IMPROVING WATER NETWORK OPERATIONAL EFFICIENCY USING SMART WATER METERS

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Background

At present, limited information about water consumption throughout the day poses challenges in the design and operation of water distribution systems.

Current inefficiencies in network designs lead to;

- Premature water infrastructure upgrades
- A total of $9.5 billion worth of water losses in water network networks worldwide (Savic et al. 2014).

Smart flow meters present an opportunity to:

- Improve water demand estimation;
- Identify losses in a water network;
- Delay network infrastructure upgrades; and
- Develop and monitor management strategies to reduce water consumption

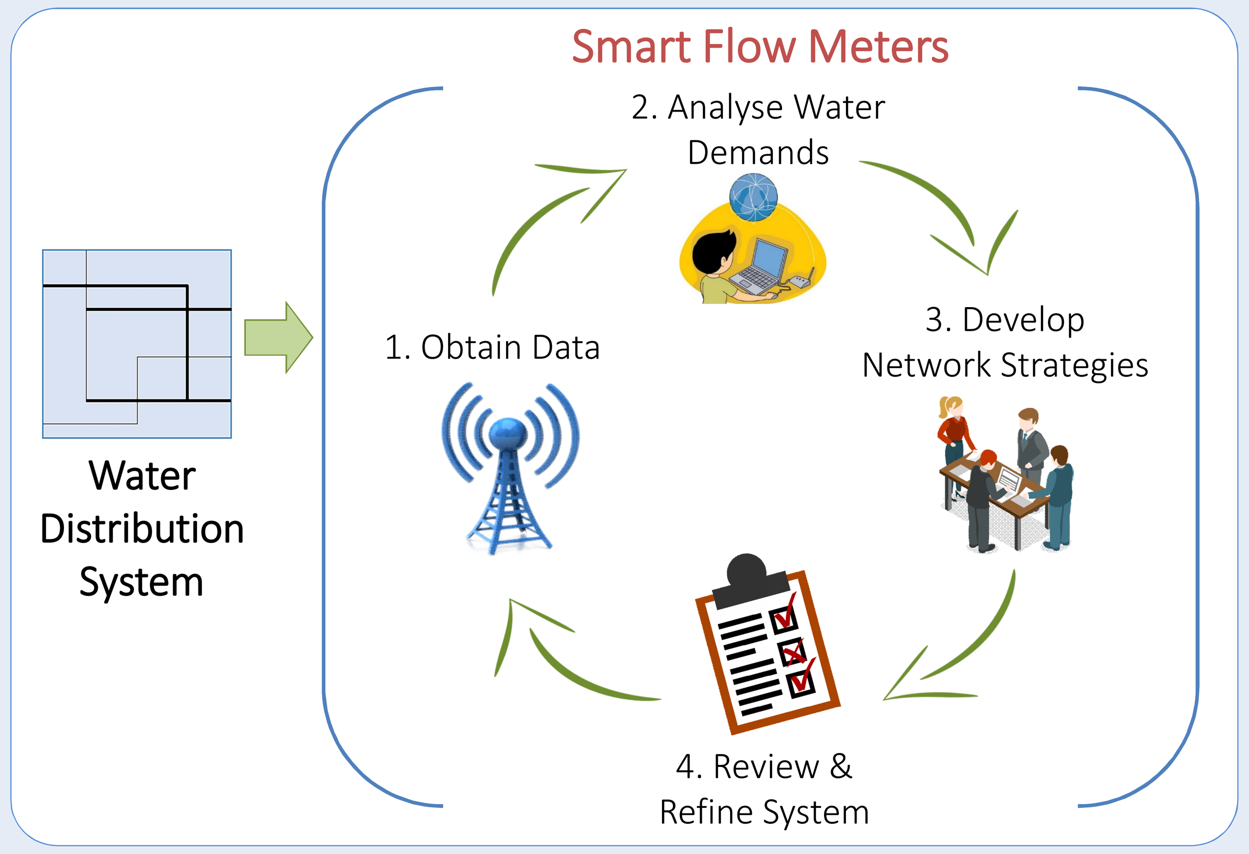

Figure 1: Smart Water Meter Assessment Sequence

Research Focus

The objectives of the research were to;

1. Analyse smart flow meter data to identify the drivers of water use.
2. Develop a computerised hydraulic model of a water network to assess the capacity of the current system.
3. Forecast future water demand scenarios and propose strategies to reduce water consumption.

