Characterisation of Current Groundwater Uses in the Surat and Bowen Basins

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1 - OVERVIEW

This project aims to estimate the amount of water extracted by groundwater bores in and around the Surat Cumulative Management Area (CMA).

This is being undertaken to independently improve accuracy of water use estimates, which can be used as inputs to future groundwater flow models used by government and the coal seam gas (CSG) industry.

Current work focuses on two main areas:

- Development of advanced statistical models to estimate water use
- Collection of data to improve statistical models

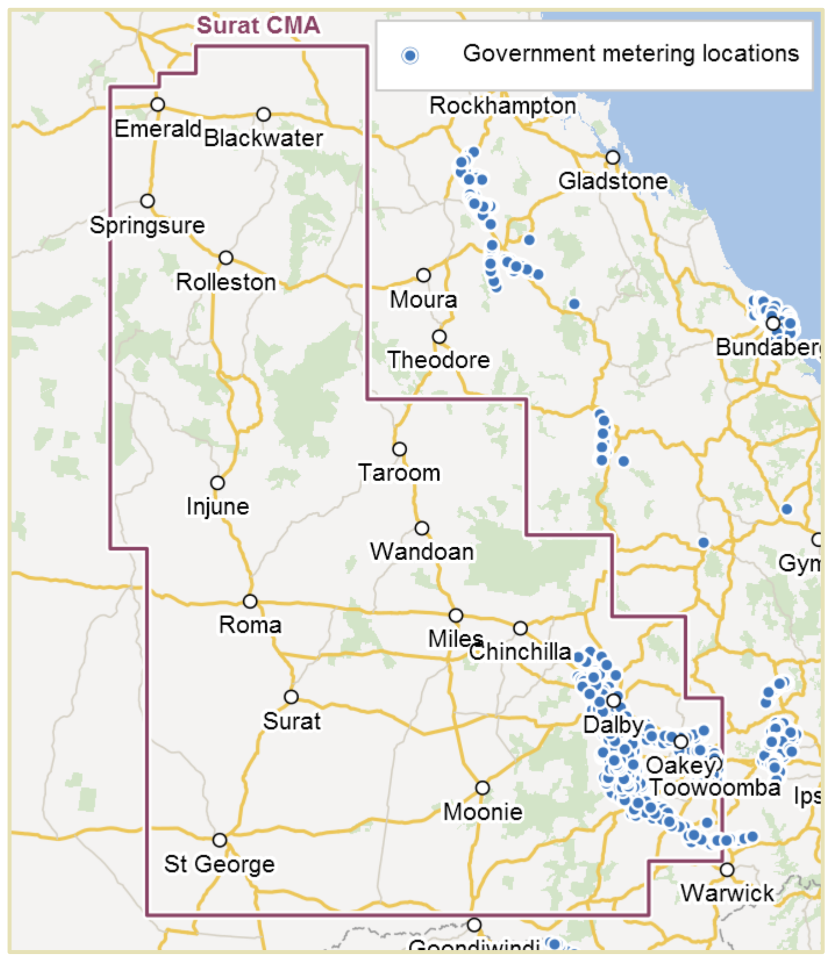

Fig 1. Location of Surat CMA and extent of existing metering reported to government

2 – DATA COLLECTION

Data collection is ongoing until the end of 2016, incorporating both:

- 'Soft data' collection (bore owner survey)
- 'Hard data' collection
  - Strategic field flow metering program of 40 bores
  - Collection of privately metered data

The data collection is being prioritised by:

- Hydrostratigraphy – targeting the most extensively used aquifers, in geographic regions where each aquifer is most accessed
- Geography – getting a balance of points uniformly across the area, and in areas close to CSG production
- Usage type – representing main usage types (stock, domestic, irrigation, intensive livestock, municipal, etc.)

