JBA consulting

Quantifying the impact of water company drought measures on water demand during the 2012 drought

Dr Maxine Zaidman

Consultants of the Year 2010 nce ace Winner

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  - Participating water companies

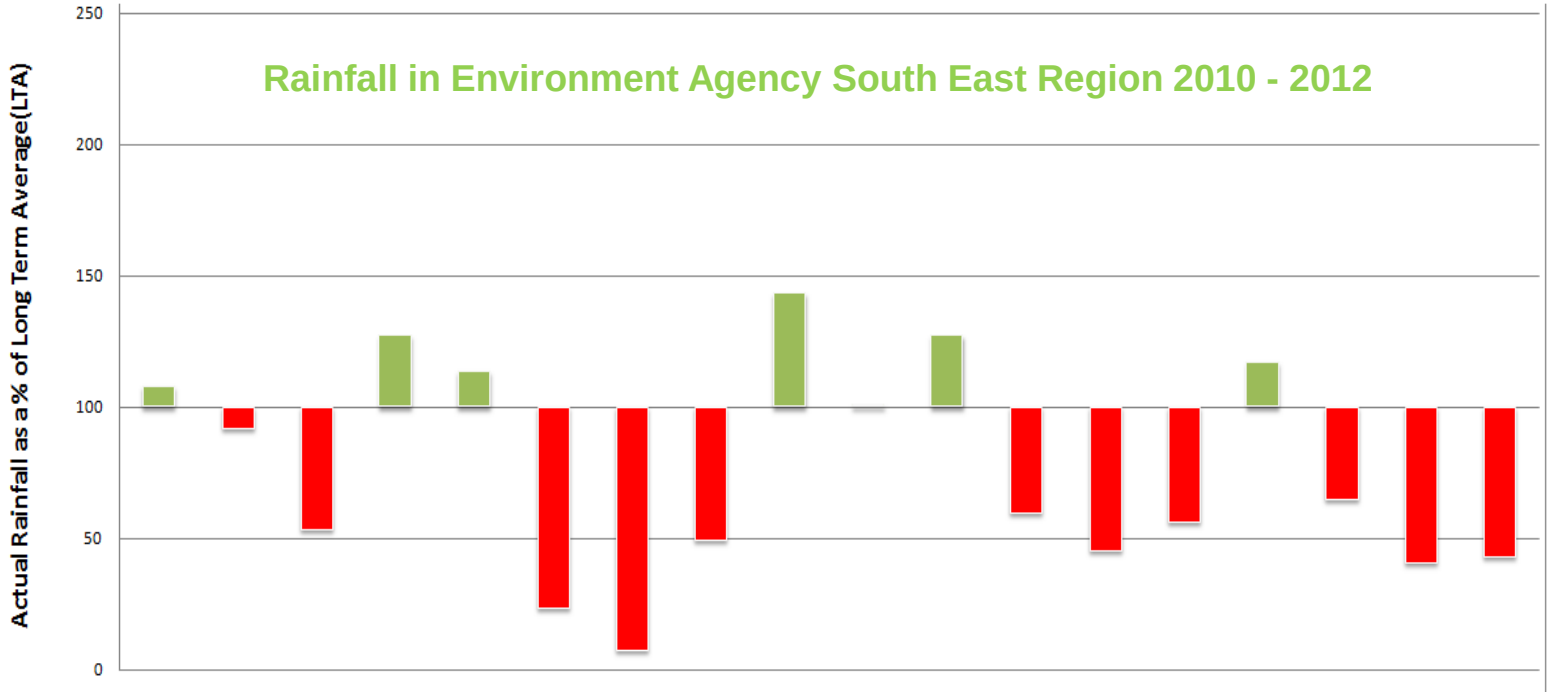
Objectives and Methodology

To identify if, when and by how much water usage reduced as a result of the restrictions put into place across the South East during the 2012 drought.

Involved modelling expected usage with no restrictions in place and comparing this with observed usage profiles.

