Stantec

Wellington Harbour Bores

Exploration Findings

Rowan Oliver and Hayden Pipe
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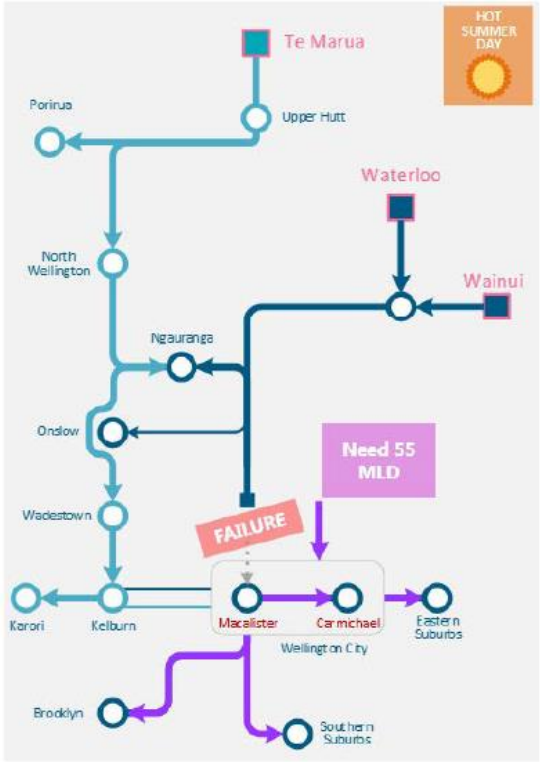
Project Objectives

Emergency objective

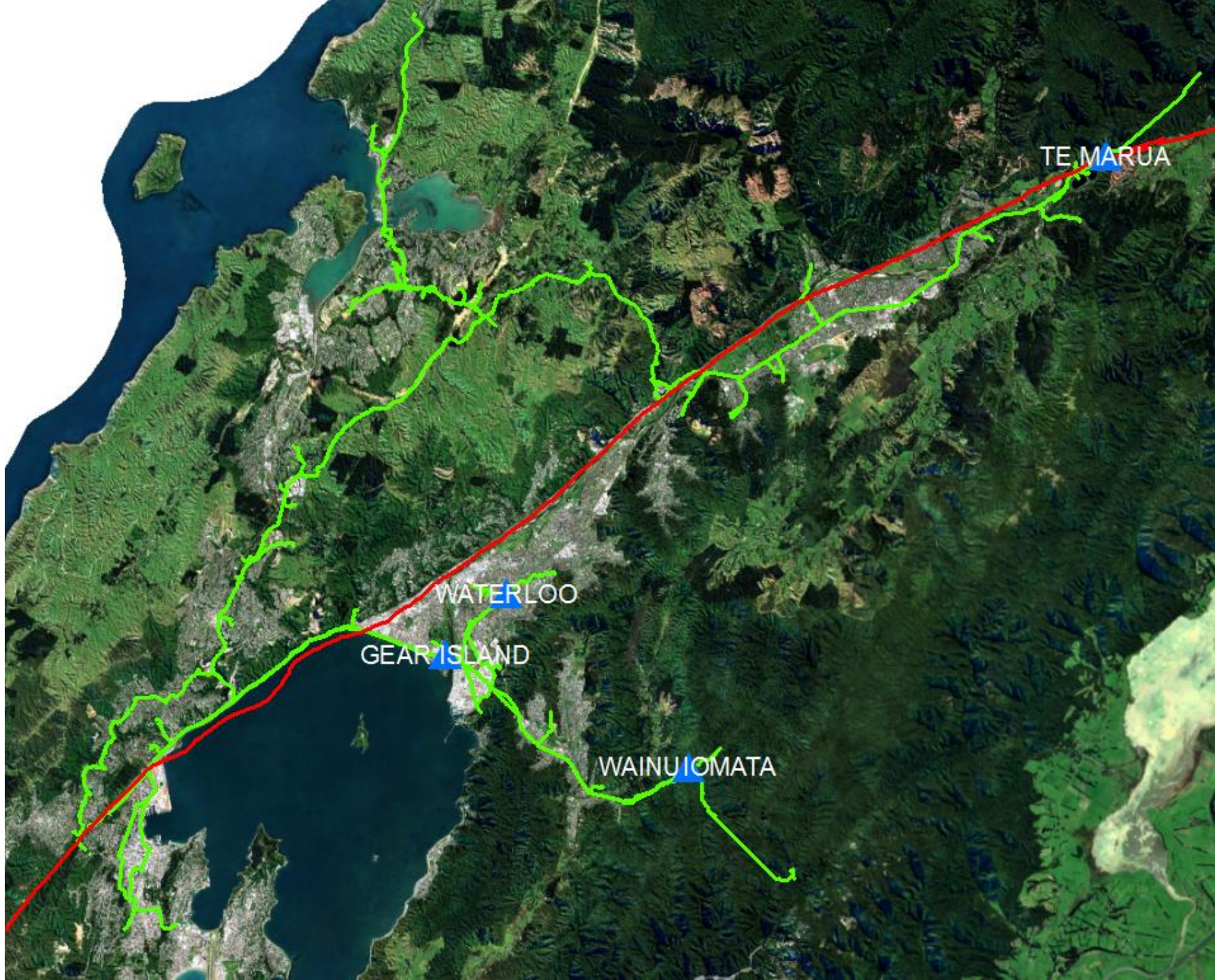
- Provide flow for ‘80-30-80’ strategy

Operational objective

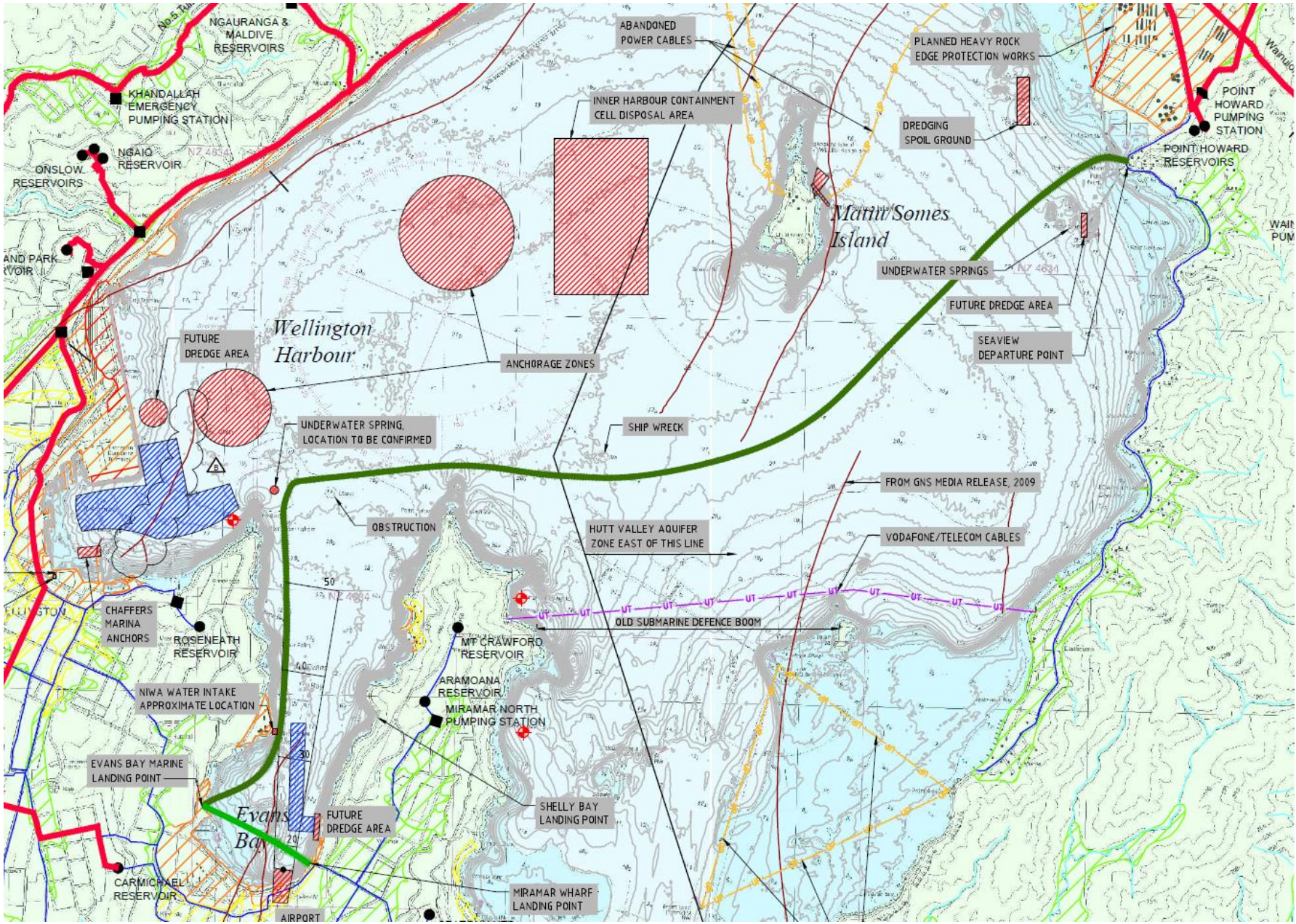
- Allow supply to be supplemented for 3 days in the event of a ‘worst’ case mains failure



