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SELLING ICE TO ESKIMOS

RETHINKING DEMAND MANAGEMENT WHEN YOU ARE NOT IN DROUGHT

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ABSTRACT

Sydney Water needed a new way to justify ongoing investment in demand management. After the success of the water-saving programs of the Millennium Drought, cheap and easy savings were no longer available.

It was decided that a robust decision framework in line with current asset management practices would be the best way to justify investment. To put this together existing spatial, cost, energy and demand data was collated. The three-step process allows Sydney Water to exploit cost-effective programs at a range of scales from the entire area of operations to specific parts of the network.

This new approach will be tested through application and will inform a number of asset strategies. The robust assessment of costs and benefits provides an evidence base to justify investment and construct an effective portfolio of water savings to meet future challenges such as drought and population growth.

INTRODUCTION

Sydney Water's water efficiency programs began in 1998 to meet operating licence targets to reduce per capita water demand. During the Millennium Drought (2002–2009) water storages dropped to 30% and government and community interest in water scarcity was unprecedented. Sydney Water increased investment in water efficiency, recycling and leak reduction to a peak of $115 million in 2007, as shown in Figure 1.

The effect of all these programs, combined with water restrictions and regulations, such as the Water Efficiency Labelling Scheme (WELS) and BASIX, has reduced per capita

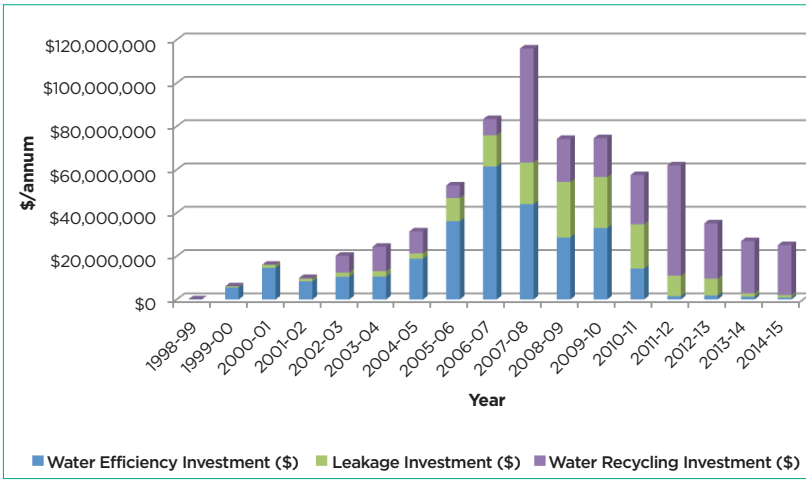

Figure 1. Sydney Water's water conservation investment 1998–2015.

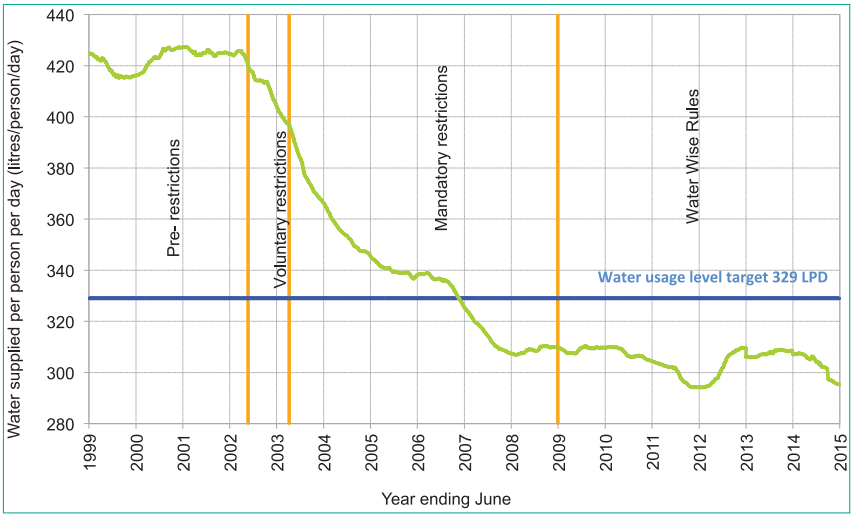

Figure 2. Per capita demand 1999–2015.

demand by 25% compared to pre-drought levels, as shown in Figure 2. The avoided infrastructure costs due to this reduction in demand are in excess of $250 million. Historically, demand is suppressed during drought conditions and "rebounds" to a similar level after restrictions are lifted. To date the efficient usage by Sydney Water customers has been maintained, despite the lifting of restrictions in 2009. The total amount of water supplied by Sydney Water is at a similar level to 2005, despite a population growth of over five per cent (see Figure 3).

