Dunedin City Council 3 Waters Modelling Criticality Assessment Critical Link Analysis

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DUNEDIN CITY COUNCIL
Kaunihera-a-rohe o Otepoti

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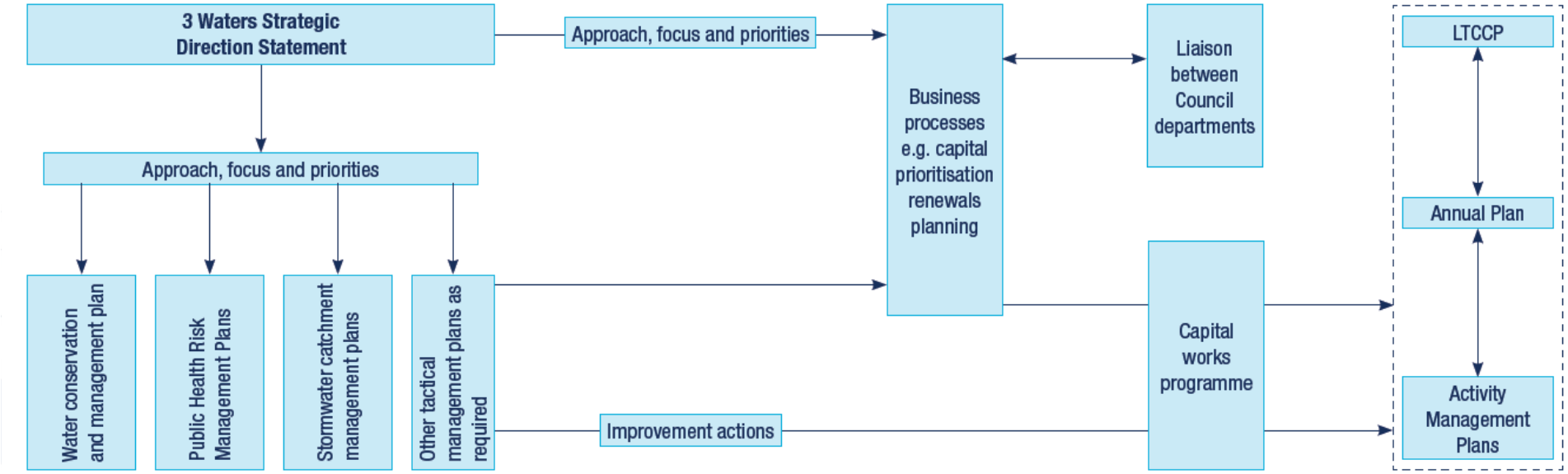
Summary

- Summary Overview of the DCC 3 Waters Strategy
- DCC 3 Waters Strategy Modelling
- Criticality Assessment
- Critical Link Analysis
- Conclusion
- Questions

Summary Overview of the DCC 3 Waters Strategy

- The 3 Waters Strategic Direction Statement 2010 – 2060
  An integrated approach to the sustainable management of water, wastewater and stormwater in Dunedin.



Strategic Issues

Security of water supply (drought) • Leakage • Risk of Critical Infrastructure Failure • Stormwater Contamination • Affordability • Foul sewer overflows and property flooding

Our Activities Today

Low confidence in leakage and domestic water consumption data.

Good drinking water quality, with reasonably high customer satisfaction.

Improving beach quality with completion of Tahuna stage 2.

Stormwater quality problems exacerbated by cross connections and overflows from foul sewers.

Property flooding and sewage spills to the environment during wet weather events.

Key Strategic Priorities

1. We will meet the water needs of the City for the next 50 years from existing water sources.
2. We will be able to adapt to a variety of future scenarios for climate change and fluctuations in population.
3. We will reduce our reliance on non-renewable energy sources and oil based products.
4. We will improve the quality of our discharges to minimise the impact on the environment.
5. We will ensure that, as a minimum, key service levels are maintained into the future.
6. We will limit cost increases to current affordability where practical.
7. We will adopt an integrated approach to management of the three waters and embrace the concept of kaitiakitaka.

The Challenges We Face

Climate change will increase likelihood of heavy rainfall events and extended dry periods.

Possible sea-level rise of around 0.8m by 2100.

Relatively stable population with declining wet industry.

Ageing infrastructure.

Increasing costs of energy and oil based products.

Changes to industry structure and governance at a national level.

Community Priorities

"Carry on providing high quality drinking water at acceptable cost"

"Work smarter to reduce costs"

"Make systems more flexible and resilient"

"Manage the future challenges of climate change and rising energy prices"

"Maintain quality of service"

"Consult more on water and waste issues"

"Educate the community on water and waste issues"

"Improve the quality of wastewater and stormwater discharges"

"Reduce demand for water"

"Manage water and waste holistically"

"Provide economic incentives for businesses to conserve water"

Key Strategic Priorities

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DCC 3 Waters Strategy Modelling

- InfoWorks Models

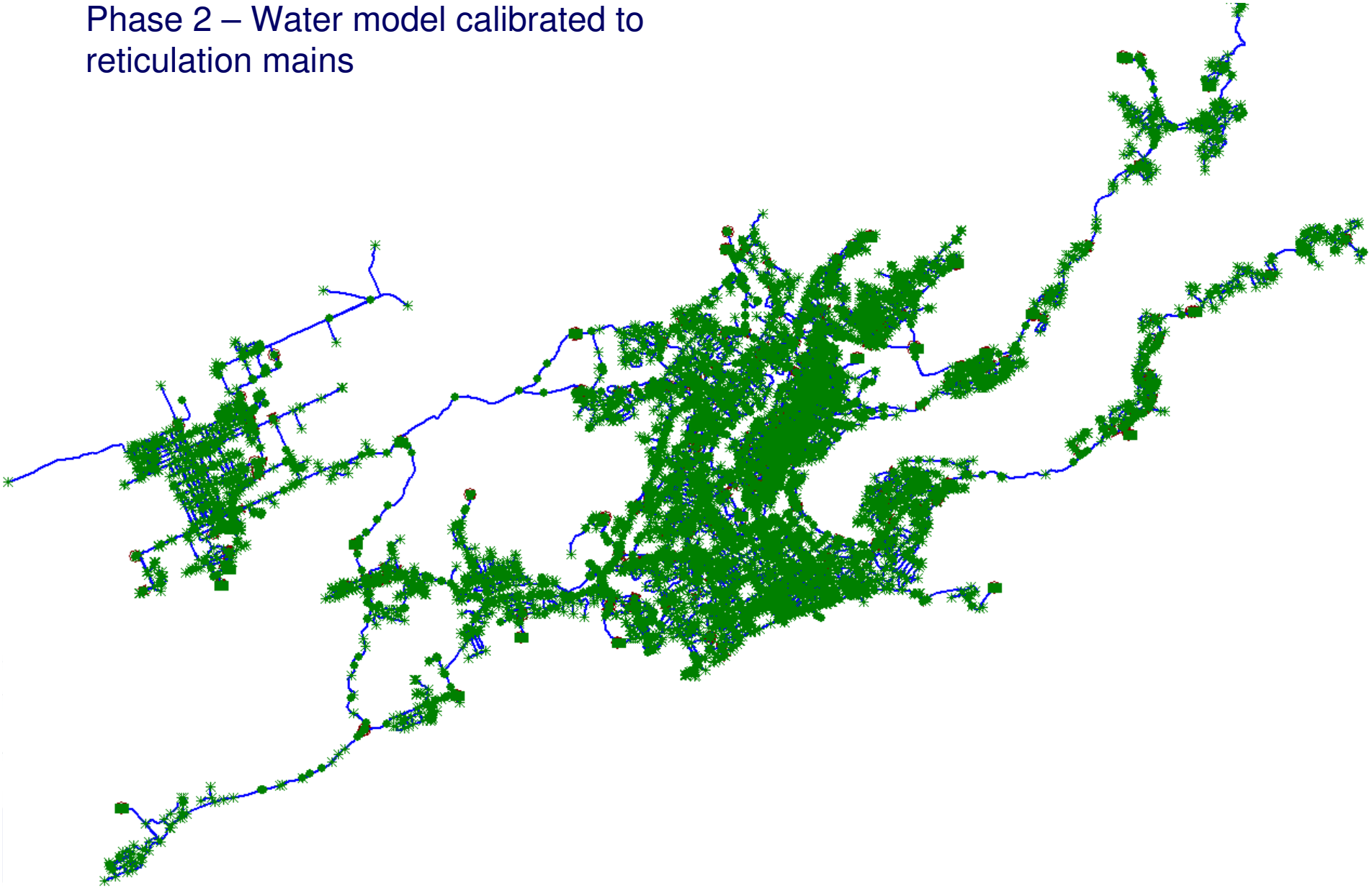
  InfoWorks WS
  Water model

  InfoWorks CS
  Raw Water model
  Stormwater model + 2D application
  Wastewater model

