Evaluation of SA Water's asset management system

Review report

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Cardno

Contact Information

Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 11
515 St Paul's Terrace
Fortitude Valley QLD 4006
Australia

www.cardno.com
Phone +61 7 3369 9822
Fax +61 7 3369 9722

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Author(s):	
Stephen Walker, Business Leader – Asset Strategies; Graydon Jeal, Director, Atkins Acuity; Dr Christopher Bridge, Senior Consultant; Adel Abdulle, Consultant	
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Stephen Walker	
Business Leader – Asset Strategies	
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Executive summary

Introduction

The Essential Services Commission of South Australia (the Commission) under the Water Industry Act 2012 has regulatory functions which include regulation of retail services in the water sector. This includes regulation of SA Water's service standards and maximum allowable revenue.

This is the third time that SA Water has been subject to regulation of its maximum allowable revenue. The Commission previously made a determination for maximum revenue and minimum service standards for SA Water's services for the period of 1 July 2013 to 30 June 2016 and then again for the period of 1 July 2016 to 30 June 2020 and will soon make a determination for the four-year period from 1 July 2020 until 30 June 2024. To assist with this function, the Commission engaged Cardno in association with Atkins to provide an independent financial and engineering assessment of the capital and operating expenditure plans of SA Water and the asset management system used to develop these plans.

The objective of this review covers three tasks which require us to assess whether SA Water's:

> decision-making systems and processes are consistent with the principles set out in its asset management framework (Task 1)

> capital expenditure in the current regulatory period (2016 – 2020) has delivered its intended outputs efficiently, and achieved its intended outcomes (Task 2), and

> capital and operating expenditure proposals for the next regulatory period (2020 – 2024) clearly identify intended outputs and outcomes, and reflect efficient costs of delivery (Task 3).

Task 2 and Task 3 included a detailed review of a sample of capital expenditure projects and programs. The projects and programs were selected to provide coverage across the different services provided by SA Water and drivers of investment.

SA Water

SA Water is wholly owned by the Government of South Australia, established by the South Australian Water Corporation Act 1994. SA Water provides water and wastewater services to approximately 1.7 million customers via over 760,000 water connections and 590,000 sewerage connections across both metropolitan Adelaide and country South Australia. SA Water owns assets with a replacement cost of more than $23 billion, including:

> More than 27,000km of water mains.

> Approximately 9,000 km of sewer mains.

> 35 water treatment plants.

> 26 wastewater treatment plants.

SA Water's operations are primarily governed by the South Australian Water Corporation Act 1994 and the Public Corporations Act 1993. The Water Industry Act 2012 came into force on1 July 2012, replacing a number of other pieces of legislation that previously provided SA Water with its powers to operate and maintain its infrastructure and charge for these services.

Methodology

The overall objective was to evaluate SA Water's asset management system, so that conclusions can be drawn on the prudence and efficiency of past capital expenditure and the prudence and efficiency of future capital and operating expenditure proposals. The methodology is informed by our team's previous experience undertaking asset management process reviews and capital and operating expenditure reviews.

Our review work commenced in late September 2019. The first two tasks were desktop assessments of information provided by the Commission and by SA Water during October 2019. Over four days in November 2019 (20th, 21st, 26th and 27th), we conducted face to face meetings with SA Water. The face to face meetings focused on Task 3 (relating to future capital and operating expenditure). Meetings were also held to discuss the initial findings from Task 2 (relating to past capital expenditure) and Task 1 (relating to embeddedness of SA Water's asset management system). Following our interviews with SA Water, further information was requested of and provided by SA Water.

To determine the recommended efficient level of capital and operating expenditure a concept of an efficient 'frontier' company competing in an open market to deliver services to customers was used. Under this framework, efficiency gains made by the frontier company are referred to as continuing efficiency, with catch-up efficiency applied to companies that are inefficient compared with the frontier company.

Before applying potential efficiency gains, we adjusted SA Water's expenditure proposals in the following areas:

> Adjustments to reflect better information provided by SA Water

> Adjustments to reflect our assessment of the prudence, timing and efficient level of expenditure of the specific projects and programs included in the sample subject to detailed review.

Following these adjustments, continuing and catch-up efficiency factors were applied, as appropriate, to arrive at a determined level of prudent and efficient operating and capital expenditure. The catch-up efficiency factors were applied to capital expenditure net of the value of the capital expenditure projects included in the sample to avoid any double counting of efficiencies. The projects and programs sampled comprise 35% of the RD16 capital expenditure program and 43% of the RD20 program.

Continuing efficiency is the scope for a frontier company to improve their efficiency. It reflects the continuing efficiencies being gained across all major sectors through innovation and new technologies. The continuing improvement element of efficiency relates to the increased productivity derived from process innovation and new technology that all well performing businesses should achieve, including frontier companies. This applies to a range of industry sectors and applies internationally to the extent that new innovations in one region are able to be adopted in other regions.

Catch-up efficiency is the productivity gains that may be realised when agency business moves from its current position to that of the frontier utility. Our assessment of catch-up efficiency is based on a qualitative, process based assessment of SA Water against leading practice for utilities in Australia and internationally, supplemented by partial indicator benchmarking. This is largely informed by our conclusions drawn from Task 1. Our assessment was based on identified improvements to processes and business opportunities that would generate efficiencies in future years and enable SA Water to move towards a frontier utility.

Asset management system

Introduction

Task 1 of this review is an evaluation of whether SA Water's asset management framework is embedded in systems and processes, and that these processes are consistent with the principles set out in its asset management framework.

SA Water's approach to asset management is aligned with the requirements of the international standard for a management system for the management of assets, ISO55001:2014, which defines asset management as the coordinated activity of an organisation to realise value from assets. Value has to be defined by the organisation and may encompass financial and non-financial aspects and should support the organisation's overall objectives.

Stakeholder expectations and asset management objectives

SA Water has sought to engage with its customers throughout development of its RD20 regulatory business proposal from setting strategy to formulating specific expenditure items. This customer engagement has helped SA Water to determine what customers value and also inform development of its corporate strategy. The main element of SA Water's customer engagement and its input into corporate planning and strategy for the RD20 period are:

> Customer values research – SA Water analysed its existing customer engagement data from different sources to then verify the areas important to customers through a series of focus groups. This resulted in 35 common themes from customer viewpoints and feedback being identified for further testing

> Explore research – the 35 themes were subject to choice testing where participants had to rank the 35 themes. Themes were then grouped into 11 "outcomes (SA Water) customers value".

> Development of strategy – the Strategy was designed to address the 11 valued outcomes.

> "What matters to you?" Research – choice modelling to test and understand customer priorities with respect to service levels

> "Would you invest in this?" research – to test customer's willingness to pay for five initiatives identified as valued by customers. The initiatives tested were improved drinking water quality for the Adelaide

metropolitan area; provide potable water to up to 340 properties across South Australia; increase the amount of recycled water used; improve the taste, smell and colour of drinking water in regional South Australian communities and to minimise environmental sewage overflows.

Under the planning approach taken, customer research has informed SA Water's strategy and this in turn has been used to develop objectives for SA Water's asset management system to achieve. The corporate strategy is therefore central to SA Water's asset management system. The willingness to pay research is also important to SA Water's business proposal as it has been used to justify improvements in service delivered to customers. A feature of SA Water's capital expenditure program for the RD20 period is the amount of expenditure proposed under the "improve service" driver. Expenditure in this category comprises one-fifth of all expenditure. SA Water has used its customer engagement, and reflected insights drawn from this research, in the objectives for its asset management system, as part of its justification for this expenditure for improved service.

SA Water also undertook customer engagement to inform its expenditure proposals for the RD16 period. SA Water identified a list of 172 "outcomes" that it desired to achieve during the RD16 period which capture customer expectations, regulatory requirements and the expectations of other stakeholders. For the RD16 period, the Commission established customer service standards for SA Water's regulated water and sewerage services which describe the quality and reliability of the water and sewerage services SA Water is to provide to its customers. The current service standard targets were set based on SA Water's performance over the two year period 2013/14 and 2014/15 as this was the data available at the time. SA Water is required to use its best endeavours to meet these standards. During the RD16 period until the end of 2017/18, SA Water has met all service standards except for two for which the level of underperformance has been assessed by the Commission as a "minor deviation" only.

As part of the RD20 determination process and through engagement with its customers, SA Water has proposed a set of new service standards to apply for the RD20 period. The final standards to be applied in RD20 will be determined by the Commission. In conducting this review, it is important that we have had regard for the existing service standards and those proposed by SA Water for the RD20 period. Where SA Water proposes new service standards, these may be presented as maintaining existing service levels where SA Water considers that it now has better information on the service expected and experienced by customers. We also have to have regard to those areas where service standards have changed, as these require different justification to satisfy the prudence condition compared with expenditure on areas where service standards are unchanged.

Within its asset management system, SA Water has defined asset management objectives which are intended to support the overall corporate objectives and reflect stakeholder requirements (such as those expressed in the customer service standards, in legislation and identified through customer research). By defining asset management objectives based on stakeholder expectations, asset management processes are then able to support technical and financial decisions, planning and activities to achieve these objectives. This is termed 'alignment' within the ISO55001:2014 standard. We consider that SA Water's asset management objectives soundly demonstrate alignment with SA Water's strategic goals and also capture SA Water's regulatory obligations including environmental protection and drinking water quality. The objectives are also consistent with SA Water's proposed service standards. However, we consider that in two respects, the asset management objectives may not provide a clear line of sight between stakeholder expectations and asset management activities. These are:

1. Inclusion of a number of objectives which do not appear to be supported by stakeholders based on the information we have reviewed.
2. Lack of clarity regarding what is within the scope of asset management and the asset management system, and what lies outside of these in the wider organisation. Specifically, we question the relevance of the brand health index and innovation index to asset management. The measurement of brand health relies on many factors outside of the control of asset management, such as changes in customer perceptions about the services they are receiving. The risk is that the performance of the asset management system is being measured on factors that are outside of its ability to influence through sound asset management practices.

