

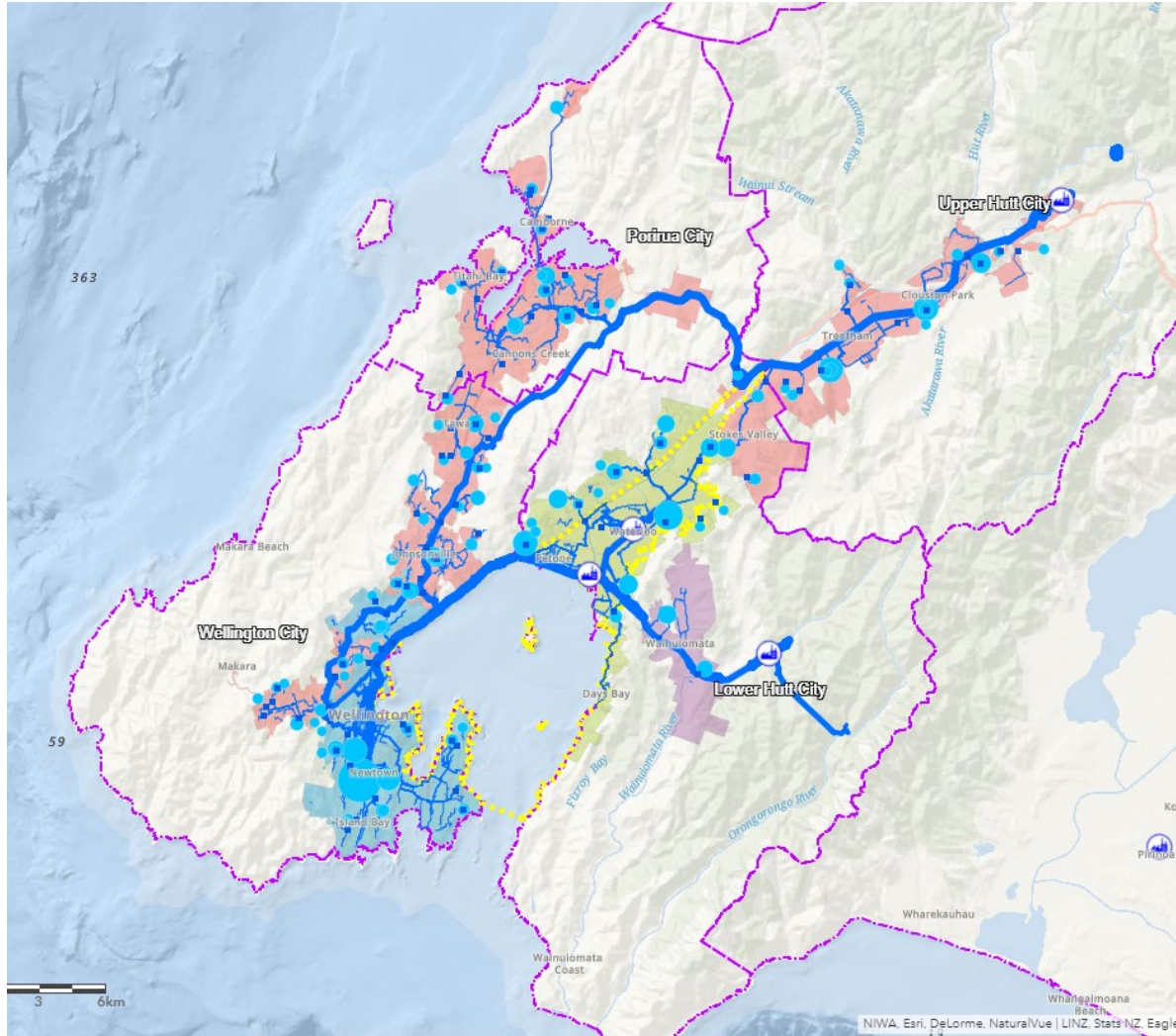
Geoff Williams and Jon Reed

# Dynamic Adaptive Pathways Planning for a Water Resource Investment Strategy



**water**  
NEW ZEALAND  
CONFERENCE & EXPO  
17-19 OCTOBER 2023  
Tākina, Te Whanganui-a-Tara Wellington

# Wellington Metropolitan Water Supply



## Challenges now

- Drought Level of Service
- Peak demand exceeds capacity
- High water loss

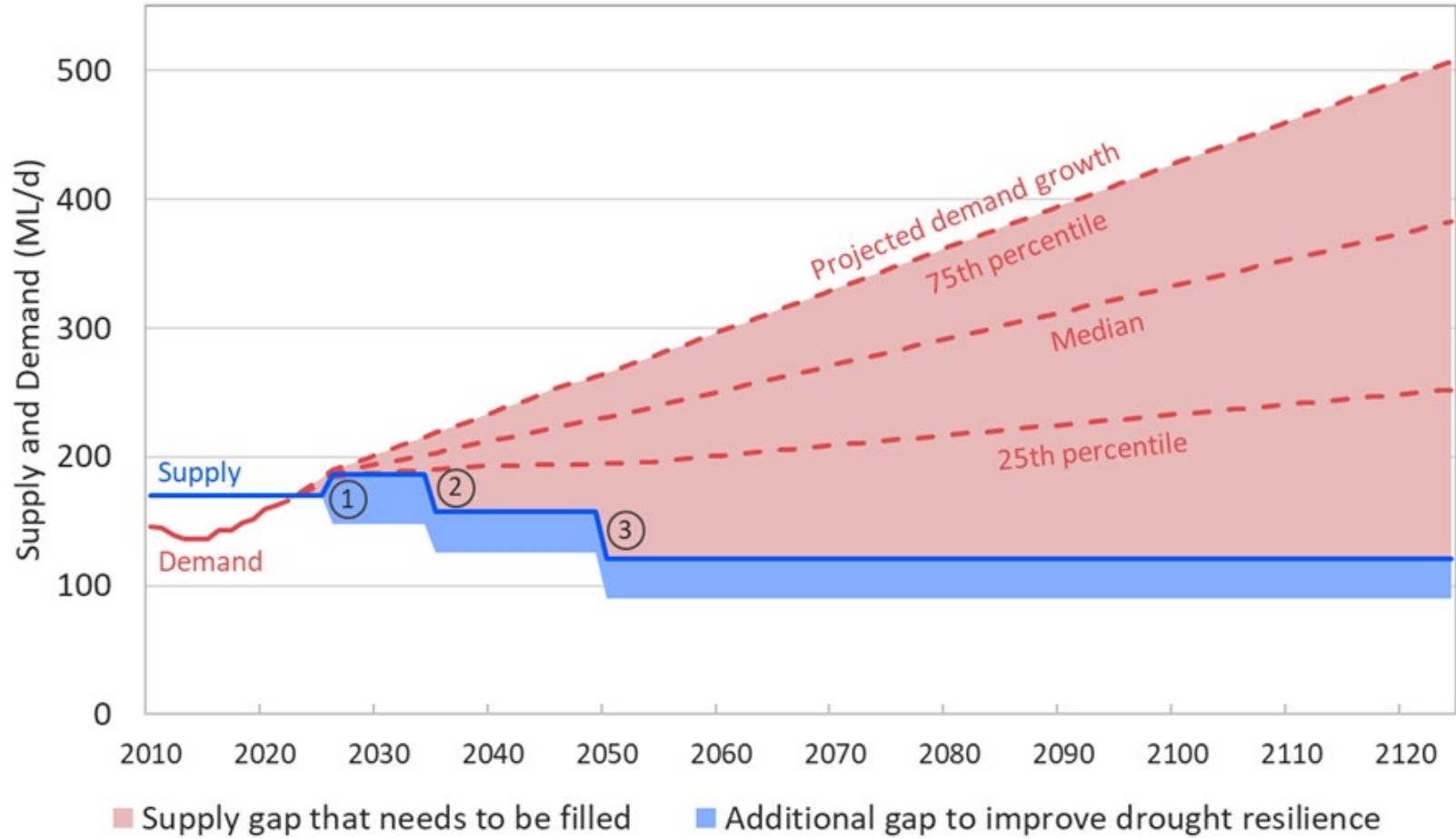


## Looking ahead

- Te Mana o Te Wai
- Growth
- Climate change and sea level rise
- Community risk appetite



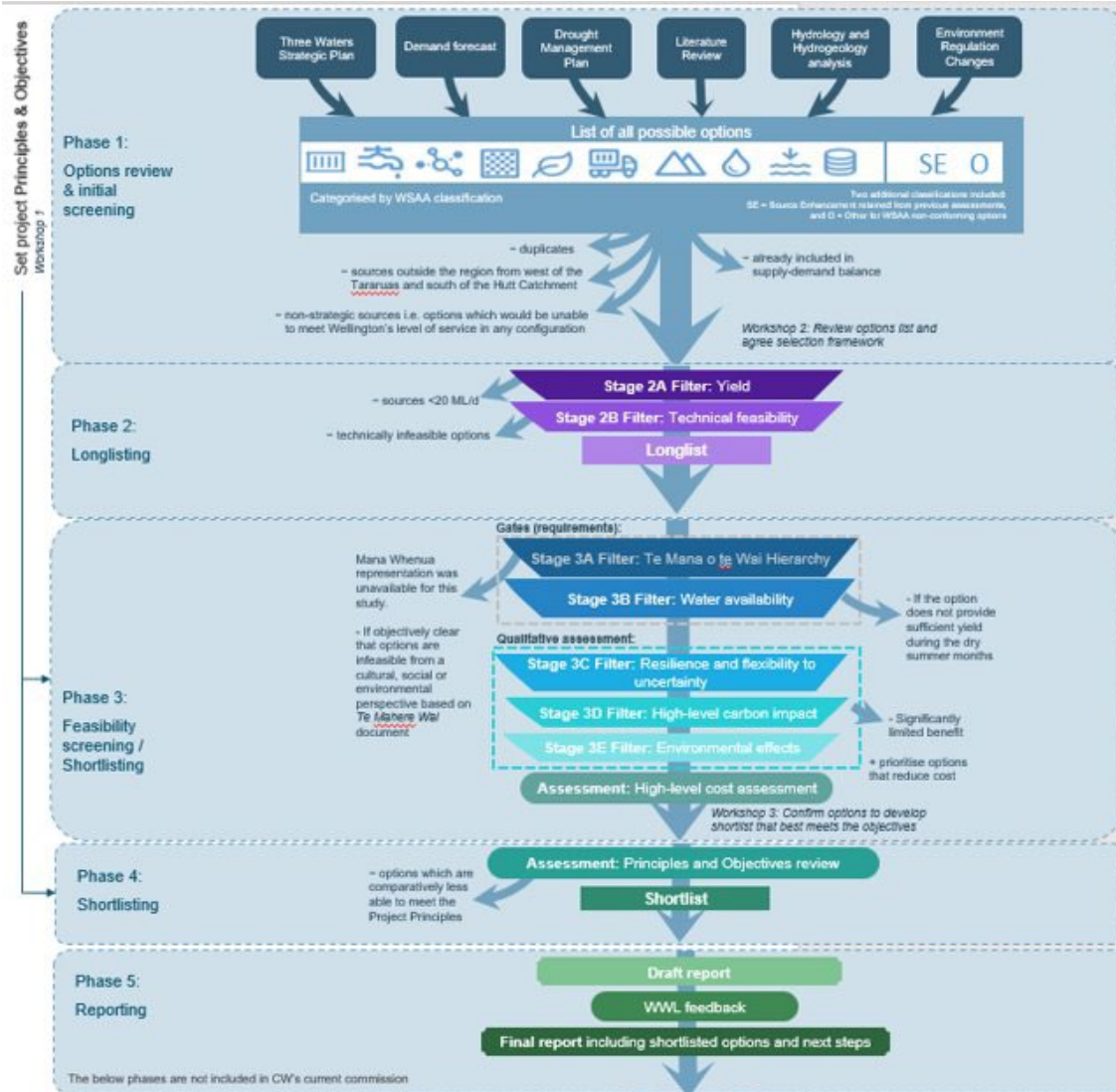
# Baseline supply / demand balance



■ Supply gap that needs to be filled    ■ Additional gap to improve drought resilience



# The options appraisal



**Phase 5a: Further Assessment**

for each shortlisted option to determine whether option should be progressed to Phase 5b

- If an option is found to be infeasible based on the 5a investigations
- If an option is feasible but the lead time is > 30 years, the option will be put on "hold" at this point

- Engagement with Taranaki Whānui
- Location(s) where the scheme could feasibly be developed, including land size, land ownership and likely timeframes of the land becoming available
- Hydrogeological and hydrological potential and yield at drought Level of Service

Options progressed to 5b for a full feasibility study:

