Modelling Group
WATER NEW ZEALAND

Modelling Symposium

Urban Flood Mapping and Stormwater Management Planning: A Case Study in Napier

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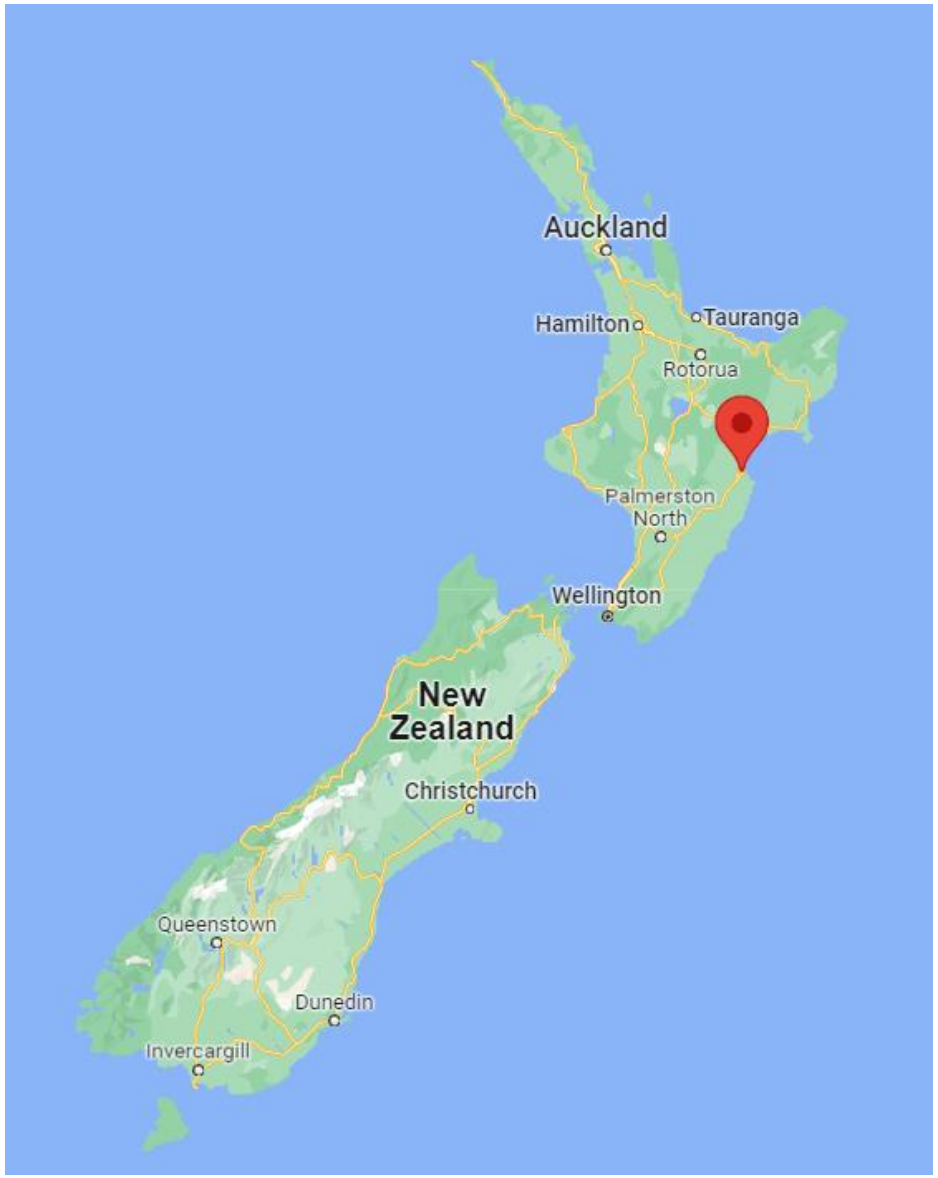
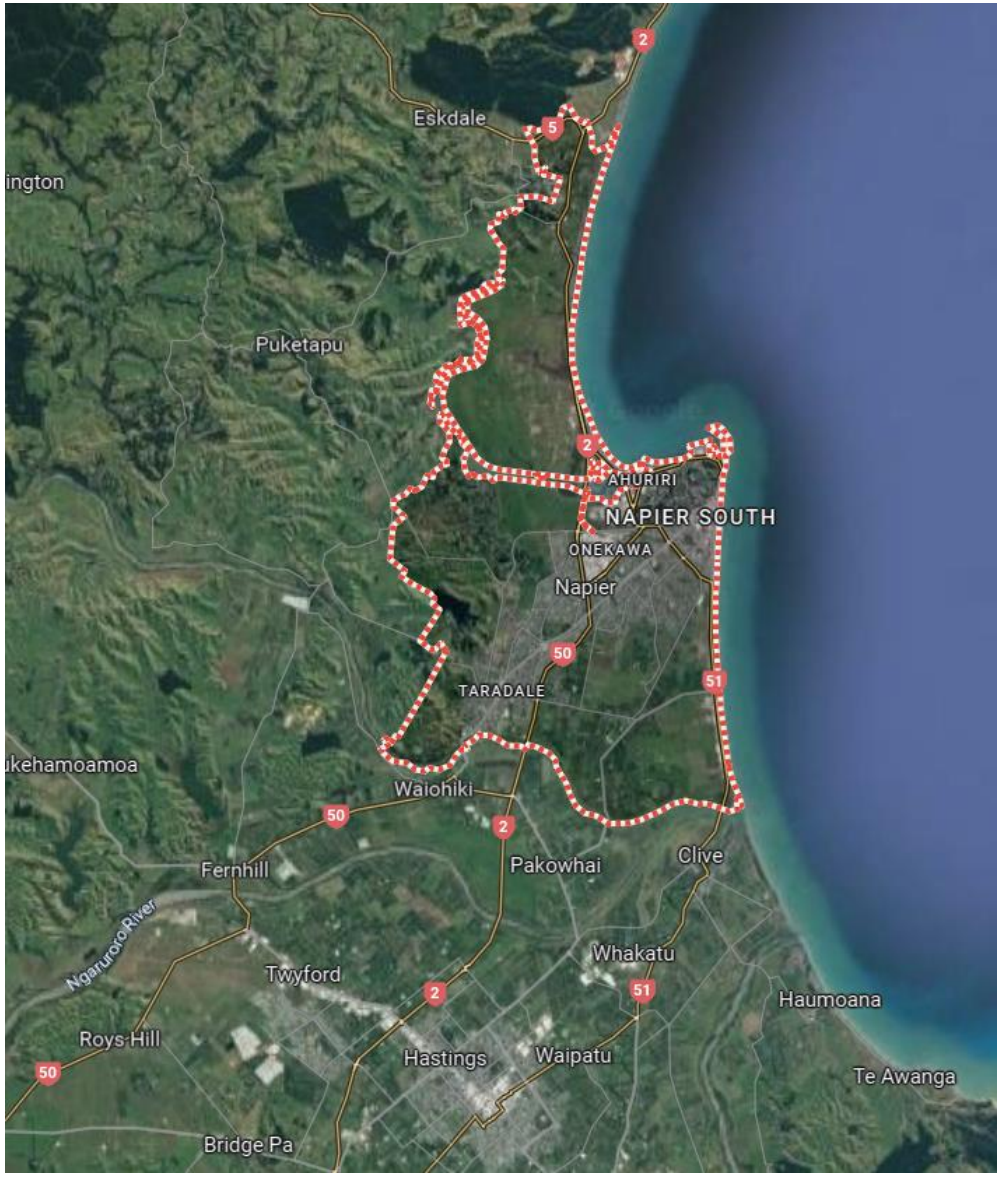
water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

