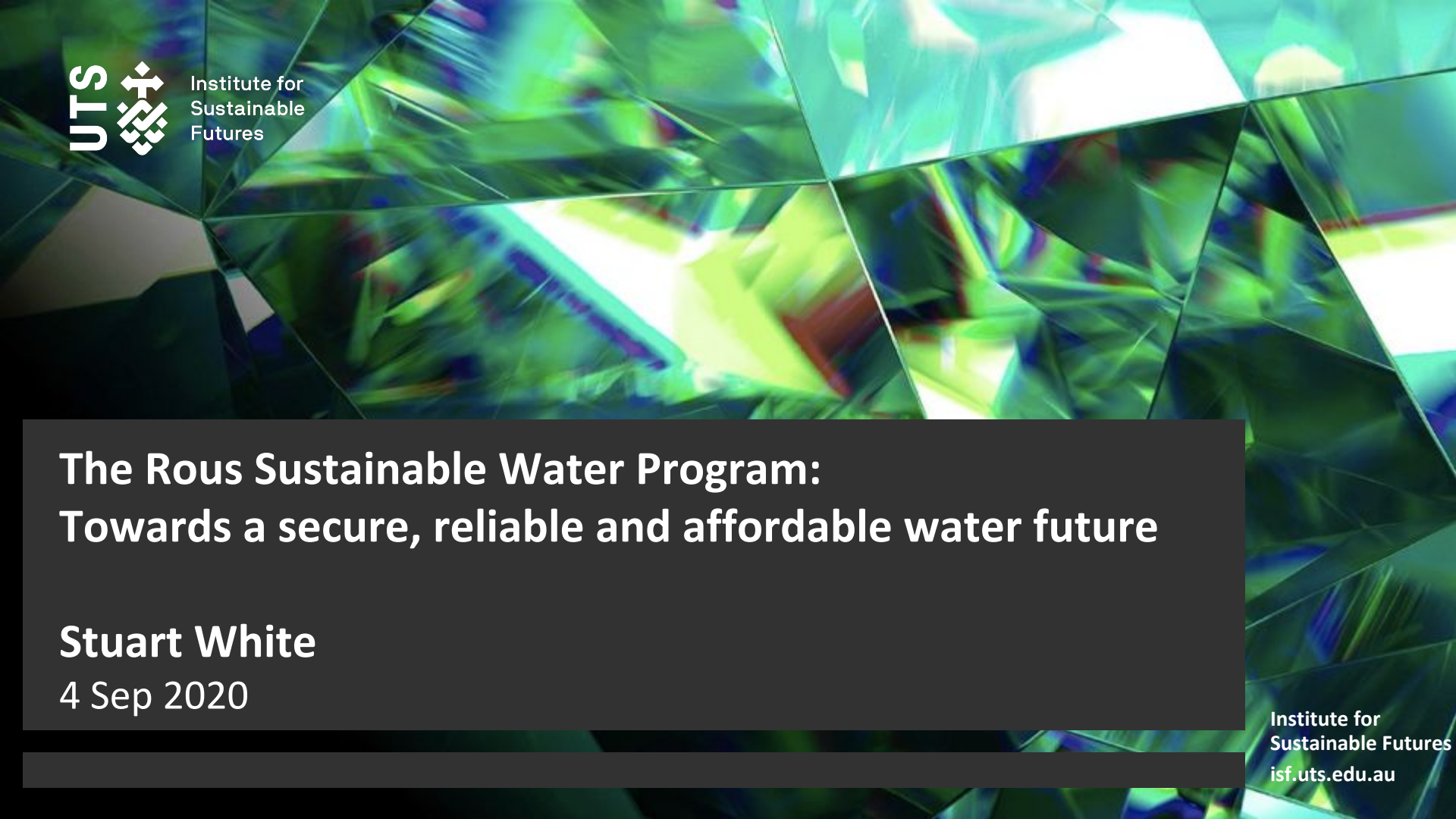


Institute for Sustainable Futures

The Rous Sustainable Water Program: Towards a secure, reliable and affordable water future