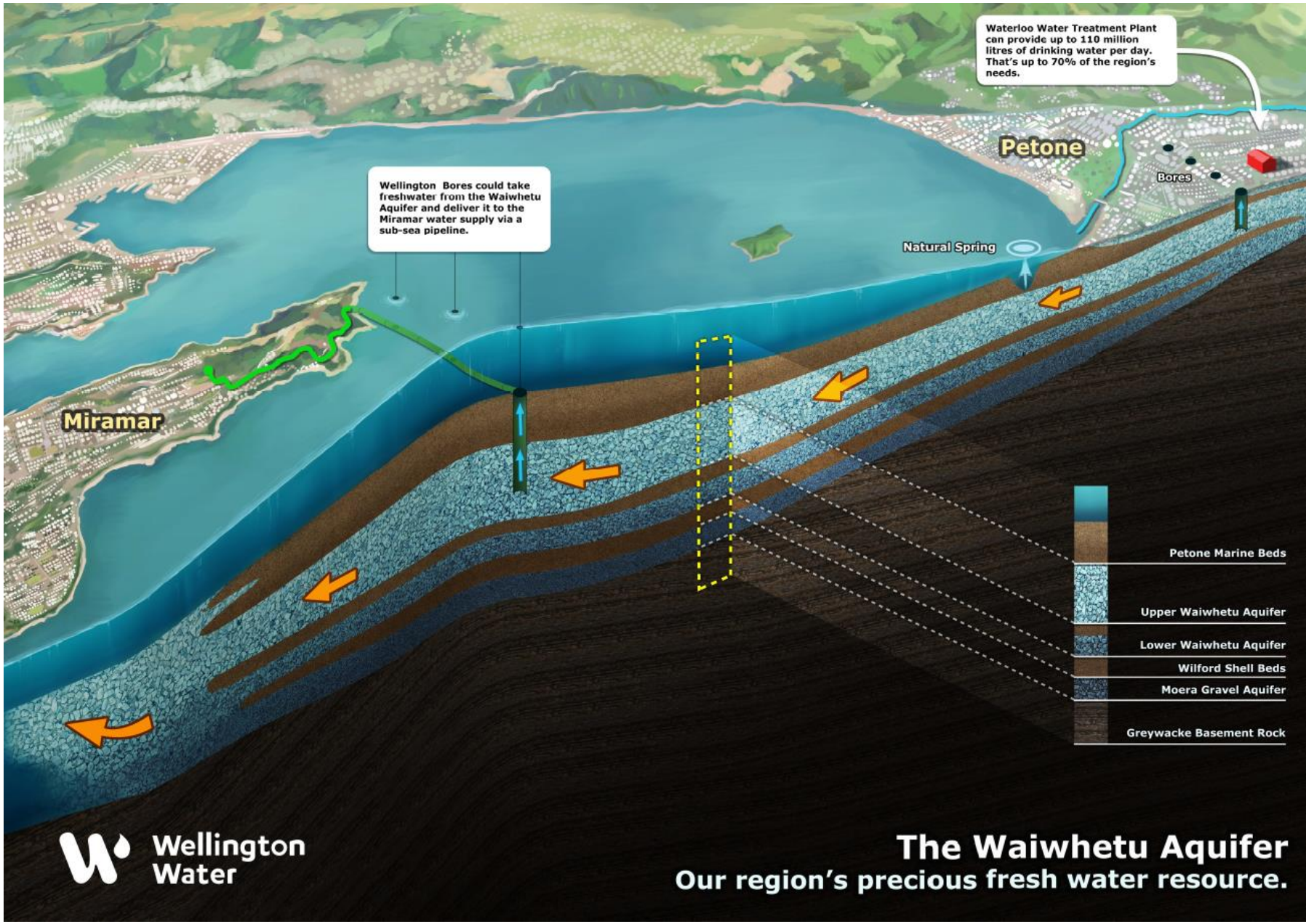
Wellington Region Bulk Water Network

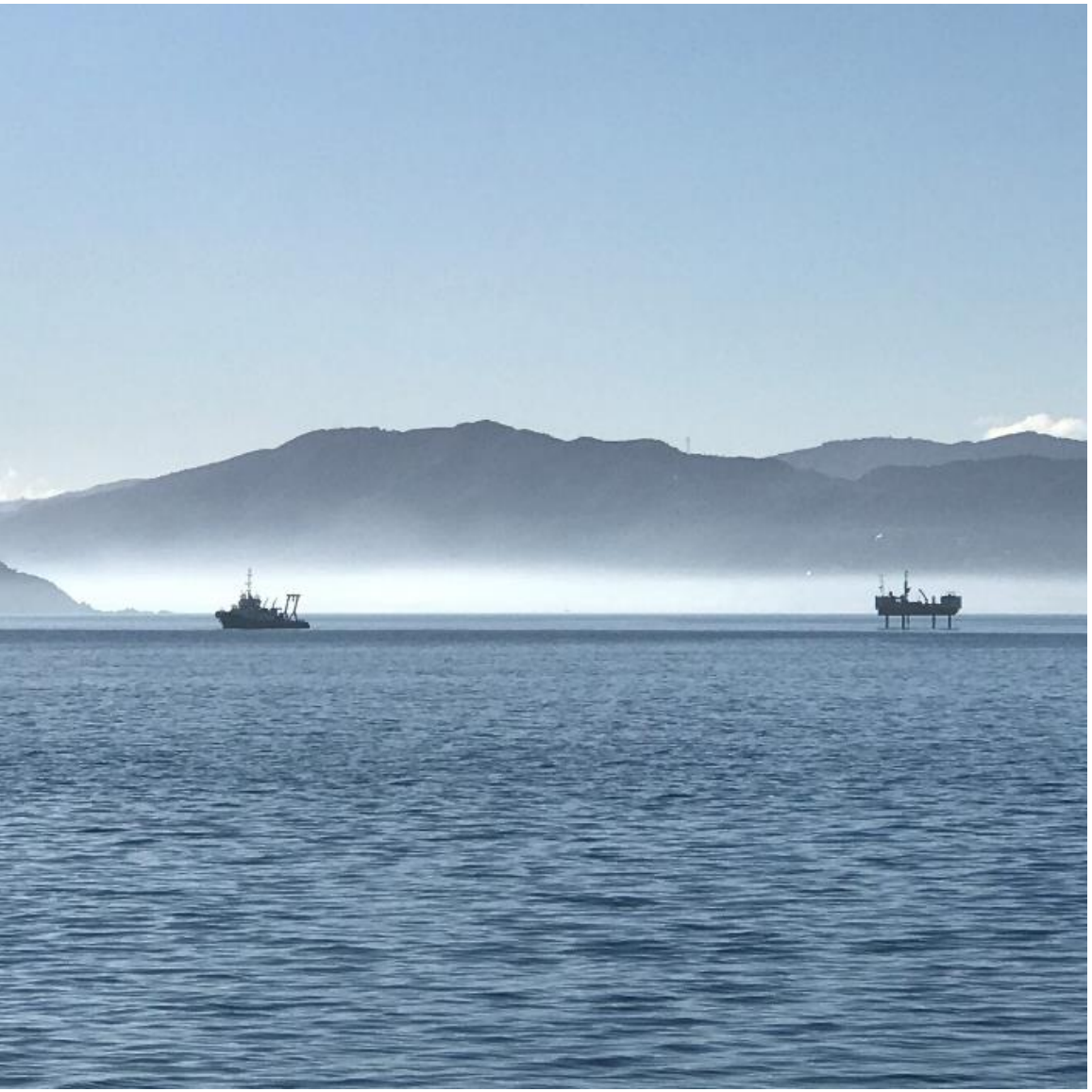


Cross Harbour Pipeline



Harbour Bores



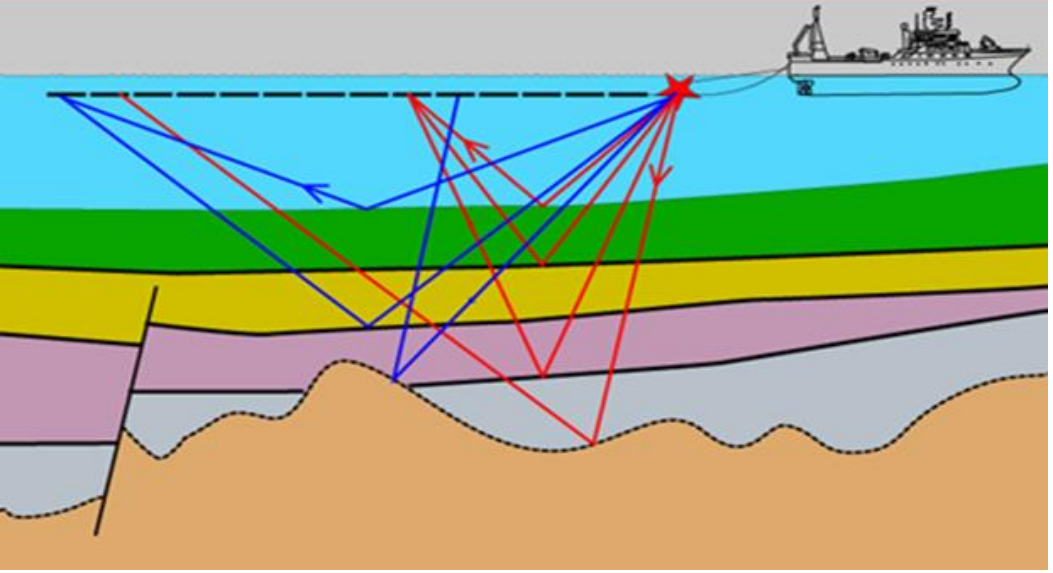


Bores Potential Fatal Flaws

1. Aquifer not present or poor yield
2. Poor water quality – treatment too costly
