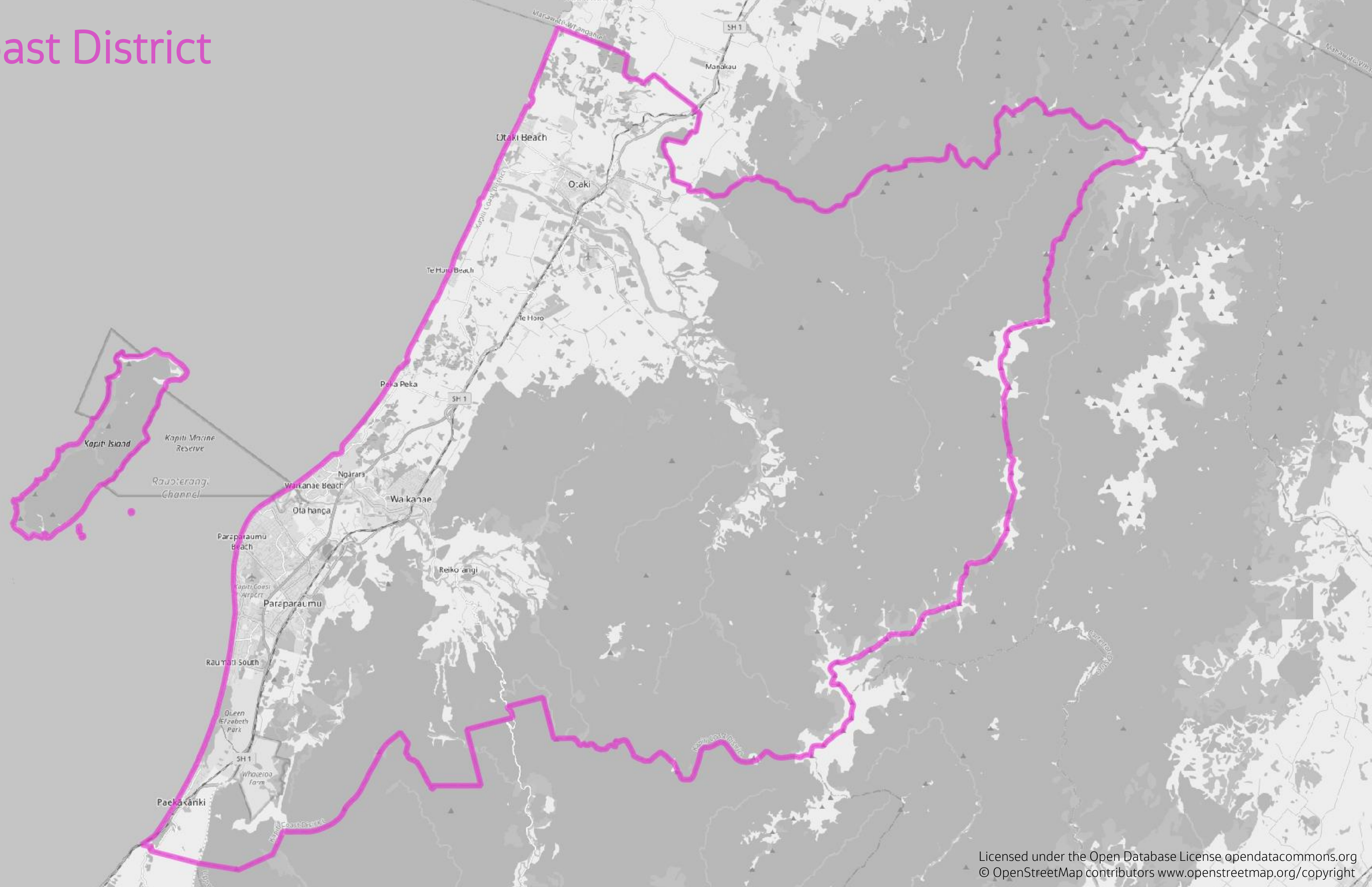
Takutai Kāpiti
CAP Meeting 30 March 2022

- GWRC Groundwater model and results
- Inland boundary for coastal effect on groundwater
- Inland boundary for coastal effect on inundation

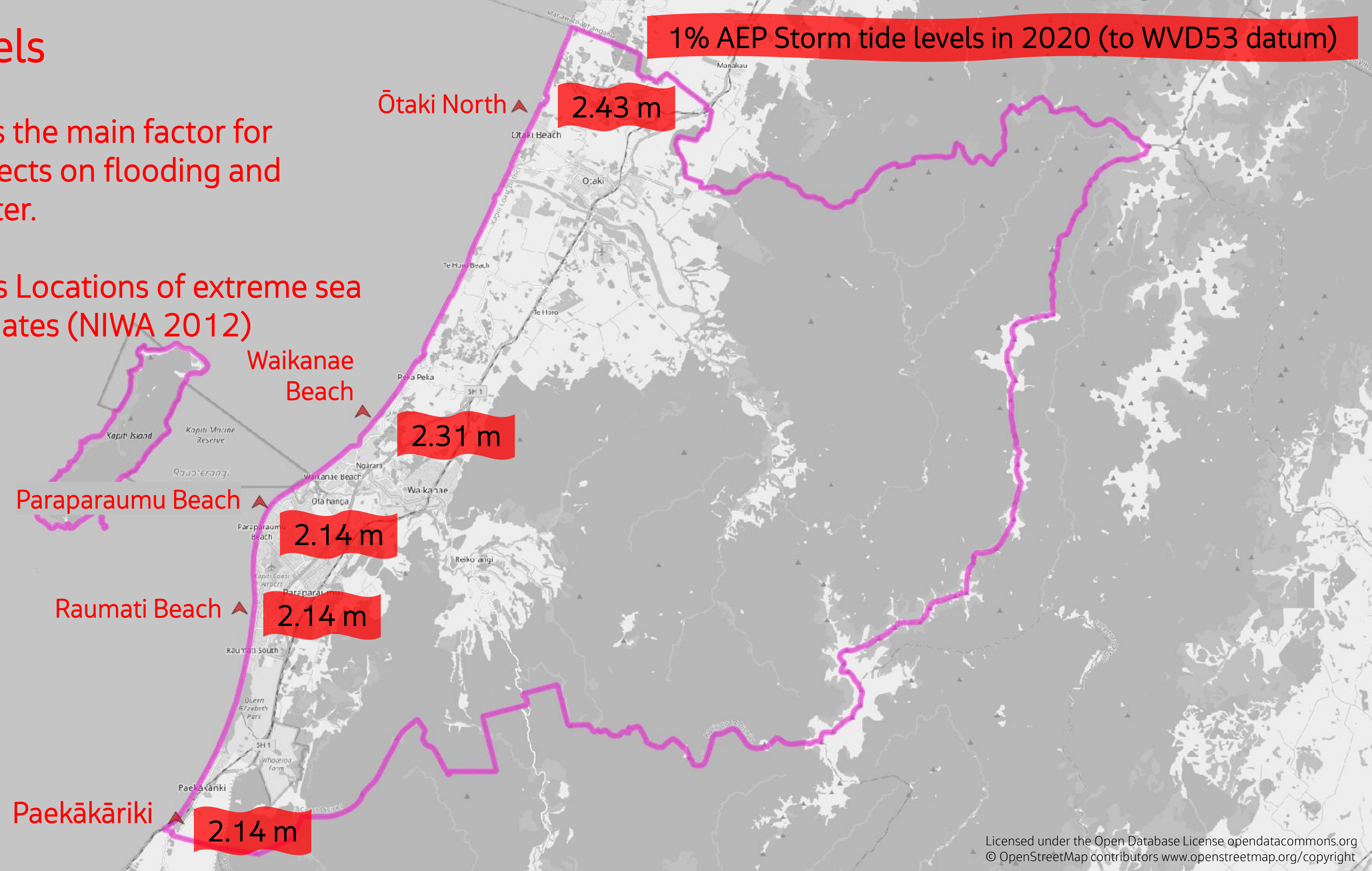
Kāpiti Coast District



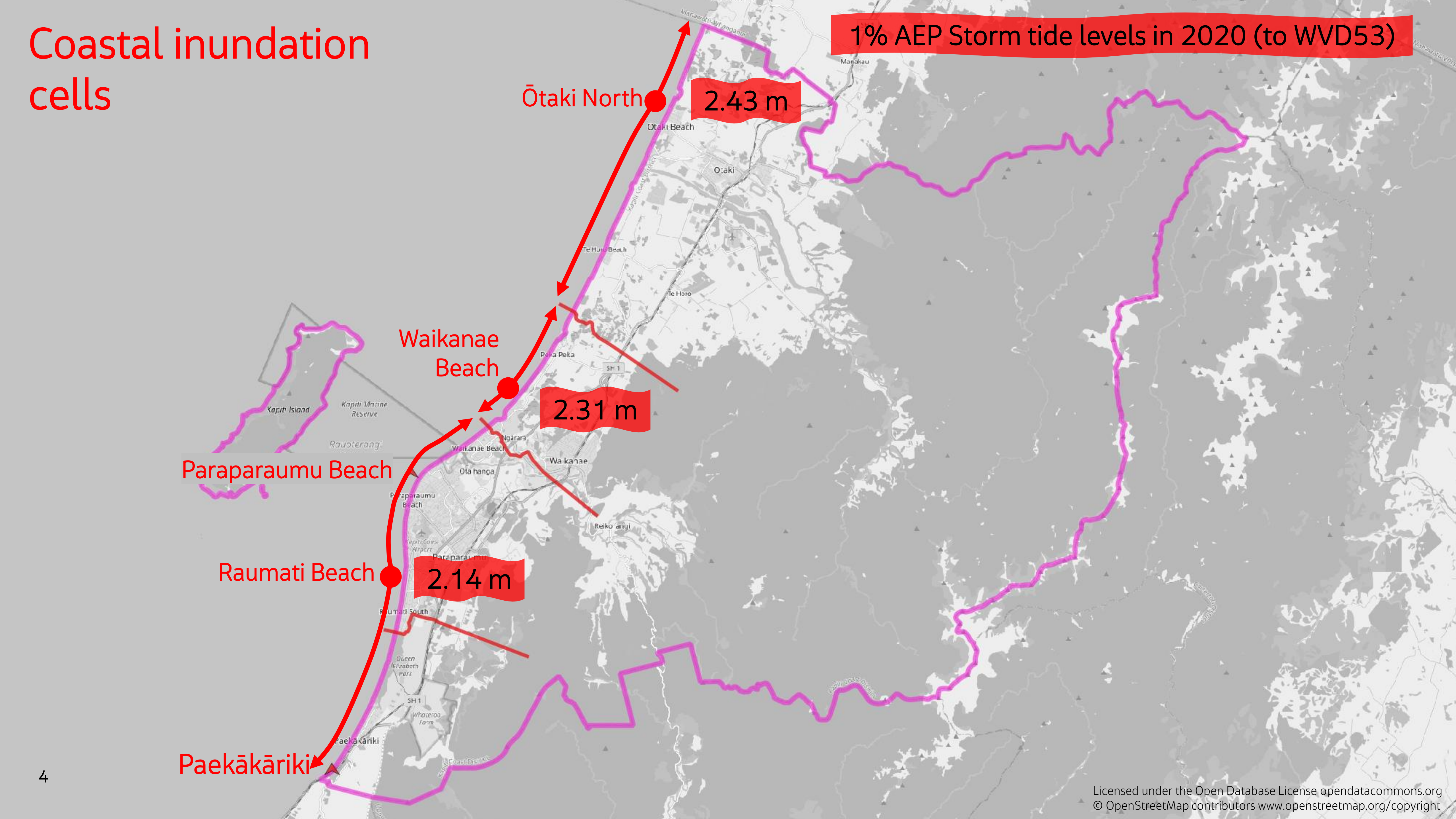
Sea levels

Sea level is the main factor for coastal effects on flooding and groundwater.

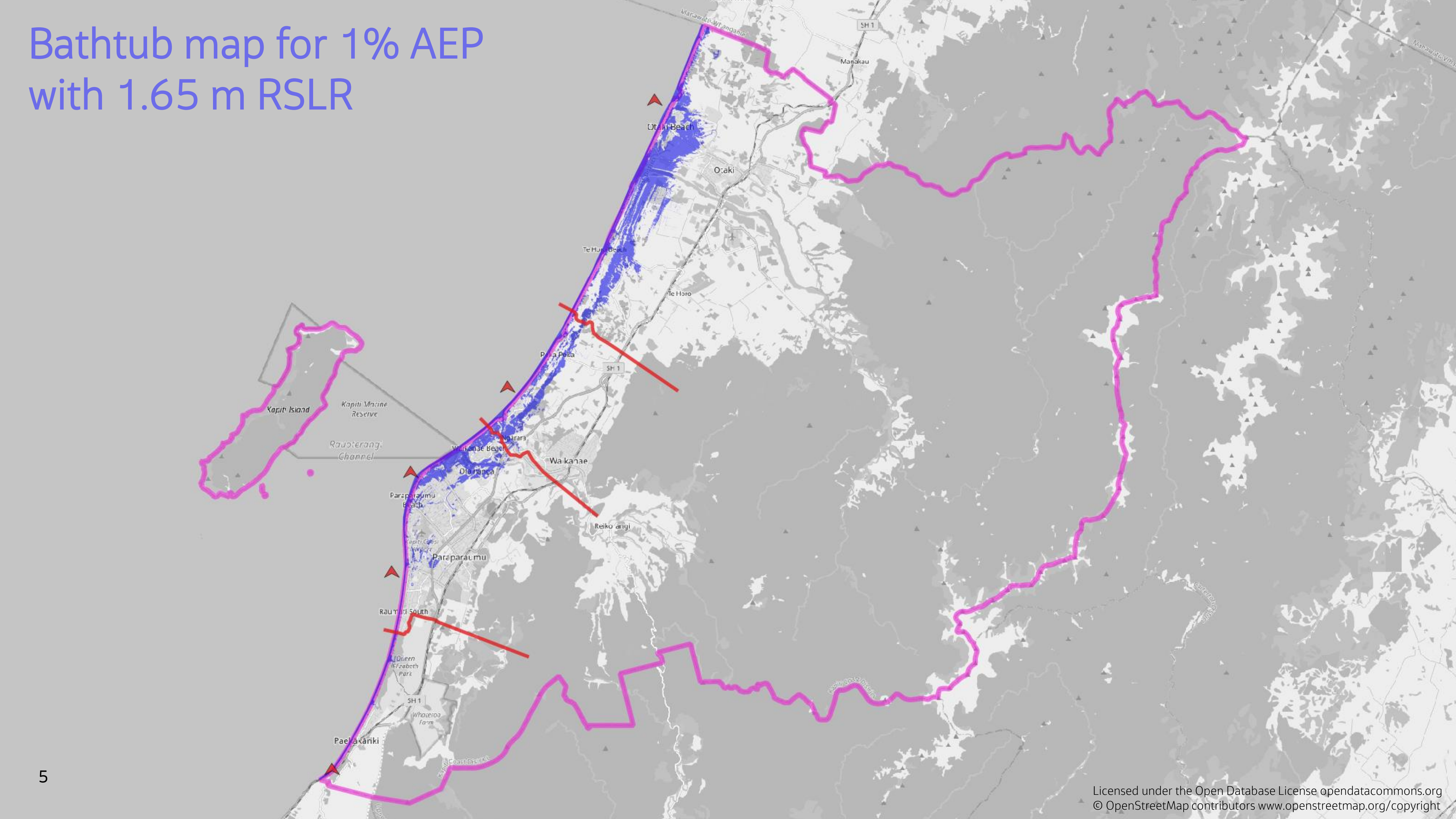
Map shows Locations of extreme sea level estimates (NIWA 2012)