**Phase 5b: Detailed Assessment**

for each shortlisted option

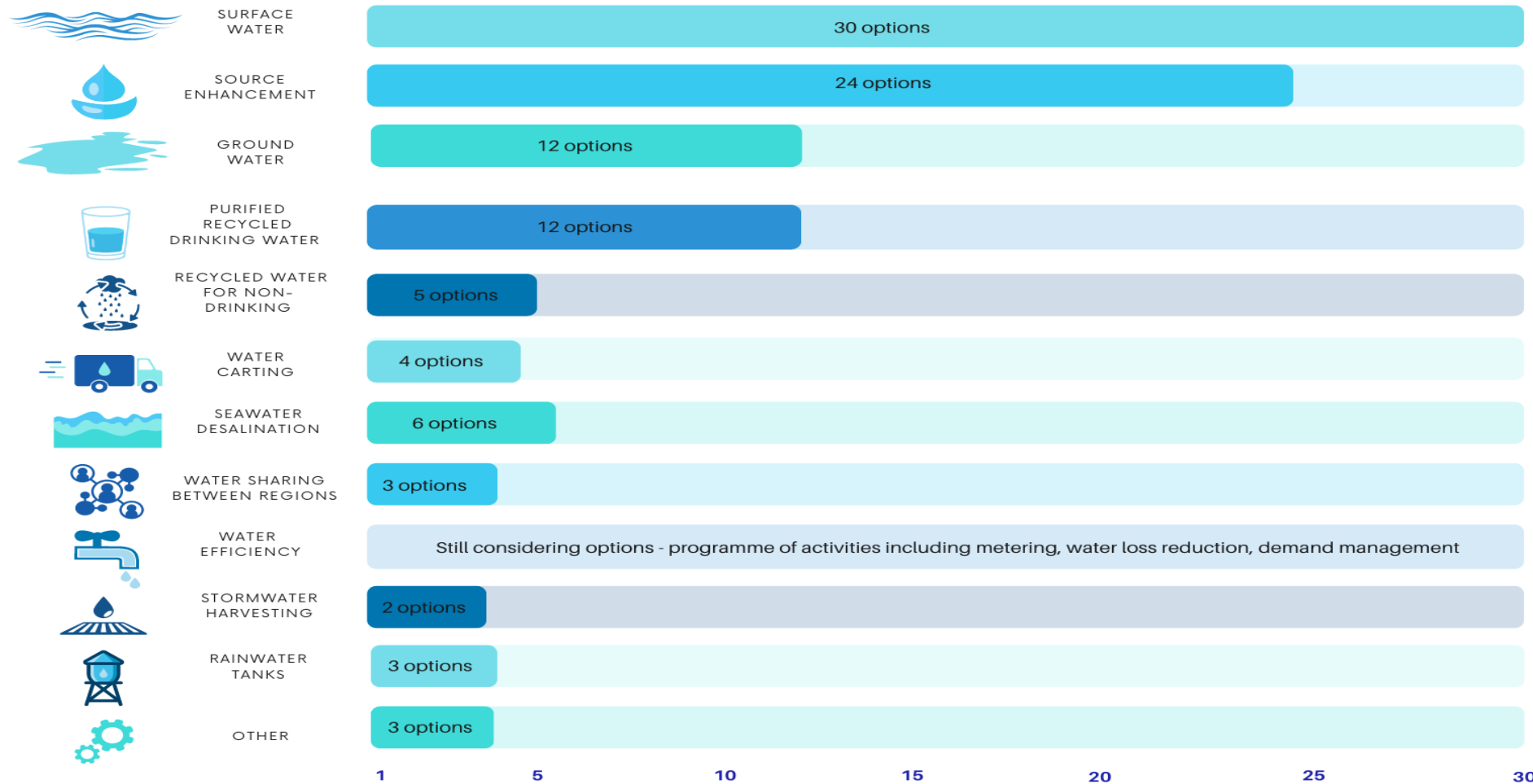
- Basis of design – scheme overview
- Main components and component sizing
- Potential lead time and phasing if applicable
- Planning considerations
- Risk assessment
- NPV Cost estimate including operational costs
- Whole-of-life carbon emissions

**Phase 6: Implementation Plans**

Steps: Economic & Carbon Analysis, Scenarios & pathway development, Implementation Plans.