Spring 2012: The prospect of a drought

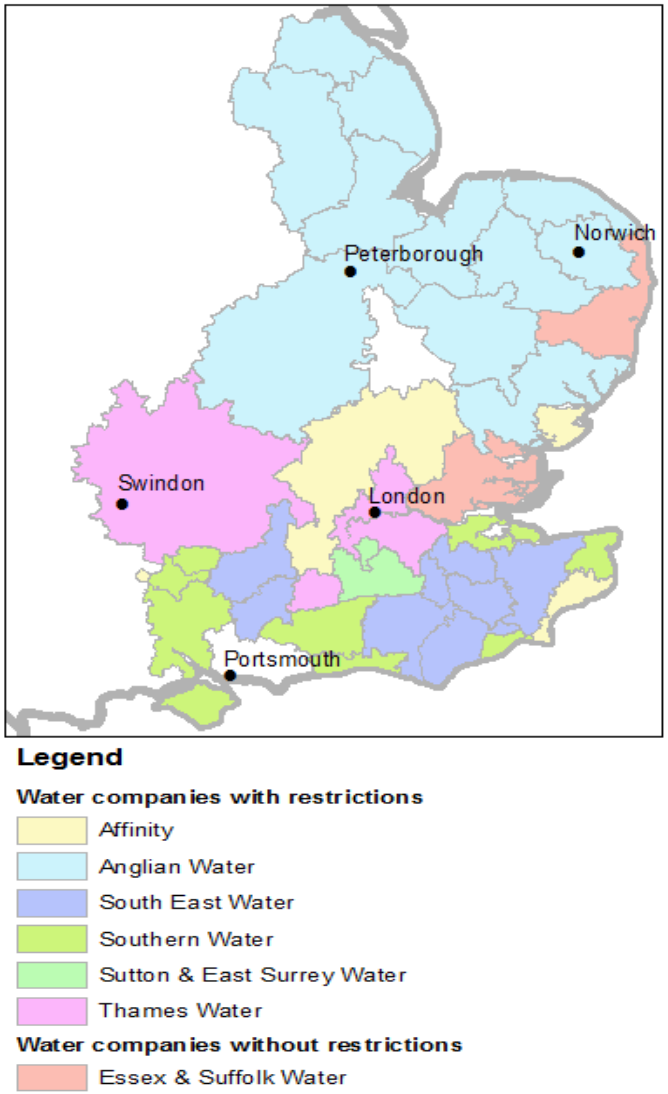
- Winters 2010-11 and 2011-12 very dry
- Jan to March 2012 rainfall totals lowest since 1973



Spring 2012: Implementation of demand management measures by water companies

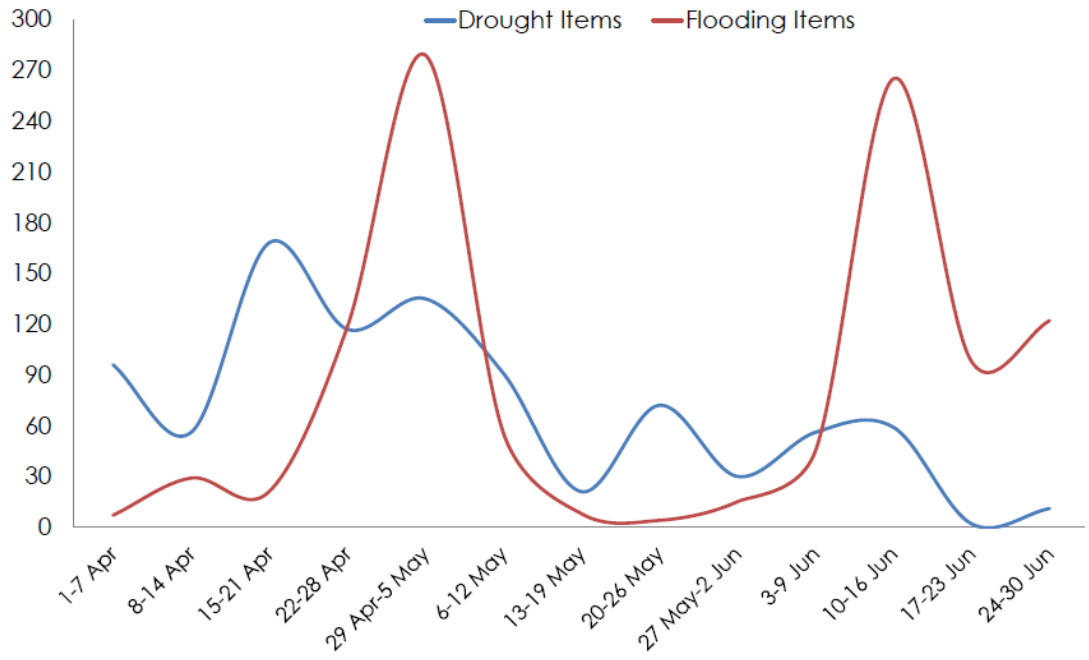
- Renewed water efficiency campaigns
- Leakage and pressure management
- Temporary Use Bans (TUBs)