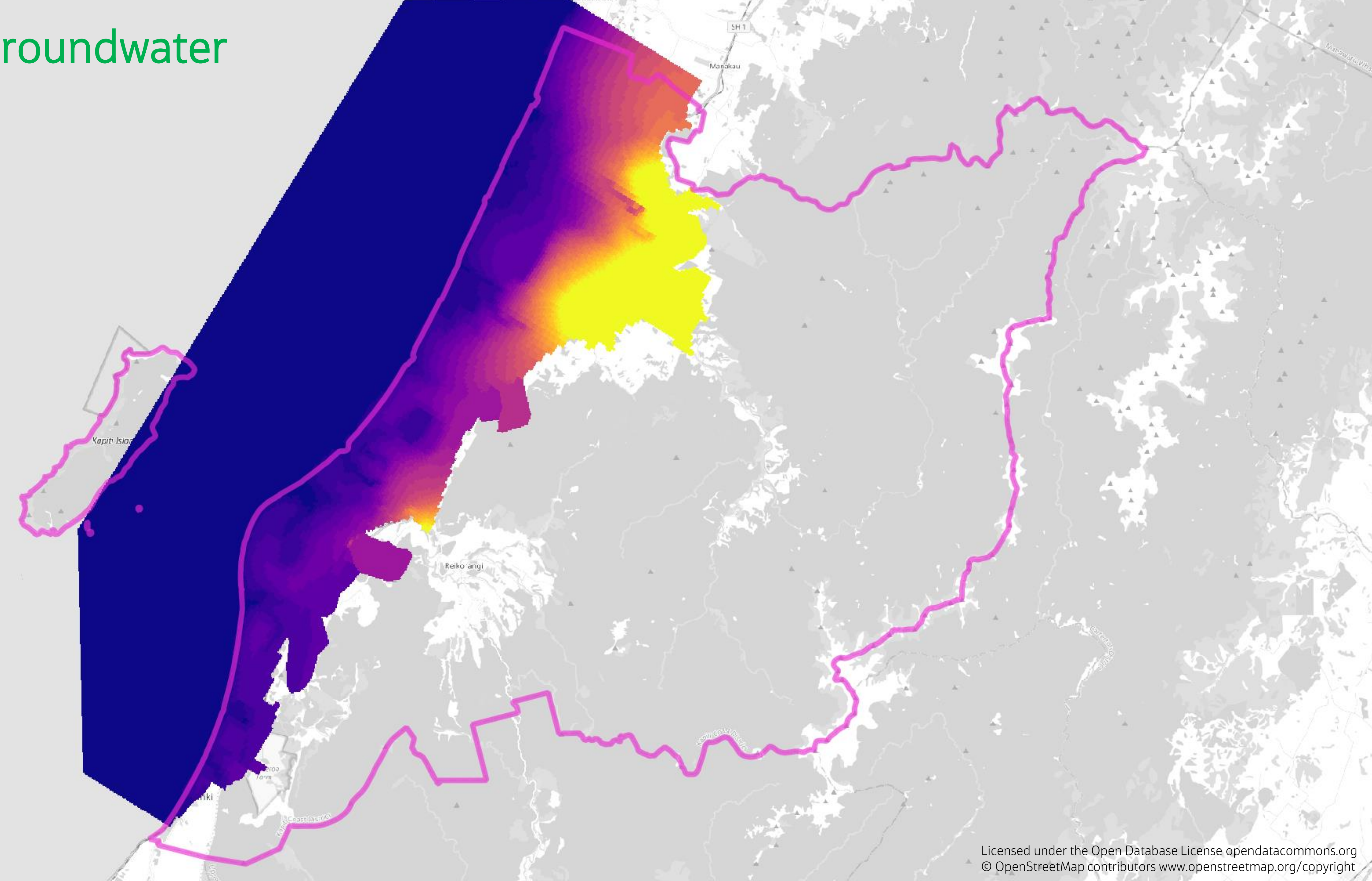
Coastal inundation cells



Bathtub map for 1% AEP with 1.65 m RSLR



GWRC Groundwater model



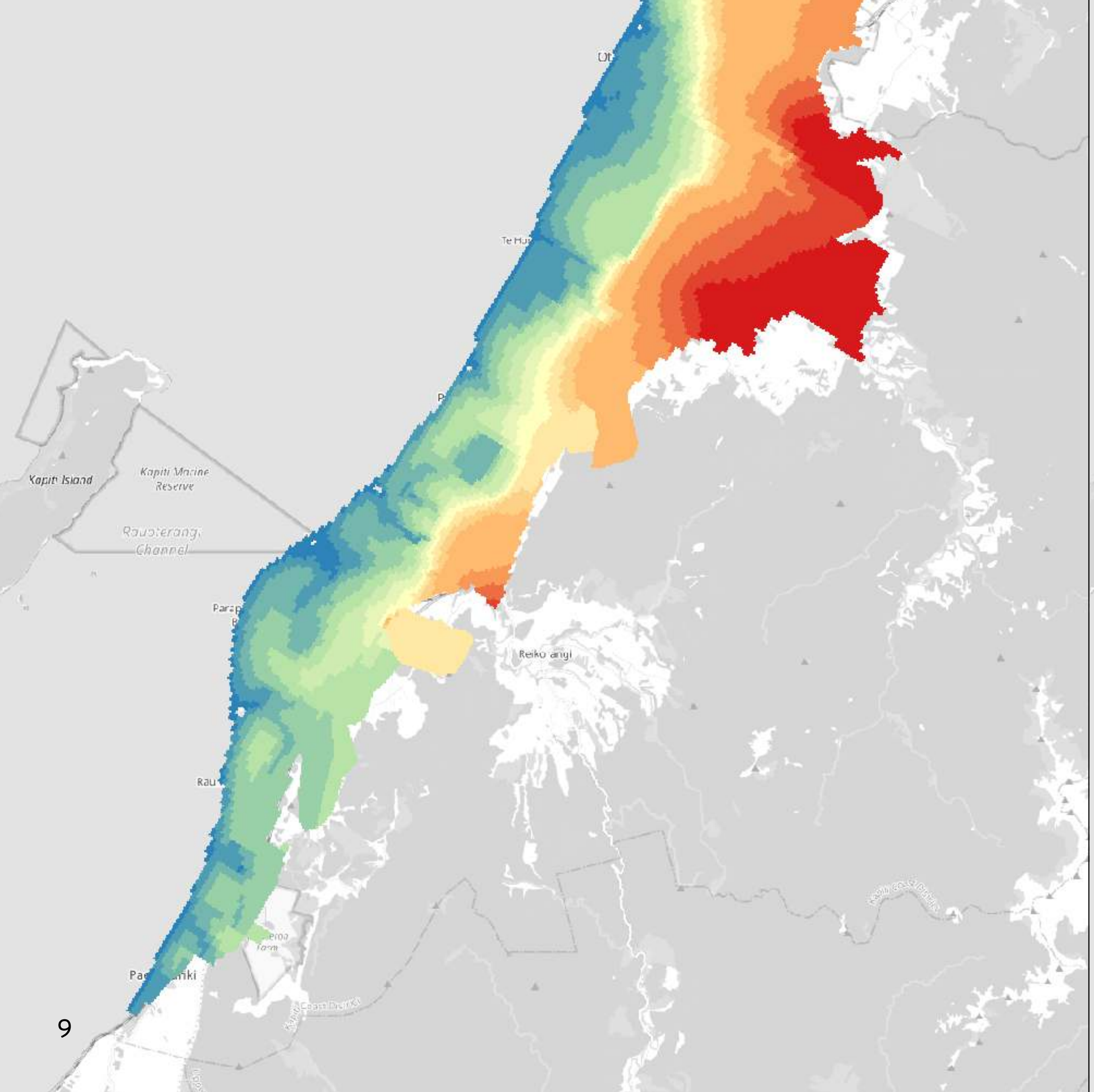
GWRC Groundwater model and results

- Originally built to support development of water management plans by providing understanding of *changes* in groundwater levels
- Uses MODFLOW software (U.S. Geological Survey open-source code) with 50m grid
- Simulates the 19-year historical period 1992 to 2011 with a weekly timestep
- Model was calibrated against observations for a 4-year period and validated against the full 19-year period
- Includes rudimentary surface water exchange at ponds and larger rivers – water is “lost” from the model when it reaches these features
- Boundaries
  - Recharge from rainfall
  - Surface water (river flows)
  - Water level in the sea along the shoreline (set to 0 m WVD53 datum for historical period)
  - Abstractions at boreholes (discrete features and global abstraction for smaller wells)

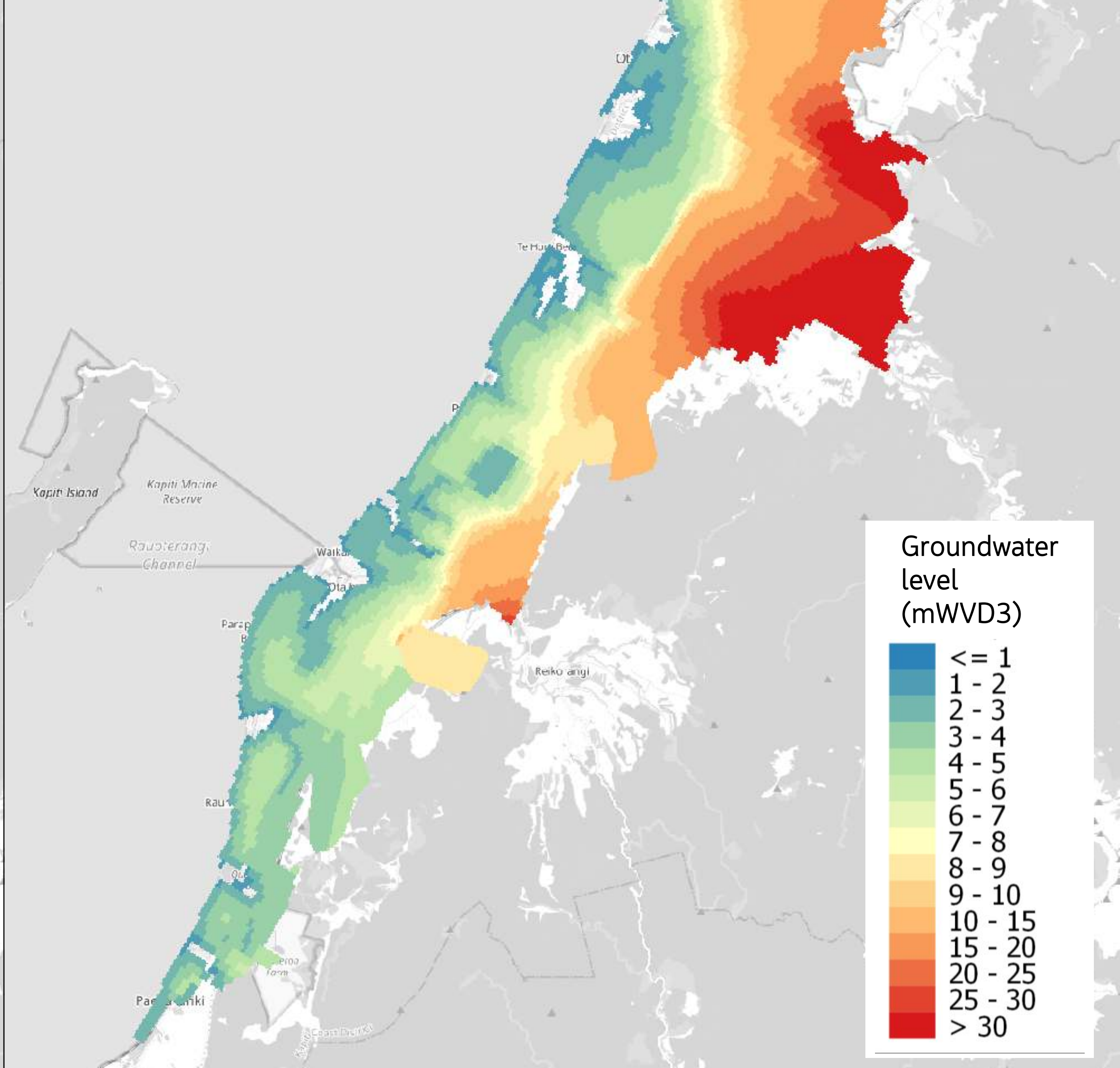
GWRC Groundwater model and results

- Scenarios simulated for KCDC Updated Stormwater Modelling (AWA project):
  - "2030" – mean sea level 0.29 m WVD53 datum
  - "2130 RCP8.5M" – mean sea level 1.32 m WVD53 datum
  - "2130 RCP8.5H+" – mean sea level 1.66 m WVD53 datum
- Simulations also include effect of climate change on rainfall recharge and river flow, abstractions kept at current values
- Model used to simulate the representative 19-year historical period, with changes to sea level, rainfall and river flow held constant over the period
- Statistical analysis of the groundwater levels over the 19-year period to produce a surface of the 50^{th} percentile values (median groundwater level)
- The absolute groundwater levels are input to the stormwater model as the initial water surface to allow the effects of the groundwater on infiltration and ponding to be included in simulations of extreme rainfall and tide

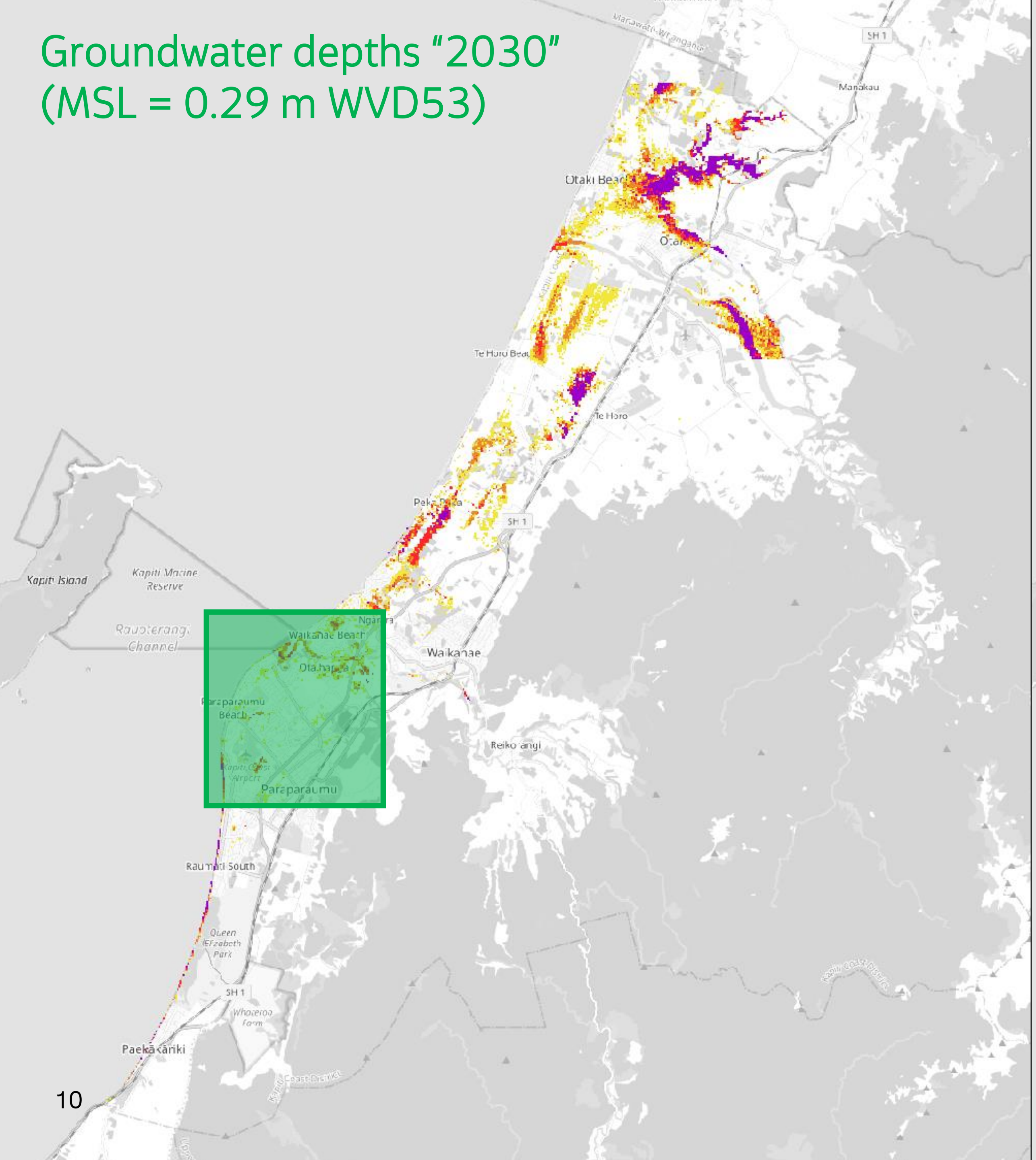
Groundwater levels “2030” (MSL = 0.29 m WVD53)



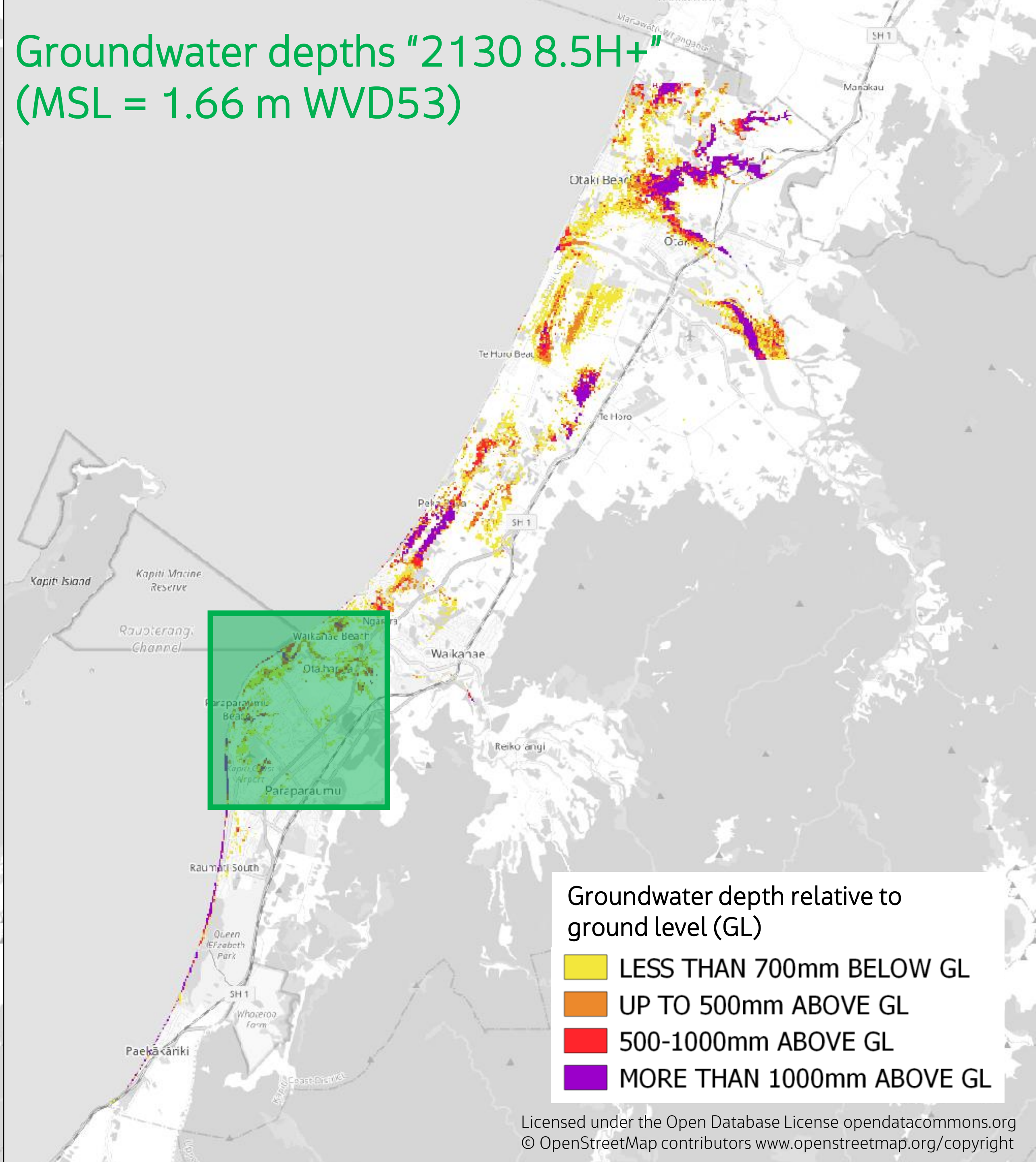
Groundwater levels “2130 8.5H+” (MSL = 1.66 m WVD53)