Stuart White

4 Sep 2020

Institute for Sustainable Futures
isf.uts.edu.au

SUMMARY

- The Rous region, and Rous County Council, provided inspiration for some of Australia's largest investments in sustainable water management, most notably for Sydney Water Corporation, to meet stretch operating licence targets, and in South East Queensland, to reduce demand during the Millennium Drought.
- While there has been some investment in improving water efficiency in the Rous region, there is significant potential for reliable and cost-effective improvements in water management and use. These improvements would enable the region to become internationally recognised for its commitment to sustainable water management.
- Increasing the investment in water efficiency from ~$500k per annum to an average initial investment in existing housing stock and businesses of ~$5m per annum for 3-5 years, declining to a steady state of ~$2m per annum, is likely to defer the need for the dam beyond the planning horizon, stimulate the local economy and provide employment, and significantly reduce water and energy bills and greenhouse gas emissions. It would avoid the financial risk associated with the cost and scale of the Dunoon Dam.
- There is no single solution. Improving water management requires an understanding of where and how water is used, and investing directly in improving it across the region.
- An indicative Rous Sustainable Water Program with a present value cost of approximately $36m, and a unit cost of an estimated $0.90/kl could defer the need for further augmentation from 2024 to 2044. In addition, changing the Level of Service from 5:10:10 to 5:10:15 would defer the need to 2053.
- The indicative program described here is based on experience with many other water efficiency programs designed and implemented, and evaluated in Australia and internationally. Savings from water efficiency programs have been extensively monitored and evaluated.
- The investment at this time in a 50 Gl storage (Dunoon Dam) at over $150m capital cost, is financially risky, and the case has not been made. See this paper for further details.
- There is a plausible risk that, if the Dunoon Dam was actually required by 2024, *and no other action was taken*, that it would not be able to provide sufficient water in time based on the secure yield - demand projections. This indicates that implementing a significant water efficiency program, as suggested here, would be a prudent course of action even if dam construction was contemplated.
- If paleoclimate data is used to guide water supply planning, the duration of possible droughts are so long that even the 50 Gl Dunoon Dam storage will be insufficient, and planning would need to be directed towards rainfall-independent solutions, including contingency potable reuse and desalination.

BACKGROUND

- Local residents in the region supplied by Rous County Council and its constituent councils have approached Stuart White at the Institute for Sustainable Futures at UTS to seek advice on options for water supply and demand in the region, in response to a proposal for construction of the Dunoon Dam, a 50 Gl storage.
- The Institute for Sustainable Futures (ISF), including its Director, Stuart White, has considerable experience in urban water supply demand planning, including in the Rous region. The ISF water team continues to work for a range of utilities and government agencies on water efficiency and demand management.
- Stuart White has prepared a response to the various planning documents produced as part of the Future Water Strategy for Rous County Council, which questions the need for the dam, based on (1) the potential for improved water efficiency (2) that the planning approach does not consider the potential for the use of 'real options' approaches and (3) the assumptions regarding the yield forecasts, which do not adequately test for customer preferences in derating the yield of the current supply system, and the uncertainty of the climate change scenarios.
- The approach described here, an indicative 'Rous Sustainable Water Program' is based on a number of principles and assumptions, which are provided in this spreadsheet. These assumptions have been made using the knowledge of the Australian water industry and the region, and would need to be verified through appropriate end-use surveys and thorough modelling. The fact that such information is not available indicates that the case for augmentation is not made. In other words the water 'conservation potential' in the region has not been adequately quantified. While the assumptions used here are estimates, even a 50% reduction in the water savings assumptions would mean that the Dunoon Dam can be deferred by two decades or more. A properly designed program would be adaptive and ramped up and down as needed.
- The indicative program has been considered and constructed based on the experience of the author, and at this stage only includes options that improve the efficiency of water use -- i.e. demand side options. There are other options e.g non-potable reuse, stormwater and rainwater capture and reuse, inter-catchment transfers, additional groundwater sources and other supply options that would complement and supplement these options. These options are quite site specific and would require more detailed analysis. Similarly, contingency options for improving drought security have not been included. The indicative program also does not consider next-generation water efficiency as described in this paper.