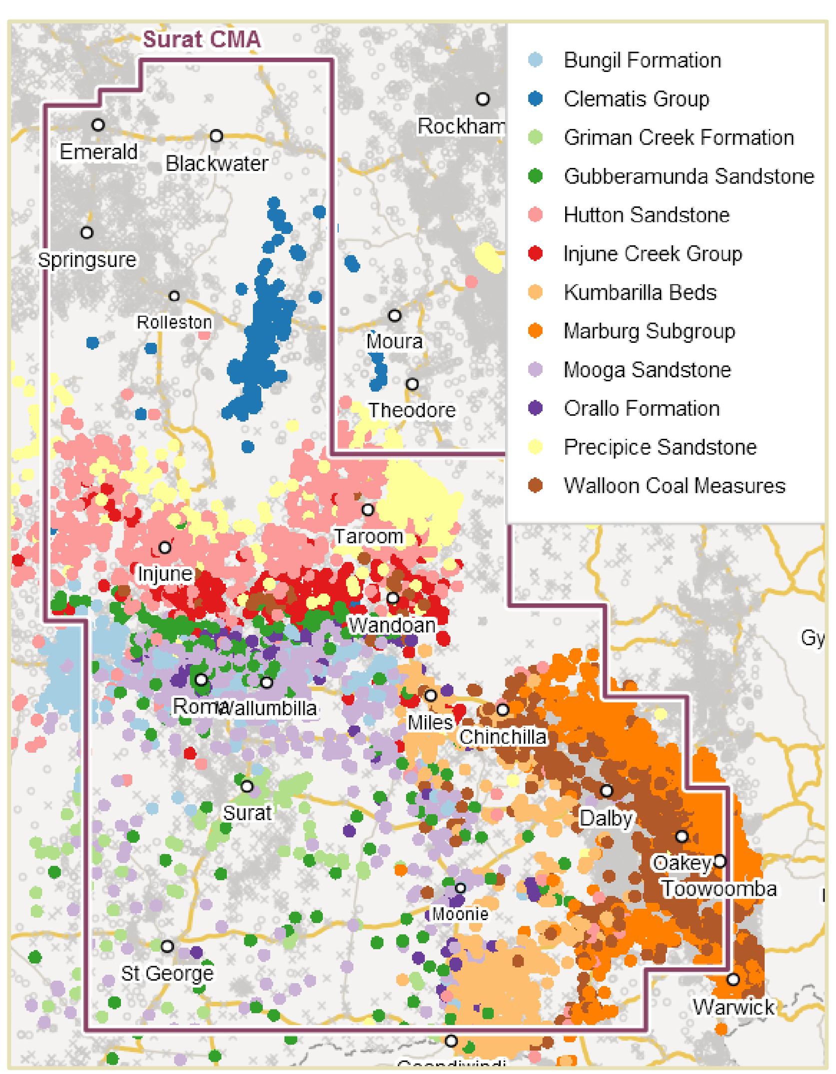

Fig 2. Distribution of existing registered water bores by aquifer

3 – DEVELOPING SPATIOTEMPORAL STATISTICAL MODELS OF GROUNDWATER USE

Several data sources are available to estimate water use: metering, estimates from member company baseline assessment, and other anecdotal estimates. There are also an increasing number of datasets of other spatiotemporal variables which may help predict extraction rates (e.g. rainfall, temperature, soils, stocking rates etc.).

These have complicating statistical features, such as zero flow readings, non-normality, and non-stationarity. Conventional spatial interpolation methods (e.g. kriging) cannot be used. We use the open-source R-INLA package to construct Bayesian spatiotemporal models which can accommodate these features.

We have successfully trialled this approach in the Condamine Alluvium (see images on right). This uses a joint model to predict both probability (using a binomial model) and magnitude (using a gamma model) of abstraction from bores in space and time. The effect of a range of spatial covariates upon the predictive ability of the model can be tested to select the most appropriate model.

The model can include a separate spatial random effect: a stochastic, spatially indexed process representing all spatially explicit processes that may have an effect on extraction (apart from those implicitly represented in other covariates).