While we consider that there is scope for SA Water to refine its asset management objectives, we are primarily interested in how the system has been applied to develop and deliver expenditure in the RD16 and RD20 periods. Alignment should help establish that expenditure is prudent. However, the asset management system alignment is of itself not sufficient to meet the prudence test. This test is more specific in that it requires that expenditure must meet one of the following criteria:

> a legislative or regulatory obligation, which SA Water must comply with

> an expectation that the activity will deliver benefits to consumers that outweigh the costs, or

> a clear expectation from customers that an outcome should be achieved, and that they are willing to pay for that outcome.

As noted, SA Water's capital expenditure program for the RD20 period includes a notable proportion of expenditure under the "improve service" driver (around one-fifth of the program). Improved service needs to be justified by either of the last two criteria for prudence – benefits outweighing the costs or that customers are willing to pay for the improvement. Even within the Maintain Service category, SA Water is proposing improved service in part, (e.g. for water main and wastewater main renewals). Based on our assessment of SA Water's line of sight and the findings from our review of a sample of capital expenditure projects and programs, we consider that greater assurance over expenditure justification – through improving line of sight and better incorporation of the regulatory requirements - will lead to savings in delivery of the program in the RD20 while still meeting service requirements.

Asset management planning and decision making

SA Water's asset planning framework sits within its overall asset management framework and has the following key components:

> Business Plans

> Asset Management Policy

> Strategic Asset Management Plan and Asset Management Objectives

> Asset Management Plans

> Implementation of Plans (Lifecycle activities).

We consider that the planning framework is sound. The planning framework allows SA Water to undertake planning at different levels and through different lenses (e.g. lifecycle strategy, safety, emergency management). SA Water applies the principles of risk management as set out in the International Risk Management Standard AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines to its asset management decision making. SA Water has evolved its risk management framework to include greater consideration of opportunities and also now uses a ten point scale for likelihood and a ten point scale for each of threats and opportunities. In the development of the Asset Management Plans, this risk matrix approach has been enhanced with greater definition of risks before and after controls and the controls in place or proposed.

In our assessment of operational expenditure activities and a sample of historical and future capital expenditure projects and programs we have reviewed the planning documents relevant to the expenditure to test their efficacy, as well as the decision making criteria applied. We have found that SA Water generally has sound plans in place for the medium and long term. However, long term planning for asset renewal is performed with varying degrees of maturity across asset classes. Many of SA Water's assets (by proportion of total asset value) have relatively long expected useful lives. However, the asset base in total and a number of asset classes are moving out of 'middle age' (as measured by the fair value divided by the replacement cost) and into a period where long term planning needs to be increasingly integrated with short term planning for renewal and replacement. The challenge is for SA Water to be able to understand the relationship between investment, asset deterioration, asset performance and service provided.

For water mains, there are complementary models in place to assist SA Water's decision making which provides it with a balanced view of long term needs and the short term interventions included in the forward expenditure program. For sewer mains, we consider that SA Water has a sound understanding of long term needs across the asset class but there can be better integration with short term planning through an enhanced approach to assessing the consequence of failure of segments of mains. For water tanks, SA Water does not yet have a complete picture of the condition of the entire asset class which limits the extent to which long term planning is informative.

SA Water undertakes lifecycle costing and other financial analyses as part of its decision making to determine appropriate interventions and the magnitude of investment required. In our review of historical and future capital expenditure projects, we identified a number of areas of concern regarding SA Water's approach to lifecycle costing including inconsistent approaches, sensitivity and scenario testing only being undertaken to a limited extent and financial analysis not being undertaken where the options analysis would have benefited from this.

Based on our findings from both the historical and future capital expenditure projects reviewed, we consider that improved decision making will be a source of capital expenditure efficiency gains for SA Water in the

RD20 period. Accordingly, we propose that a catch-up efficiency be applied to the future capital program to reflect these potential gains.

Program development and delivery

To develop its Regulatory business proposal, SA Water first prepared a "Technical Investment Plan". This Technical Investment Plan is an unconstrained plan put forward by the asset managers which includes the activities considered necessary to achieve service levels in the forward period as well as the expenditure that SA Water assessed would be required to deliver on the areas where customers had expressed a desire for improved service. Therefore, the Technical Investment Plan is the sum of all known needs and wants across the business for the RD20 period. The Technical Investment Plan totalled $2,079 million for both water and sewerage assets, net of expenditure for information systems.

The Technical Investment Plan was then subject to scenario testing before a plan was developed to put forward to the Customer Negotiation Committee. The 'baseline' scenario considered totalled $1,280 million and was developed to meet service requirements while sustaining or reducing asset risk. The program put forward to the Customer Negotiation Committee was $1,512 million, a $232 million (11%) increase on the scenarios tested. In moving from the scenarios to the program put forward to the Customer Negotiation Committee, SA Water has in aggregate reduced expenditure on asset renewals and increased expenditure to improve service levels. By inference, the Technical Investment Plan has a more conservative risk profile than what the business is now willing to take for the RD20 period. While we consider that SA Water's approach to assessing asset risk is reasonable for its level of maturity (and consistent with its water utility in peers across Australia), there are also limitations in this process.

Analysis of the prioritisation of the overall capital expenditure program between the program put forward by SA Water to the Customer Negotiation Committee and that included in its regulatory submission shows that some of the largest variances are $104 million for the ZCEF project and $124 million for growth projects (Kangaroo Island desalination and the Upper Spence Gulf Augmentation). The emergence of new needs is not unusual but the magnitude of these expenditure items is given their timing. The late inclusion of relatively large additional expenditure in these areas calls into question the cost-service-risk balance presented to the Customer Negotiation Committee as no expenditure has been deferred or re-prioritised to off-set these new items, they have been simply added to the previously proposed program.

Considering SA Water's approach to development of its RD20 capital program, we note that SA Water has identified that a $1,280 million expenditure program will meet required service levels and sustain or reduce asset risks. It has then proposed additional expenditure on top of the $1,280 million 'baseline' program to improve service (35% increase) and to respond to growth drivers (10% increase). While improving service delivered to customers can often be demonstrated to be 'aligned' with overall corporate objectives within the asset management system, there is a need for SA Water to justify this expenditure against the requirements of the regulatory framework which includes tests to ensure that the benefits of this expenditure exceeds its costs and is supported by customers. We have reviewed a sample of projects and programs which includes some expenditure to improve service but we have not reviewed all expenditure for this driver.

While capital program development and prioritisation seeks to optimise benefits to customers with cost, circumstances will inevitably change during the delivery period. Therefore, monitoring the benefits realised by expenditure provides assurance to customers and stakeholders that an expenditure program continues to deliver value for money. 'Benefits realisation' is a standard process within expenditure governance or gateway frameworks. In this area, SA Water has identified a list of 172 "outcomes" that it desired to achieve during the RD16 period. These outcomes are a combination of outputs (i.e. activities undertaken or works delivered) and outcomes, as well as measures of outcomes. While this list of outcomes is comprehensive, it is difficult to map these to SA Water's line of sight within its asset management framework and the use of outputs and outcomes within the framework for the same purpose creates some confusion around the relationship between expenditure and performance.

We consider that there is benefit in SA Water revisiting this framework for the RD20 period and providing a more focused benefits realisation framework that distinguishes between outputs and outcomes, and has a more defined link to the asset management objectives and service standards. We consider that this is particularly important for the areas in which SA Water has proposed expenditure to improve service as there is an explicit regulatory requirement that the benefits of this expenditure exceed the costs. Therefore, benefits realisation should include scheme specific measurement of performance or benefits before expenditure occurs to establish a robust baseline and further measurement afterward to confirm that the anticipated benefits have been achieved. Where benefits are unknown or uncertain, SA Water's customers are likely to benefit from a cautious approach that first verifies benefits through trials before wider expenditure programs are pursued.

SA Water has a structured approach to cost estimating with different classes of estimates defined for different states of project development. However, this is an area that SA Water has identified as needing further refinement during the RD20 period. SA Water intends to strengthen its cost estimating function in the RD20 period by capturing more estimated and outturn costs in its cost estimating database. An internal audit in October 2019 of SA Water's approach to cost estimating concluded that the team is currently in a transitional stage.

In the current regulatory period, SA Water has had contracts with six major capital delivery partners. The contracts were generally based on asset classes and geographical areas. For the RD20 period, SA Water has reduced the number of major delivery partners to three, with contracts in place for: water north, water south and wastewater networks. The RD20 model includes minor delivery frameworks and panels. We consider that the RD20 delivery model is sound for the expenditure program with a reduced number of major partners expected to lead to efficiencies due to economies of scale while retaining specialist services on minor panels.

SA Water has identified that areas in which it will be able to achieve its nominated 5% top down capital delivery efficiencies in the RD20 period include improved internal cost estimating processes, early on boarding of its planning partner for RD20 and re-evaluation of supplier agreements for materials, equipment and services.

Conclusions

The scope of this Task 1 includes specific criteria for testing SA Water's asset management system. We conclude against each of these criteria drawing on the preceding observations and analysis:

> Does SA Water demonstrate an understanding of its critical asset systems and facilities, and have a mature approach to assessing risks and opportunities for managing those assets?