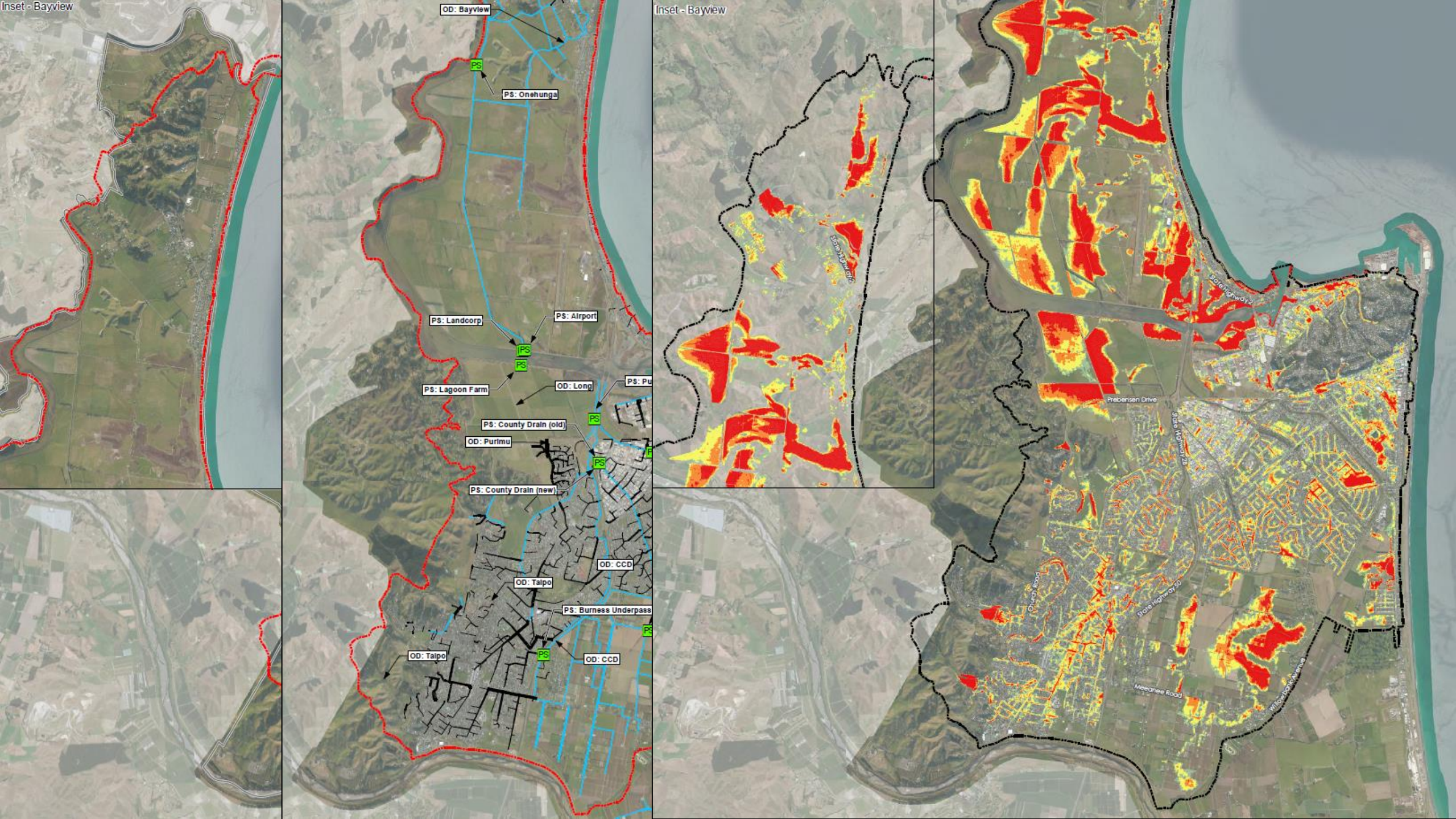
Overview

1. Introduction to Napier
2. What is in and what is not
3. Modelling for an uncertain future
4. The Napier SWMP
   - SWMP Objectives
   - Methods & Limitations
   - Model Results
   - Proposed Upgrades & Costing
   - WSD, Infill, and Planning Tools
   - Overall Recommendations
5. What happened next?
6. Q&A

Napier City


Auckland
Hamilton
Tauranga
Rotorua
Palmerston North
Wellington
New Zealand
Christchurch
Queenstown
Dunedin
Invercargill


Eskdale
Puketapu
MAHURIRI
NAPIER SOUTH
ONEKAWA
Napier
TARADALE
Waiohiki
Fernhill
Pakowhai
Clive
Ngaruroro River
Twyford
Whakatu
Haumoana
Roys Hill
Hastings
Waipatu
Te Awanga
Bridge Pa


Inset - Bayview
OD: Bayview
PS
PS: Onehunga
PS: Landcorp
PS: Airport
PS
PS
PS: Lagoon Farm
OD: Long
PS: Pu
PS
PS: County Drain (old)
OD: Purimu
PS
PS: County Drain (new)
OD: CCD
OD: Taipo
PS: Burness Underpass
PS
OD: Taipo
PS
OD: CCD
Inset - Bayview
State Highway 2
Prebensen Drive
State Highway 35
State Highway 50
Church Road
Meeanee Road
Willowpark Avenue

What is and what is not

What's in? What's out?

IN	OUT
Napier City & Bayview	Awatoto, Esk Valley
Urban Flooding Sources	Non-urban Flooding Sources
The Stormwater Master Plan	The Stormwater Model Build
Timelines up to Sept 2020	Timelines post-Sept 2020

Modelling for an uncertain future

Stormwater Master Plan

What does the future look like? How can we model it when we don't know?

- Models are planning tools
- Quick assessments
- Scenario testing
- Inform decision makers

Expected Climate Changes

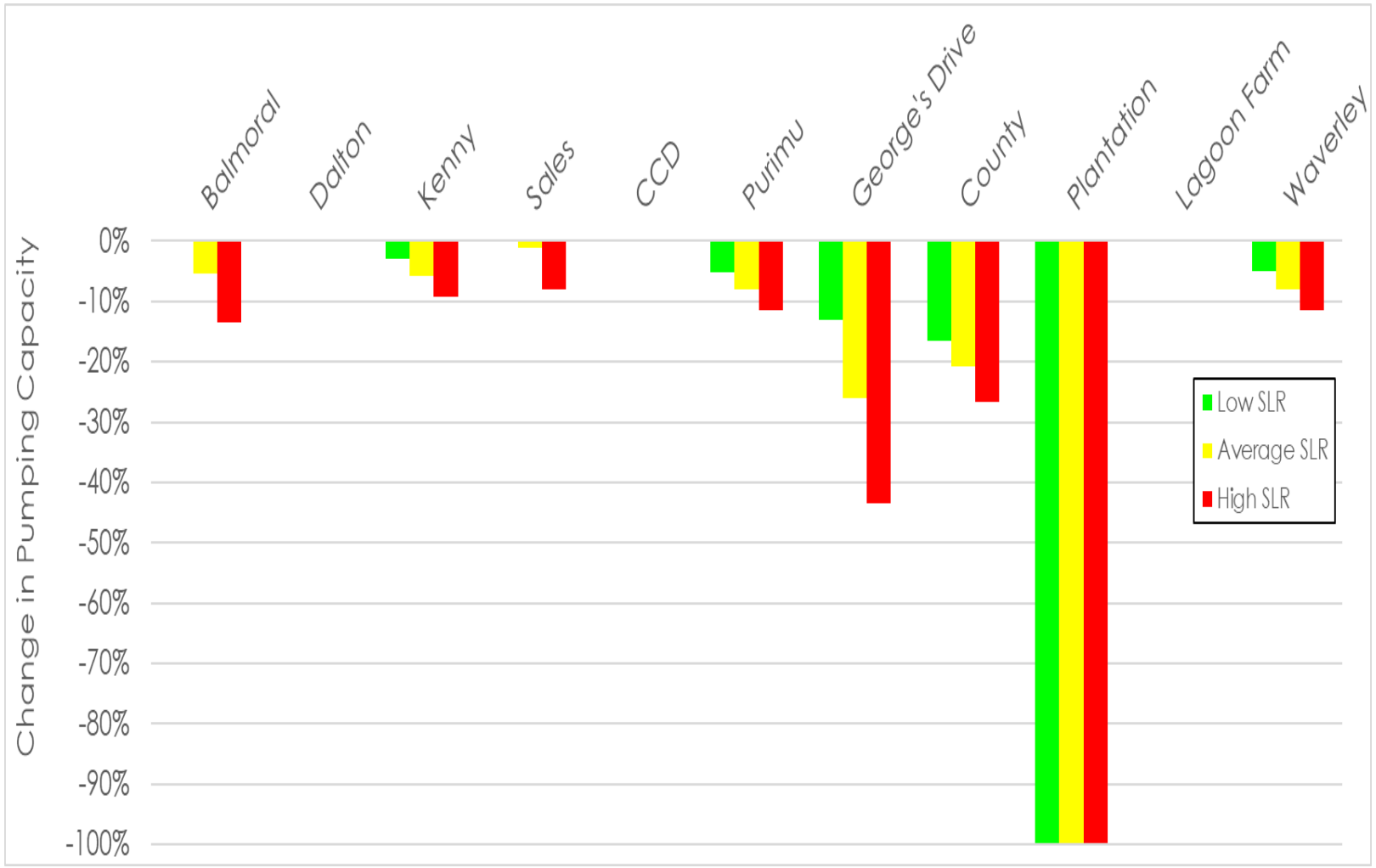
What's happening?