3. Aquifer unusable following large seismic event
4. Saline intrusion from pumping

Drilling Methodology

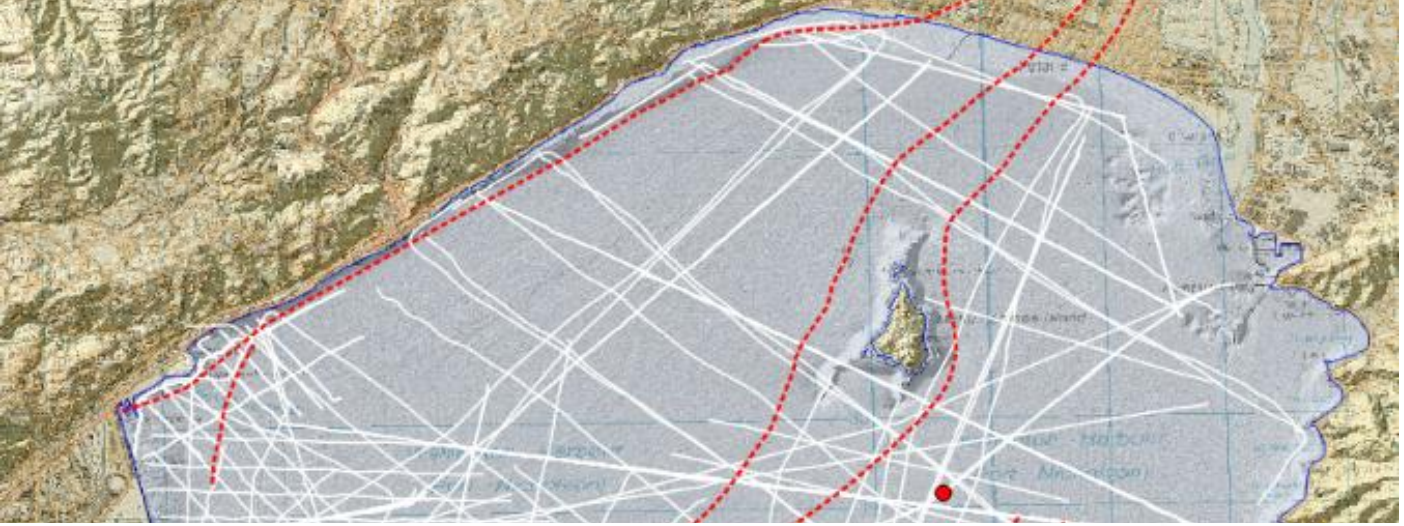
- Fixed platform – jackup barge
- Sonic rig – good core recovery
- Water quality checks
- Pump testing

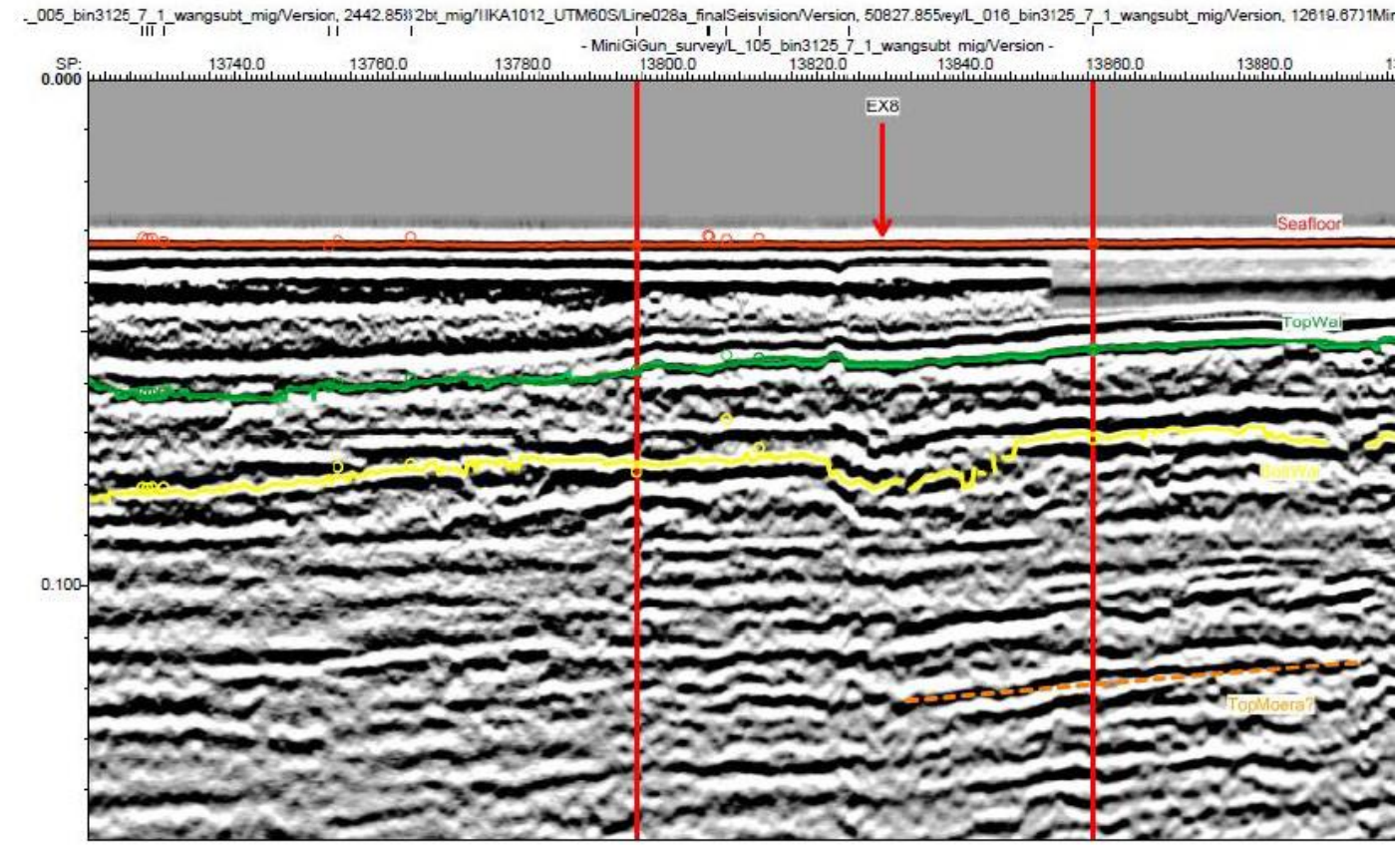


Where do we drill?