Data from 12 smart flow meters at the University of Adelaide were used to demonstrate the application of smart water meters to improve operation.

Improving Demand Estimation

What are the drivers of water use at the University Campus?

Primary drivers that contribute to water use at the Campus are;

1. Student use
2. Employee use
3. Experimental use
4. Irrigation use

Characteristics used to separate types of water use include the time of day, time of year and the location.

- The largest single contributor appears to be commercial and employee use with an average consumption of 100 kL/day.

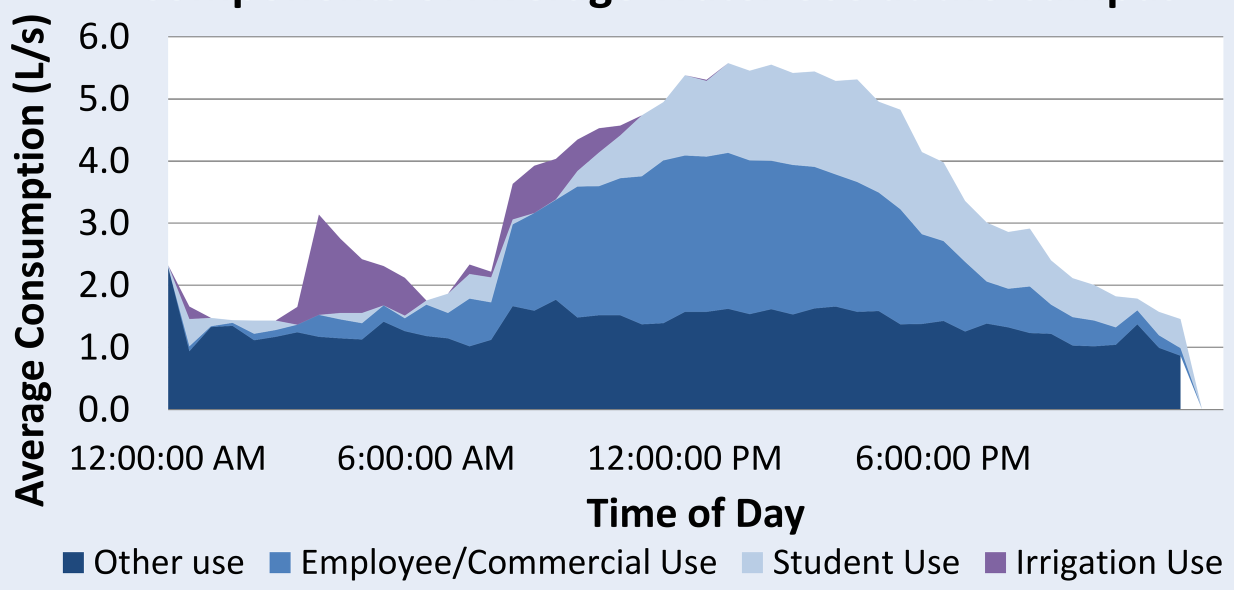

Figure 2: Components of average water use at the campus

Comparing smart flow water meter demands to the traditional method

Traditional demand estimation in Australia relies on approximations of typical demand for different types of land use. Using smart water meter data, a method has been developed to distribute demands spatially across the Campus, improving demand estimation.