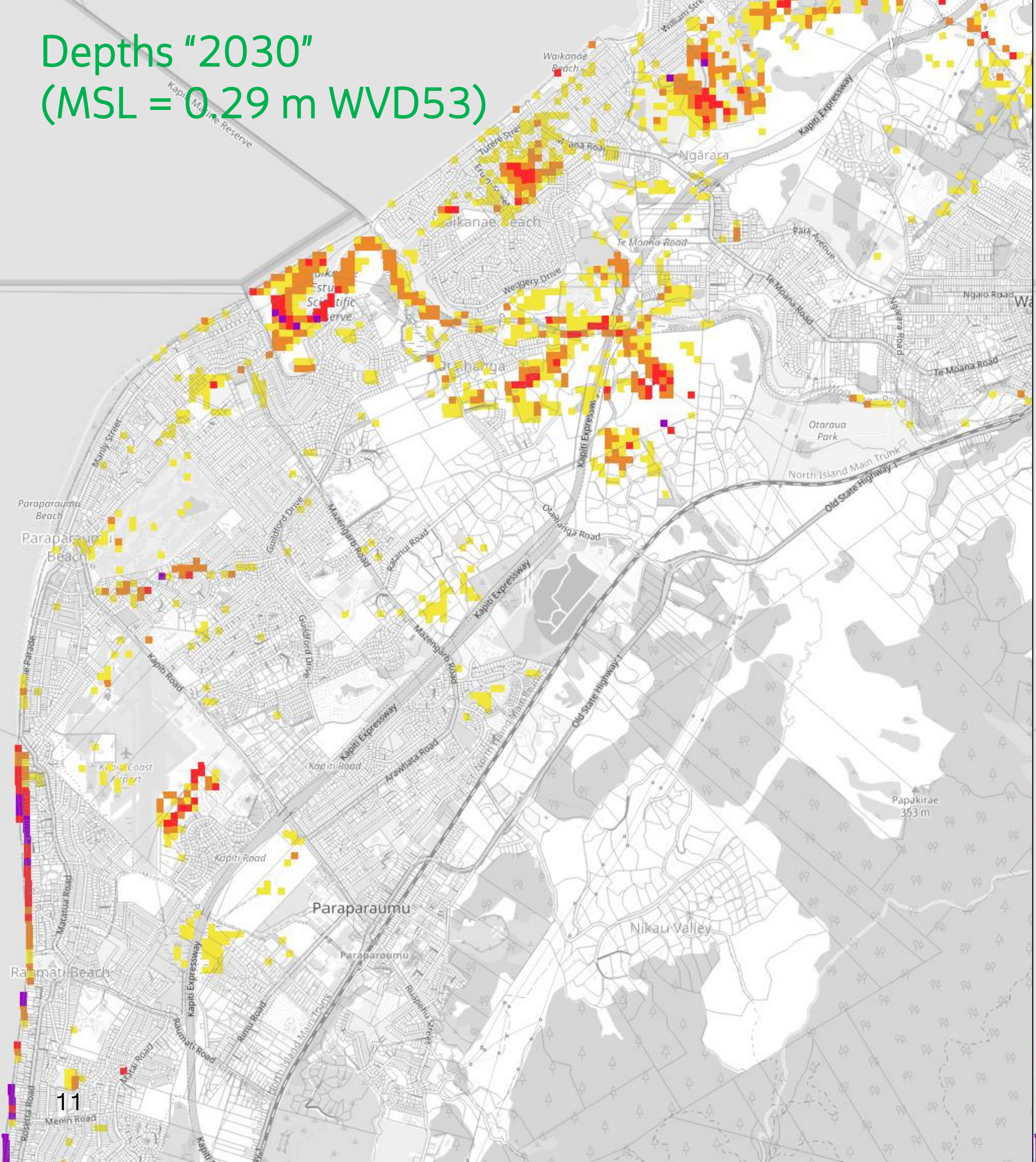
Groundwater depths "2030" (MSL = 0.29 m WVD53)



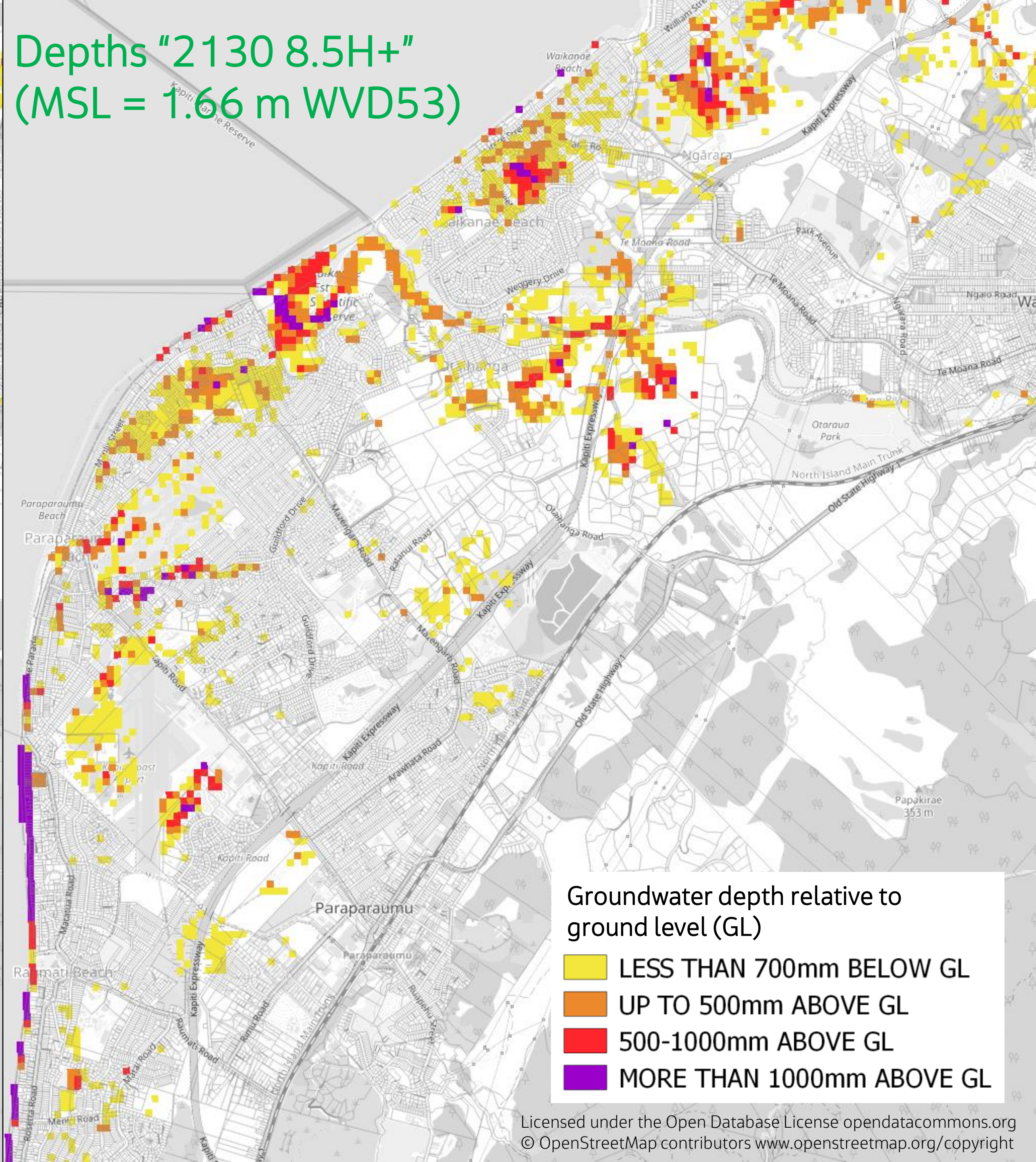
Groundwater depths "2130 8.5H+" (MSL = 1.66 m WVD53)



Depths "2030" (MSL = 0.29 m WVD53)

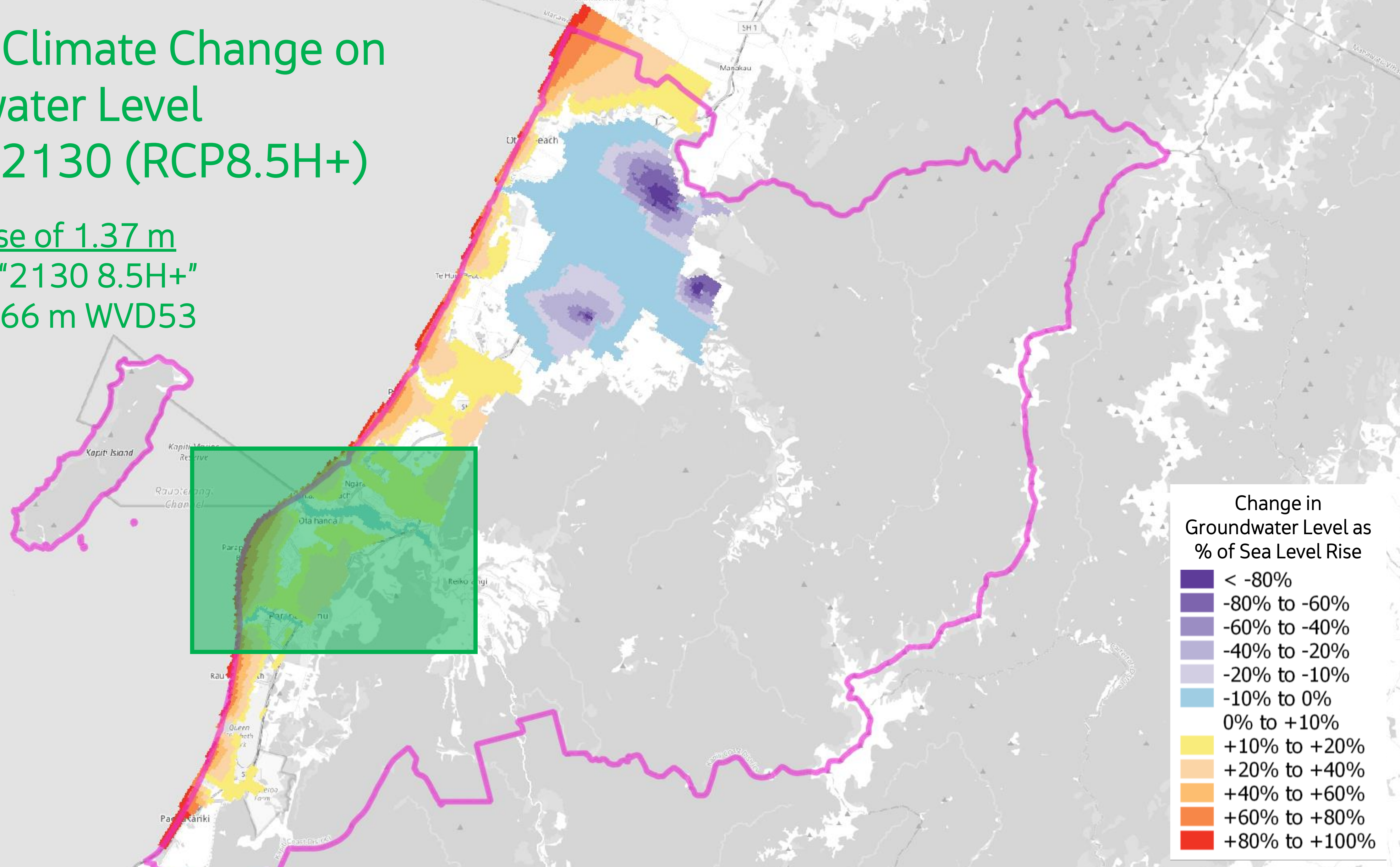


Depths "2130 8.5H+" (MSL = 1.66 m WVD53)



Effect of Climate Change on Groundwater Level 2030 to 2130 (RCP8.5H+)

<u>Sea Level Rise of 1.37 m</u>
"2030" to "2130 8.5H+"
0.29 m to 1.66 m WVD53



Effect of Climate Change on Groundwater Level 2030 to 2130 (RCP8.5H+)

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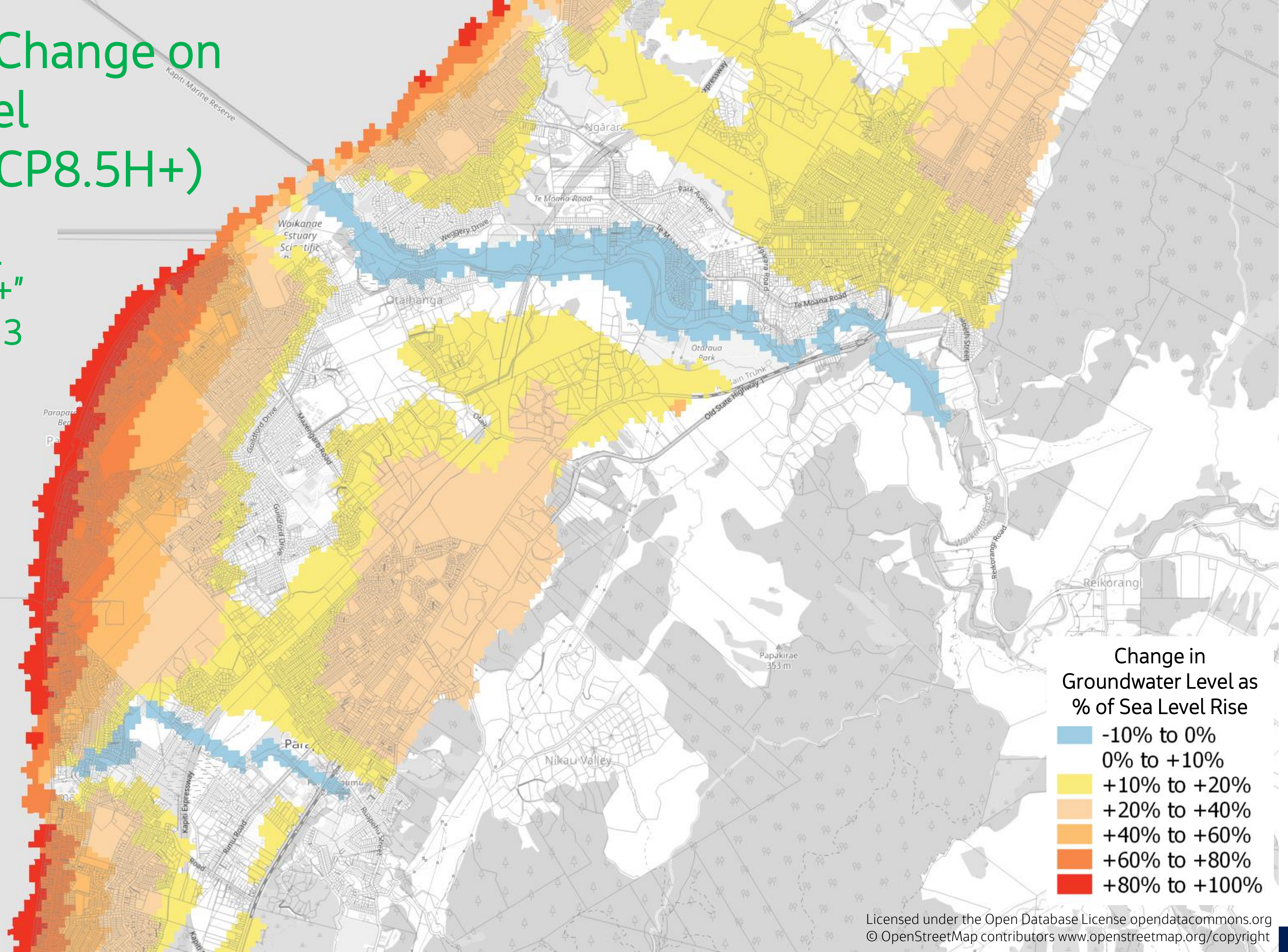
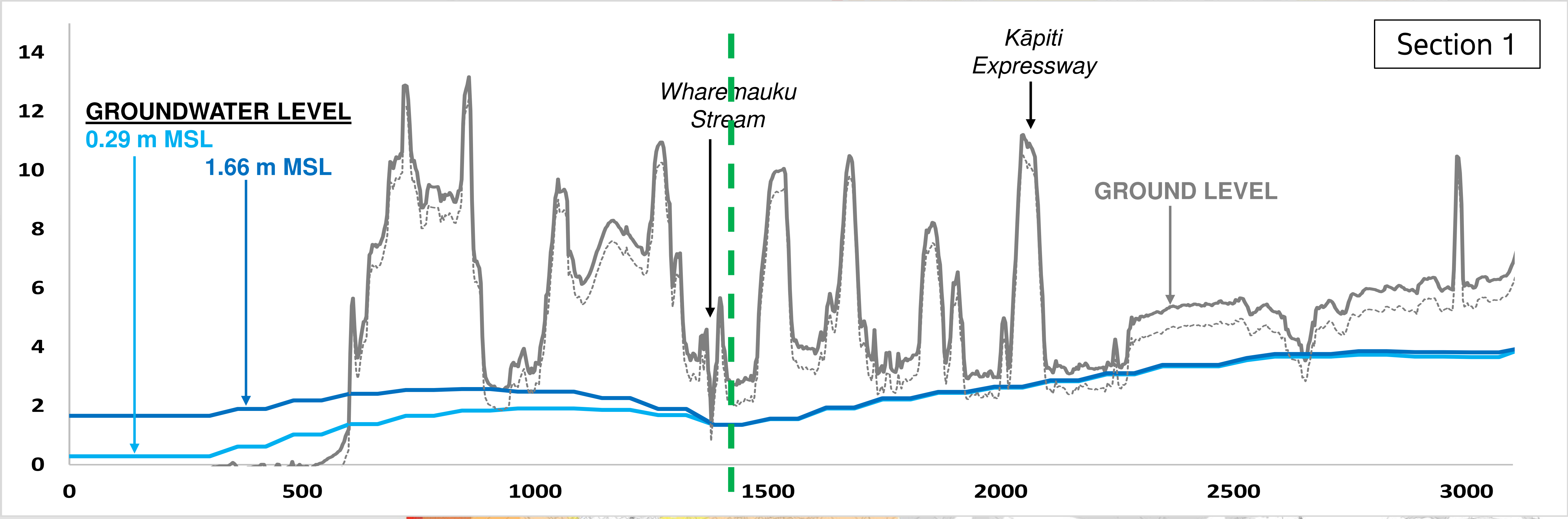
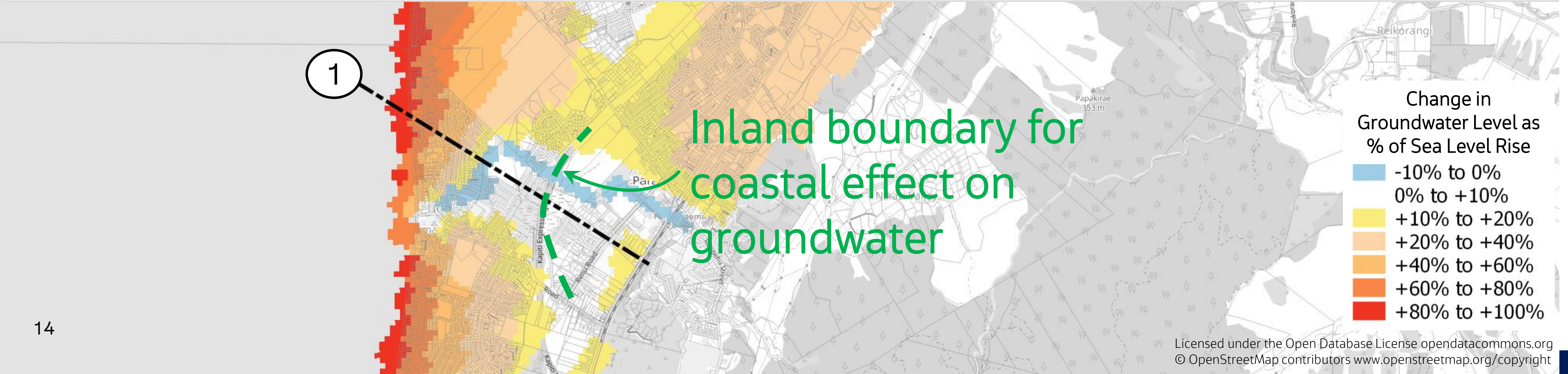



