Earthworks
- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe Upgrades
- Stormwater Pipe
- Wastewater Pipe
- Open Channels
- Catchment Boundary

B12

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

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LEGEND

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

- Proposed Flap Valve
- Stormwater Pipe
- Open Channels
- Stormwater Pipe Upgrades
- Wastewater Pipe
- Catchment Boundary

B13

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road Network Improvements (Existing Development)

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Appendix C – 0.5% AEP Flood Depth after Network Improvements (Existing Development)

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Overview Map

Paper Size A3

0 125 250 500 750 1,000

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 23 Sep 2016

0.5% AEP Flood Depth after Network Improvements Existing Development

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Working\5134131_G003_RevA_0.5% AEP Flood Depth after Network Improvements (Without Growth)_Overview.mxd

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Dickens Lane
Pickwick Road
SH 3
Great North Road
Kingston Way
Mannington Road
Tirimoana Place
Edmonds Drive
Diana Place
Eaton Crescent
Kowhainui Drive
Virginia Road
Turere Place
Beachcroft
Taylor Road
Sandcroft Drive
Sandy Lane
Babbage Place
Montgomery Road

LEGEND

Flood Depth (m)
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Manhole Spill Volume
- No Spilling
- 0.1 - 50 m3
- 50 - 100 m3
- > 100 m3

Stormwater Pipe
- Not surcharged
- Surcharged due to backwater
- Surcharged due to pipe capacity

Wastewater Pipe
- Not surcharged
- Surcharged due to backwater
- Surcharged due to pipe capacity

- Existing Open Channel
- MH Levels Assumed
- Catchment Boundary

C1

Paper Size A3

0 30 60 120 180 240

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 23 Sep 2016

0.5% AEP Flood Depth after Network Improvements Existing Development

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Working\5134131_G003_RevA_0.5% AEP Flood Depth after Network Improvements (Without Growth).mxd

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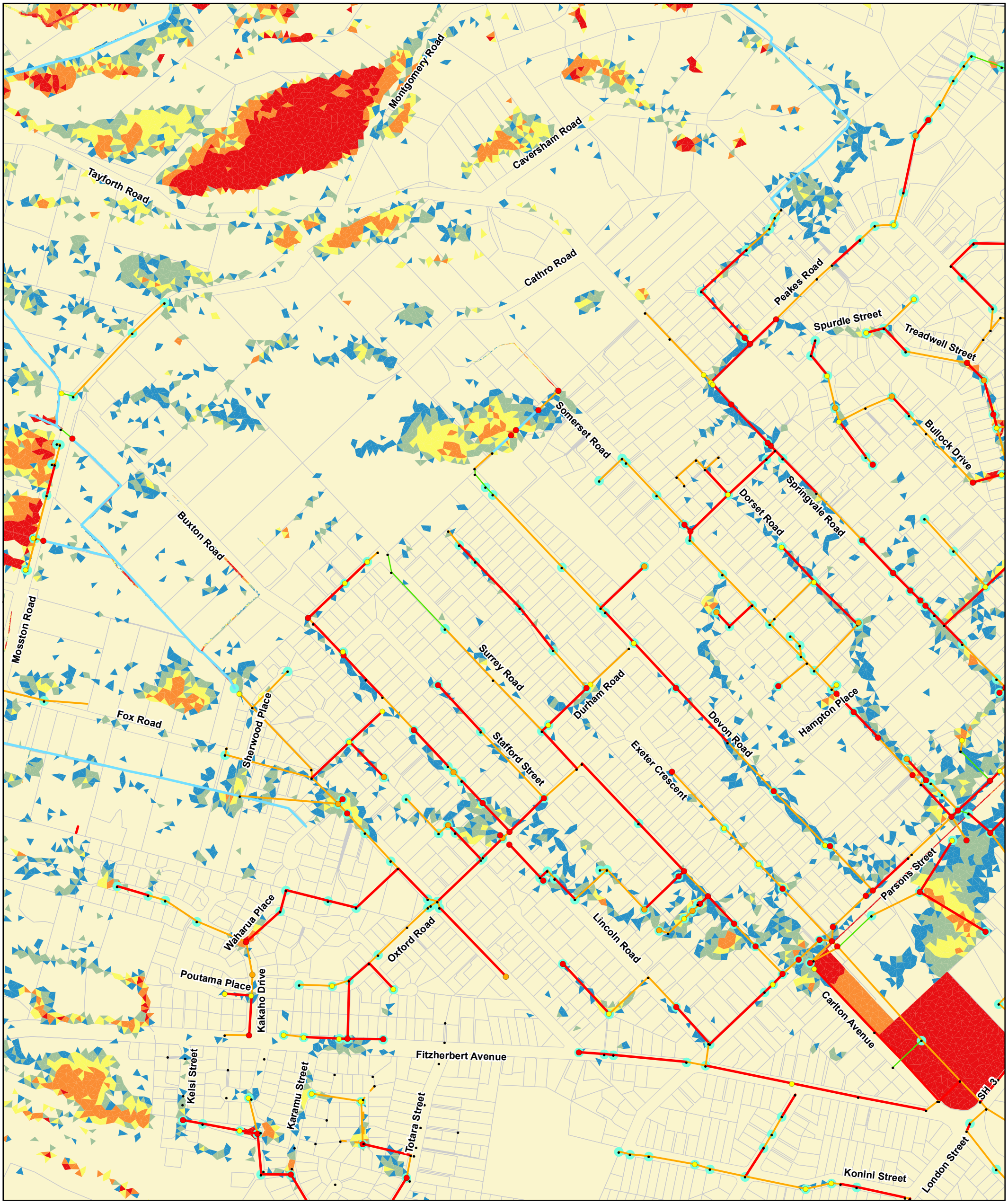

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity
0.3 - 0.5	> 100 m3		
> 0.5			

Existing Open Channel
MH Levels Assumed
Catchment Boundary

C2

Paper Size A3

0 30 60 120 180 240

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number	51-34131
Revision	A
Date	23 Sep 2016

0.5% AEP Flood Depth after Network Improvements Existing Development

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Working\5134131_G003_RevA_0.5% AEP Flood Depth after Network Improvements (Without Growth).mxd

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 3531801 **E** palmmail@ghd.com **W** www.ghd.com