  We consider that SA Water has a sound understanding of its critical assets and risk based decision making. However there was some evidence that risk based decision making is not being conducted thoroughly or consistently implemented across the different asset classes. Generally, investment decisions for renewals are made on a risk basis, although this appears to be more mature for water assets than wastewater assets. SA Water has in place a sound business continuity planning approach for business critical assets.

> Does SA Water have internal monitoring and reporting systems that are sufficient to actively manage expenditure and assess the effectiveness of its outcomes?

  SA Water has effective monitoring and reporting systems in place for asset management and the asset management system. This includes business KPI reporting, asset management system reviews and ongoing internal audits. However, there was some evidence that the recommendations arising from reviews and audits had not been actioned.

> Does SA Water optimise use of capital and operating expenditure solutions for its core maintenance?

  We have reviewed the lifecycle strategies adopted for various asset classes through the sample of capital projects reviewed. We consider that the capital and operating interventions strategies are broadly appropriate. However, our review of a sample of capital projects found that lifecycle costing can be improved. This means that the current balance between capital and operating expenditure is unlikely to be optimised where lifecycle costing has informed asset lifecycle strategies.

> Does SA Water conduct options analysis that includes a clear 'base case' and 'lowest lifecycle costing?

  Options analysis is an area in which SA Water can improve. On numerous projects that we reviewed, the lifecycle costing fell short of good practice. Our observations include financial analysis not being undertaken to support options selection where benefits and costs should have been a key part of the project justification limited sensitivity testing and scenario analysis and the analysis period not matching the expected life of the underlying assets. SA Water's approach to lifecycle cost analysis appears to be inconsistent and lacking in rigour. We also consider that sensitivity testing and scenario analysis can be strengthened. The findings from our review of capital expenditure projects is summarised in Section 5.2.2 and Section 5.3.2

> Is there a clear line of sight from the drivers of the investment decisions through to the outcomes achieved through that expenditure?

  There a defined line of sight from SA Water's strategic goals and its asset management objectives into business planning. The asset management objectives adequately capture SA Water's regulatory

obligations including environmental protection and drinking water quality. The objectives are also broadly consistent with SA Water's proposed service standards.

However, we consider that there is scope for SA Water to refine its asset management objectives and line of sight so that there is greater recognition and integration with the regulatory framework in which SA Water operates. This will provide more assurance that expenditure is justified based on both stakeholder expectations and the regulatory framework that SA Water operates within. We are concerned that the asset management objectives include intentions that do not have stakeholder support and that are outside of the influence of the asset management system.

We identified multiple examples of expenditure being proposed where there was insufficient evidence to conclude that this was a prudent investment. Improved asset management decision making should result in the avoidance of expenditure that is not genuinely needed by SA Water to deliver its services.

> Is there an appropriate and timely feedback loop between planning processes, project delivery and the outcomes achieved considering expenditure trade-offs and the likely impact of deferrals and reprioritisation of expenditure across the entire organisation

SA Water tracks a number of indicators for project delivery including performance against KPIs and a suite of 'outcomes'. We consider that there is benefit in SA Water revisiting this framework for the RD20 period and providing a more focused benefits realisation framework that distinguishes between outputs and outcomes and has a more defined link to the asset management objectives and service standards.

> applying appropriate budget constraints at the asset portfolio/General Manager level.

We consider that governance and monitoring of expenditure is appropriate. Planning documents had appropriate levels of approval where reviewed and we saw that SA Water has in place systems for tracking expenditure delivery.

Based on our review of SA Water's asset management system, we consider that there is scope for SA Water to realise catch-up efficiencies in the RD20 period for capital expenditure in the areas of:

1. Improved assurance over expenditure justification – through a refined line of sight to provide greater assurance over expenditure justification. We recommend a catch-up efficiency in this area of 1.0% per annum over the RD20 period.
2. Improved asset management decision making – through improved lifecycle decision making and risk analysis to determine optimum intervention to assets to achieve the asset management objective. We recommend a catch up efficiency in this area of 0.5% per annum over the RD20 period, as decision making processes improve.

Zero Cost Energy Future

The ZCEF program seeks to provide SA Water and its customers with reduced and more stable electricity costs with a desired outcome of "work(ing) towards a $0 net energy cost future". SA Water's submission states that the project will save approximately $47 million per year on energy costs which "has been built into the budgets for 2020-24 and beyond". The expected capex for these works is $368 million.

The scope of the proposed works includes the installation of up to 152 MW of solar PV generation capacity and 35 MWh of storage across approximately 70 sites. SA Water has also included expenditure of $5 million for purchase of an energy management system.

While ZCEF was originally part of the scope for this review, further investigation by the Commission revealed that the nature of this proposed investment meant that it did not meet the definition of a retail service under the Water Industry Act, and therefore was not relevant to the determination of prudent and efficient expenditure. We therefore have excluded this project from the analysis within this report and have removed it from our recommended prudent and efficient operating and capital expenditure. This impacts both the RD16 and RD 20 period.

Capital expenditure in the current period

In the current regulatory period, SA Water is predicting that its capital expenditure will exceed the 2016 Regulatory Determination by around $415 million ($1.7 billion actual v $1.3 billion – see Figure E-1). The overspend is largely due to expenditure on three projects that were not anticipated at the time of RD2016: Zero Cost Energy Future (ZCEF), Northern Adelaide Irrigation Scheme and additional water main relays. The overspend is large in both absolute and relative terms.

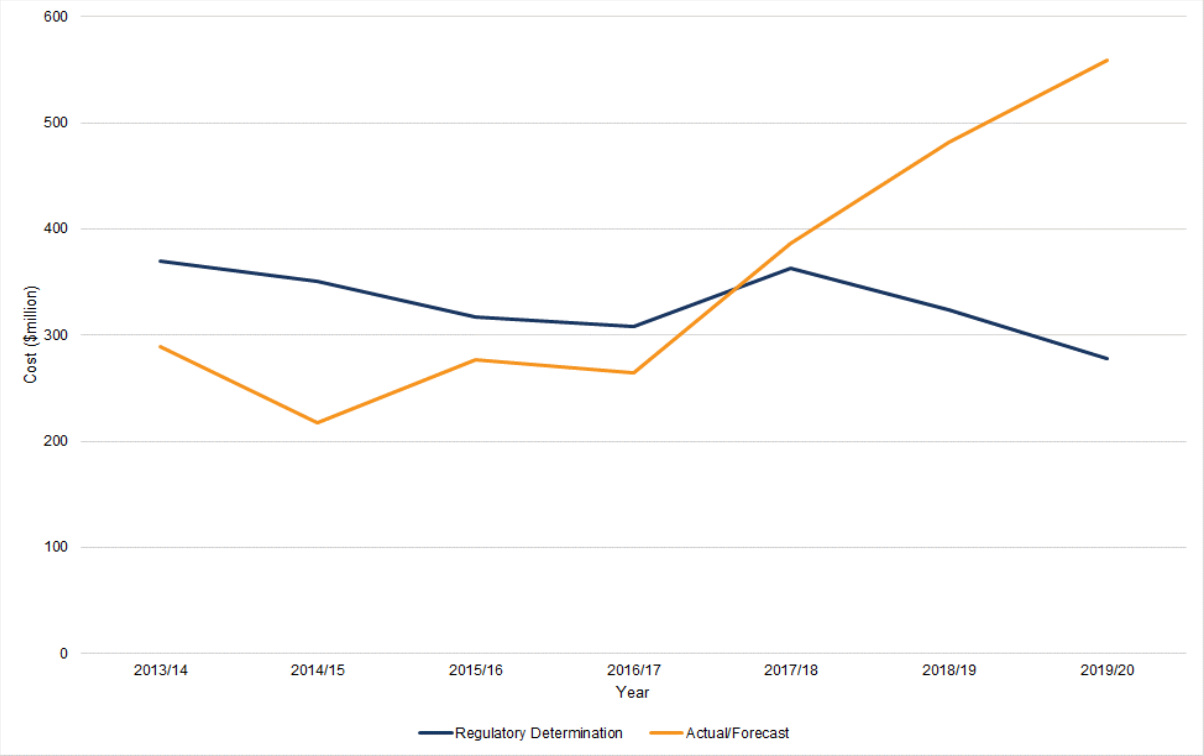

Figure E-1 Variance of forecast and actual capital expenditure between 2015/16 and 2019/20 to Regulatory Determination

We have reviewed SA Water's asset management processes to assess their adequacy to support the development and delivery of prudent and efficient capital expenditure. We have identified expenditure on specific projects that we consider do not meet prudence and efficiency requirements. We make the following conclusions regarding the prudence and efficiency of specific projects:

> We have removed all expenditure related to the ZCEF project given the advice from the Commission that it does not meet the definition of retail services under the

> We concluded that a prudent and efficient level of expenditure for the Water Network Mains Renewals program is $22 million less than that forecast by SA Water for the RD16 period

> We concluded that the efficient expenditure for the Western Adelaide Wastewater Network project was $600k less than that recorded by SA Water

> We concluded that no expenditure was prudent and efficient for the CBD Smart Water Network Management program.

Our recommended prudent and efficient expenditure for the RD16 period based on adjustments for these specific projects is summarised in Table E-1.