- Warmer air carries more moisture
- Changes in global climate patterns
- Increase in volatile weather
- Glaciers / sea ice melting, ocean expanding

Expected Changes:

- More intense rainfall
- Changing annual rainfall volumes
- More extreme weather events
- Sea level rise

Expected Climate Change Impacts



SWMP Objectives

Stormwater Master Plan Objectives

Primary Objectives:

- Determine LOS
- Flooding extents and risk
- Impacts of growth and climate change
- Solutions to meet LOS targets
- CAPEX programme
- Recommendations for District Plan / LTP Input

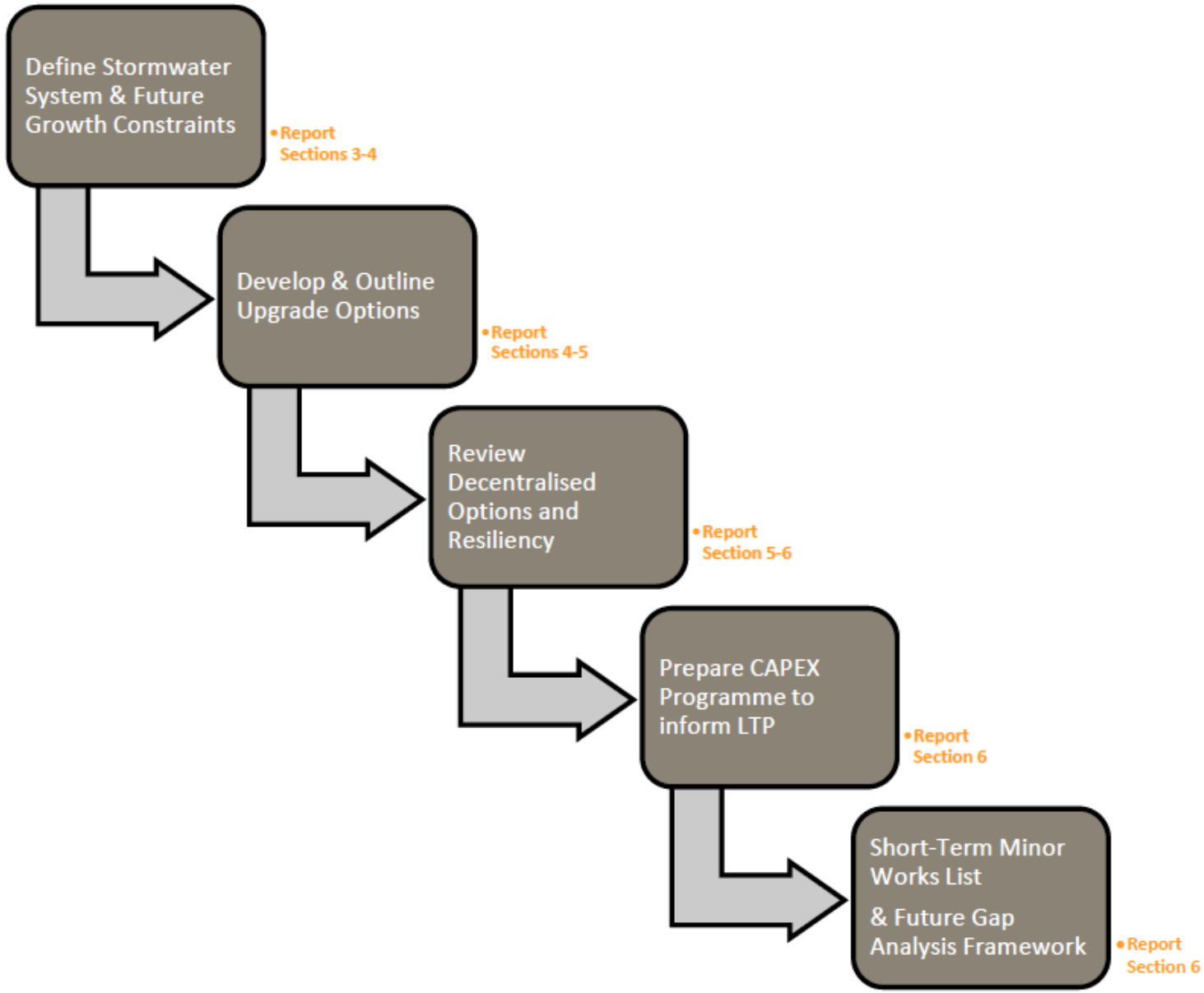
Assessment Criteria

Level of Service:

- Initially assessed pipes for 10% AEP
- Widespread network deficiencies
- Re-focused priorities on properties for 1% AEP
- Property threshold set to 150mm, clustered
- Result = more manageable criteria

Methods and Limitations

Graph 1.1 SWMP Guiding Process



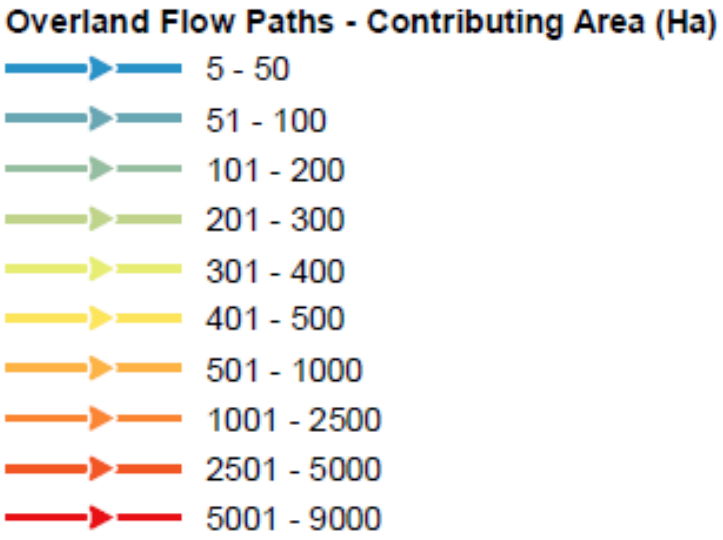
Limitations

- Urban / NCC environment
- Data confidence i.e., LIDAR
- Uncalibrated model, pre-peer review
- Uncertain future
- Cost estimates
- Pre-COVID-19

