

The Manukau Harbour: A Dynamic History



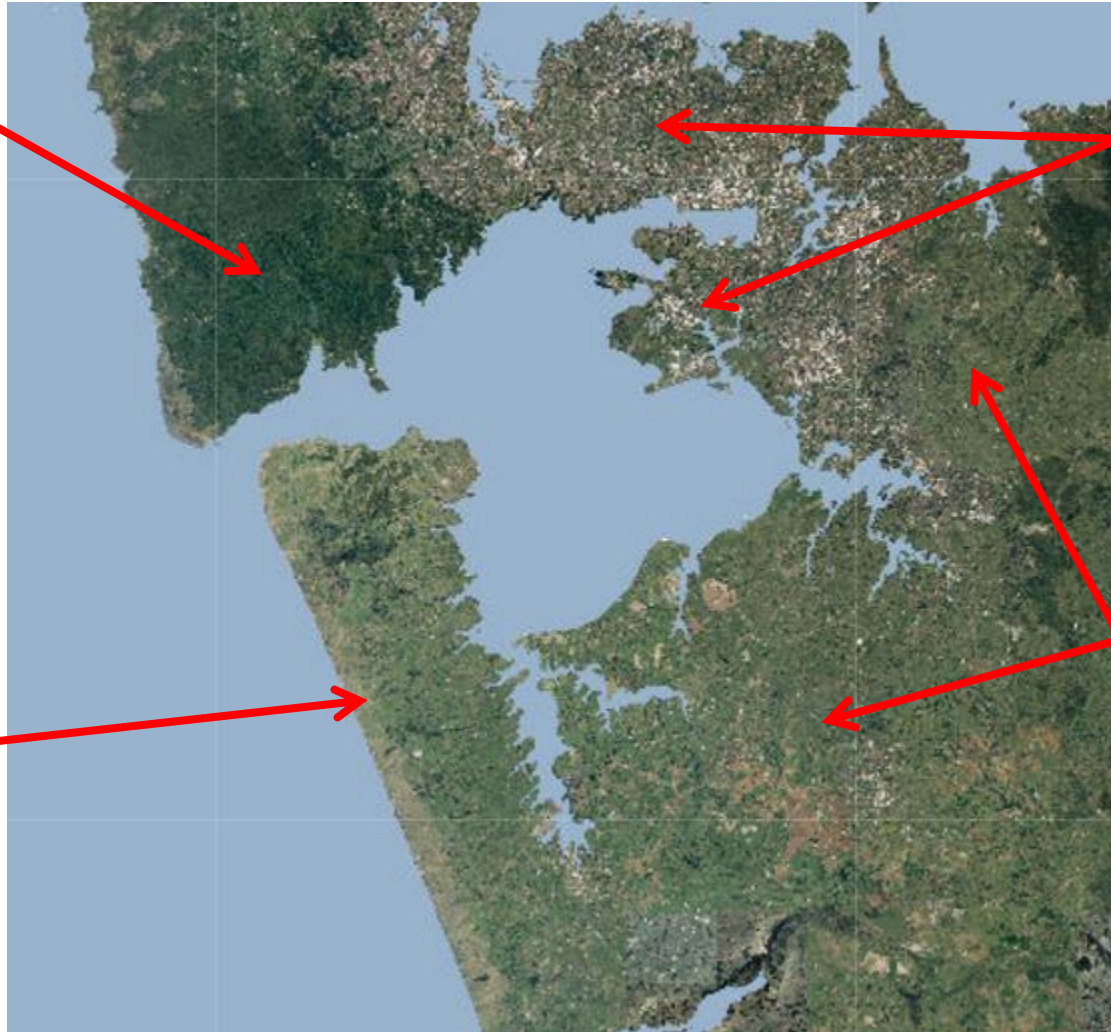
Geology

**Volcanic Origin
(22-15m yrs)
From the
Waitekere
Volcano**

**Volcanic Fields
(150,000 - 600
yrs)**

**Quarternary
Dune Barrier
(2.6m yrs)**

**Puketoka
Formation (5.3-
1.8m yrs)**

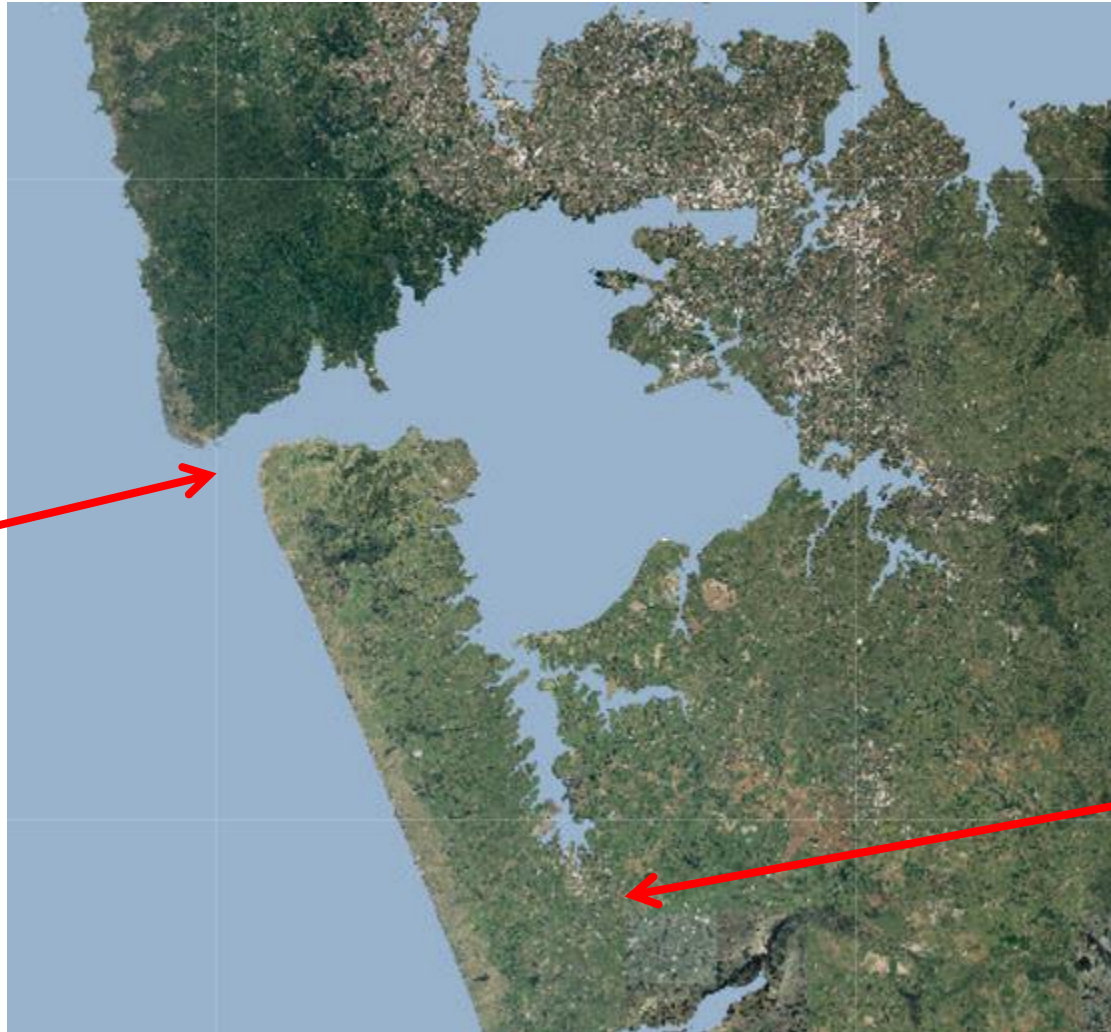


