NIWA - Tauranga Harbour Inundation Modelling 2019

Executive summary

Bay of Plenty Regional Council (BOPRC), Tauranga City Council (TCC) and Western Bay of Plenty District Council (WBOPDC) commissioned NIWA to calculate and model coastal inundation levels and their likelihood for the Tauranga Harbour coastline. This technical report details the data, models and methods employed in the study and presents the resulting inundation levels and mapping.

For hazard assessment purposes coastal inundation is defined as the combination of storm tide and wave setup plus any allowance for future sea-level rise. A previous report titled Tauranga Harbour Extreme Sea Level Analysis (Stephens 2017), calculated storm-tide frequency and magnitude by analysing extreme sea levels at all existing tide-gauge locations within Tauranga Harbour.

The purpose of this study is to map the overland extent of coastal inundation for the Tauranga Harbour coastline. This study expands on the previous extreme sea-level analysis by modelling storm-tide around the entire harbour and calculating the wave setup component.

The study used a calibrated hydrodynamic model (DelfFM) forced by tidal water levels, annual average river flows, wind, and air pressure (inverse barometer effect). The model used a flexible mesh with a high spatial resolution for populated areas of approximately 15 m cell edge. The model calculated storm–tide around the entire harbour shoreline and dynamically mapped the water depth overland.

The model’s ability to simulate overland inundation was validated against post-inundation surveys from the 5 January 2018 storm event. The model validated well in locations sheltered from waves to within a few centimetres of observed elevations. The wave set up component was calculated at over 100 sites using empirical formulae and the results validated well with observed elevations in exposed locations.

Inundation maps were produced for the total inundation level based on both the storm-tide and wave setup for a set of annual exceedance probability likelihoods of 2%, 1% and 0.2% (50, 100 and 500-year average recurrence intervals). The inundation levels and maps were calculated relative to Moturiki Vertical Datum 1953 (MVD–53) and include a present day mean sea level of 0.13 m to the year 2020. Further inundation maps were produced for additional sea-level rise scenarios of 0.2, 0.4, 0.6, 0.8, 1.25 and 1.6 m MVD–53. These sea-level rise scenarios were designed to meet the requirements of the New Zealand Coastal Policy Statement, the Bay of Plenty Regional Policy Statement and the recently updated MfE 2017 guidance for local government on climate change and coastal hazards.

All resulting coastal inundation maps have been supplied to the clients as digital GIS layers. These inundation hazard map outputs can be used for RMA planning and climate change adaptation planning.