PRINCIPLES AND ASSUMPTIONS

- The secure yield should exceed the annual average demand over the planning period.
- A permanent reduction in demand from sources is equivalent to a permanent increase in the yield of the supply system. The options to increase supply, or decrease demand, should be compared on the same basis, that is: what is their relative unit cost.
- The unit cost, or marginal cost of an option for water supply or water saving, should be calculated based on the additional capital and operating cost of that option and the additional yield it provides *that would actually be used, not the total amount of water that it could supply*. If this correct method of calculation is used, the marginal cost of water from the Dunoon Dam is likely to be more than $7.50/kl, compared to the modelled water efficiency program which provides sufficient water until 2044 or 2053 at a unit cost of about $0.80/kl. This indicates the financial risk associated with the large capital expenditure. Building a large asset generates an increase in price, which reduces demand and can result in a stranded asset, and the 'utility death spiral'.
- Water efficiency options can be described using two important principles: (1) *pennies add up to pounds*, in other words small changes in the efficiency of water using equipment and appliances, multiplied by many households and businesses can make a material difference in water demand (2) *you get what you pay for*, in other words, if you invest a small amount in education, communication you may get 2-5% change in the behaviour or purchasing decisions of water customers, and if you provide rebates you may get a 10-20% change. If you directly invest in retrofitting fixtures and appliances you can get a much greater, more than 50% change, but it will cost more to achieve those savings.
- The average household water demand in the Rous region is not high relative to other cities or towns on the eastern seaboard. However, it is not useful to compare one town to another on kl/household/a or litres per person per day. The real test, and the useful question, is: How efficient is the town or region relative to how efficient it could be? Hence the term 'conservation potential' which measures the difference between the demand for water using current fixtures, appliances and processes and practices, relative to best practice fixtures, appliances and processes and practices.
- Utilities have traditionally focussed on water supply, and seen their business as a 'low cost commodity supply'. Increasingly utilities are seeing their business more as service provision, in which the needs of the customer are paramount. Customers do not need water, they need the services that water provides (e.g. sanitation, clean clothes, nice landscapes, manufactured products) and so the future of utilities is to supply these services reliably, affordably, efficiently and with the lowest social and environmental impact.

THE ROUS SUSTAINABLE WATER PROGRAM

A SUSTAINABLE WATER FUTURE FOR THE ROUS REGION: FOUNDATION INITIATIVES

1. **Regional cooperation.** Establish a Rous region-wide commitment from all constituent councils and local water utilities (LWUs) to a regional, sustainable, commonly branded water program, with each LWU providing staff support. All planning, design and funding to be centralised, as it would have been for the Dunoon Dam.
2. **Community engagement.** Undertake a deliberative democratic engagement process with residents in the region (randomly selected, with adequate information and deliberation, and linked to decision-making) to determine the acceptable level of service (reliability standards e.g. 5:10:10 - 5:10:20) for the water supply system, including willingness to pay, canvassing various options. See this paper for background and references.
3. **Water pricing reform.** Review and reform water pricing over the next 4 years to ensure that it supports economic efficiency and water efficiency, including an investigation of drought or scarcity pricing, and ensure that hardship provisions are adequate and enhanced.
4. **Regulatory reform.** Review and reform development consent conditions and the potential for improvements in the interests of improved water efficiency. This could include: enhanced BASIX conditions, compliance and longevity; investigation of water efficiency disclosure or incentivised retrofit at point of sale; design of developer contributions and consent conditions extending BASIX including into non-residential requirements.
5. **Modernise water metering.** Investigate the centrally coordinated staged replacement of the existing water meter fleet, starting with Rous retail customers, with digital automatic meter reading (AMR) meters over the next 5 years to support improved water efficiency measures and automatic customer feedback regarding exceptions and leakage. Use the opportunity to install submetering in all shared-meter multi-customer residential and non-residential connections where practicable using remote metering.
6. **Measure end-use demand.** Undertake a thorough end-use survey to obtain a more accurate picture of where and how water is used, and to quantify the conservation potential.
7. **Enhanced marketing and communication program**. Implement a major ongoing region-wide, commonly branded marketing and communication campaign, linked to retrofit, advisory, assessment and audit services. The goal of this campaign and services is to maximise take-up of options, and to ensure a water services approach is provided to households and businesses, with linkages to energy and other resource efficiency programs e.g. Sustainability Advantage.
8. P**rogram management.** There will need to be staff engaged centrally and allocated to the task of managing the contracts for the work undertaken as part of the various initiatives on behalf of Rous County COuncil and the constituent councils. Most work will involve management of service providers and contractors. This will included training, quality assurance and compliance monitoring.