Section 1
GROUNDWATER LEVEL
0.29 m MSL
1.66 m MSL
Wharemauku Stream
Kāpiti Expressway
GROUND LEVEL
14
12
10
8
6
4
2
0
0
500
1000
1500
2000
2500
3000


1
Inland boundary for coastal effect on groundwater
Change in Groundwater Level as % of Sea Level Rise
-10% to 0%
0% to +10%
+10% to +20%
+20% to +40%
+40% to +60%
+60% to +80%
+80% to +100%
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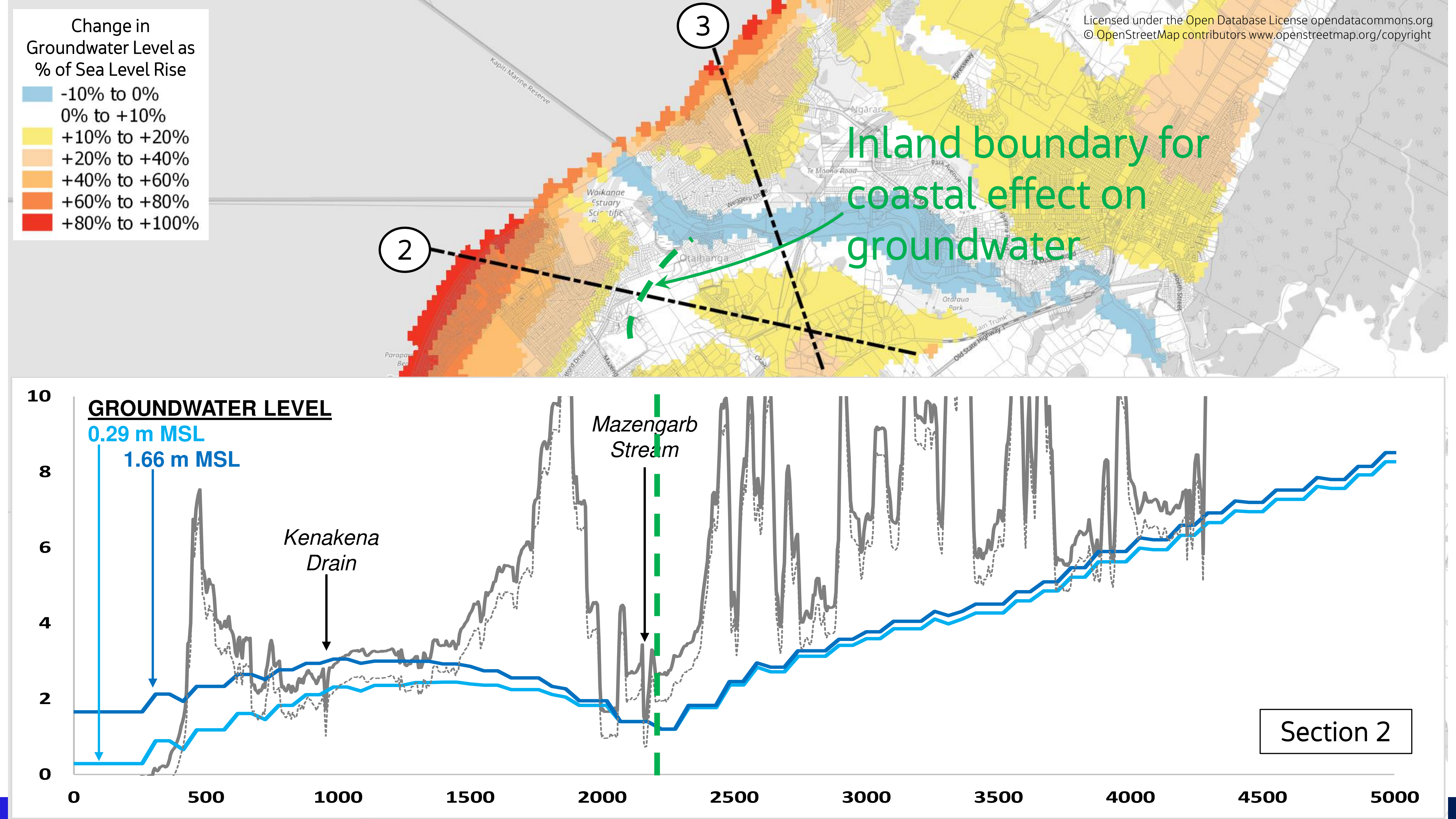

Change in Groundwater Level as % of Sea Level Rise
-10% to 0%
0% to +10%
+10% to +20%
+20% to +40%
+40% to +60%
+60% to +80%
+80% to +100%
3
2
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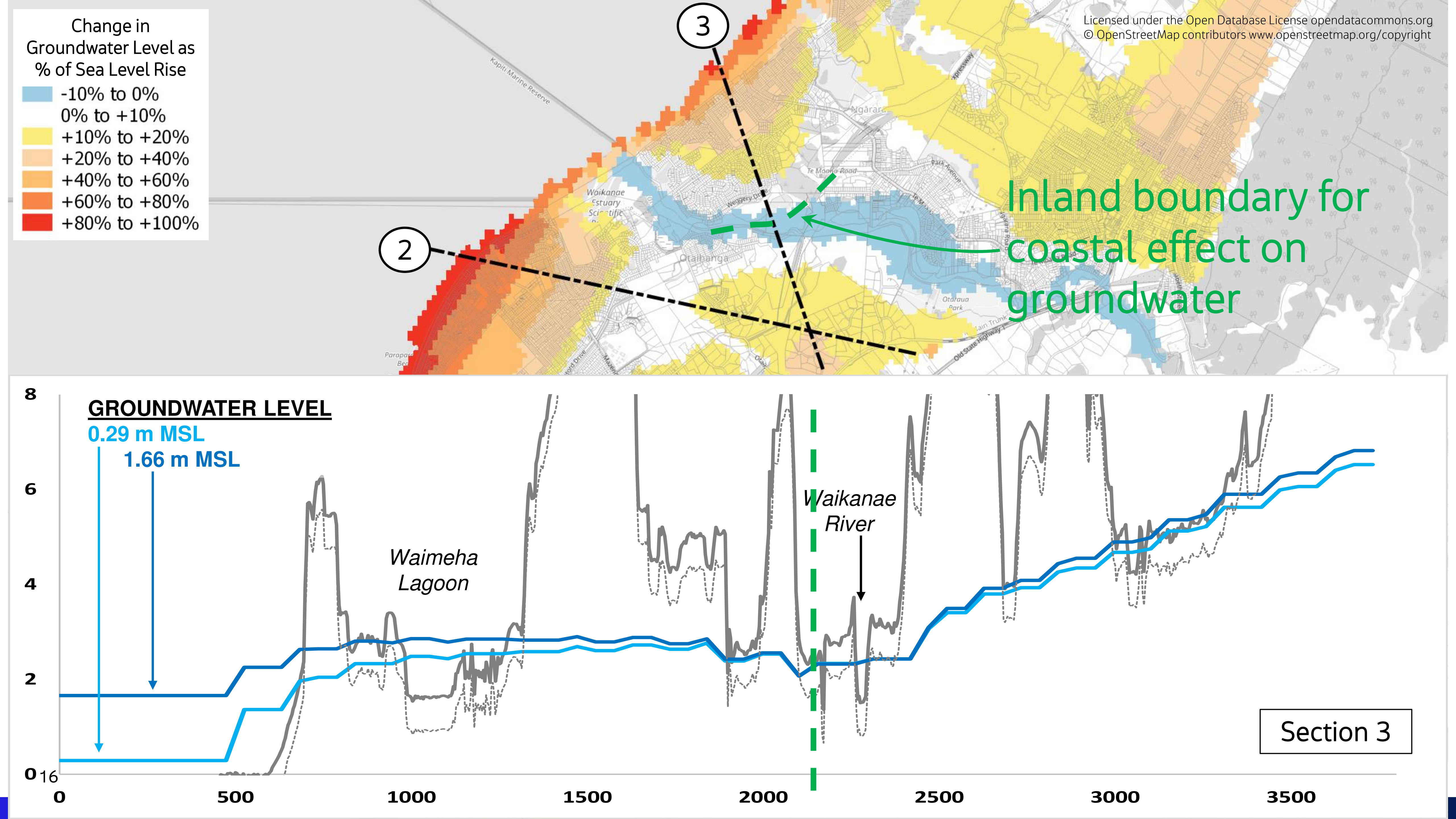
Inland boundary for coastal effect on groundwater
GROUNDWATER LEVEL
0.29 m MSL
1.66 m MSL
Kenakena Drain
Mazengarb Stream
Section 2
10
8
6
4
2
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000



Change in Groundwater Level as % of Sea Level Rise
-10% to 0%
0% to +10%
+10% to +20%
+20% to +40%
+40% to +60%
+60% to +80%
+80% to +100%
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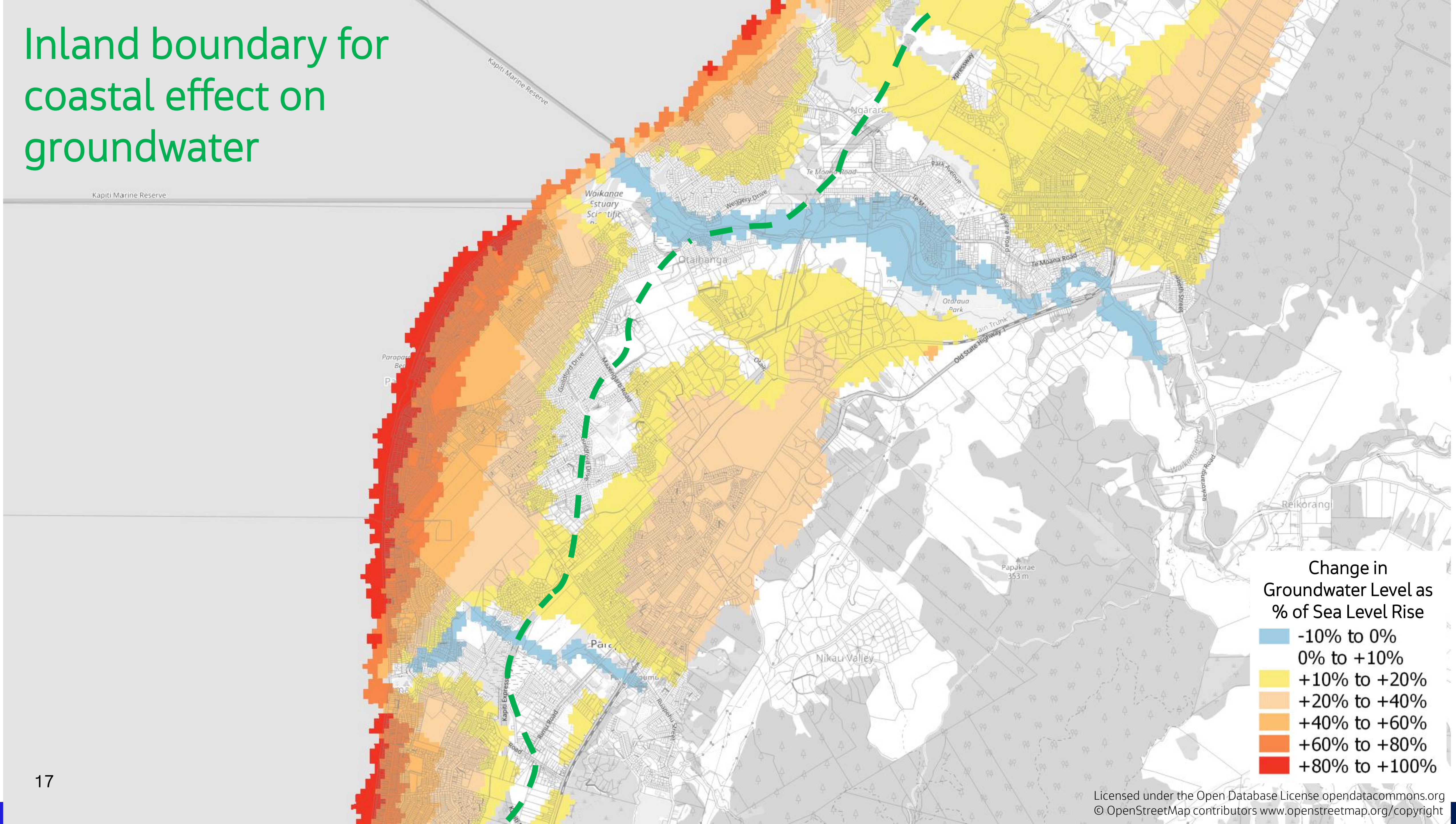
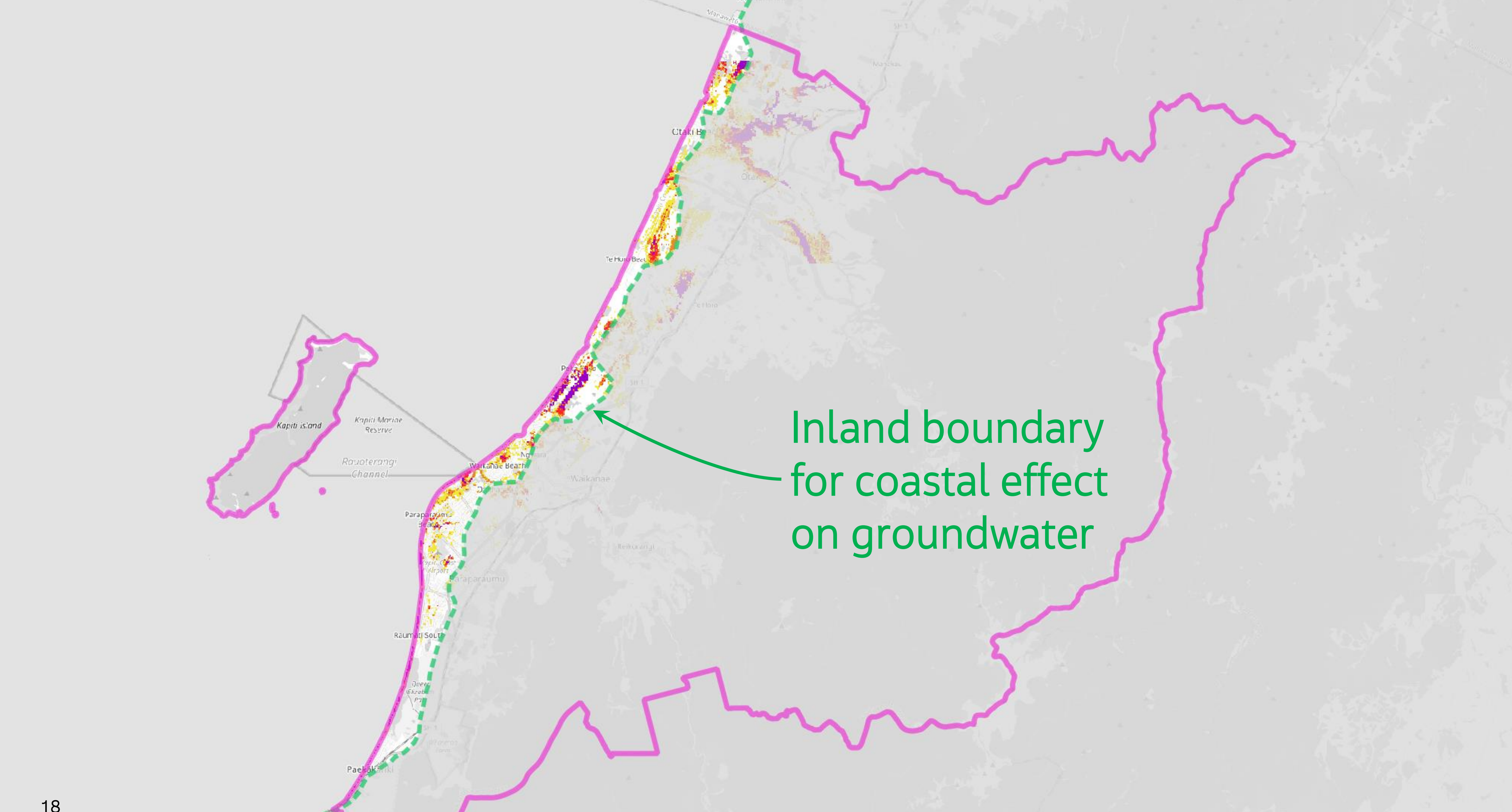
Kapiti Marine Reserve
Waikanae Estuary Scientific
Otaihanga
Ngārara
Te Moana Road
Otaraua Park
Inland boundary for coastal effect on groundwater
2
3
GROUNDWATER LEVEL
0.29 m MSL
1.66 m MSL
Waimeha Lagoon
Waikanae River
Section 3
8
6
4
2
0
0
500
1000
1500
2000
2500
3000
3500

