Exploring the practices and outcomes of detailed stormwater flood modelling on Eastern Busway

# FLOOD CHALLENGES AND COLLABORATIVE SOLUTIONS: COMPREHENSIVE STORMWATER MODELLING ON EASTERN BUSWAY

Tom Newman (AECOM) and Paul May (Jacobs)

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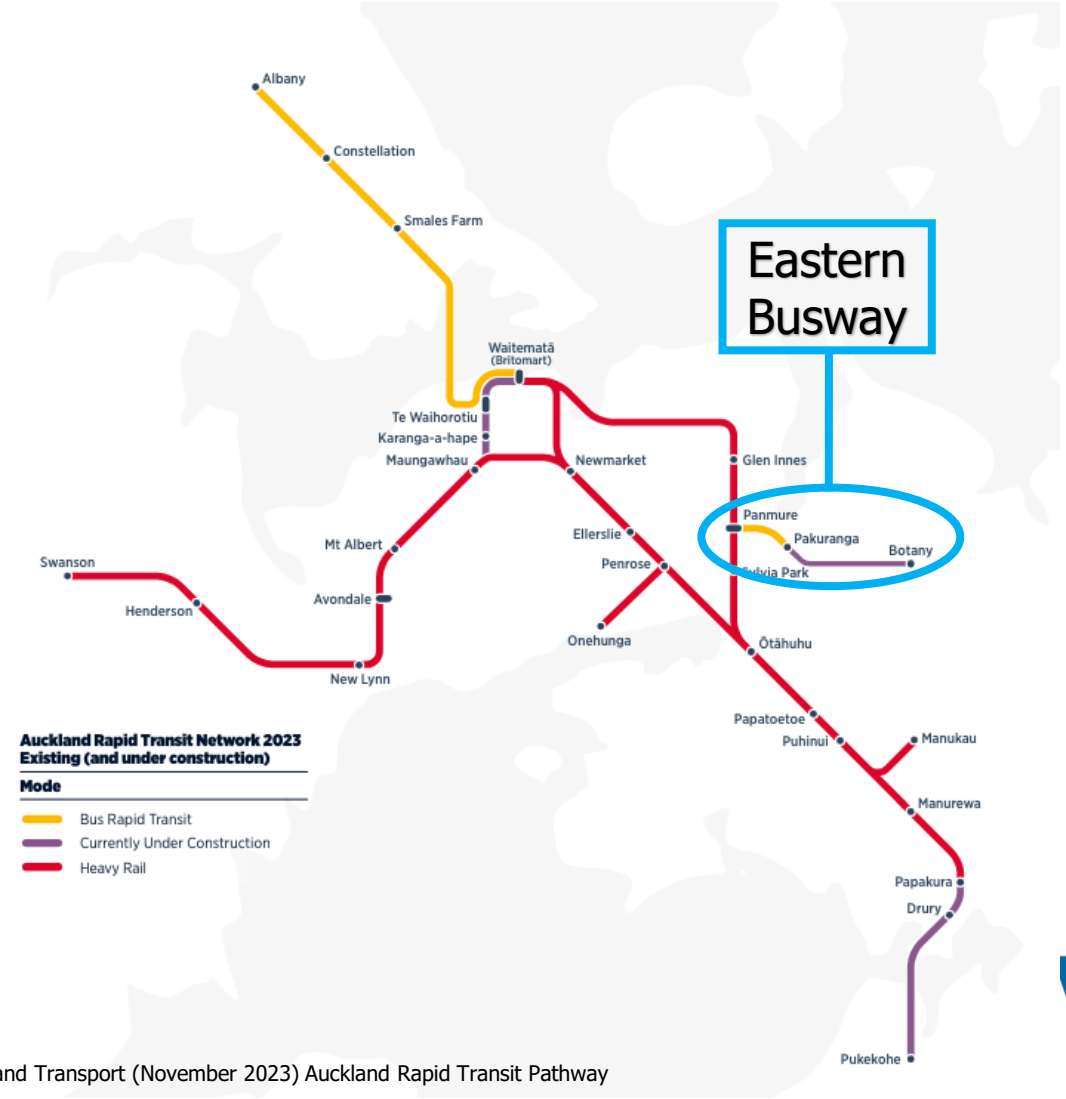
Stormwater 2024
15–17 May | Tākina Wellington Te Whanganui-a-Tara

# Agenda

- Eastern Busway Project Overview
- Flood Modelling Methodology
- Modelling Exercises
- Flooding Results and Outcomes

*Artist impression of the Eastern Busway and Edgewater Station on Ti Rakau Drive*

# Eastern Busway Project Overview




- Eastern Busway Alliance formed from Auckland Transport, Fletcher Construction, ACCIONA, AECOM and Jacobs
- Significant infrastructure initiative aimed at providing alternative transportation options for East Auckland