Table E-1 Recommended prudent and efficient capital expenditure for RD16 period

$M (18/19)	2016/17	2017/18	2018/19	2019/20	Total
SA Water RD16 actual and forecast capital expenditure	274.8	393.2	481.7	558.2	1,707.8
Adjustment for ZCEF	-0.7	-36.3	-227.1	-103.7	-367.8
Less adjustment for western Adelaide wastewater network	-	-0.6	-	-	-0.6
Less adjustment for CBD smart water networks	-3.0	-1.4	-0.0	-	-4.3
Less adjustment for water mains	-5.5	-5.5	-5.5	-5.5	-22.0
Recommended RD16 prudent and efficient expenditure	265.6	349.4	249.1	449.0	1,313.1

Operating expenditure

Our overall conclusions with respect to operating expenditure are:

> On the basis of the simple benchmarking that we have carried out, it is clear that SA Water has a low unit operating expenditure relative to its peers. However, it has above average capex per property for both water and sewerage which may be driving some of the operating expenditure efficiency.

> We recommended a different basis to derive an efficient base year operating expenditure for the start of the RD20 period as set out below:

- We have applied an alternative normalisation which reduces 18/19 operating expenditure to $462.7 million, below the figure of $479.0 million proposed by SA Water. We consider this a reasonable estimate for 'normal' operating expenditure. It is lower than the average operating expenditure from 16/17 and 17/18 of $469.3 million when wholesale electricity prices were unusually high.
- To project the normalised operating expenditure forward to the RD20 base year, we have also incorporated the efficiency savings expected in 2019/20. We have applied the Commission's RD16 Determination general efficiency saving of $4.1 million. We have also applied the net IT-enabled efficiency saving proposed by SA Water in RBP16. These two efficiencies reduce RD20 base year operating expenditure by an additional $5.8 million to $456.9 million.
- We have also made an adjustment to take account of the change in accounting for government radio network (GRN) expenditure, reducing base year RD20 operating expenditure by a further $1.3 million resulting in an operating expenditure budget of $455.7 million.

> SA Water is projecting a reduction in operating expenditure in RD20, with an initial reduction (largely due to savings from the ZCEF program) followed by a steady increase back to $475.3 million by the end of the RD20 period. However, stripping out the savings associated with ZCEF, the underlying trend in SA Water's proposed operating expenditure is an average 1.7% p.a. increase relative to its normalised 18/19 operating expenditure.

> ZCEF: we have removed all expenditure related to the ZCEF project given the advice from the Commission that it does not meet the definition of retail services under the Water Industry Act.

> SA Water has low unit operating expenditure, but it should still be possible to increase operating expenditure efficiency. We have identified a number of specific ways in which SA Water can make operating expenditure savings in the next period, including:

- Savings already identified by SA Water and incorporated in the RBP: ZCEF and procurement cost savings.
- Savings already identified by SA Water but not explicitly incorporated in the RBP: changes to the Metro Alliance and savings associated with the IT program.
- There are also other, as yet undefined, savings which we expect an efficient utility to identify. Recognising this, SA Water has applied a 0.5% p.a. ongoing efficiency.
- We consider that some of these savings, notably the procurement cost and Metro Alliance savings, are clear specific actions which can be taken now to improve the efficiency of the business. As such we consider that these savings should be treated as 'catch-up' efficiencies.

> Even utilities operating at the efficiency frontier should continue to make efficiency gains. We recommend that a movement in frontier efficiency (continuing efficiency) of 0.8% per annum should be applied to proposed operating and capital expenditure.

> The operating expenditure savings associated with the IT program are at least partially derived from additional capex as well as operating expenditure. These additional costs will contribute to all expenditures and customer bills. As such, we recommend that the savings should be treated as an addition to the continuous efficiency challenge.

Our recommended level of efficient operating expenditure for the future (RD20) period is set out in Table E-2.

Table E-2 Recommended efficient operating expenditure for future period - water and sewerage combined

($M 18/19 real)	20/21	21/22	22/23	23/24	Average
Base Year costs	**455.7**	**455.7**	**455.7**	**455.7**	**455.7**

($M 18/19 real)	20/21	21/22	22/23	23/24	Average
Savings and efficiencies	**-7.5**	**-21.6**	**-29.6**	**-36.2**	**-23.7**
Energy savings (including revenue)	0.0	0.0	0.0	0.0	0.0
0.8% continuous efficiency	-3.6	-7.3	-10.9	-14.6	-9.1
Procurement contract savings	-6.3	-6.3	-6.3	-6.3	-6.3
Savings associated with the IT program	-1.5	-4.0	-6.9	-9.9	-5.6
Alternative arrangements to the Metro Alliance	4.0	-4.1	-5.4	-5.4	-2.7
Plus incremental change:					
Total Growth	0.4	2.4	2.8	3.2	2.2
External obligations	2.3	8.6	10.3	11.9	8.2
Improve	2.9	5.6	8.9	11.5	7.2
Sustain	2.4	3.1	3.8	4.4	3.4
Sub-total Incremental Change	**8.0**	**19.6**	**25.7**	**30.9**	**21.1**
Total recommended expenditure	**456.2**	**453.7**	**451.8**	**450.4**	**453.0**

Capital expenditure in the future period

SA Water's proposed capital expenditure program for the RD20 period totals $1,882.9 million (including ZCEF). The water service accounts for 65% of all expenditure, wastewater 27% and IT 8%. The profile of expenditure by service across the period is shown in Figure E-2.

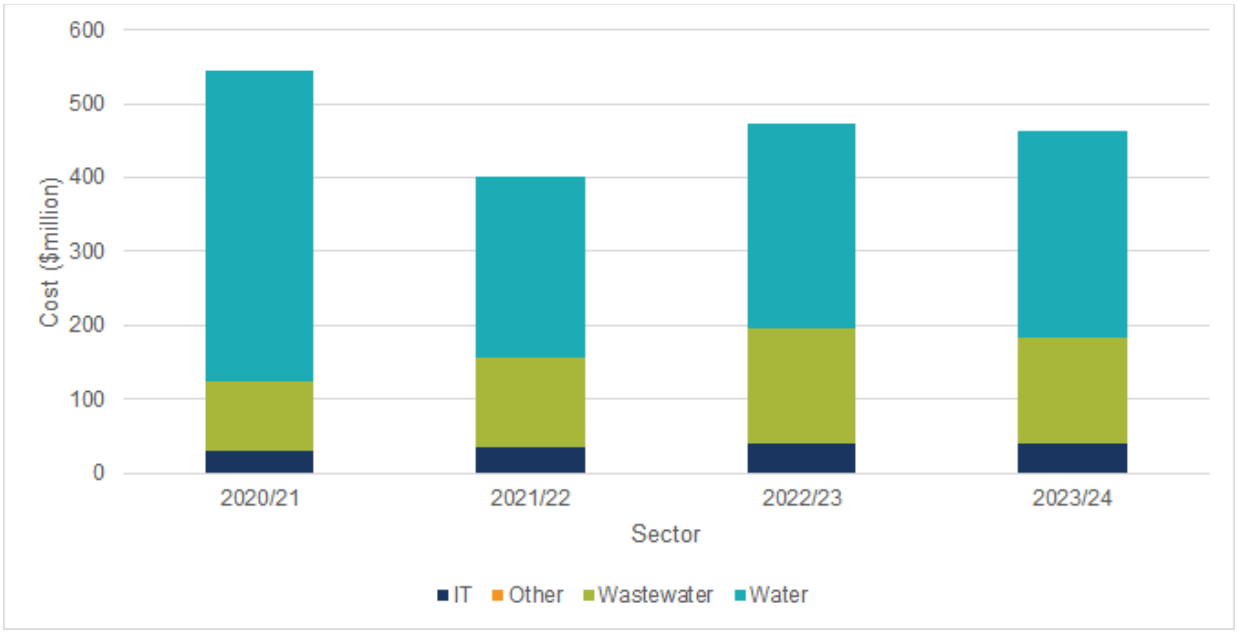

Figure E-2 Forecast capital expenditure 2020/21 to 2023/24

Our recommended level of prudent and efficient capital expenditure for SA Water for the future regulatory period has been developed in line with our methodology as follows:

> Removal of all expenditure related to the ZCEF project given the advice from the Commission that it does not meet the definition of retail services under the (net -$103.7 million impact)

- Reprofiling of the Happy Valley water quality and chloramination projects to occur over a longer period to provide greater assurance that the expected benefits from these works to improve service are realised (deferral of $41.4 million outside the period)
- Reduction in the network water structures program to reflect the risk profile implied by the information available ($5.8 million reduction)
- Removal of expenditure for expansion of the Glenelg to Adelaide Parklands recycled water scheme as there is no evidence that there is demand for this expansion (reduction of $10.0 million).
- Reduction in the reticulation water mains program of $13.3 million to better reflect a balanced program
- Reduction in the reticulation wastewater mains program by $22.6 million as the case for additional expenditure to improve service is not justified based on SA Water's current approach to prioritising and optimising this program and the improved performance observed in recent years
- Reduction in the IT Asset Refresh and Resilience program by $9.6 million to reflect the likely efficiencies from greater challenge to and refinement of this program.

We propose the following adjustments for capital expenditure efficiency:

- We recommend that SA Water's proposed capital expenditure be subject to a continuing efficiency target of 0.8% per annum.
- We recommend that catch-up efficiencies adjustment be applied to reflect the potential for SA Water to realise gains through improved assurance over the needs for its expenditure in the RD20 period as well as improved decision making. To avoid the potential for double counting of efficiencies resulting through these broader process improvements, the catch-up efficiencies have been applied to the RD20 program net of the expenditure within the projects and programs subject to review.

Table E-3 details our recommended prudent and efficient capital expenditure following the application of the adjustments and efficiency factors outlined above.