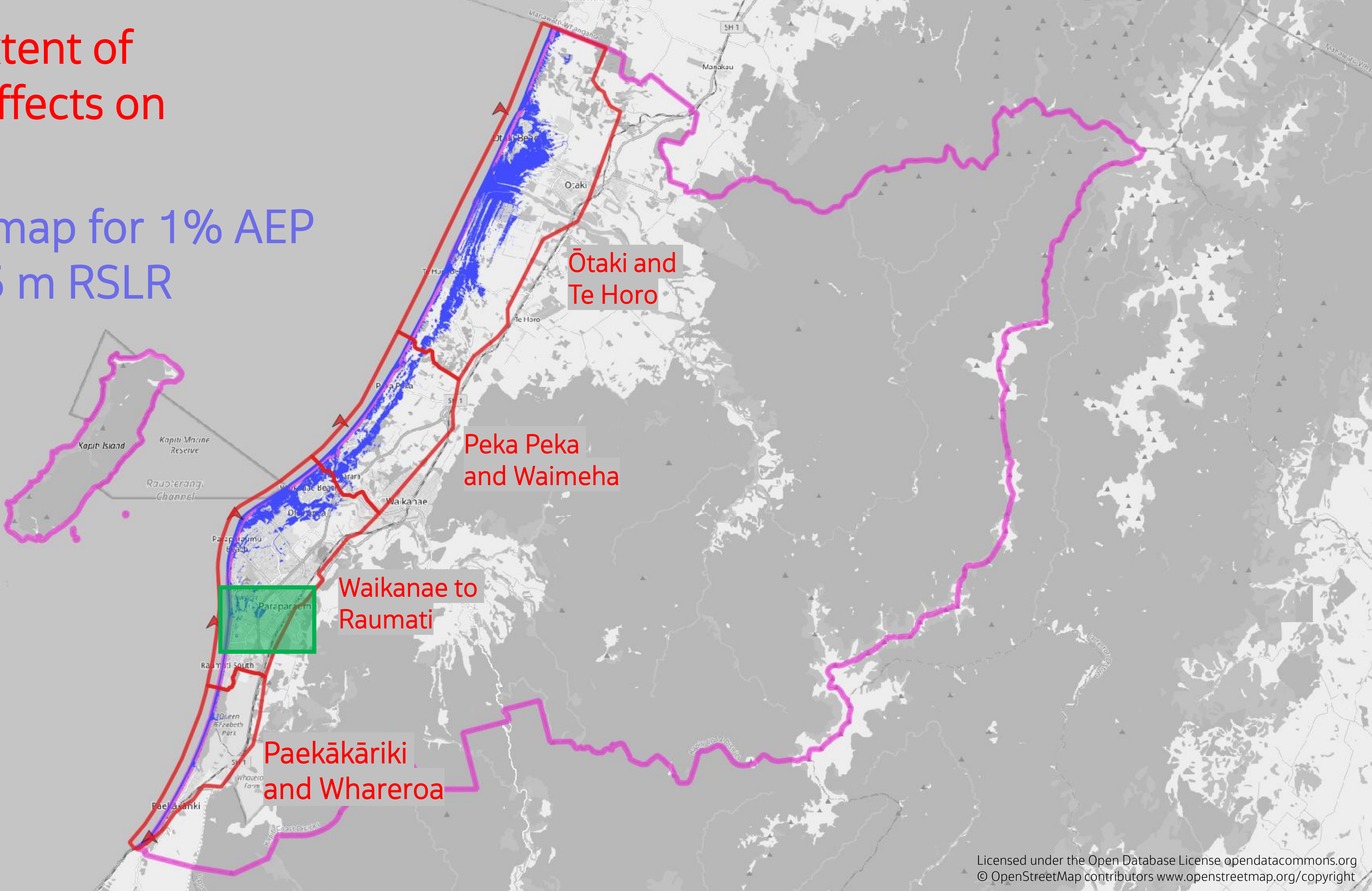
Inland boundary for coastal effect on groundwater




Inland boundary
for coastal effect
on groundwater
Kapiti Island
Kapiti Marine
Reserve
Rauoterangi
Channel
Te Horo Beach
Waikanae Beach
Waikanae
Paraparaumu

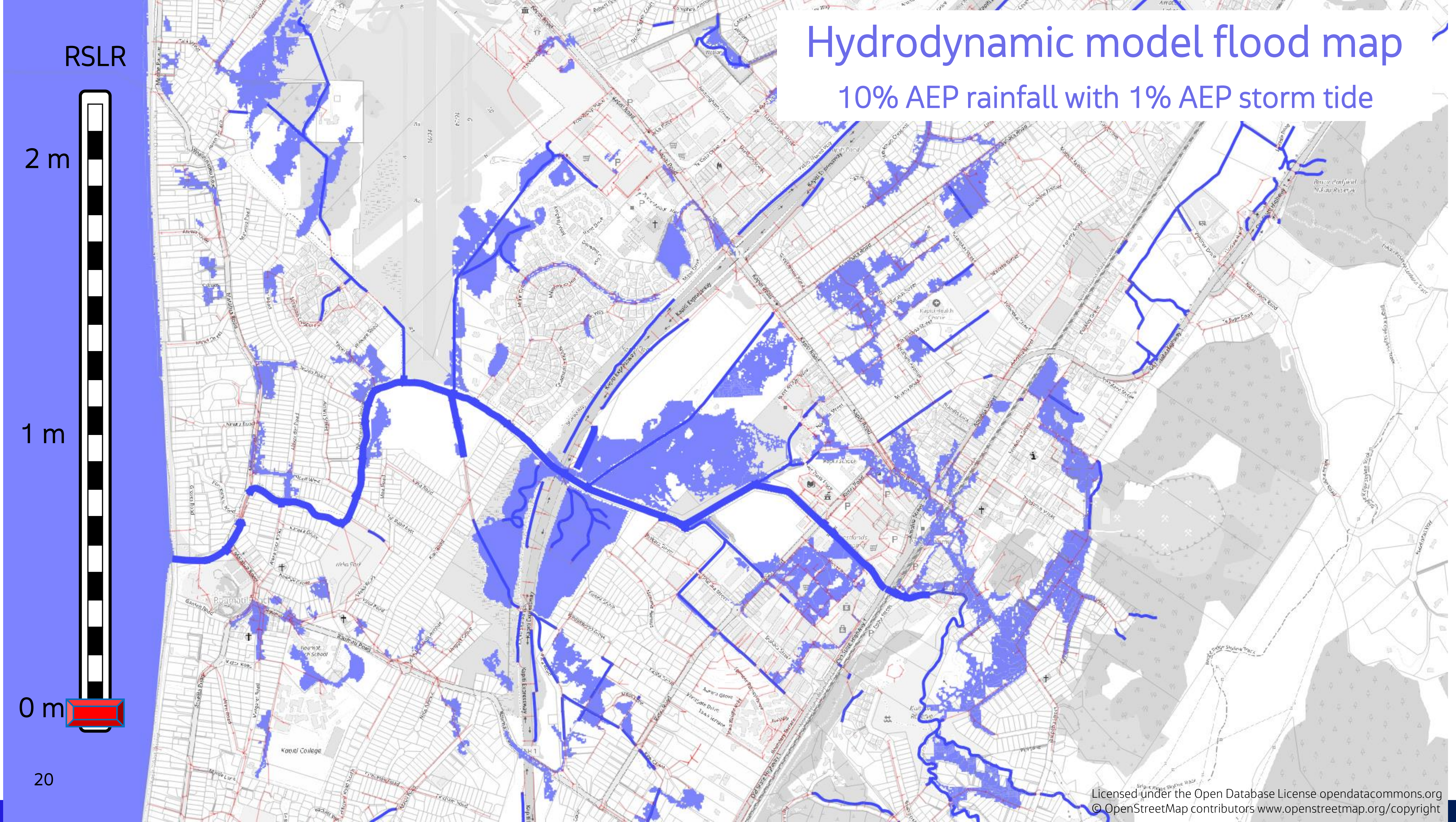
Inland extent of coastal effects on flooding

Bathtub map for 1% AEP with 1.65 m RSLR



Hydrodynamic model flood map

10% AEP rainfall with 1% AEP storm tide



Hydrodynamic model flood map

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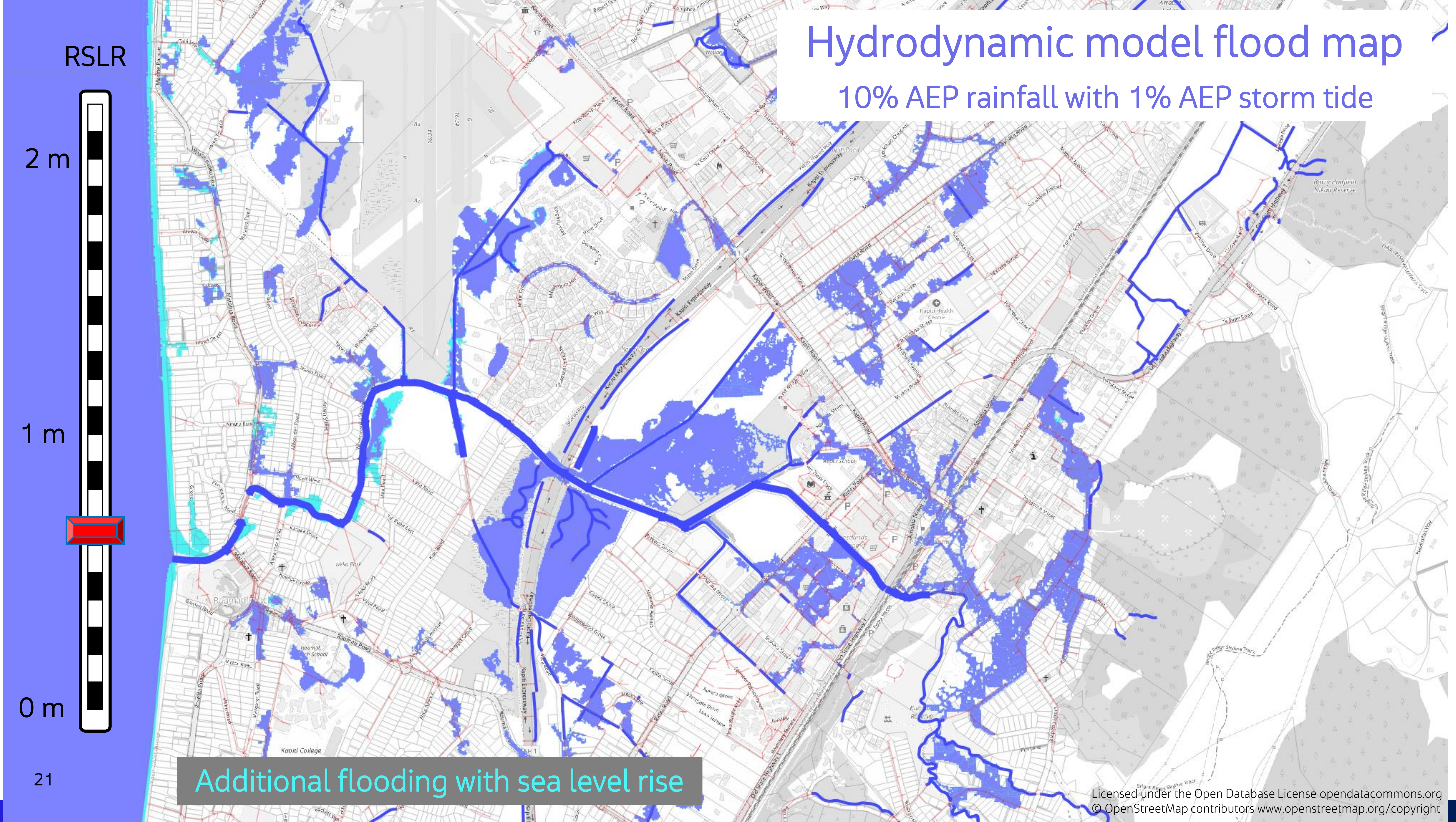
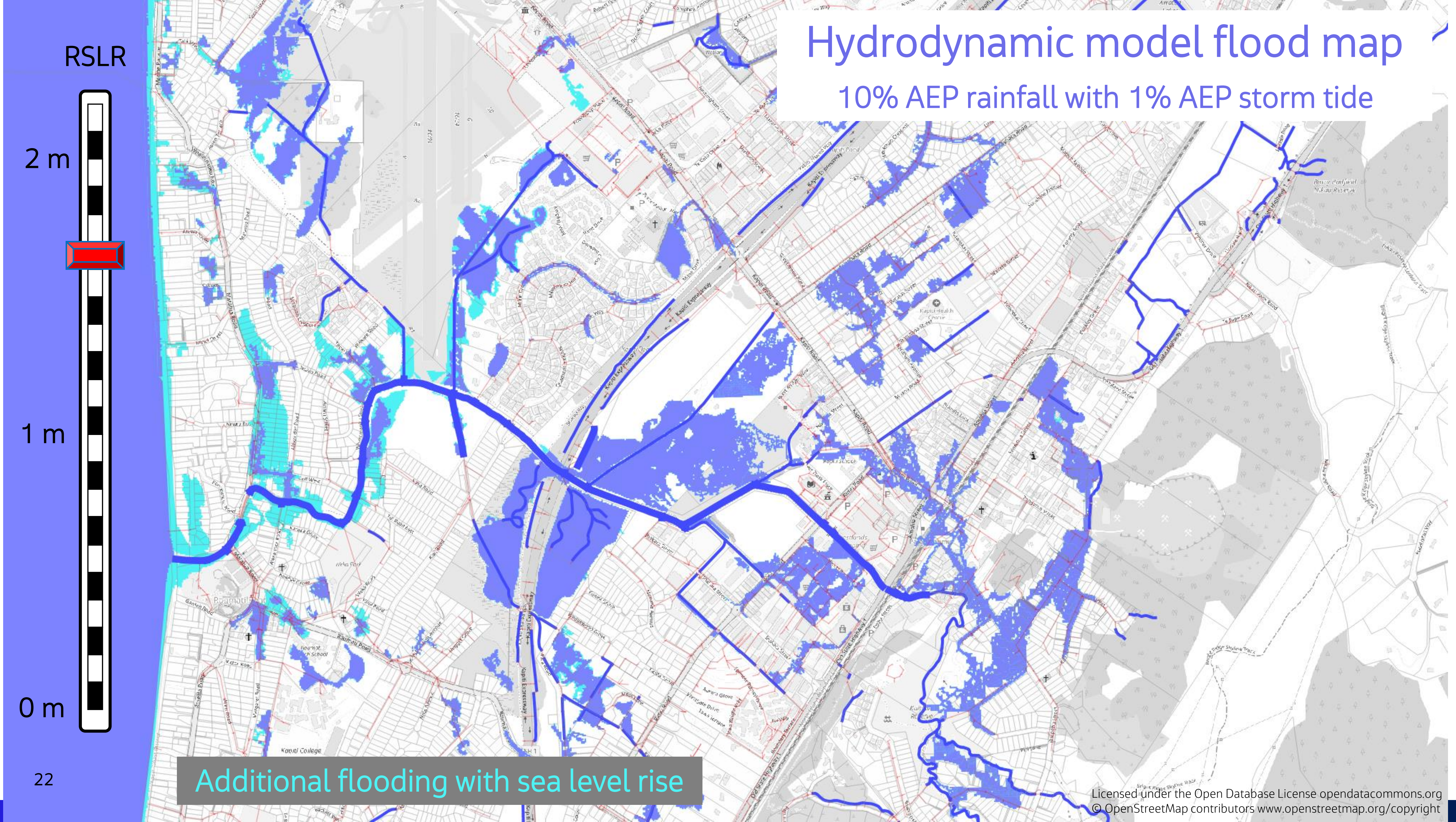
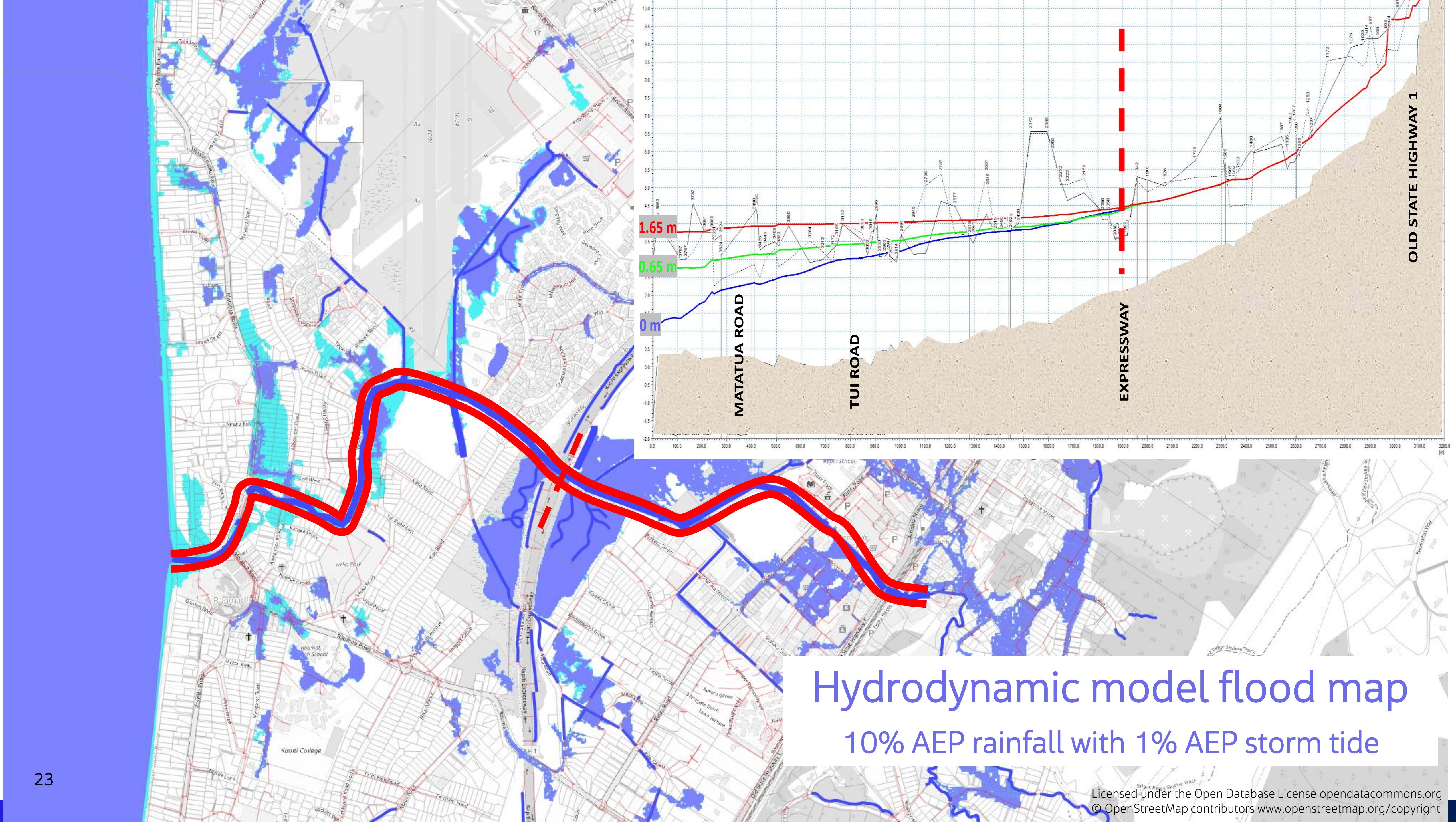