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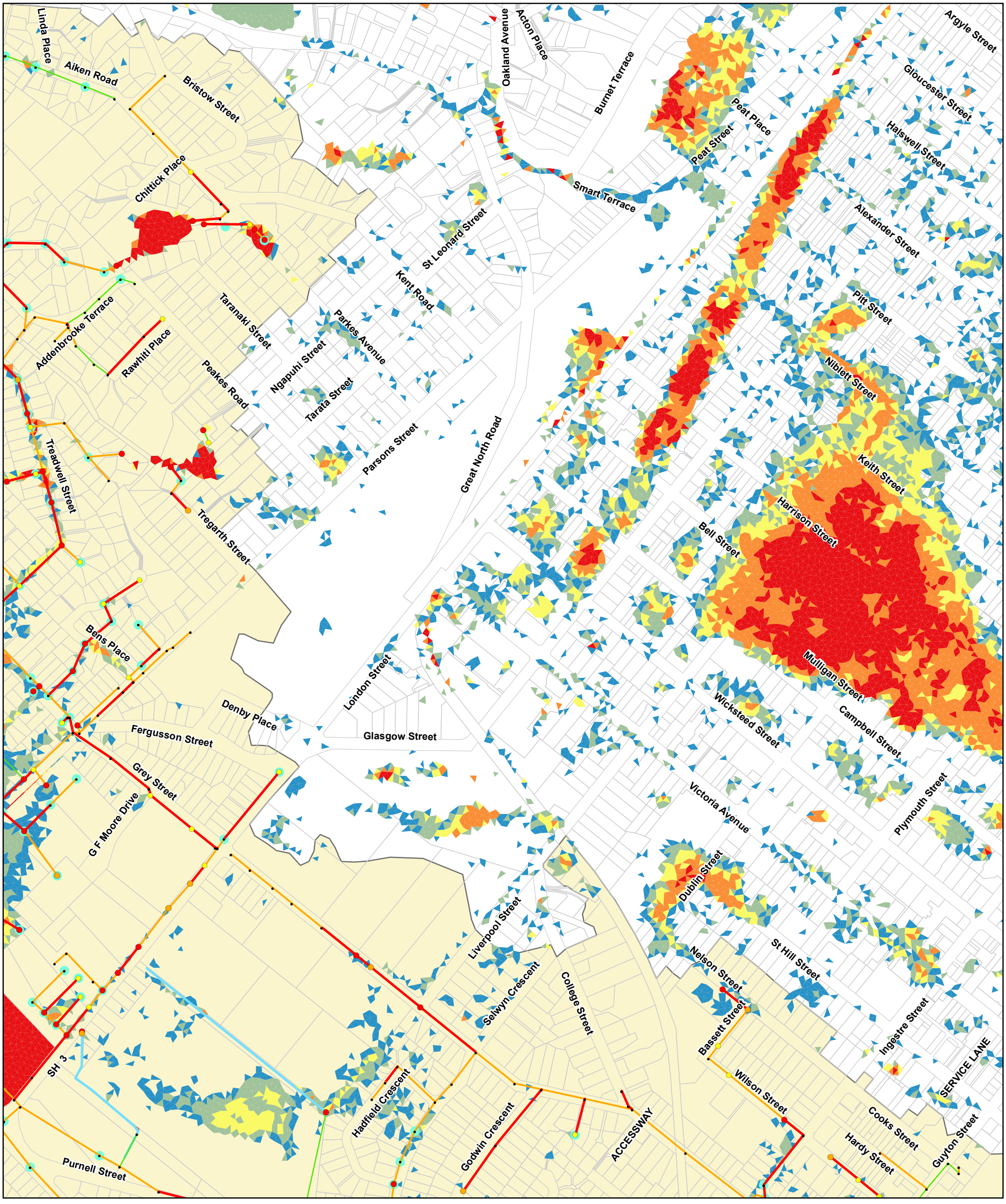
Data source: WDC: Cadastre, Roads, Asset data; GHD: Catchments, Model results. Created by:bsenior



LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity
0.3 - 0.5	> 100 m3		
> 0.5			

Existing Open Channel
MH Levels Assumed
Catchment Boundary

C3

Paper Size A3
0 30 60 120 180 240
Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 23 Sep 2016

0.5% AEP Flood Depth after Network Improvements Existing Development

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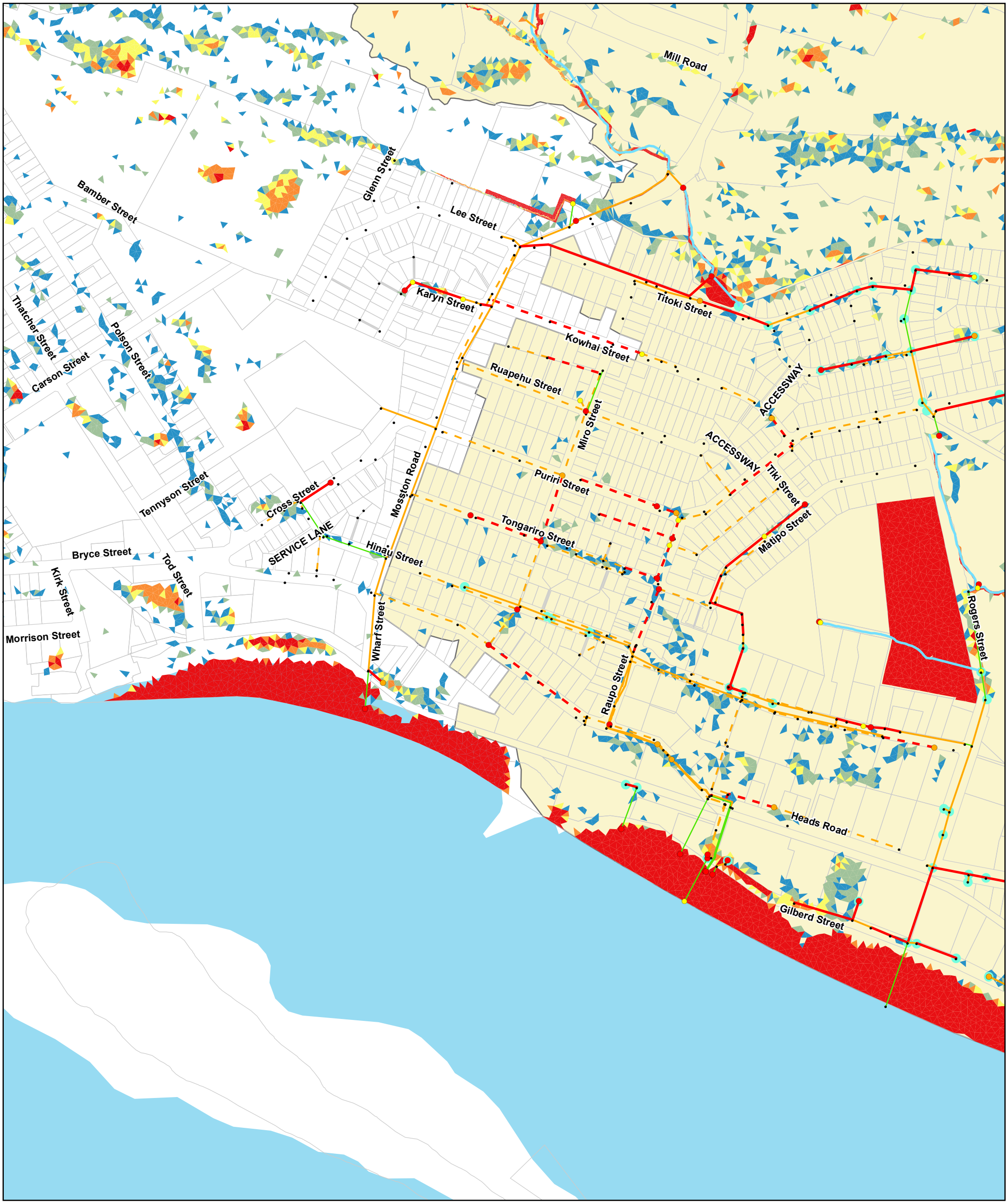

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity
0.3 - 0.5	> 100 m3		
> 0.5			

Existing Open Channel
MH Levels Assumed
Catchment Boundary

C4

Paper Size A3
0 30 60 120 180 240
Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 23 Sep 2016

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LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity
0.3 - 0.5	> 100 m3		
> 0.5			

Existing Open Channel
MH Levels Assumed
Catchment Boundary

C5

Paper Size A3
0 30 60 120 180 240
Metres
Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 23 Sep 2016

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LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

C6

Paper Size A3

0 30 60 120 180 240

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number	51-34131
Revision	A
Date	23 Sep 2016

0.5% AEP Flood Depth after Network Improvements Existing Development

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LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity
0.3 - 0.5	> 100 m3		
> 0.5			

Existing Open Channel
MH Levels Assumed
Catchment Boundary

C7

Paper Size A3
0 30 60 120 180 240
Metres
Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number	51-34131
Revision	A
Date	23 Sep 2016

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Appendix D – Network Improvements (Proposed Growth)