As the drought crisis receded and a number of programs reached maturity or saturation the investment in water conservation reduced. With all of the easy and cheap programs implemented it was timely for Sydney Water to rethink where and how to

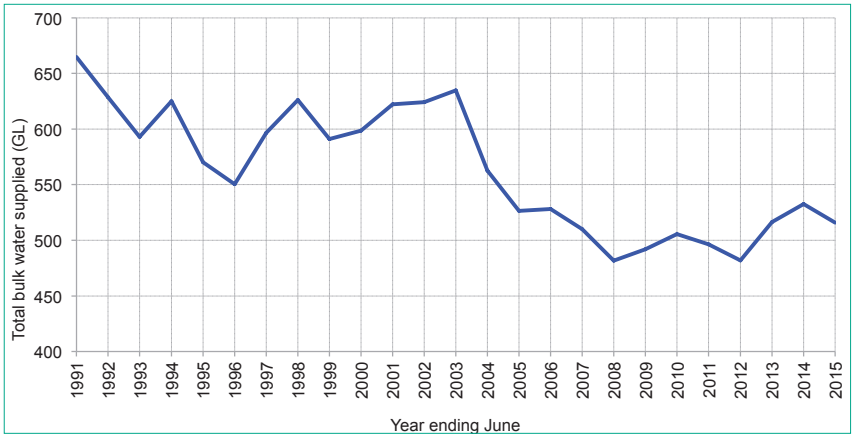

Figure 3. Total water use 1999–2015.

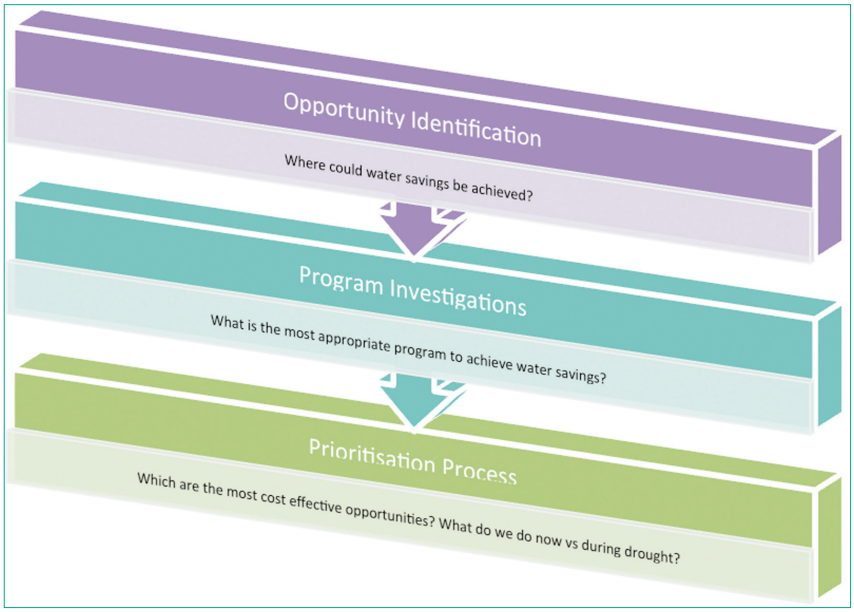

Figure 4. The key steps in Sydney Water's demand management decision framework.

target future investment to deliver the best value for customers. The first step in this process was to develop a decision framework to identify, cost and prioritise targeted demand management opportunities. Some of the programs that were offered to residential customers included rebates for:

- Water-efficient showerheads
- Tap aerators
- Leak repairs
- Water-efficient washing machines
- Dual-flush toilets
- Rainwater tanks
- Assessment of garden watering requirements.

The business programs worked with water-intensive industries to better understand water use and identify water-saving opportunities in processes and facilities. Sydney Water also worked with councils to target small-to-medium size businesses. A number of educational programs in schools also contributed to water savings. The biggest individual water-saving initiatives included business water efficiency, active leak detection (on Sydney Water's network) and water restrictions. Significant savings were also achieved from the Waterfix program, Washing Machine Rebate, Pressure Management, Wollongong Recycled Water Scheme, the Water Efficiency Labelling Scheme (WELS) and BASIX.

METHOD

Sydney Water engaged Arup to develop a decision framework that would drive future investment in demand management (similar to what exists for assets). The initial phase of the project was focused on collating existing data sources from across the business and publicly available datasets form the Australian Bureau of Statistics (ABS). Extensive consultation with subject matter experts in the following areas was completed:

- Economics and regulation
- Asset planning
- Demand management program delivery
- Demand forecasting
- Energy management.