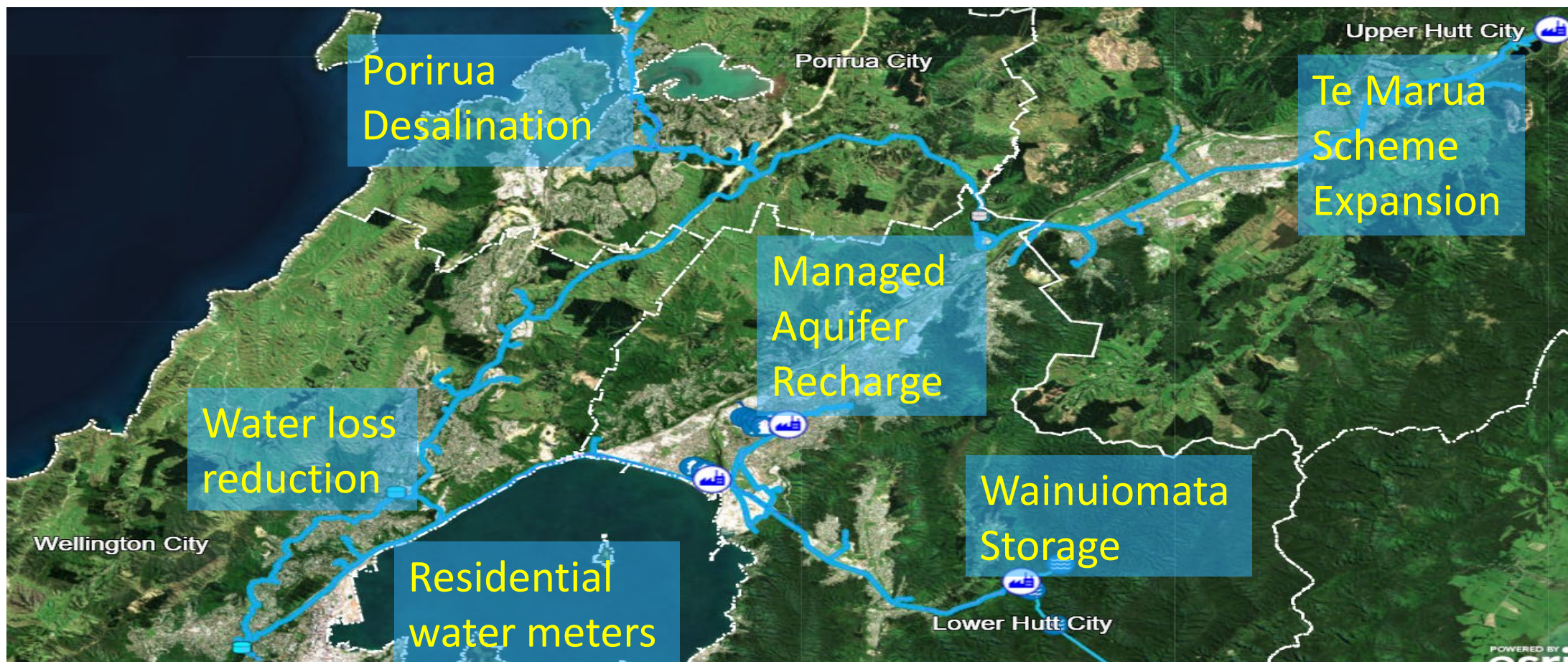
**Dynamic Adaptive Pathway Plan**

# Over 100 options were considered

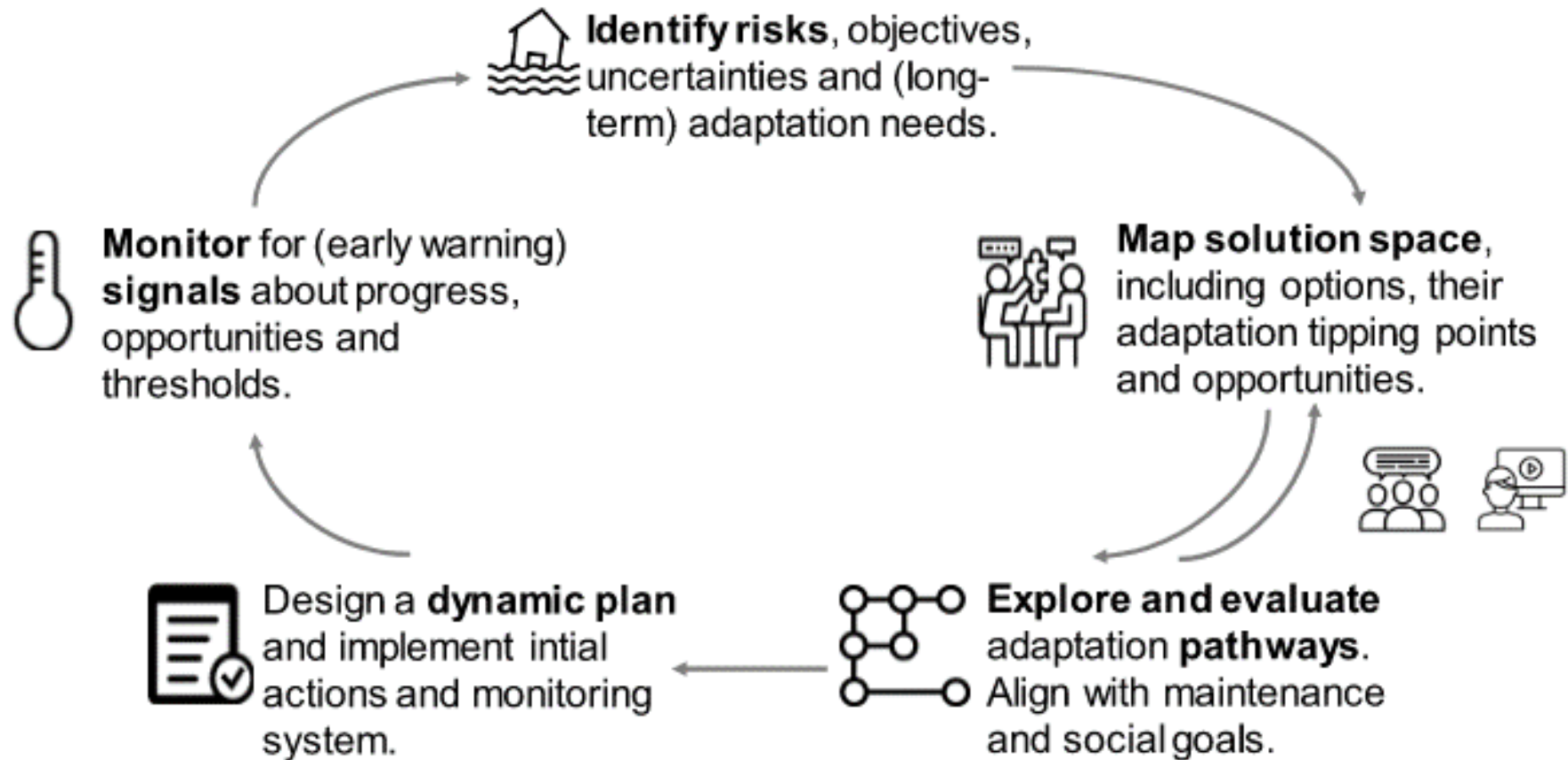




# Shortlisted options



# Dynamic Adaptive Pathway Planning (DAPP)





# DAPP supported by Robust Decision Making

9 actions and  
13 Pathways

Policy Levers (L)

576 combinations  
of external factors

External  
Factors (X)

Relationships in System  
(R)

Performance  
Metrics (M)