Table E-3 Recommended prudent and efficient capital expenditure for the future period

$M (18/19)	2020/21	2021/22	2022/23	2023/24	Total
SA Water RD20 actual and forecast capital expenditure	**423.9**	**394.3**	**466.4**	**453.8**	**1,738.3**
Project and program level adjustments					
Adjustment for ZCEF	-103.7				
Adjustment for Happy Valley WQ and chloramination	-10.35	-10.35	-10.35	-10.35	-41.4
Adjustment for network water structures	-1.45	-1.45	-1.45	-1.45	-5.8
Adjustment for GAP expansion	-1.50	-2.50	-3.00	-3.00	-10.0
Adjustment for reticulation water mains	-3.33	-3.33	-3.33	-3.33	-13.3
Adjustment for reticulation wastewater mains	7.65	-7.61	-11.32	-11.32	-22.6
Adjustment for IT risk management (IT Asset Refresh and Resilience) program	-2.41	-2.41	-2.41	-2.41	-9.6
Total expenditure after adjustments	**412.5**	**366.6**	**434.6**	**421.9**	**1,635.6**
Continuing and catch-up efficiency					
Continuing efficiency					
Continuing efficiency factor	0.80%	1.60%	2.40%	3.20%	
Continuing efficiency adjustment	-3.3	-5.9	-10.4	-13.5	-33.1
Catch-up efficiency					
Sample of project and programs reviewed (linear)	170.3	170.3	170.3	170.3	
RD20 program net of projects and programs reviewed	253.5	224.0	296.1	283.4	
Catch-up efficiency: Needs identification and justification	1.00%	2.00%	3.00%	4.00%	
Catch-up efficiency: Decision making	0.50%	1.00%	1.50%	2.00%	
Total catch-up efficiency	1.50%	3.00%	4.50%	6.00%	

$M (18/19)	2020/21	2021/22	2022/23	2023/24	Total
Catch-up efficiency adjustment	-3.8	-6.7	-13.3	-17.0	-40.9
Total efficiency adjustment	-7.1	-12.6	-23.8	-30.5	-73.9
Recommended prudent and efficient expenditure	**405.4**	**354.0**	**410.8**	**391.4**	**1,561.6**

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1 Introduction

1.1 Background

The Essential Services Commission of South Australia (the Commission) is established under the Essential Services Commission Act 2002 with the primary objective of "protection of the long term interests of South Australian consumers with respect to the price, quality, and reliability of essential services". Under the Water Industry Act 2012, the Commission has regulatory functions which include regulation of retail services in the water sector.

The Commission previously made a determination for maximum revenue and minimum service standards for SA Water's drinking water services for the period 1 July 2016 to 30 June 2020 and will soon make a determination for the next four-year period from 1 July 2020 until 30 June 2024.

The Commission has prepared a number of Guidance Papers which cover subjects important to its deliberations for making its determination.

1.2 Purpose of this review

The objective of this review is to evaluate SA Water's asset management system, to inform the Commission's Regulatory Determination 2020 (SAW RD20), by assessing whether SA Water's:

> decision-making systems and processes are consistent with the principles set out in its asset management framework (Task 1)

> capital expenditure in the current regulatory period (2016 – 2020) has delivered its intended outputs efficiently, and achieved its intended outcomes (Task 2), and

> capital and operating expenditure proposals for the next regulatory period (2020 – 2024) clearly identify intended outputs and outcomes, and reflect efficient costs of delivery (Task 3).

Cardno in association with Atkins were appointed by the Commission to undertake these tasks.

1.3 Scope of this report review

1.3.1 Evidence of an embedded asset management system

The Commission requires an evaluation of whether SA Water's asset management framework is embedded in systems and processes across the organisation (Task 1). The evaluation must consider whether SA Water's decision-making systems and processes are consistent with the principles set out in its asset management framework. This evaluation is to consider how SA Water demonstrates:

> understanding its critical asset systems and facilities, and having a mature approach to assessing risks and opportunities for managing those assets

> having internal monitoring and reporting systems that are sufficient to actively manage expenditure and assess the effectiveness of its outcomes

> optimising use of capital and operating expenditure solutions for its core maintenance

> conducting options analysis that includes a clear 'base case' and 'lowest lifecycle costing'

> having a clear line of sight from the drivers of the investment decisions through to the outcomes achieved through that expenditure

> having an appropriate and timely feedback loop between planning processes, project delivery and the outcomes achieved

> considering expenditure trade-offs and the likely impact of deferrals and reprioritisation of expenditure across the entire organisation, and

> applying appropriate budget constraints at the asset portfolio/General Manager level.

1.3.2 Assessment of capital expenditure during the 2016 – 2020 regulatory period

The scope of Task 2 is to determine whether capital expenditure during the current regulatory period (2016 – 2020) has delivered its intended prudent outputs efficiently, and if that led to the intended outcomes being achieved. The purpose of this assessment is to:

> reveal how well SA Water's asset management system has worked in the current regulatory period, and

> inform an assessment as to whether any capital expenditure should not be included in the regulatory asset base, or should not be included until a future date, on the basis that it was not prudent or efficient.

This assessment is to be based on a sample of projects and programs selected from all of SA Water's activities undertaken in the current regulatory period.

1.3.3 Assessment of proposed operating and capital expenditure for the 2020 – 2024 regulatory Period

The Commission requires an assessment as to whether SA Water's proposed operating and capital expenditure for the next regulatory period (2020 – 2024) is prudent and efficient (Task 3). The purpose of this assessment is to:

> reveal how well SA Water's asset management system has been applied in developing the proposals, and

> inform an assessment as to whether proposed expenditure is prudent and efficient and, if proposed expenditures for any particular activity is not prudent and efficient, advice on an expenditure amount that it considers is prudent and efficient.

Specifically, this assessment is required to consider, but not necessarily be limited to:

> for the overall expenditure proposal:

> the extent to which proposals are linked with outcomes for consumers

> the extent to which proposals fit with SA Water's longer term planning

> whether an internal monitoring, evaluation and reporting system has been used to develop the proposals

> how well trade-offs between capital and operating expenditure have been considered in identifying options with the lowest long-term cost that deliver the desired outcomes

> whether SA Water's assumptions about cost escalation, efficiency, and contingency costs across the next regulatory period are reasonable (for example, with respect to wages growth, productivity assumptions, and materials costs), and

> the potential for further cost reductions or efficiency gains and, if applicable, recommendations on catch-up or continuing efficiency targets.

> for the operating expenditure proposal:

> whether the efficient operating expenditure base year incorporates expected efficiencies from the 2016 – 2020 regulatory period

> whether the efficient operating expenditure base year includes any abnormal or inefficient expenditure that should not be reflected in SA Water's baseline efficient operating expenditure, and

> whether there is an appropriate focus on core maintenance expenditure for critical asset systems and facilities, supported by sound risk/opportunity assessments and mitigation strategies.

> for the capital expenditure proposal:

> on a sample of activities, advice based on engineering or IT expertise about the requirement, timing and selected option

> on a sample of activities, a comparison of costs, including unit costs with those of similar activities in other jurisdictions, and

> on the Zero Cost Energy Future program, advice based on engineering expertise about the expected lifespan of new assets.

1.4 Review methodology

In undertaking this review, we have developed a methodology based on our previous experience undertaking asset management process reviews and capital and operating expenditure reviews. The overall objective is to evaluate the SA Water's asset management system, so that conclusions can be drawn on the prudence and efficiency of past capital expenditure and the prudence and efficiency of future capital and operating expenditure proposals.

Our review work commenced in late September 2019. The first two tasks were desktop assessments of information provided by the Commission and further documents requested of and provided by SA Water during October 2019. Over four days, we conducted face to face meetings with SA Water in November 2019 (20, 21, 26 and 27). The face to face meetings focused on Task 3 (relating to future capital and operating expenditure). Meetings were also held to discuss the initial findings from Task 2 (relating to past capital expenditure) and Task 1 (relating to embeddedness of SA Water's asset management system). Following our interviews with SA Water, further information was requested of and provided by SA Water.

To determine our recommended efficient level of capital and operating expenditure required by SA Water for the upcoming regulatory period, we have used an approach consistent with that employed by Cardno and Atkins for the 2016 regulatory determination of SA Water. This approach uses the concept of an efficient 'frontier' company competing in an open market to deliver services to customers. Under this framework, efficiency gains made by the frontier company are referred to as continuing efficiency, with catch-up efficiency applied to companies that are inefficient compared with the frontier company.

Before applying potential efficiency gains, we have adjusted SA Water's expenditure proposals in the following areas:

> Adjustments to reflect better information provided by SA Water

> Adjustments to reflect our assessment of the prudence, timing and efficient level of expenditure of specific projects and programs subject to detailed review

Following these adjustments, continuing and catch-up efficiency factors were applied, as appropriate, to arrive at a determined level of prudent and efficient operating and capital expenditure. The catch-up efficiency factors were applied to the capital expenditure net of the value of the capital expenditure projects included in the sample to avoid any double counting of efficiencies. The projects and programs sampled comprise 35% of the RD16 capital expenditure program and 43% of the RD20 program.

Continuing efficiency is the scope for top performing or frontier companies to continue to improve their efficiency. It reflects the continuing efficiencies being gained across all major sectors through innovation and new technologies. The continuing improvement element of efficiency relates to the increased productivity derived from process innovation and new technology that all well performing businesses should achieve, including frontier companies. This applies to a range of industry sectors and applies internationally to the extent that new innovations in one region are able to be adopted in other regions.

Catch-up efficiency is the productivity gains that may be realised when an agency moves from its current position to that of the frontier utility. Our assessment of catch-up efficiency is based on a qualitative, process based assessment of SA Water against leading practice for utilities in Australia and internationally, supplemented by partial indicator benchmarking. This is largely informed by our conclusions drawn from Task 1. Our assessment was based on identified improvements to processes and business opportunities. These improvements would generate efficiencies in future years to enable SA Water to move towards the frontier utility.