Niwa Seismic Reflection Survey (February 2016)

- Seismic reflection
- Mini-GI Air-gun
- Hydrophone Streamer
- R.V. Kaharoa



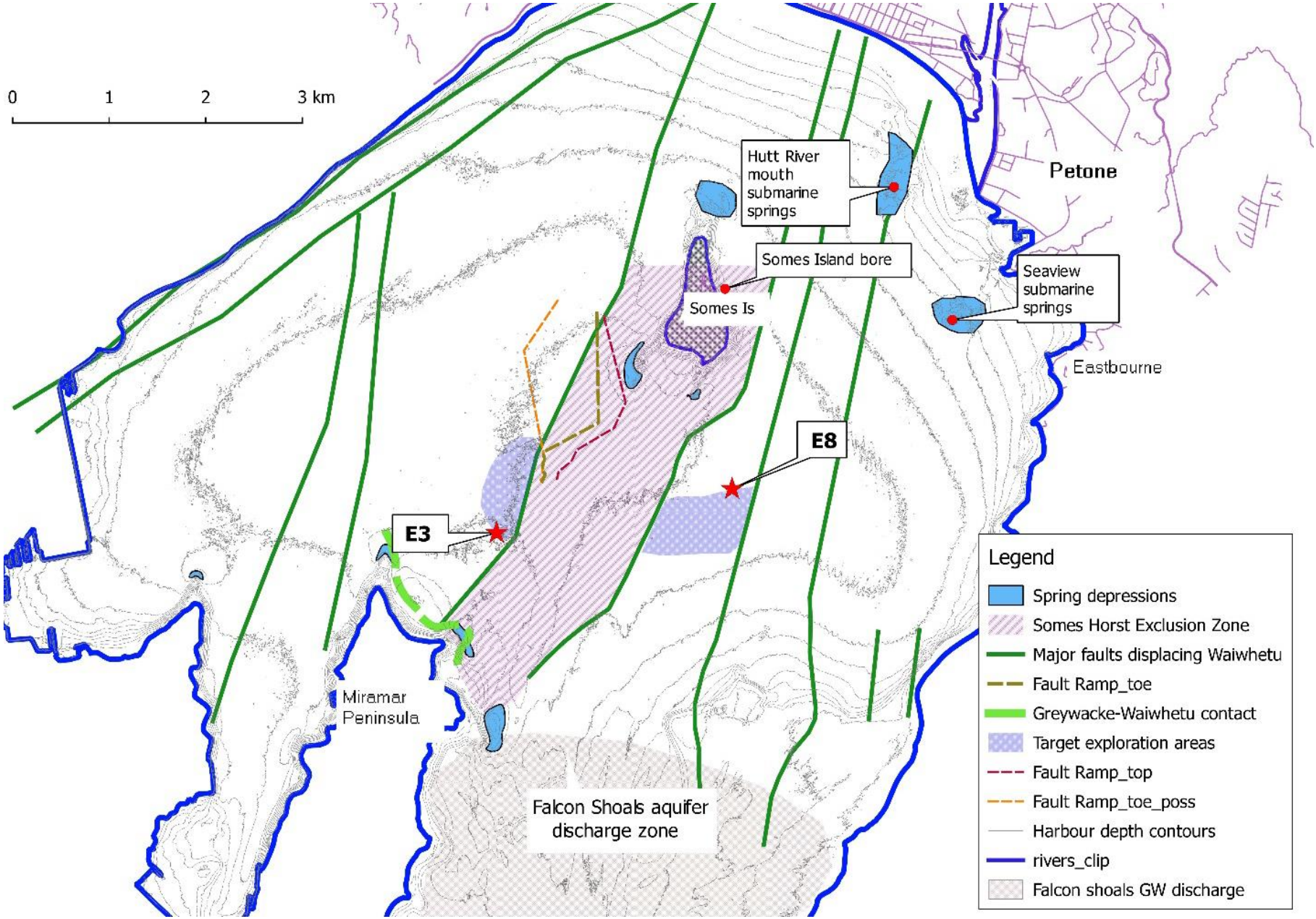


Where do we drill?

Considerations

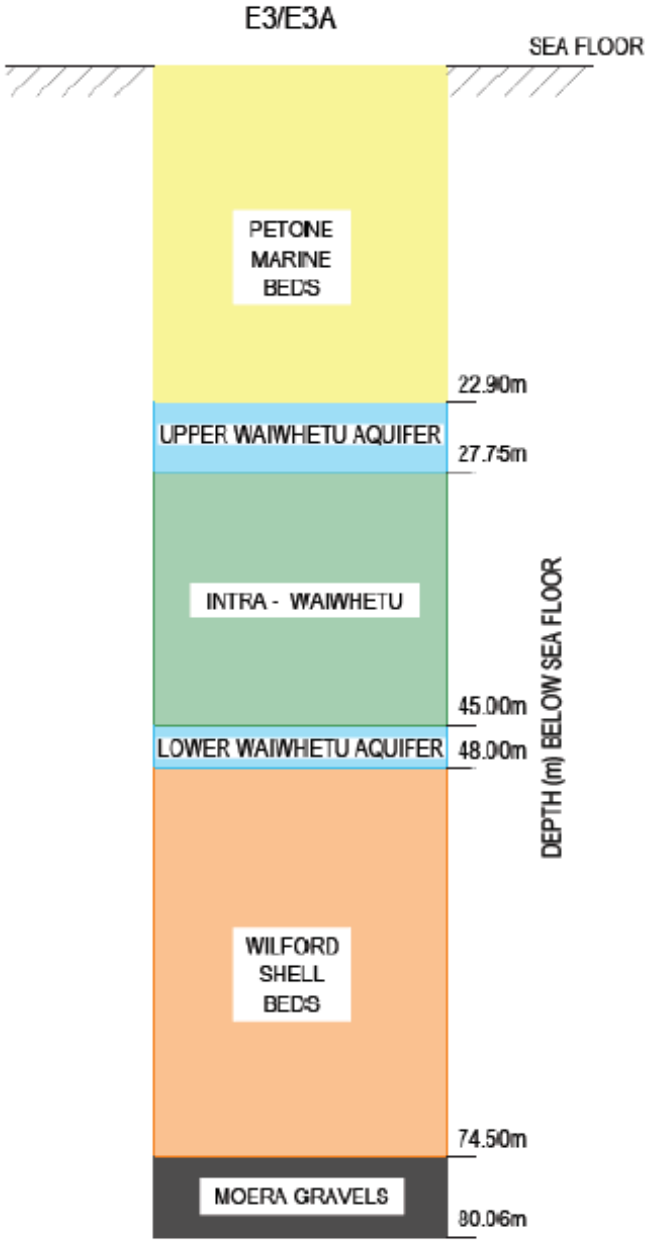
- Aquifer thickness
- Minimise risk of saline intrusion
- Seismic faults
- Minimise borefield cost

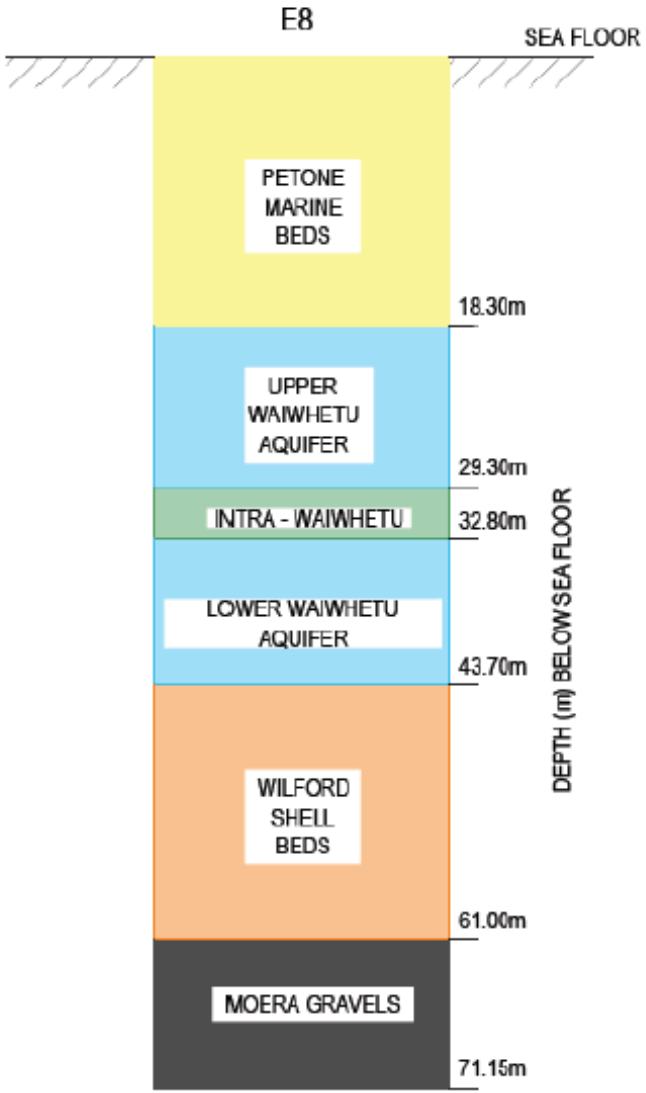
Where did we drill?



What did we find?

