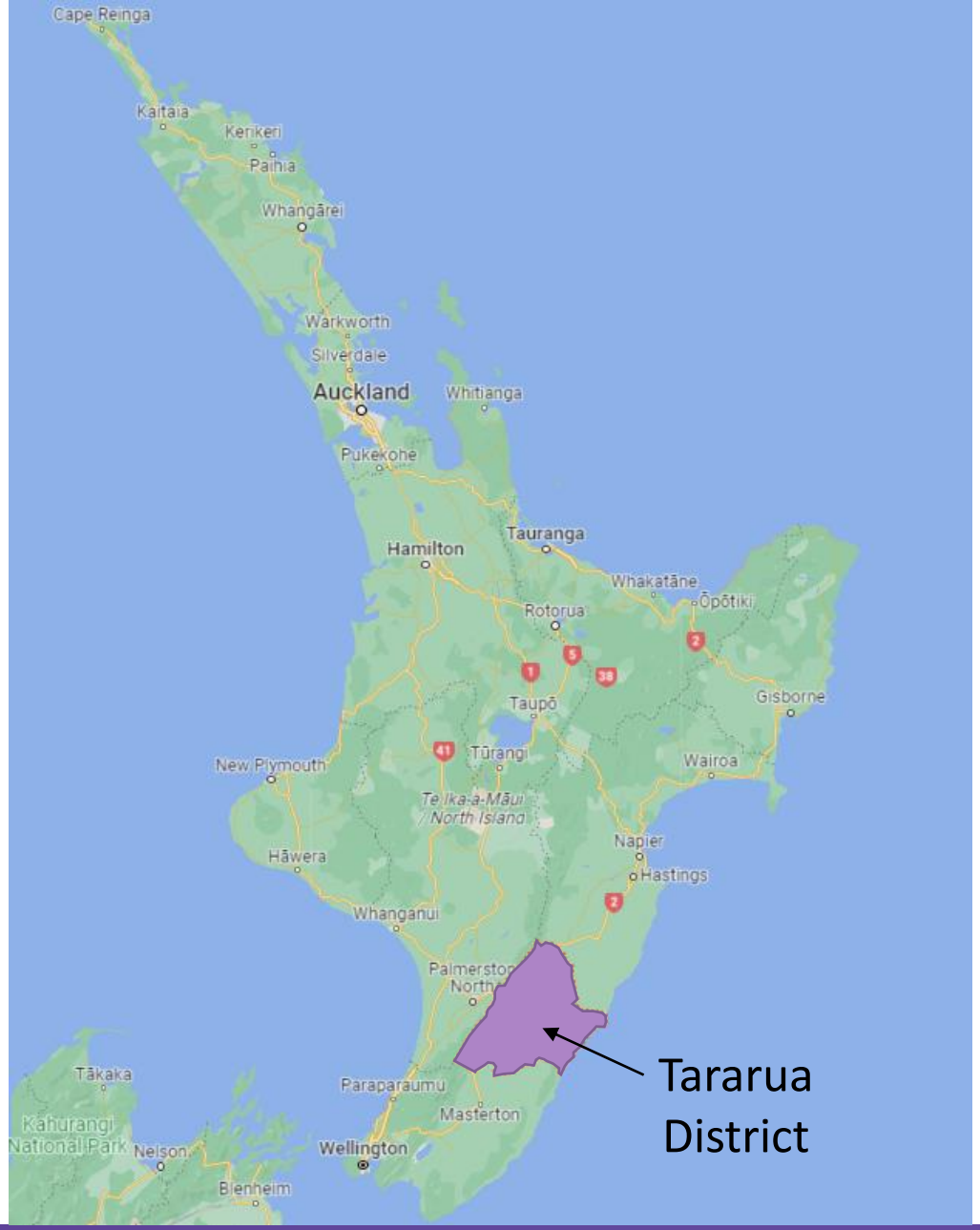
Modelling Group
WATER NEW ZEALAND

Modelling Symposium

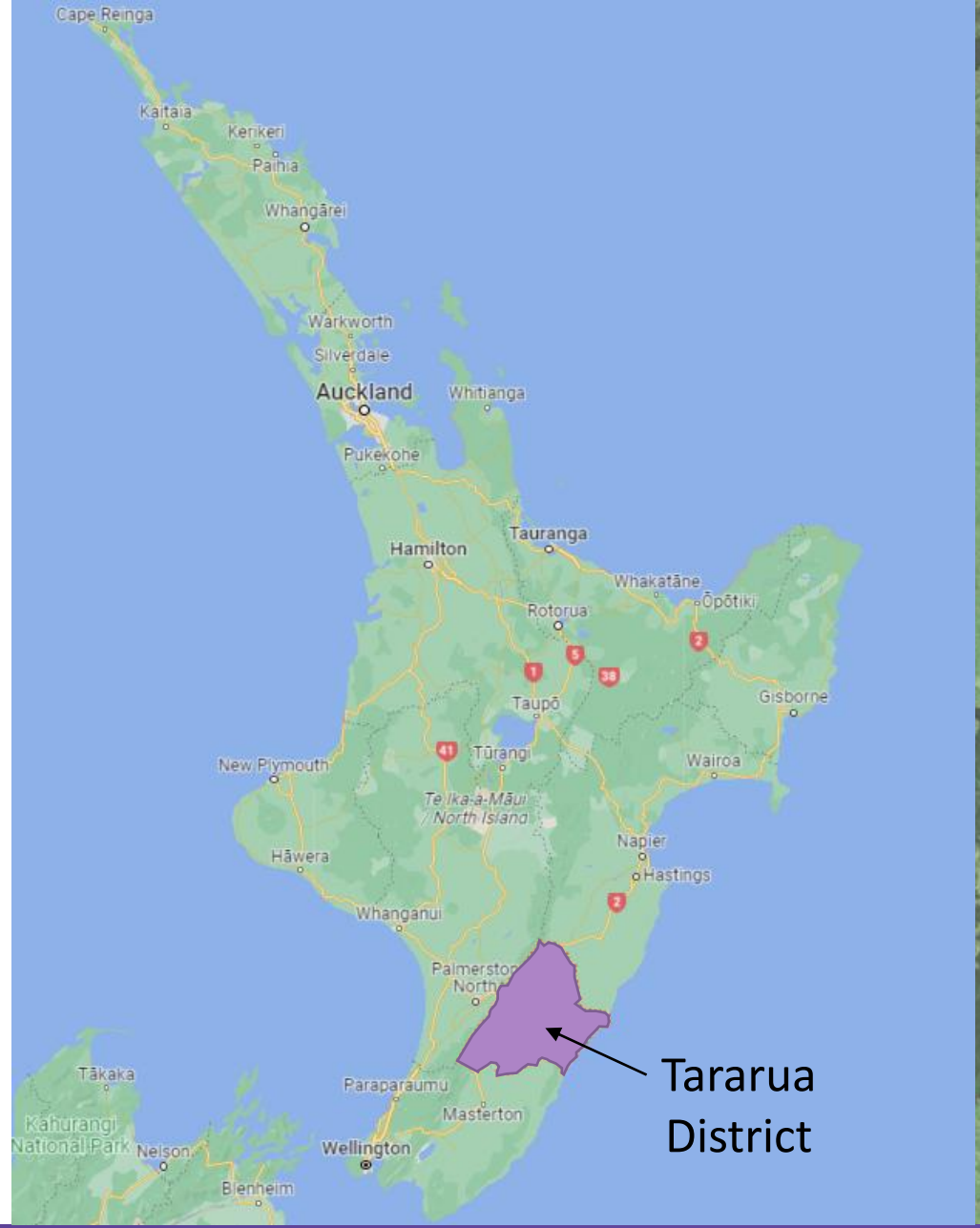
Masterplanning For Climate Resilient Communities