2m x 1.5m Swale

2m x 1.2m Swale

Mill Road

15m x 2.5m Mill Road Swale

Lower ground surface to 15.0 m RL

Bund 16.3 m RL

15m x 1.2m Springvale Swale

Mosston Road

Fitzherbert Avenue

Karewa Street

Cornfoot Street

Matai Street

Karaka Street

Manuka Street

Kuaka Place

Kotuku Street

Bamber Street

Thatcher Street

Polson Street

Laird Street

Carson Street

Hood Street

Omori Place

Aotea Street

Arawa Place

Seafront Road

Ashton Terrace

Egmont Street

Tennyson Street

Bryce Street

Tod Street

Kirk Street

Short Street

Morgan Street

Morrison Street

Tregenna Street

Glenn Street

Lee Street

1350

225

Titoki Street

Karyn Street

Kowhai Street

Ruapehu Street

Miro Street

Gibbons Crescent

ACCESSWAY

Puriri Street

Rogers Street

Cross Street

SERVICE LANE

Tongariro Street

Matipo Street

Hinau Street

Raupo Street

Wharf Street

Heads Road

LEGEND

Open Channels

Stormwater Pipe

Stormwater Pipe Upgrades

Wastewater Pipe

Proposed Earthworks

Bund

Lower Ground Surface

Swale

Proposed Growth Areas

Mill Road Industrial

Otamatea

Springvale

Paper Size A3

0 40 80 160 240 320

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road

Network Improvements - Mill Road Industrial Growth Area

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Deliverables\Network Improvements to Service Proposed Growth Areas - Mill Road.mxd

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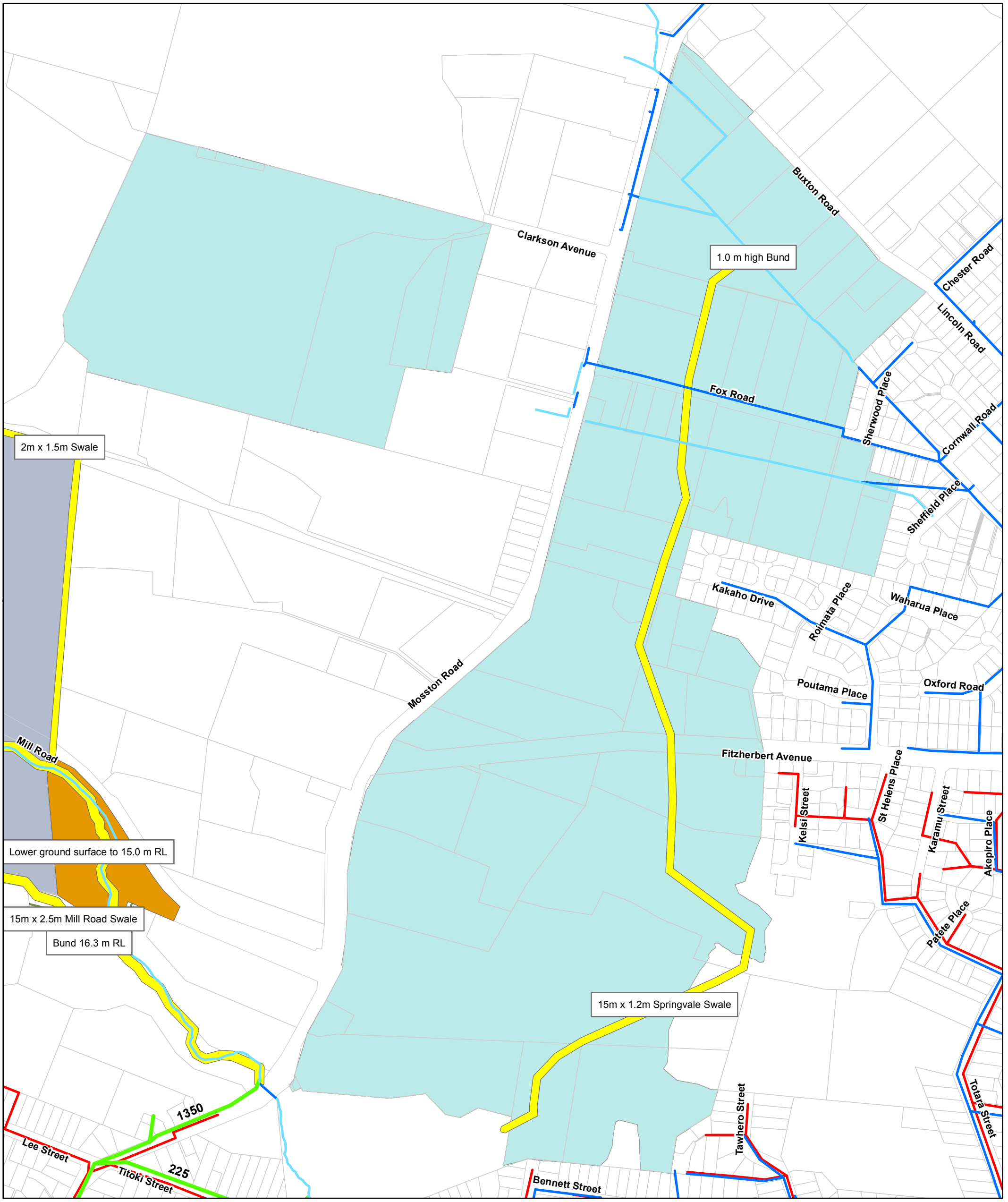

LEGEND

- Open Channels
- Stormwater Pipe
- Stormwater Pipe Upgrades
- Wastewater Pipe

Proposed Earthworks

- Bund
- Lower Ground Surface
- Swale

Proposed Growth Areas

- Mill Road Industrial
- Otamatea
- Springvale

Paper Size A3

0 25 50 100 150 200

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	23 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road

Network Improvements - Springvale Growth Area

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Deliverables\Network Improvements to Service Proposed Growth Areas - Springvale.mxd

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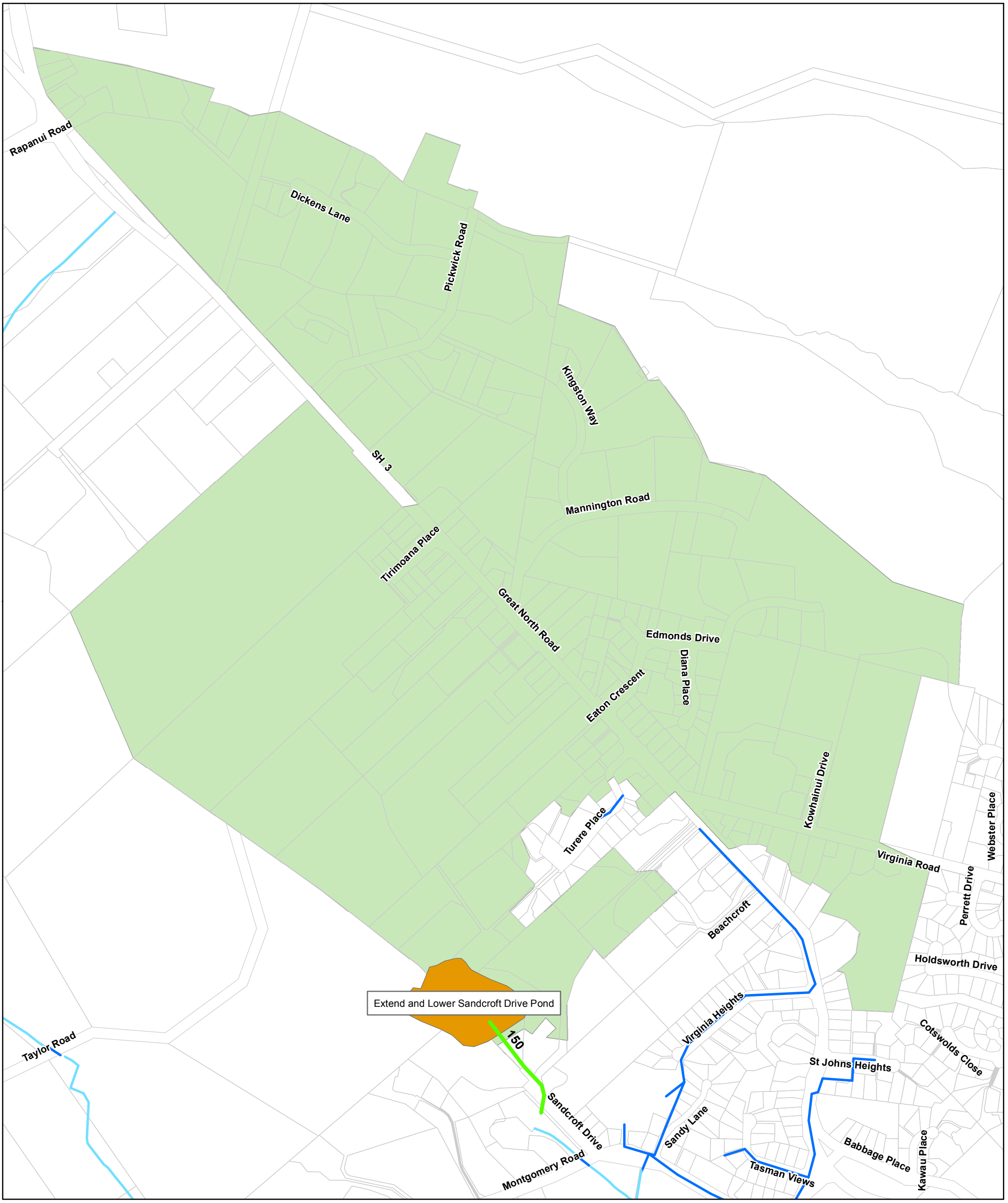
Data source: WDC: Cadastre, Roads, Asset data; GHD: Catchments, Model results. Created by:bsenior