Depth: 24.30 m to 26.25 m

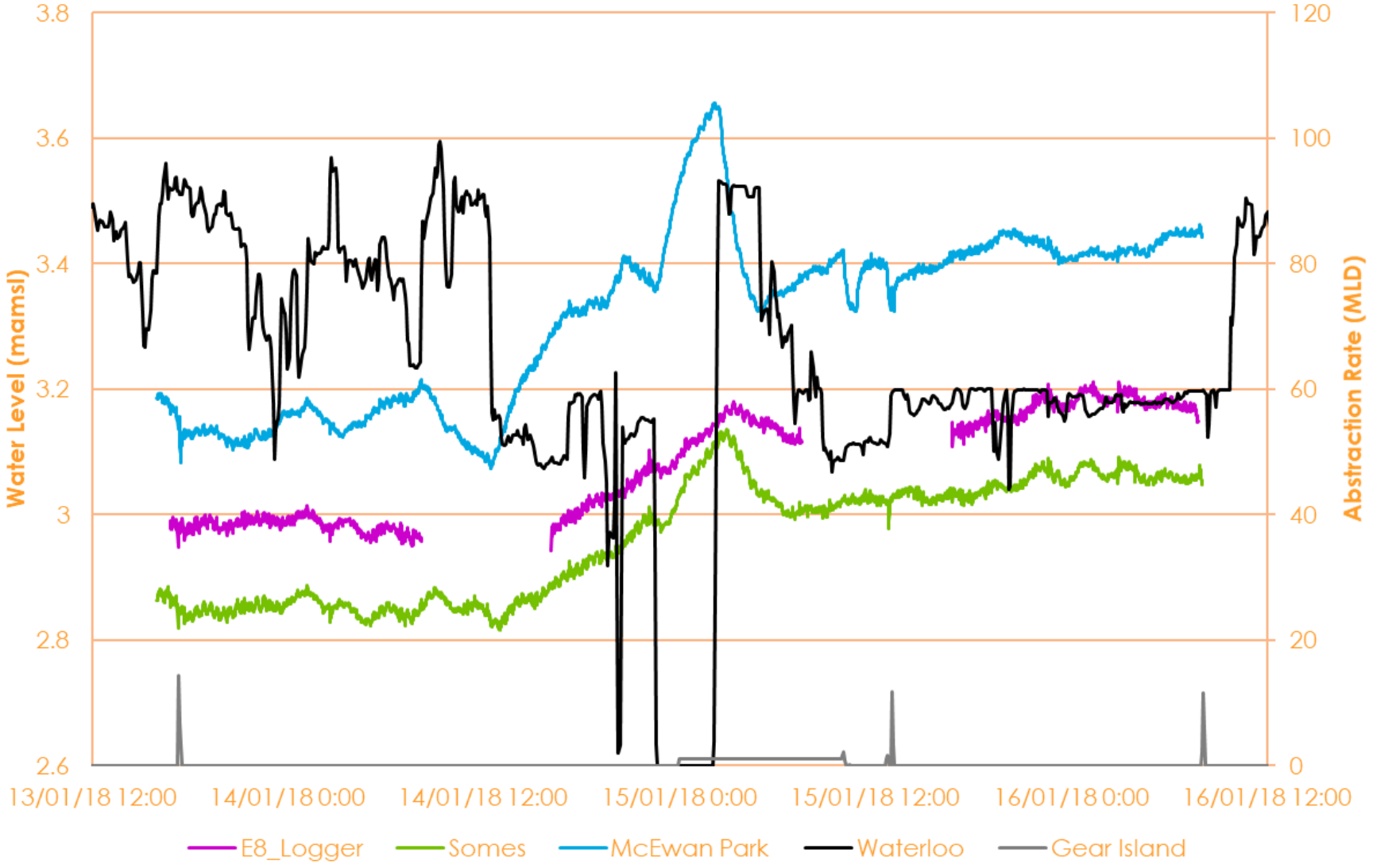




Pump Testing

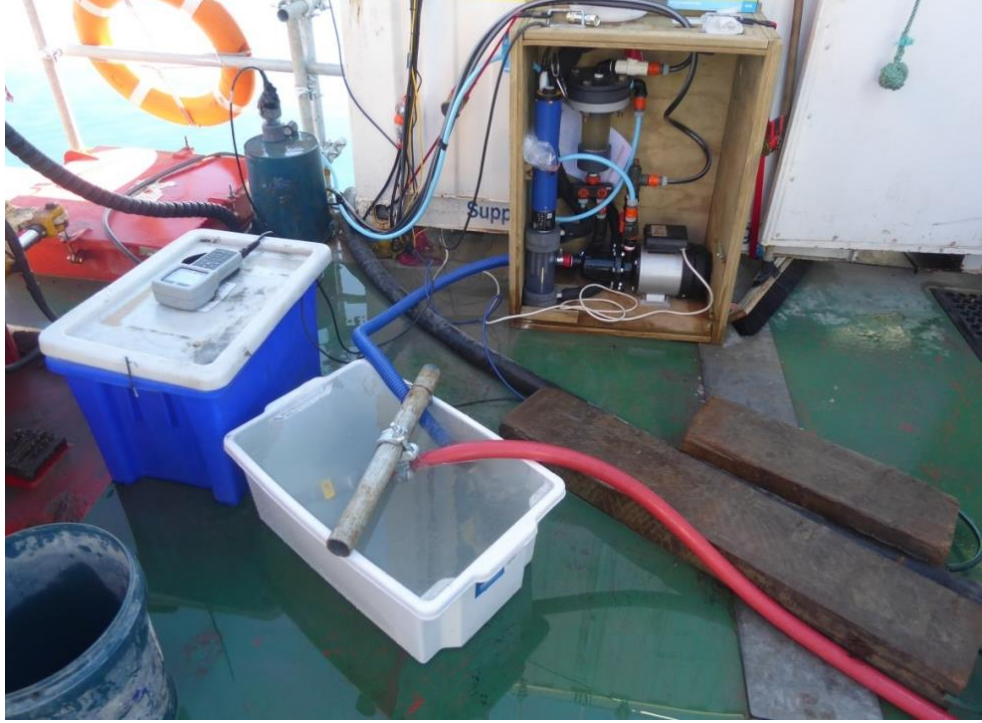
Bore	Aquifer	Yield (MLD)
E8	Upper Waiwhetū	10 – 20
E3	Upper Waiwhetū	2
E3	Moera	2.5 - 3