The agreed approach has three key steps, as outlined in Figure 4.

The Opportunity Identification phase uses spatial data layers that are mapped to Sydney Water's water and sewerage zones to compare and analyse different attributes. The data is a combination of Sydney Water cost, energy and demand data, along with census information. Thematic maps, as shown in Figure 5, are then able to highlight areas or "hotspots" with the most potential for demand management programs. These layers can be periodically updated as new datasets become available.

The Program Investigation phase involves developing solutions or potential programs that could be implemented to target demand management opportunities. This includes rebate programs, behaviour change, education and auditing. The best solution will depend on the attributes of the area being targeted. For example, a water supply network with large industrial customers may achieve more cost-effective savings through auditing business water use, while an area predominantly comprised of large, single dwellings may be better targeted with an outdoor water use program.

The Prioritisation tool is a spreadsheet that uses existing

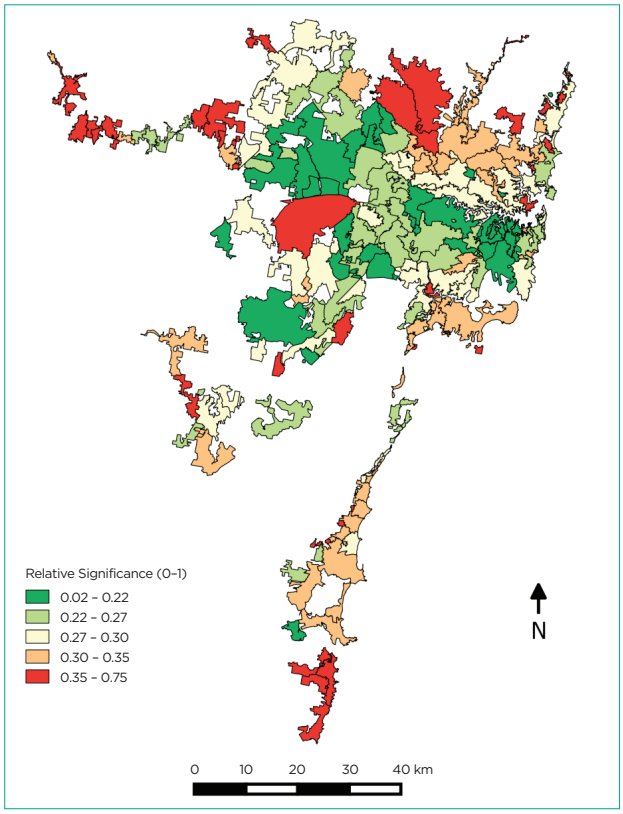

Figure 5. An example of a thematic map produced in the Opportunity Identification phase.

Sydney Water data to quantify the costs and benefits of various water saving programs. The data includes energy savings, avoided capital expenditure and reduction in operating costs. The tool also allows different programs to be compared against each other, as shown in Figure 6. This allows Sydney Water to construct the most cost-effective portfolio of programs to suit its current situation based on both costs and the quantum of savings that can be achieved.

RESULTS AND DISCUSSION

Spatial Analysis

An analysis of thematic maps for a number of attributes yielded the following results:

- The highest proportion of customers in the over-55 age category is on the fringes of Sydney Water's area of operations in the southern Illawarra, Upper Blue Mountains and Upper North Shore. They are known to be avid gardeners and receptive to previous programs relating to outdoor water use.
- The highest proportion of renters is centred in the major commercial centres of Sydney CBD, Liverpool, Parramatta, Blacktown, Richmond and Wollongong, as well as the Northern Beaches. Renters have typically found it difficult to participate in water-efficiency programs, as they require the consent of the property owner to make any modifications.
- Large households (with four or more residents) are generally located west of Parramatta and in southwestern Sydney. These households have limited discretionary water use but greater potential to make savings with efficient appliances and fixtures in the home, as they have more showers and toilet flushes each day.
- The highest proportion of single dwellings is in west and southwest Sydney and the Blue Mountains. Single dwellings generally have higher occupancy and higher outdoor water use on gardens.
- The areas likely to experience the greatest population growth are between the CBD and Botany Bay, and the northwest and southwest growth centres. These represent areas that are likely to reach capacity in the future due to growth, with greater potential to defer capital expenditure.
- The areas with the highest incomes include the North Shore, Eastern Suburbs and The Hills District. The lowest incomes are clustered in Canterbury-Bankstown, Fairfield, Liverpool, Illawarra, Blacktown and the Upper Blue Mountains. Figure 7 shows that many of the lowest income areas had the lowest participation in previous water-efficiency programs (matching areas of darkest green are low income and low participation). A key exception is the Illawarra area, which historically has had high participation in water efficiency programs.
- The highest uptake of demand management programs was in the Upper North Shore, The Hills District, the lower Blue Mountains and Illawarra. The lowest uptake of demand management programs was in southern and western Sydney inner ring suburbs to the

Some programs offered a rebate to customers who fixed leaks.