LEGEND

Open Channels
Stormwater Pipe
Stormwater Pipe Upgrades
Wastewater Pipe

Proposed Earthworks
Bund
Lower Ground Surface
Swale

Proposed Growth Areas
Mill Road Industrial
Otamatea
Springvale

Paper Size A3
0 30 60 120 180 240
Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council

Job Number	51-34131
Revision	A
Date	16 Sep 2016

Stage A - Churton Creek & Rogers St / Heads Road
Network Improvements - Otamatea Growth Area

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Deliverables\Network Improvements to Service Proposed Growth Areas - Otamatea.mxd

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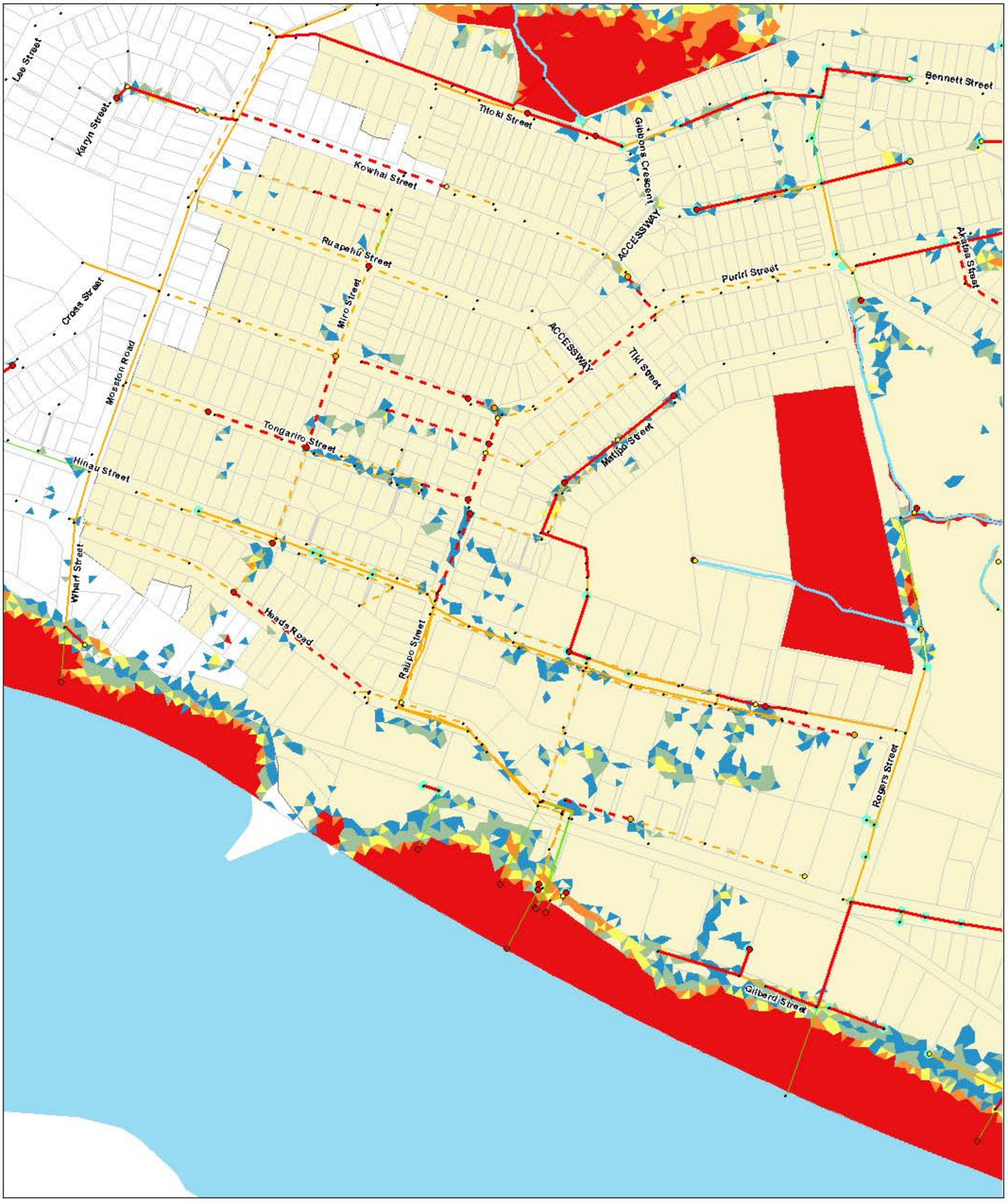
Appendix E – 0.5% AEP Flood Depth after Network Improvements (Proposed Growth)



LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

N

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 16 Sep 2016

0.5% AEP Flood Depth after Network Improvements Proposed Growth

N:\NZ\Palmerston North\Projects\51\34131\GIS\Maps\Working\0.5% AEP Flood Depth after Network Improvements (With Growth).mxd

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LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
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Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

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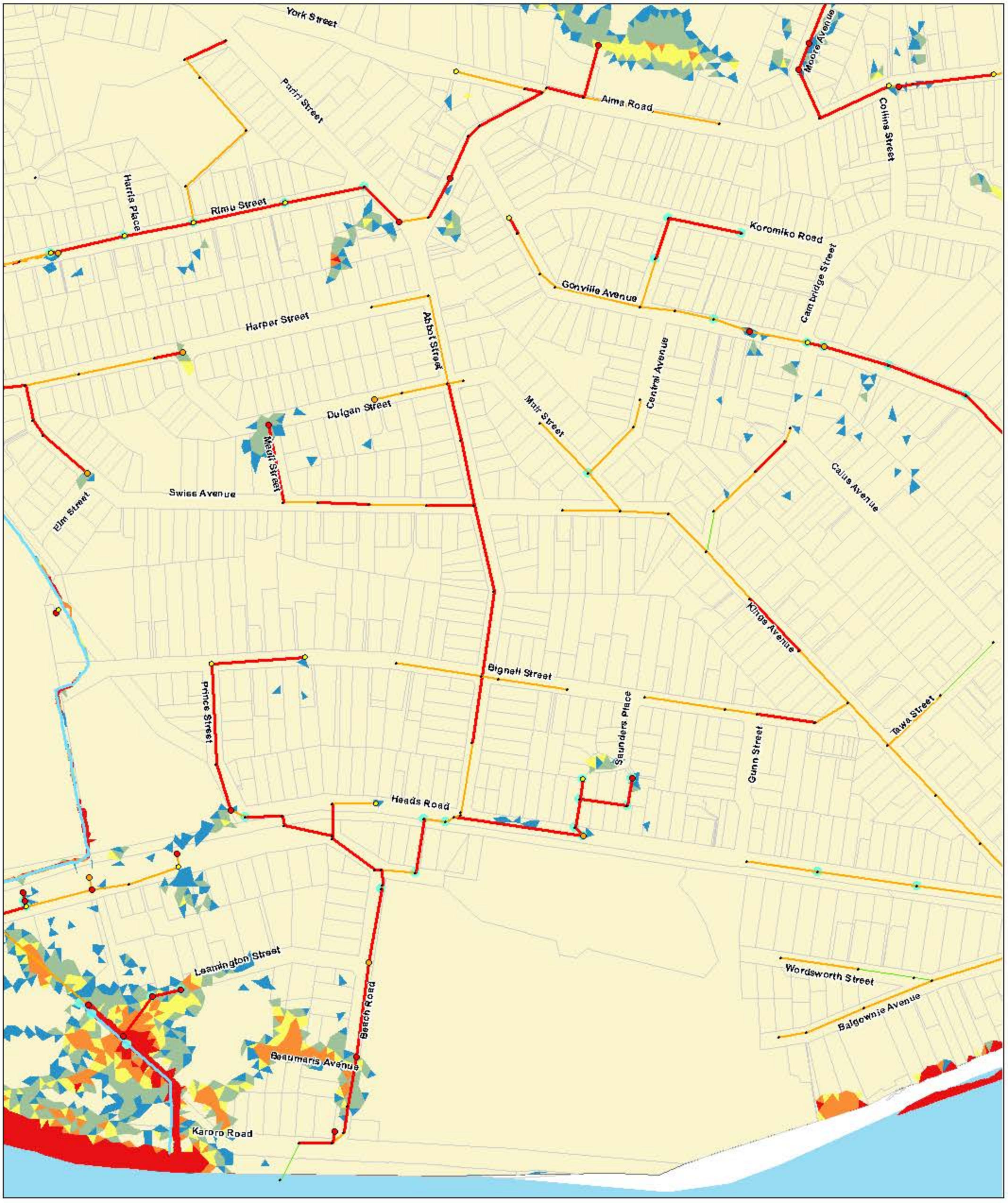