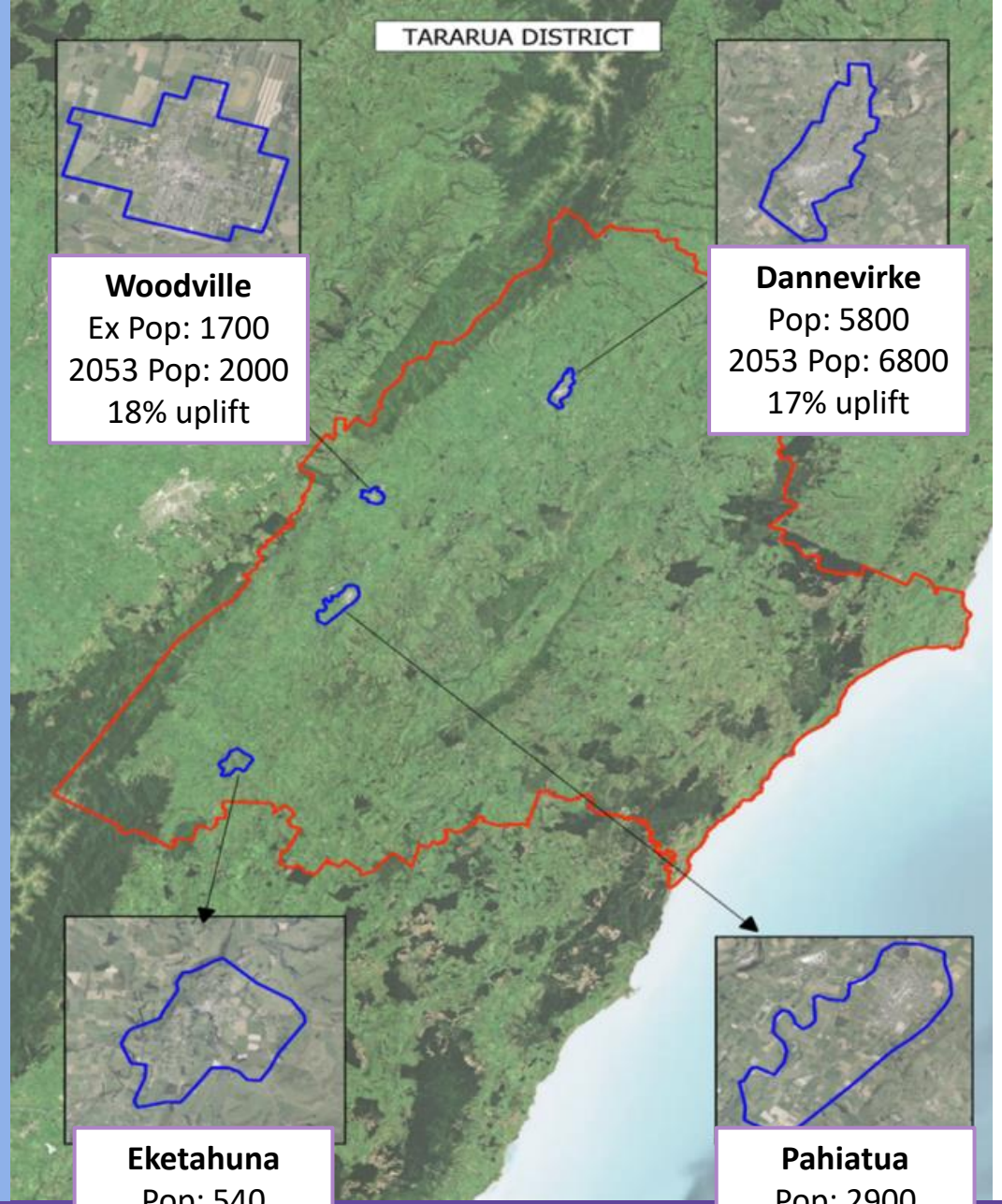
Presented by
Gina Nicholas – Woods

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

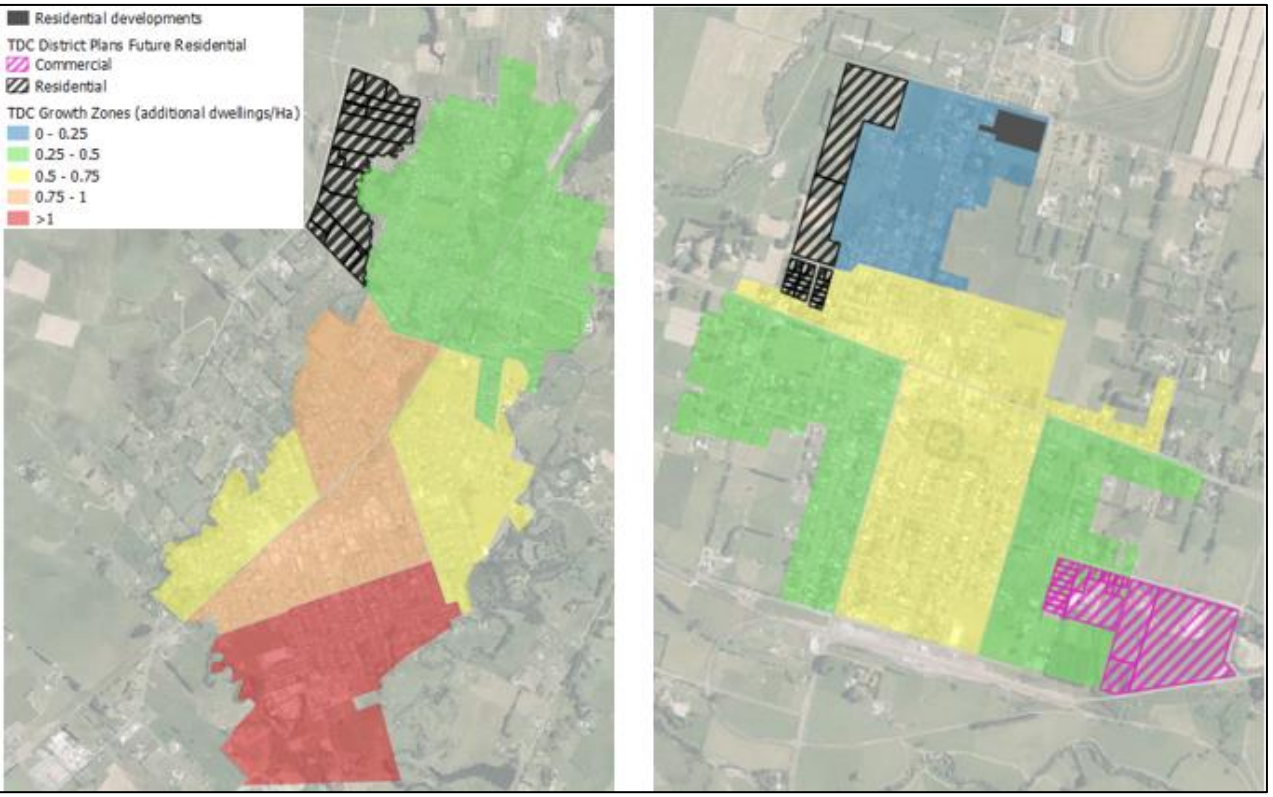


Four largest towns within the Tararua district; Dannevirke, Woodville, Pahiatua and Eketahuna.


Cape Reinga
Kaitaia
Kerikeri
Paihia
Whangārei
Warkworth
Silverdale
Auckland
Whitianga
Pukekohe
Hamilton
Tauranga
Whakatāne
Ōpōtiki
Rotorua
Taupō
Gisborne
New Plymouth
Tūrangi
Wairoa
Te Ika-a-Māui
North Island
Napier
Hastings
Hāwera
Whanganui
Palmerston North
Tākaka
Paraparaumu
Masterton
Kahurangi National Park
Nelson
Wellington
Blenheim
Tararua District


TARARUA DISTRICT
Woodville
Ex Pop: 1700
2053 Pop: 2000
18% uplift
Dannevirke
Pop: 5800
2053 Pop: 6800
17% uplift
Eketahuna
Pop: 540
2053 Pop: 630
14% uplift
Pahiatua
Pop: 2900
2053 Pop: 3300
20% uplift

District plan growth zones



Masterplanning Objectives

- **Develop calibrated hydraulic models** for each service in each area to help inform current and future infrastructure planning decisions
- **Provide TDC with a clear plan for how to service** in a coherent, predictable, and cost-effective manner, existing areas zoned for development but not yet developed
- Ensure, as much as practicable, servicing solutions developed also provide wider benefits by overcoming (or contribute to overcoming) **existing constraints and deficiencies** within the service
- Ensure servicing solutions have the maximum degree of **flexibility** as practicable in terms of **staging, timing, benefits, and extensibility,** and these are well understood by TDC
- Provide TDC with a plan of **what to build, why it's needed and when it's needed**