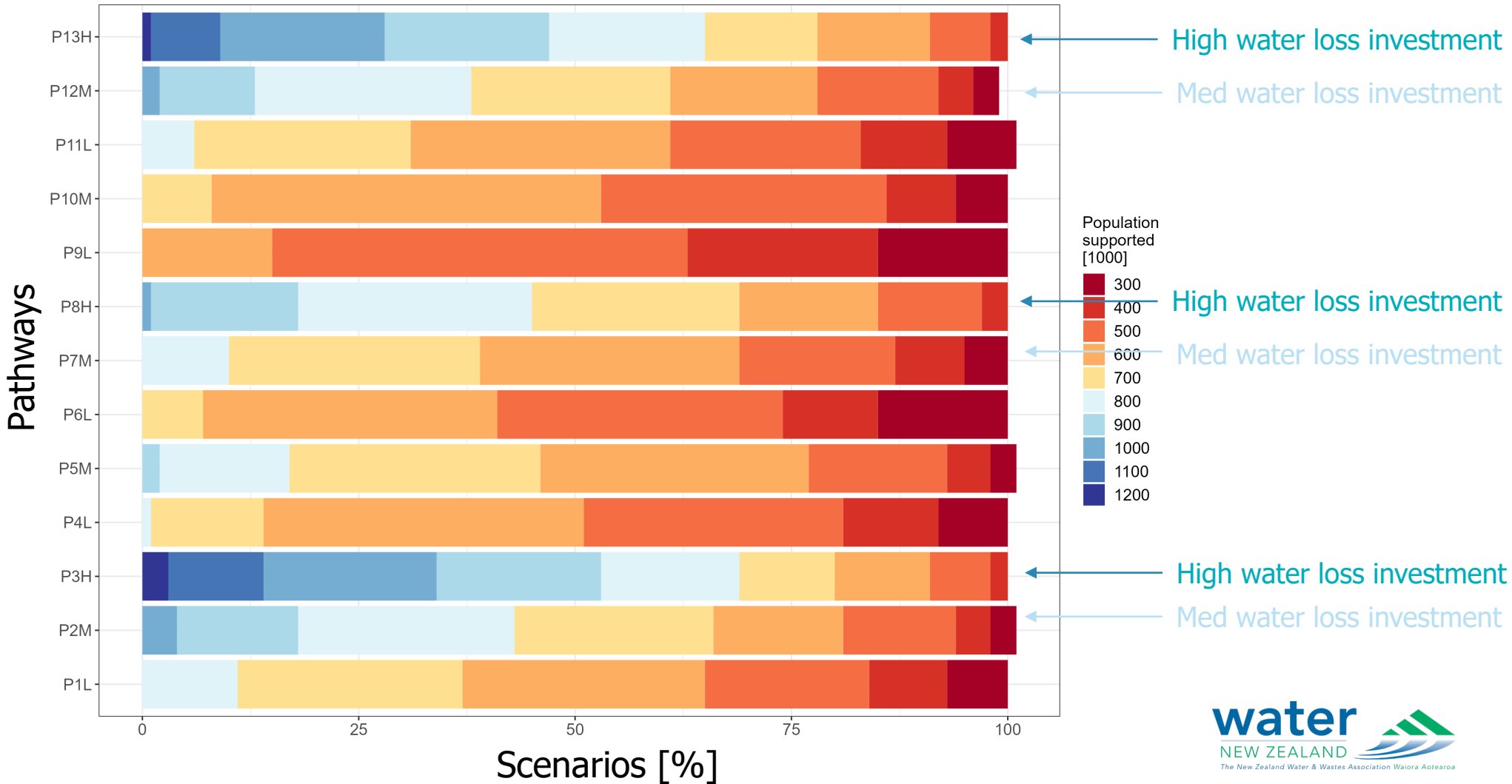
Sustainable Yield Model  
(supported by NIWA)



570 Billion days of stress test  
60,000 system failure points



# Pathway success overview

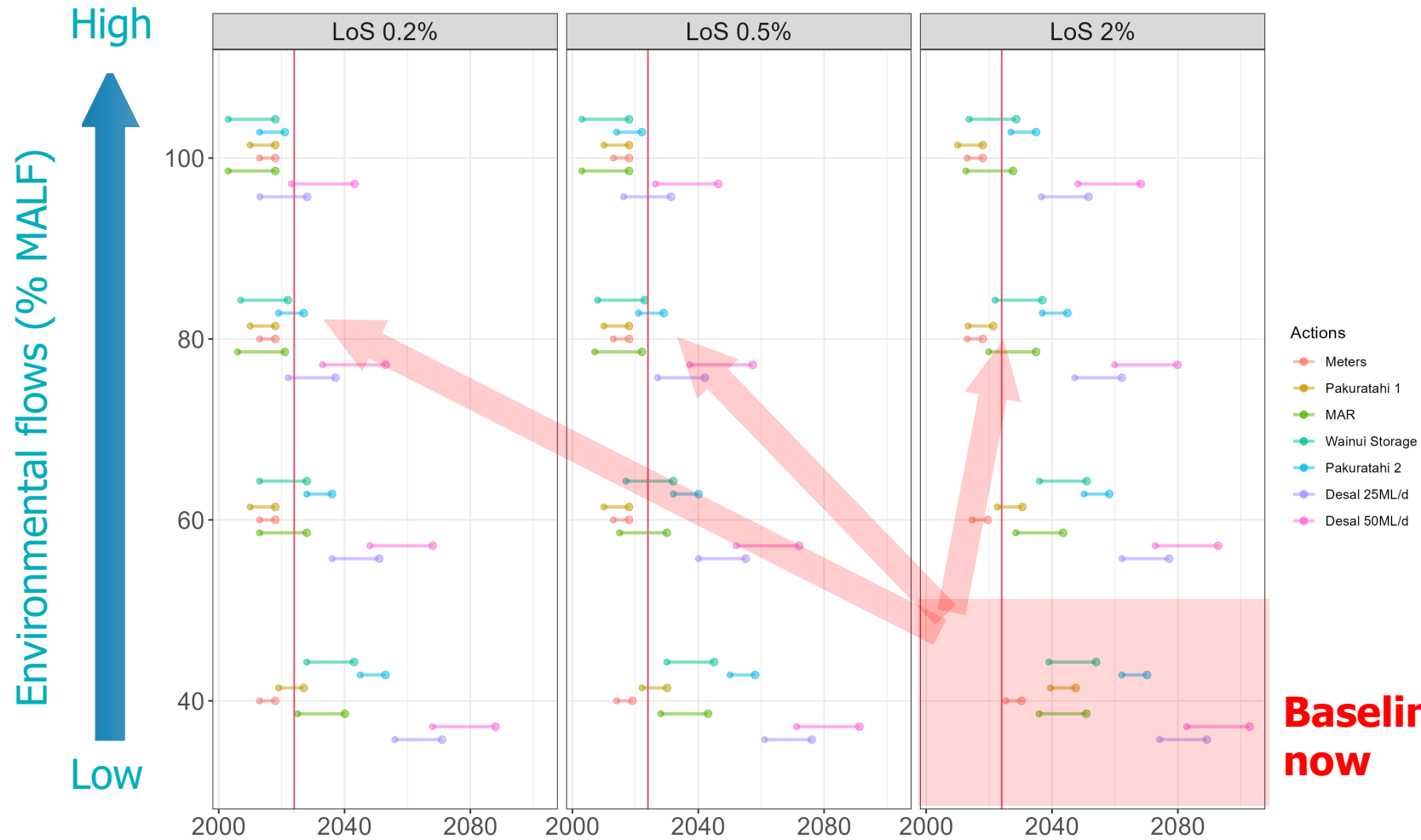


# Quantifying external effects

External factor	Variation explained
Environmental regulation	60%
Sea level rise	10%
Residential PCD	9%
Climate change	4%
Other	17%

