

ADAPTIVE PLANNING FOR RESILIENT URBAN WATER SYSTEMS UNDER AN UNCERTAIN FUTURE

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INTRODUCTION

The challenge of ensuring current and future water security under growing demands has become increasingly significant with recent droughts providing a compelling reminder of the variability of the Australian climate and its vulnerability to climate change impacts. In the past, reserve supplies and water restrictions have been the default strategy, however more recently water service providers are seeking 'diversified portfolios' and 'flexible strategies' as a means toward providing improved security and resilience at reduced costs.

The emergence of this new way of thinking represents a challenge to existing conceptual and analytical models underlying resource planning decisions, since it requires a shift from deterministic approaches to an approach that builds in flexibility based on the information at hand and one that delivers much needed information on phasing and sequencing under different circumstances. A number of advanced methods from finance and decision theory have been suggested in the literature, but these methods are often too complex for practical implementation. A different approach is required that translates and situates these methods in the context of water resource planning.

As such, an adaptive planning approach was developed for the Melbourne Metro Utilities next fifty year Water Supply Demand Strategy (WSDS) to incorporate the value of water, future uncertainty and suites of options. Incorporating multiple values of water into the decision making approach includes the way in which water contributes to a sustainable, liveable, prosperous and healthy city as well as values attached to individual supply options. By identifying and delivering flexible and robust outcomes future uncertainties which may include climate change, population growth, economic activity and unexpected shocks, can be planned for and managed. Key to achieving this flexibility and robustness, is the ability to assess suites of options, in terms of assessing potential synergies and/or duplication between options and the potential benefits to system resilience of diverse supplies.

METHODOLOGY/ PROCESS

Specifically this approach firstly proposes a method for understanding and prioritising contextual influences with high levels of uncertainty and high significance to the ensuring water security. By separating out the influences into future trends, potential shocks to the system such as step changes, and extreme variability in the trend, the impact of the influences can be better understood and thereby appropriate response measures can be identified (See Table 1). Based on combinations of the influence trends (such as reduced run-off or demand growth) and shocks, scenario paths can be described and the resultant projected shortfall in supply calculated.

Secondly, the approach proposes the use of “investment strategies” to identify response measures and the order in which they are packaged into portfolios to meet a projected supply shortfall. The “investment strategies” are policy statements that define what type of response measure is considered first when addressing a shortfall. For example, an “investment strategy” could specify that decentralised recycling options be first considered before large scale potable options. By assembling portfolios of response measures in response to the scenario paths, the “investment strategies” that produce a set of least cost portfolios to address the range of scenarios can be identified.

RESULTS/ OUTCOMES

A process map for the steps in the approach has been developed, and “field tested” by the Melbourne Metro Utilities in the development of their Water Supply Demand Strategy for the next 50 years. The practical implementation produced a set of “investment strategies” and an associated portfolio of measures, which were put forward as strategic policy considerations for WSDS.

Given that the development of a WSDS is often time and data constrained, it was recognised that a key benefit of this approach is that it can be undertaken at a more strategic level, with more detailed analysis being included as and when available.

CONCLUSION

The shift in focus from long term deterministic planning to a more flexible adaptive planning and management approach, means that large scale centralised supply infrastructure will in future compete with small scale and decentralised options in order to address the uncertainty in the future while still maintaining water security. By undertaking a WSDS planning process as described in this paper, uncertainty in future influences and impacts can be accommodated by developing a flexible and robust portfolio of measures through the application of “investment strategies”.

Table 1: Changes in the planning assumptions

Types	Description	Responses
Trends	Gradual changes (but we don't know how gradual or in which direction) Eg. run-off, water demand	Flexibility in decision making (taking into consideration lead times)
Shocks	Step changes in the trends (we don't know how big or when it will occur) Eg. Bush fires, energy pricing	Flexibility and Robustness
Extreme variability	Extremes in the trends of normal variation (eg seasonal or annual fluctuation) Eg. Drought, floods	Robustness and Redundancy