Constant flooding 'bloody annoying' for Woodville residents

Georgia Forrester . 21:56, Apr 06 2017

Woodville res

Flooding causes chaos in Dannevirke

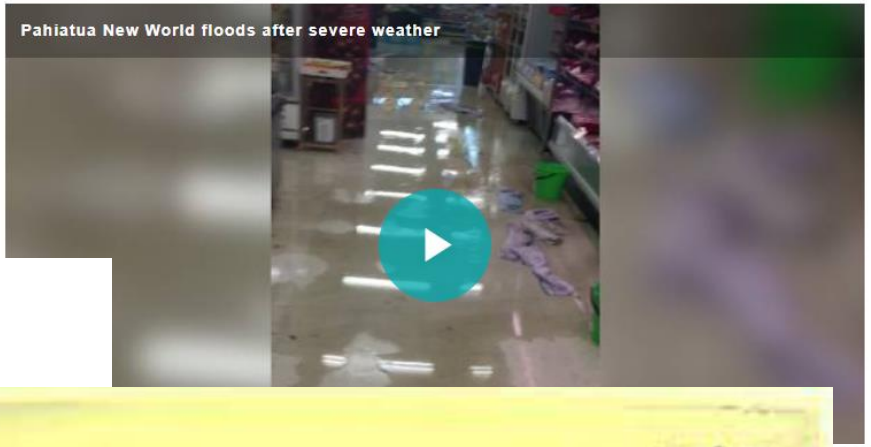
Hawkes Bay Today
By Christine McKay

6 May, 2016 09:11 AM · 2 mins to read

A car is driven through flooding on Dannevirke's Gordon St yesterday afternoon, as a torrential downpour overwhelmed the stormwater system. Photo / Christine McKay

Streets flood in heavy rain, lightning splits a tree

Paul Mitchell and Kirsty Lawrence . 15:33, Nov 29 2017



Dannevirke streets underwater following heavy rain

ay

0 AM · Quick Read

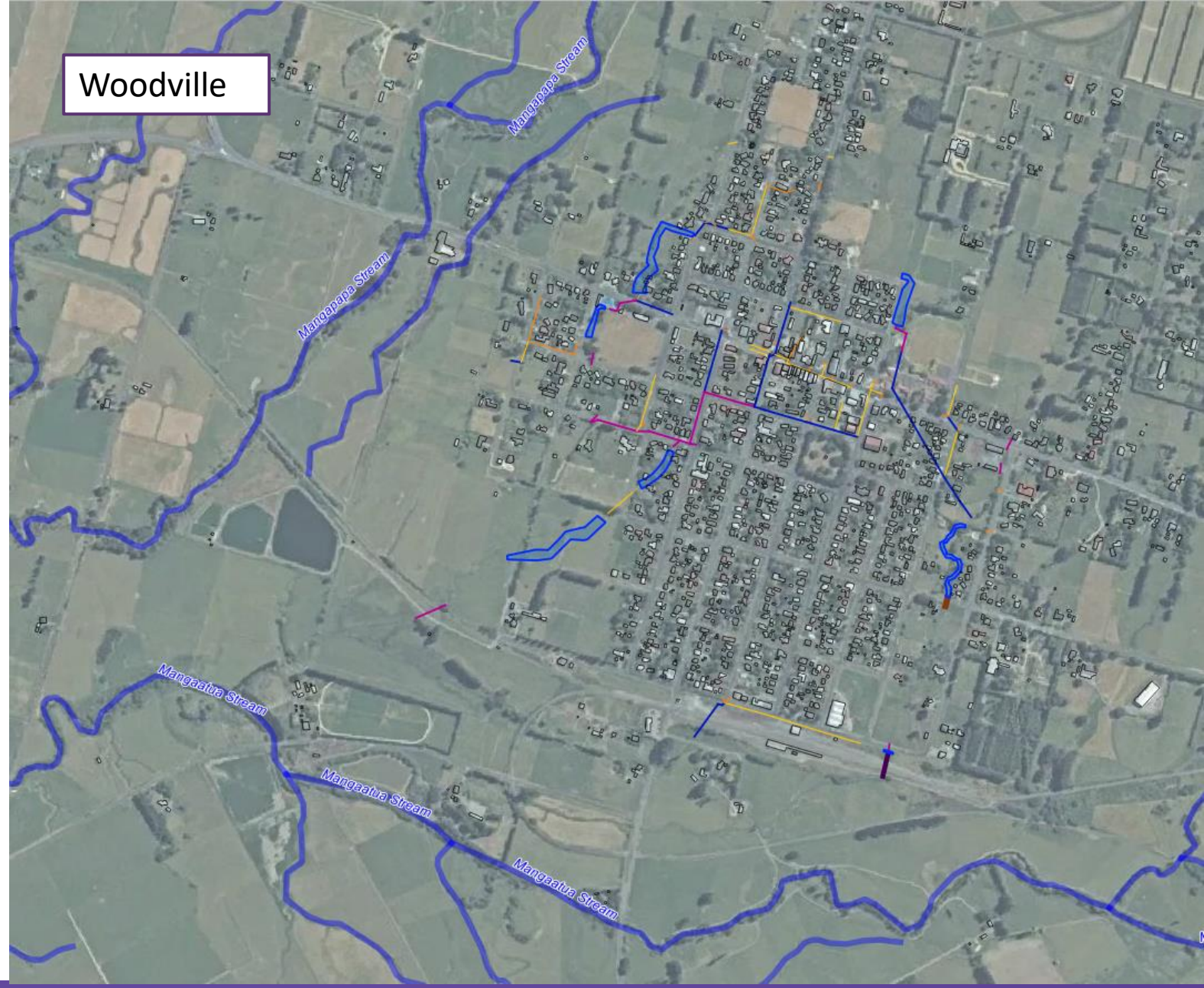
Save Share

SUPPLIED

Motorists had to wade to their cars after Tuesday's storm submerged Main St in Pahiatua.

Existing stormwater network

- Combination open drains and piped network
- All towns drain to the Manawatu River



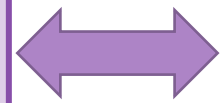
Existing wastewater network

- Gravity system with a small number of local pump stations
- Each town has a treatment facility
- Wastewater networks established 1895 (Dannevirke) – 1940 (Eketahuna)
- Predominantly earthenware pipes
- Significant amount has been relined (Woodville 20% and Eketahuna 50%)

Model Expectations

TDC Objectives

- Identify existing deficiencies
- Identify solutions and develop servicing plan – what to build when
- Service new developments
- 30 year program



Level 1 Model Build*

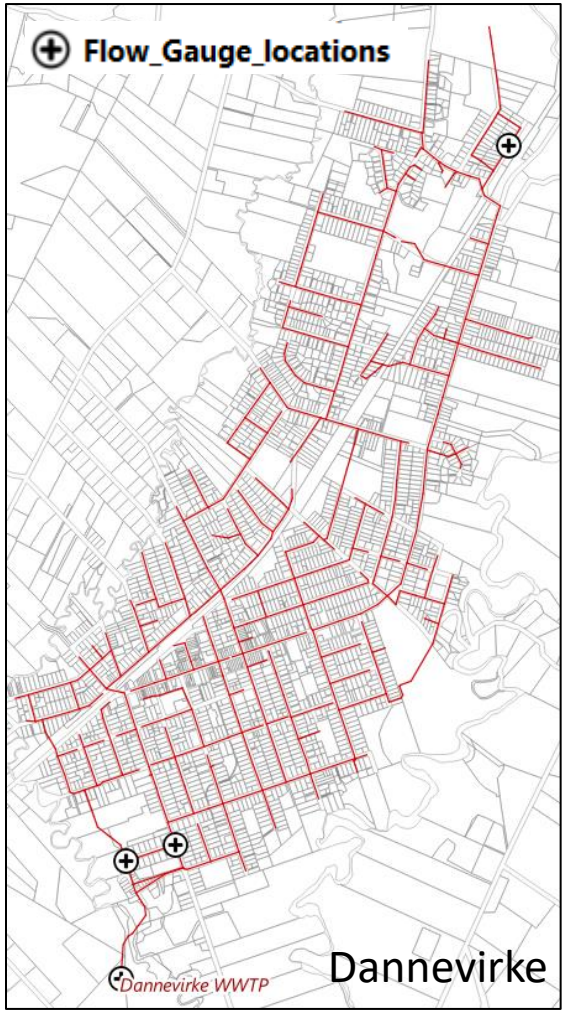
- Bulk conveyance and treatment options
- Impact assessment of major regional initiatives
- Prioritisation plan for upgrading of catchments, trunk mains, major pump stations
- Development of planning & investigation programs
- Scenario development, assessment, and costing
- 20–50-year upgrade programs
- Identification of high-risk assets
- High level impact of proposed development

