Rous Water supply augmentation proposal - brief review

As part of its Future Water Strategy 2060, Rous Water has recommended proceeding with augmentation of its water supply through the construction of a new dam near Dunoon, comprising a 50 GL storage and associated works, at an estimated present value cost of more than $150m (Hydrosphere Consulting 2020, Rous County Council 2020).

The stated need for the dam is based on a conclusion that the demand for water in the Rous region will exceed the yield of the Rous water supply system by 2024, and that, in the absence of this dam, the gap between supply (secure yield) and demand will reach 6,500 ML/a by 2060, which is roughly 50% of the current supply capacity. The planning documents conclude that there are no viable alternatives to this option.

My view is that the need for this dam has not been demonstrated by the available data and analysis.

Amongst other concerns, committing to the construction of the Dunoon Dam option would represent a significant financial risk, and further, would waste an opportunity to demonstrate leadership in sustainable water management and to provide timely support for economic development and employment in the region.

In summary, the following items need to be considered, investigated and implemented before such a major investment is committed.

1. Water efficiency

There is scope for major improvements in the **efficiency of water use in the region**, to cap and reduce total demand below the supply capacity. This option has not been adequately analysed, quantified or costed, and has not been included in the demand forecast.

In the 1990s, Rous Water and some of its constituent councils pioneered the investigation, and in some cases implementation, of water efficiency programs and pricing reform (White 1997). The local water utilities (LWUs) in the region were some of the first to follow Hunter Water's move to volume-based pricing. Water use per household in the region is not high, in part due to climate, demographics and the impact of these water pricing reforms and efficiency programs. However, the investment in water efficiency over the years, while higher than in some other regional utilities, has been relatively low. This investment is more consistent with a foundational education and communication program rather than a planned and costed investment strategy that recognises that improving the water efficiency of customers and the supply and reticulation system represents the largest, cheapest and quickest way to improve the supply-demand balance that water utilities have at their disposal. In the past, when the marginal cost of water was relatively low, this strategy may have been understandable, however it is not appropriate when faced with the potential for a $200m investment, when the marginal cost of water will significantly increase (Fane and White 2006).

The potential for improving the efficiency of water-using appliances, fixtures, processes, practices and pipes is by now well documented and demonstrated, including in Sydney (NSW Government 2006) and South East Queensland (Liu et al. 2017, pp. 22-29) where hundreds of millions of dollars have been spent to improve water efficiency, saving many thousands of megalitres per year.

There is insufficient analysis presented in the planning documents that quantifies this potential, for example, by asking and answering the following types of questions.

- How many cooling towers are there in the Rous water region that do not have TDS (total dissolved solids) sensors controlling their bleed-off? How much would it cost to remedy that?
- How many toilet cisterns are there in the region which are not current best practice (4.5/3 litre dual flush or equivalent)? What is the cost to replace them, and over what period, and how much water would that save?
- How many top loading washing machines remain in use in the Rous region? What is the cost to change them out over the next 5 years?
- How many shower heads in the region are not 4-star?
- In the Rous water region are there industrial or manufacturing processes remaining including washdown, hosedown processes that have not been optimised? How many large users have had free water audits and financial support for efficiency improvements? What savings would accrue to businesses to pay for the improvement, and how much water would be saved?
- What level of automation and soil moisture control exists for irrigation of playing fields, sports grounds and passive recreational areas in the Rous water region?
- What processes are in place to ensure that long pipe runs for rural water consumers are inspected and surveilled including through the use of smart meters with automatic notifications of exceptional use? How much would this, and other efficiency measures, reduce the high per household consumption of these consumers?
- Have the constituent councils and Rous Water undertaken the maximum possible and cost effective implementation of leakage reduction and pressure management, and burst and break response for all of their reticulation system? It would appear that this investment has not matched that of some other utilities. In the case of Sydney Water, for example the investment has been significantly higher on a per connection basis.