Water

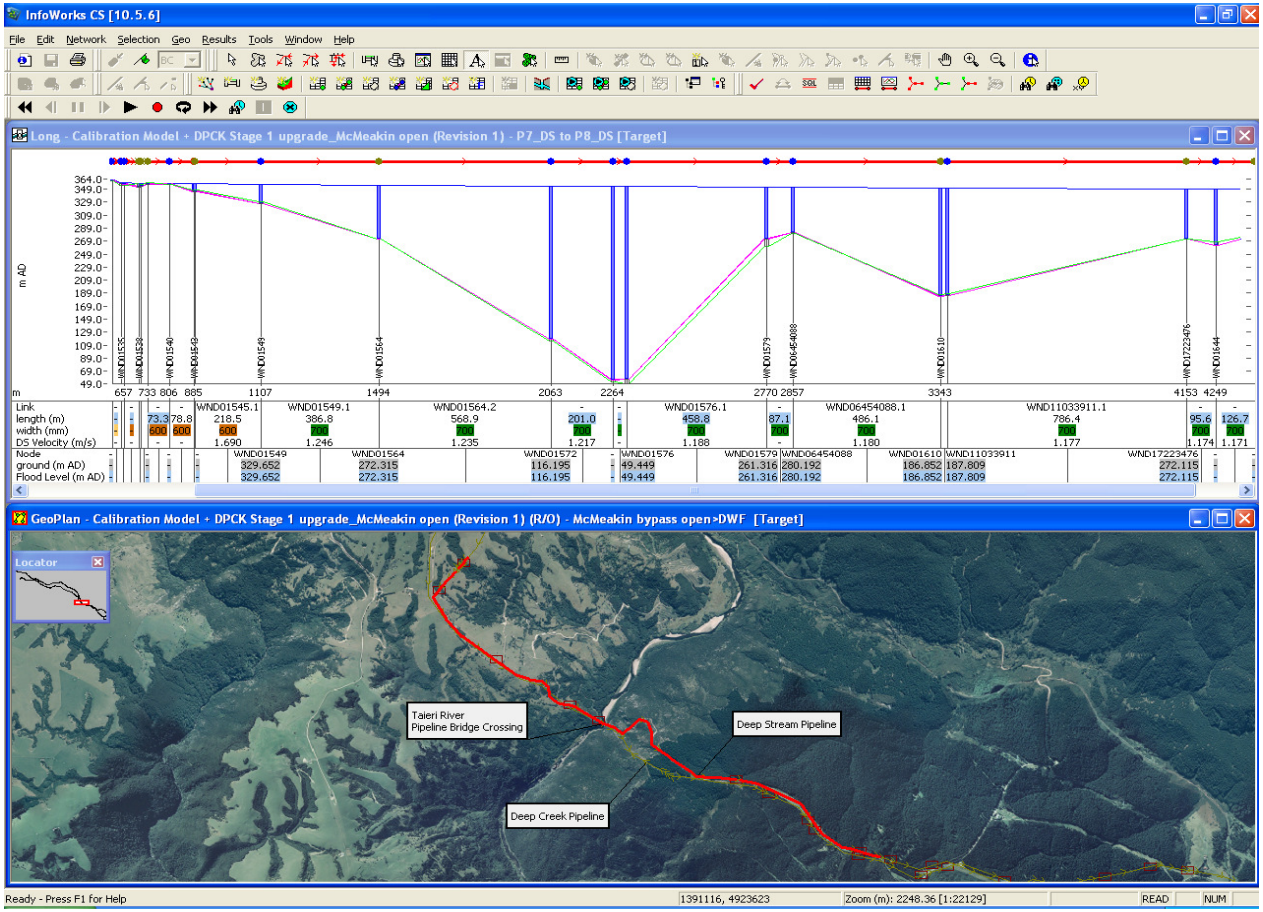
Phase 1 – Water model calibrated to strategic high level mains

Phase 2 – Water model calibrated to reticulation mains



Raw water

Deep Creek and Deep Stream
Taieri Bores and Silverstream



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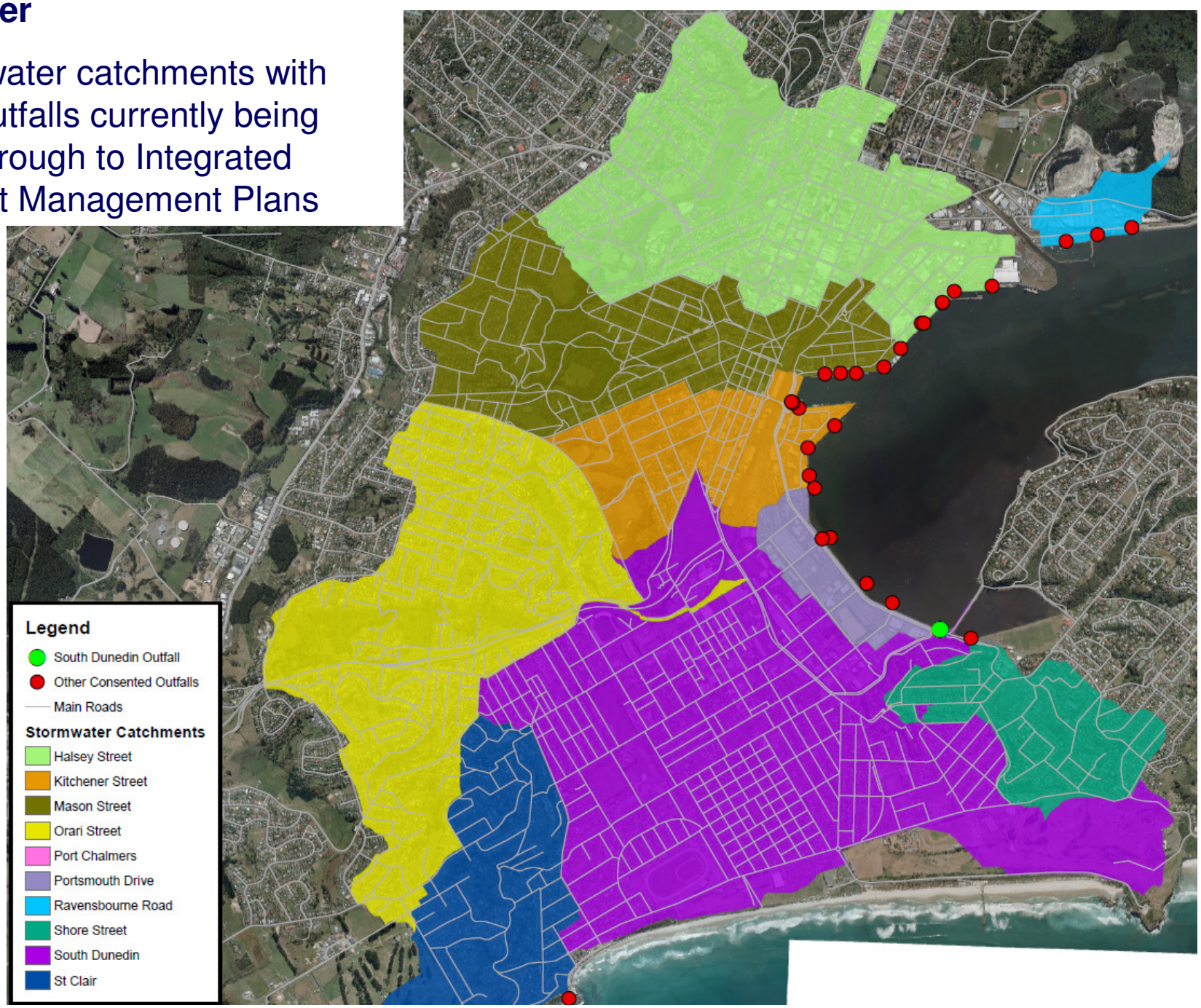
Stormwater