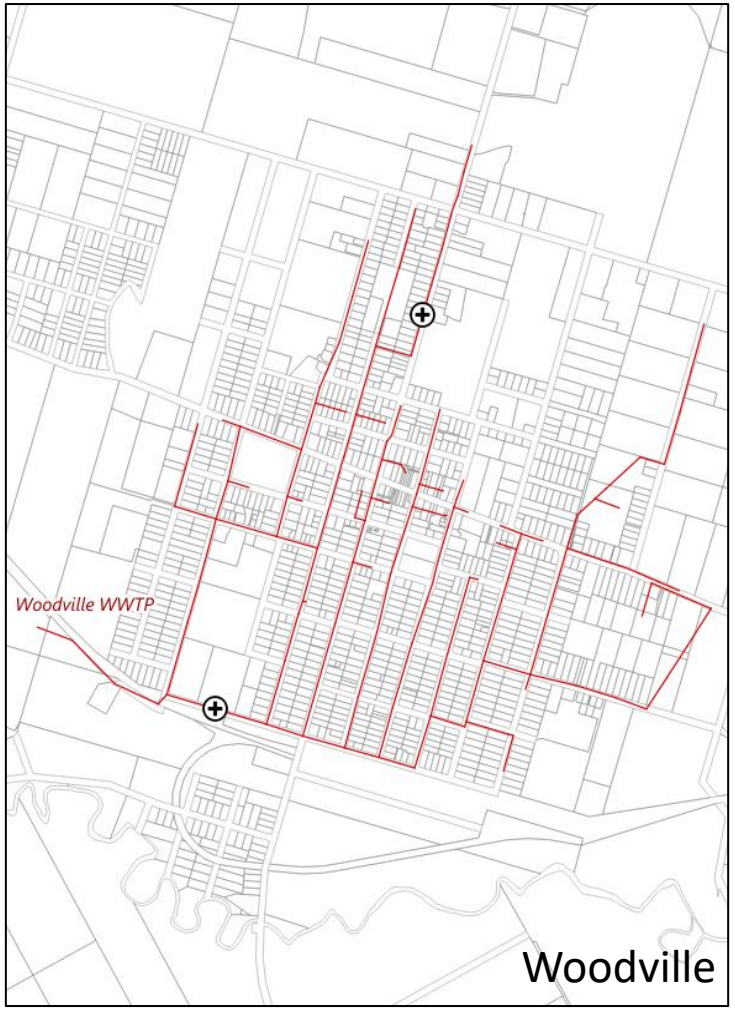
*Water New Zealand Modelling Group National Modelling Guidelines, Wastewater Network Modelling, November 2017

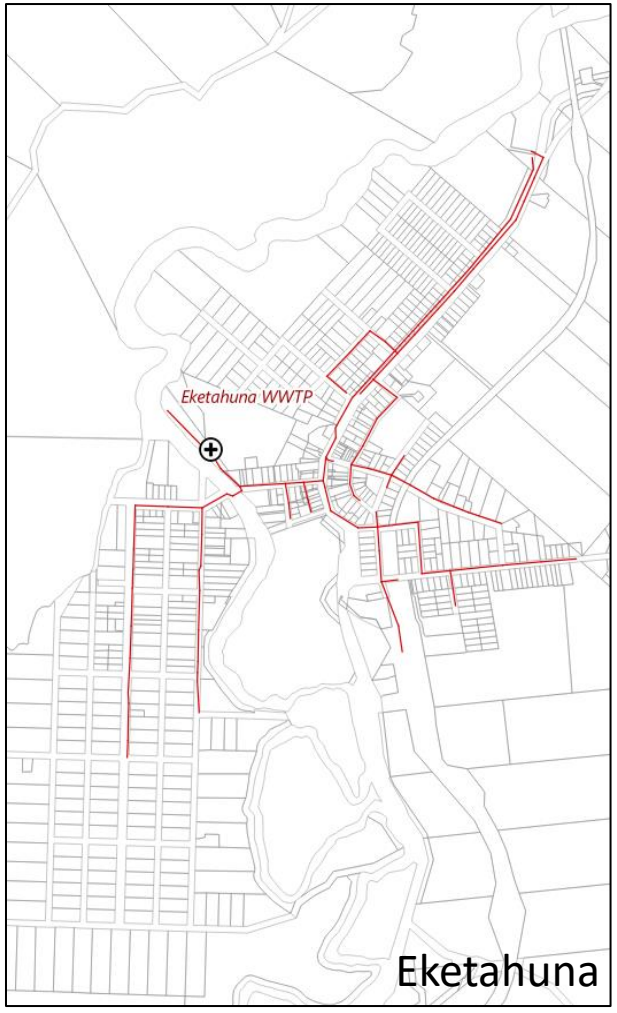
Hydraulic Models

- InfoWorks ICM
- Subcatchment delineation
- Catchment loadings (population based and area based)
- Network asset data from GIS and survey data
- Terrain - LiDAR data
- Set hydraulic parameters to represent losses associated with pipes, inlets, outlets and overland flows
- Rainfall - HIRDS v4. An RCP8.5 was considered for the climate change scenario (stormwater)
- Gauge data from long term monitoring sites (wastewater)

Wastewater flow gauge locations







Wastewater High Level Calibration

High-level calibration suitable for a Level 1 model build:

- Average and peak DWF, base flows (minimum daily flows recorded), wet weather peaking factor
- No assessment of rainfall return period was undertaken. The peaking factor is based on the highest wet weather flows recorded during the gauge period (typically 1 year)
- Limited position of gauges within the network, wastewater lost from the system due to overflows cannot be quantified.
- Observed variation between weekday and weekend and summer and winter base flows and dry weather flows

Inflow & Infiltration Assessment

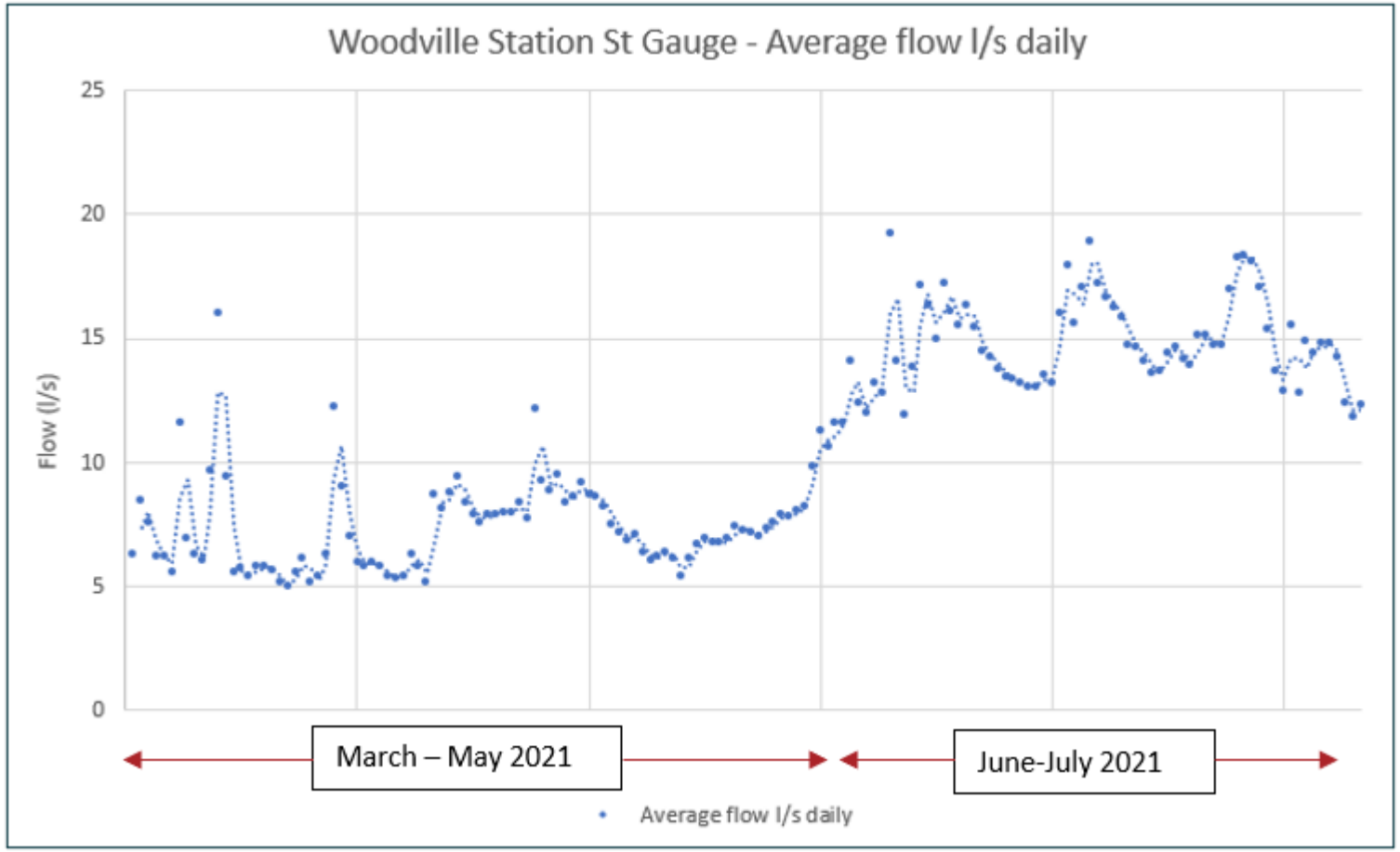
Groundwater infiltration

	Target LoS[1]	Dannevirke	Woodville	Pahiatua	Eketahuna
GWI_1	< 20%	28	62	31	38
GWI_2	< 270	505	655	253	387