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number	51-34131
Revision	A
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Data source: WDC: Cadastre, Roads, Asset data, GHD: Catchments, Model results. Created by: bennor

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Protection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
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LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
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0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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Whanganui District Council
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0.5% AEP Flood Depth after Network Improvements Proposed Growth

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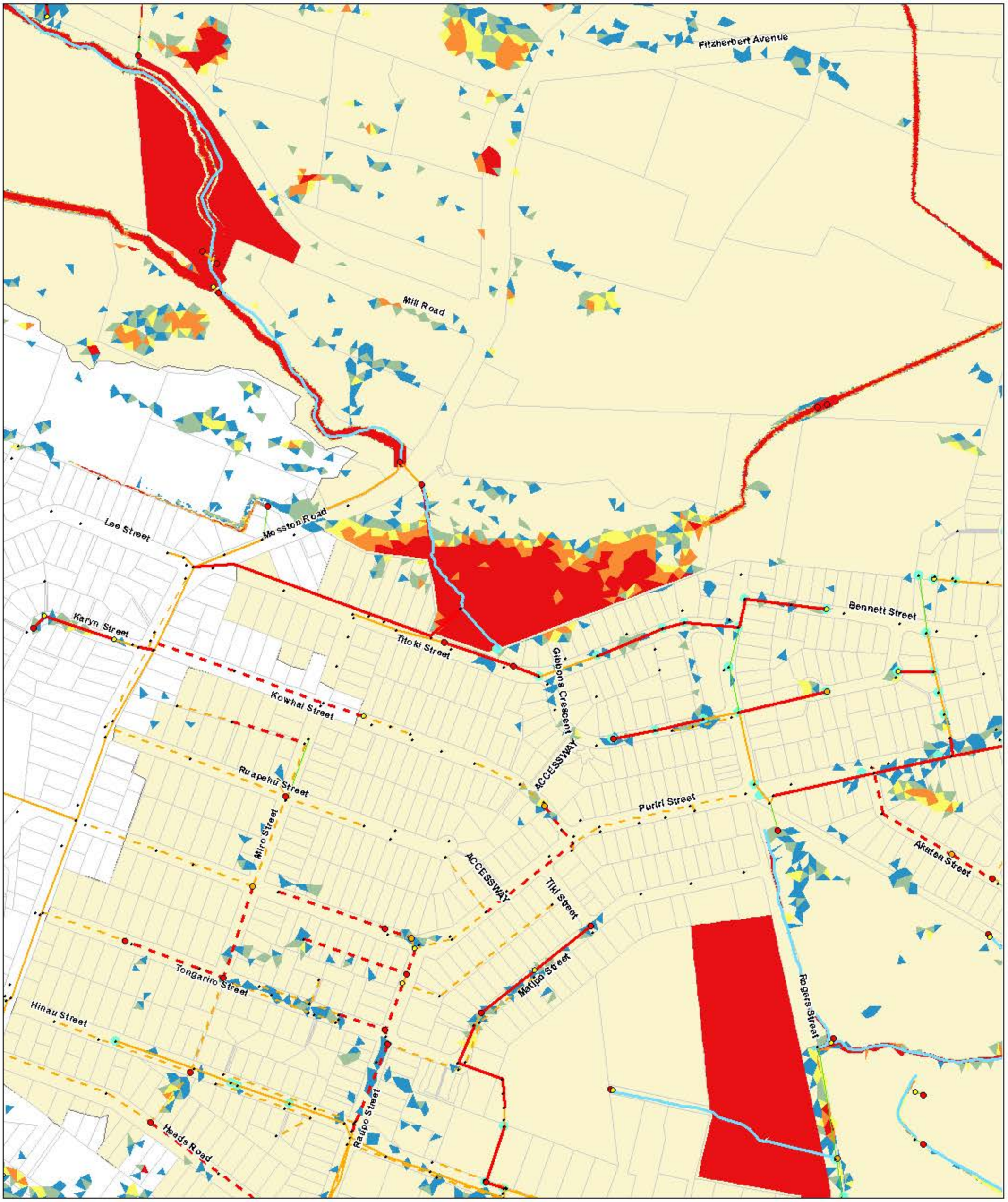

LEGEND

Flood Depth (m)	Manhole Spill Volume	Stormwater Pipe	Wastewater Pipe	
0.05 - 0.1	No Spilling	Not surcharged	Not surcharged	Existing Open Channel
0.1 - 0.2	0.1 - 50 m3	Surcharged due to backwater	Surcharged due to backwater	MH Levels Assumed
0.2 - 0.3	50 - 100 m3	Surcharged due to pipe capacity	Surcharged due to pipe capacity	Catchment Boundary
0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

0 20 40 80 120 160

Metres

Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Whanganui District Council
Stage A - Churton Creek & Rogers St / Heads Road

Job Number 51-34131
Revision A
Date 16 Sep 2016

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LEGEND

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0.3 - 0.5	> 100 m3			
> 0.5				

Paper Size A3

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Lincoln Road
Parsons Street
Carlton Avenue
SH-3
London Street
Grey Street
Fitzherbert Avenue
Hadfield Crescent
Burns Street
Konini Street
Toi Street
Eden Place
Churchill Crescent
Purnell Street
Murch Place
ACCESSWAY
Selwyn Crescent
Brooking Street
Smithfield Road
Jackson Street
Watkin Street
Moore Avenue
Poynter Place
York Street
Alma Road
Collins Street
Gorran Avenue
Dustin Street
May Street
Kawatiri Avenue
Koromiko Road
Abbot Street
Granville Avenue
Cambridge Street
Rata Street
Taiwa Street

LEGEND

Flood Depth (m)
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Manhole Spill Volume
- No Spilling
- 0.1 - 50 m3
- 50 - 100 m3
- > 100 m3

Stormwater Pipe
- Not surcharged
- Surcharged due to backwater
- Surcharged due to pipe capacity

Wastewater Pipe
- Not surcharged
- Surcharged due to backwater
- Surcharged due to pipe capacity