10 Stormwater catchments with harbour outfalls currently being brought through to Integrated Catchment Management Plans



Stormwater

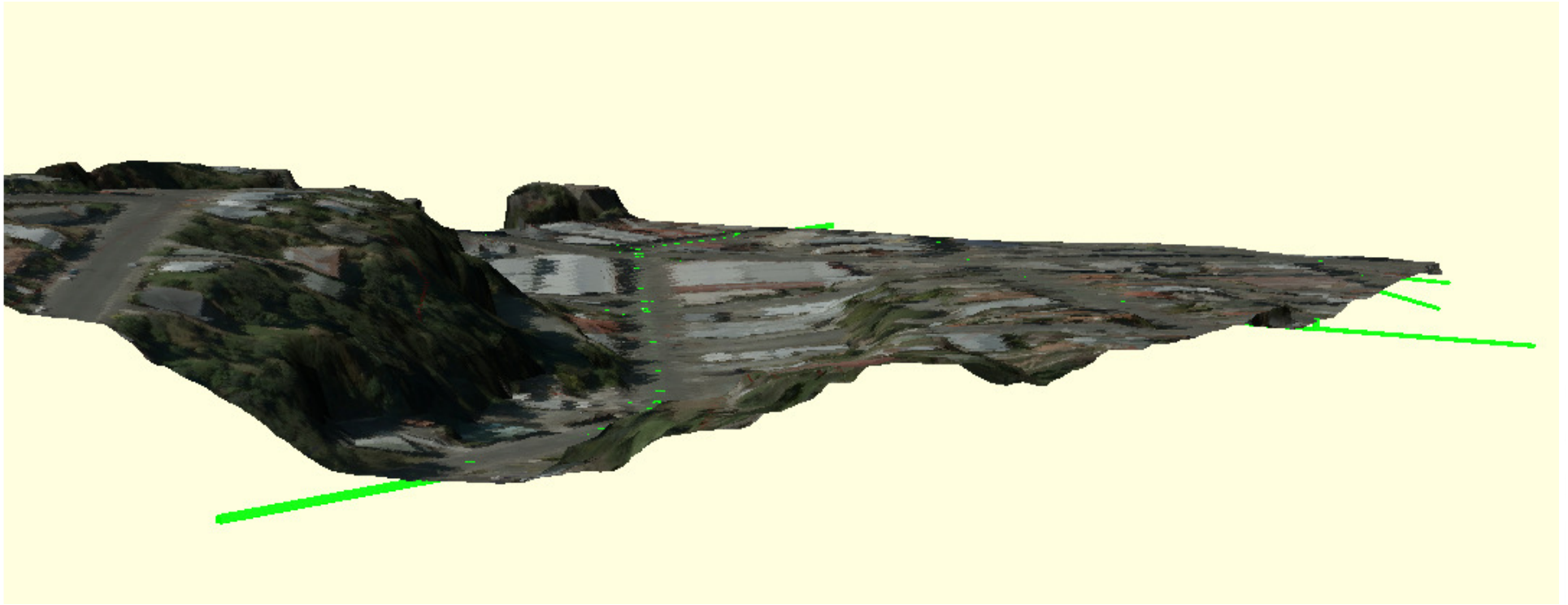
Image of stormwater model

Mason Street catchment, 2D model, pruned network

Stormwater

Image of stormwater model

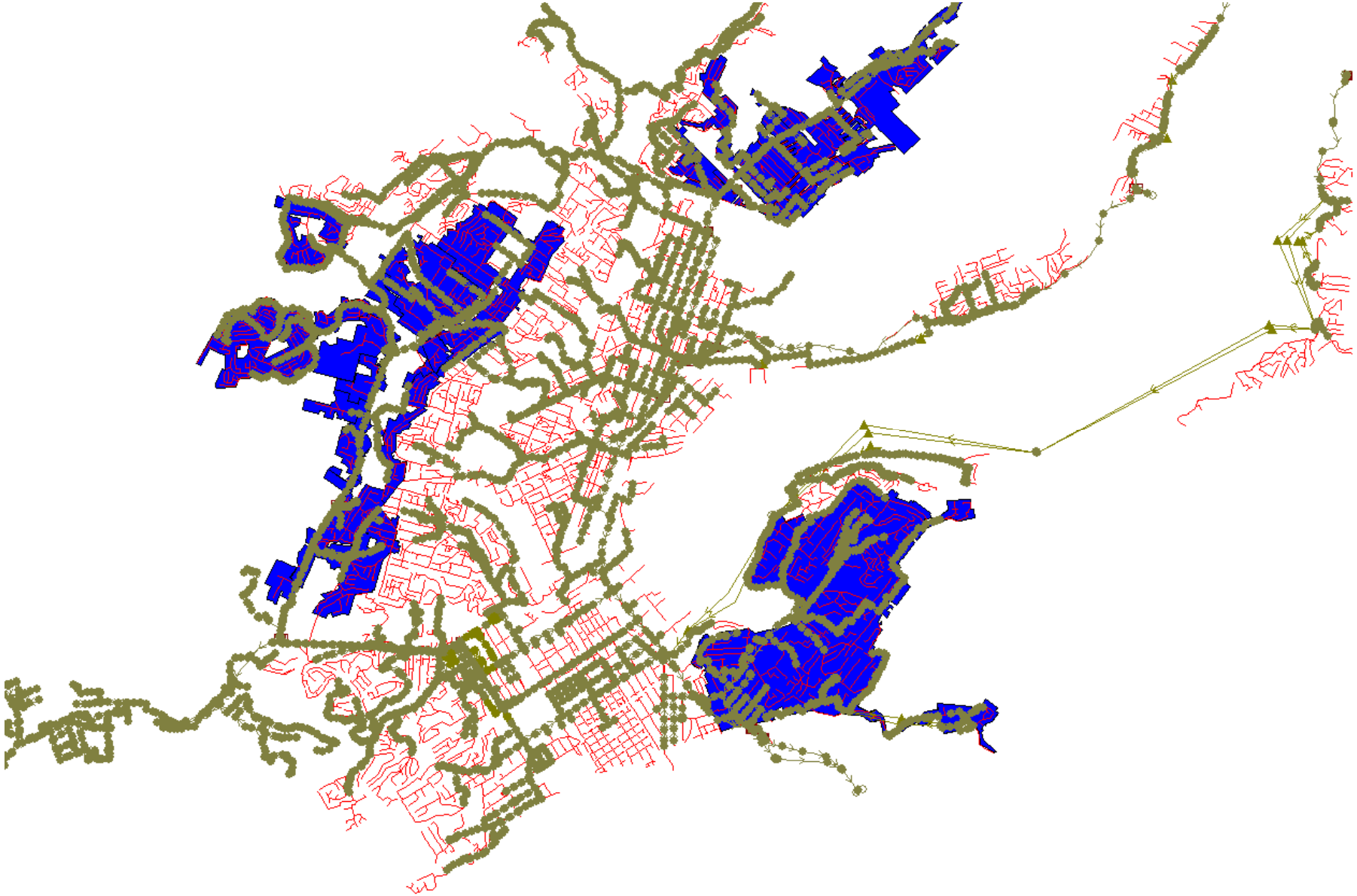
Mason Street catchment, 3D model view



Wastewater

Phase 1 – Green network with red pipes excluded but storage compensation used

Phase 2 – Blue areas being modelled as full pipe networks



Wastewater

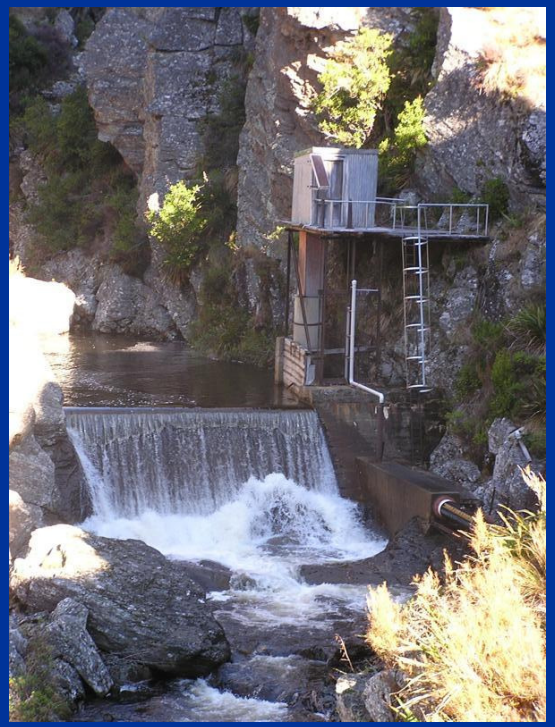
Detailed Phase 2 model – all pipes

Criticality Assessment

What is Criticality?

Why Assess Criticality?

RISK = CONSEQUENCE x LIKELIHOOD



Assessment Framework

Weighting the Factors