[1] Infiltration and Inflow Control Manual, Volume 1 2nd Edition. Water New Zealand Modelling Group, March 2015

GWI_1 = 80% minimum night-time flow / ADWF (l/s) < 20%
GWI_2 = ADWF (l/day) / Population < 270

Inflow & Infiltration Assessment



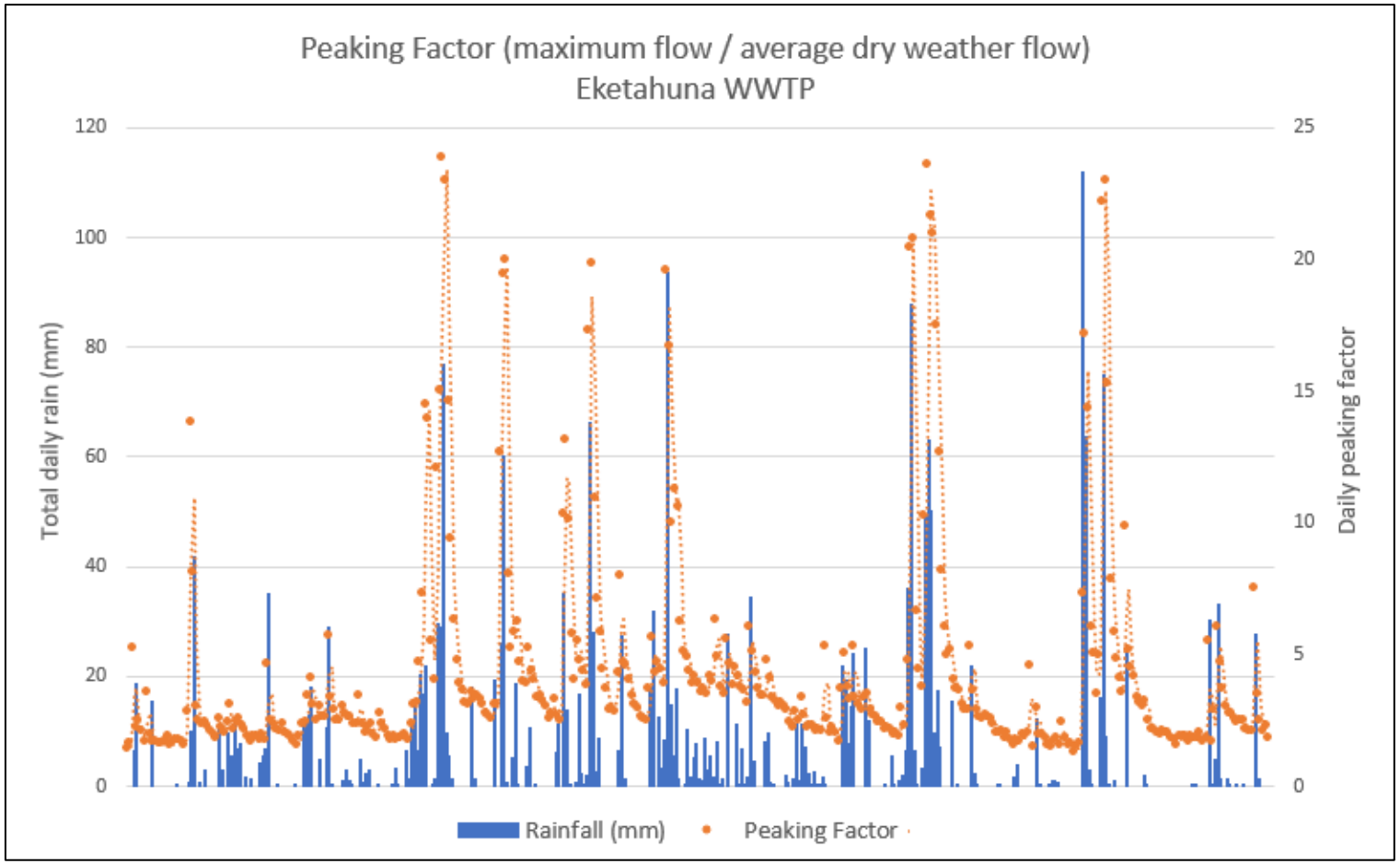
Inflow & Infiltration Assessment

Stormwater inflow

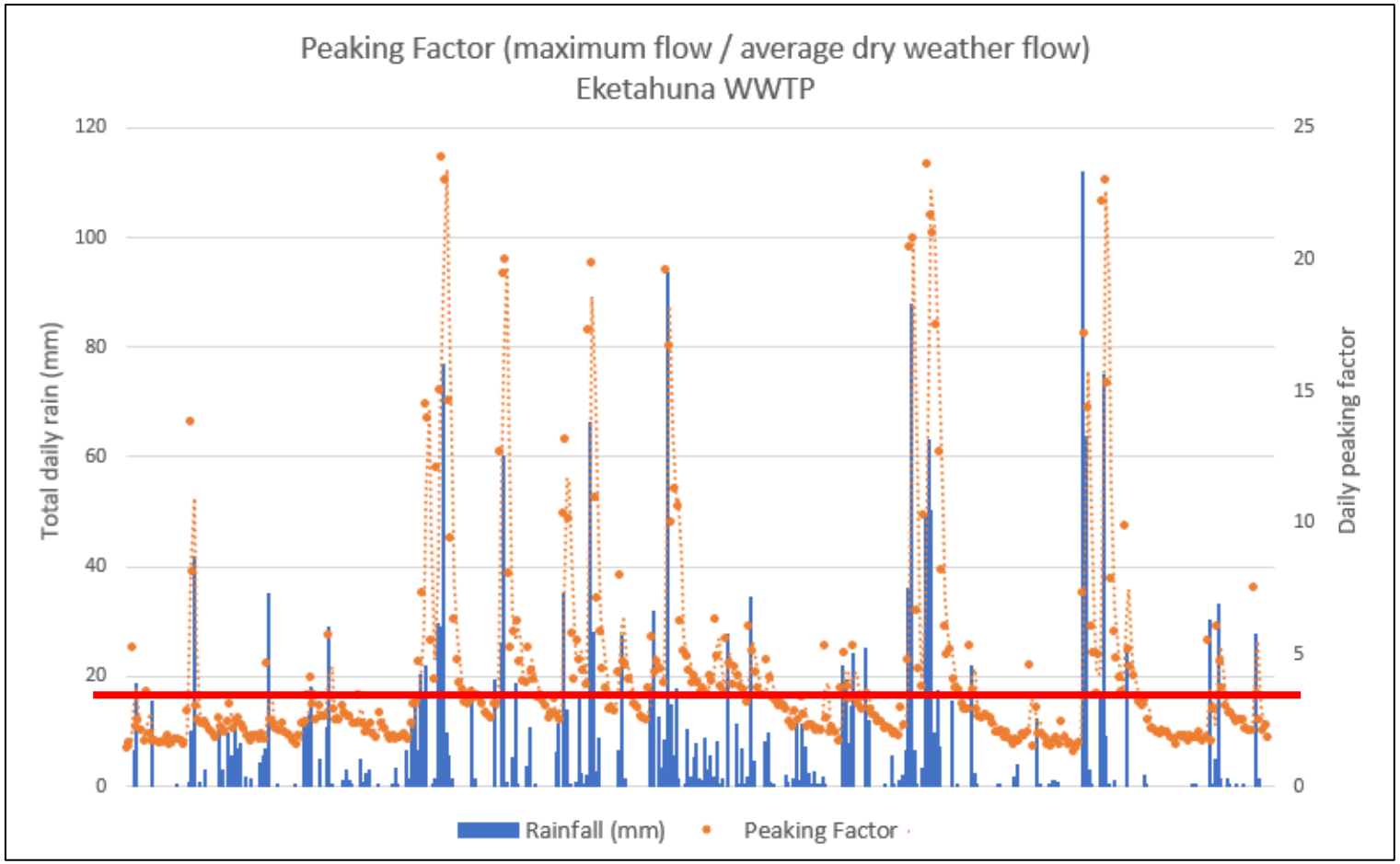
	Target LoS[1]	Dannevirke	Woodville	Pahiatua	Eketahuna
SWI (PWWF/ADWF)	4	4.3	4.8	8.1	22.3