An overarching question would be, what level of investment in improving water efficiency in the region would be required, over what time period, to cap demand below the level of the secure yield, and is the present value cost of these investments lower than $150m?

It is also worth noting that implementing a large-scale water efficiency program would not only be a highly cost-effective measure, with the potential to save the region tens of millions of dollars, it would have major co-benefits, including the following:

- Reducing regional energy use, through reduced treatment and pumping costs, as well as reduced hot water use, leading to reduced greenhouse gas emissions (see e.g. Turner et al. 2007, p. 61).
- Reducing business costs, including lower water, energy, trade waste and materials input costs for local businesses, through improving water and energy management as a result of audits and investment in water efficiency measures, which are correlated with improved business outcomes.
- Creating employment and upskilling, especially in local trades and small and medium enterprises, through sales and service provision for water efficient equipment and services and engineering, trade and landscaping expertise. The relative employment benefits from investment in improving efficiency and customer-focussed initiatives is well documented in the energy sector (see e.g. Briggs et al. 2020).

In summary, a complete and proper investigation of the potential for water efficiency, and investment in a significant program of improving water efficiency represents a ‘no-regrets’ option for the region. An indicative program has been proposed in a companion paper. Such a path is highly likely to enable significant deferral of the need for the commitment to Dunoon Dam, when combined with a diverse portfolio of demand and supply options, including contingency options.

2. Planning approach

The planning process has not employed best practice water infrastructure planning in the form of **real options analysis** assessing a **diverse portfolio of demand and supply options** including contingency options in case of severe drought. Selection of a single large option with high capital cost, in the face of significant uncertainty in demand and secure yield, means that constructing the Dunoon Dam would lead to a significant risk of a stranded asset, and a potential price-demand spiral (see e.g. Martin 2017). Further, the planning process has incorrectly applied the concept of marginal cost in comparing options.

The planning documents have excluded a number of supply options on the basis that they have a higher marginal cost, or that they provide insufficient annual yield to meet the supply demand gap until 2060. The marginal cost of Dunoon Dam, and other supply options, is calculated assuming that the entire yield is used from the commencement of operation, significantly overstating the denominator in the marginal cost calculation. If only a small fraction of the additional yield of the combined Rocky Creek Dam (RCD) and Dunoon Dam (DD) system is required or utilised in the first 20-30 years, then it is this water volume that should be used as the denominator in the marginal cost calculation. Alternatively, a range of water efficiency and supply options should be considered as a portfolio, taking into account different scenarios for the secure yield of the existing system, and how that changes with the addition or removal of smaller supply options.

The principle of real options planning is that you don't need to build some supply options in order to have the benefits of being able to bring them on line in sufficient time to meet external contingencies such as drought. So the option to build an asset represents a contingency option. In fact, the implementation of water restrictions themselves represents a contingency option in the context of drought. Water restrictions have long been used in the water industry and they have strong community acceptance and support, and they are assumed to be part of the secure yield of most water supply systems.

The first major application of real options planning for water infrastructure in the water industry was in Sydney in 2006. The review of the Metropolitan Water Plan (White et al. 2006) recommended that a trigger level be set for the construction of Sydney's desalination plant at 30% dam level, based on the low statistical likelihood of reaching that level, representing a risk-weighted saving of $1bn.

Real options planning is not unlike an insurance policy where there is a relatively low premium and a high excess, in which the costs of readiness are low relative to the costs of mobilising quickly in response to a low likelihood outcome. Other examples of readiness strategies have included: (1) rapid mobilisation of groundwater sources, also adopted as part of the Sydney real options strategy, for an additional 15 GL/a; (2) the rapid construction of transfer pipelines (e.g. on the Gold Coast); (3) the rapid development of waste water recycling plant capacity and associated pipelines, with the option for indirect potable reuse application (e.g. the Western Corridor Recycled Water Scheme in South East Queensland). (4) the accelerated "emergency" rollout of water efficiency and leakage reduction measures, as proposed and implemented in Sydney and South East Queensland during the Millennium Drought (Turner et al. 2016).