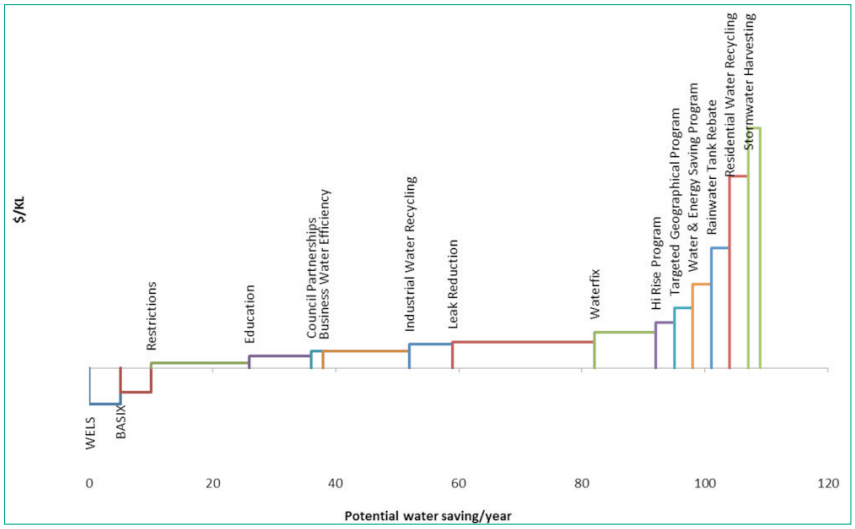

Figure 6. A marginal abatement cost curve of the demand management portfolio.

west and east of Sydney CBD. In theory those areas with the lowest uptake of demand management have the greatest potential for future savings. It is also likely that there are underlying barriers to customers in these areas participating in Sydney Water's program, therefore the cost to target these areas effectively may be higher (e.g. marketing and advertising, higher levels of subsidy to encourage participation).

- The highest proportion of customers with swimming pools was in the North Shore, The Hills District, and the surrounding areas of Sutherland, Campbelltown and Penrith. Previous data analysis from 2006 found that pools use 50kL/year in eastern Sydney and 30kL/year in other areas. The higher water usage on pools in the east of Sydney is estimated to be related to higher wind speeds and, hence, evaporation.
- The highest costs to supply water are on the fringes of Sydney Water's area of operations, which either require a lot of pumping or are serviced by relatively small systems. These areas include the southern Illawarra, southern Macarthur region (around Picton), Wollondilly (south of Penrith), the lower Blue Mountains, The Hills District, Hornsby and Hawkesbury (north of Richmond). In some areas the cost to supply water is higher than the amount customers are charged for water usage. This provides an added incentive to save water in these areas.
- The highest costs to provide wastewater services are in Riverstone (north of Blacktown), and in the Bondi system from Balmain in the west along the southern shore of the Harbour to Bondi. Saving water indoors, such as in showers, toilets and washing machines, also reduces wastewater discharge.