Hydrodynamics

Shore length:
460 km

Surface Area:
365 km²

Constricted
Flow

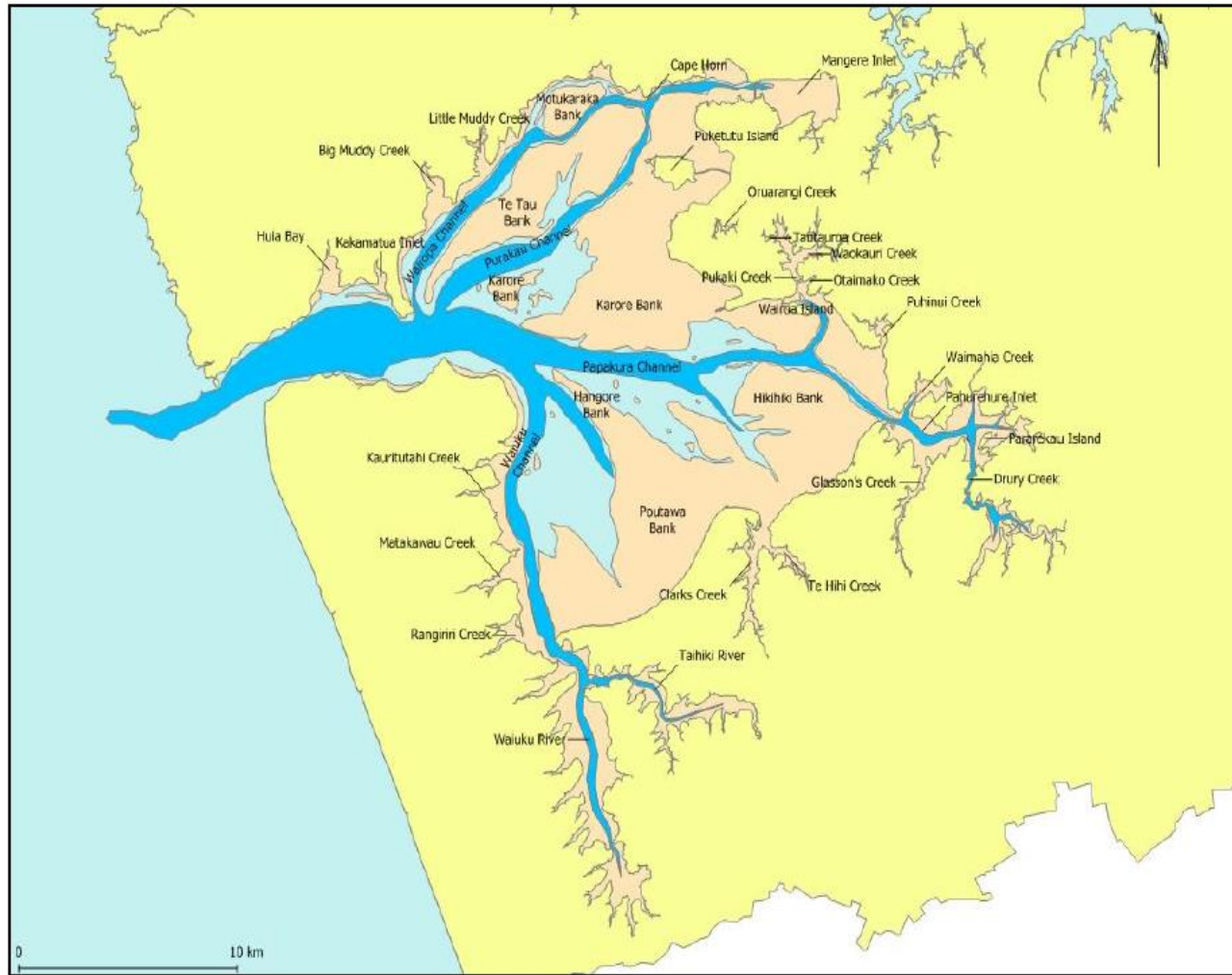


Waikato River
cut off 3m yrs
ago

Hydrodynamics

Four main channels:
Wairopa
Parakau
Waiuku
Papakura

Spring Tide
Volume:
221.5 million
m³



62% of
area are
sand/mud
banks

Hydrodynamics