- **Extent** – loss of service
- **Cost** – direct cost
- **Effect on 4 Well-beings (Location)** - indirect financial costs, environmental effects, social, cultural impacts

Rating Factor 1 - Extent		
Function Failure	Population Affected	Rating
Insignificant	Any	1
Minor (delivery)	Small	2
Minor (delivery)	Large	3
Major (safety, supply, containment)	Small	4
Major (safety, supply, containment)	Large	5

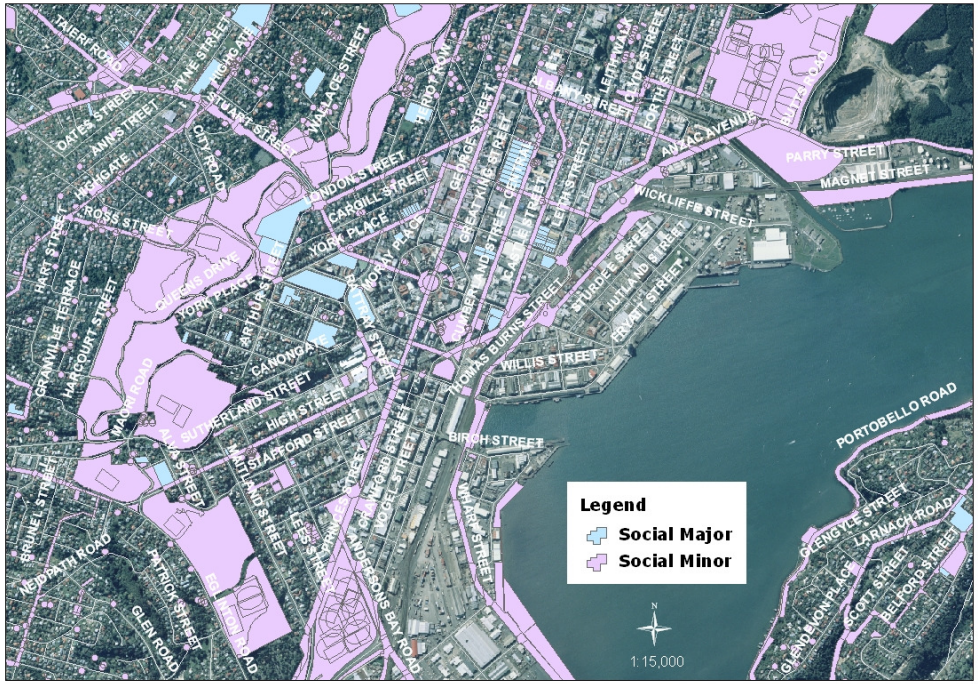
Rating Factor 3 - Location:	
1	within 10 m of minor
2	within 5m of minor
3	within 10m major or within 1m minor
4	within 5m major
5	within 1m of major

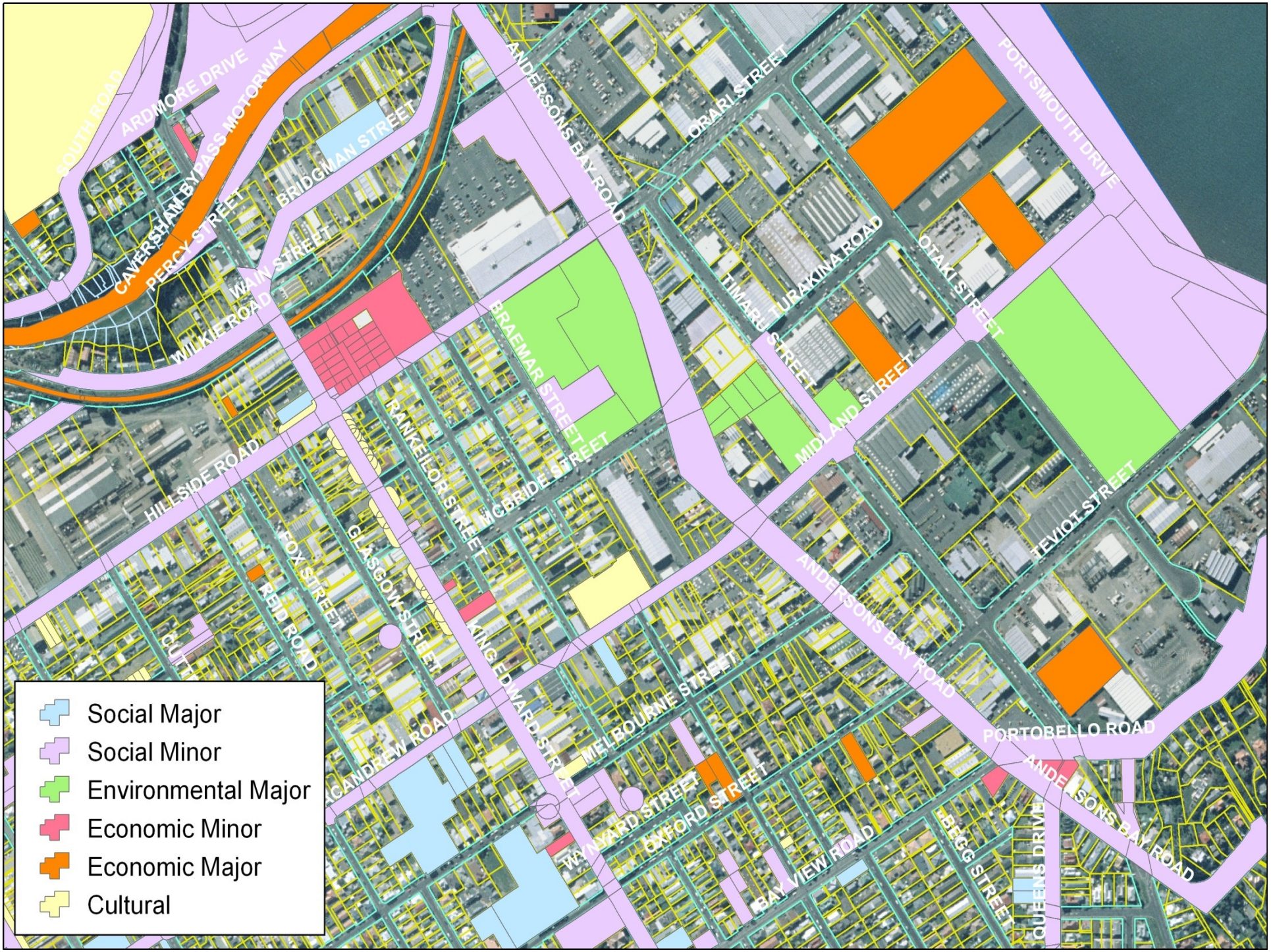
Rating Factor 2 - Cost	
Replacement Cost	Cost Grading
Up to$20,000	1
$20,000 - $150,000	2
$150,000 - $400,000	3
$400,000 - $1m	4
Over $1m	5