Auckland Transport (November 2023) Auckland Rapid Transit Pathway

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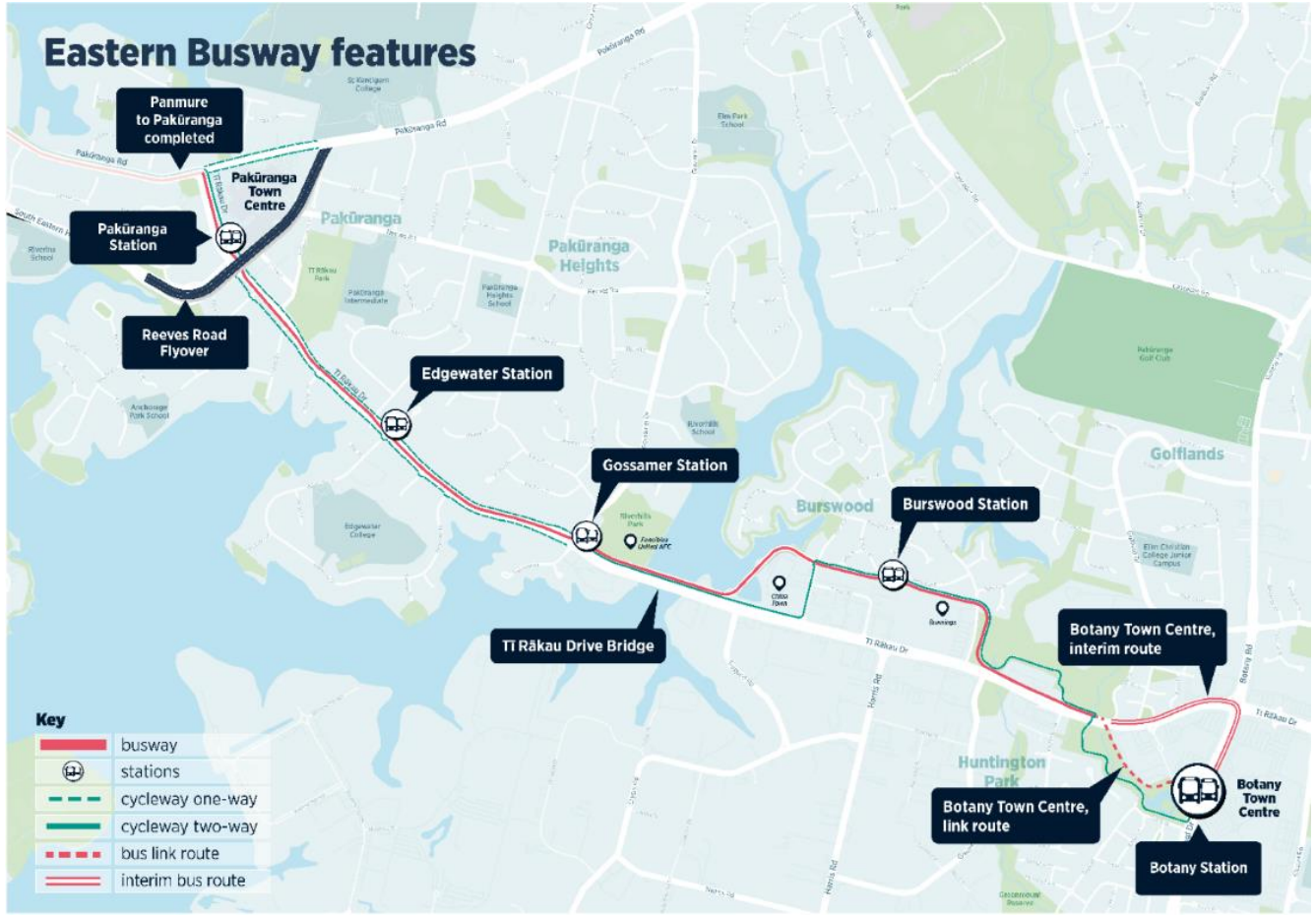
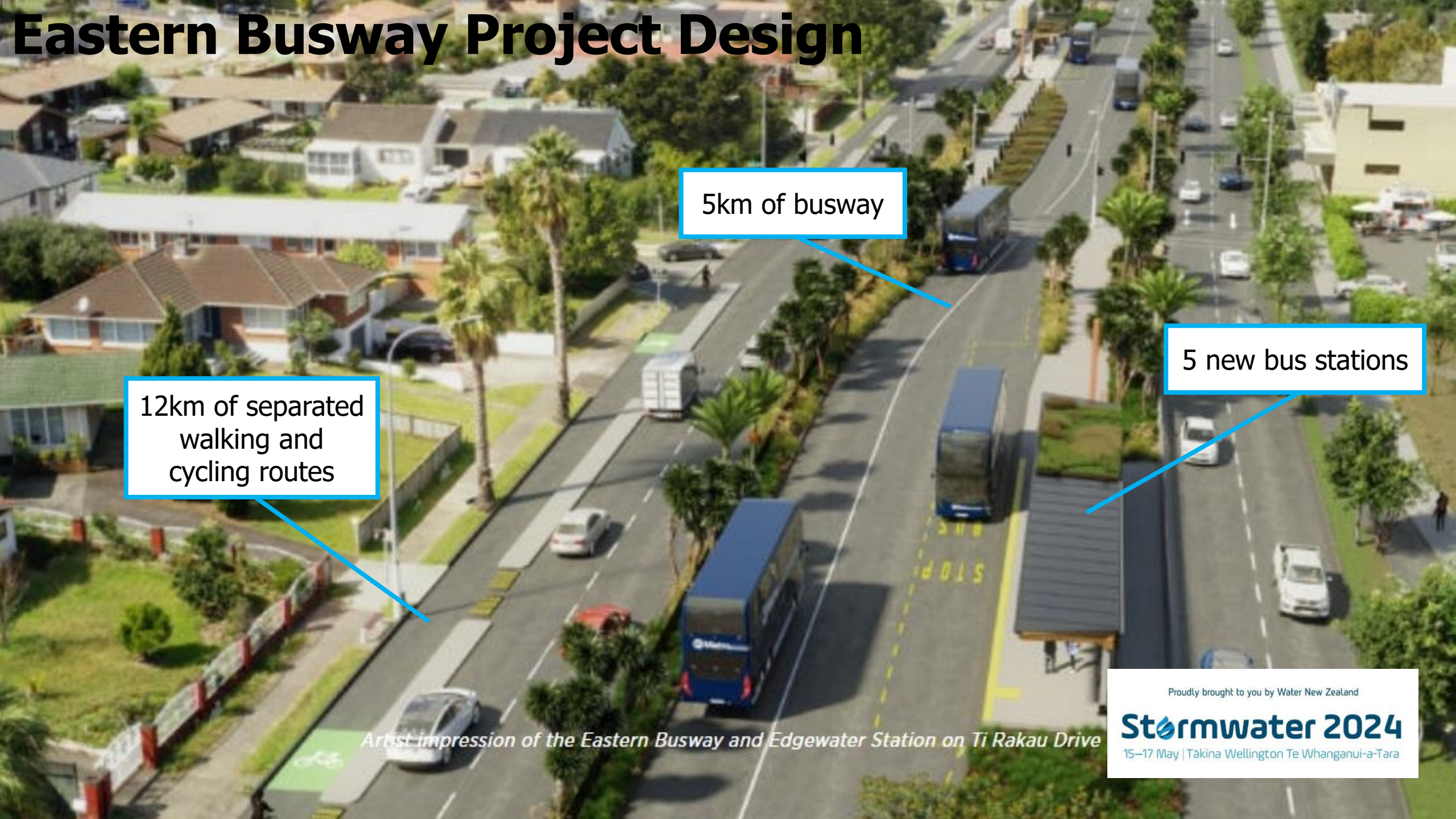