A SUSTAINABLE WATER FUTURE FOR THE ROUS REGION: RESIDENTIAL WATER EFFICIENCY INITIATIVES

1. **Residential indoor retrofit program**. Direct investment in replacement and installation (household assessment and retrofits) by qualified plumbers of 4-star showerheads, taps and toilets to best-practice efficiency across the entire existing residential housing stock. Program to run over the next 4 years intended to cover 5,000 households per year.
2. **Targeted outdoor water use program**. Provide assessments and advisory services for irrigation use, based on data analytics of high water users (initially top 20% of outdoor water use) including irrigation and landscape advice, discounted equipment, plants and services, lawn buybacks and follow-up support.
3. **Washing machine program.** Provide delivered replacement 5-star front loading washing machines with a significant discount on condition of returning a top loading machine.

The estimated savings from these programs are based on the experience from a number of large scale programs implemented in other cities, and monitored and evaluated extensively.

A SUSTAINABLE WATER FUTURE FOR THE ROUS REGION: NON-RESIDENTIAL WATER EFFICIENCY INITIATIVES

The design of these programs is critically dependent on an understanding of the profile of demand in the non-residential sector and the customer types. The indicative program below is based on a general understanding of the non-residential sector in a number of jurisdictions informed by the previous Rous Demand Management Program.

1. Major users' program. This program would involve free water audits for major water users (the top 100 water using customers) and support for installation and replacement of water using equipment at no cost or heavily discounted cost. The financing would be as a grant, or as a revolving loan fund.
2. Medium users' program. This would be for the next 1,000 water-using businesses, similar to the major users' program, but would be designed in a streamlined way to offer specific programs and support for improving the operation of, or replacement of: urinals, toilets, cooling tower controls, washdown system improvements and irrigation controllers and improvements. This would apply to e.g smaller schools, depots, smaller shopping centres, hairdressers, restaurants.
3. Small users' program. This would be for the remaining ~7,000 customers, including many Rous retail customers, who have mainly domestic end-uses, such as toilets and taps, eg small retail customers. These would be managed in much the same way as residential customers, with assessments and retrofits by approved plumbing contractors.

A SUSTAINABLE WATER FUTURE FOR THE ROUS REGION: LEAKAGE AND PRESSURE MANAGEMENT

1. The Sydney Water Corporation leakage and pressure management program is one of the best practice programs in Australia, and includes a number of components including active leakage detection and repair, in which the 21,000 km of pipelines are inspected each 12 months, as well as implementing pressure management, and rapid response to leaks and bursts.
2. In the Rous region, there has been a council-by-council approach to leakage management, and some councils have established district metering zones, while others have progressed less.
3. In this case the costs per connection and the savings per connection have been prorated to estimate the costs and savings associated with a fully fledged, regional approach.
4. It is worth noting that an evaluation undertaken by the Institute for Sustainable Futures at UTS of pressure management on the Gold Coast, showed that not only did pressure management significantly reduce burst frequency and leakage, but also reduced water use in houses and businesses, ie beyond the meter, due to reduced flow rates and internal leakage.