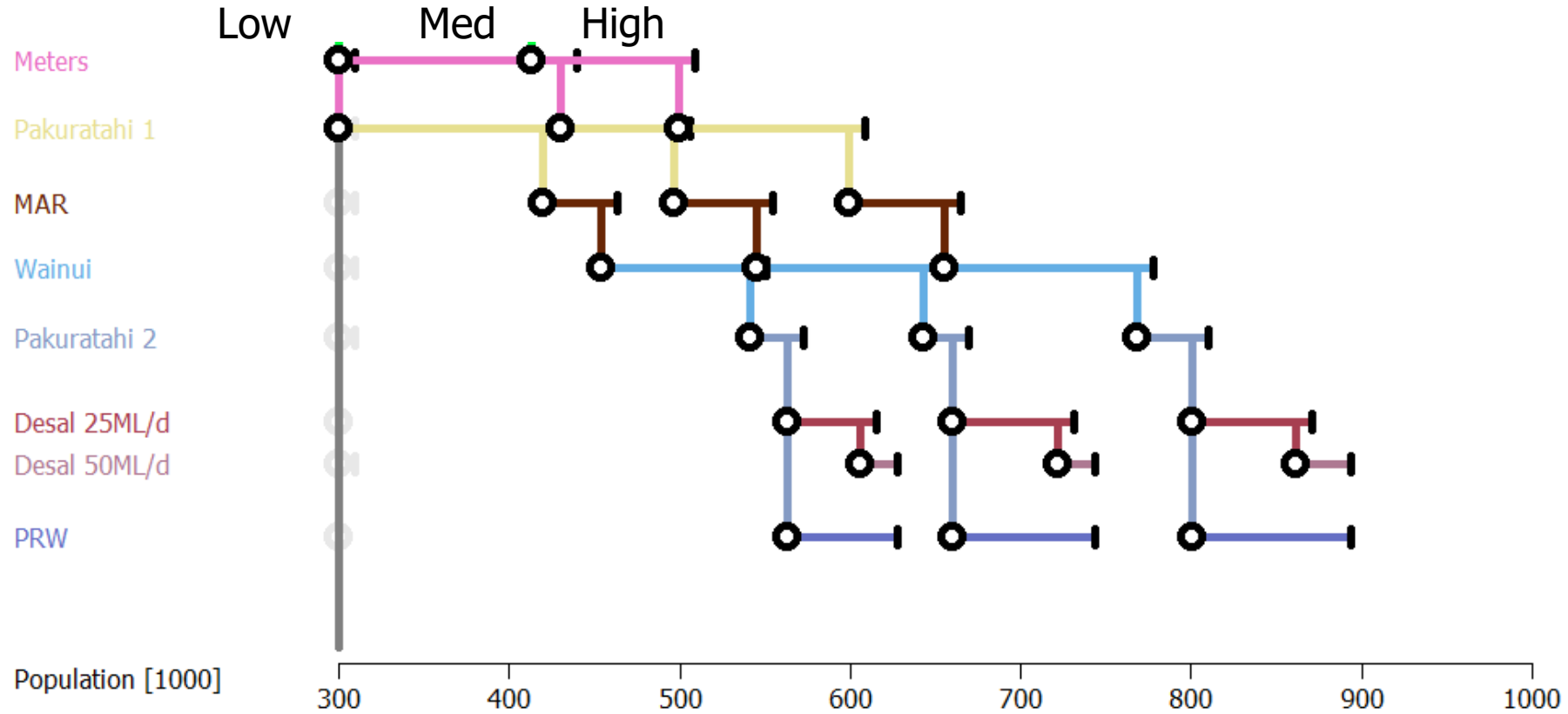
# Influence of MALF and LoS

Good practice (500yr) ← Existing (50yr)





# Implementation plan



25%ile growth scenario	2023	2042	NA	NA	NA	NA	NA
50%ile growth scenario	2023	2031	2052	2075	2097	2120	NA
75%ile growth scenario	2023	2027	2035	2043	2051	2060	2068

