# Regionwide Flood Modelling for Rural Auckland

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## ABSTRACT

Significant gaps in flood data have been identified for rural Auckland, mostly due to issues such as model currency, consistency, and accuracy. With Auckland facing increased growth pressures in these areas, it is paramount for Council to have up-to-date flood data for land use planning and development controls. Auckland pressingly needs a high confidence model of flood risk, which can be built in a relatively short timeframe and is capable of running different growth and climate change scenarios consistently. With later LiDAR and other new base data available, regionwide flood modelling was initiated in 2020 for 80% of the Auckland Region, covering approximately 4,000km$^2$ of land area.

Due to the project scale and substantial data volume, the project was split into two stages, with the first stage focusing on piloting and defining modelling methodology using a coarse 2D model representation for the region, and the second stage refining the model and producing flood risk data and flood plains.

Comparing to a typical catchment model, the challenges to the project are mostly related to balancing the heavy data processing needs and the detail and quality required for flood plain publication. Innovation and automation of GIS processing was a critical and integrated project component, which made it possible to achieve the required output data granularity across the entire region. Scripts and programming were used to populate model inputs such as:

- 29,000km of stream network with hydraulic connectivity,
- 650,000 cross sections perpendicular to flow directions,
- 3,500 rain profiles considering land use, soil type and spatial variability,
- 1,000km of low flow channels for DEM smoothing and undercut, etc.

The modelling was carried out in TUFLOW and the methodology was fine-tuned throughout the project based on learnings from numerous model iterations, to achieve the best practicable model representation for quality and consistency. Comparing to rapid flood hazard models, the regionwide model consists substantially more details both for hydrological and hydraulic modelling.

Comprehensive reviews were undertaken for input data processing, model setup and results. The model was also validated using rain RADAR and flood data from the August 2021 Kumeu flood event. During the validation, several sensitivity simulations were undertaken to confirm the model robustness by altering key parameters such as roughness's, grid sizes, tide boundaries, stream low flow channel profiles, as well as by utilising sub grid sampling for improved flow and volume calculations. After model

finalisation, flood plain mapping was also produced mostly using automated algorithms, which enabled speedy delivery without compromising quality.

The regionwide flood modelling project is one of its kind and will produce the best model for rural Auckland since 2009. It completes the floodplain mapping for the region with confidence and provides additional data for error checks on detailed catchment models. After this project, the regionwide flood model is planned to be used for additional scenario runs, generating more regional data sets for various planning purposes. A similar modelling methodology will also be applied to urban Auckland for further improvement to Auckland's flood data.