Hydrodynamic model flood map

10% AEP rainfall with 1% AEP storm tide





Hydrodynamic model flood map

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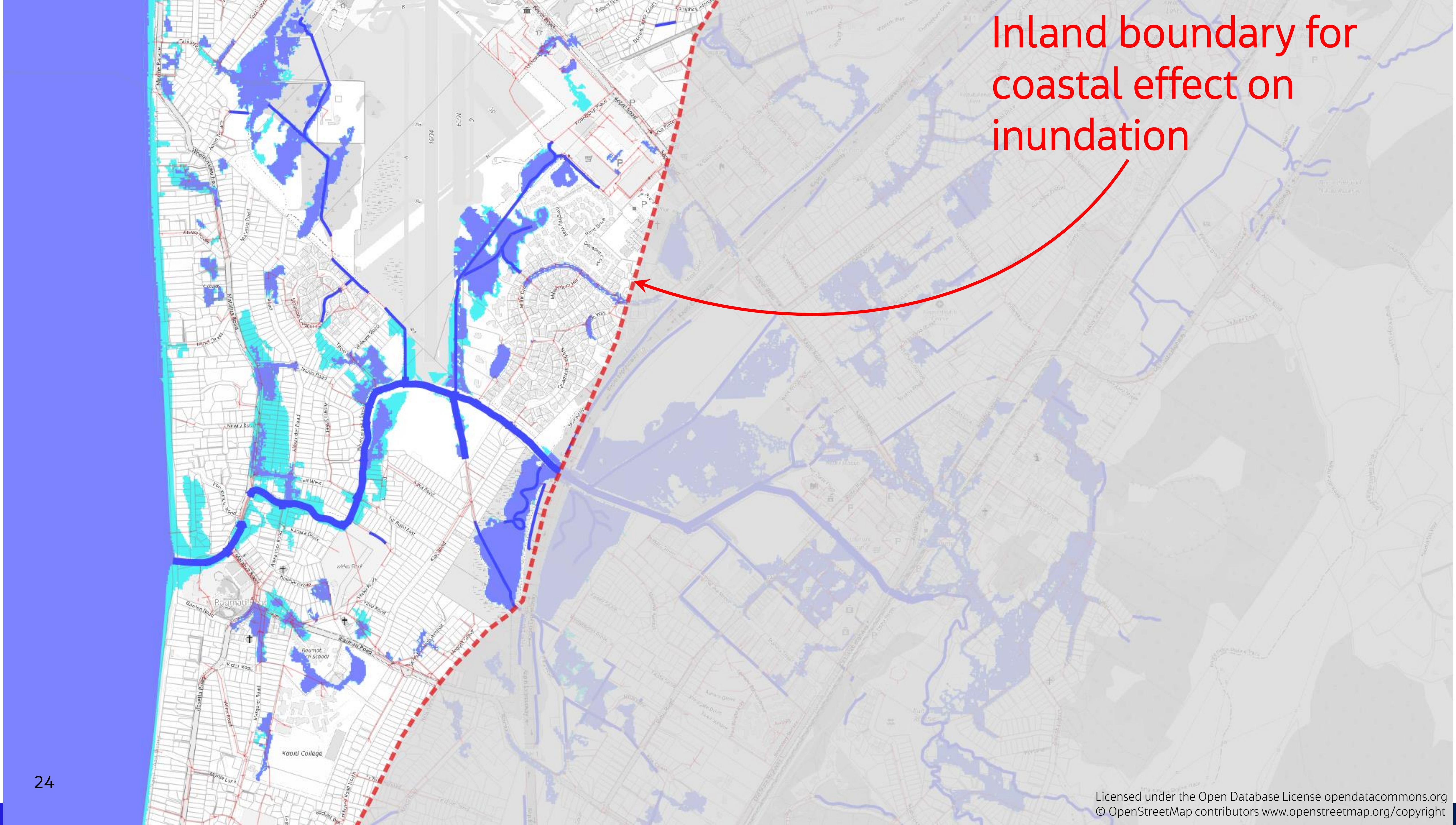
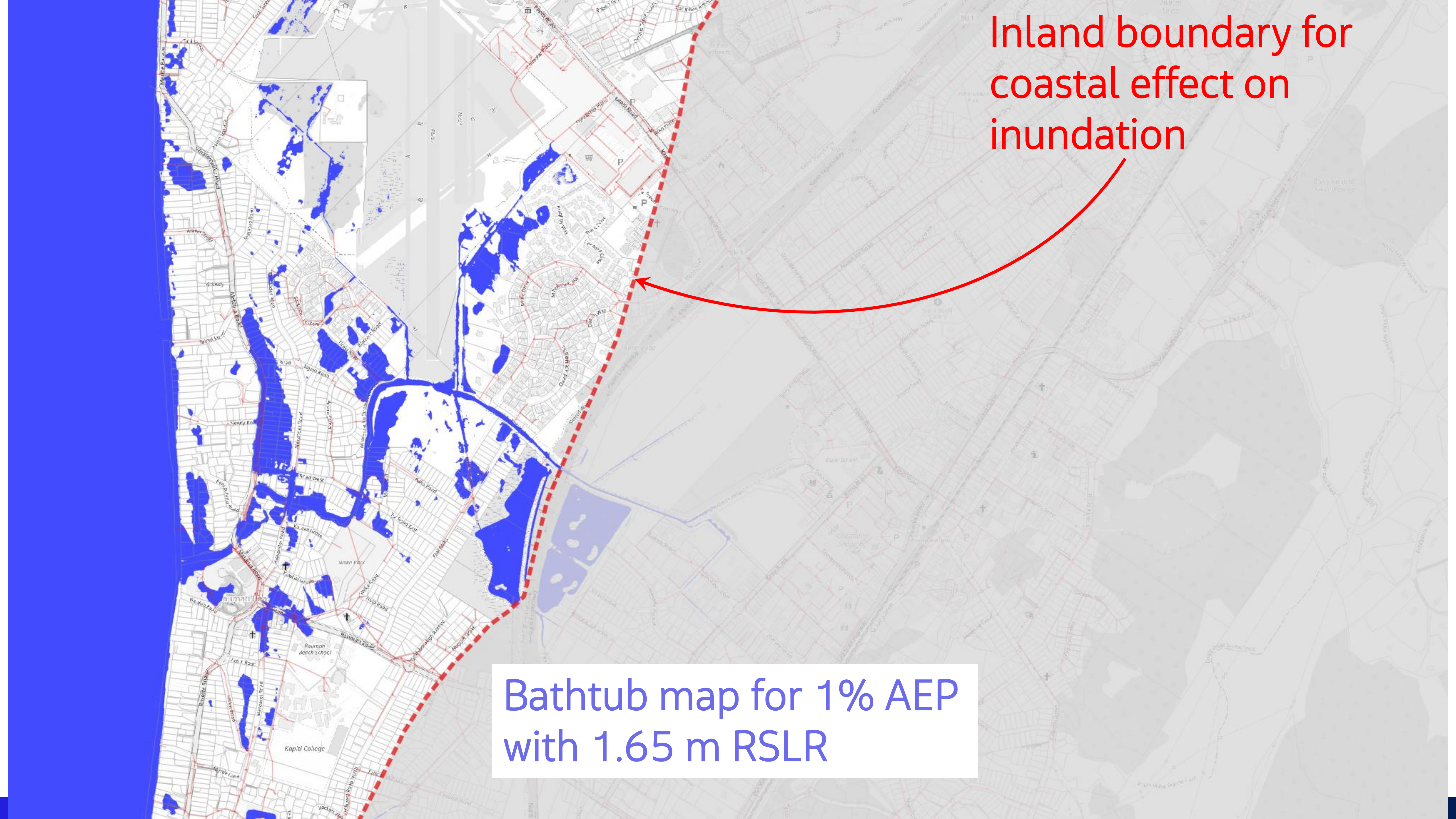
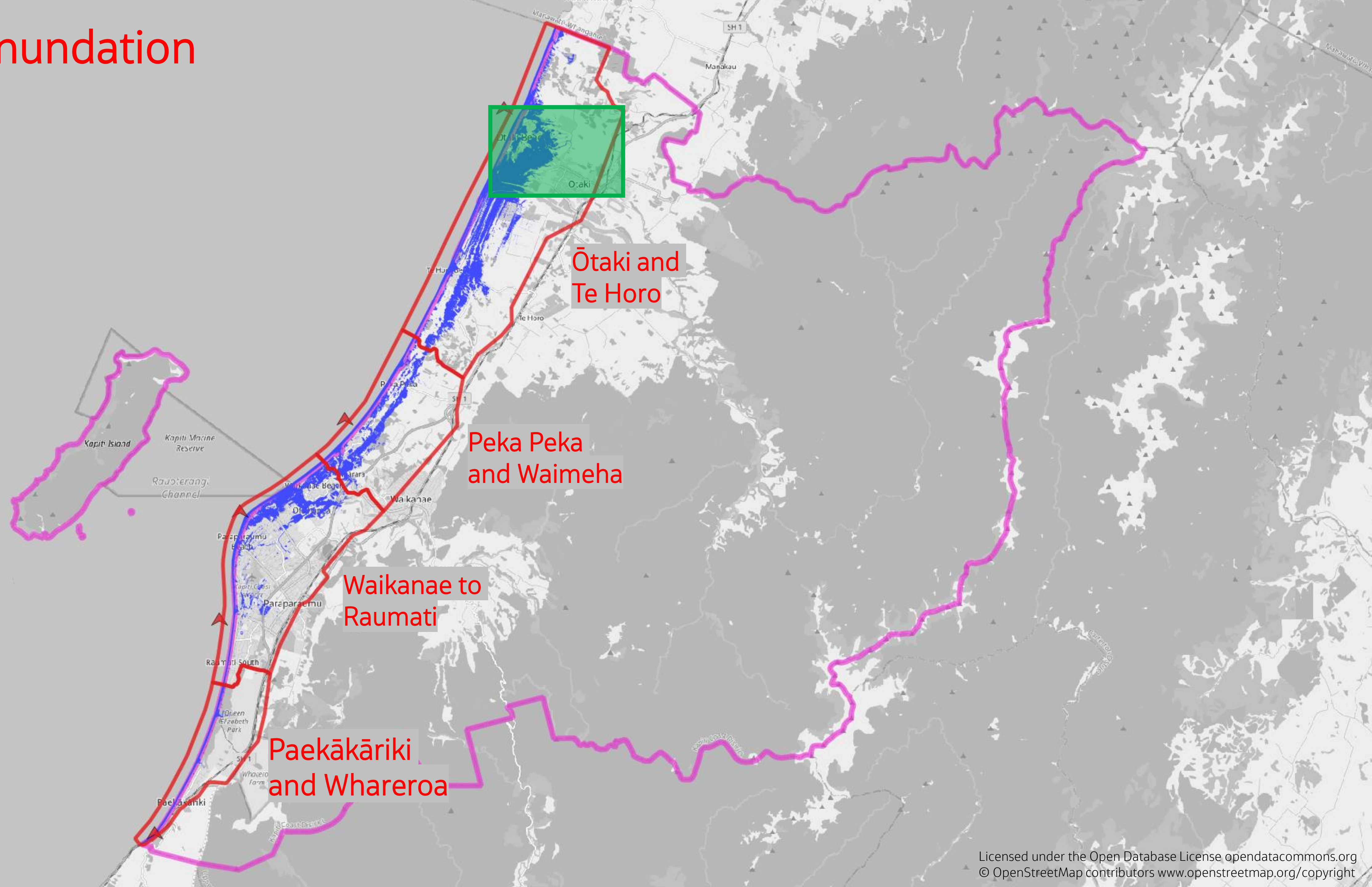

Inland boundary for coastal effect on inundation


Inland boundary for coastal effect on inundation
Bathtub map for 1% AEP with 1.65 m RSLR

Coastal inundation cells



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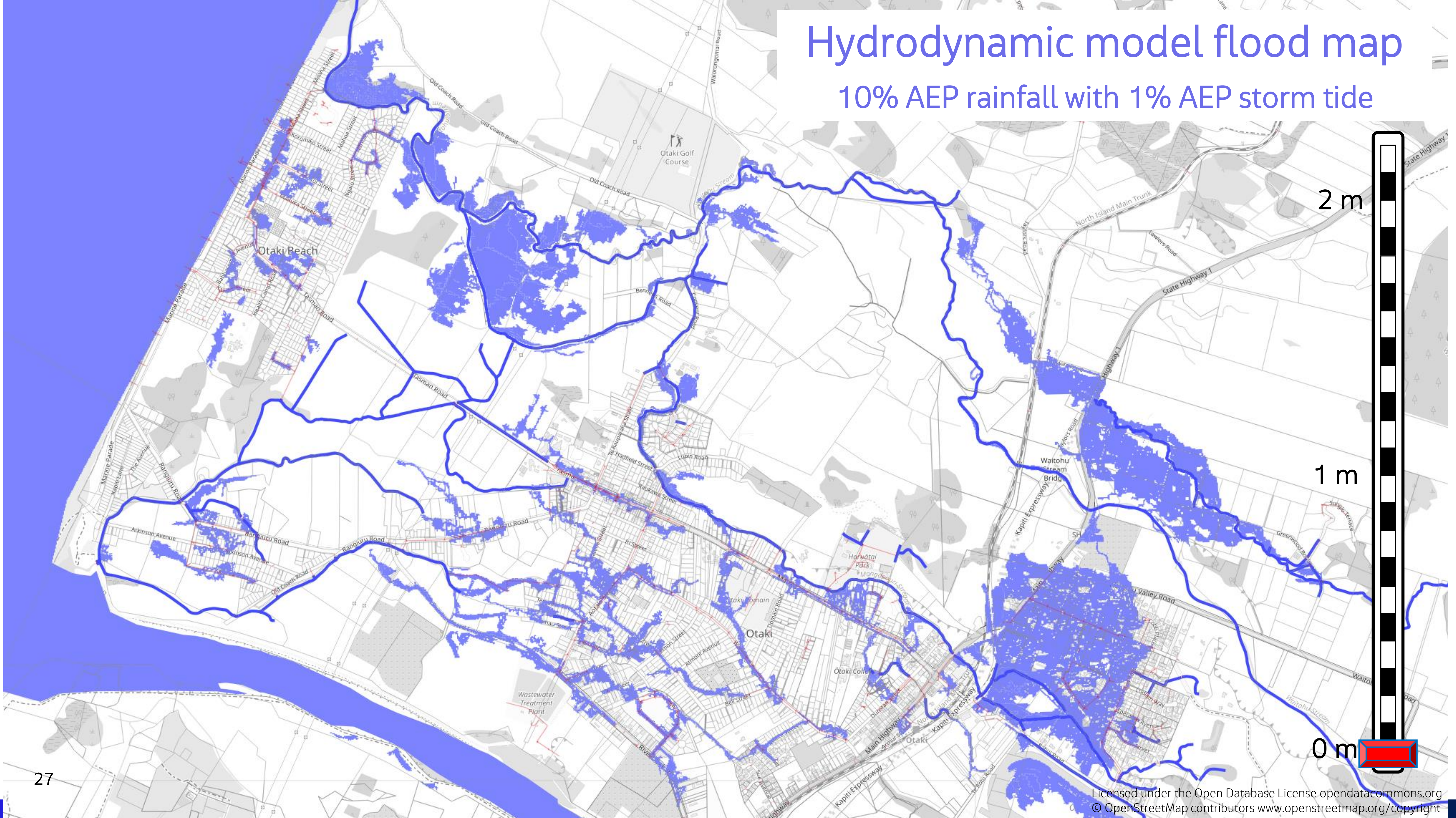

