

## TANK Plan – Heretaunga Groundwater Model

### *How to download and run the model*

**This factsheet is for consultants and modellers who are interested to download and check the Heretaunga groundwater model.**

The proposed TANK Plan makes significant changes to how the allocation of water is to be managed in the Tūtaekurī, Ahuriri, Ngaruroro and Karamū catchments.

To download the model files, follow [this link](#).

To run the model, you need to be familiar with the Command line or Python FloPy package to run MODFLOW. This may be possible using other software, but it will be up to the user to trouble-shoot any issues that may arise from the use of a specific software.

### **The groundwater model**

The Heretaunga groundwater model was developed to support the setting of water allocation limits through the TANK stakeholder process. The model was developed by Hawke's Bay Regional Council in collaboration with GNS, ESR, Lincoln University, HydroGeoLogic Pty Ltd, Watermark Numerical Computing, WWLA and Aqualinc.

The industry-standard MODFLOW-2005 was used to simulate groundwater flow under steady state (i.e. all hydrological stresses are constant and time-averaged for a specific period) and transient conditions (constant, time-averaged hydrological stresses for each month but varies from one month to another) for the period from 1 July 1980 until 30 June 2015. The total modelled area was 506 km<sup>2</sup> including the Heretaunga Plains, connected river valleys and offshore areas where springs likely occur. The aquifer was divided vertically into two model layers:

- Layer 1- combined Holocene gravels (mainly river-fan gravels in the unconfined area) and the underlying Last Glacial Gravels
- Layer 2- deeper deposits of the main Heretaunga aquifer, to a maximum depth of about 250 metres.

Model calibration was performed using the industry-standard parameter estimation software PEST. More than 800 parameters were used in the model calibration. PEST runs were conducted using a high-performance computing facility, totalling nearly 50,000 processing hours.

### **Stream Depletion Calculator**

Because of the complexity of the MODFLOW model, a simplified approach was developed to enable more

people to predict the effects of groundwater takes on stream flow. R programming language and Shiny (R package) were used to develop a user friendly, interactive calculator that allows stream depletion to be estimated. The results of thousands of model runs are stored in the stream depletion calculator - around 217 million rows of data. The user can nominate a single well or hundreds of locations and associated pumping rates. In a few seconds the calculator will show the estimated impact on selected streams at certain time intervals. The Stream Depletion Calculator also provides a range of possible estimates. These are based on the Monte Carlo uncertainty analysis using PEST on a high-performance computing facility. Follow this link to [try the Stream Depletion Calculator](#).

### **Model limitations**

Despite the groundwater model being well calibrated, there is uncertainty associated with model predictions. For example, several combinations of model parameters will provide an acceptable match to the calibration datasets. That is why uncertainty analysis in the model predictions was undertaken using PEST. Despite the enormous complexity of the groundwater model, it is by necessity a simplification of the actual aquifer system intended for large-scale predictions.

Limitations of the model calibration also include:

- Poor match to observation data in some areas of the Heretaunga plains
- Limited data to calibrate to in some areas
- Conceptual uncertainty
- Uncertainty in the rate of recharge during high rainfall events.

Follow the links below to access the model reports:

[Heretaunga Aquifer Groundwater Model - Executive Summary of Development Report -](#)

[Heretaunga Aquifer Groundwater Model - Development Report -](#)

[Heretaunga Aquifer Groundwater Model - Scenarios Report](#)

[Heretaunga Aquifer Groundwater Model - Stream Depletion Assessment Report](#)

Please contact us [here](#), if you have questions about the model.