Pump Testing

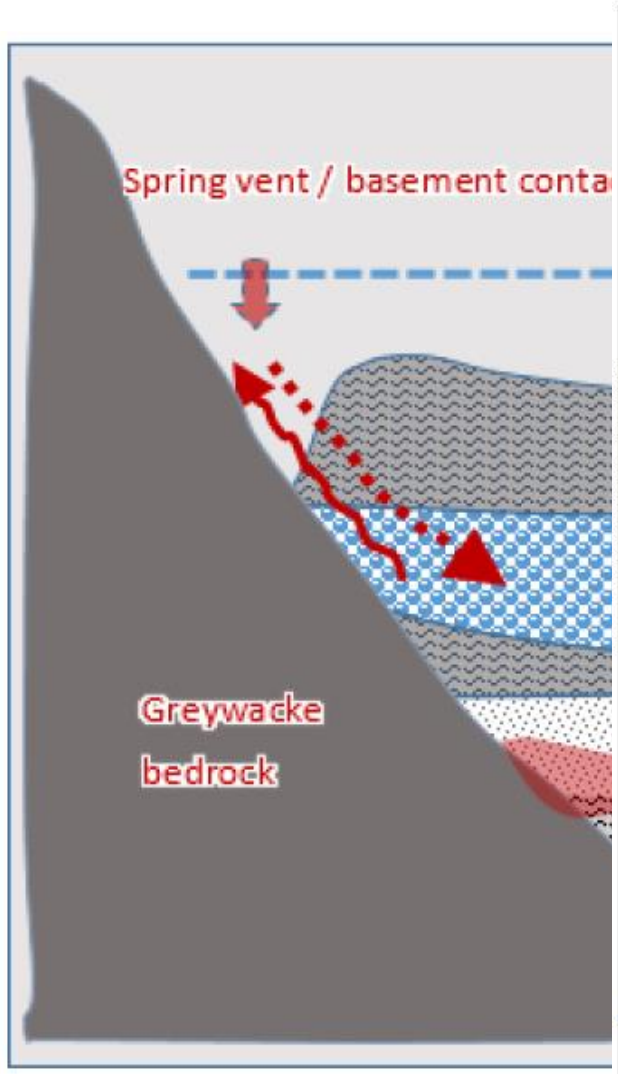


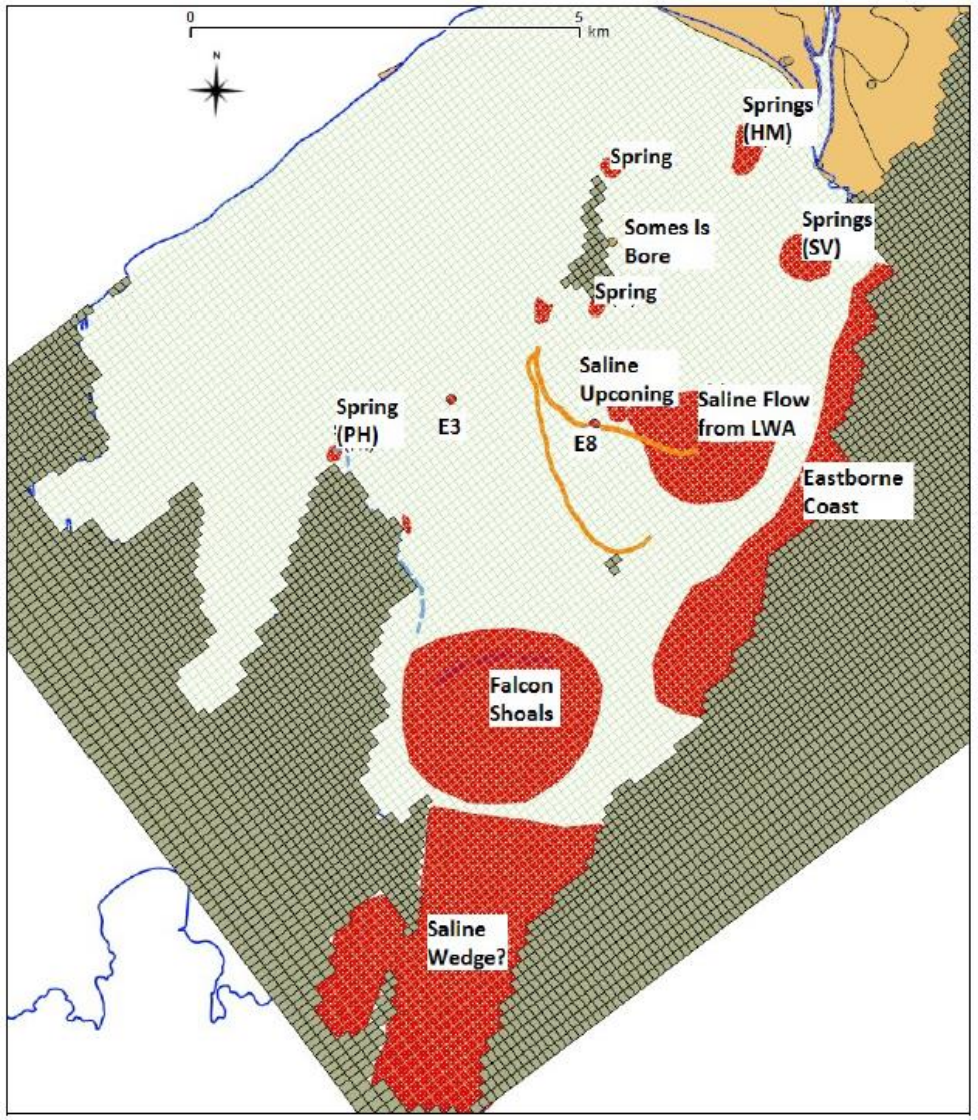
Water Quality

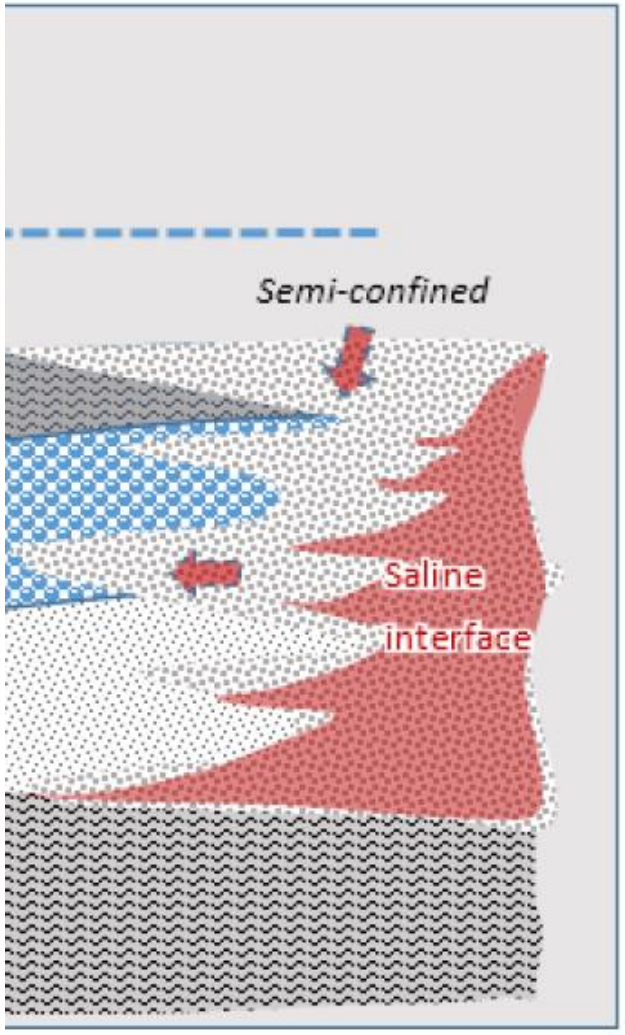
Parameter (mg/L)	DWSNZ		Upper Waiwhetū		Lower Waiwhetū	Moera
	Aesthetic	Human Health	E3	E8	E8	E3
Chloride	250	-	125	74.8	854	314
Ammonia N	1.5	-	3.41	1.08	7.75	5.14
TDS	1000	-	283	236	1750	596
Arsenic (total)	-	0.01	0.006	0.023	<0.001	<0.001
Iron (total)	0.2	-	2.65	0.515	2.45	1.59
Manganese (total)	0.04	0.4	0.537	0.123	0.389	0.299



Saline Intrusion Risk







Summary of Findings from Drilling Activities

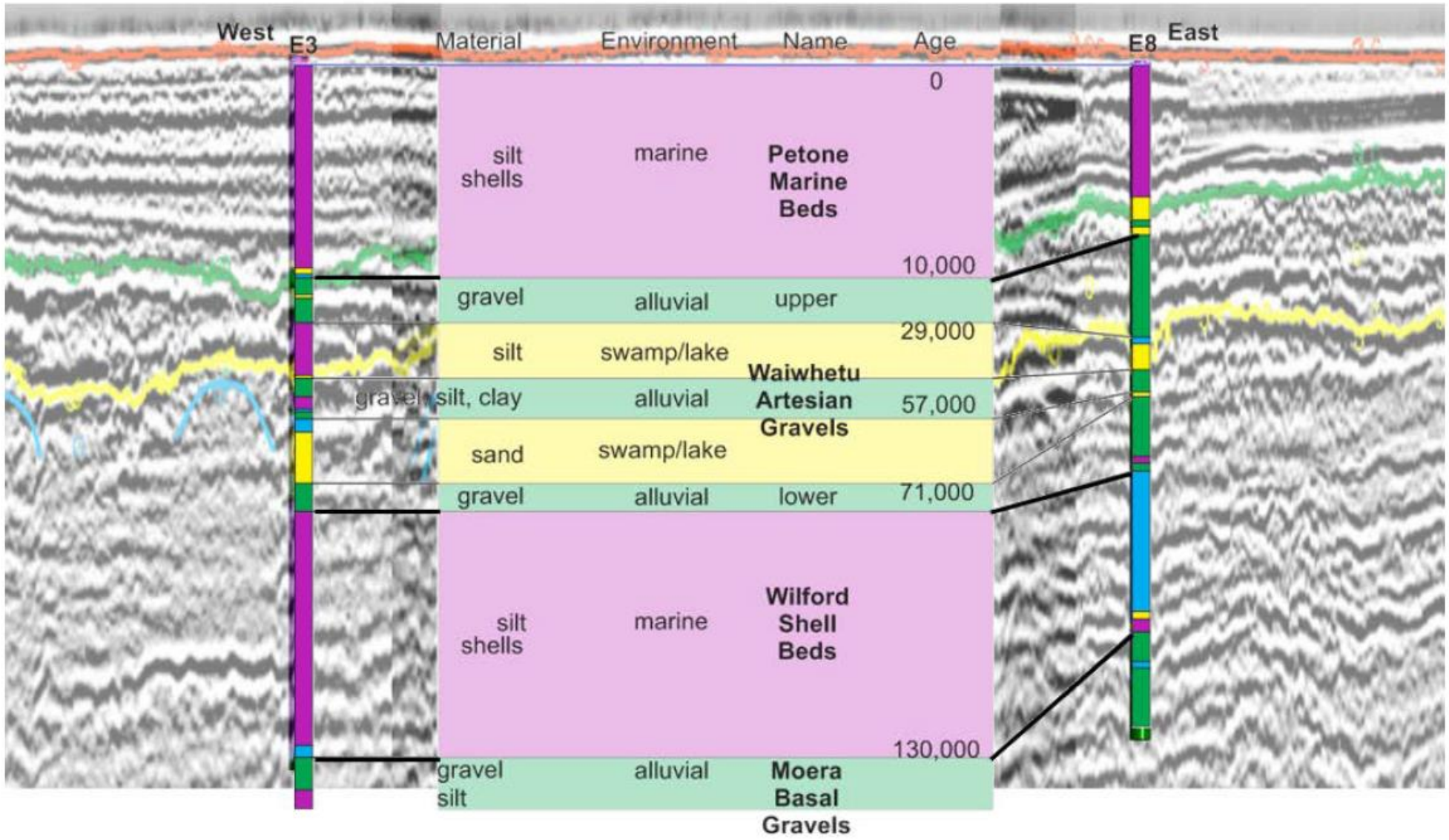
- Yield 10 – 20 MLD
- Potable water present - Treatment required for DWS NZ
- Saline intrusion risk – more testing required

Further Testing Required

MCA review - Yield not sufficient to meet objectives, and treatment cost increase

Cross Harbour Pipeline now preferred option.