**Hydrodynamics dominated by tides in main areas,
Wind and fresh water in upper arms**

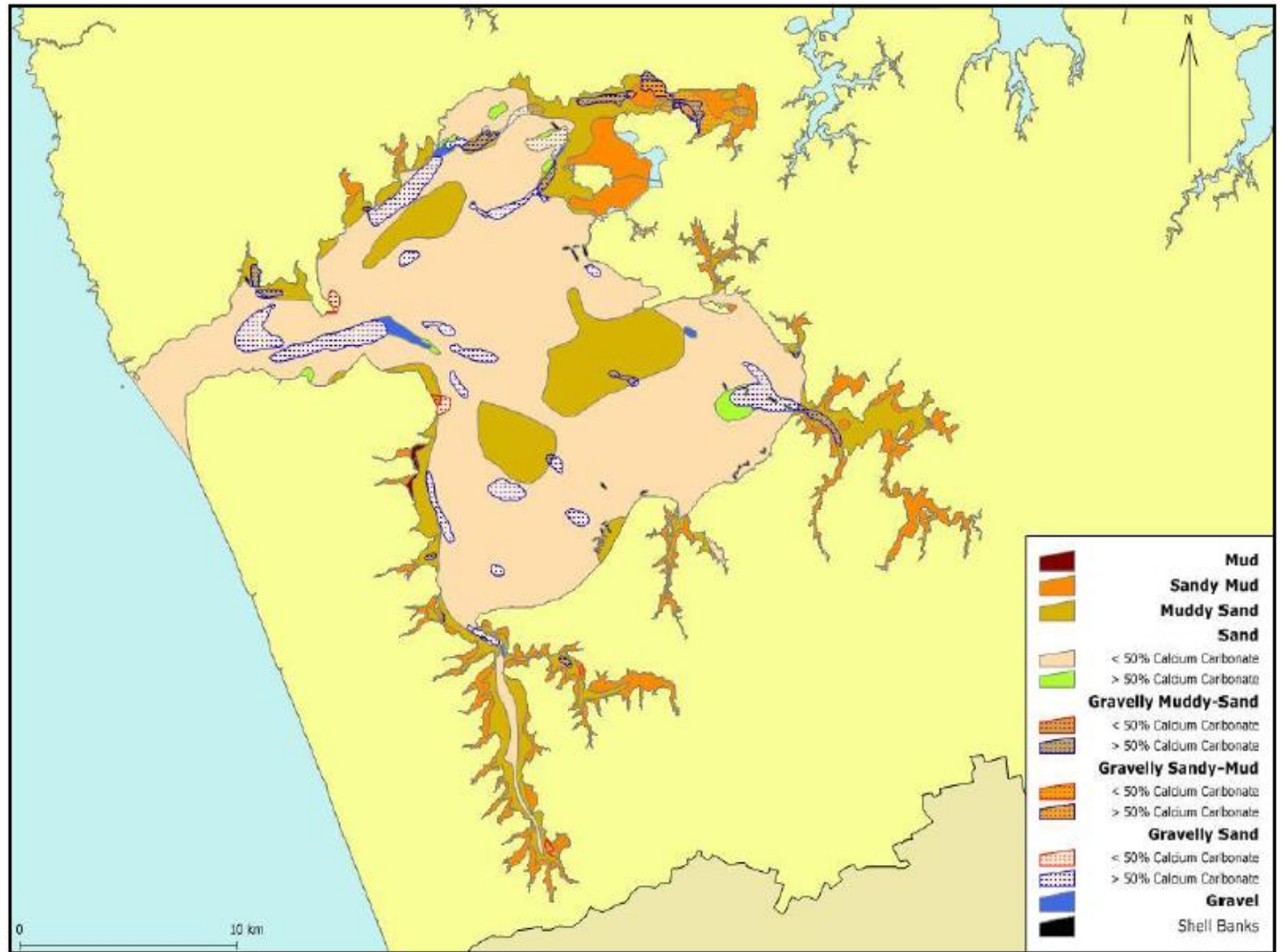
Sediment movement causes high turbidity



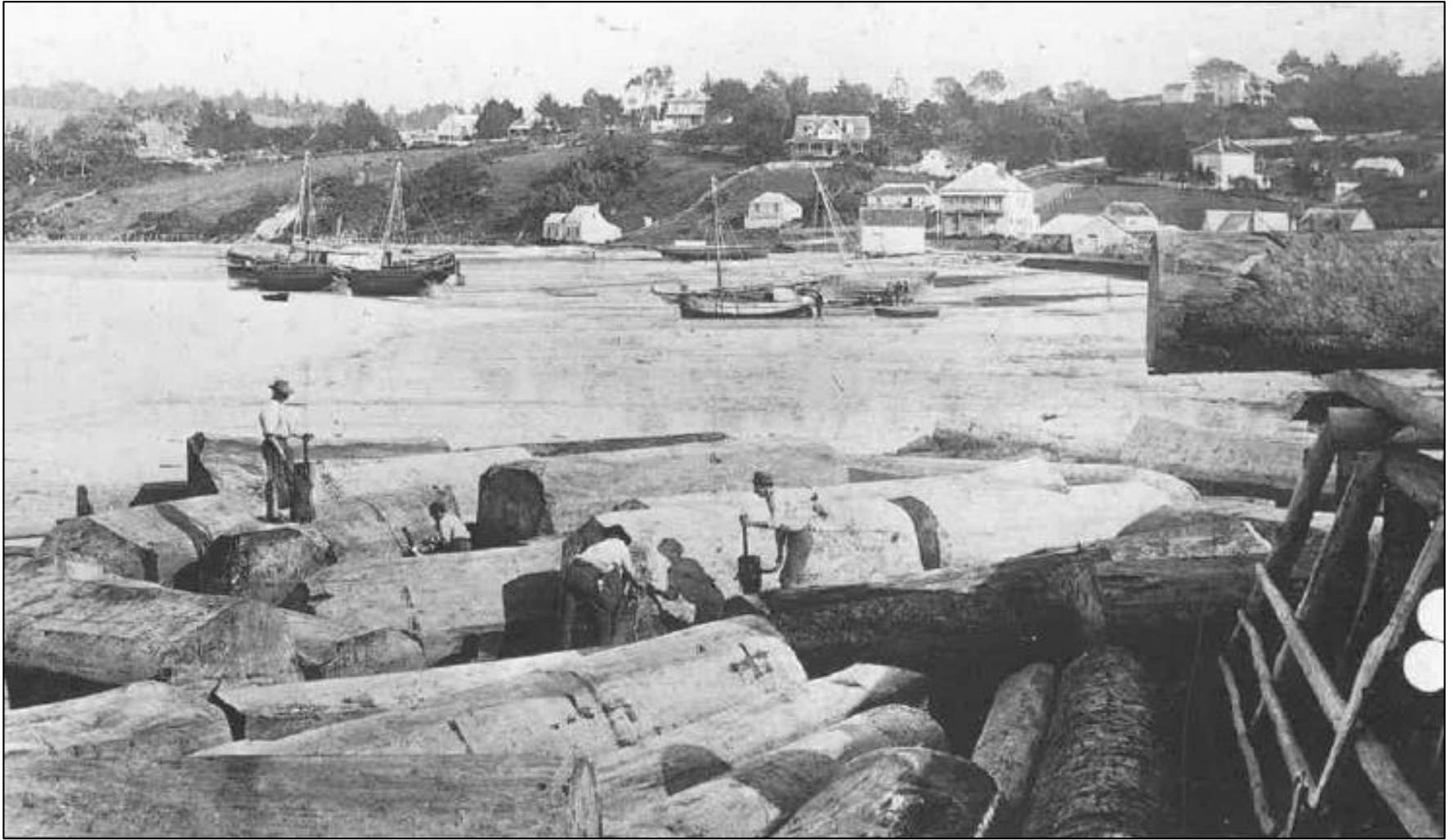
Sediment

Sediment laden
harbour

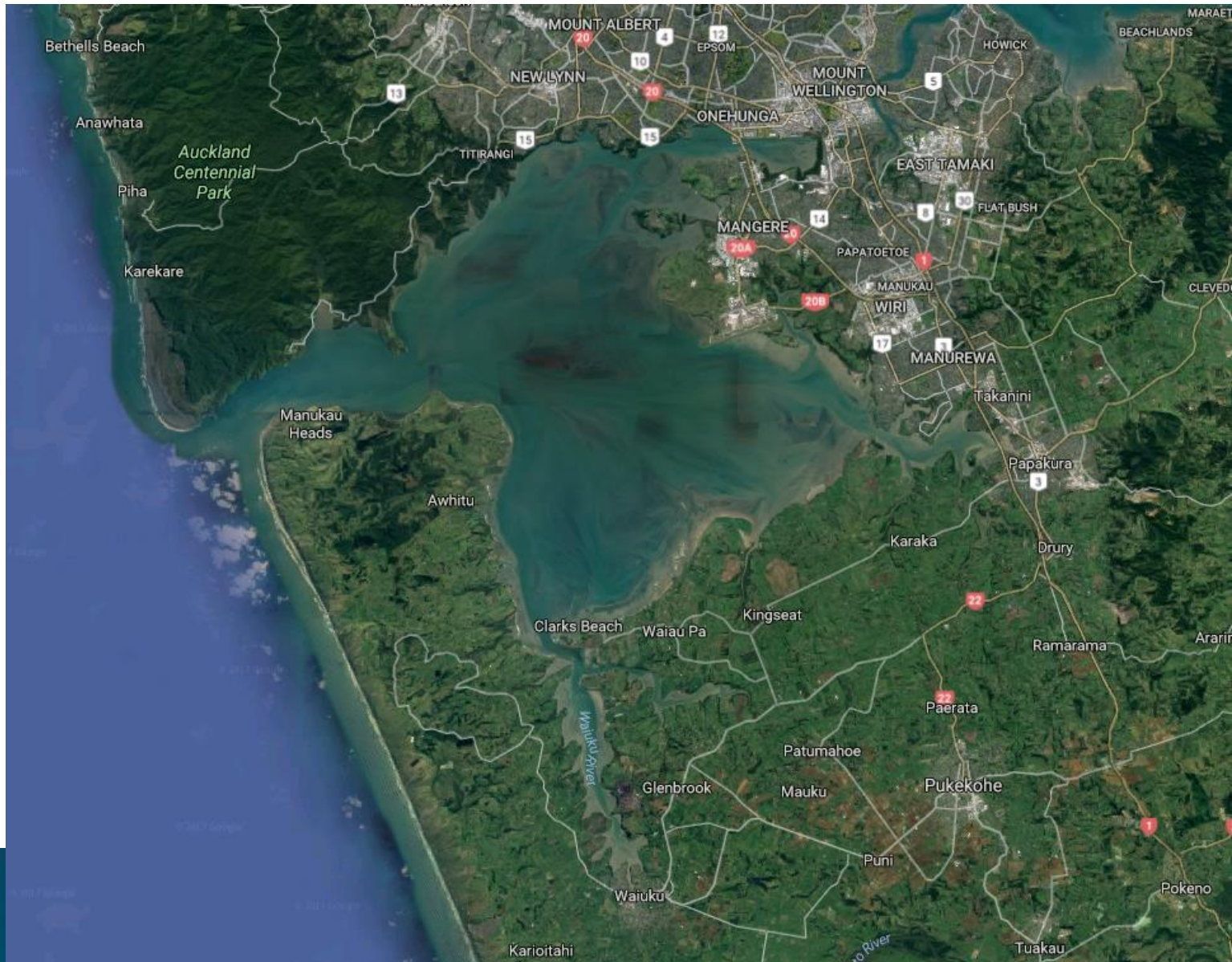
Increased
Sediment from:
Deforestation
Urbanisation
Farming