- Projected to accommodate 18,000 passengers per day by 2028 and 24,000 by 2048
- Stormwater flood modelling was done between zones EB2 (Pakuranga Town Centre) to EB4 (Botany)

# Eastern Busway Project Design

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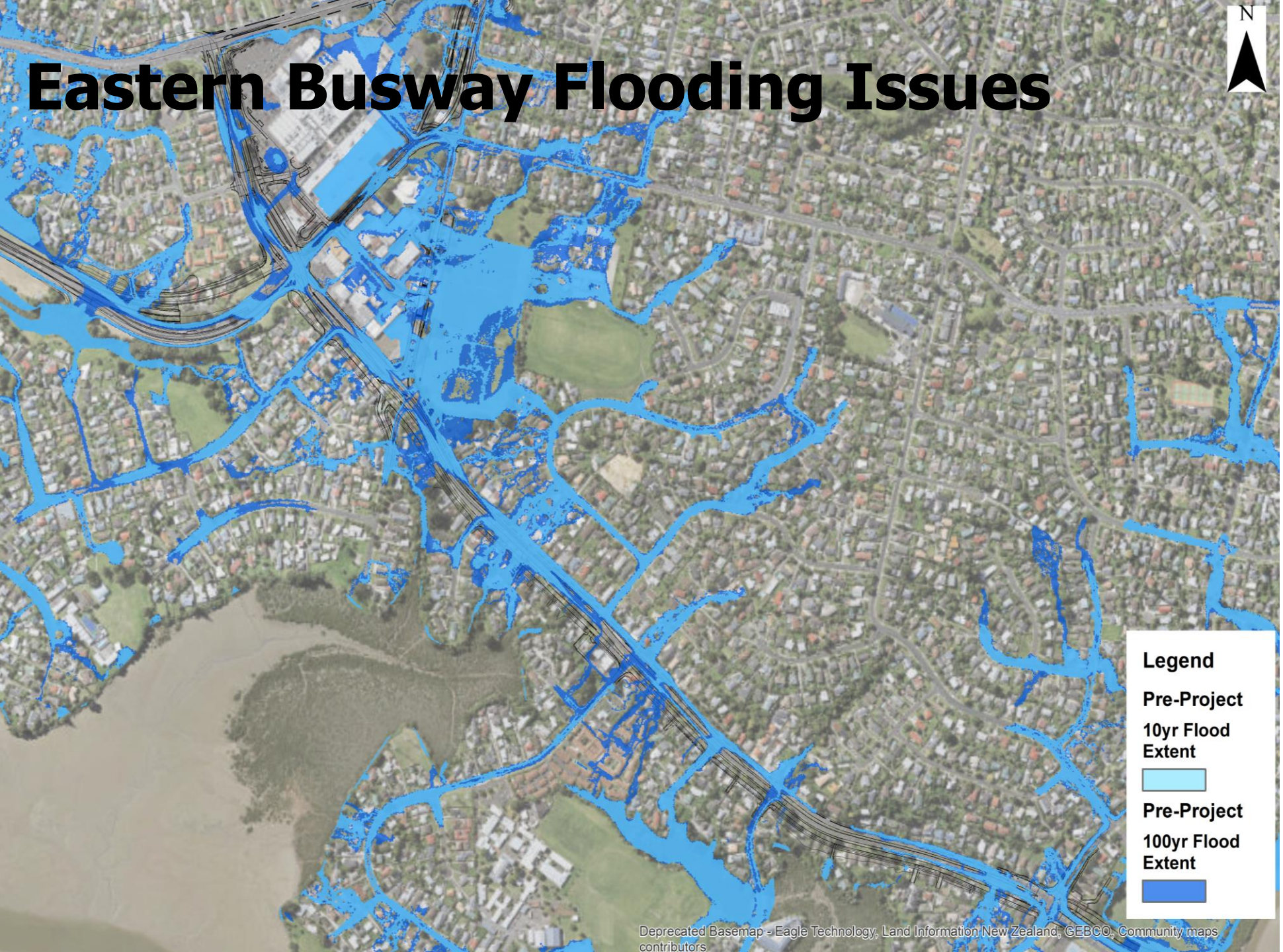
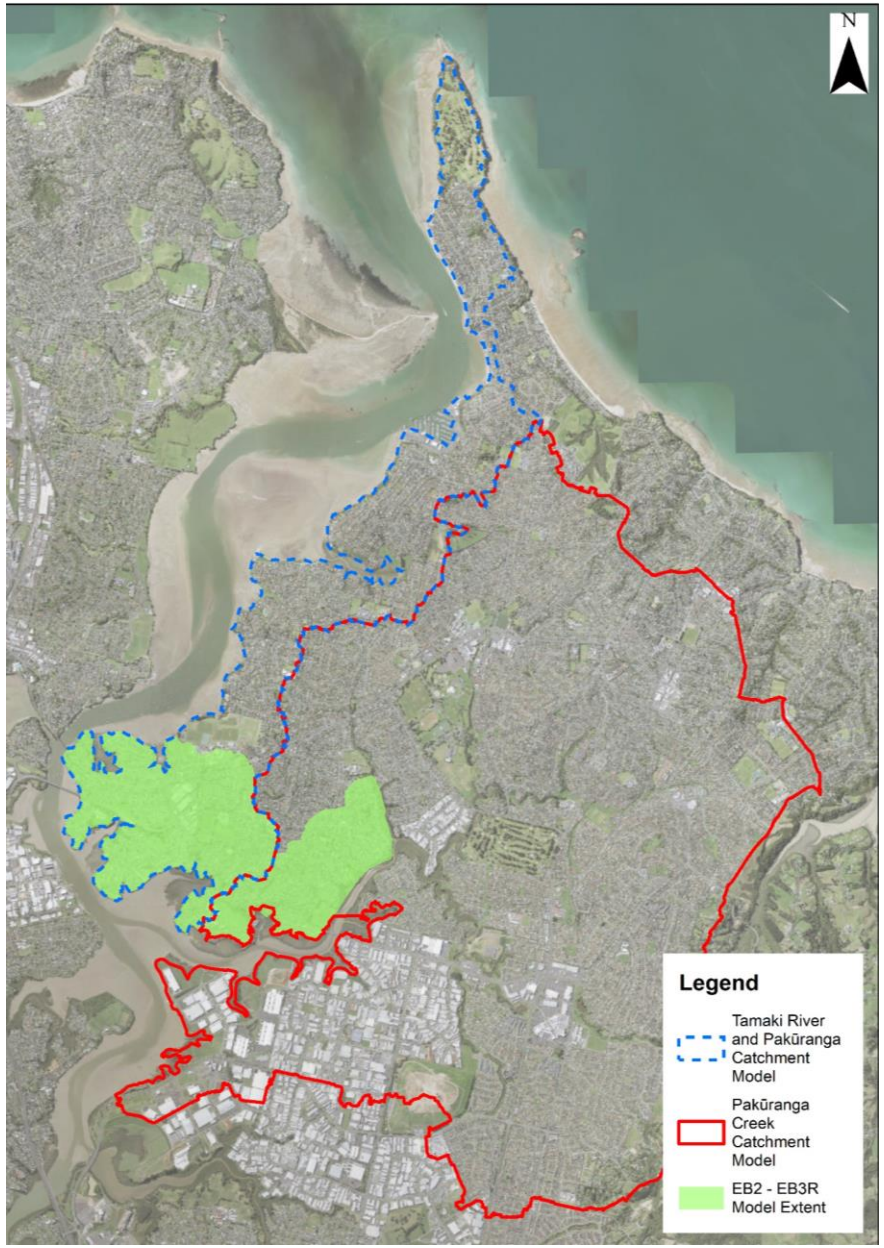
# Eastern Busway Flooding Issues




- Aging pipe network undersized creating overland flows
- Climate change increasing rainfall and tidal boundary level
- Urbanisation reducing infiltration and increasing runoff

# Flood Modelling Methodology



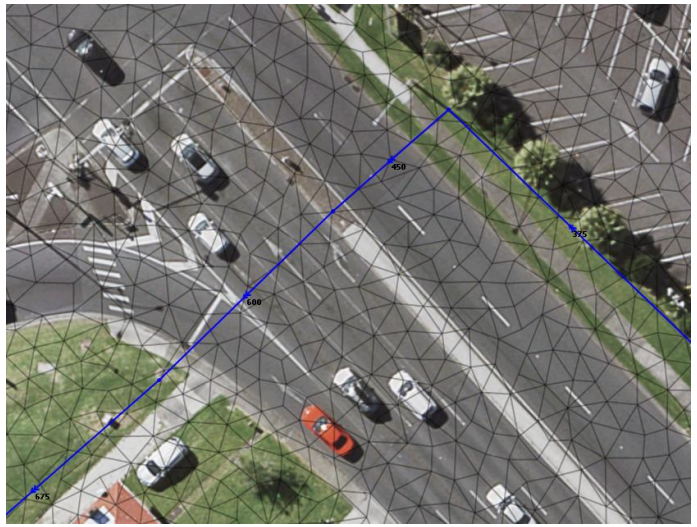

- Flood modelling was done in Infoworks ICM 2021.7
- 1D-2D model including 1D pipe network and 2D floodplain
- Model updates discussed:
  - Created a finer mesh zone around the project extent
  - Modelled catchpit inlets and connection lines
  - Divided subcatchments