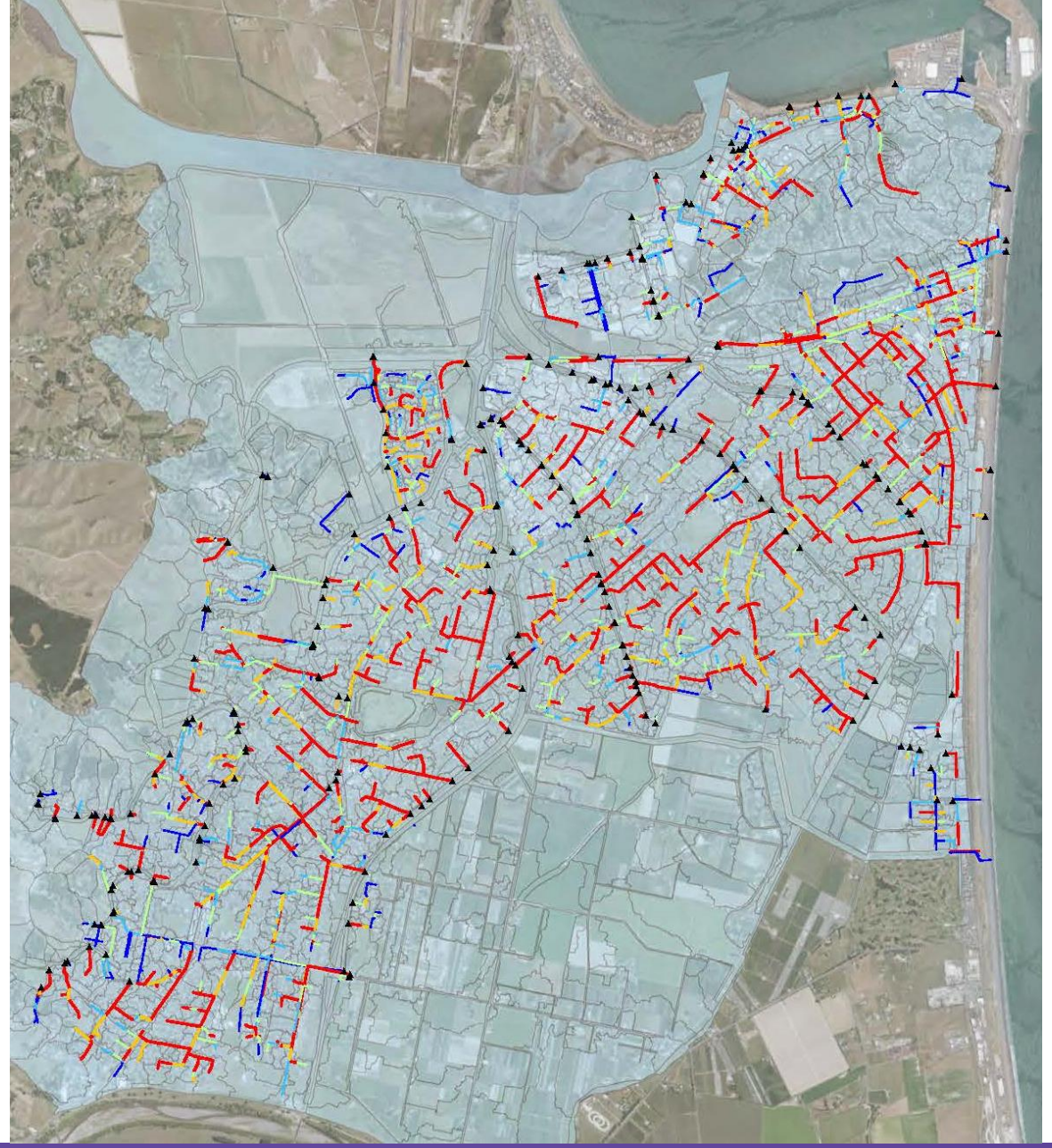
Model Results

Existing Flow Paths, Napier

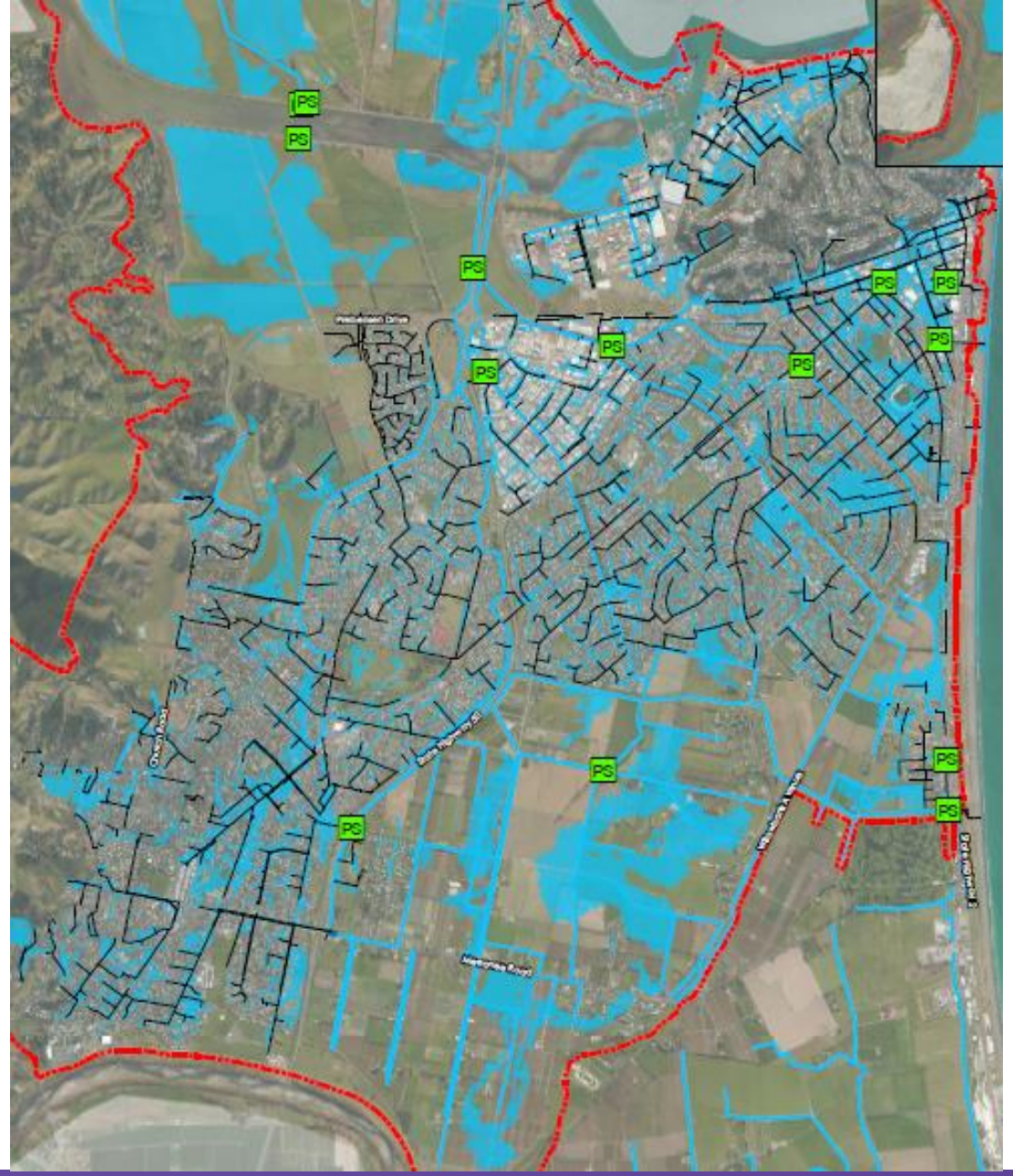
<u>Recommendation:</u>
That critical flow paths (>5ha)
be protected using the District Plan



Existing Pipe Utilization, 10% AEP



Existing System Flooding, Napier 2% AEP



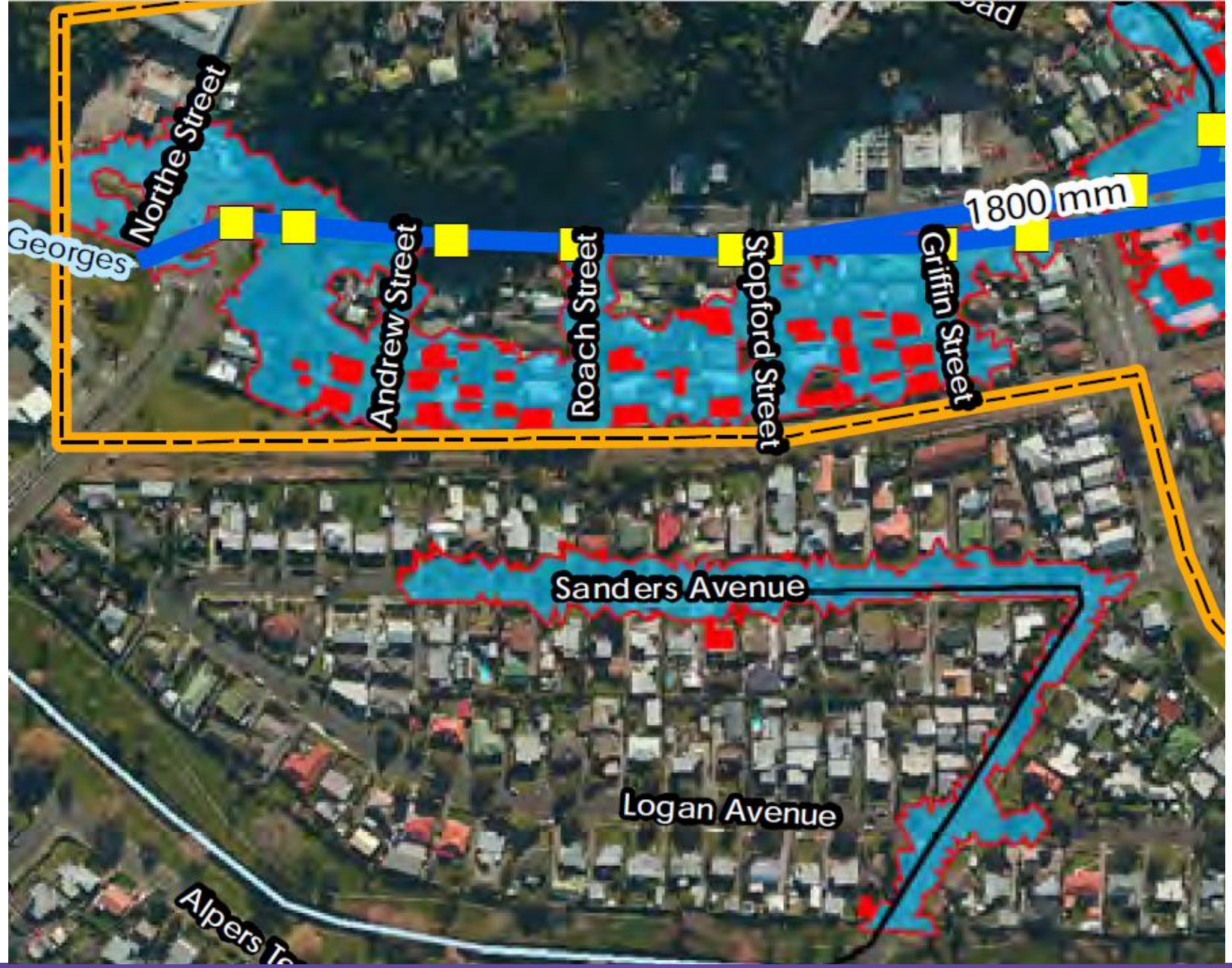
Flooded Building Results

Location	# Buildings Flooded		% Improvement
	Existing	After Upgrades	
Napier	2,122	1,440	32%
Bay View	204	164	20%
Total	**2,326**	**1,604**	**31%**