Landuse Change (Deforestation)



Urban Expansion

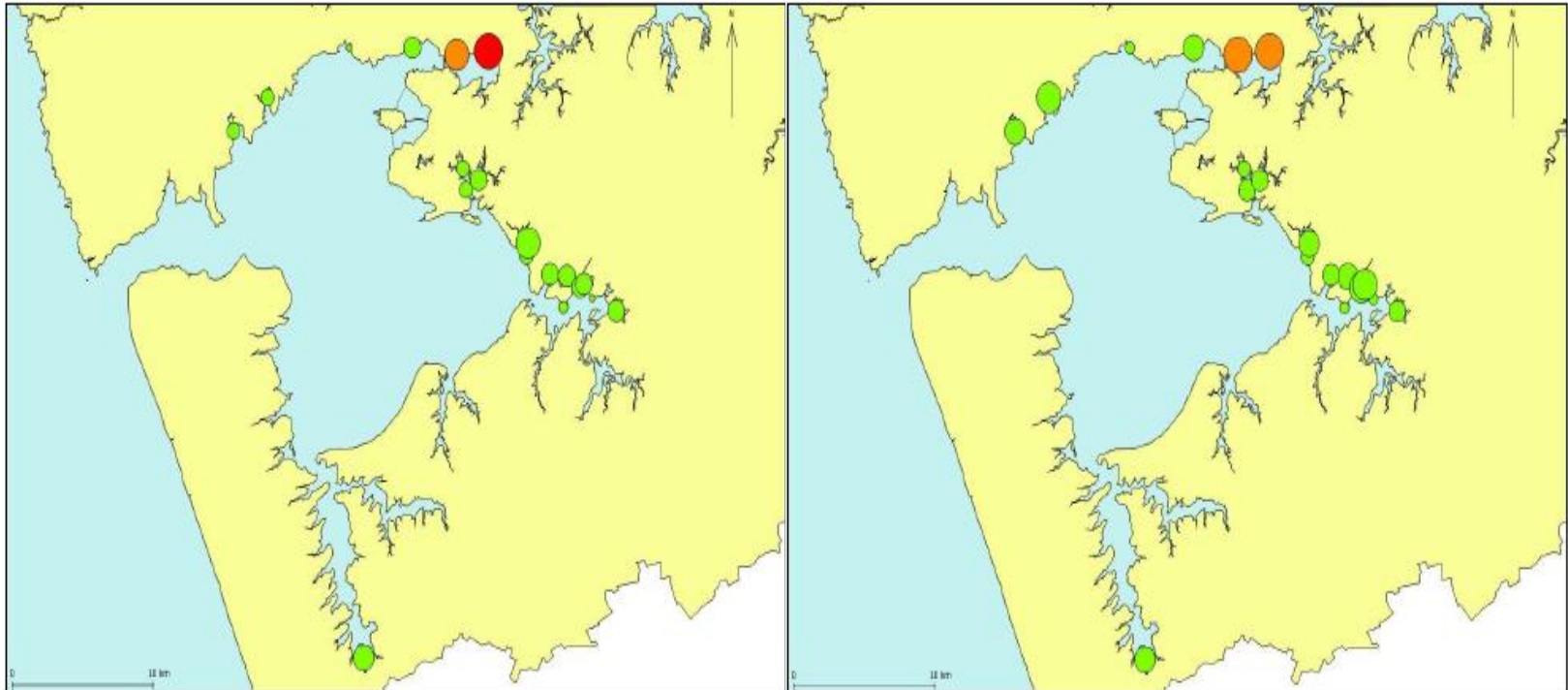


Discharges into the Mangere Inlet

Raw discharge from:

- 3 large meat works
- An abattoir
- 3 phosphate fertiliser works
- 2 wool scours
- Several fellmongers
- Soap and candle works
- A wood-pulp works
- A battery works
- A woollen mill
- A tannery
- A glue works
- Middlemore Hospital
- Leachate from multiple refuse tips
- Run-off from Ōtāhuhu railway workshops
- Run-off from Pacific Steel
- And Ōtāhuhu Borough Council septic tanks