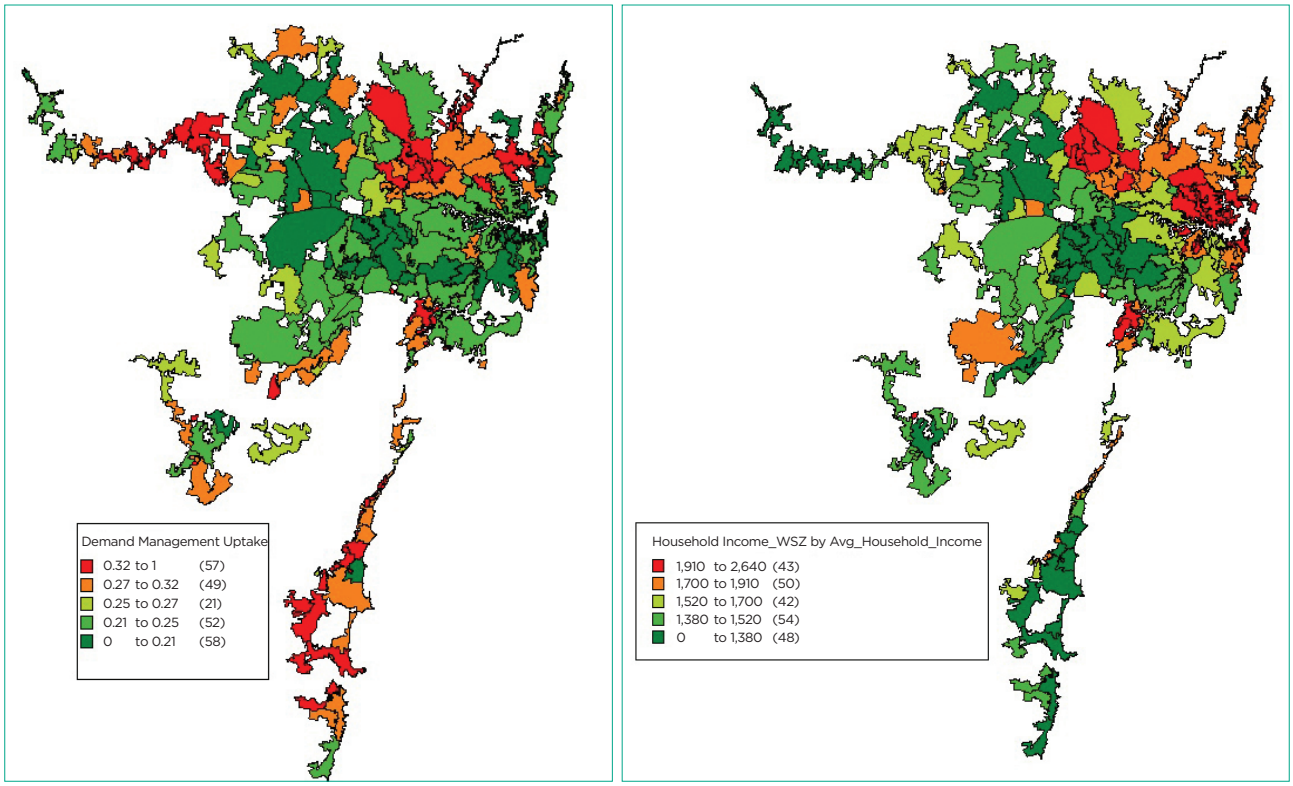

Figure 7. Demand management uptake and household income.

Customers were also offered rebates to install water-efficient showerheads.

Financial Analysis

In order to complete financial analysis suitable for business cases, the Excel-based decision support tool includes a number of standard financial metrics, including:

- Electricity tariffs
- Inflation
- Weighted average Cost of Capital
- Depreciation
- An option to include the costs of desalination.

The broad types of programs that may be assessed include behaviour change, retrofits and education. Specific end uses and geographic areas can then be selected for application. A key metric is the ability to defer capital expenditure. At this stage this still requires working closely with asset planners to test a number of demand scenarios and determine if demand management has the ability to defer or delay capital expenditure. Any savings in peak demand (mostly driven by outdoor watering on hot days) has greater potential to avoid capital expenditure.

Implementation

The decision framework provides a robust method for Sydney Water to both identify and justify further investment in demand management. Compared to the mass marketed programs that were offered to all customers, Sydney Water will now be able to identify opportunities to save water on a much smaller geographic scale.

The next step in this process is to apply the decision framework to various levels of asset planning and strategy. These master plans cover entire products, regions and specific networks within the water system. The new approach will be tested through application at a range of scales. In the long term, non-asset demand solutions will be embedded seamlessly into existing asset planning and capital expenditure programs.

Sydney Water is currently developing a methodology to determine an Economic Level of Water Conservation (ELWC). This will combine demand management, leak reduction and water recycling. By quantifying the costs and benefits of demand management initially, the organisation is well placed to expand and improve this approach for leak reduction and recycling.

CONCLUSION

This project shows that it is possible to find cost-effective opportunities to save water at a relatively small geographic scale. It will be possible to do this by putting existing data to better use. This approach can be further refined by collecting more granular data, particularly on household water use behaviour and appliance stock. It also proves that the traditional focus on demand management purely as a means of balancing supply and demand is overly simplistic (Feinglas *et al*., 2013). With a holistic consideration of all costs and benefits, demand management can be justified despite the fact that it reduces utility revenue. The avoided costs in terms of capital and energy are significant in certain areas. This new approach positions Sydney Water well to proactively target the next generation of cost-effective water savings.

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REFERENCES

Feinglas S, Gray C & Mayer X (2013): Conservation Limits Rate Increases for a Colorado Utility. Alliance for Water Efficiency.