# Mesh Zone

- Mesh zone added around road corridor
- Mesh zone decreased the maximum triangle size
- Smaller triangle size allowed for more detail

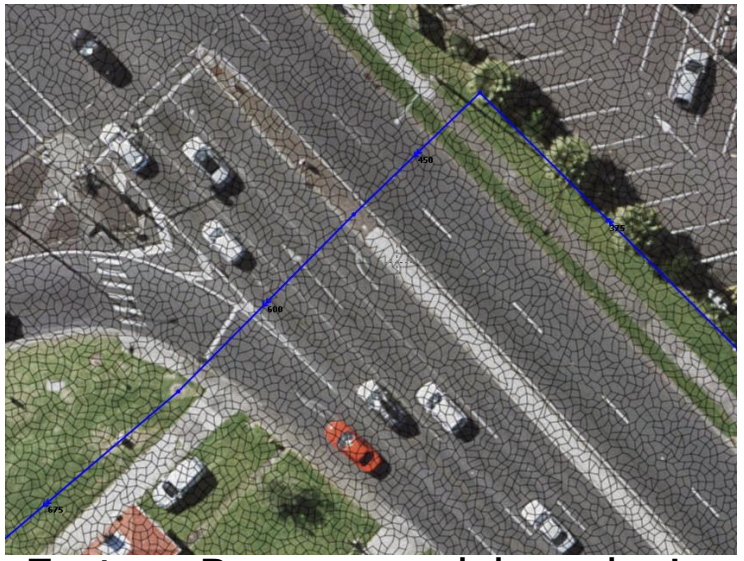
Table: Model triangle mesh size comparison

| Model | 2D Area (ha) | Max Triangle Size ($m^2$) | Min Triangle Size ($m^2$) |
|---|---|---|---|
| **Tamaki River and Pakūranga** | 739 | 4 | 2 |
| **Pakūranga Creek** | 2,880 | 25 (8 for major overland flow paths) | 10 (2 for major overland flow paths) |
| **EB2-EB3R** | 425 | 4 (0.25 for the road corridor) | 2 (0.24 for the road corridor) |