Heavy Metal Contamination



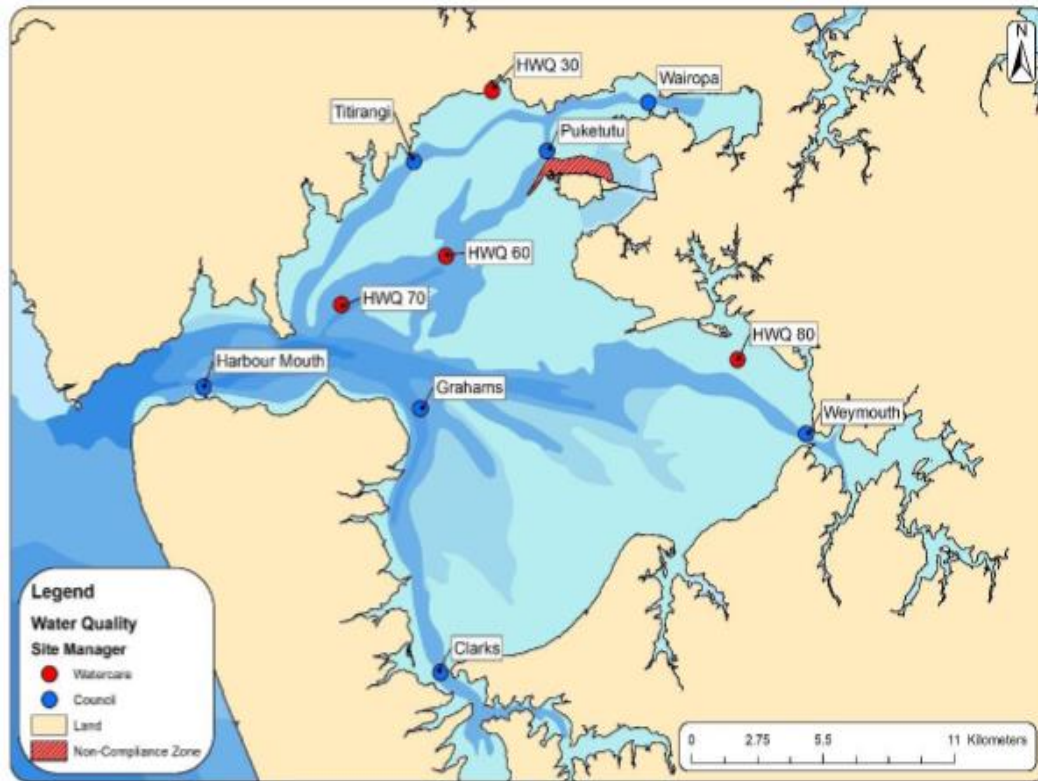
Total zinc

Total copper

Mangere WWTP



Environmental Monitoring



Water
Sediment
Benthic ecology
Benthic macro algae
Marine biota (shellfish)



Why Build a Hydrodynamic Model?

We have

- Pieces of the environmental puzzle:
 - Data
 - Theoretical understanding but without quantifiable cause and effect

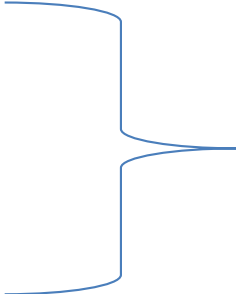
We don't have

- A mechanism to fit these pieces together to obtain quantifiable results

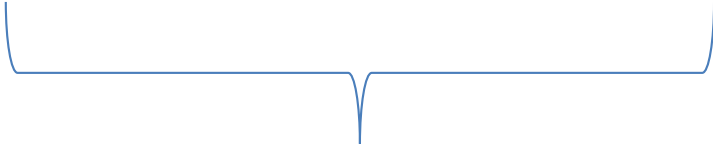


Four Models in One

Catchment Models

1. Hydrological Model (TOPNET)
 2. Water Quality Model (CLUES)
- 

Harbour Models

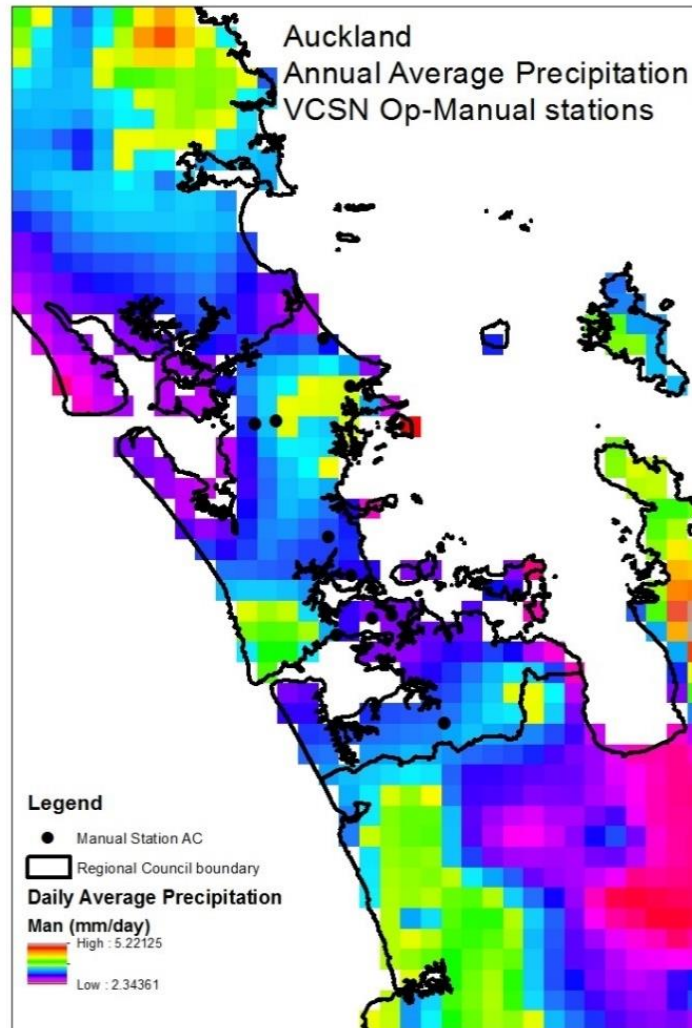
1. Hydrodynamic Model (DeltaFM)
 2. Water Quality Model (DELWAQ)
- 