Legend
Environmental Major
1:30,000


Legend
Cultural


Legend
Economic Minor
Economic Major


Legend
Social Major
Social Minor
1:15,000


SOUTH ROAD
ARDMORE DRIVE
CAVERSHAM BYPASS MOTORWAY
PERCY STREET
BRIDGMAN STREET
WAIN STREET
WILKIE ROAD
ANDERSONS BAY ROAD
ORARI STREET
PORTSMOUTH DRIVE
TIMARU TURAKINA ROAD
OTAKI STREET
BRAEMAR STREET
MIDLAND STREET
HILLSIDE ROAD
RANKEILOR STREET
McBRIDE STREET
TEVIOT STREET
FOX STREET
REID ROAD
GLASGOW STREET
KING EDWARD STREET
ANDERSONS BAY ROAD
MELBOURNE STREET
PORTOBELLO ROAD
ANDREW ROAD
WAINYARD STREET
OXFORD STREET
BAY VIEW ROAD
BEGG STREET
QUEENS DRIVE
ANDERSONS BAY ROAD
Social Major
Social Minor
Environmental Major
Economic Minor
Economic Major
Cultural

Critical Link Analysis

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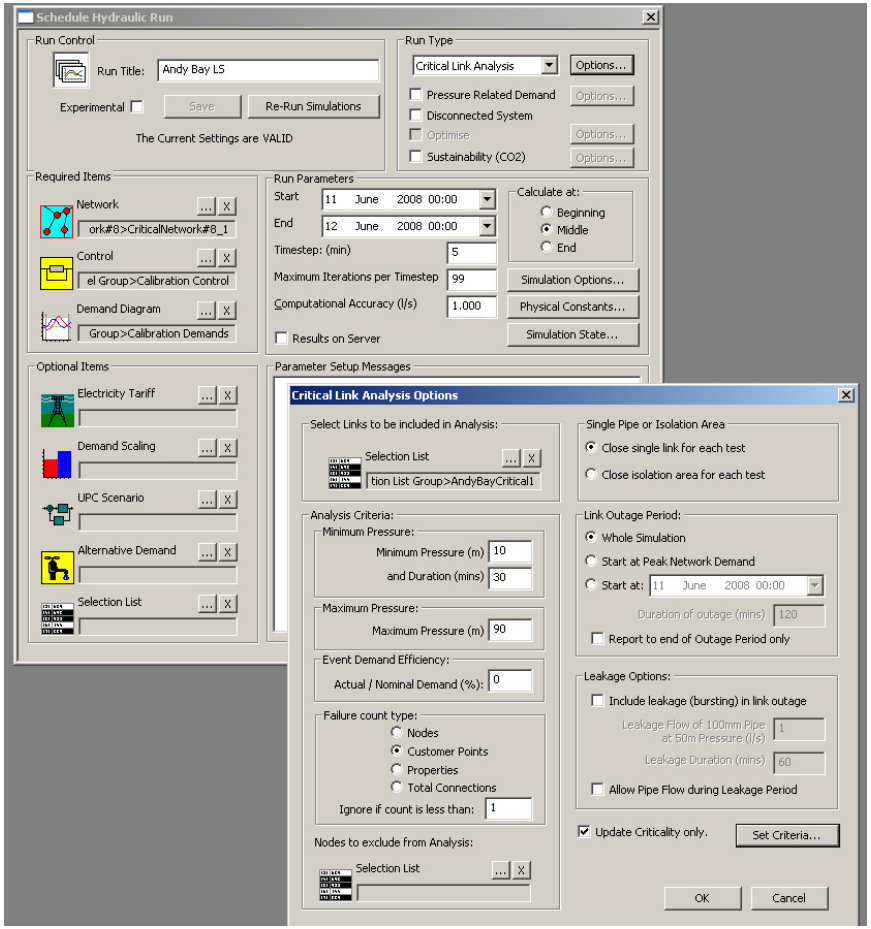
InfoWorks WS Critical Link Analysis



Critical Link Analysis (CLA) is a model simulation that enables the testing and reporting of the effect of a link failure through an automated simulation

11,896 pipes @ 3 minutes per simulation + analysis

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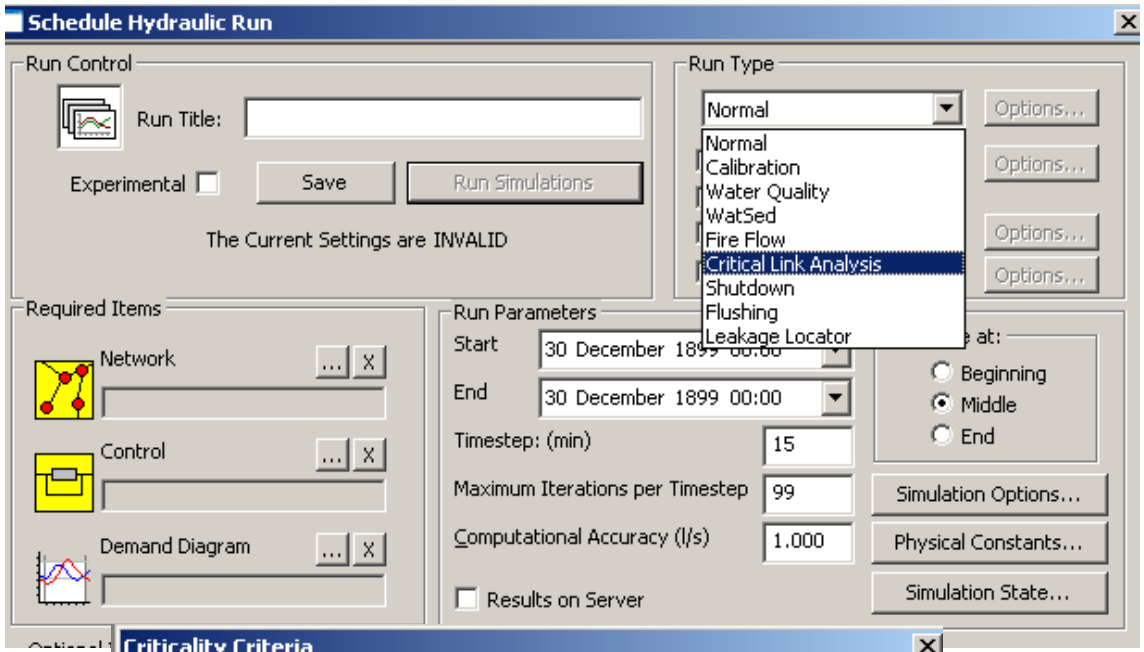
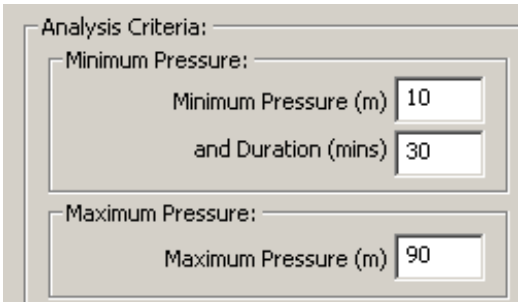
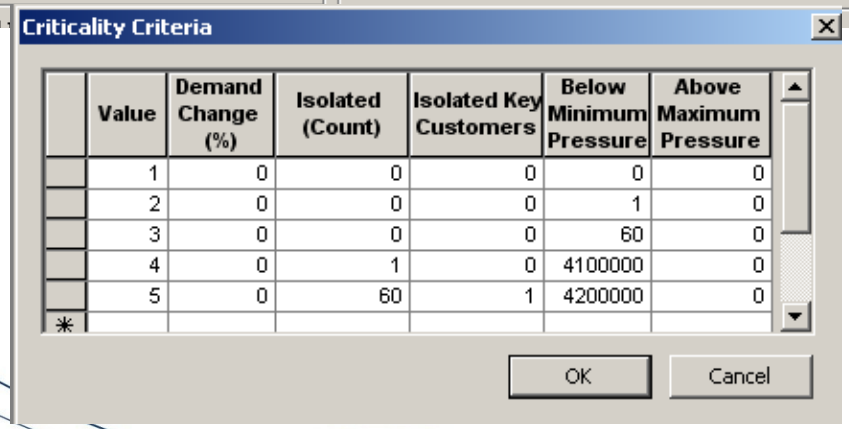
InfoWorks WS Critical Link Analysis