Updated Interpretations



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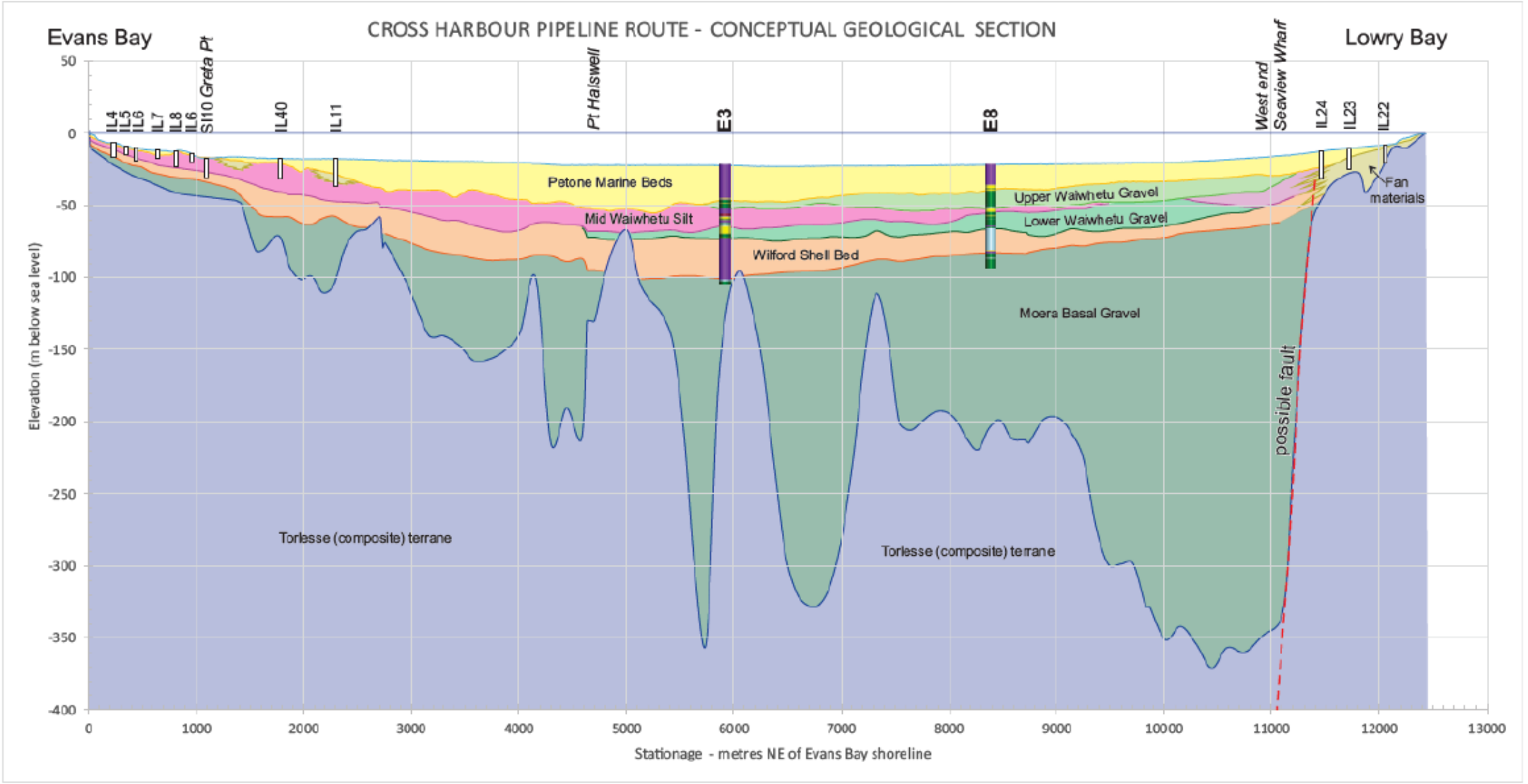
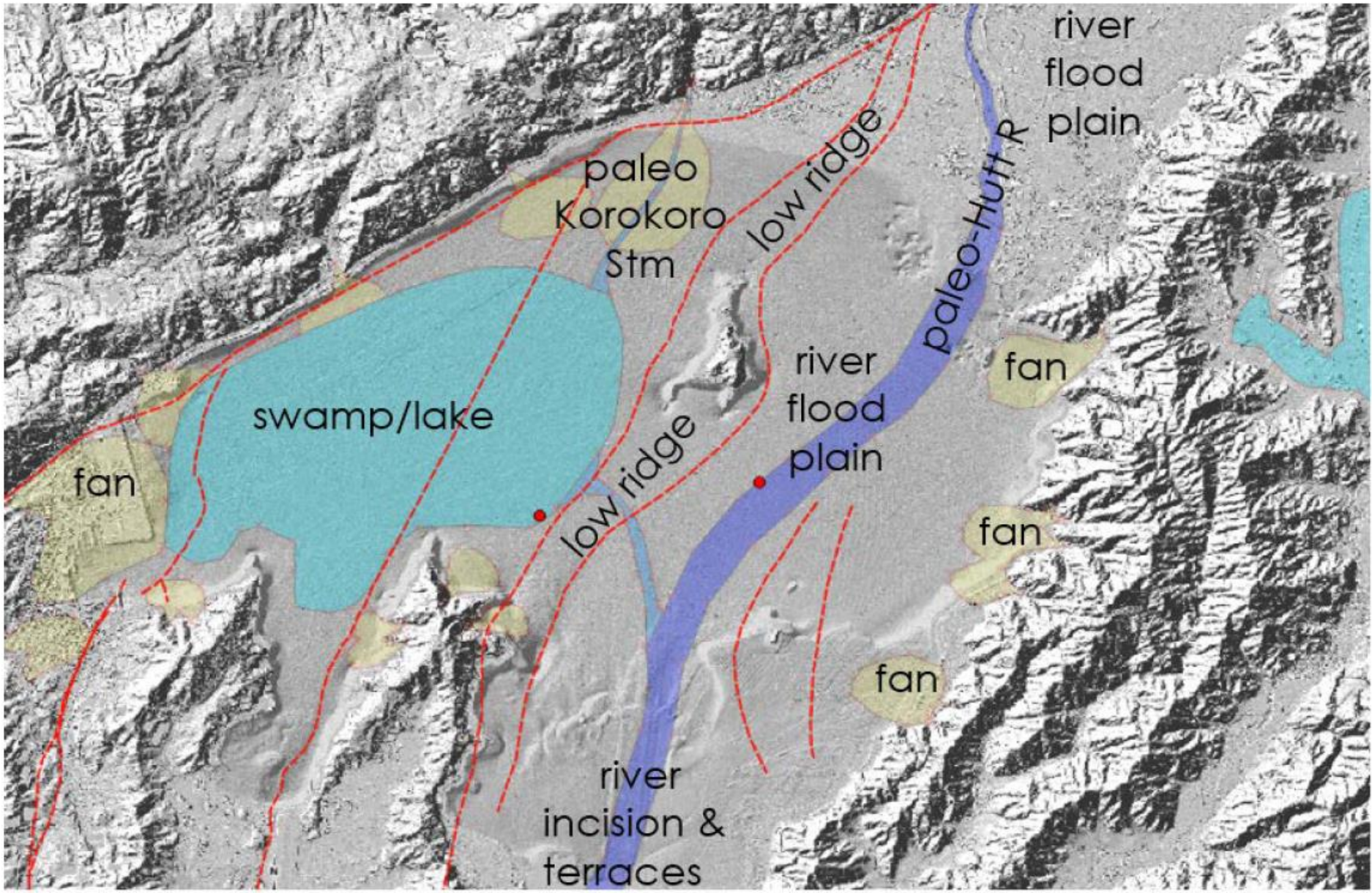
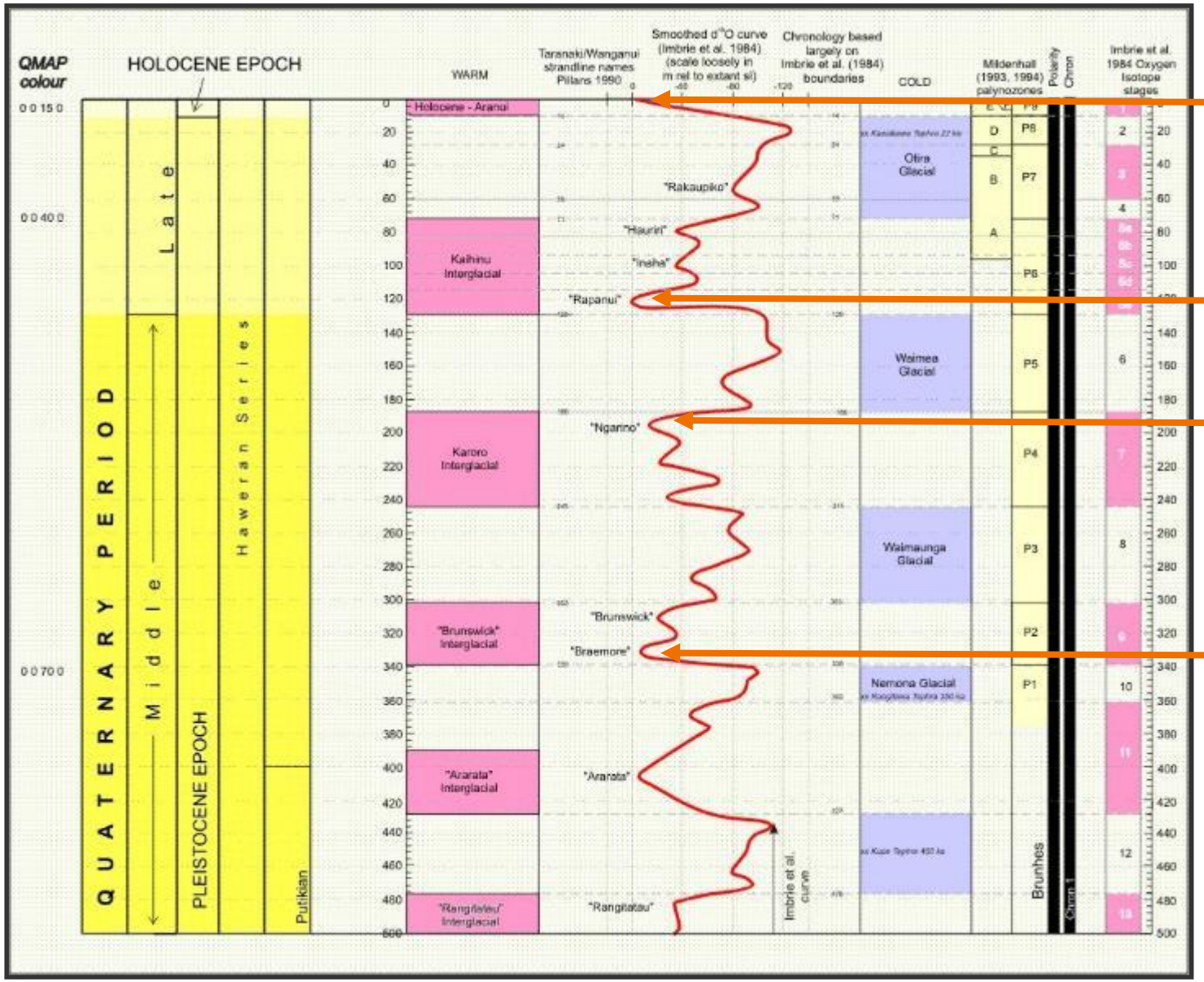