- On average, traditional methods overestimate demands for smaller networks by 130%

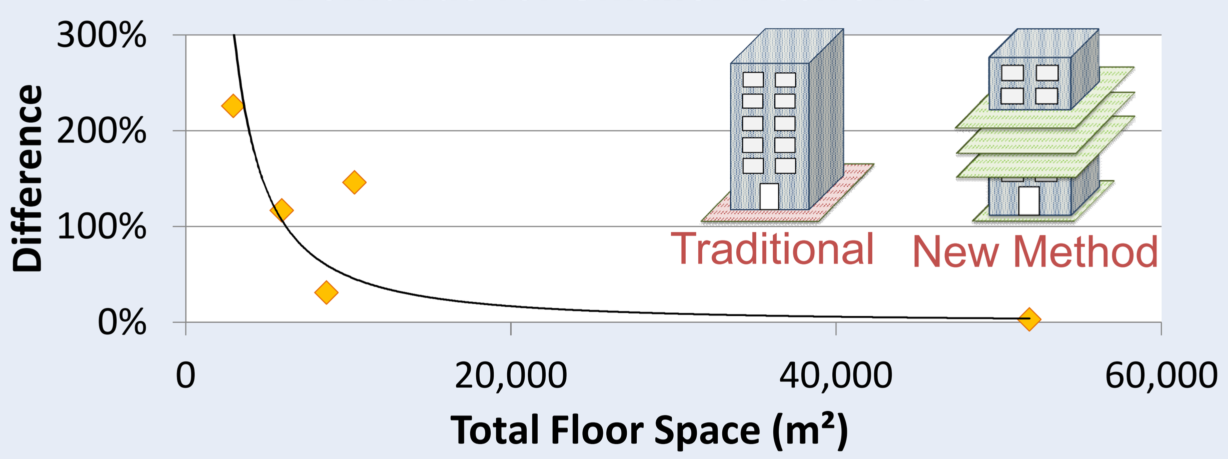

Figure 3: Comparison of demands for different sized networks

Forecasting & Strategy Development

Determining the capacity of the current water network

The capacity of the current system was determined according to each of the demand estimation methods.

- **Traditional approach** – Operates at 60% capacity.
- **Smart flow meters** – Identified to operate at 53% capacity

This suggests that the system has an extra 7% capacity when more accurate demands are used.

This enables better decision making when considering upgrades to system infrastructure.

Forecasting future University Campus water demands

- Future water demands have been predicted based on changes to campus infrastructure and population.
- Smart water meter demands and traditional demands were forecasted based on future campus occupants ranging from 30,000 to 50,000.

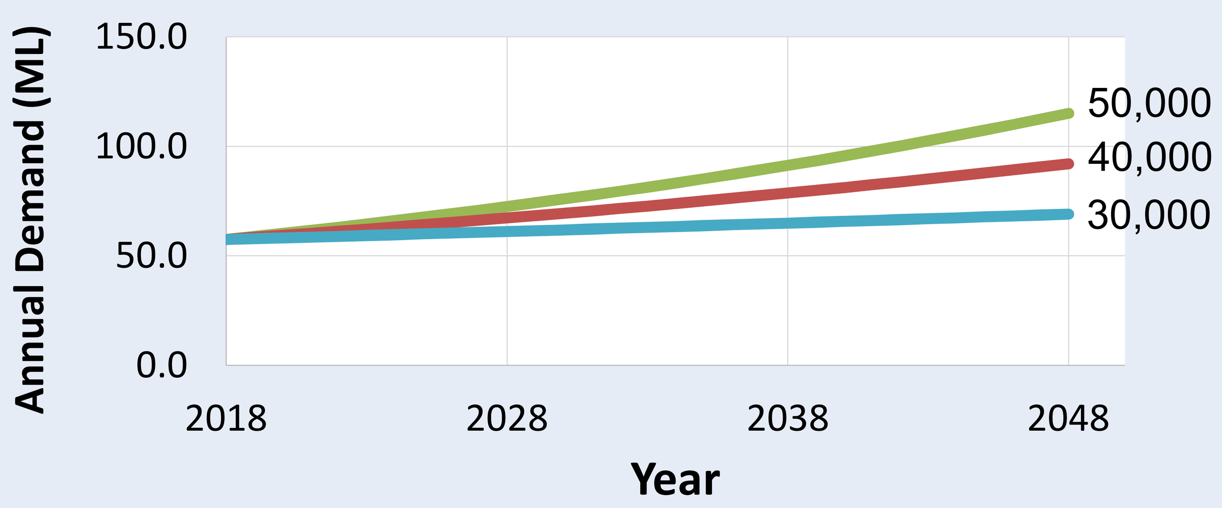

Figure 4: Future estimated demands for population scenarios

Using water demand management strategies to reduce costs at the University Campus