- On 5 April 2012 seven water companies imposed restrictions through TUBs
- This affected 20 million customers across the SE



Spring-summer 2012: A total washout

- Focus switched to flooding as the spring/summer saw exceptional rainfall
- Surface water resources recovered very quickly
- Groundwater resources recovered more slowly but faster than expected
- 3 companies lifted bans on 13 June 2012, the rest on 8 July 2012



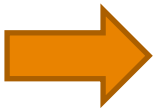
Media coverage of the EA's responsibilities in relation to drought and flood management (from Media Measurement, 2012)

The need to quantify the impact of the measures

Did the demand measures have any affect on usage?

Are communication campaigns effective at reducing use?

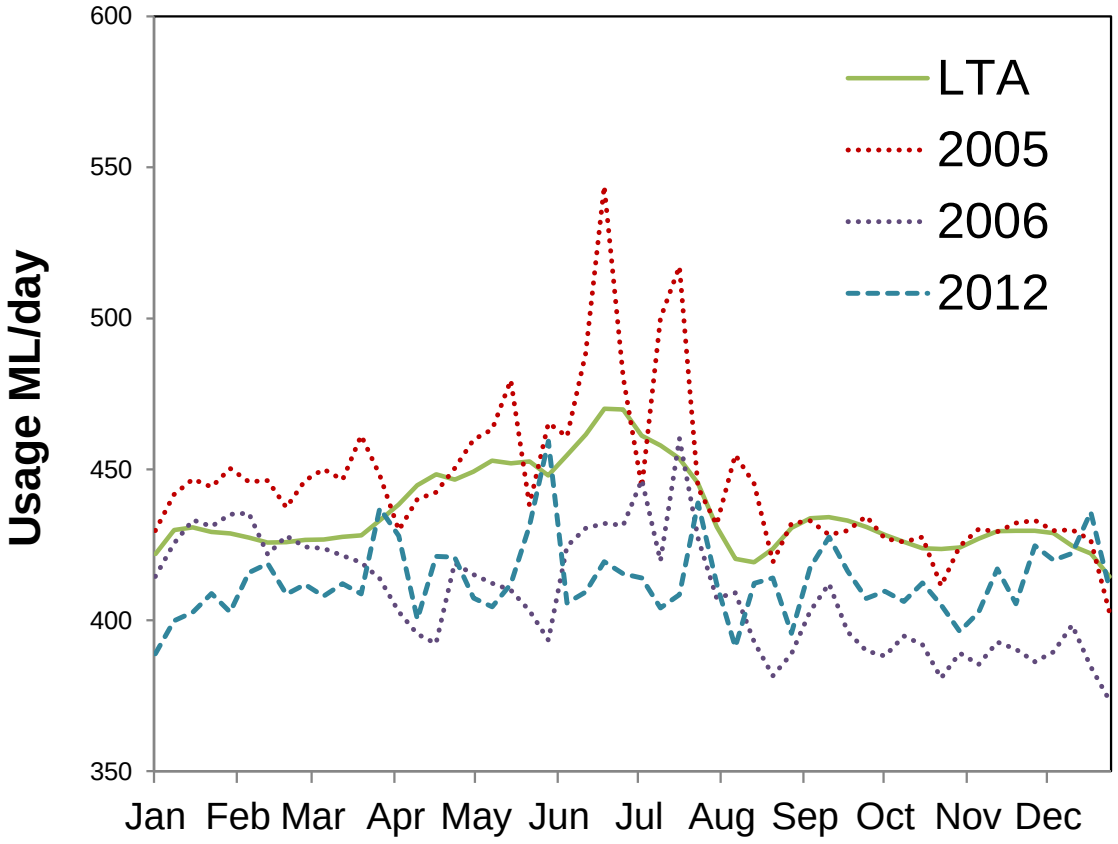
What would the use have been in 2012 if no restrictions?