Proposed Upgrades & Costing

Upgrade Option Types

- Pipes
- Channels
- **Storage**
- Pump Stations / PS Upgrades
- Diversions


Northe Street
Georges
Andrew Street
Roach Street
Stopford Street
Griffin Street
1800 mm
Sanders Avenue
Logan Avenue

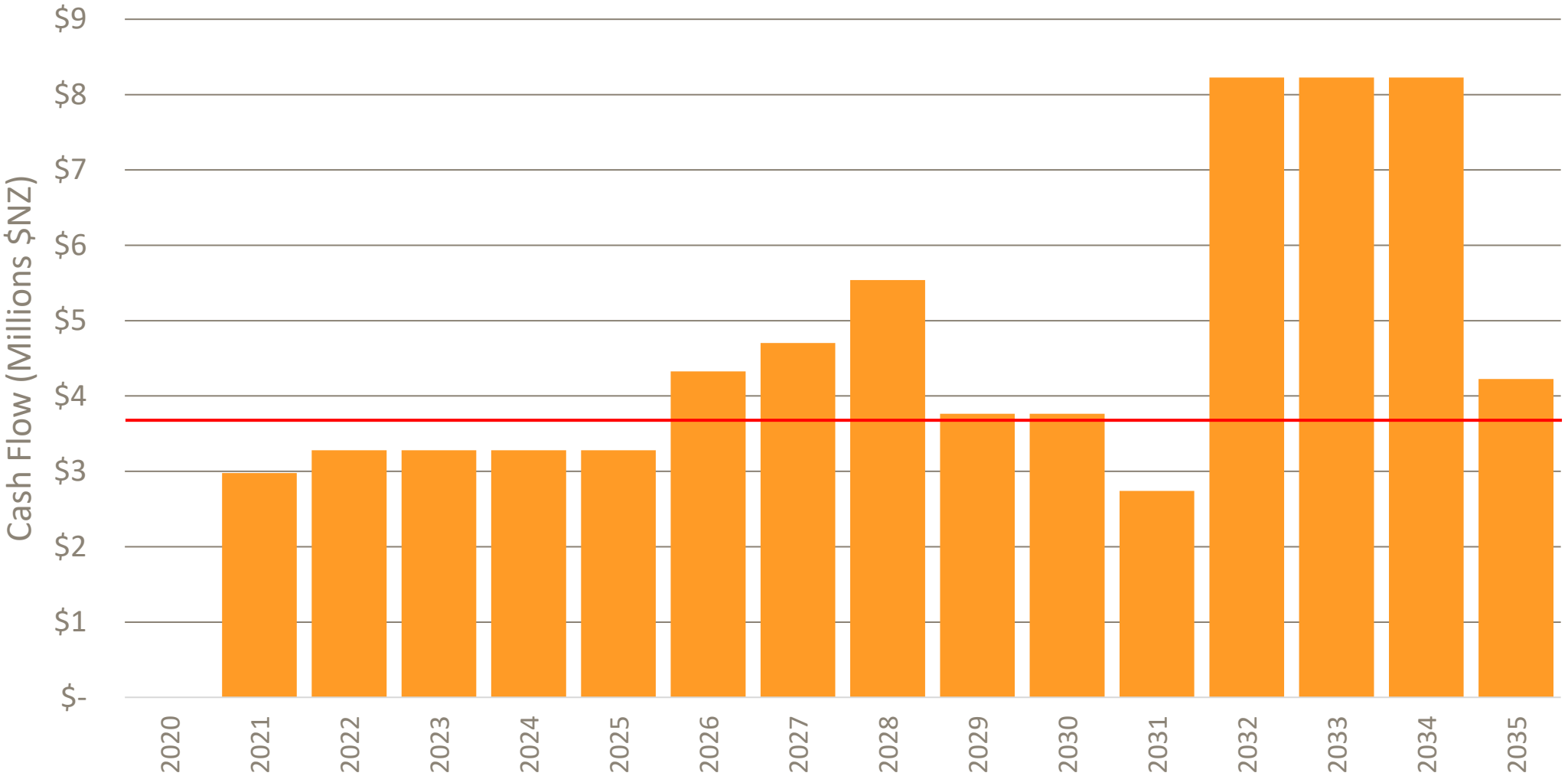
Proposed Upgrades

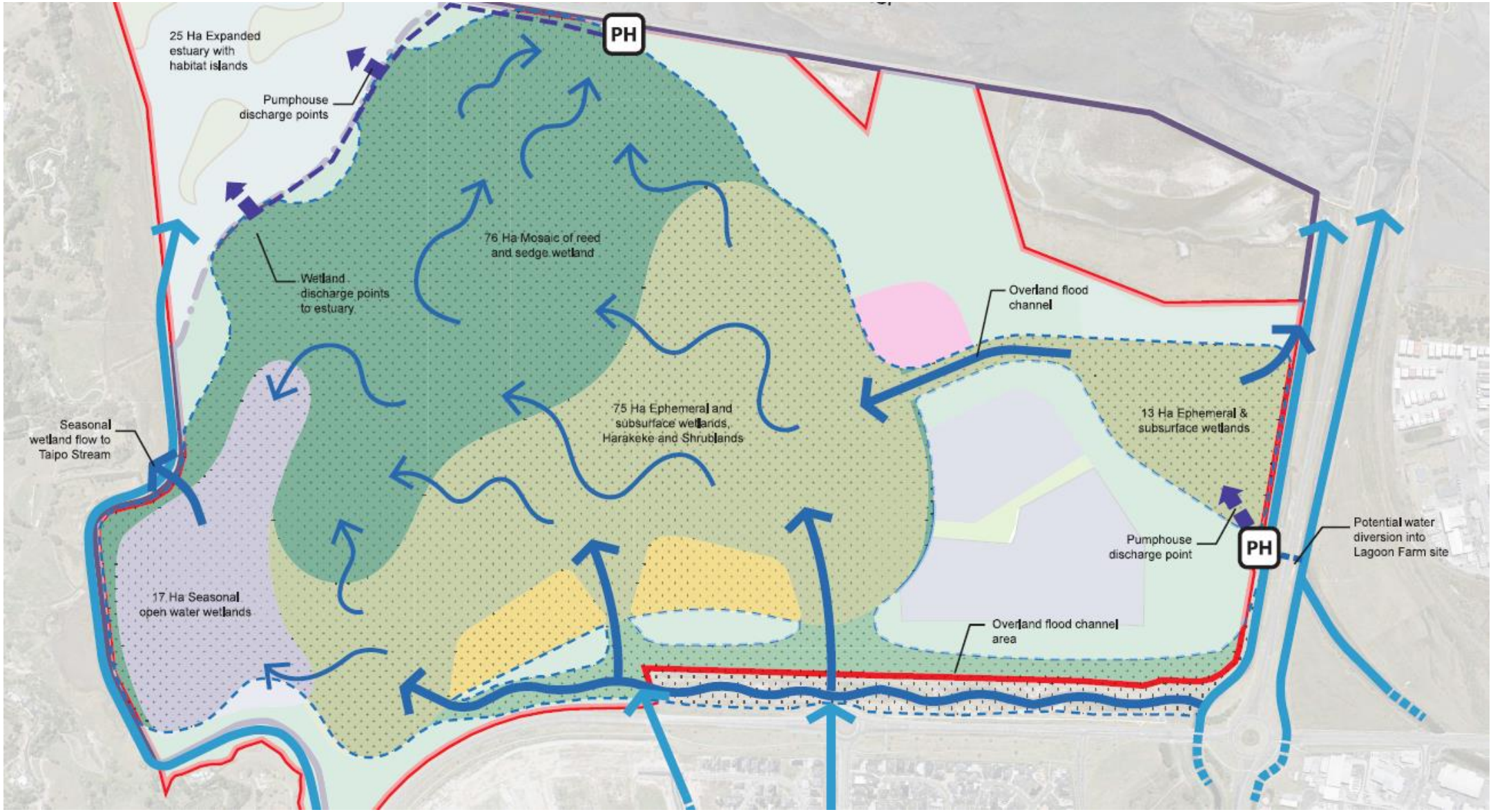
- Improve existing system deficiencies
- 32 upgrade projects
- Total cost: **$429M**
- Will take time…
- Next10-year timeline