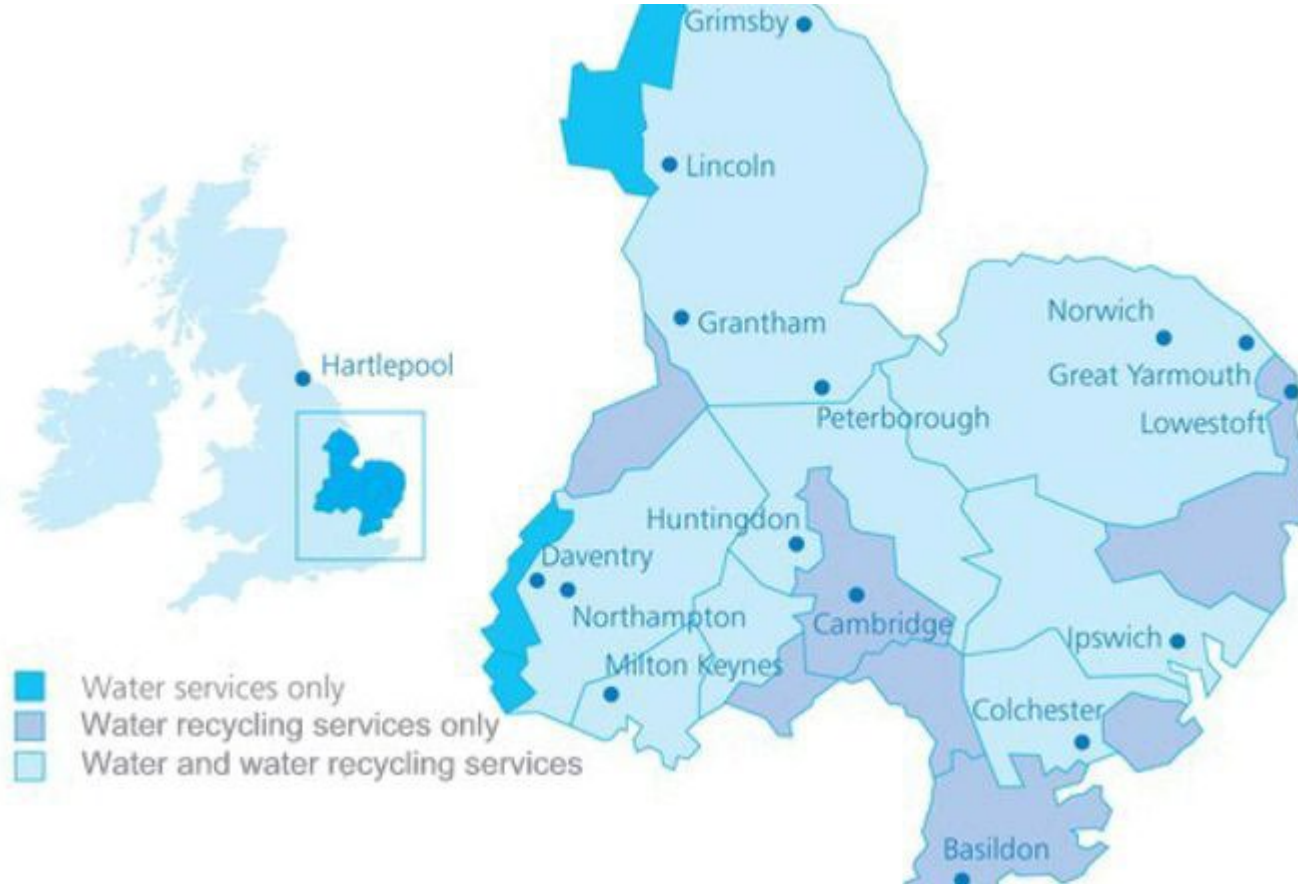
# Monitoring and triggers

Backwards looking i.e. are we still on plan?	Forward looking i.e. forecasting plan changes
Population (Census...)	
Water demand: <ul style="list-style-type: none"> <li>• Peak demand (in summer/winter)</li> <li>• Winter demand</li> <li>• Demand in dry/wet years</li> </ul>	
Leakage reduction	New connections/a proxy variable to forecast demand increase
Metering progress	
Yield from new supply options (compared to modelled yield in SYM)	External factors <ul style="list-style-type: none"> <li>• precipitation anomaly</li> <li>• groundwater levels</li> <li>• temperature increase</li> <li>• sea level rise</li> </ul>

Demand side

Supply side

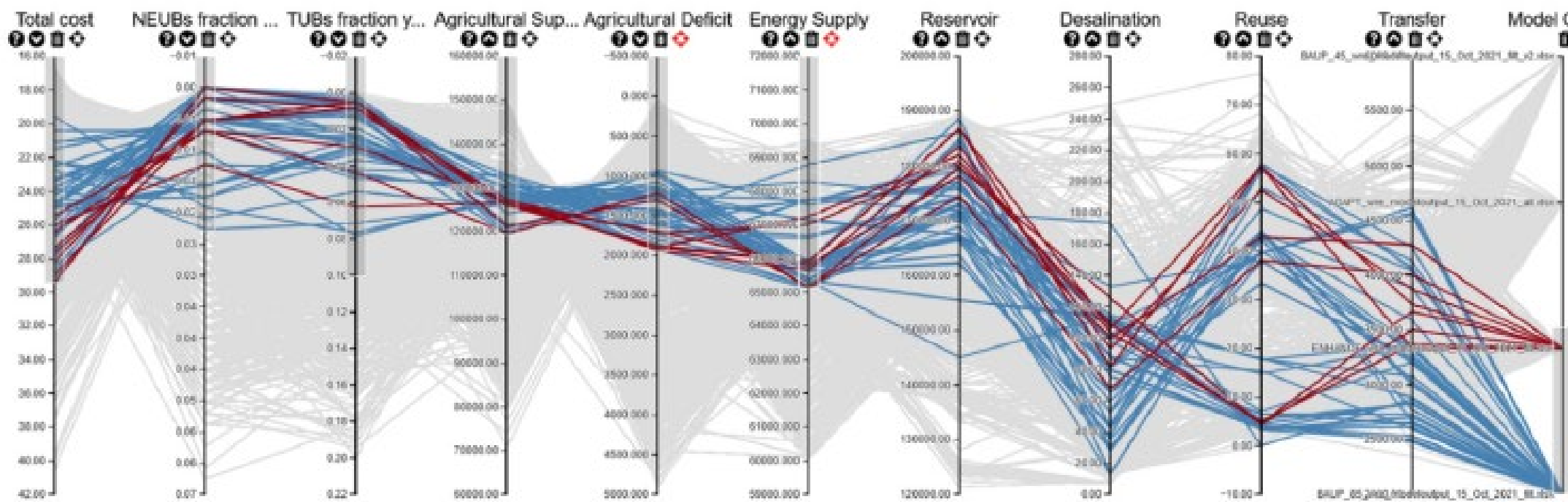
# Anglian Water



- 7 million customers
- One of the driest regions of the UK
- Environmental drivers
- 4 different water supply companies in the region