Analysis Criteria





	Value	Demand Change (%)	Isolated (Count)	Isolated Key Customers	Below Minimum Pressure	Above Maximum Pressure
	1	0	0	0	0	0
	2	0	0	0	1	0
	3	0	0	0	60	0
	4	0	1	0	4100000	0
	5	0	60	1	4200000	0
*						

Criticality Criteria

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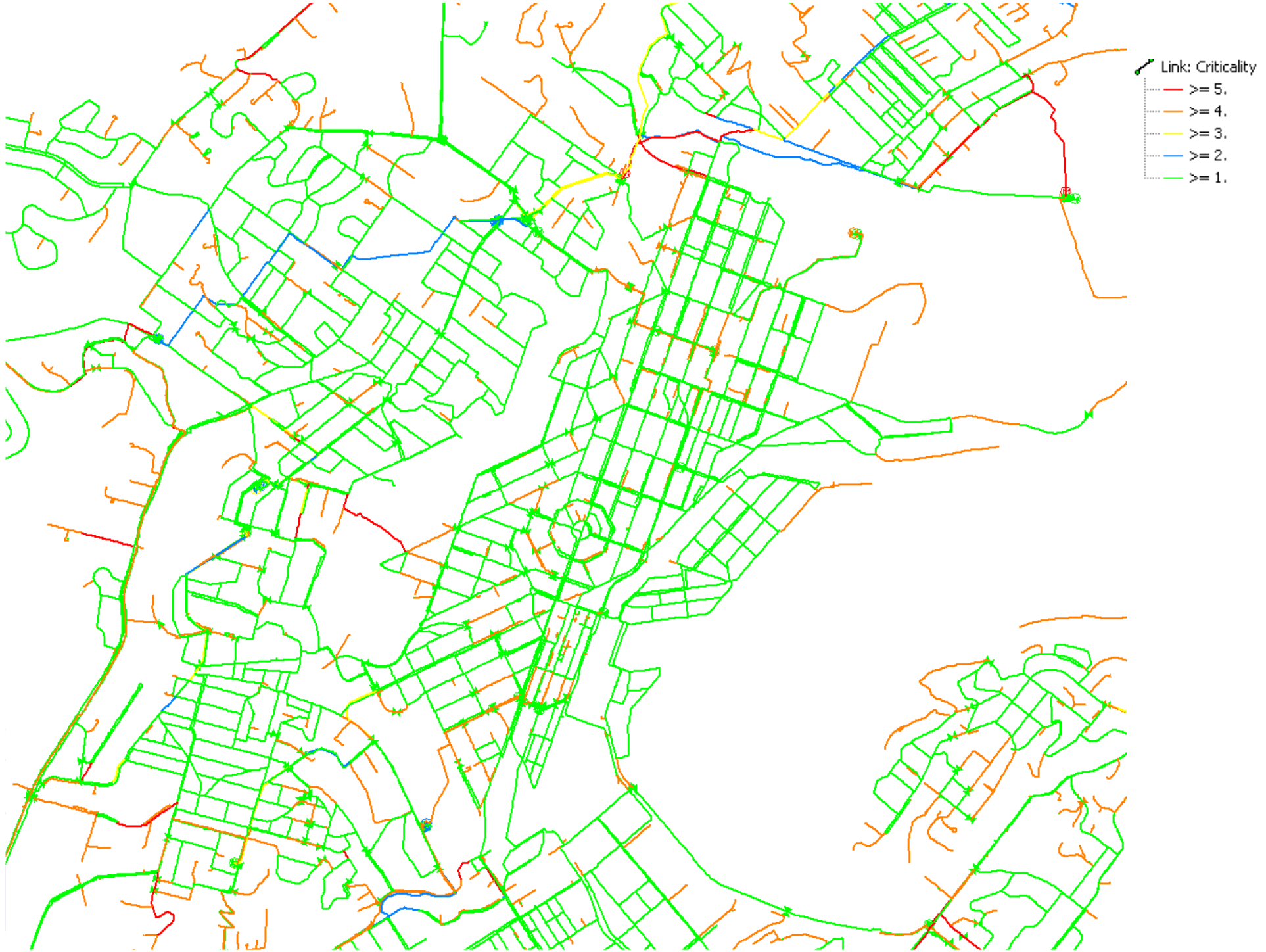
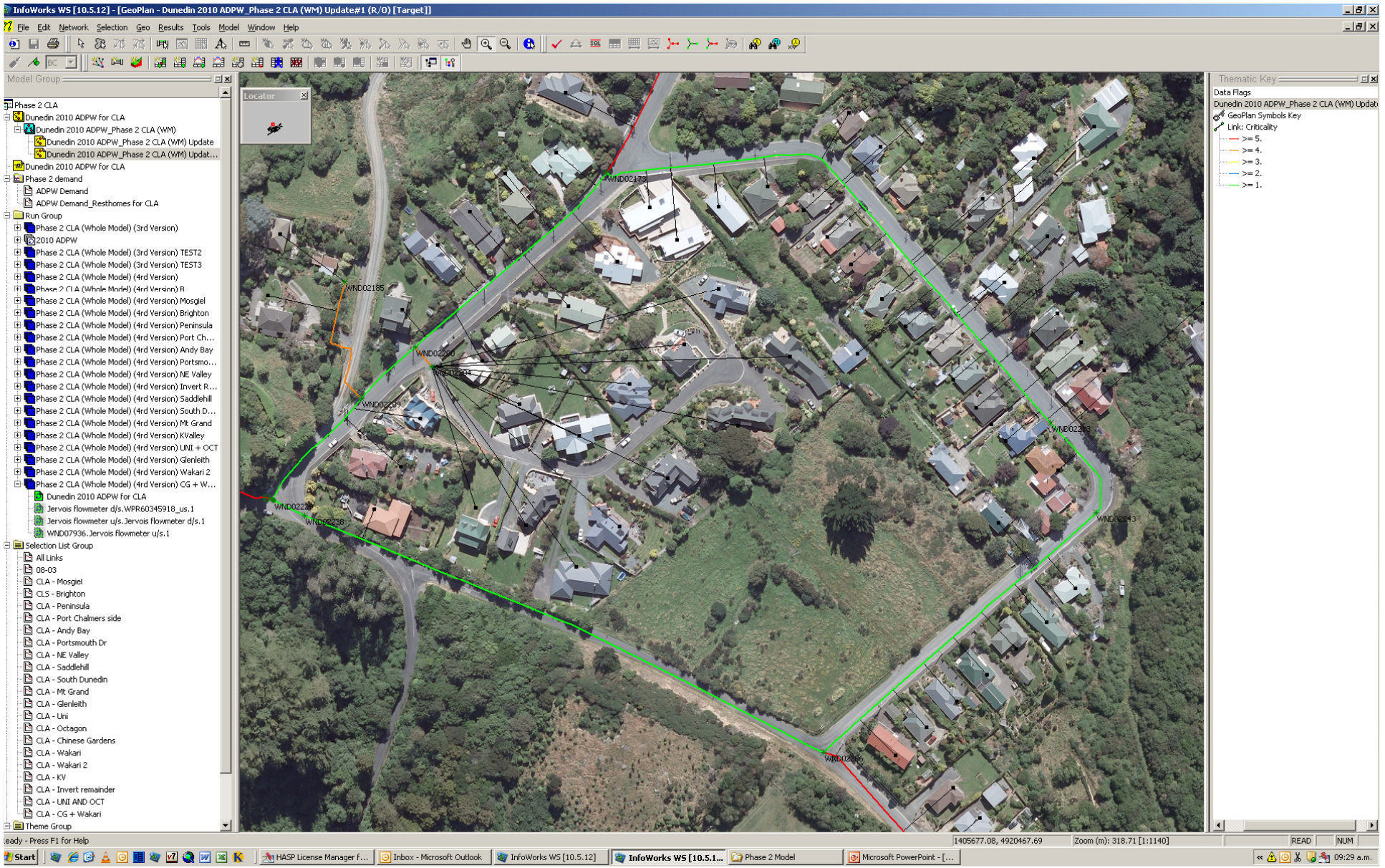
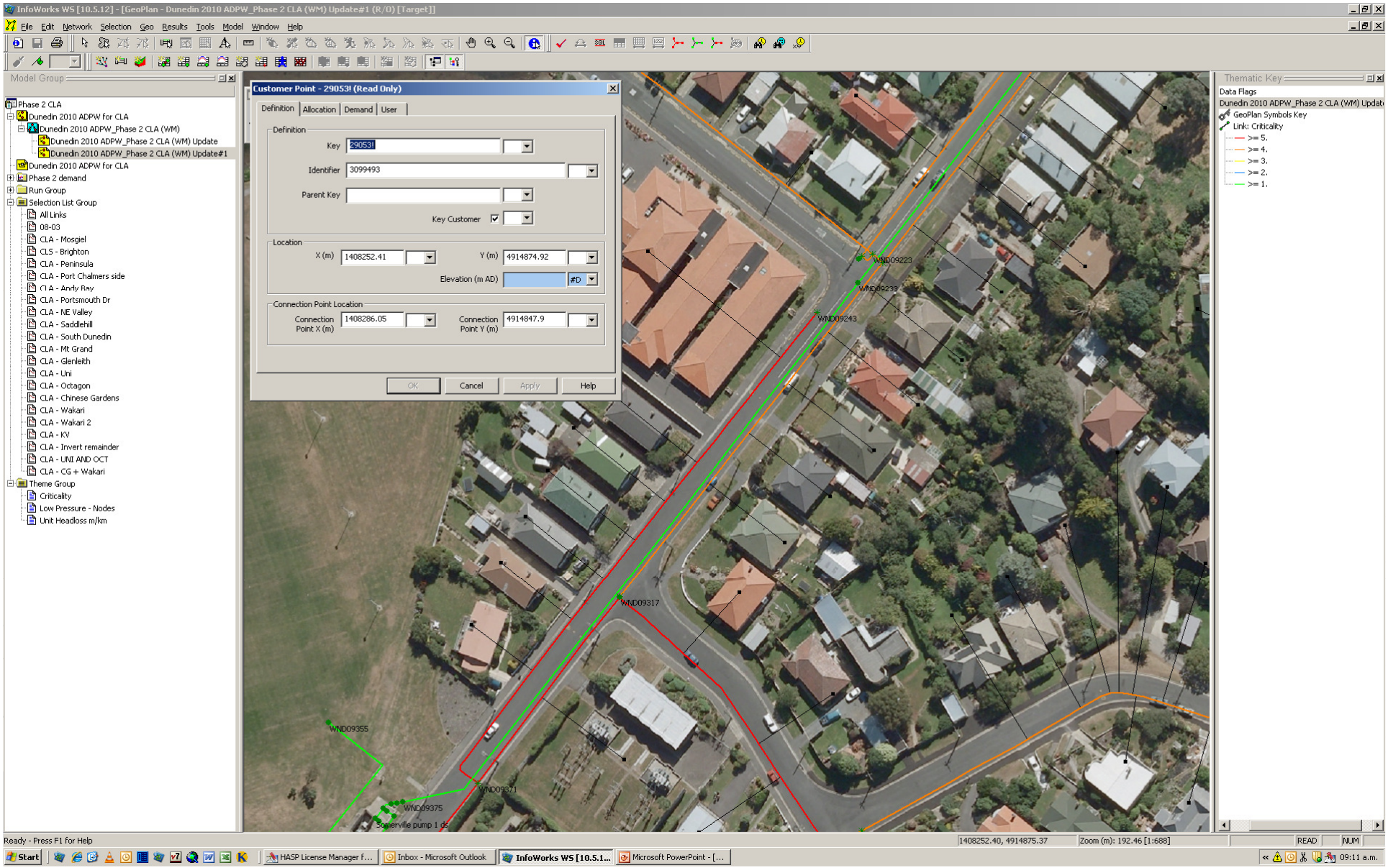