- Existing Open Channel
- MH Levels Assumed
- Catchment Boundary

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Metres

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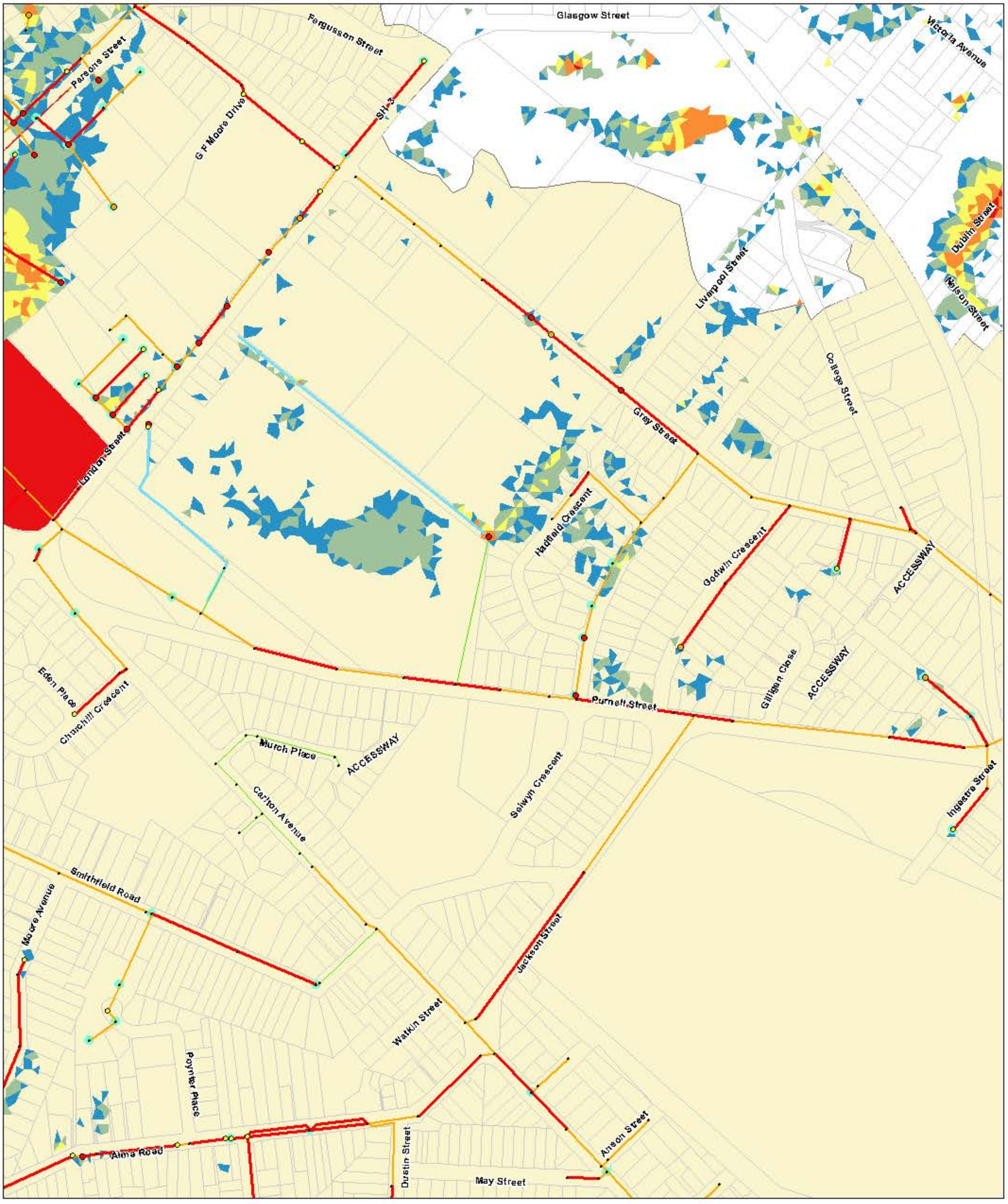

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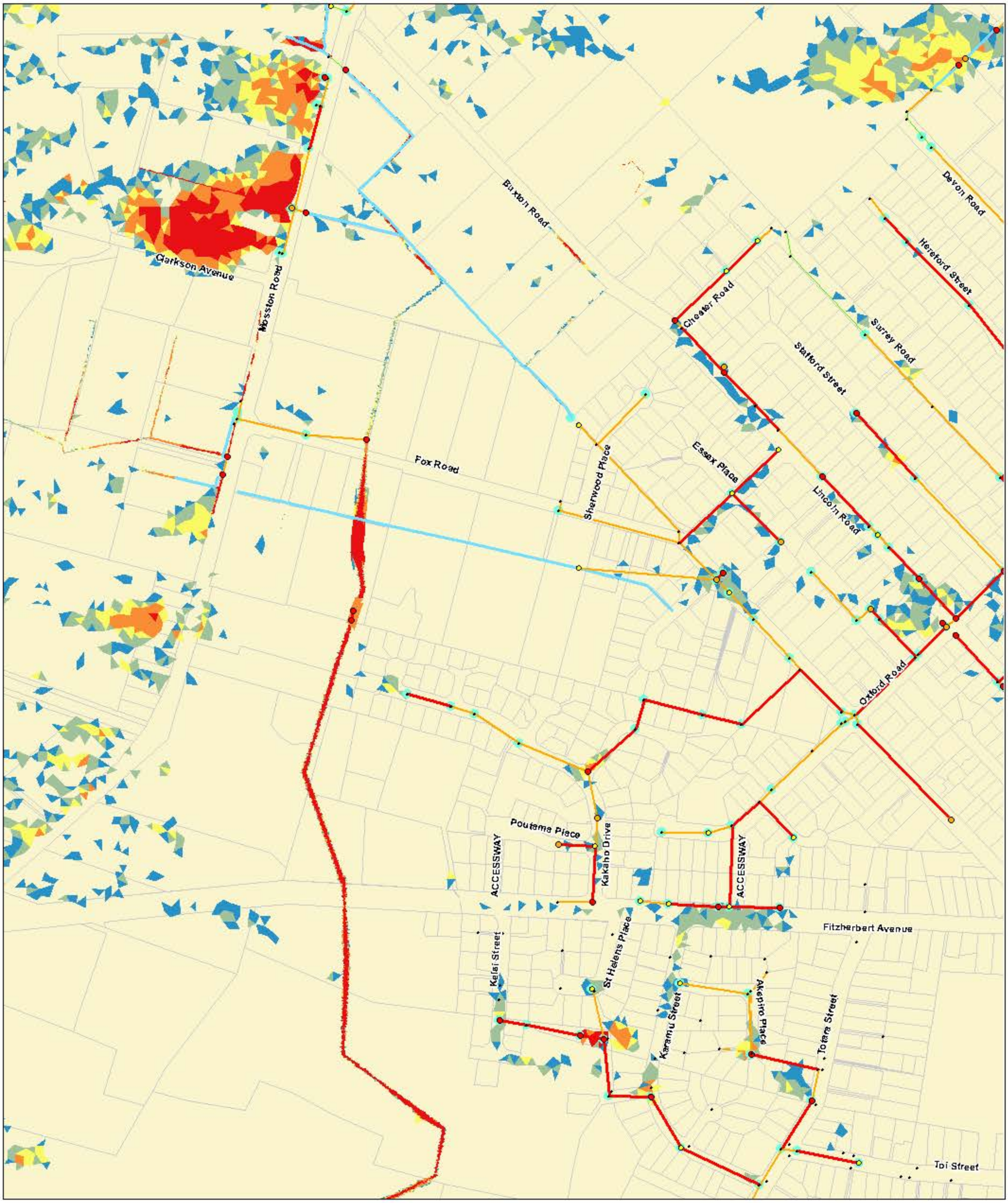