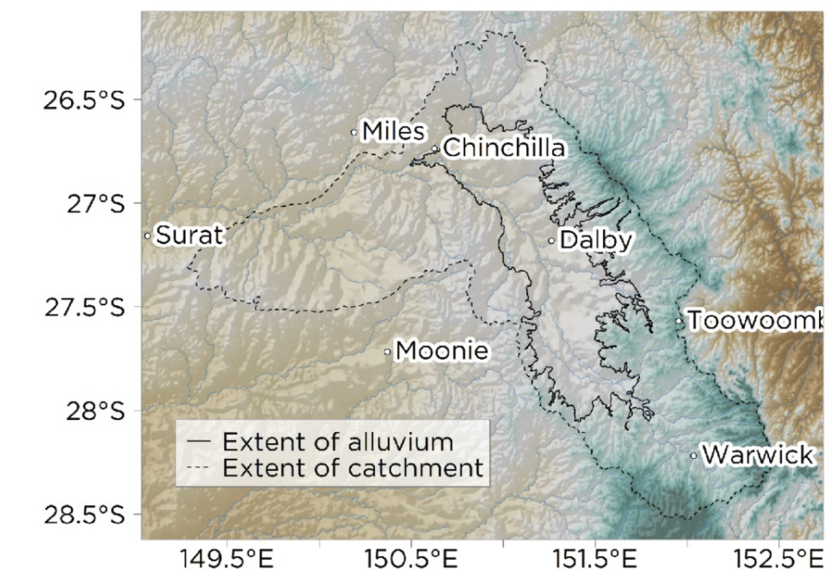

Fig 4. Location of Condamine Alluvium

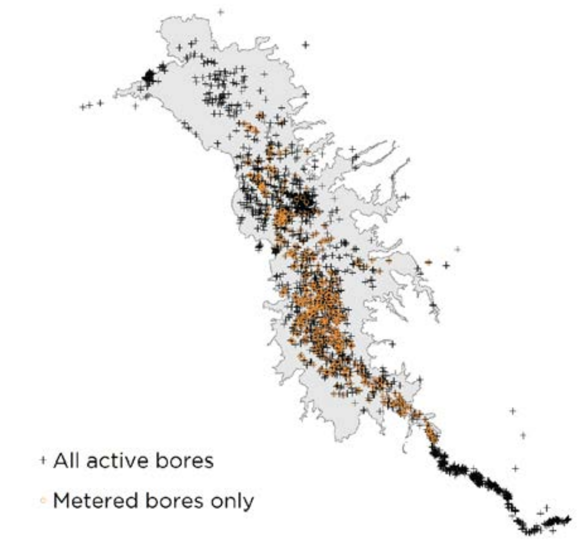

Fig 5. Location of current water supply bores

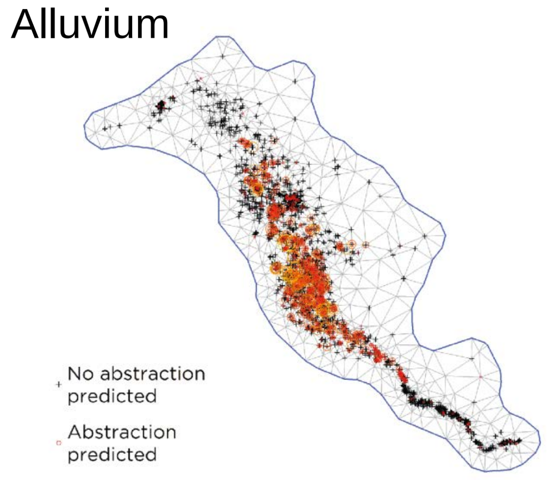

Fig 6. Sample realisation of model prediction

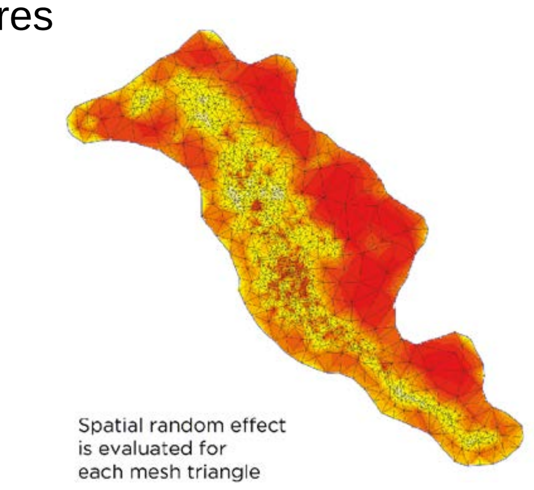

Fig 7. Sample realisation of model spatial random effect

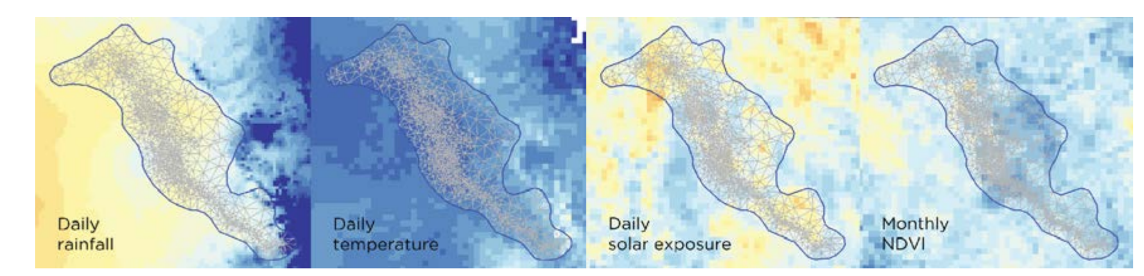

Fig 8. Example of gridded meteorological covariates

4 – NEXT STEPS

Over the next year we will be:

1. Implementing our non-invasive field metering program, including:
   - Installation of 40 ultrasonic flow meters and large tipping bucket flow meters
   - Collection of data in mid-2016 and end of 2016
   - Examining options to extend the life of the metering program past 2016

Fig 3. Non-invasive ultrasonic flow metering equipment

2. Continuing existing data acquisition and collation, including:
   - Privately metered data, e.g. councils, intensive livestock users, share bores
   - Anecdotal estimates of use, e.g. government studies surveys, parish records
   - Other supporting spatiotemporal datasets, e.g. climate, soils, agriculture

3. Refining and upscaling our predictive water use models to the entire Surat CMA

By the end of 2016, we will produce basin-wide estimates of groundwater use, and corresponding uncertainty, made publicly available for use in numerical groundwater modelling and other applications.

ACKNOWLEDGEMENTS, DISCLOSURE & DISCLAIMER

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