[1] Infiltration and Inflow Control Manual, Volume 1 2nd Edition. Water New Zealand Modelling Group, March 2015

Inflow & Infiltration Assessment

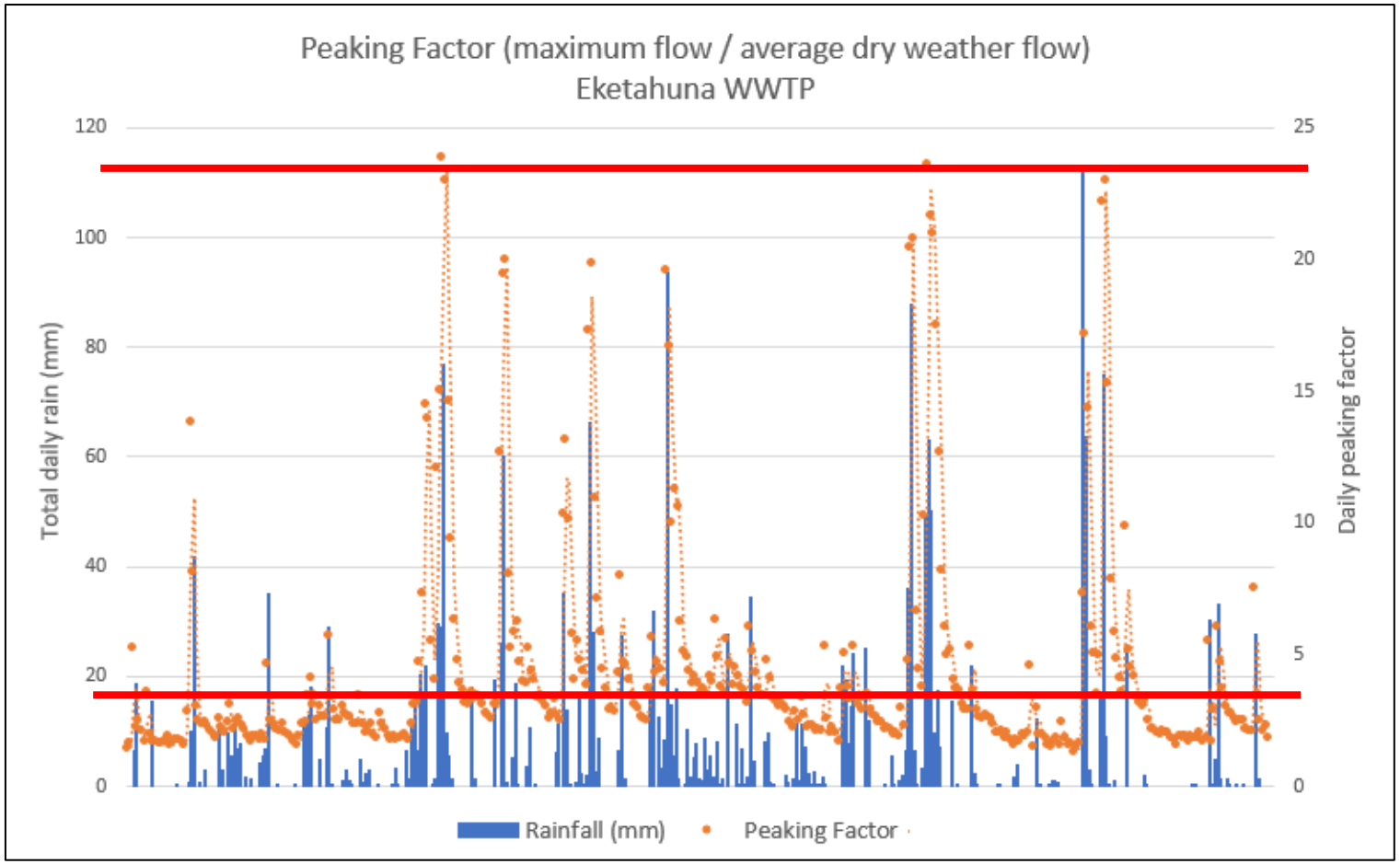


Inflow & Infiltration Assessment



Target LoS = 4

Inflow & Infiltration Assessment



Peak SWI
5 x over LoS

Target LoS = 4

Inflow & Infiltration Assessment

Relined pipes (yellow) in Eketahuna

Wastewater treatment facilities

- Treatment plant capacities exceeded in wet weather flow. backwater causing capacity issues in the downstream network

- In parallel to Masterplanning study, WSP undertaking WWTP strategy study

Understanding the issues

Wastewater

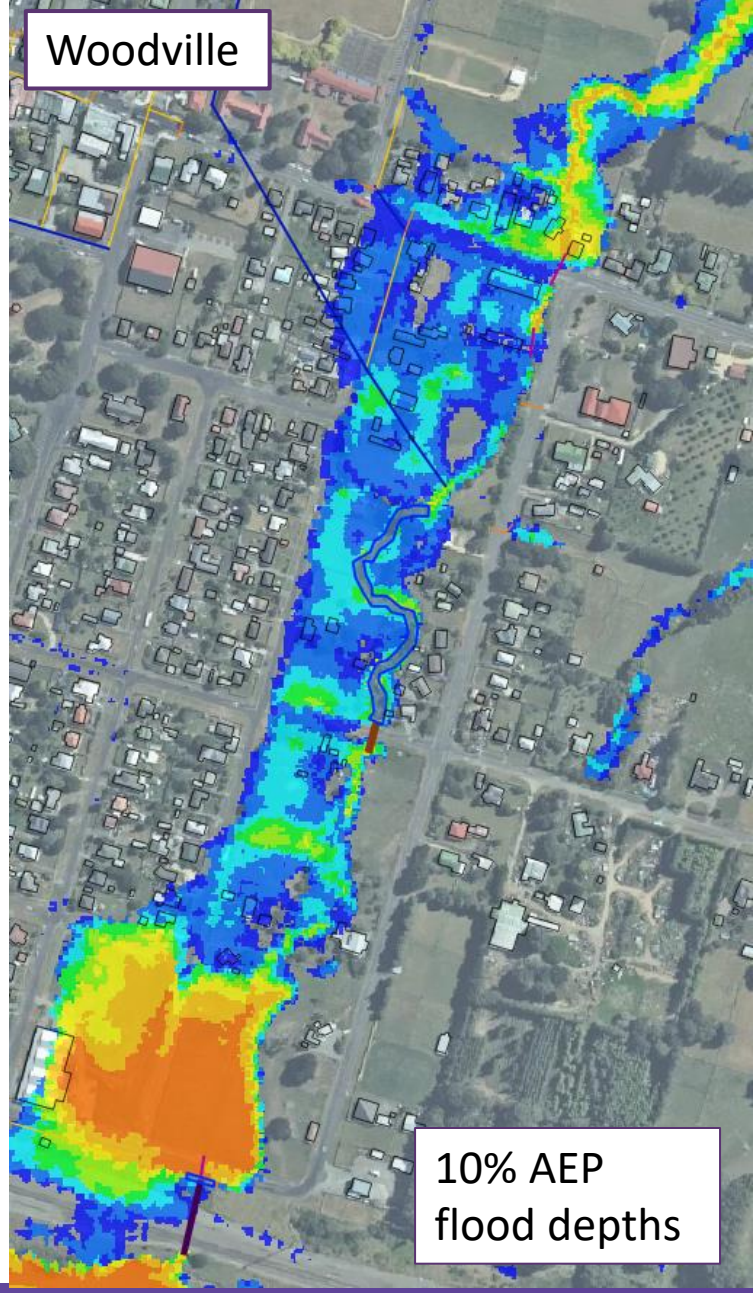
Reticulation is well sized and should have capacity, however high levels inflow and infiltration (I&I) result in overflows:

- Pipe age and condition (50% of the Woodville wastewater network was built pre 1920)
- Ground conditions – 'swampy' land and high ground water levels
- Issues are not confined to public assets
- Downstream network and treatment facilities becoming overwhelmed in wet weather
- Existing issues, but will be exacerbated by growth

Understanding the issues

Stormwater

- Network is undercapacity with limited inletting
- Limited consideration of secondary overland flow paths
- Access issues for operation and maintenance
- Stream health – contaminated water ends up in the Manawatu river
- Existing issues, but will be exacerbated by growth



Servicing solutions

Upgrade existing infrastructure or remedial work?

