

Anglesea Groundwater Model

We have recently completed an update to the Anglesea Groundwater Model, a tool to help forecast and determine how much water can be taken sustainably from the Anglesea borefield when storages are low.

A groundwater model is a computer-based and interpreted estimation of how groundwater flows through rocks and sediments underground. Models allow us to examine how groundwater systems would respond to different stressors and predict what is likely to occur under future climate conditions and any potential groundwater extraction activities. Because of this they play an integral role in informing water management decisions.

The Anglesea Groundwater Model was initially developed in 2008 to support Barwon Water's original Bulk Entitlement application. It has been updated over time to capture the additional knowledge and understanding that has been obtained from monitoring activities undertaken as part of our Monitoring and Assessment Program (MAP).

The model has been reviewed and revised in the lead up to the BE review, to include new data, climate change scenarios and other groundwater users. This includes factoring in Alcoa's hydrogeological and monitoring data. Using all available information – as well as factoring in other groundwater users – will ensure our groundwater model and forecasts are as robust as possible.

The revised model will provide a greater understanding of the factors that may influence what Barwon Water can sustainably take from the Anglesea borefield to supplement drinking water supplies when storages are low.

Model Development Process



Data review

Prior to building the model, a comprehensive review of the existing data (from Alcoa, Barwon Water and the Department of Energy, Environment and Climate Action) was used to interpret the geological and hydrogeological conditions of each aquifer system.

This included:

- data from > 140 groundwater monitoring bores
- data from 6 stream gauges
- findings from the historic and recent pump tests
- long-term climate data
- the observed recovery following Barwon Water and Alcoa's extraction periods.

This is >60 groundwater bores more than the previous model.

The inclusion of the Alcoa data has also provided additional detail around the aquifers and their physical and hydraulic properties, particularly around the mine pit.

Model build

The Anglesea Groundwater Model update involved using the latest numerical code, updated layer structure and parameterisation schemes to develop a computer-based representation of reality.

The current model includes 12 layers to reflect their inter-relationships and variations in hydraulic properties between, and within, each of the geological formations. This includes areas that were excavated and backfilled as part of Alcoa's operations.

Calibration

Once developed, the model was 'trained' to the observation data set and results from the recent groundwater pumping test. This used significantly more data that has been collected since the previous model.

Model 'training' comprised an iterative process to optimise model parameters across 250+ different but equally plausible models. This aims to ensure that simulated groundwater levels and surface water flows adequately reflect what we are observing in the monitoring data. The alternative models provide a measure of uncertainty in simulated groundwater and surface water flow, in recognition of the model being an estimate of what may truly be happening beneath our feet.

External review

Upon completion of the draft Anglesea Groundwater Model, it was reviewed by the Inter-Agency Group (IAG) comprising Department of Energy, Environment and Climate Action, Southern Rural Water and Department of Jobs, Precincts and Regions – Earth Resources Regulation, who were supported by a Technical Review Panel (TRP) consisting of independent experts from a wide range of fields including geology, hydrogeology, modelling, geochemistry, and ecology.

Together, the IAG and TRP provided feedback on the groundwater model to ensure the model is appropriate and robust enough to be used for the intended purpose. This feedback has been addressed and the IAG has since determined that the model is 'fit for purpose'. This means that the model can now be used to conduct predictive modelling as part of the groundwater pumping impact and risk assessment process.

How will the model be used?

The Anglesea Groundwater Model will be used to predict how the groundwater system may respond to climate and Barwon Water's potential groundwater pumping activities. This includes the use of current, median and high (dry) climate change scenarios to assess how forecast changes in rainfall patterns may impact the sustainability of the groundwater systems. This also includes an estimate of uncertainty in model predictions, by using 250+ different but equally plausible models.

Model outputs include:

- Maps of groundwater depth over time
- Maps showing seasonal variation in groundwater depths over time
- Groundwater depth hydrographs at specific locations
- Stream flow frequency-duration plots and zero flow periods
- Groundwater system inflows and outflows (i.e. flux) over time
- Alcoa pit water body levels

These outputs will then be used to help determine how much water Barwon Water can sustainably take from the borefield into the future.

The groundwater model will also be used by Alcoa to help inform Alcoa's mine rehabilitation strategy.