- Hot days cause spikes in use, particularly for social use, e.g. filling pools
- Prolonged soil moisture deficits result in increased use
- Social factors impact on use

How did observed use in 2012 compare to other years?

- Preliminary work showed a marked decrease in usage with the TUB
- For some areas only
- Could have been a “fluke”

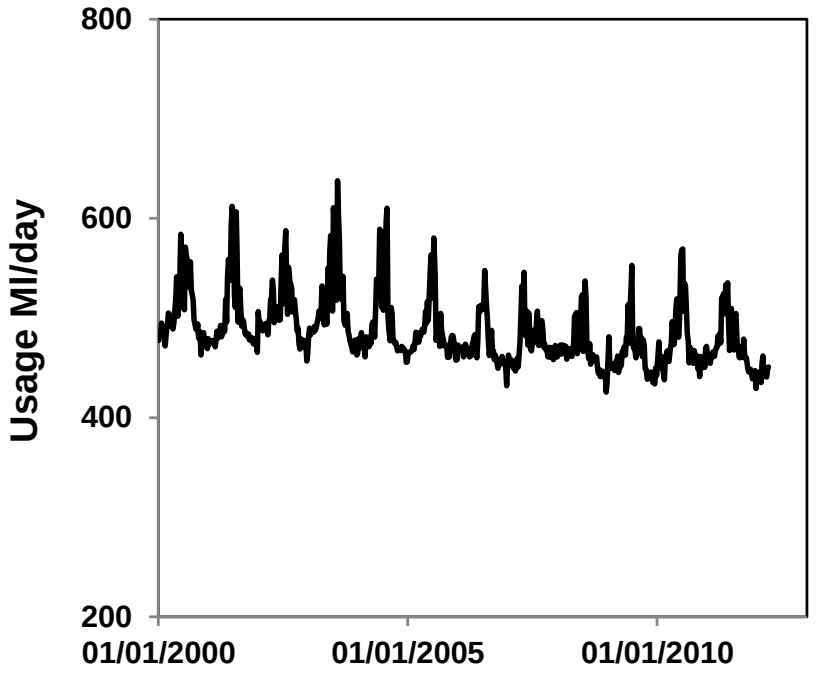


Project Approach

- Develop multivariate regression approach to predict unrestricted use based on meteorological and social factors, calibrated on “historical” data
- Focus on good model performance during periods of peak use
- Use the models to estimate non-restricted use during 2012
- Compared modelled and observed use, quantify differences