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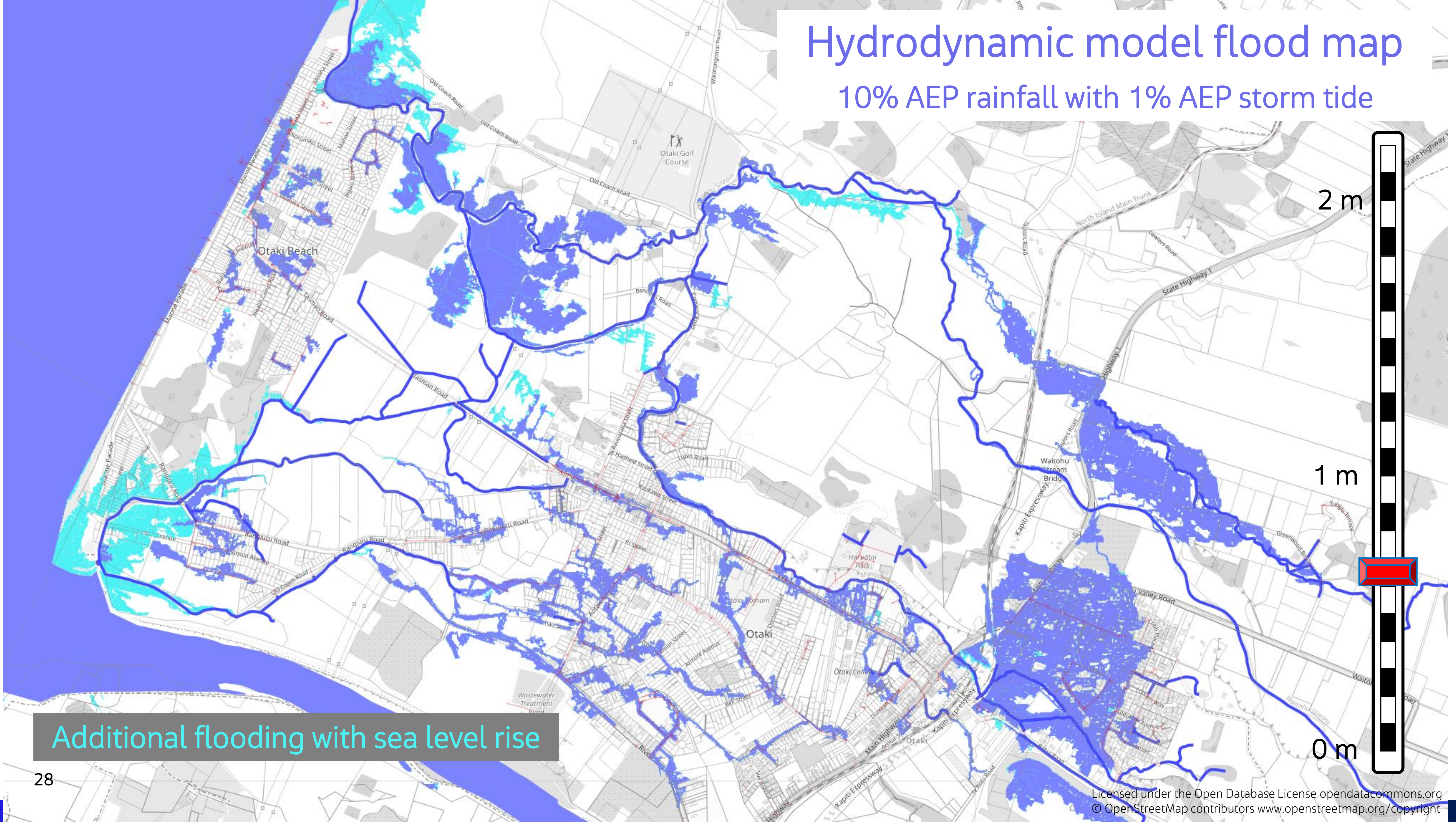
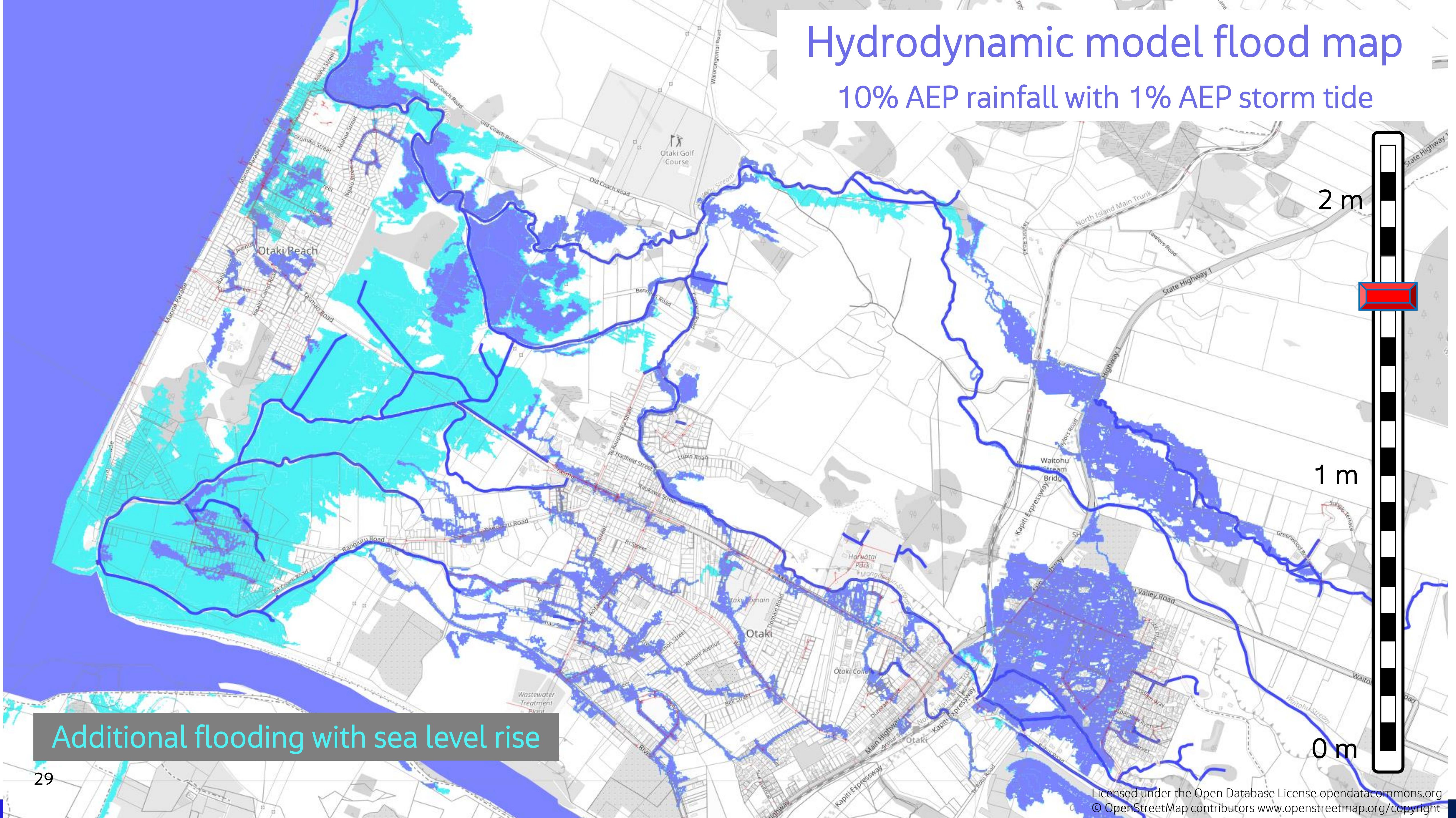
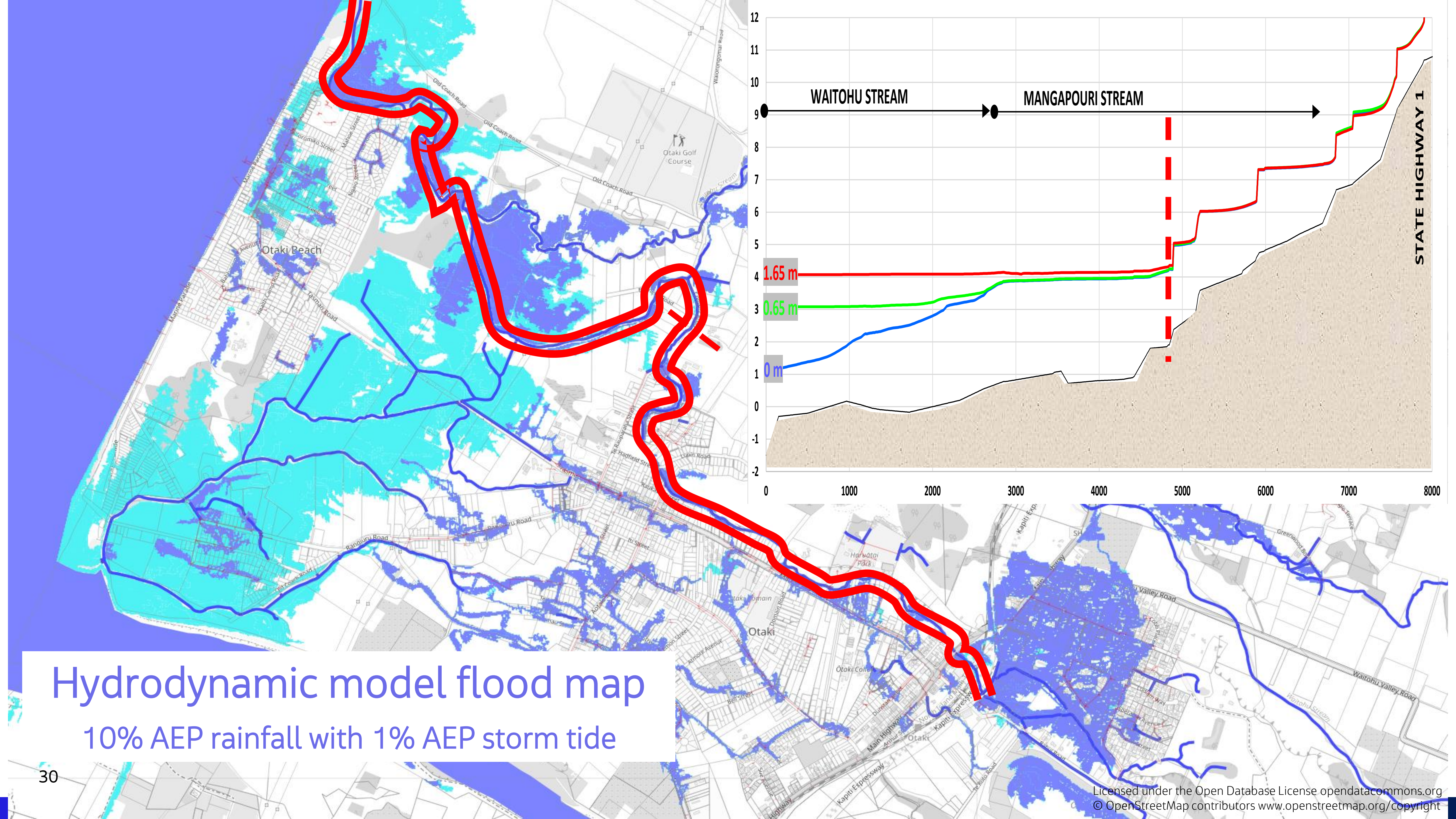