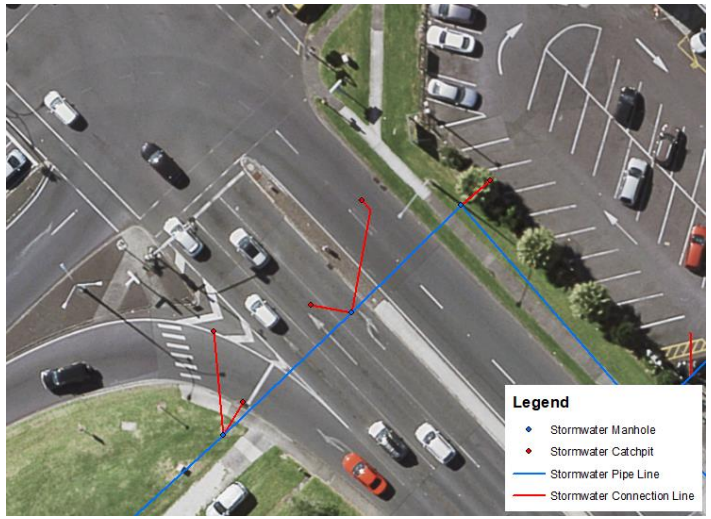
Council model mesh size

Decreased mesh size



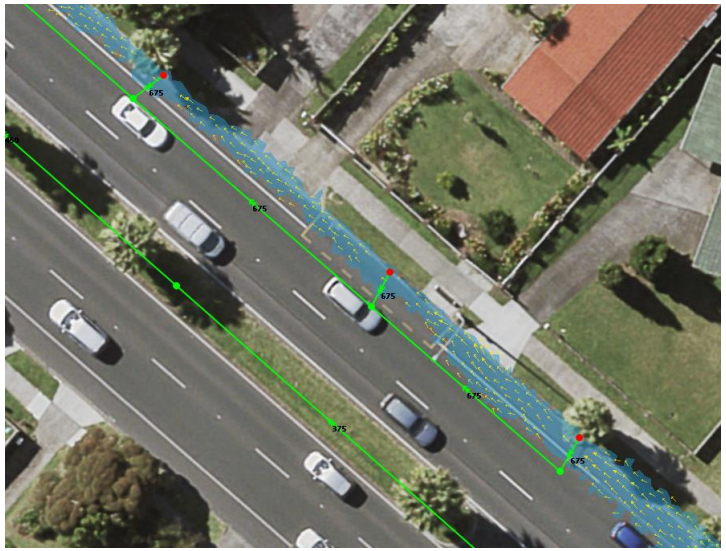
Eastern Busway model mesh size

# Catchpits

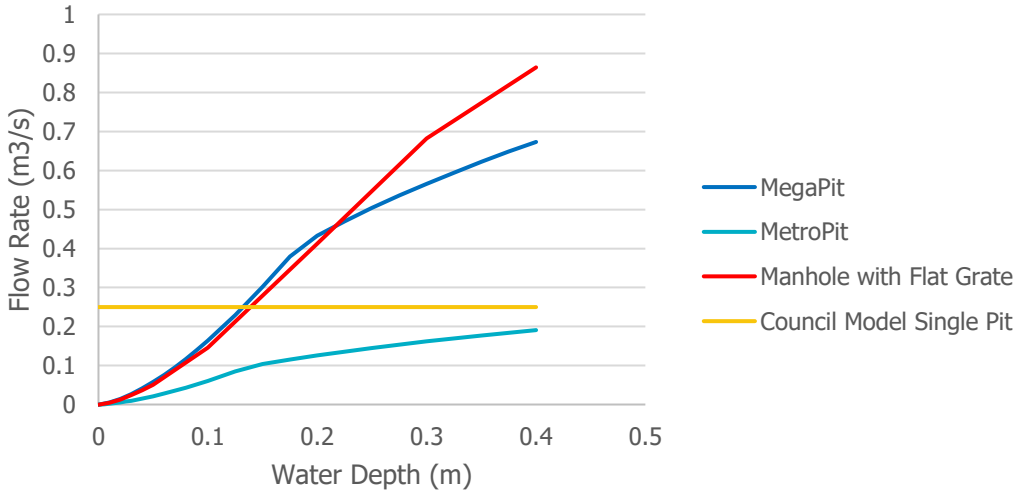



GeoMaps stormwater network

Added catchpits



Eastern Busway catchpits in red within the overland flow path

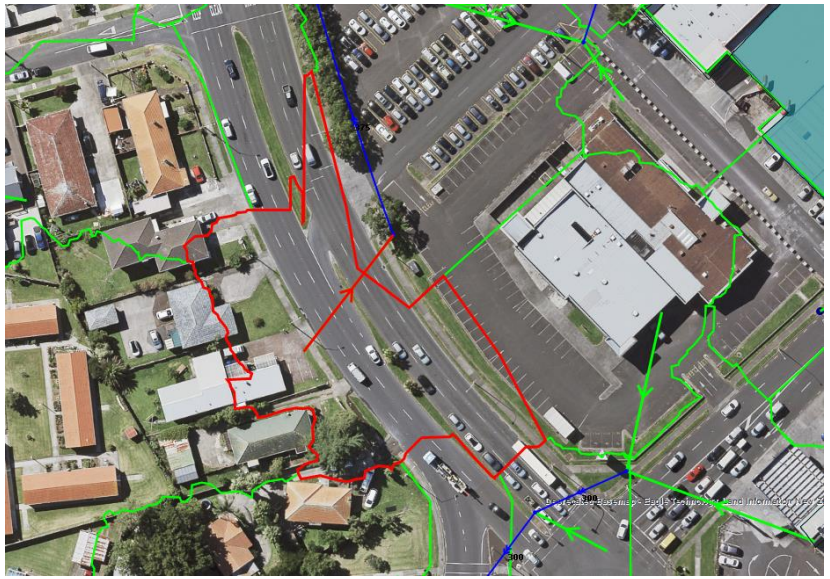



Catchpit Q/H curve examples

- Added catchpits and connection lines
- Represented catchpit types through Q/H curves

# Subcatchments

- Existing model subcatchments were divided into smaller subcatchments within the road corridor
- Subcatchment loading could be loaded throughout the stormwater network to identify surcharging pipe locations