The long timescales and the uncertainty in the supply-demand balance (MWH 2014) indicate that a more financially prudent approach for the future water strategy would involve the application of real options planning, with a portfolio of options. For example, candidates for real options for supply include groundwater sources, regional transfers and interconnections, and rapid deployment of wastewater recycling (non-potable or indirect potable). Many of these options have been discounted on the grounds that they do not provide a sufficiently large increment of yield, or on marginal cost grounds, but this fails to consider the uncertainty in the supply-demand gap and the long timescales and uses an incorrect approach to calculating marginal cost. This would also ensure consistency with the national urban water planning principles (Australian Government 2019), particularly principles 4 and 5.

3. Yield forecasts

Putting aside the demand forecast, the supply-demand gap that is the basis of the stated need for Dunoon Dam is driven largely by **two factors in the yield estimate**: (1) the reduction in secure yield that results from a change in the level of service, from a 5:10:20 restrictions regime to a 5:10:10 regime (2) the reduction in secure yield based on estimates from climate change modelling, with a reduction in yield of about 30% by 2060.

The planning documents provide differing estimates for the impact of the change in level of service, ranging from 800 ML/a (MWH 2014, p. 19) to more than 1,100 ML/a (MWH 2014, p. 57). The impact of climate change is further assumed to reduce the secure yield from 2020 levels by 2,300 ML/a by 2030 and by 4,700 ML/a by 2060. These two adjustments, or derating of the assumed yield of the water supply system, are alone almost sufficient to make the difference in demand and supply that drives the stated need for the dam, given the demand forecast that is used. It is therefore worth applying some scrutiny to these assumptions and acknowledging their level of uncertainty.

Firstly, the level of service changes reflect guidelines for LWUs from the NSW Government Office of Water, in part in response to demand hardening, or the impact that reductions in outdoor water use have had in reducing the potential for savings during restrictions. Nonetheless, the frequency, duration and depth of restrictions, and indeed the optimisation of them to improve effectiveness while reducing negative impact, have not been sufficiently explored in the Northern Rivers region, or indeed in many other jurisdictions (Chong et al. 2009). In the face of a $200m investment, it would be prudent for a monopoly service provider to assess the community's willingness to pay, and to assess whether water consumers were willing to trade off the change in level of service and the 800 to 1,200 ML/a reduction in yield for the value of deferring such a large investment. Such an exercise would most effectively use best practice techniques of deliberative democracy, for which the Northern Rivers region can boast several previous examples.

Secondly, there is significant uncertainty associated with the climate change projections, as described in the planning reports by MWH (2014, p. 21):

> *There is significant uncertainty associated with both the demand and supply forecasts. The demand forecast is strongly driven by serviced area growth rates and customer water usage behaviour. The supply forecast is highly influenced by future climate conditions. The supply-demand balance adopted in this study provides a starting point for strategic assessment, using available information and practices. It also recognises that the forecasts are uncertain and include the need for ongoing monitoring and regular review of foundation assumptions, as well as the promotion of adaptive management.*

This suggests that a more prudent approach is needed, in which the climate change scenarios are used as scenarios for sensitivity testing rather than locked in as hard line forecasts. Such an approach is consistent with the idea of a portfolio approach, considering all available, and fully-costed demand and supply options, including contingency options, in an adaptive real options approach.

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This document is a brief initial review of the proposal for the construction of a 50 GL dam near Dunoon by Rous Water. It is based on the experience of the author from 1990 to the present, including investigations of urban water supply and demand options in the Rous Water region, and in all states and territories in mainland Australia, as well as in California, USA; Sao Paulo, Brazil; Alexandria, Egypt; Ilo Ilo and Zamboanga, The Philippines; Salalah, Oman.

See a selection of the urban water research undertaken by the Institute for Sustainable Futures here.

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10 August 2020