- CAPEX vs OPEX
- Carbon footprints
- Future maintenance
- Constructability

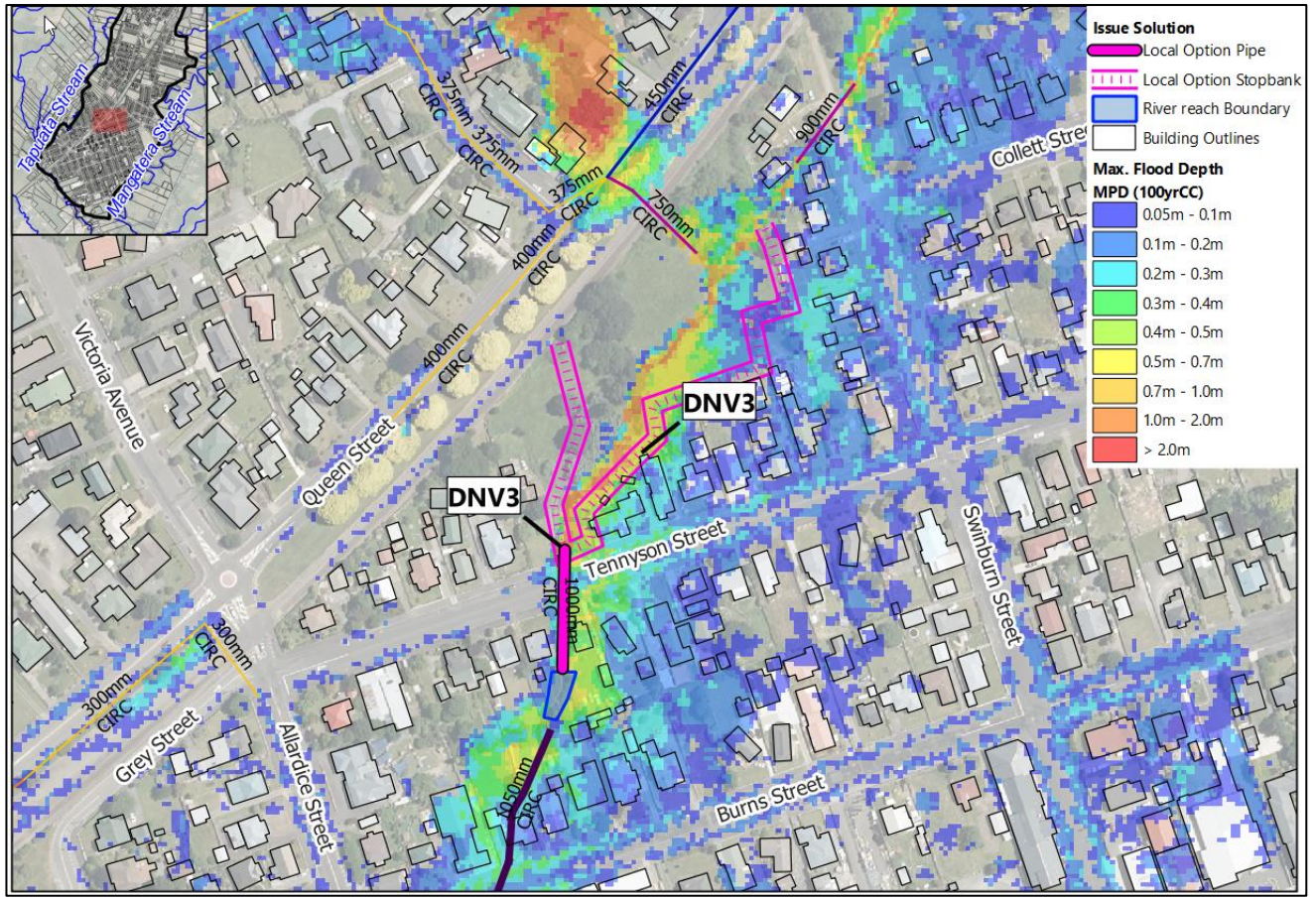
Future proofed for climate change and growth

Wastewater recommended solutions

- Capital works - in general focussed on the downstream end of the network
- I&I investigation study

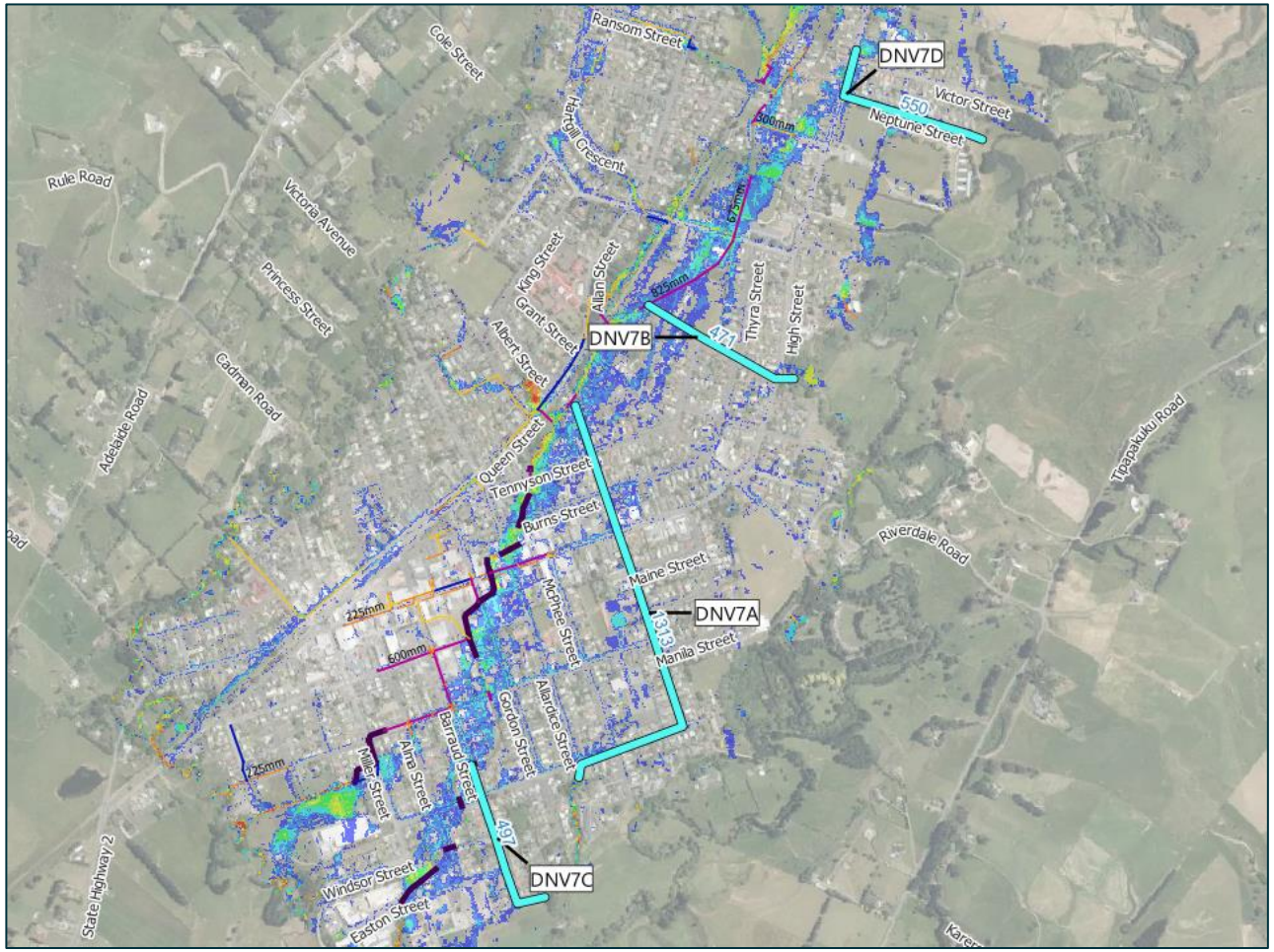
Stormwater recommended solutions

- Retention and detention (benefits water quantity and quality)
- Conveyance / pass flow forward (strategic approach)