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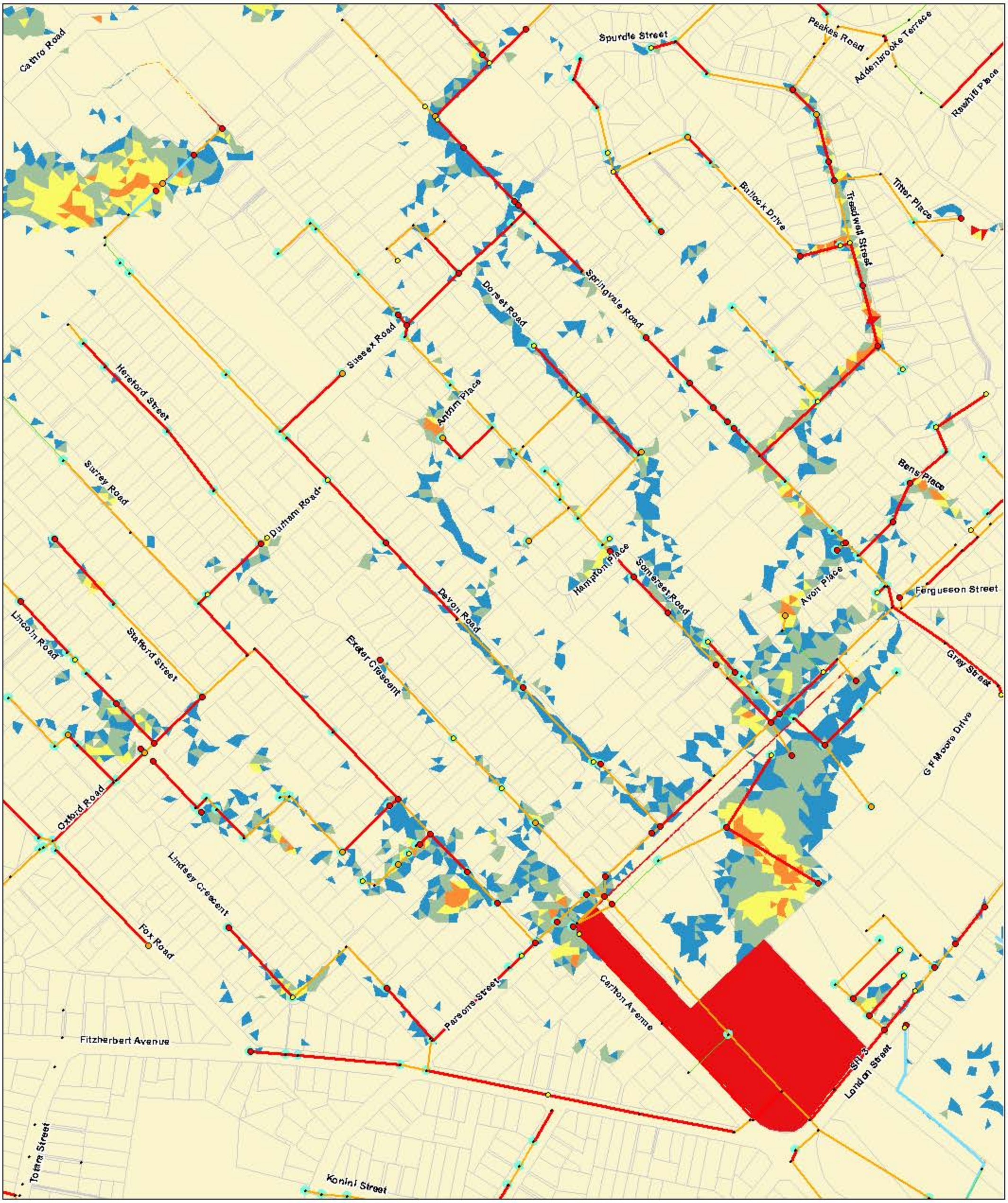

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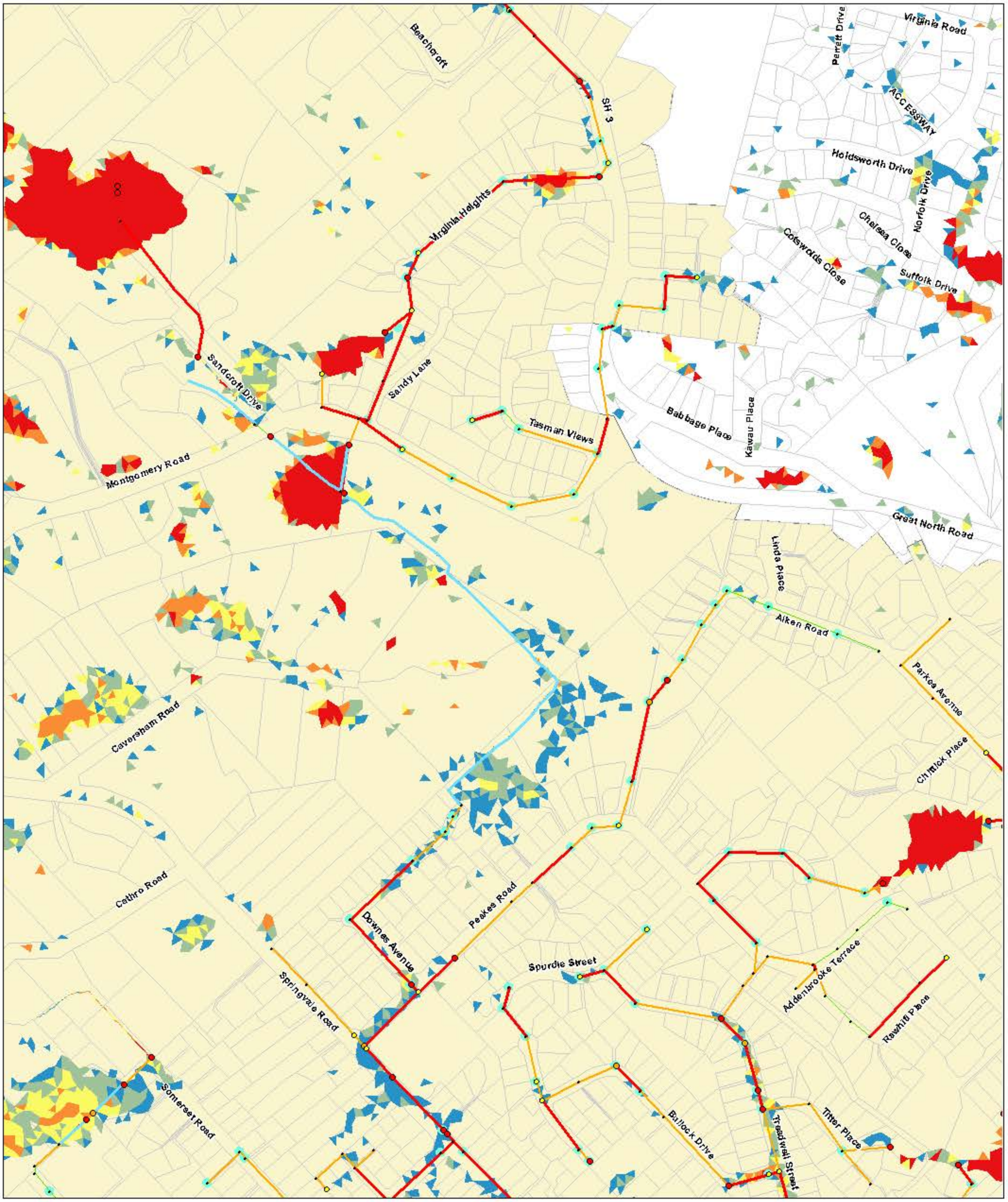

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Appendix F – System Improvements Cost Estimate