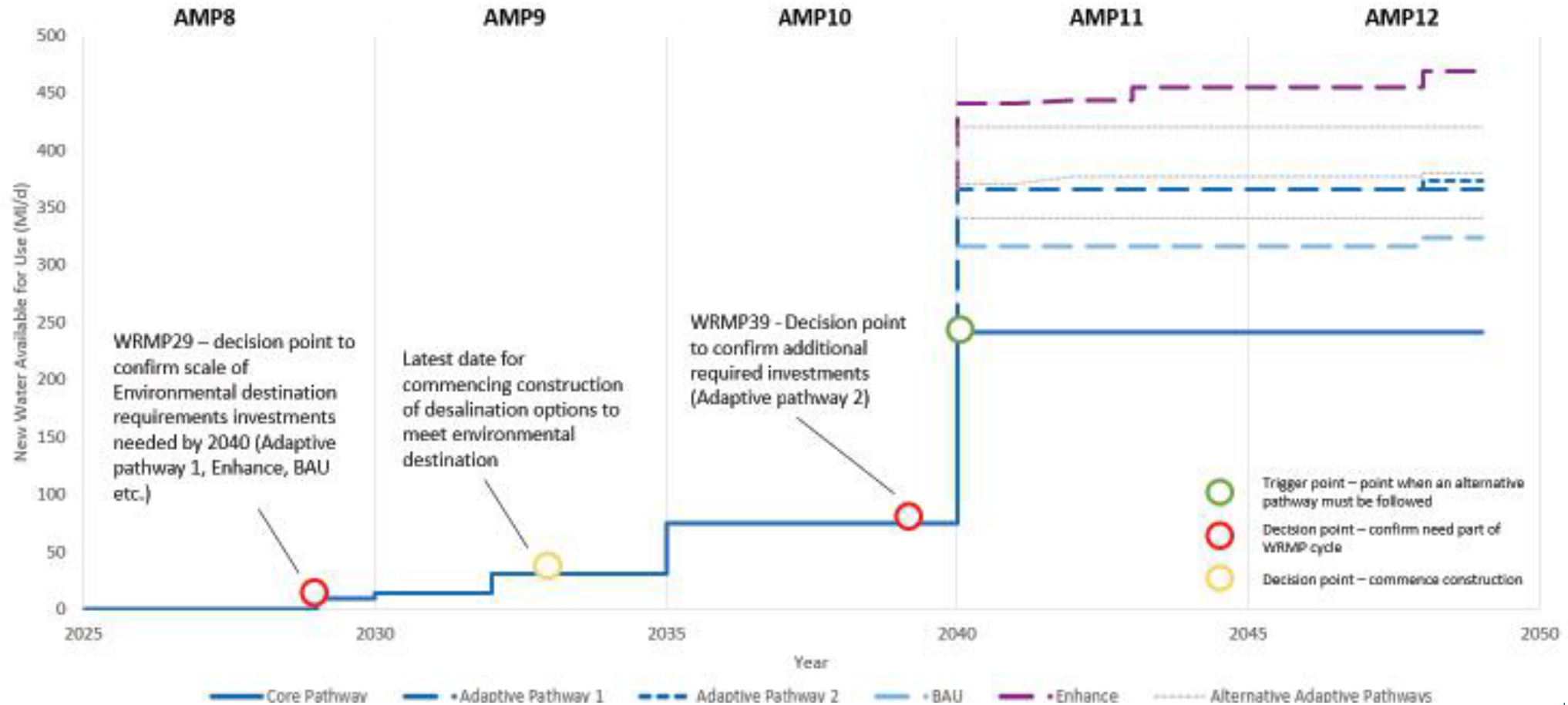
# Anglian Water



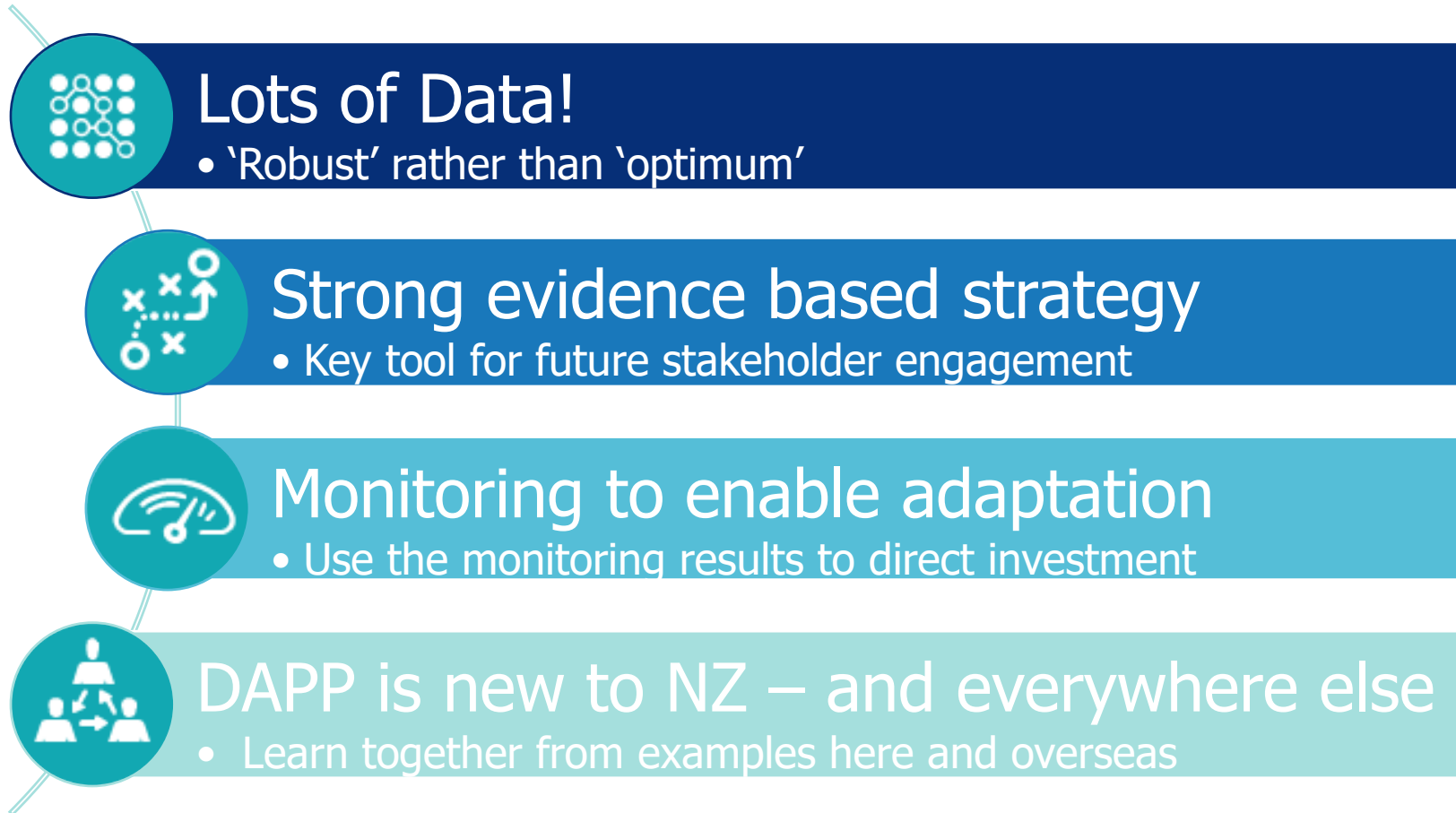
Source: University of Manchester, 2021

— BAU+ — ENHANCE

# Anglian Water's adaptive plan



# Conclusions





# Acknowledgements

Geoff Williams – Wellington Water

Jon Reed, Raphael Menke & Emma Benn – Beca

Judy Lawrence – PS Consulting & Te Herenga Waka, Victoria University of Wellington

Shailesh Singh – NIWA

Geoff Darch – Anglian Water

Alistair Allan – WSP

# Pātai?