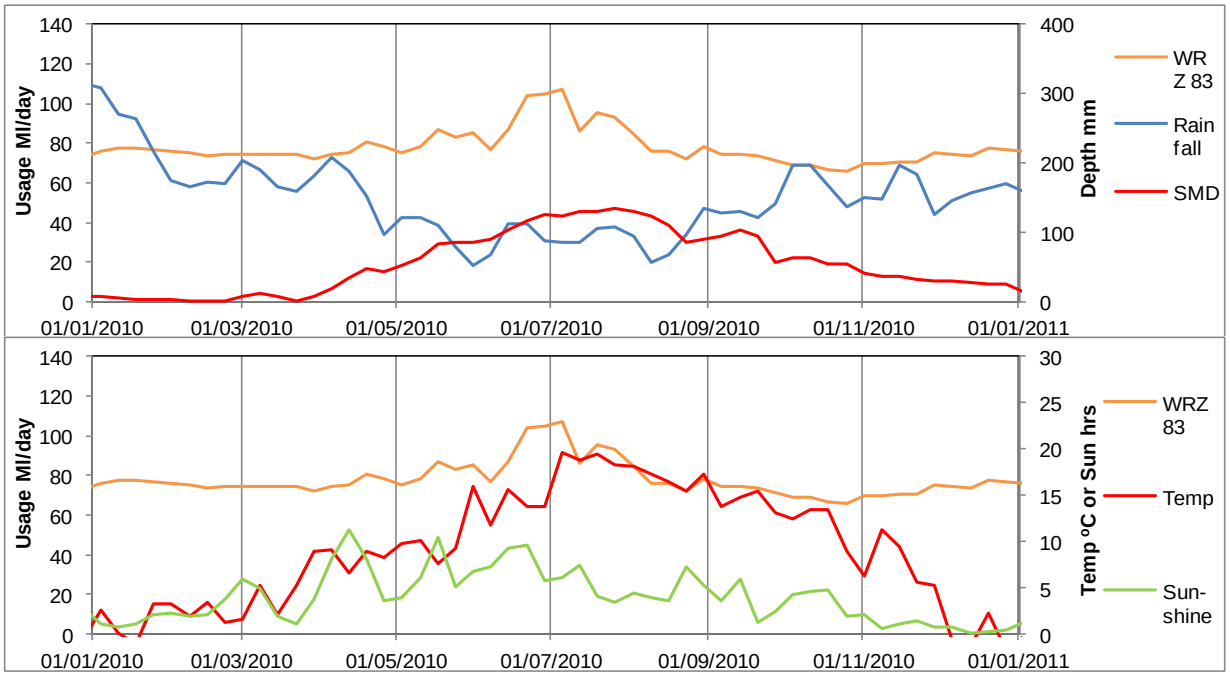
Usage data: Complications and challenges

- Temporal and spatial resolution of usage data not great
- Historical usage data from 2000 only
- Data affected by long term or step changes (e.g. water company reporting units changed)
- A number of wet summers in the data record
- No dry summers without restrictions



Usage data: Meteorological drivers

- Impact of meteorological drivers varies seasonally – usage has a non-linear response to some drivers
- Rates of water use generally increase during periods of low rainfall, high temp, sunshine and greater SMD



Model development

Co-dependencies between variables taken into account

Data transformations to ensure residuals normally distributed

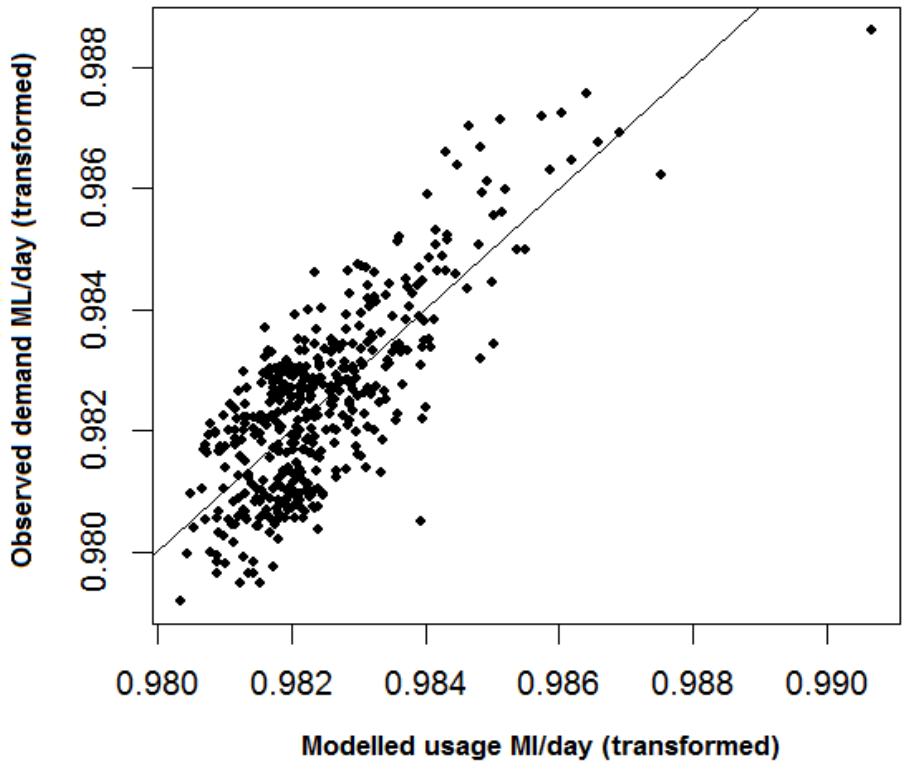
Used weekly values to reduce the number of explanatory variables