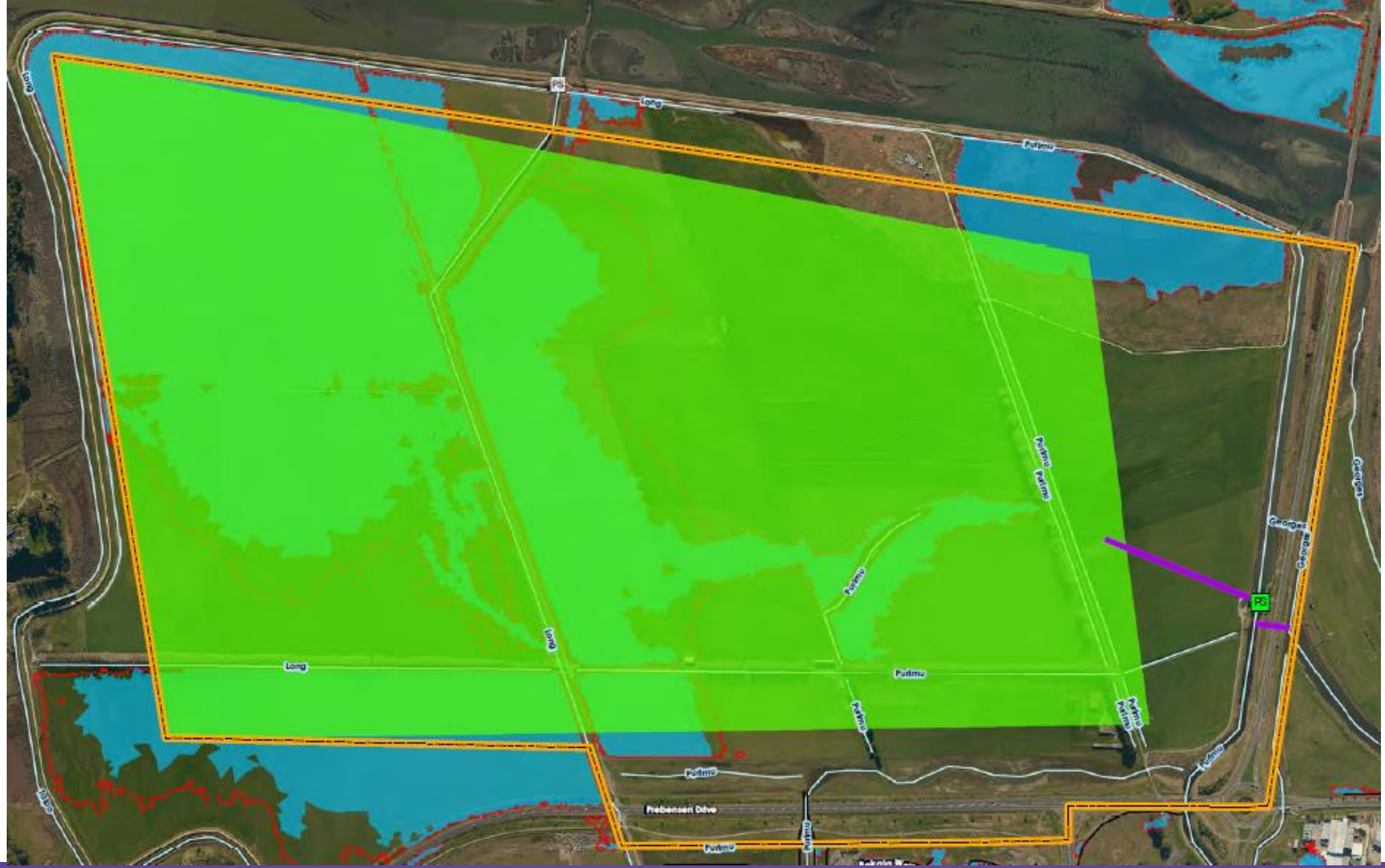
Proposed
Existing System
Upgrades

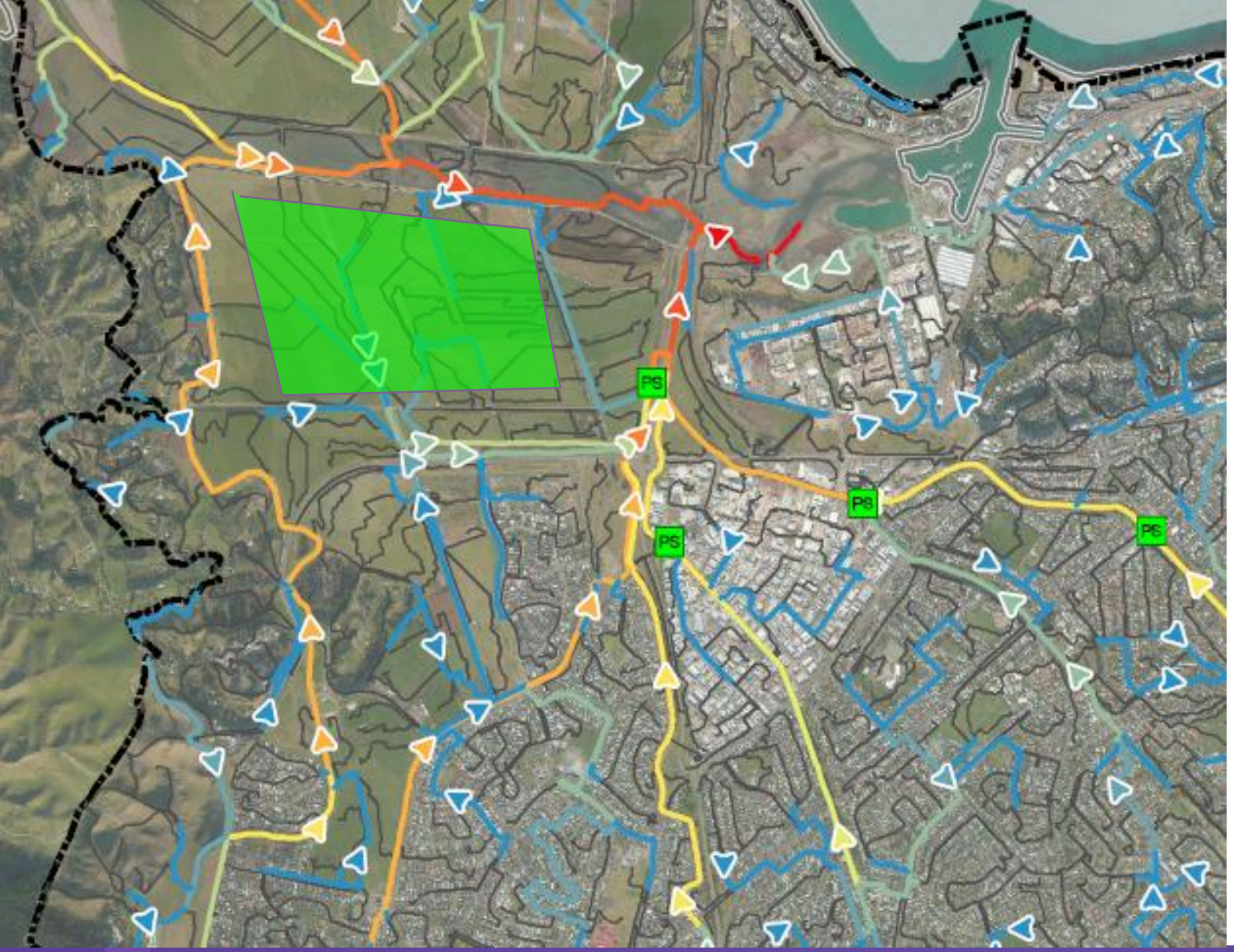
10 Year Capital Expenditure Projects

1. Stormwater Plan Minor Works ($0.7M)
2. Lagoon Farm Diversion ($18.2M)
3. Tennyson Outfall Modifications ($0.5M)
4. CBD & West Central Storm Trunks ($18.8M)


Cash Flow (Millions $NZ)
$9
$8
$7
$6
$5
$4
$3
$2
$1
$-
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035


25 Ha Expanded estuary with habitat islands
PH
Pumphouse discharge points
76 Ha Mosaic of reed and sedge wetland
Wetland discharge points to estuary
Overland flood channel
75 Ha Ephemeral and subsurface wetlands, Harakeke and Shrublands
13 Ha Ephemeral & subsurface wetlands
Seasonal wetland flow to Taipo Stream
Pumphouse discharge point
PH
Potential water diversion into Lagoon Farm site
17 Ha Seasonal open water wetlands
Overland flood channel area