Hydrodynamic model flood map

10% AEP rainfall with 1% AEP storm tide



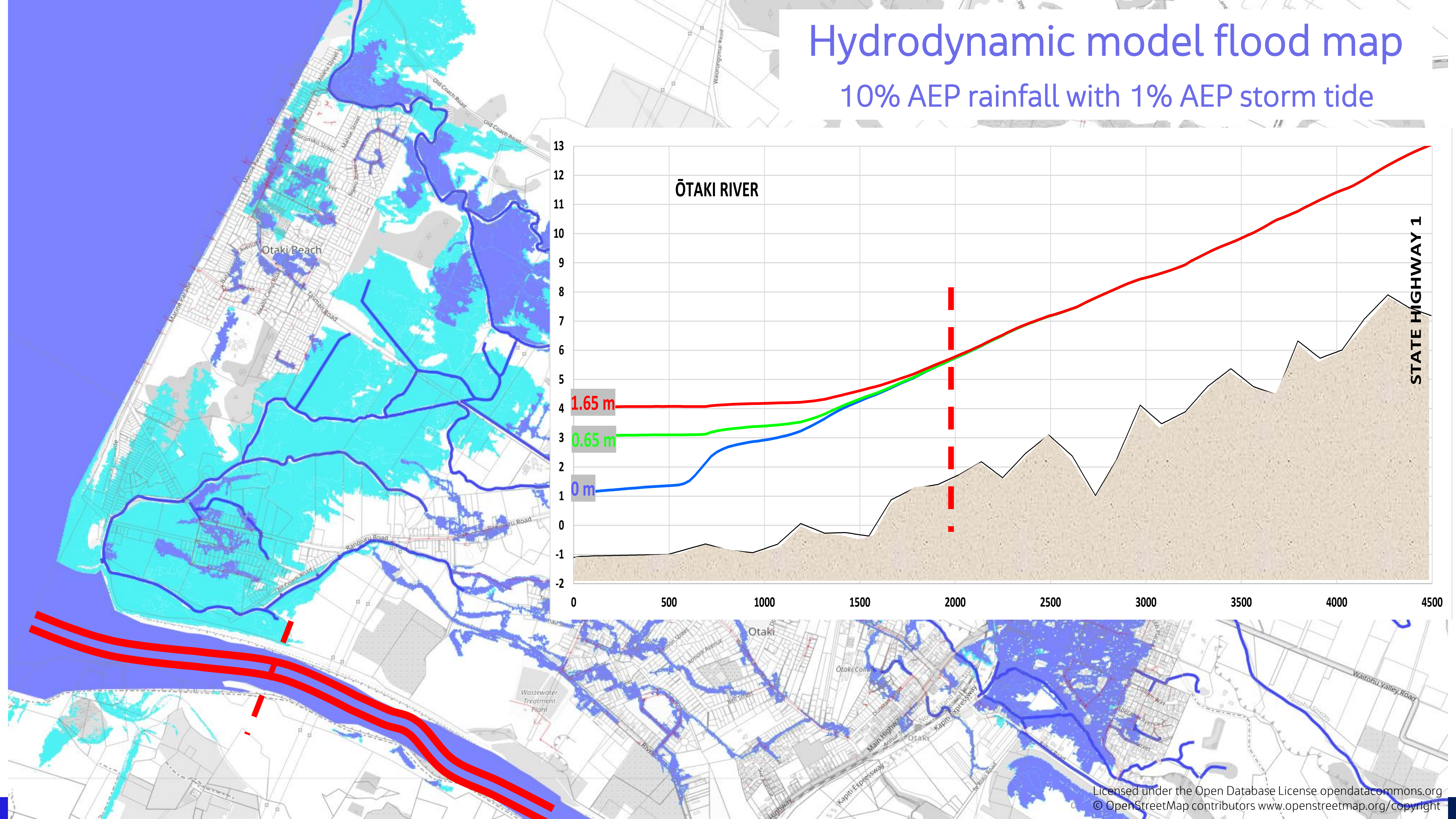


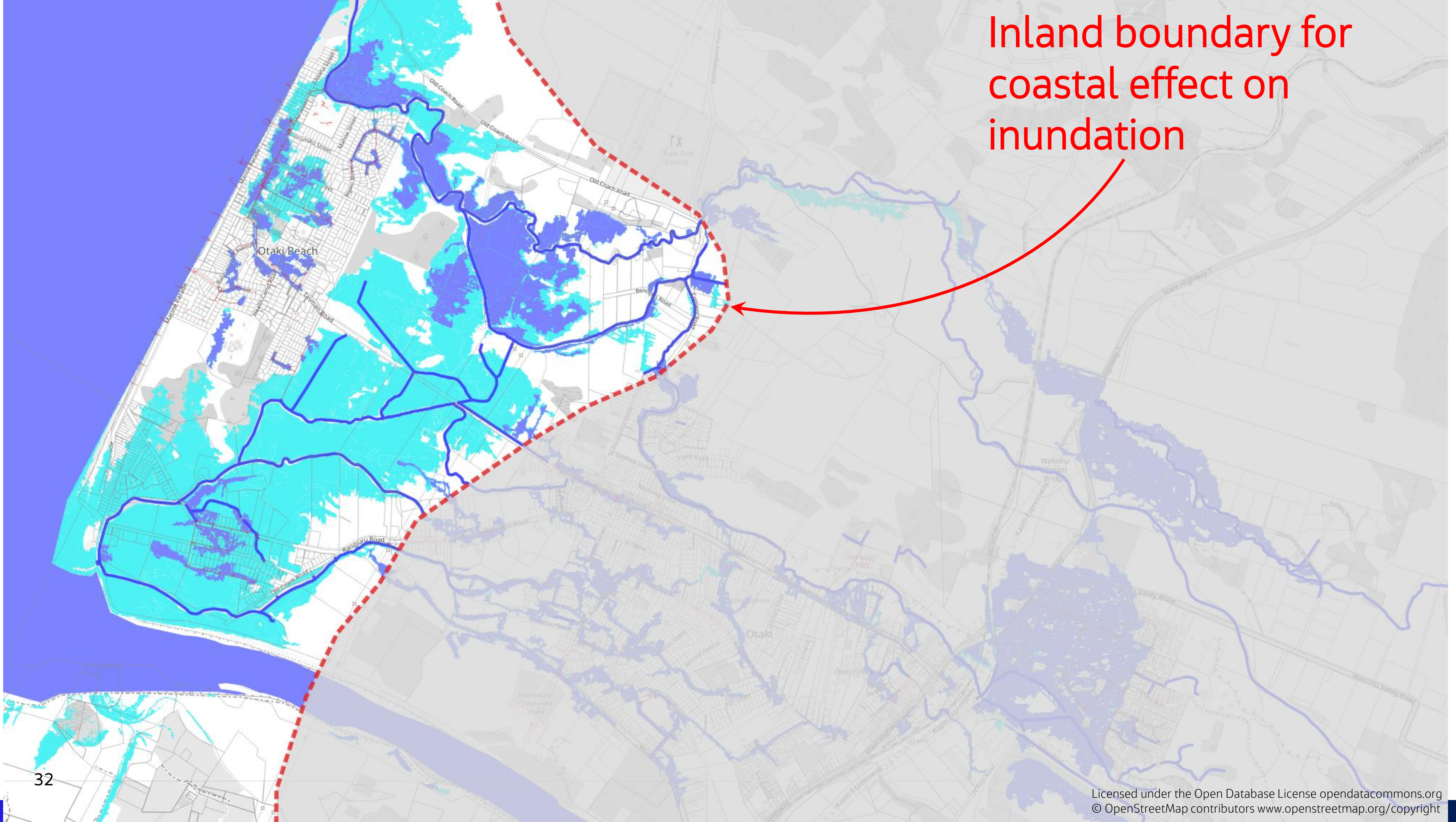
Hydrodynamic model flood map

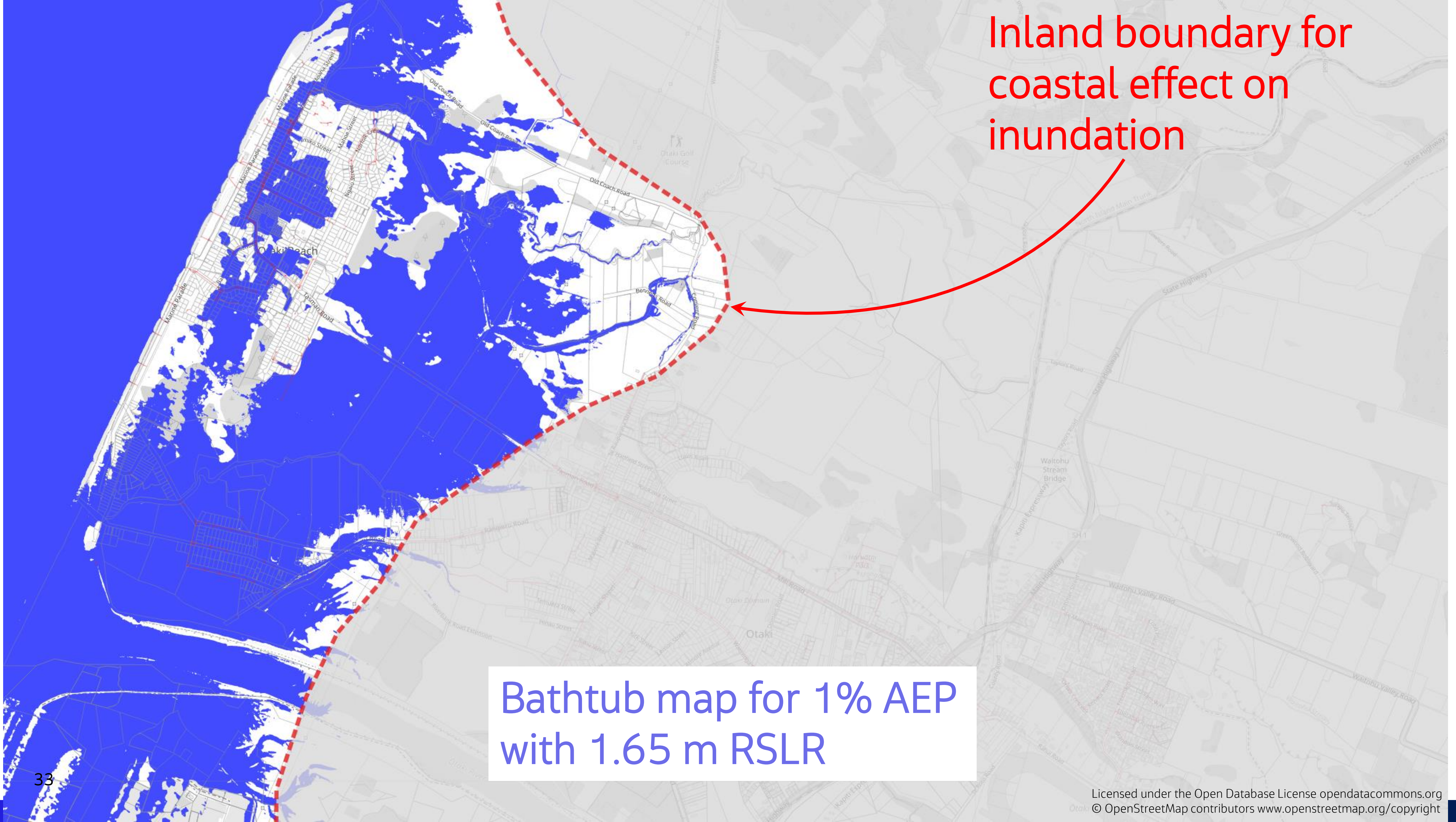
10% AEP rainfall with 1% AEP storm tide

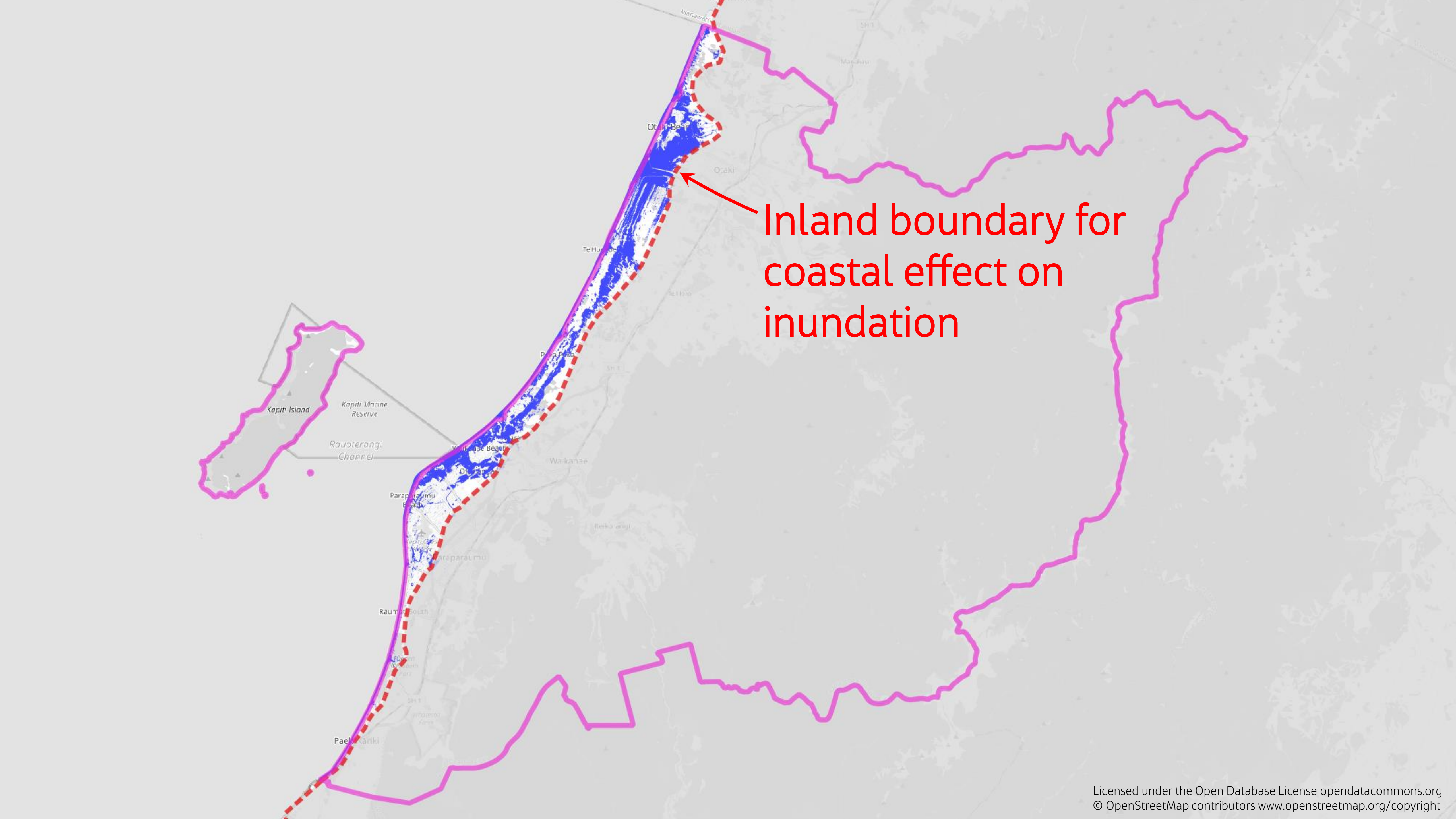
Hydrodynamic model flood map

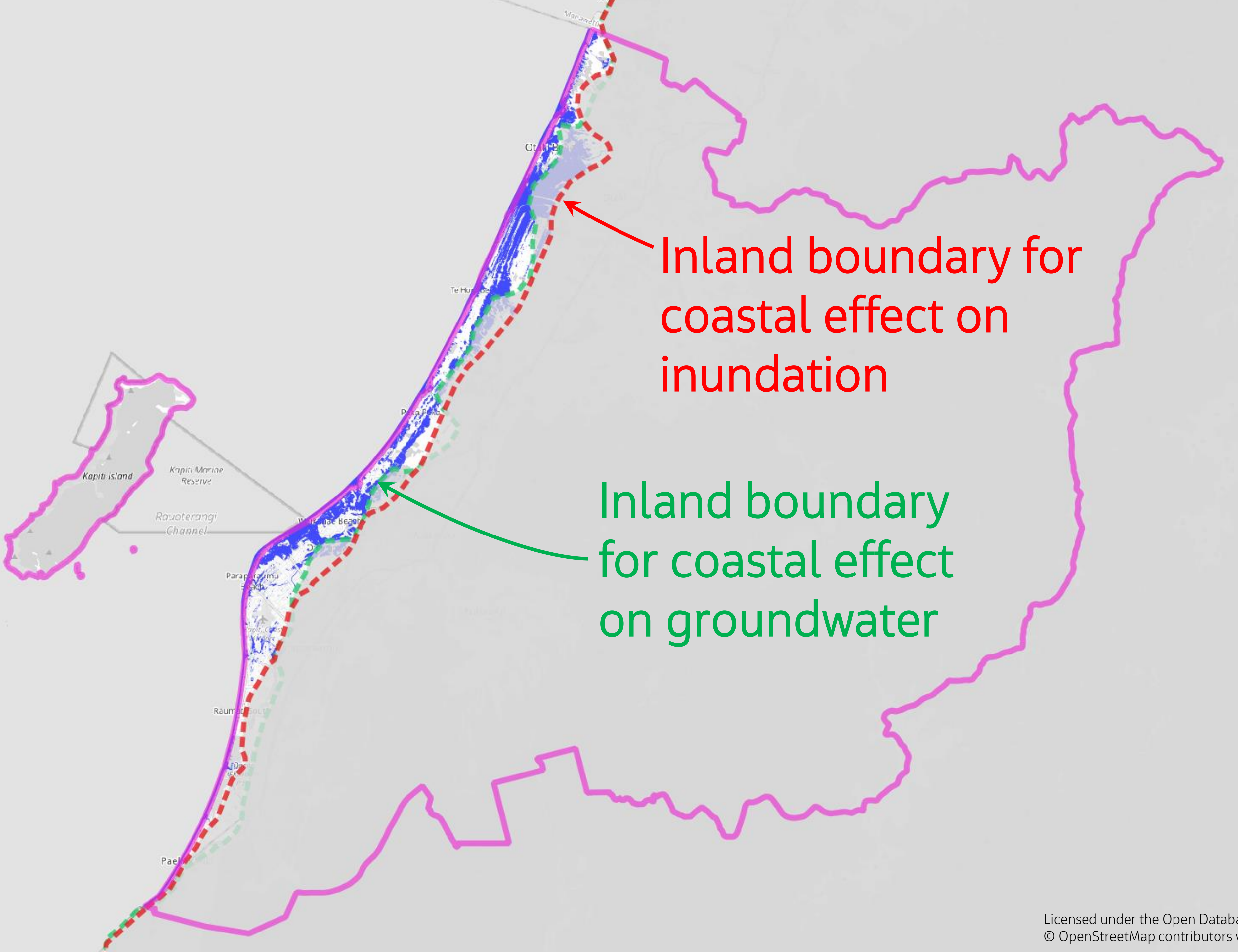
10% AEP rainfall with 1% AEP storm tide

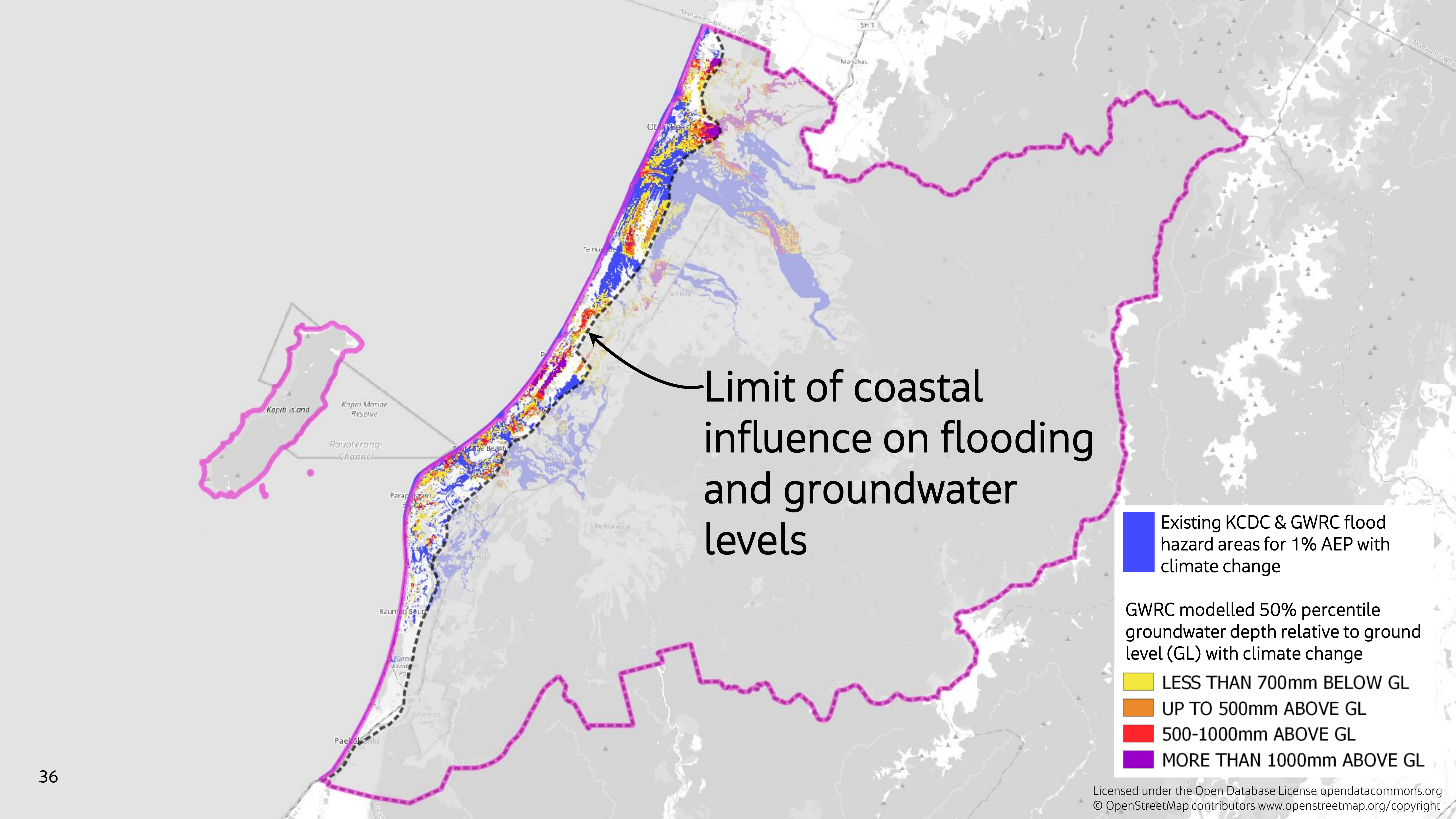



Inland boundary for coastal effect on inundation
Otaki Beach
Old Coach Road
Tasman Road
Marine Parade
Rangiuru Road
Bennetts Road
Otaki
State Highway 1
Waitohu Stream Bridge
Waitohu Valley Road


Inland boundary for coastal effect on inundation
Bathtub map for 1% AEP with 1.65 m RSLR
Otaki Beach
Otaki


Inland boundary for coastal effect on inundation
Kapiti Island
Kapiti Marine Reserve
Waikanae
Reikorangi


Inland boundary for coastal effect on inundation
Inland boundary for coastal effect on groundwater
Kapiti Island
Kapiti Marine Reserve
Rauoterangi Channel


Limit of coastal influence on flooding and groundwater levels
Existing KCDC & GWRC flood hazard areas for 1% AEP with climate change
GWRC modelled 50% percentile groundwater depth relative to ground level (GL) with climate change
LESS THAN 700mm BELOW GL
UP TO 500mm ABOVE GL
500-1000mm ABOVE GL
MORE THAN 1000mm ABOVE GL
Kapiti Island
Kapiti Marine Reserve
Rauoterangi Channel
Manakau
SH 1