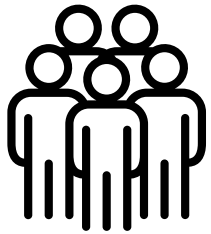


Council model larger subcatchments

Split Subcatchments

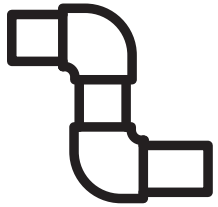
Eastern Busway model split subcatchments

# Modelling Exercises



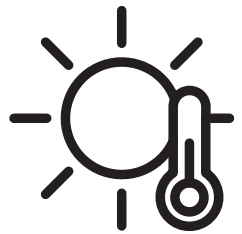
## Existing stormwater network betterment

A modelling exercise was undertaken to identify existing stormwater network pipes that were surcharging in the 10-year AEP with climate change



## Pipe capacity reduction scenarios

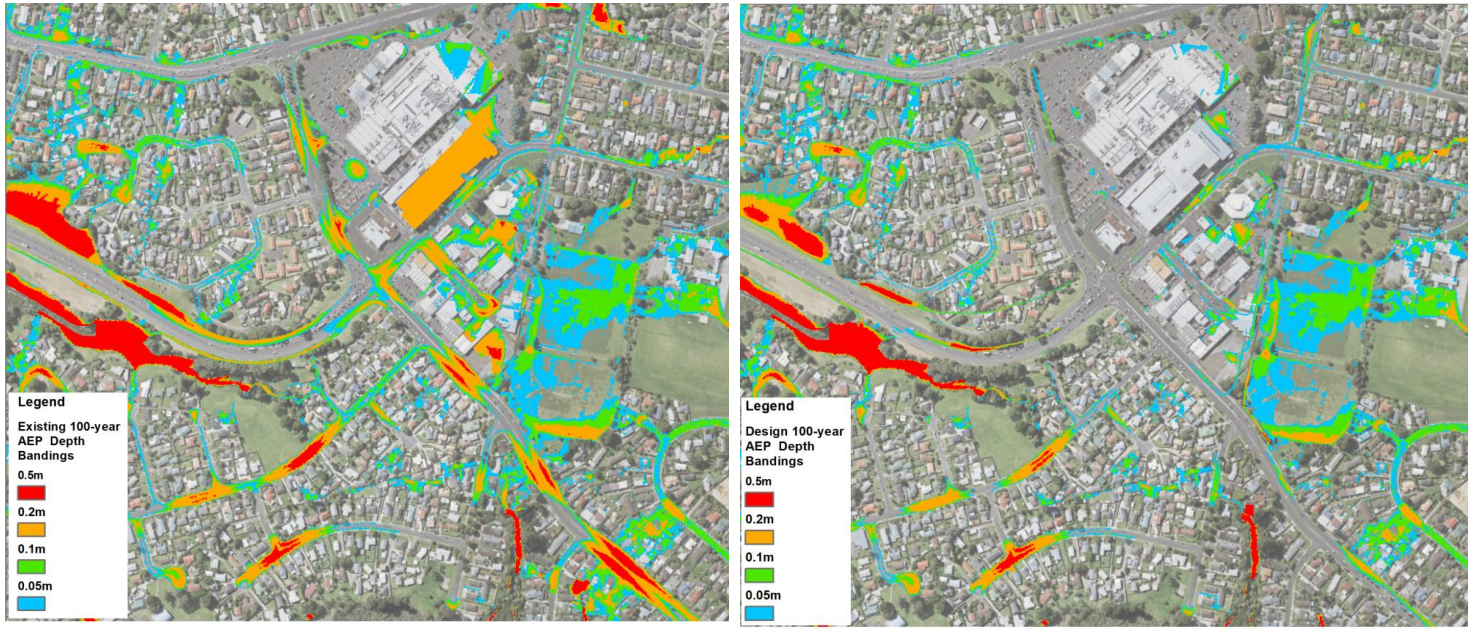
An assessment was undertaken to determine the impact of pipe blockages on the secondary stormwater network overland flow paths according to the Auckland Council Code of Practice