Results

**Nutrient: sources, processes,
& final destinations**

Hydrological Model

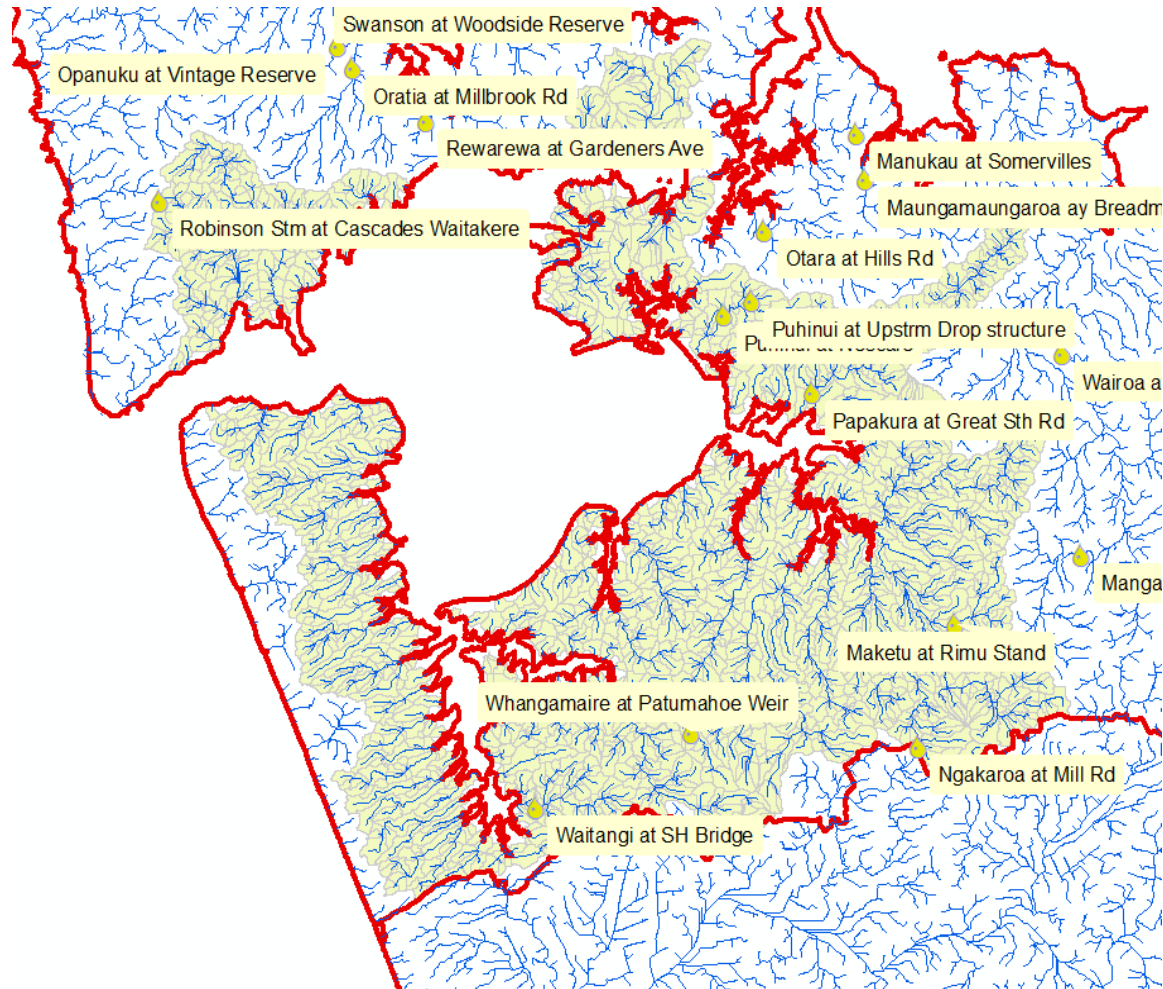
Precipitation Map



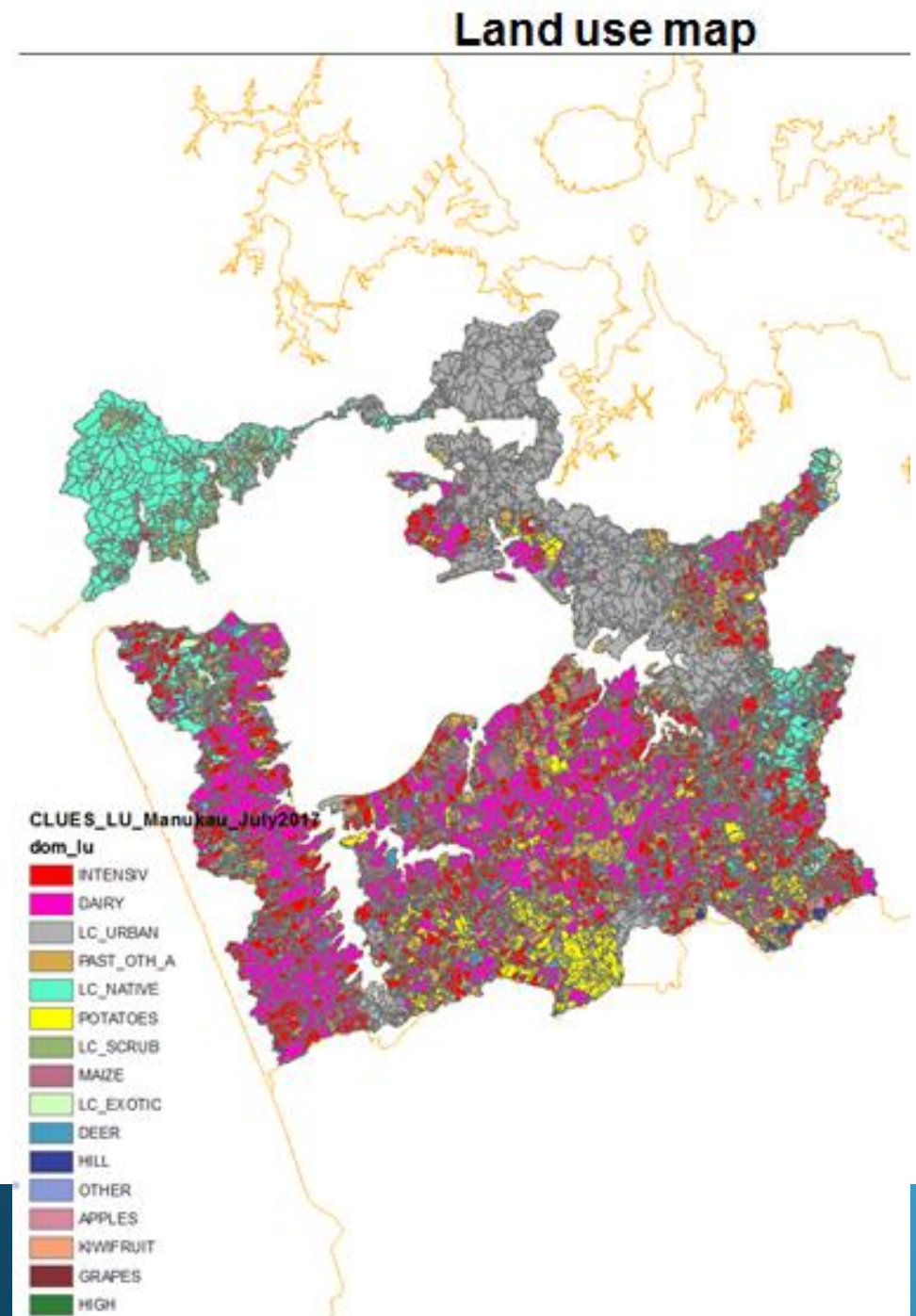
Hydrological Model

Modelling characteristics

- 1907 subcatchments (0.5 km²)
- Inflows to Harbour provided at 297 locations for Clues and hydrodynamic modelling