Stormwater recommended solutions

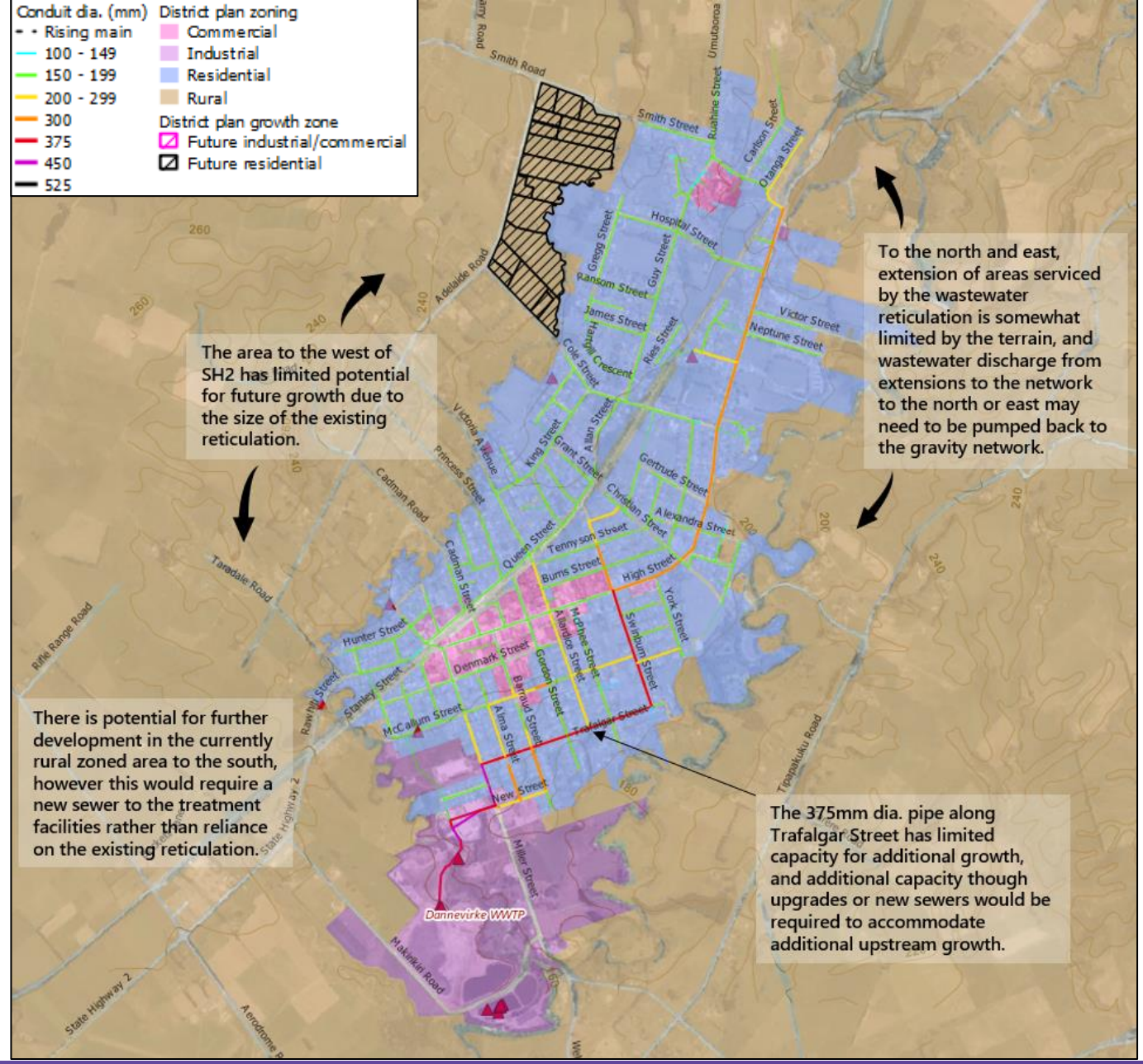
- Retention and detention (benefits water quantity and quality)
- Conveyance / pass flow forward (strategic approach)
- Diversions (local and trunk)



Opportunities for further growth

Wastewater

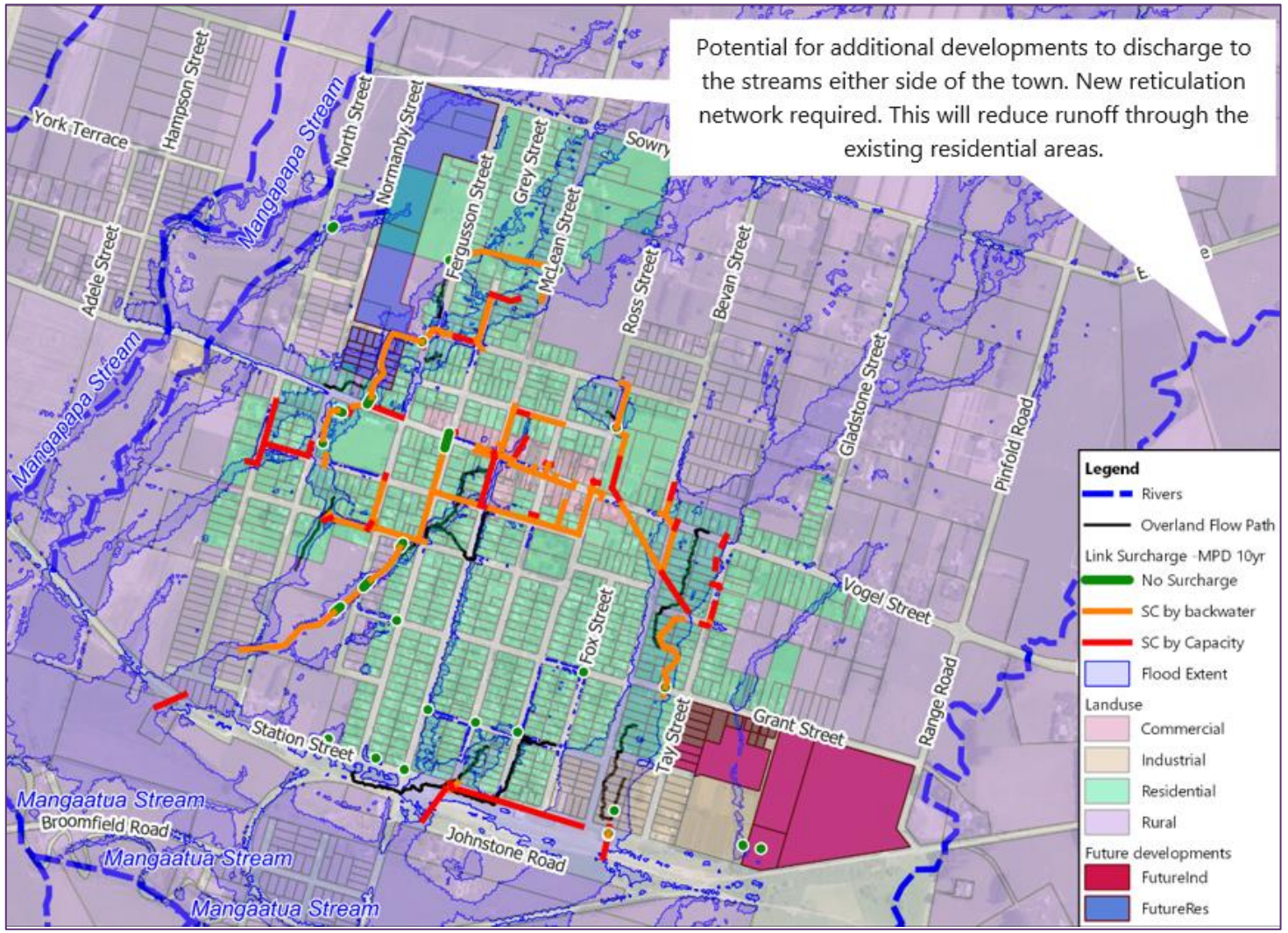
- In general, infill growth can be supported
- Significant change of currently zoned rural land to residential or commercial would require a new reticulation network to WWTP
- Reducing I&I will free up capacity in the network for further growth.



Opportunities for further growth

Stormwater:

- Existing reticulation networks are at capacity and cannot support further growth.
- Change of currently zoned rural land to residential or commercial would require a new reticulation network which discharges to one of the major streams
- Will potentially benefit existing residential areas by diverting stormwater runoff away from properties currently at risk of flooding



Conclusions and next steps

Stormwater and wastewater models were developed suitable to be used at a Masterplanning level to identify existing deficiencies and provide servicing solutions future proofed for climate change.

Wastewater:

- Fix existing issues (capital works), future proofed to allow for development
- I&I investigation study - Flow gauging to identify I&I hotspots, CCTV, smoke testing.
  - Key will be inspection of private laterals and connections
  - Further asset survey and sewer level monitors installed at known risk points would help improve model confidence
- Reassess issues and options with confirmation of preferred WWTP options

Conclusions and next steps

Stormwater and wastewater models were developed suitable to be used at a Masterplanning level to identify existing deficiencies and provide servicing solutions future proofed for climate change.

Stormwater:

- Climate change effects will put pressure on an already strained network
- Stormwater upgrades to mitigate the existing flood hazards, future proofed to allow for climate change
- Potential for development of rural areas provides opportunity to divert flows away from the existing townships, however sizing, treatment and consideration of secondary flows will be crucial.

Acknowledgements

- Tararua District Council and the Tararua Alliance – Derek Wood and Marcus Clifford
- WSP – Jivir Viyakesparan

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Thank you!
Questions? Patai?

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