Long
Purimu
Georges
Prebensen Drive
PS

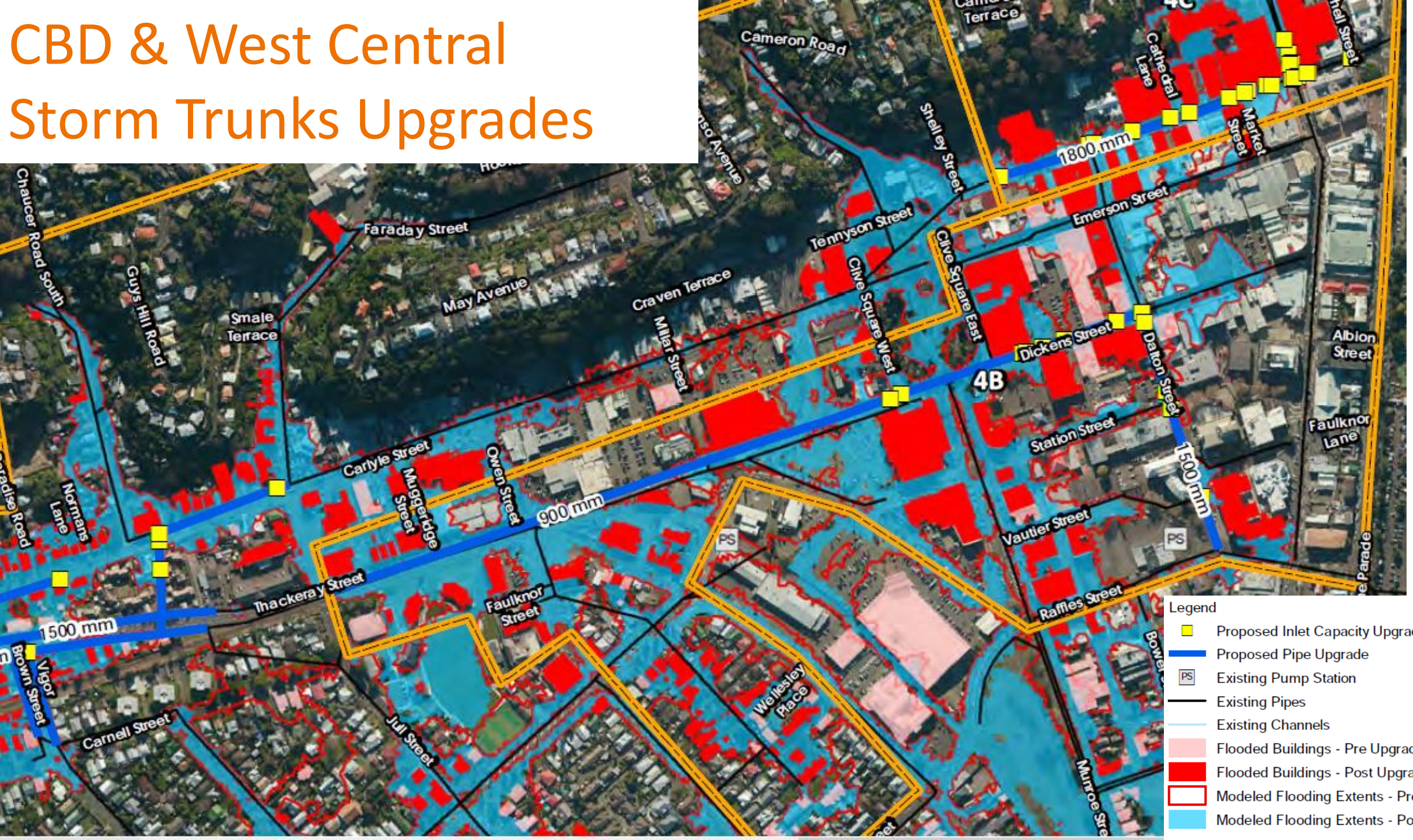


Large-volume overflow from Purimu Drain into low-lying Lagoon Farm lands.

Purimu drains >2,500 ha of land. Overflow to Lagoon Farm limits water levels on Drain, which beneficially impacts network.

WQ benefits as well.

CBD & West Central Storm Trunks Upgrades



Marewa – Whitmore Park Flood Alleviation

The Fine Details…

- Who pays?
- What first?
- Hydro-economic Analysis

Model	Estimated Annual Cost of Building Damages
Existing Baseline	$1,071M
Existing with Upgrades	$ 965M
Annual Cost Savings	$ 106M

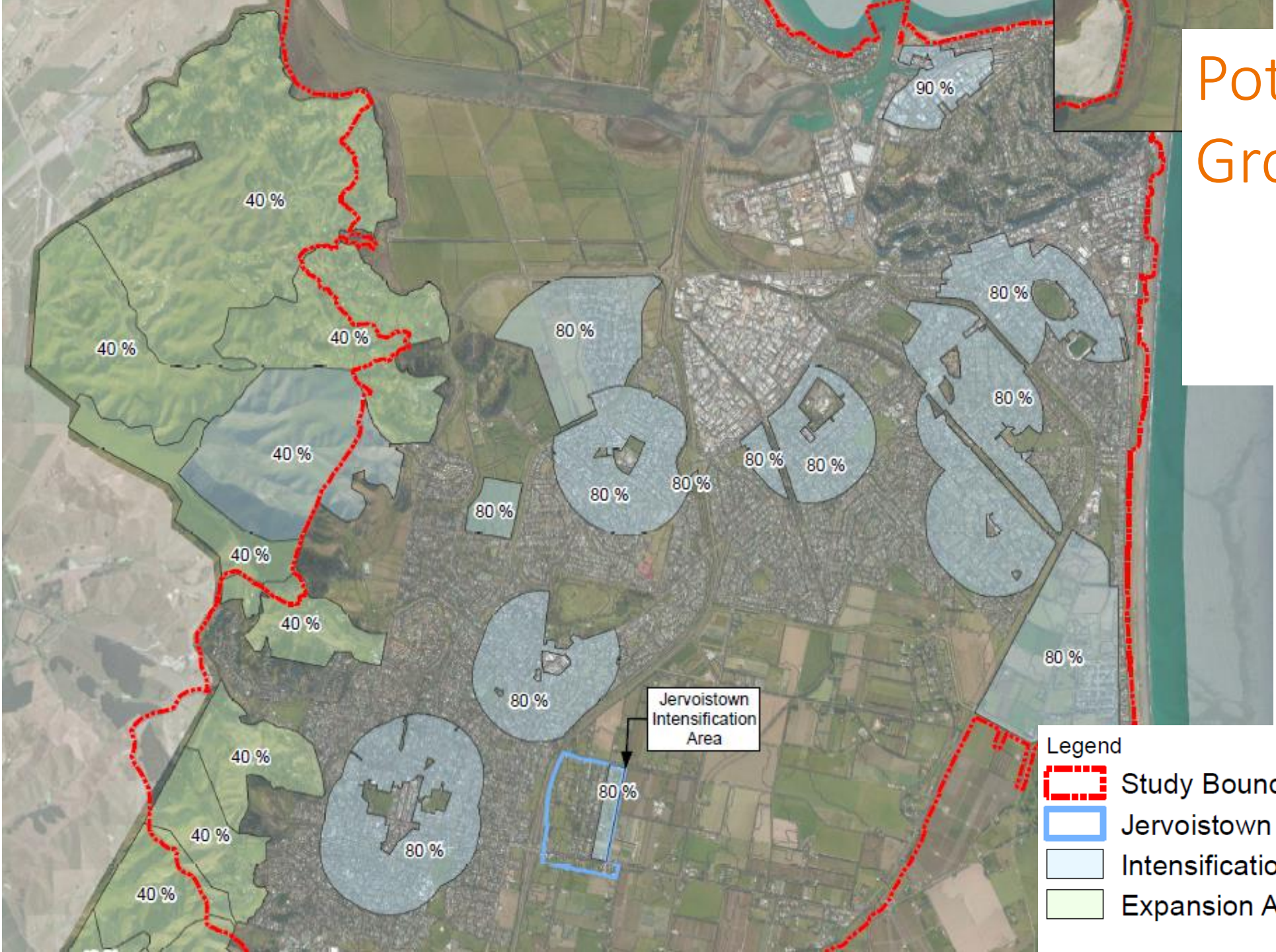
Future Growth Projects

- Intended to facilitate growth
- Not tied to any specific timeline
- Assumed 100% developer funded