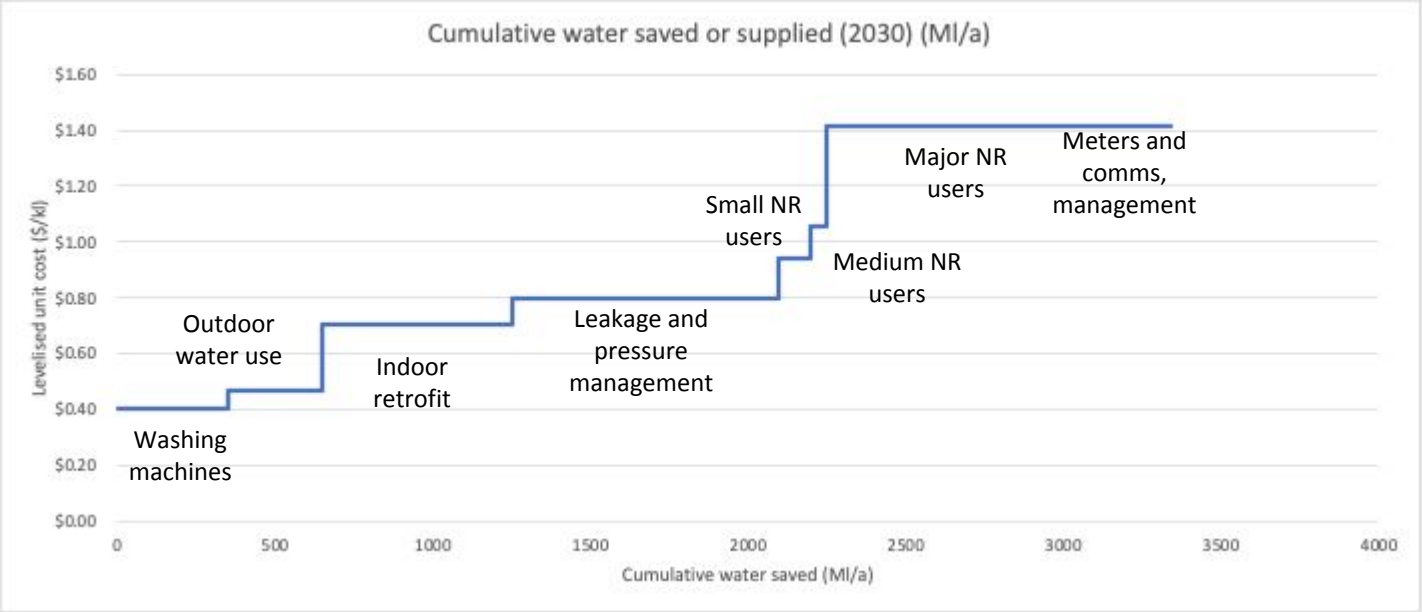
COSTS AND BENEFITS

This table shows the estimated costs, water savings and unit cost for a number of the options modelled as part of an indicative program. The actual program would be designed based on more detailed analysis and with the benefit of more end-use data. This program covers all sectors and end uses, but does not include the potential for non-potable reuse, rainwater or stormwater capture and reuse, contingency or 'real options' consideration of supply options, such as inter-catchment transfers, indirect or direct potable reuse or further groundwater use.

As shown in the next slides, these options deliver sufficient savings to defer the need for the dam to beyond 2040.

The Dunoon Dam would cost more than four times the cost of this program, and in 2030 would usefully supply about 60% of the volume of water. The unit cost of the water usefully supplied by the Dunoon Dam would be about 9 times the unit cost of the water saved by the water efficiency program.

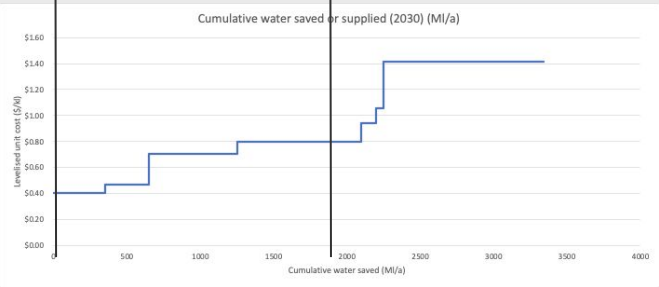
Option	Cost (present value) ($m)	Water saved or supplied (2030) (Ml/a)	Levelised cost ($/kl)
Foundation initiatives	14.4	974	$1.41
Indoor retrofit	5.1	600	$0.71
Outdoor water use program	1.7	300	$0.47
Washing machine program	1.6	350	$0.40
Major users program (top 100)	2.0	120	$1.41
Medium users program (middle 1000)	0.6	50	$1.06
Small users program (all the rest)	1.2	104	$0.94
Leakage and pressure management	9.1	846	$0.80
Total RSWP	35.8	3,344	$0.90
Dunoon Dam	154.3	1,842	$7.75



SUPPLY CURVE - WATER EFFICIENCY OPTIONS

This graph shows the cumulative contribution to reducing the supply demand gap (as at 2030) on the horizontal or x-axis, and the levelised unit cost of the options on the vertical or y-axis. This is a typical 'supply curve', in this case of conserved water, based on the 'total resource cost' of each option. The levelised cost is calculated by dividing the present value of the stream of capital and operating costs from 2021-2060, by the present value of the volume of water saved (or usefully supplied in the case of Dunoon Dam) over the same period and using the same discount rate. In this case the discount rate is 7% based on NSW Treasury guidelines.