1.5 Price Base and cost data for review

The Commission has requested that SA Water provide all future forecasts of expenditure in a real price base of 2018/19 with a reference point as at December 2018. For our analysis and within this report, we have sought to present all historical and forecast costs in a consistent, real price base of 2018/19. This allows for better comparison of the underlying drivers of costs over time. To achieve a consistent price base, the consumer price index Weighted Average for Eight Capital Cities index was used. As advised by the Commission, an offset of nine months has been used to select the appropriate consumer price index value. The indices applied to convert all costs to a real 2018/19 price base are summarised in Table 1-1.

Table 1-1 Indices used to convert costs to real 2018/19 price base

	2013/14	2014/15	2015/16	2016/17	2017/18
Index	1.100	1.068	1.054	1.041	1.019

Unless otherwise noted, all prices within this report are presented in a real price base of 2018/19.

1.6 Terminology relating to the regulatory process

A small number of terms are used within this report which have specific meaning relating to the regulatory process. These terms are as follows:

> RD16 period – this is the period from 1 July 2016 to 30 June 2020. The Commission made a previous determination for this period regarding the maximum revenue that SA Water was able to recover from its customers to provide drinking water and sewerage services.

> RD20 period – this is the period from 1 July 2020 to 30 June 2024. The Commission will make a new determination (the RD20 determination) for this period.

> Regulatory business proposal – refers to the submission made by SA Water to the Commission to inform the RD20 determination. The regulatory business proposal is titled “Our Plan 2020-24”.

2 Profile of SA Water

The South Australian Water Corporation (SA Water) is wholly owned by the Government of South Australia, established by the *South Australian Water Corporation Act 1994*. Prior to the corporatisation of SA Water, water and sewerage services were provided by the State Engineering and Water Supply Department.

SA Water provides water and wastewater services to approximately 1.7 million people via over 700,000 connection points across both metropolitan Adelaide and country South Australia. SA Water provides water and sewerage services to most of the state of South Australia with only a few exceptions.

SA Water owns assets with a replacement cost of more than $23 billion. Figure 2-1 is a schematic representation of SA Water's infrastructure assets as at 30 June 2019.

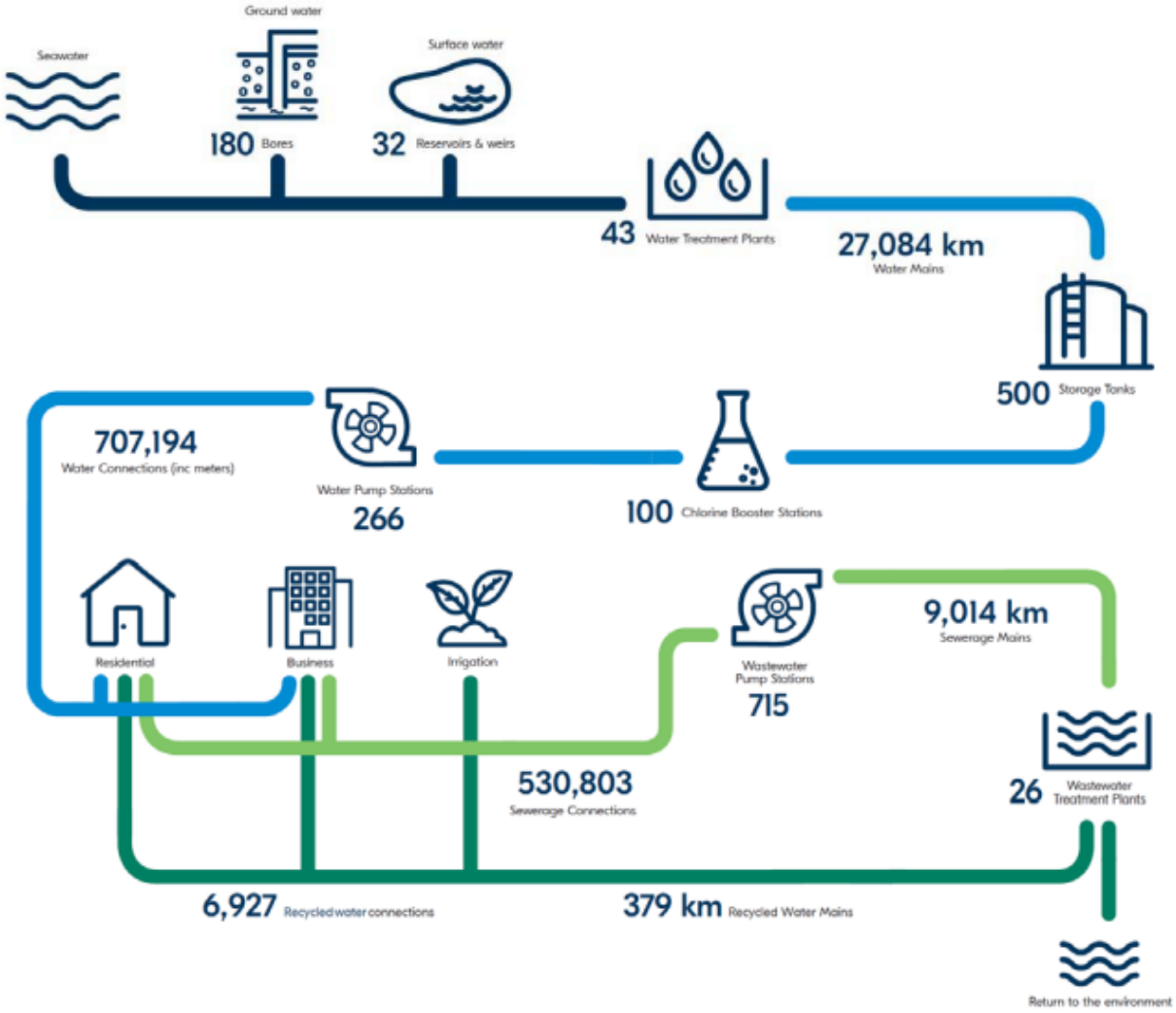


Figure 2-1 Schematic of SA Water's infrastructure assets

Source: SA Water Strategic Asset Management Plan

2.2 Regulatory environment

SA Water's operations are primarily governed by the *South Australian Water Corporation Act 1994*, the *Public Corporations Act 1993* and the *Water Industry Act 2012*. The key legislation guiding SA Water is summarised in Table 2-1.

Table 2-1 Key legislation

Legislation	Description
South Australian Water Corporation Act 1994	This Act establishes the SA Water Corporation and makes it subject to the Public Corporations Act 1993. SA Water's primary functions, as set out in the Act, include: ▪ Supply of water by means of reticulated systems; ▪ Storage, treatment and supply of bulk water; and ▪ Removal and treatment of wastewater by means of sewerage systems.
Public Corporations Act 1993	This Act requires SA Water to operate as a commercial entity in accordance with a charter, performance statement or other direction issued by the Minister.
Water Industry Act 2012	The Water Industry Act regulates the South Australian water industry, including appointing the Commission as economic regulator, licensing retail service providers, and ensuring appropriate technical standards for water and sewerage infrastructure and plumbing.
Cost of Living Concessions Act 1986	The *Cost of Living Concession Act* (formerly the *Rates and Land Tax Remission Act)* provides for rates concessions for various rates to be granted to eligible pensioners. The remission scheme is funded by the Government but administered by SA Water.

SA Water's operations are also subject to regulation and oversight by a number of entities who are conferred powers under different items of legislation. The main entities involved in regulating the South Australian water sector are detailed in Table 2-2. A number of these other bodies set standards, with which SA Water must comply in delivering services to consumers. Appendix A to SA Water's regulatory submission, Our Plan 2020-2024, provides some information on how SA Water has accounted for regulatory requirements in developing its forward plan.

Table 2-2 Regulatory framework

Regulatory area	Regulators	Overview of role within the water industry	Major legislation
Environment	Department of Environment, Water and Natural Resources	Regulates state water resources, and other natural resource management matters	▪ Natural Resources Management Act 2003
	Environmental Protection Authority	Regulates the environmental impact of water businesses.	▪ Environmental Protection Act 1993
Drinking water quality	SA Health	Regulates health aspects relating to the provision of drinking water supplies.	▪ Safe Drinking Water Act 2011
Technical requirements	Office of the Technical Regulator	Technical regulator responsible for safety and technical matters.	▪ Water Industry Act 2012
Economic regulation	Essential Services Commission of South Australia	Protection of the long term interests of consumers with respect to the price, quality and reliability of water and sewerage services	▪ Essential Services Commission Act 2002 ▪ Water Industry Act 2012
Finance and procurement	Treasurer	Sets application and issue licence fees for water industry entities, issue Ministerial directions (billing and meters), and Pricing Orders.	▪ Water Industry Act 2012
	Minister for Water	Administers the Water Industry Act, and responsible for non-regulatory instrument (e.g. schemes) and appointing water industry entities.	▪ Water Industry Act 2012
Customer protection	Energy (and Water) Ombudsman	Handles complaints of customers of water licensees.	▪ Water Industry Act 2012 ▪ Corporations Act 2001
	Consumer and Business Services	Regulates the relationship between landlords and tenants in relation to the payment of rates and charges for water and sewerage services.	▪ Residential Tenancies Act 1995

Regulatory area	Regulators	Overview of role within the water industry	Major legislation
		CBS also regulates the professional conduct of plumbers.	▪ Plumbers, Gasfitters and Electricians Act 1995
	Department for Communities and Social Inclusion	Sets hardship and concession policy	▪ Water Industry Act 2012
Energy	Australian Energy Regulator	Regulation of the wholesale and retail energy markets, and energy networks, under national energy legislation and rules. Our functions mostly relate to energy markets in eastern and southern Australia.	▪ National Electricity (South Australia) Act 1996 ▪ Australian Energy Market Commission Establishment Act 2004
	Essential Services Commission of South Australia	Licensing, setting standards and performance monitoring for electricity generation, transmission and distribution	▪ Electricity Act 1996

2.3 Strategic Management

SA Water has in place a corporate strategy informed by its customer engagement. This strategy sets out SA Water's vision as "world class water services for a better life". SA Water has identified strategic goals to support this strategy as shown in Figure 2-2.