2035: 15 projects, **$484M**

2050: 12 Projects, **$196M**

Potential Future Growth

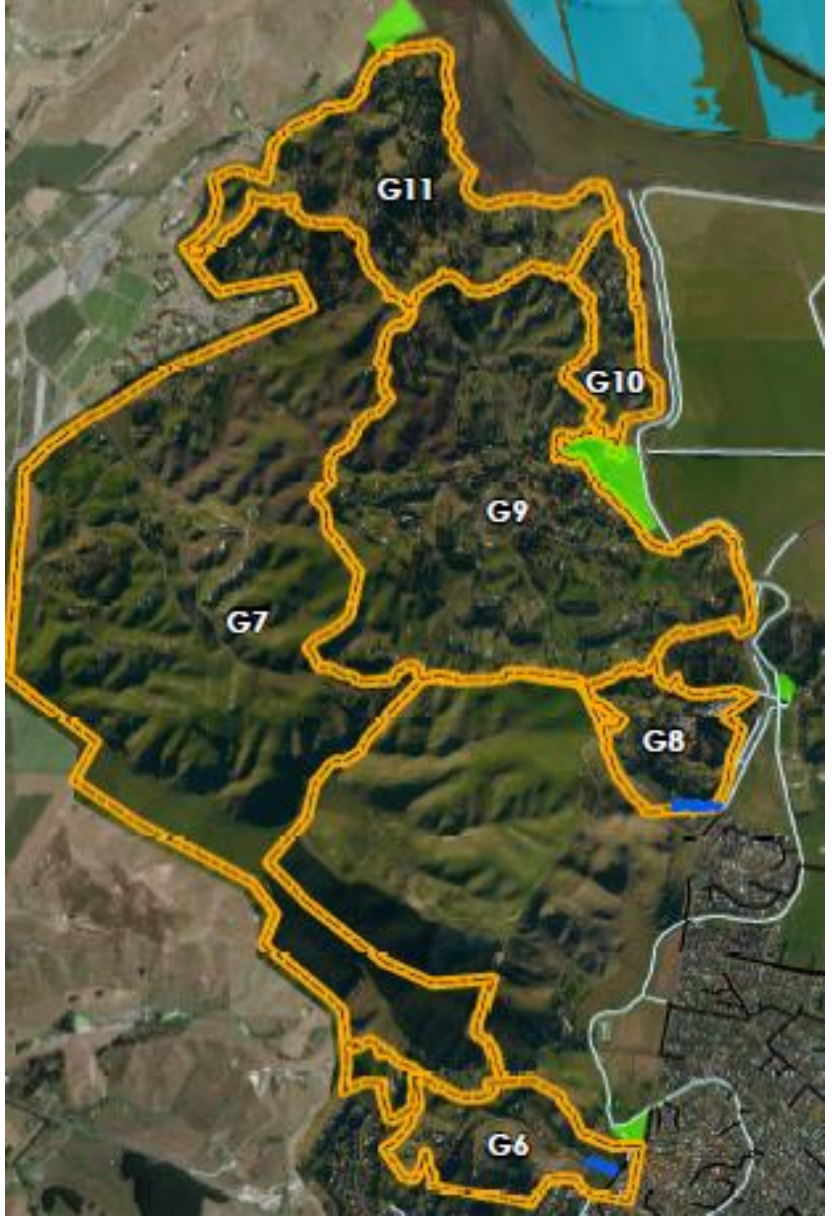


Future Growth Projects, 2035 Horizon

Legend

- Proposed Flap Gate
- Proposed New / Upgraded Pump Station
- Proposed Culvert Upgrade
- Proposed Diversion
- Proposed SWMF
- Existing Pump Station
- Existing Pipes
- Existing Channels
- Flooded Buildings
- Modeled Flooding Extents
- Upgrade Project Area

Future Growth Projects, 2050 Horizon



Legend

- Proposed Flap Gate
- Proposed New / Upgraded Pump Station
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- Proposed Diversion
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- Existing Pipes
- Existing Channels
- Flooded Buildings
- Modeled Flooding Extents
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WSD, Infill and Planning Tools

Water Sensitive Design (WSD) Toolbox

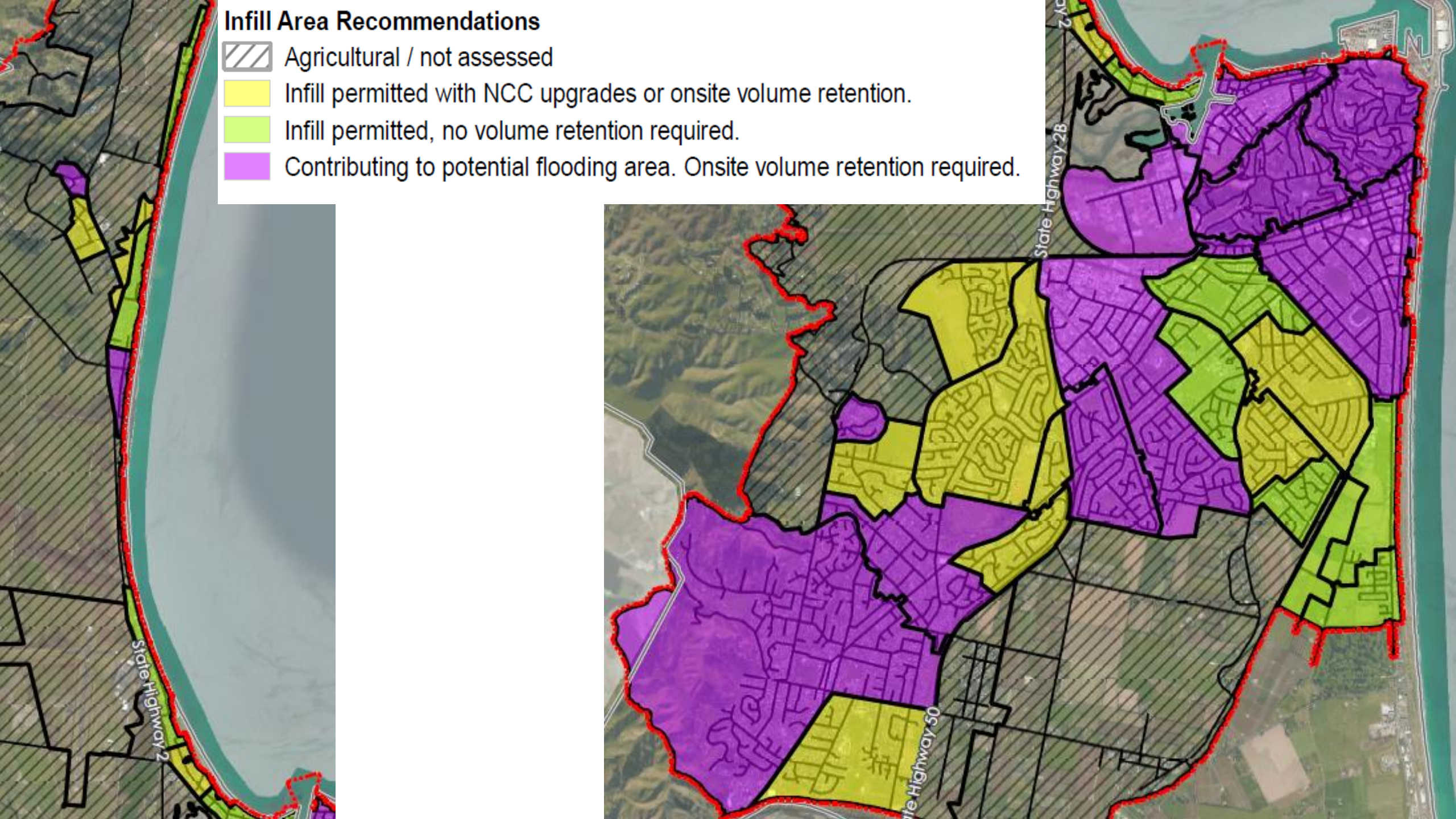
- AKA Green Infrastructure, LID
- Aims to achieve volume reduction, mimicking natural hydrology and runoff processes

Examples include:

- Rain tanks
- Rain gardens
- Bioretention
- Infiltration galleries
- Soakaway Pits

Planning Recommendations

- Peak flow rate control
- Volume detention (up to 50-year event)
- Volume retention where required: 20mm on impervious areas
- Develop local guidelines for implementation of WSD.
- Provide educational resources to developers an residents.
- Protection of critical OFP
- Investigation of decentralized infrastructure


Infill Area Recommendations
Agricultural / not assessed
Infill permitted with NCC upgrades or onsite volume retention.
Infill permitted, no volume retention required.
Contributing to potential flooding area. Onsite volume retention required.
State Highway 2
State Highway 2B
State Highway 50

Recommendations

Recommendations

- CAPEX: Implement 10-year Capital Programme (~$38M)
- Planning: Implement the proposed planning changes
- Next Steps:
  - Updates to CoP
  - Incorporate input into LTP & District Plan Review
  - Enact the Minor Works List

What happened next?

Napier in flood - Hawkes Bay Today News - NZ Herald

A climate for change: Napier flooding just a taste of what's to come | Stuff.co.nz

https://www.youtube.com/watch?v=ykunZ2dEgxM

https://www.youtube.com/watch?v=dIUi4-Zt3Yw

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Modelling Symposium

Thank you!
Questions? Patai?

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