Dunoon Dam comparison (unit cost and volume of water supplied in 2030)



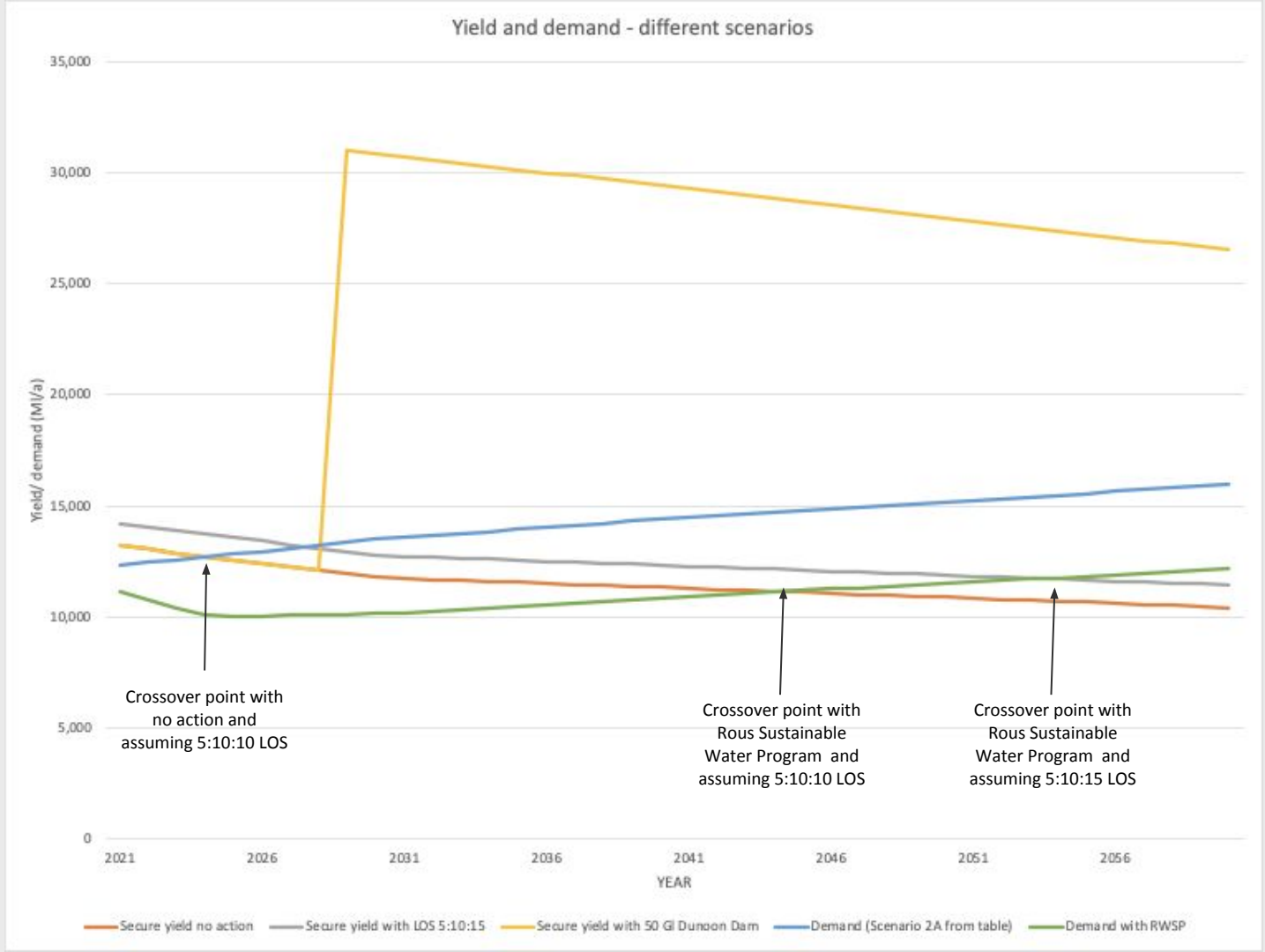
COMPARING WATER EFFICIENCY WITH DUNOON DAM