Schedule of Quantities - DRAFT

Whanganui District Council: Stormwater Masterplan Stage

Pre-Growth and Post-Growth 1 in 200 System Upgrades

Prepared By/Checked By : CHaegoda/ CJAnderson

DESCRIPTION	UNIT	QTY	RATE	AMOUNT	TOTAL
All costs allow for design, project management and professional fees, supply of materials, physical works and contract supervision/administration for the described works					
Pre-Growth					
Locate and Confirm Check Valves on River Discharges					
Investigation and remedial works	LS	1	$ 50,000	$ 50,000	
					$ 50,000
Area 1 - Heads Road Industrial Area					
Pipe Upgrades					
DN300mm Gravity Main	m	345	$ 423	$ 146,000	
DN450mm Gravity Main	m	100	$ 480	$ 48,000	
DN600mm Gravity Main	m	25	$ 650	$ 16,000	
DN900mm Gravity Main	m	170	$ 830	$ 141,000	
DN1050mm Gravity Main	m	210	$ 1,175	$ 247,000	
DN1350mm Gravity Main	m	720	$ 1,450	$ 1,044,000	
Sumps	LS	1	$ 15,000	$ 15,000	
Storage					
Lower Gilberd St					
Earthworks	m^3	884	$ 32	$ 28,000	
Connections and Relocate Services	LS	1	$ 20,000	$ 20,000	
Landfill Wetland					
Earthworks	m^3	189700	$ 20	$ 3,794,000	
Connections	LS	1	$ 20,000	$ 20,000	
Check Valves					
Check valve in pipe network	each	1	$ 15,000	$ 15,000	
Total Area 1 (Excl. 20% Contingency)					**$ 5,534,000**
Area 2 - Titoki Street and Mosston Road					
Pipe Upgrades					
DN375mm Gravity Main	m	120	$ 455	$ 55,000	
DN450mm Gravity Main	m	40	$ 480	$ 19,000	
DN825mm Gravity Main (Larger pipe required to service Growth)	m	390	$ 750	$ 293,000	
DN900mm Gravity Main (Larger pipe required to service Growth)	m	625	$ 830	$ 519,000	
Sumps	LS	1	$ 15,000	$ 15,000	
Swale					
Moston Road Swale (South)	m^3	649	$ 22	$ 14,000	
Moston Road Swale (North)	m^3	1811	$ 22	$ 40,000	
Drain along the Titoki Wetland Bund	m^3	386	$ 22	$ 8,000	
Inlets	LS	1	$ 10,000	$ 10,000	
Wetland					
Bund Titoki Wetland	m^3	1930	$ 27	$ 52,000	
Total Area 2 (Excl. 20% Contingency)					**$ 1,025,000**
Area 3 - Alma Road					
Pipe Upgrades					
DN450mm Gravity Main	m	65	$ 480	$ 31,000	
DN525mm Gravity Main	m	290	$ 600	$ 174,000	
Sumps	LS	1	$ 5,000	$ 5,000	
Total Area 3 (Excl. 20% Contingency)					**$ 210,000**
Area 4 - Smithfield Road & Konini Street					
Pipe Upgrades					
DN600mm Gravity Main	m	230	$ 650	$ 150,000	
DN750mm Gravity Main	m	170	$ 725	$ 123,000	
DN900mm Gravity Main	m	920	$ 830	$ 764,000	
Sumps	LS	1	$ 5,000	$ 5,000	

Total Area 4 (Excl. 20% Contingency)					**$ 1,042,000**
Area 5 - Gonville Avenue					
Pipe Upgrades					
DN675mm Gravity Main	m	450	$ 680	$ 306,000	
DN975mm Gravity Main	m	150	$ 880	$ 132,000	
Sumps	LS	1	$ 5,000	$ 5,000	
Total Area 5 (Excl. 20% Contingency)					**$ 443,000**
Area 6 - Springvale					
Pipe Upgrades					
DN375mm Gravity Main	m	180	$ 455	$ 82,000	
DN525mm Gravity Main	m	65	$ 600	$ 39,000	
DN600mm Gravity Main	m	145	$ 650	$ 94,000	
DN750mm Gravity Main	m	205	$ 725	$ 149,000	
DN825mm Gravity Main	m	40	$ 750	$ 30,000	
DN900mm Gravity Main	m	265	$ 830	$ 220,000	
DN1050mm Gravity Main	m	345	$ 1,175	$ 405,000	
Sumps	LS	1	$ 15,000	$ 15,000	
Storage					
Springvale Park					
Lower Springvale Park (North)	m^3	9246	$ 22	$ 203,000	
Lower Springvale Park (South)	m^3	40012	$ 22	$ 880,000	
Springvale Park Swale	m^3	1168	$ 20	$ 23,000	
Bund in Park	m^3	700	$ 27	$ 19,000	
Connections and Relocate Services	LS	1	$ 50,000	$ 50,000	
Montgomery Road					
Bund	m^3	235	$ 27	$ 6,000	
Connections and Pipework	LS	1	$ 30,000	$ 30,000	
Overland Flow					
Lower Parson St	m^3	1770	$ 30	$ 53,000	
Relocate Services	LS	1	$ 50,000	$ 50,000	
Check Valves					
Check valves in pipe network	each	5	$ 15,000	$ 75,000	
Total Area 6 (Excl. 20% Contingency)					**$ 2,423,000**
Area 7 - Heads Road / Cemetery					
Pipe Upgrades					
DN600mm Gravity Main	m	190	$ 650	$ 124,000	
DN750mm Gravity Main	m	265	$ 725	$ 192,000	
DN1350mm Gravity Main	m	50	$ 1,450	$ 73,000	
Sumps	m	1	$ 5,000	$ 5,000	
Total Area 7 (Excl. 20% Contingency)					**$ 394,000**
Area 8 - Taupo Quay, near Pacific Place					
Pipe Upgrades					
DN300mm Gravity Main	m	85	$ 423	$ 36,000	
Total Area 8 (Excl. 20% Contingency)					**$ 36,000**
Area 9 - Hospital Carpark and Heads Road					
Pipe Upgrades					
DN450mm Gravity Main	m	65	$ 480	$ 31,000	
DN525mm Gravity Main	m	290	$ 600	$ 174,000	
Sumps	LS	1	$ 5,000	$ 5,000	
Total Area 9 (Excl. 20% Contingency)					**$ 210,000**
Area 10 - Totara Street					
Pipe Upgrades					
DN450mm Gravity Main	m	360	$ 480	$ 173,000	
DN525mm Gravity Main	m	130	$ 600	$ 78,000	
DN600mm Gravity Main	m	170	$ 650	$ 111,000	
Sumps	LS	1	$ 10,000	$ 10,000	
Total Area 10 (Excl. 20% Contingency)					**$ 372,000**
Area 11 - Nikau Street					
Pipe Upgrades					
DN525mm Gravity Main	m	190	$ 600	$ 114,000	
Check Valves					
Check valve in pipe network	each	1	$ 15,000	$ 15,000	

Total Area 11 (Excl. 20% Contingency)					**$ 129,000**
	PRE-GROWTH TOTAL (EXCL. 20% CONTINGENCY)				**$ 11,868,000**
Post-Growth					
Mill Road Industrial Growth Area					
Earthworks					
Larger Mill Road swale	m³	92125	$ 22	$ 2,027,000	
Lower ground surface for storage	m³	46780	$ 20	$ 936,000	
Bund	m³	880	$ 27	$ 24,000	
Drains along industrial area boundary	m³		$ 22	$ -	
Address Services	LS	1	$ 50,000	$ 50,000	
Connections and Pipework	LS	1	$ 50,000	$ 50,000	
Pipe Upgrades					
DN225mm Gravity Main	m	365	$ 360	$ 131,000	
DN1350mm Gravity Main (Costed for smaller pipe under Pre-Growth)	m	1150	$ 1,450	$ 1,668,000	
Sumps	LS	1	$ 15,000	$ 15,000	
Total Mill Road Industrial (Excl. 20% Contingency)					**$ 4,901,000**
Springvale Growth Area					
Springvale swale	m³	30990	$ 22	$ 682,000	
Bund	m³	100	$ 27	$ 3,000	
Total Springvale (Excl. 20% Contingency)					**$ 685,000**
Otamatea Growth Area					
Extend and lower Sandcroft pond	m³	28908	$ 20	$ 578,000	
Pipe Upgrades					
DN150mm Gravity Main	m	210	$ 300	$ 63,000	
Total Otamatea (Excl. 20% Contingency)					**$ 641,000**
	POST-GROWTH TOTAL (EXCL. 20% CONTINGENCY)				**$ 6,227,000**
		TOTAL (EXCL. 20% CONTINGENCY) *			**$ 17,268,000**
*** Any pre-growth upgrade costs removed when upsizing the same upgrade for post-growth**					

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev0	C Haegoda/ C Anderson	J McArthur	P.P.	A Chisholm		27/9/16

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