Figure 2-2 SA Water's strategy

Source: Our Plan 2020-24, Appendix B - Customers shaping the future, SA Water, November 2019

The strategic goals are further defined through statements of intent as summarised in Table 2-3.

Table 2-3 Statements of intent

Strategic Priorities	Statement of Intent
Getting the basics right every time	Customers expect us to get the basics right: the safety and availability of quality drinking water and dependability of sewerage services. We are responsive when things go wrong, fix faults

Strategic Priorities	Statement of Intent
	quickly and meet our regulated responsibilities. Customers expect our prices to be low and stable.
Working Together	As a team, our productive, respectful relationships with our customers, regulators and other stakeholders are key to delivering services our customers value. Understanding and supporting our customers is vital.
Leading the Way	We are leaders nationally and globally to give our customers confidence that we are innovating to achieve outcomes for them. We support the South Australian community and economy.
Capable and Committed Team	Our experienced and capable team consistently live our values with actions and behaviours to safely deliver for our customers every day. Our team are valued brand ambassadors.
Keeping it simple	Simple, easy, customer friendly processes are important to create value for our customers.

Source: Strategic Asset Management Plan, SA Water, October 2019

We discuss how customers have informed development of these strategic priorities and SA Water's strategy in Section 3.2.1.

An important consideration in testing SA Water's asset management system is how asset management decisions support SA Water's overall corporate objectives and strategy. Therefore, establishing and testing the 'line of sight' between asset management decision making and strategy is important. We expand on this further in Section 3.

2.4 Asset Base

Table 2-4 provides a summary of SA Water's asset base including value and quantities. Water assets comprise 65% of the asset base by replacement cost and sewerage assets comprise 30%.

Table 2-4 Summary of SA Water's infrastructure

Asset Class	Value		Quantity		
	Gross Replacement value	Written Down Value	Total	Country	Metro
Water					
Water Mains	3,429	1,734	24,913 km	15,701 km	9,218km
Major Pipelines	4,384	2,631	2,291 km	2,078 km	213 km
Desalination Plant	1,859	1506	4	1	3
Reservoirs	1,269	551	36	12	24
Water Filtration Plants	1,406	770	35	29	6
Water Services	1,066	667	781,339	232,512	548,827
Water Tanks	945	449	510	357	153
Water Pumps	686	281	269	215	54
Leased Water	209	74	11	11	-
Dosing Stations	77	36	100	79	21
Earth Storages	128	70	81	71	10
Water Meters	71	33	709,407	212,622	496,785
Bores & Wells	54	31	173	172	1
Wastewater					
Sewer Mains	3,280	2,077	9,078km	1,543km	7,535km
Sewer Connections	1,228	628	612,350	73322	539028
Wastewater Treatment Plant	2,022	1,188	26	18	8
Sewer Pumps	482	294	613	257	356

Asset Class	Value		Quantity		
	Gross Replacement value	Written Down Value	Total	Country	Metro
Leased Sewer	36	17	1	1	0
Corporate					
Land	380	380			
Software	225	46			
Telemetry	155	50			
Other	429	205			
Total	**23,820**	**13,718**			

Source: SA Water

2.5 Expenditure drivers

Expenditure drivers are categories that provide insight into the underlying reasons for expenditure. The Commission's SA Water Regulatory Determination 2020: Guidance Paper No. 4 on Prudent and efficient expenditure sets out broad categories for expenditure which include meeting minimum requirements (including legislation), complying with State Government policy, financing costs and customer driven initiatives. The regulatory framework requires that expenditure will only be considered prudent if there is a clear justification for expenditure demonstrated by:

> a legislative or regulatory obligation, with which SA Water must comply

> an expectation that the activity will deliver benefits to consumers that outweigh the costs, or

> a clear expectation from customers that an outcome should be achieved, and that they are willing to pay for that outcome.

For expenditure included in its regulatory business proposal, SA Water has used the following drivers for categorisation:

> External obligations – the costs of meeting all our legal and regulatory requirements, including compliance for drinking water quality, protecting the environment, safety and many others.

> Maintain service – maintaining the level of service customers currently receive. This includes operating and maintaining current infrastructure, replacing it when necessary, providing an experienced Adelaide-based Customer Care Centre to answer phone calls and field-based crews able to attend and restore temporary service interruptions.

> Growth – costs associated with servicing new water and sewerage customers or increasing the services available to existing customers

> Efficiency – investments that will deliver savings and reduce the cost to deliver services to our customers.

> Improve service – improvements supported by customers and that they are willing to pay for. This includes enhancements to water quality for people currently receiving a non-drinking water supply and improvements to the taste, odour and physical properties of water supplied.

The maintain service driver is for expenditure to continue to meet existing legislative or regulatory obligations. The external obligations driver captures new or changed regulatory requirements. The maintain service category comprises the largest proportion of expenditure for the RD20 period (46%) followed by external obligations (21%). Of interest is that the improve service category represents 20% of all future capital expenditure. As there is no legislative or regulatory obligation for SA Water to improve its service, expenditure in this category needs to be justified on benefit-cost grounds or by there being a clear expectation from customers that an outcome should be achieved, and that they are willing to pay for that outcome.

We note that SA Water's supporting asset management system processes and documentation don't fully reflect these driver categories. For example, the Strategic Lead Asset Management Plans only include three drivers – asset renewal (maintain service), external obligations and growth. .

3 Asset management system

3.1 Overview

The primary objective of this review is to evaluate SA Water's asset management system by assessing whether its decision-making systems and processes are consistent with the principles set out in its asset management framework and embedded across the organisation (Task 1). The supporting objectives are to assess whether past and future expenditure has delivered intended outcomes, or is planned to, and whether the actual and forecasts costs are efficient (Task 2 and Task 3). Task 2 and Task 3 also provided evidence for the evaluation in Task 1.

The purpose of this section of the report is to provide our findings relating to Task 1. This task requires that SA Water's asset management framework be described and evidence sought as to whether the framework has been applied for the delivery of expenditure in RD16, and for the development of the RD20 Regulatory business proposal.

SA Water's approach to asset management is aligned with the requirements of the international standard for a management system for the management of assets, ISO55001:2014, which defines asset management as the coordinated activity of an organisation to realise value from assets. Value has to be defined by the organisation and may encompass financial and non-financial aspects and should support the organisation's overall objectives. As SA Water aligns its asset management system with this standard, this section uses terminology consistent with the standard and is structured to broadly follow key areas within the standard.

3.2 Stakeholder expectations

Under an ISO55001:2014 approach to asset management, SA Water is required to:

> Understand the requirements and expectations of stakeholders (ISO55001:2014, Clause 4.2). Stakeholders typically include customers, customer representative groups, environmental regulators, safety regulators etc. Expectations should include legislation, regulations, service standards, customer desires and willingness to pay, contracts, etc., and

> Define asset management objectives (Clause 6.2.1) which support the corporate objectives and reflect the stakeholder requirements.

By defining asset management objectives based on stakeholder expectations, asset management processes are then able to support technical and financial decisions, planning and activities to achieve these objectives. This is termed "alignment" within the standard and also commonly known as "line of sight" (although there are minor, technical differences between the two terms).

The external obligations which SA Water is required to meet derive from its regulatory environment, which was described in Section 2.2. In this section, we discuss the various expectations stakeholders have of SA Water. This includes the activities SA Water has undertaken to engage with customers to understand their expectations. We then discuss the asset management objectives that SA Water has defined in Section 3.3.

3.2.1 Customer engagement

SA Water has sought to engage with its customers throughout development of its RD20 regulatory business proposal from setting strategy to formulating specific expenditure items. The process used to develop the regulatory business proposal and the customer engagement undertaken is shown in Figure 3-1.

Figure 3-1 SA Water's process for developing its regulatory business proposal

Source: Our Plan 2020-24, Appendix B - Customers shaping the future, SA Water, November 2020

The main features of SA Water's planning approach and associated customer engagement are:

> Customer values research – SA Water analysed its existing customer engagement data from different sources to then verify the areas important to customers through a series of focus groups. This resulted in 35 common themes from customer viewpoints and feedback being identified for further testing

> Explore research – the 35 themes were subject to choice testing where participants had to rank the 35 themes. Themes were then grouped into 11 "outcomes (SA Water) customers value".

> Development of strategy – the Strategy was designed to address the 11 valued outcomes.

> "What matters to you?" Research – choice modelling to test and understand customer priorities with respect to service levels

> "Would you invest in this?" research – to test customer's willingness to pay for five initiatives identified as valued by customers. The initiatives tested were:

> improve drinking water quality for the Adelaide metropolitan area

> upgrade the water supply to up to 340 properties across South Australia to provide them with safe, clean drinking water

> increase the amount of recycled water used

> improve the taste, smell and colour of drinking water in regional South Australian communities

> minimise environmental sewage overflows.

Under the planning approach taken, customer research has informed SA Water's strategy and this in turn has been used to develop objectives for SA Water's asset management system to achieve. The corporate strategy is therefore central to SA Water's asset management system. The willingness to pay research is also important to SA Water's business proposal as it has been used to justify improvements in service delivered to customers.