Water Quality Model

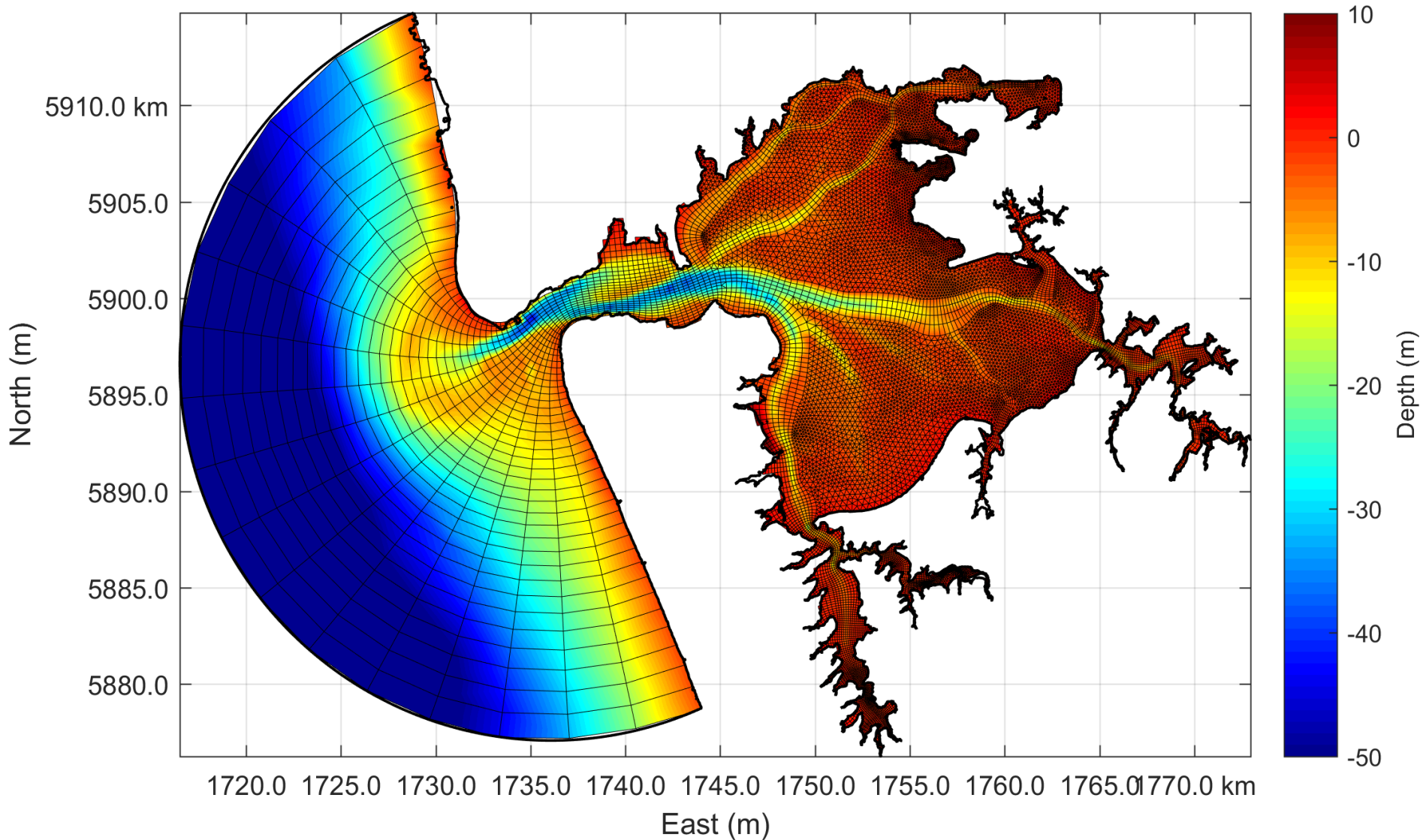


Land Water Quality Model

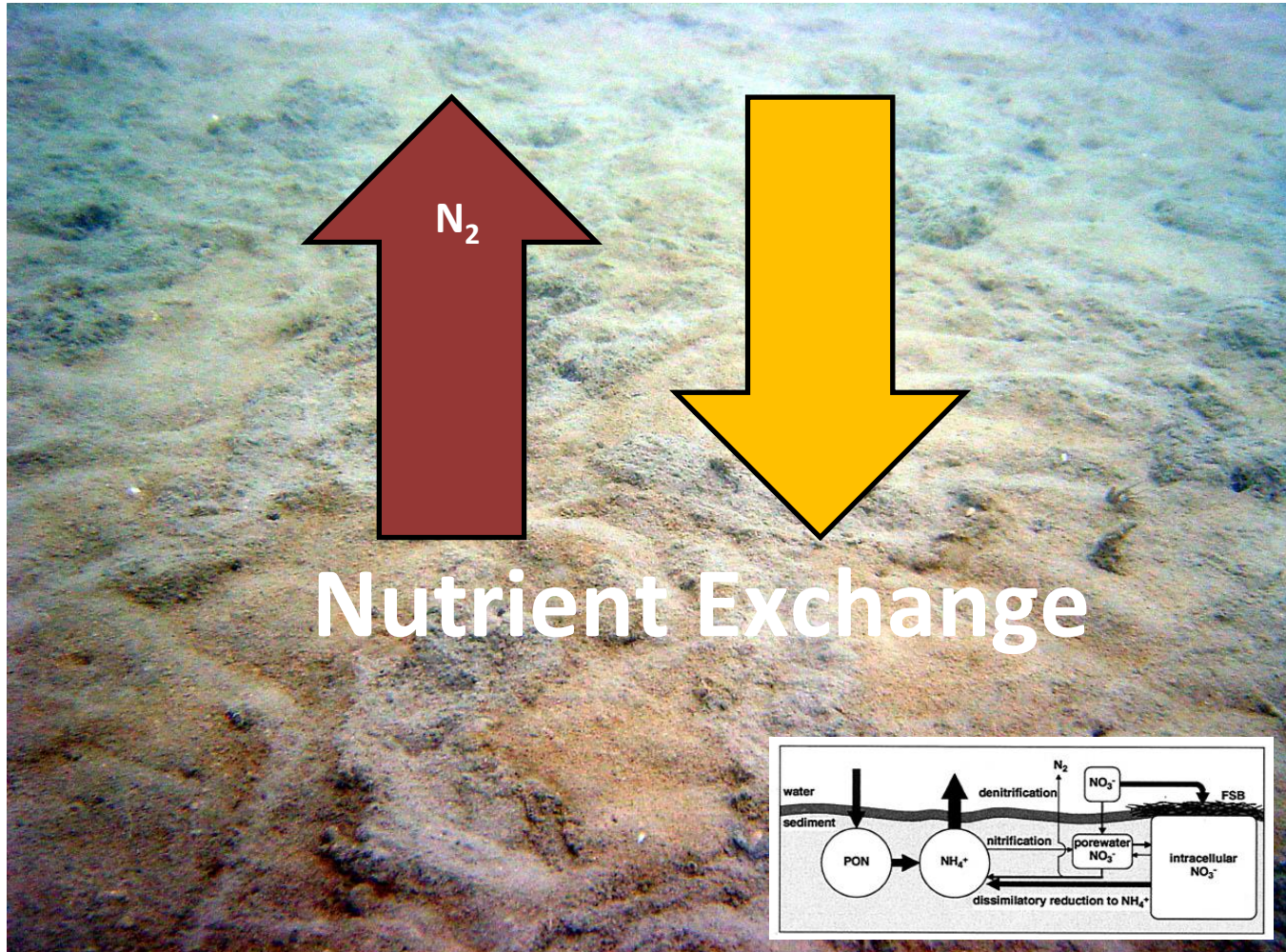
Land use table

CLUES land use classes – diffuse sources	Area (ha)	Percentage of total
SB Intensive	16850	21
Dairy	16010	20
Urban	14900	18
Other Stock	11240	14
Native Forest	10000	12
Potatoes	4090	5
Scrubland	2410	3
Maize	1890	2
Plantation or Exotic Forest	1630	2
SB Hill, SB High, Deer, Tussock, Ungrazed pasture, Onions, Kiwifruit, Apples, Grapes, Other land use covers	2760	3
TOTAL	81780	100