Different types of water demand management strategies were assessed using the hydraulic model.

Maintenance	Reducing losses in the system by monitoring minimum night flows
Education	Reducing demand by changing behaviour
Technology	Installing water efficient appliances in buildings
Combination	Combining the other strategies

All of the strategies provided an economic benefit to the University over a 30 year period.

Combining all of the strategies resulted in the greatest benefits, estimated to be between $0.87-1.2 million over 30 years.

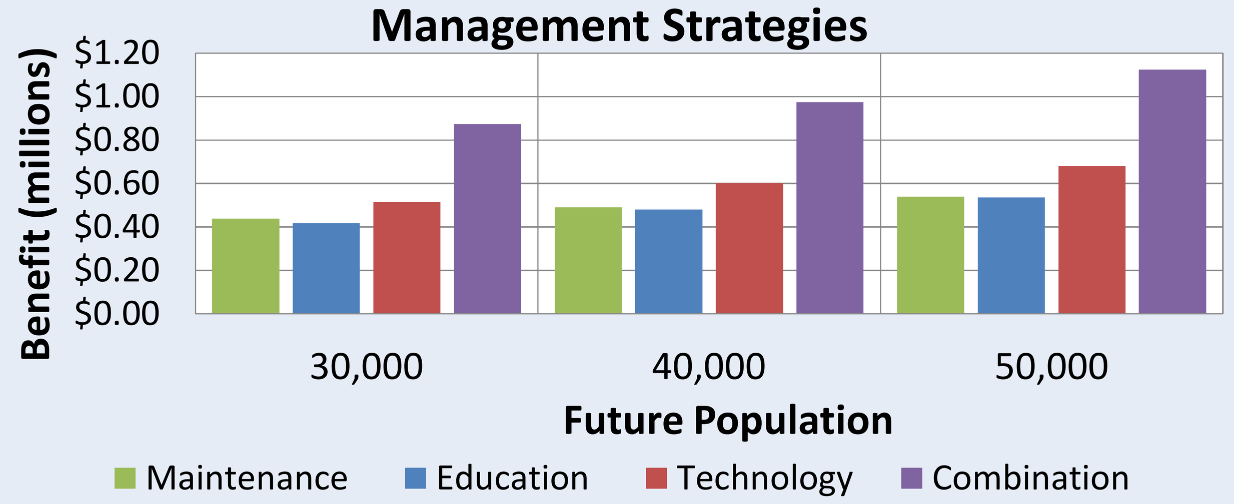

Figure 5: The NPV of water demand management strategies

Conclusions

- Commercial and employee water usage is the largest contributor at the Campus, consuming an average of 100 kL/day.
- Smart flow meters provide a more accurate demand estimation for smaller systems when paired with the new floor space method instead of the traditional method.
- Water demand management strategies implemented using smart water meters offer opportunities to reduce costs at the University.

Future Research Opportunities

- Installing smart water meters on individual buildings to refine water demand estimation.
- Conduct a water appliance survey to highlight the primary water end-uses at the University.
- Pairing flow data with other data sets such as occupancy data to identify relationships that would further improve water demand estimation and decision making.

References

Savic, D, Bicik, J, Morley, MS, Duncan, A, Kapelan, Z, Djordjevic, S & Keedwell, E 2013, 'Intelligent urban water infrastructure management', *Journal of the Indian Institute of Science*, vol. 93, no. 2.