Theory (Begg 2019)



Climate and the Sea Level Curve



Today's sea level

low sea level

125 ka sea level

low sea level

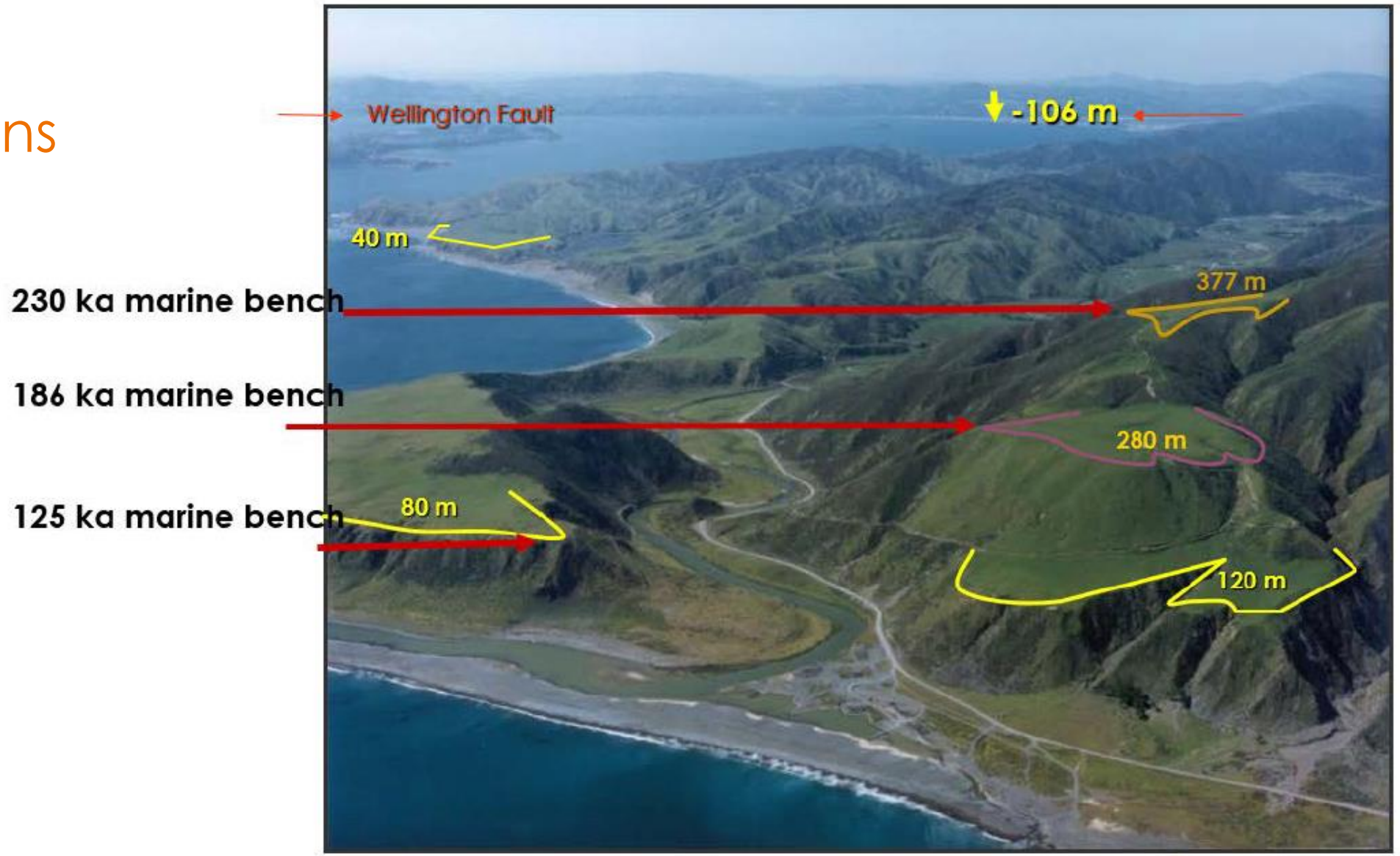
186 ka sea level

low sea level

230 ka sea level

low sea level

Updated Interpretations



Benefits of Information Obtained from Harbour Drilling

Improved management of the onshore Waiwhetū Aquifer through:

- Enhanced understanding of the offshore and near-shore hydrogeology
- Will enable refinement of sustainable onshore yield and management
- Improved confidence in saline intrusion risk minimisation – including aiding design of optimal and cost-effective monitoring

Future Studies

- Detailed core study of pollens, shells, radiocarbon dates
- Characterise changing climate and environments through the sequence
- Model geological units across entire harbour/Hutt Valley area
- Calculate subsidence rates across entire basin

Acknowledgements

greater WELLINGTON REGIONAL COUNCIL Te Pane Matua Taiao

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Stantec

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Heron

ENGEO

pdp

GNS SCIENCE TE PŪ AO

EarthinMind

NIWA Taihoro Nukurangi