No one unilateral model form could be found:

Typical covariates:

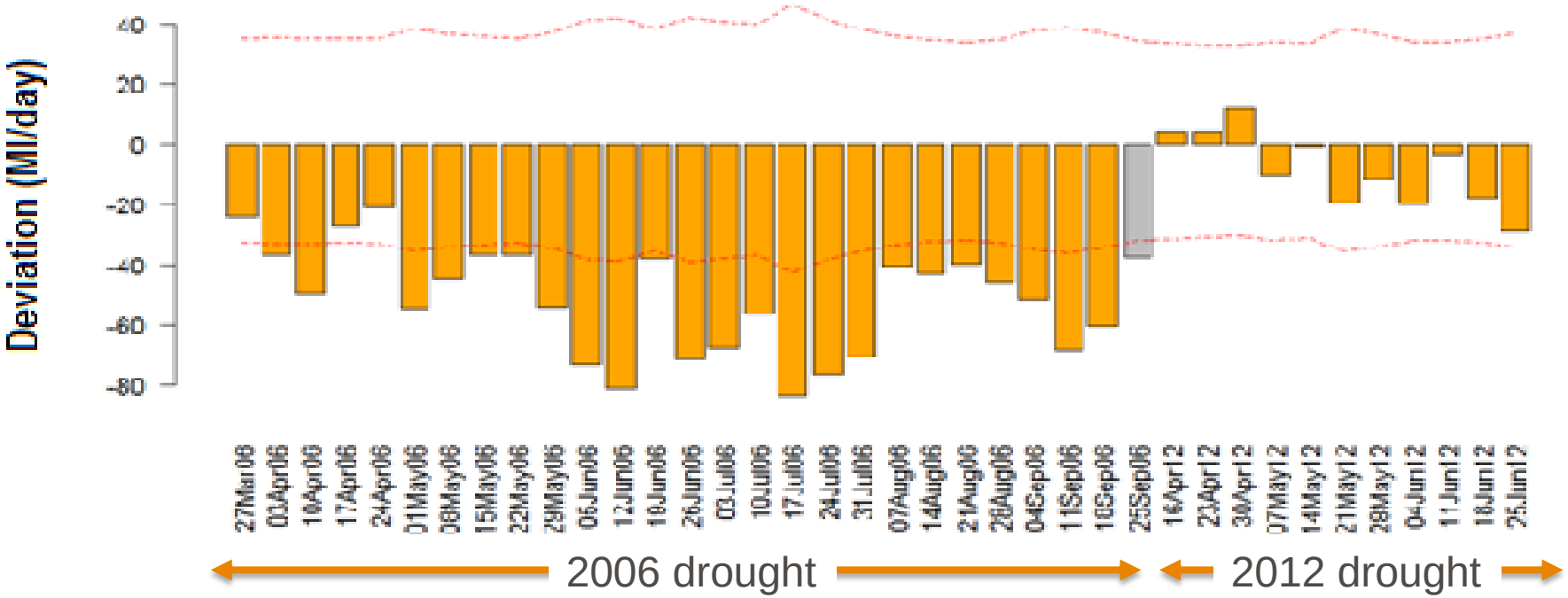
PE, SMD, Sunshine (hrs),

Sq Max. Temp, Sqrt(rainfall)