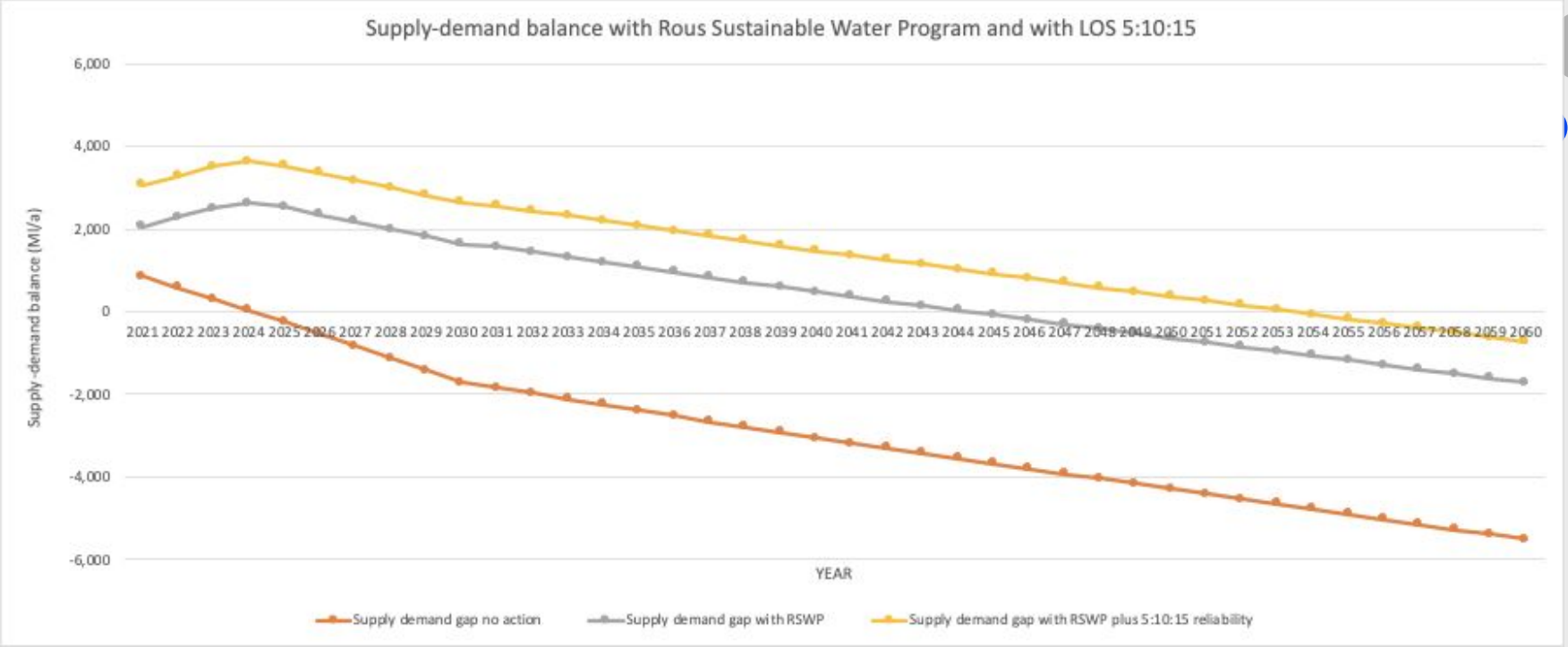
This graph shows the comparison between the unit cost of water usefully supplied by Dunoon Dam (in 2030) compared to the options that form the components of the water efficiency program.

This shows that the unit cost of the water usefully supplied by Dunoon Dam is ~9 times more expensive than the water efficiency program and usefully supplies only 60% of the equivalent demand reduction in 2030 that the water efficiency program would provide.

SECURE YIELD AND PROJECTED DEMAND

1. As indicated in this paper, there are significant uncertainties in the forecasts of secure yield and also the forecast demand. In both cases the planning approach has been cautious, that is, assuming a ~30% reduction in secure yield due to the climate change scenarios, and assuming a level of service, or reliability standard consistent with a 5:10:10 rule. Similarly the demand projections have assumed dry year demand. In this analysis, the yield and demand forecasts have been assumed as stated, using Scenario 2A for the demand forecast, with a minor exception of an apparent error in the brochure for the demand in 2060 of ~400 Ml/a, and an error in Table 2A which overstates the demand by 112 Ml/a across all years from 2025 (the sum of the demand by sector and LWU does not equal the total in the table).
2. The graph on the following slide shows the various projections, including the base case forecast demand (corrected 2A, blue line) and the assumed secure yield (orange line). Note that the supply-demand gap or deficit starts in 2025 and the supply deficit is the gap between the blue and the orange lines.
3. The yellow line shows the secure yield with the Dunoon Dam, as per the brochure, assuming it is able to supply water by 2029. Note that the marginal cost of water from Dunoon Dam is NOT the cost divided by the gap between the yellow and orange lines, but the cost divided by the gap between the blue and the orange lines, that is, the volume of water usefully supplied by the dam.
4. The grey line shows the estimated impact of changing the reliability or level of service from the 5:10:10 rule to 5:10:15 ie increasing the yield through allowing restrictions to occur more often and deeper. This would depend on a robust process of community engagement.
5. The impact of the indicative water efficiency program is shown as the green line, and so the point at which the supply-demand balance goes into deficit is pushed out to 2044, or with the change in level of service, out to 2053. This indicates that there is plenty of headroom, that is, even if the assumptions regarding potential efficiency gains were halved, the point of supply-demand deficit could still be pushed out a decade.


