



# Using Models to Manage Water Resources

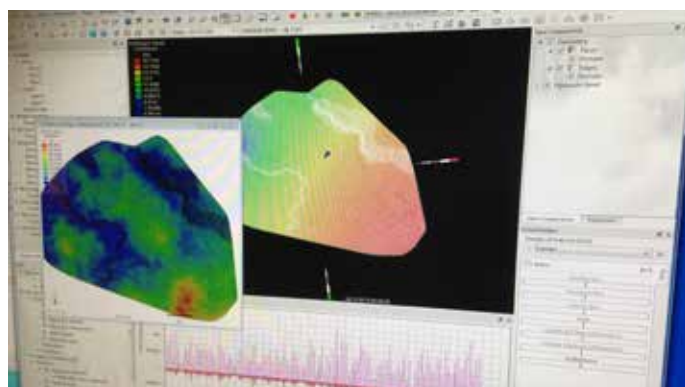
## What is a model?

Water resource models are used by the Department to simulate and predict surface water and groundwater processes and conditions. Models can be used to replicate natural water movement in the environment and predict the effects of development. Given this ability models are commonly used when developing water allocation plans and managing water extraction licences.

Water resource models are generally built and operated by experts who understand the interaction of water and geology.

The model used by the department simulate groundwater and surface water interactions. The two key elements involved are a conceptual model and a mathematical model. The conceptual model provides a simplified picture of how a natural system works. It maps key water flow processes, according to the surface and underground properties of the area. The mathematical model uses a set of equations that describe the physical processes of the aquifer and rivers being investigated.

Models use information about the characteristics of rivers and aquifers such as topography and thickness of soil/rock layers and extent, as well as data on rainfall, evaporation, water extraction, river flows and groundwater levels. In general the more data available the more accurate the model.



## Purpose of models

Models can help answer the 'what if' questions by:

- Replicating natural system behaviour
- Estimating the impact of development on the system
- Predicting future development impacts
- Predicting future natural change – climate variations

## Benefits of models

Estimate the natural system response

- Generate and apply statistically supported long term datasets
- Provide indicative water balance quantities
- Quantifies impacts under different usage patterns
- Test scenarios for future development impacts, extreme events and worst case predictions.





## Can we rely on models?

The performance of a model is measured by the accuracy with which it can simulate observed data. That is, if the model can faithfully reproduce observed river flows and groundwater levels then the model may be said to be reliable. The accuracy which is required for a model to be reliable enough to use in decision making is a matter of professional judgement.

Some considerations regarding accuracy include:

- Models are never 100% accurate:- It is a numerical construction of reality which attempts to describe real world processes using mathematical equations. It is not real world.
- Models involve generalisations, averaging and extrapolation of field data.
- Large basin scale models cover several thousands of square kilometers incorporating different hydrological and geological features, and may include several aquifers and catchments. If a model is able to replicate 80% or more of the observed data then it is deemed to be reasonably accurate.

Modelled data is often the best estimate available for making decisions. But it is not the only information available. Modelled data must be used in conjunction with other knowledge, including local knowledge and observations.

An important aspect of model reliability is climate change. In the Top End increased rainfall and temperatures have been recorded over the past 30 years, and indications from the Bureau of Meteorology are that this trend is set to continue and indeed accelerate in the years ahead.

This means that the calibration and verification datasets are constantly changing. To ensure that our models can replicate the 'moving target' and continue to provide best estimates requires ongoing review and recalibration at regular intervals, as well as improvements of monitoring networks.