## RCP 8.5 Climate Change Modelling

A sensitivity analysis was done to understand the risk from a temperature increase to 3.8$^{o}$C by 2090 (RCP 8.5)

# Modelling Results and Outcomes




Pre-project (left) and post-project (right) 100-year AEP Depth Bandings

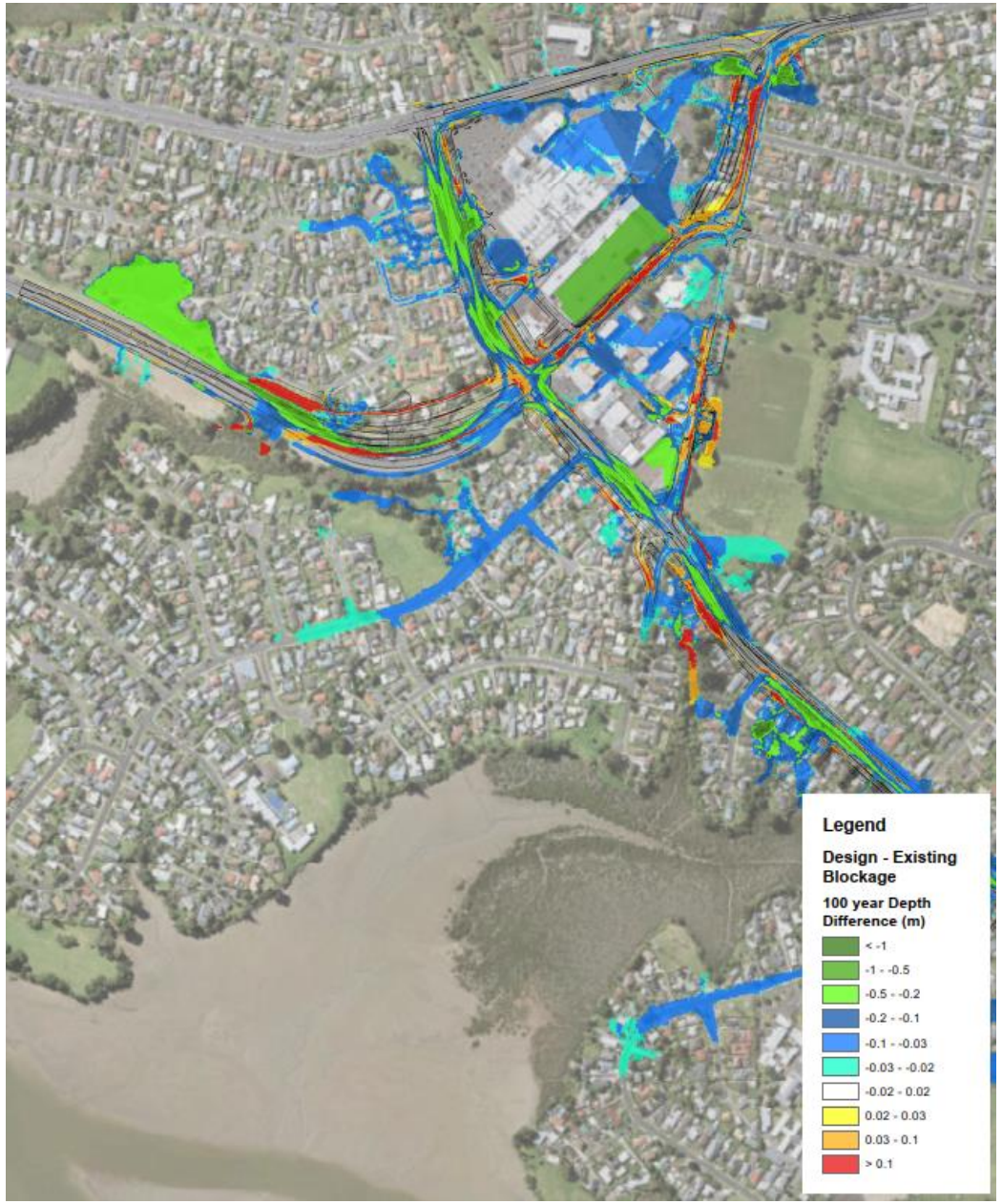
The flood modelling was an iterative process going through multiple design stages:

1. Assessment of existing flood risk
2. Do minimum reference design
3. Flood mitigation design
4. Minimum requirement compliant design
5. Betterment design

| Flood Depth Banding (m) | Existing 100-year Scenario Hectares of Flooding | Design 100-year Scenario Hectares of Flooding | Flooded Hectares Difference (Existing – Design) | % Difference (Existing – Design) |
|---|---|---|---|---|
| 0.05 | 59.13 | 49.93 | -9.2 | -15.55 |
| 0.1 | 43.25 | 36.48 | -6.77 | -15.65 |
| 0.2 | 30.86 | 26.48 | -4.39 | -14.21 |
| 0.5 | 20.55 | 19.65 | -0.9 | -4.39 |

Table: Reduction in flooding between pre- and post-project

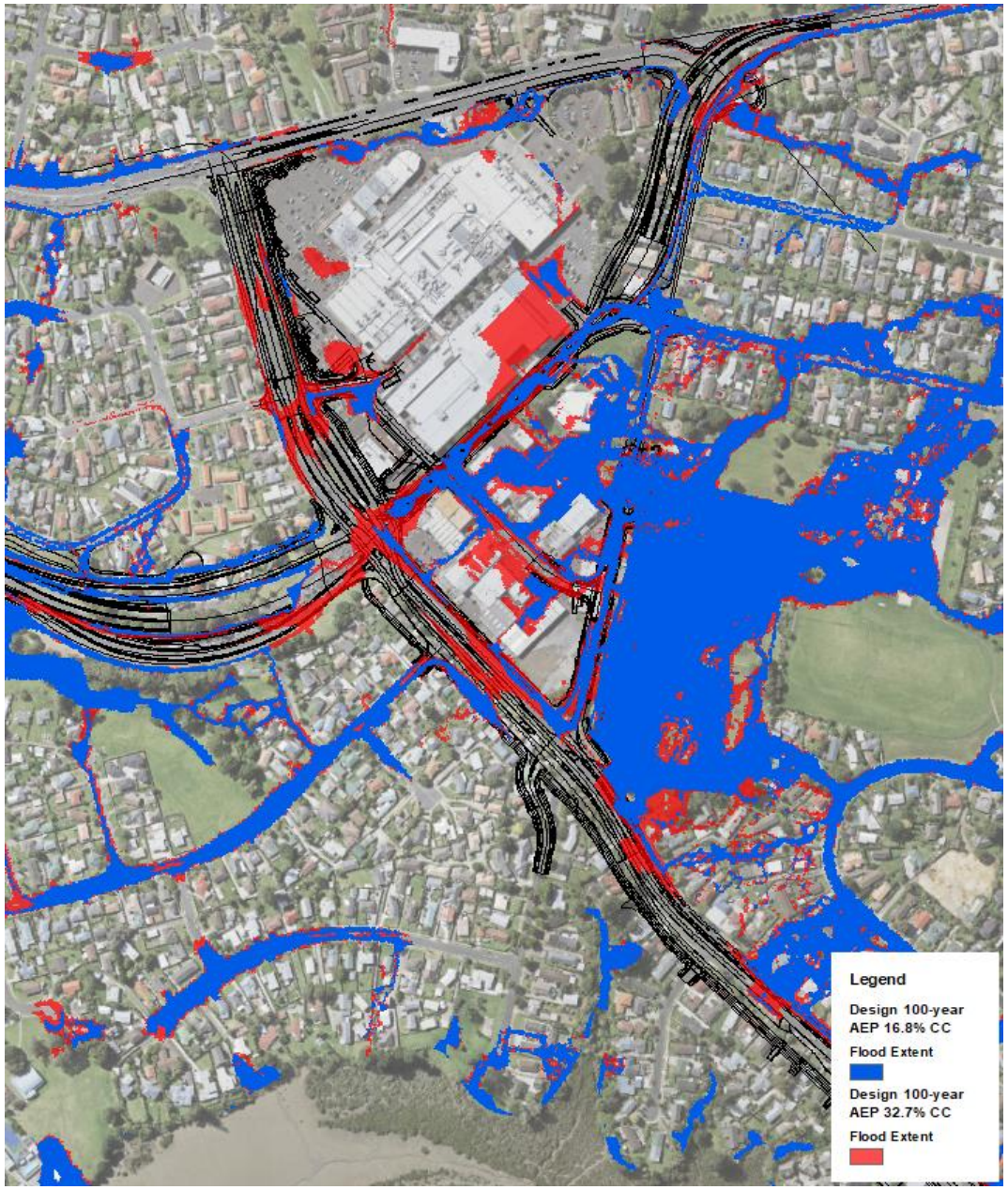
# Modelling Results and Outcomes




The flood modelling supported the design team to achieve a busway that:

- Achieved the minimum requirement to keep the bus lanes operational during a 10-year and 100-year AEP with 2.1°C climate change flood event
- Provided betterment to the existing stormwater network resulting in a best-for-Auckland outcome on flooding

# Modelling Results and Outcomes




The Eastern Busway project provided an opportunity for a collaborative approach that improved the flooding outcomes across the project extent.

However, RCP 8.5 sensitivity analysis shows the potential future risk to the project and highlights the importance of flood risk assessments across New Zealand today to protect future generations tomorrow.

# Thank you!
# Questions? Patai?

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