Forecast of residential demand drivers for Greater Darwin

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Abstract: The city of Darwin has seen significant shifts in the make-up of housing in recent years, with a considerable departure towards smaller lot sizes in residential development in addition to an increase in the proportion of semi-detached and flat or unit style housing. The implication of this is that, all other things being equal, future residential development can be anticipated to use less water leading to an overall downwards movement in average residential water consumption across the city.

When preparing forecasts of future demand for application in water resource simulation, it is important that the forecasts consider the impact of key demand drivers, both the annual average and the seasonal demands. This includes the forecast of the impact of demographic and socio-economic change in demands.

HARC has previously undertaken work that assessed the potential for demand management across Darwin, and developed a cross-sectional regression model that was able to explain why water consumption per household in low-density residential development areas varied across the city. One of the observed key drivers was the average area of land on each lot that was not covered by a dwelling or other building. Building on this previous work, this study focused more closely on changes in the detached dwelling customer type as the most dominant housing type. Trends in the dwelling mix were also examined in order to quantify the potential impacts of any increase in the proportion of higher density dwelling types on future demands.

The methodology adopted in this study included the update of the previously developed multi-variable regression analysis to estimate water consumption at the suburb level utilizing an updated database of historical data available for Greater Darwin; and estimation of future changes in water demand for Greater Darwin based on forecast changes in key drivers. The difference between the average lot size and average building area (the average non-building area) was estimated based on the most recent building and cadastral data for residential areas across Darwin. This data in addition to data on soil types, household size and median household income, was analysed for its impact on water consumption per account. This analysis identified that non-building area and median household income were statistically significant in determining the level of water consumption per account.

In examining potential for changes in future demand, trends in the dwelling mix and real median household income were extrapolated from historical data. Changes in non-building area were predicted on the basis of forecasts of future development at the suburb level provided by Power and Water Corporation. These forecast changes were applied to the demand forecasting model which is used to provide forecasts of seasonal and non-seasonal demands for application in water security assessments. The paper will also provide an overview of how these forecast changes result in changes to weather-driven water demands in the water resource system simulations.

In considering the impact of future drivers of residential water demand in Darwin, it was clear that both the decline of lot sizes, and changes in the dwelling mix and average income showed to have some influence. Of these identified drivers, changes in real household income have the potential to cause a greater impact, although, as the experience with Covid-19 pandemic has shown, there is considerable uncertainty over future outcomes for income. Given that they represent a plausible future development outlook, forecasts of future changes in lot size can result in robust estimates of shifts in future single dwelling residential water consumption.

Keywords: *Residential water demand, water demand forecast, residential development, water demand simulation*