Link: Criticality
>= 5.
>= 4.
>= 3.
>= 2.
>= 1.

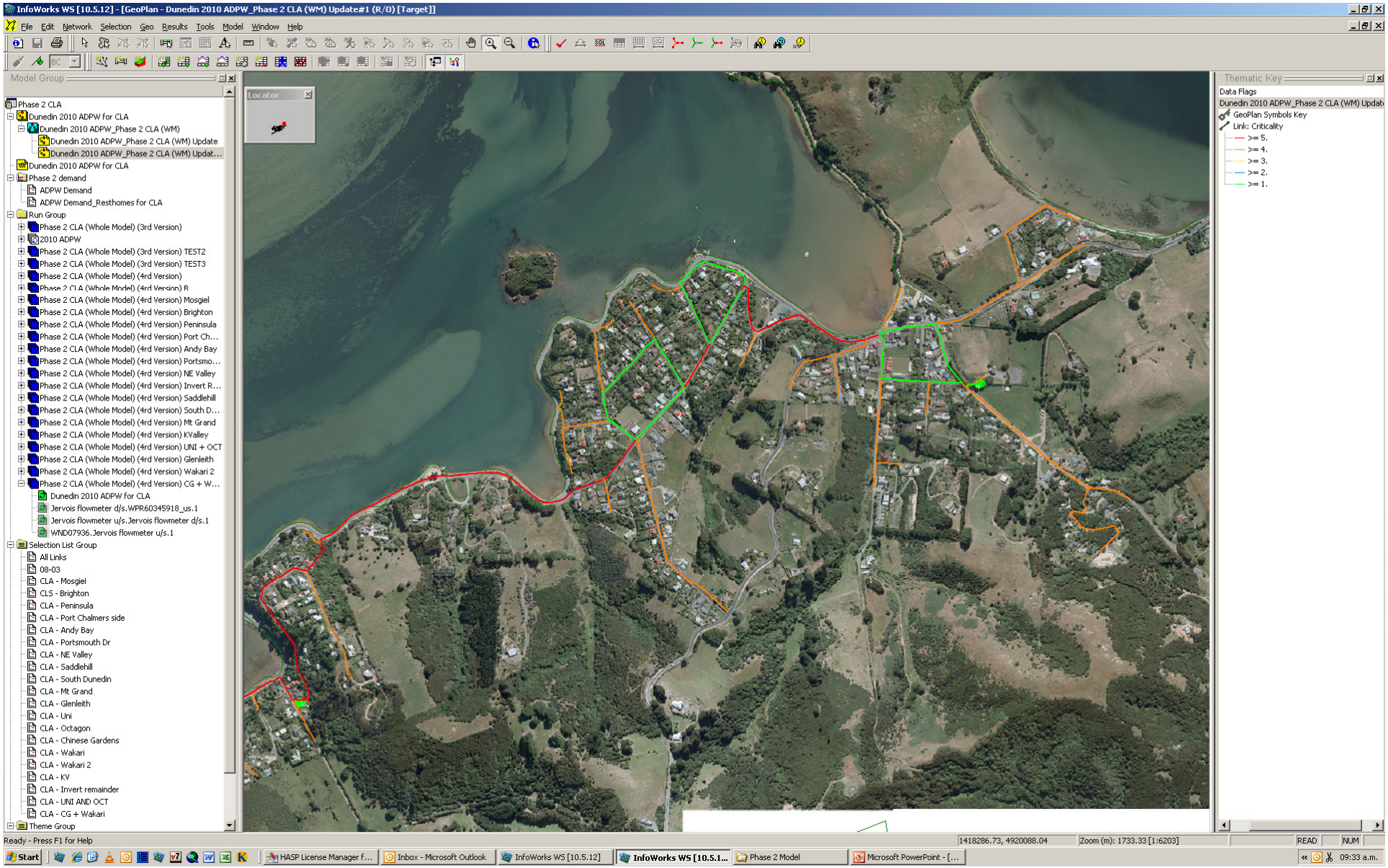
CLA – Ring fed example (1)