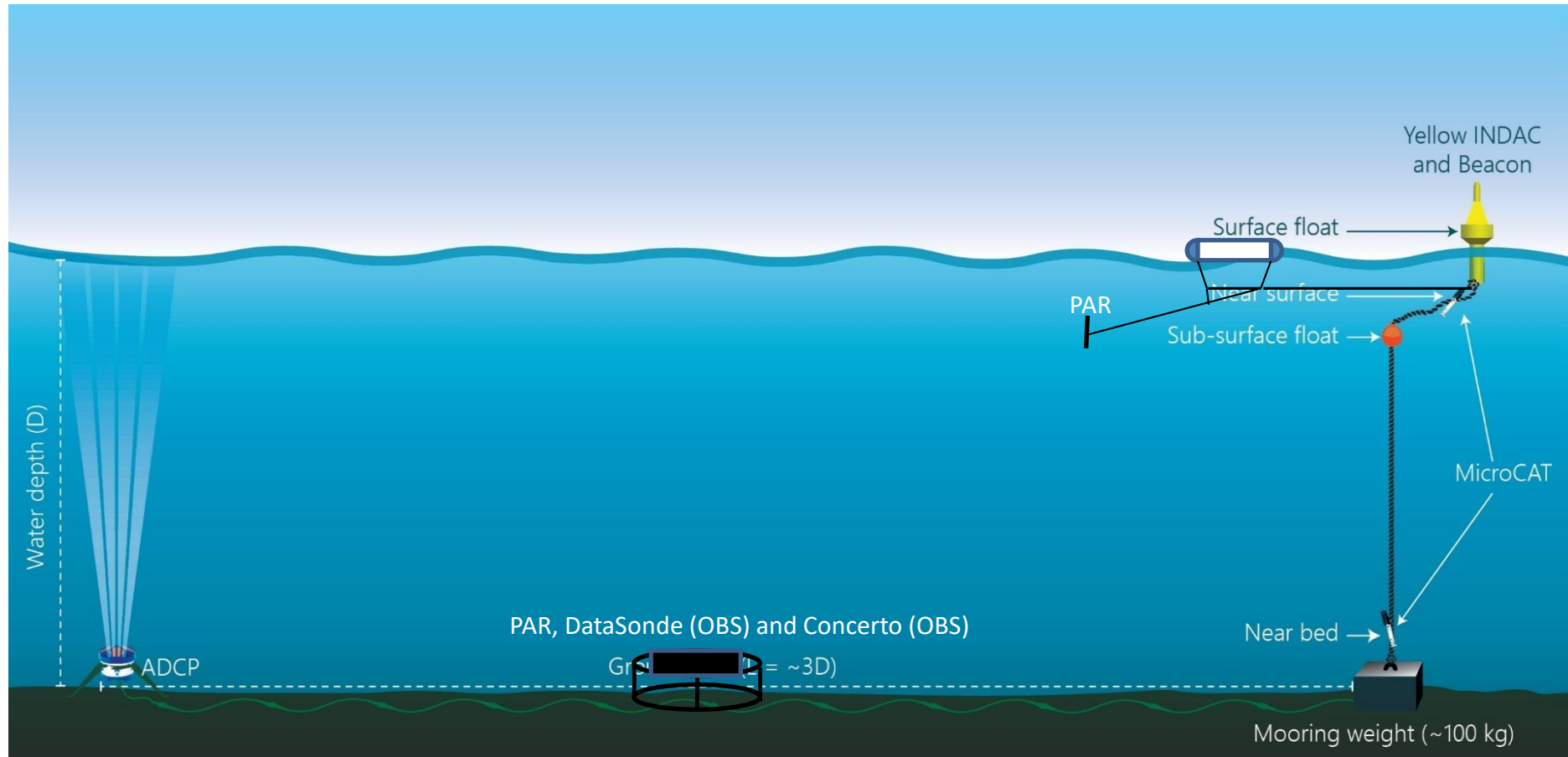
Hydrodynamic Model



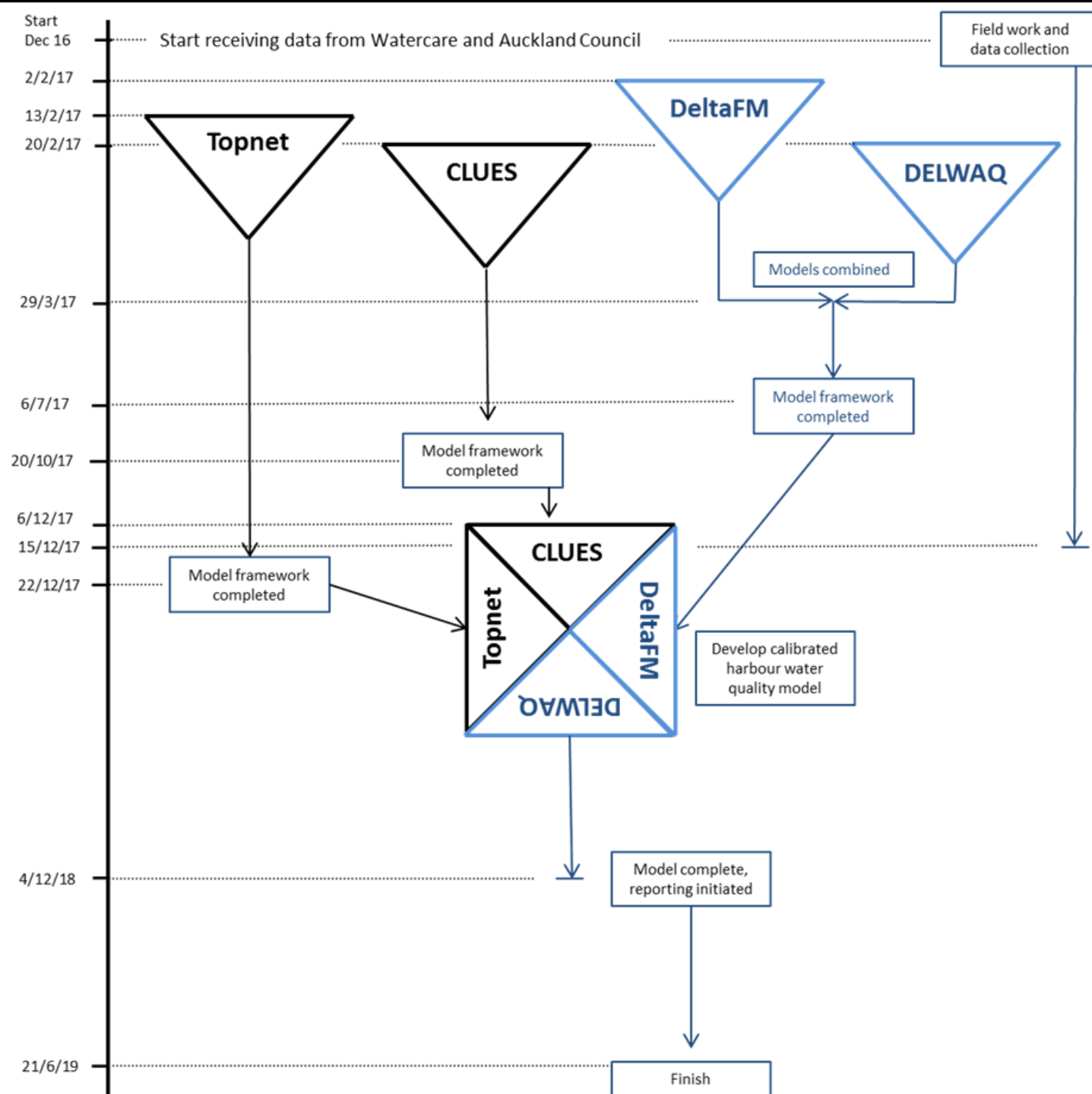
Harbour Water Quality Model



Harbour Water Quality Model



Timeline





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