Applying the model

- Usage modelled for 2006 and 2012 droughts and compared to observations
- During periods in which drought measures are in place, usage should be lower than expected (observations should show a negative and significant deviation from model)

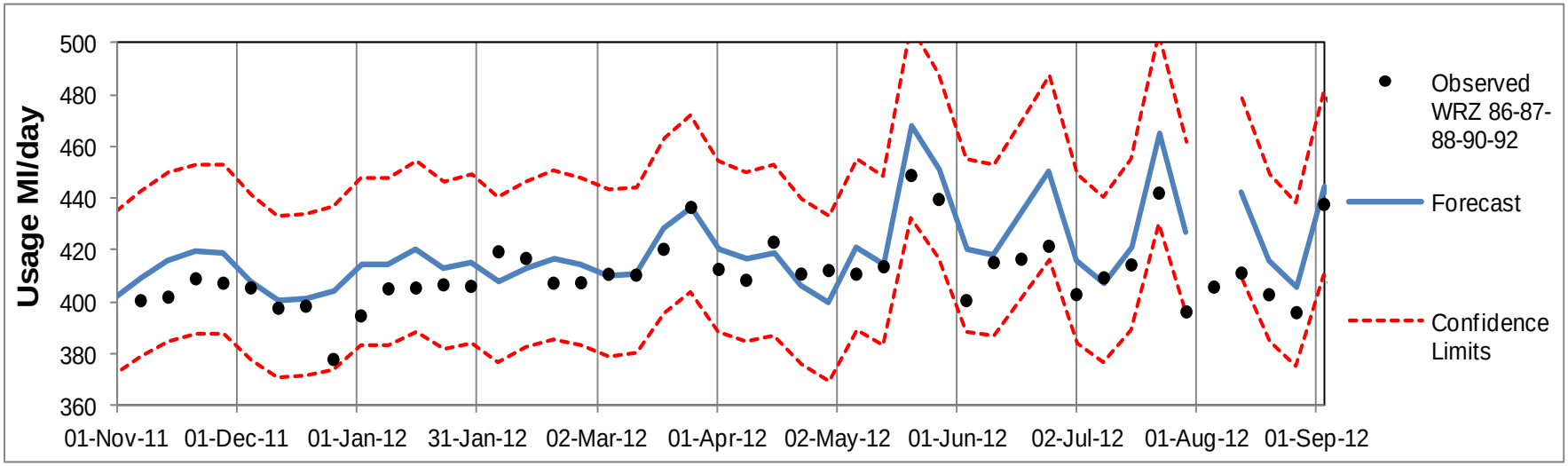


Modelling outcomes

- There are occasions where the usage is outside the model confidence intervals, which are not associated with any TUBs.
- The usage was persistently lower than predicted during the 2006 TUB period by a statistically significant amount (well below the lower confidence interval).
- Preceding, during and following the 2012 TUB period the usage often drops close to, but not outside of, the confidence interval; i.e. the decreases were not statistically significant.
- Restrictions were much more successful in controlling use in 2006 than 2012. In 2006 restrictions were in force during a dry summer
- The measures were most effective in some of the smaller resources zones or those located in rural or affluent areas

Quantification of impact of drought measures

- Difference between forecast and observed varies temporarily
  - Model performance issues; Quality of observed data; Social factors (e.g. holidays), Wet summer meant behaviour atypical?



Conclusions

- Increased demand in 2012 was modest; weather meant there was no sustained high usage
- Use in winter 2011/12 appears lower than typical implying efficiency campaigns had some success
- Demand was 1-2% lower than forecast during the period of leading up to and during the TUB. This is **not** statistically significant
- In the run-up to the TUB the maximum decrease was 6.5% of forecast. During the TUB this figure increased to 10%
- This is suggestive of the TUB having an impact but isn't conclusive.