Yield and demand - different scenarios
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Yield/ demand (Ml/a)
2021
2026
2031
2036
2041
2046
2051
2056
YEAR
Crossover point with no action and assuming 5:10:10 LOS
Crossover point with Rous Sustainable Water Program and assuming 5:10:10 LOS
Crossover point with Rous Sustainable Water Program and assuming 5:10:15 LOS
Secure yield no action
Secure yield with LOS 5:10:15
Secure yield with 50 Gl Dunoon Dam
Demand (Scenario 2A from table)
Demand with RWSP



SUPPLY-DEMAND GAP

This graph shows the gap or difference between demand and secure yield for three scenarios. (1) the orange line is the base case ‘no action’, showing the supply-demand goes into deficit in 2024 (2) the grey line is with the impact of the indicative water efficiency program, showing the crossover is ~2044, and (3) the yellow line which shows the scenario with the water efficiency program plus changing the reliability or level of service to a 5:10:15 rule, which defers the point of deficit to ~2053.

REFERENCES (1)

This list includes the references in this paper, which is a companion document which provides a brief review of the case for the Dunoon Dam. Further references can be found here.

Australian Government (2019) 'National Urban Water Planning Principles', Department of Agriculture, Water and the Environment, https://www.agriculture.gov.au/water/urban/policy-reform-urban-water/planning-principles

Briggs, C., Rutovitz, J., Dominish, E. and Nagrath, K. (2020) Renewable Energy Jobs in Australia: Stage One. Prepared for the Clean Energy Council by the Institute for Sustainable Futures, University of Technology Sydney

Chong, J., Herriman, J., White, S. and Campbell, D. (2009) Review of Water Restrictions Volume 1 - Review and Analysis, Final Report. Prepared for the National Water Commission by the Institute for Sustainable Futures, University of Technology Sydney and ACIL Tasman

Fane, S. and White, S. (2003) Levelised Cost, a General Formula for Calculations of Unit Cost in Integrated Planning. Institute for Sustainable Futures, University of Technology Sydney

Hydrosphere Consulting (2012) Rous County Council Bulk Water Supply Demand Forecast: 2020–2060 Final Report

Hydrosphere Consulting (2020) Rous County Council Future Water Strategy Coarse Screening Assessment of Options, Rous County Council

Liu, A., Turner, A., and White, S. (2017) 'Assessment of future water efficiency measures'. Report prepared for City West Water, Yarra Valley Water, South East Water, Melbourne Water, Barwon Water and Department of Environment, Land, Water and Planning by the Institute for Sustainable Futures, University of Technology Sydney

REFERENCES (2)

Martin, P. (2017) 'Death Spiral: why electricity prices are set to climb ever higher', *Sydney Morning Herald*, 21 Sep 2017.

MWH (2014) Rous Water Strategy Integrated Water Planning Process, prepared for Rous Water by MWH Australia.

NSW Government (2006) Review of the Metropolitan Water Plan

Rous County Council (2020) 'Future Water Project 2060: Information for the community about the preferred options for securing the region's water supply'.

Turner, A., Willetts, J., Fane, S., Giurco, D., Kazaglis, A., and White S. (2008) Guide to Demand Management. Prepared by the Institute for Sustainable Futures, University of Technology Sydney for Water Services Association of Australia Inc.

Turner, A., White, S., Chong, J., Dickinson, M.A., Cooley, H. and Donnelly, K. (2016) Managing drought: Learning from Australia, prepared by the Alliance for Water Efficiency, the Institute for Sustainable Futures, University of Technology Sydney and the Pacific Institute for the Metropolitan Water District of Southern California, the San Francisco Public Utilities Commission and the Water Research Foundation.

White, S. (1997) Rous Regional Water Efficiency Program: Final Report of the Rous Regional Demand Management Strategy, prepared by Preferred Options for Rous County Council.

White, S., Campbell, D., Giurco, D., Snelling, C., Kazaglis, A. and Fane, S. (2006) Review of the Metropolitan Water Plan, Final Report. Prepared by the Institute for Sustainable Futures, University of Technology Sydney for the NSW Metropolitan Water Directorate.