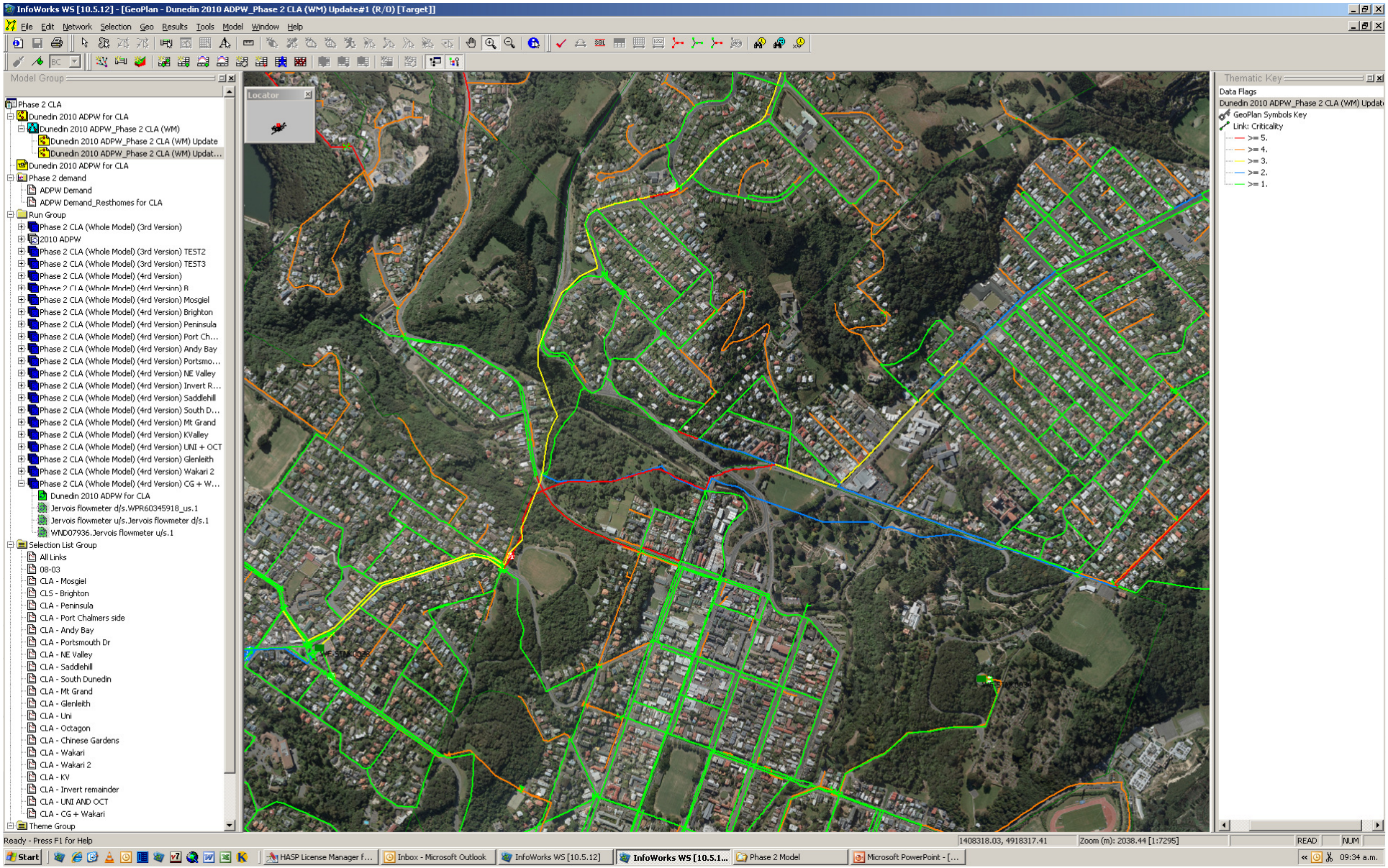
CLA – Key Customer Example (4)



CLA – Peninsula Set up (1/4/5)

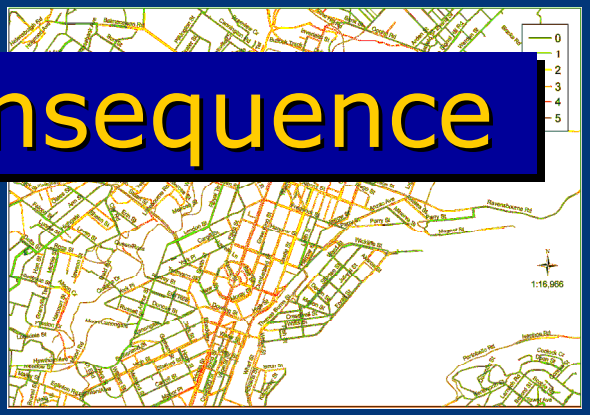


CLA – All ratings



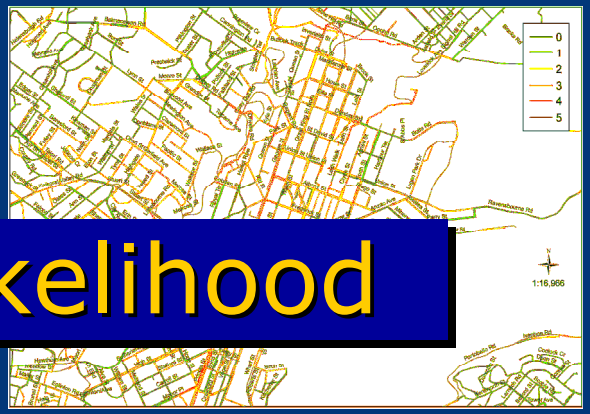
CONSEQUENCE
=
CLA (Extent)
+
Cost rating
+
Location (4 Well beings)

Consequence

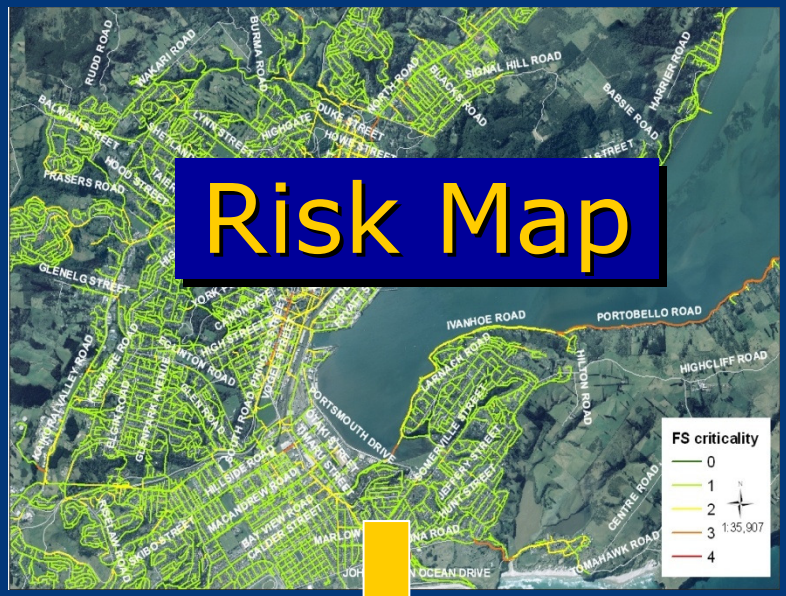


x

Likelihood



Risk Map



Prioritised List of Works

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Conclusions

- Critical Link Analysis is a powerful tool which aids risk assessment and therefore prioritisation of works

- Now working on refining wastewater and stormwater extent and reviewing all plant assets

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Thanks to
Madelaine Martin
&
Tom Dyer

Any Questions?
Thanks for listening