To help elucidate the process to develop the Strategy, Figure 3-1 provides a mapping between the initial 35 themes and the 11 valued outcomes into which they were categorised. The final column is a measure of the importance of the initial themes based on a survey of 427 residential customers and 200 business customers where respondents were required to select the theme they considered most important.

Table 3-1 Mapping of customer valued outcomes to initial themes

Customer valued outcome	Statement derived from initial research	Importance of statement
Safe water	Provide safe drinking water to all homes in South Australia	13.40%
Safe water	My tap water is safe to use	12.30%
Minimal interruptions	Fixes bursts, leaks or sewage overflows quickly	5.50%
Minimal interruptions	Proactively keeps bursts, leaks, water outages and sewage overflows to a minimum	3.60%
Minimal interruptions	Issues are fixed the first time, so that they won't happen again	2.80%
Minimal interruptions	Makes investment decisions that keep prices as low as possible	2.60%
Minimal interruptions	Issues are resolved quickly and simply	1.50%
Assurance of price and service stability	SA Water should remain government owned	12.70%
Water security	Take steps now to make sure that SA Water has a sustainable water supply in the future	8.10%
Water security	Protect areas where water comes from to make sure that it is clear and has good pressure	3.80%
Consistent, high quality water	Water is always there when I turn on the tap	5.70%
Consistent, high quality water	My tap water doesn't smell, is clear and has good pressure	2.50%
Consistent, high quality water	The quality of my tap water (pressure, smell and colour is always the same	2.30%

Customer valued outcome	Statement derived from initial research	Importance of statement
Consistent, high quality water	My tap water tastes nice to drink	1.30%
Safe, reliable, invisible sewer services	Sewage is removed and treated safely without harming the community or the environment	2.60%
Safe, reliable, invisible sewer services	My sewerage services are always available	1.50%
Safe, reliable, invisible sewer services	My sewerage service is invisible. That is, I don't see or smell it	0.90%
Same quality drinking water for all	Provide the same quality of drinking water to all homes across South Australia	4.30%
Support and fairness	Supports business customers who are having difficulty paying their bills	1.30%
Support and fairness	Water, sewerage and trade waste charges reflect the cost to provide these services	1%
Support and fairness	Extra help for those affected by a water outage, major flooding or sewer overflow	1%
Support and fairness	Work to help people avoid hardship by giving them tools to prevent future excessive bills	0.50%
Protecting the environment, with the community	Take steps beyond what is required to make sure that we have a healthy environment	1.30%
Protecting the environment, with the community	Initiatives to reduce water wastage (e.g. Recycling schemes)	0.70%
Protecting the environment, with the community	Working with other government agencies to protect the environment	0.60%
Protecting the environment, with the community	Support the community to save water and protect SA's water supply (e.g. education programs)	0.50%
Great customer service	When I call I speak to a local who understands my situation	1.60%
Great customer service	Communicates clearly and timely when something goes wrong	0.50%
Great customer service	SA Water provides a great customer service if I need it	0.40%
Looking after SA with and for the community	SA Water works with government and industry to create jobs in SA	0.80%
Looking after SA with and for the community	Genuinely engaging with its customers and the community to include them in the decision making process	0.30%
Looking after SA with and for the community	Uses smart technologies to improve the way that services are delivered	0.20%
Looking after SA with and for the community	SA Water provides free water at events through the Quench Bench trailer	0.20%
Looking after SA with and for the community	SA Water provide sponsorship to various organisations and community events	0.10%
Looking after SA with and for the community	Community information that people are interested in hearing about	0.10%

Source: SA Water. What's important to our customers, Colmar Brunton, June 2017

Based on the findings from this survey, the customer valued outcomes were ranked as shown in Figure 3-2. These themes were used to inform development of the Strategy.

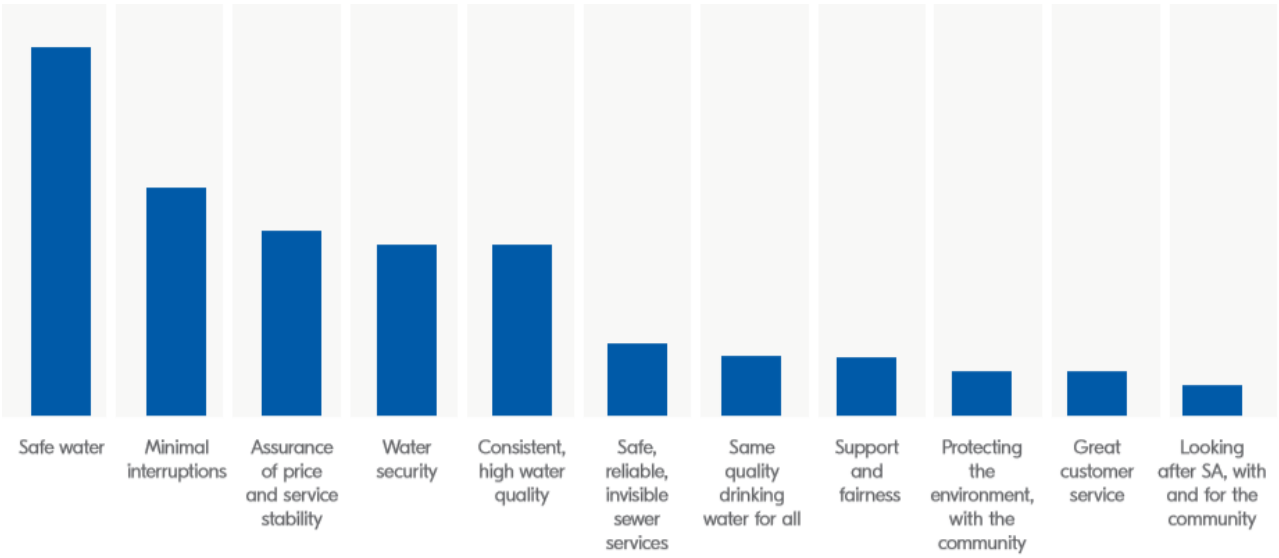


Figure 3-2 Ranking of the 11 valued customer outcomes

Source: Our Plan 2020-24, Appendix C – Our Plan Customer Engagement, SA Water, November 2019

The Strategy developed is encapsulated in Figure 2-2. This Strategy includes five strategic goals. Three of the Strategic goals are desired outcomes – getting the basics right, working together and leading the way and two are enablers - capable and committed team and keeping it simple. SA Water has also prepared level of service statements that demonstrate how SA Water will achieve the strategic goals and these are detailed in Table 3-2.

Table 3-2 Strategic goals and statements that support the strategic goal

Strategic goal	Level of service statement
Getting the basics right	▪ meeting regulated public health and environmental responsibilities
	▪ providing responsive, reliable and dependable services, including water security
	▪ being responsible custodians of water resources and build assets for future generations
	▪ ensuring supplied water quality is consistently good, and improving aesthetics
	▪ making the right decisions that keep prices as low and as stable as possible over time
	▪ being financially viable by adapting to our competitive environment ensuring our sustainability for the long-term.
Working together	▪ working together as a team with and for our community
	▪ understanding our customers, engaging with them about what is happening and focusing on solving their concerns and problems
	▪ providing proactive services and communications tailored to customers' differing needs
	▪ working together with our regulators and stakeholders to be the water utility our community expects
	▪ taking steps to care for the environment by reducing wastage and providing efficient water practices education.
Leading the way	▪ develop innovative solutions to address customers' issues now and into the future
	▪ use smart technology to achieve better outcomes for customers and be 'smart water' leaders internationally
	▪ contribute to the South Australian community, by supporting state development initiatives
	▪ continually seeking to improve what we do and how we do it.
Capable and committed team	▪ Keeping ourselves and the community safe
	▪ Our values being lived in our actions and behaviours
	▪ Everyone building a high performing culture that delivers excellence for our customers

Strategic goal	Level of service statement
	▪ Having a diverse, collaborative and capable workforce ready to deliver into the future
Keeping it simple	▪ Continually seeking efficiencies and optimising how we operate and sustain assets
	▪ Our processes supporting our people and our culture to achieve outcomes for customers
	▪ Having a customer led management system to drive performance

We make the following observations regarding development of the Strategy through the process described:

> The mapping between the 35 themes and 11 valued outcomes highlights the difficulty in achieving alignment. For example, the theme “Support the community to save water and protect SA's water supply (e.g. education programs)” has been assigned to the outcome of “Protecting the environment, with the community” where it could have also been assigned to “water security”.

> The scoring of the initial 35 themes and ranking of the 11 valued outcomes provide some insight into customer preferences but this information has been lost in the Strategy. The Strategy goals and supporting statements appear to seek to include almost all of the initial 35 themes and their insights rather than providing any distillation or refinement of expectations. For example, the initial theme that SA Water “Uses smart technologies to improve the way that services are delivered” has one of the lowest levels of importance of the 35 themes but there is in the Strategy a statement that SA Water intends to “use smart technology to achieve better outcomes for customers and be ‘smart water’ leaders internationally”. It is not apparent why smart technologies would be singled out in the Strategy given its very low rating.

> The initial 35 themes make no mention of innovation or that SA Water should “lead’. However, these terms have been included in the Strategy and “leading the way” is a strategic goal. Their inclusion in the Strategy does not appear to be based on customer expectations or preferences.

We recognise that there will always be subjectivity in an exercise such as this and that ultimately, SA Water and its Board need to arrive at a strategy that it considers appropriate to guide the organisation into the future. Also, customers are not the only stakeholders that should inform the development of Strategy. Our interest in this area is how SA Water uses its Strategy to direct its asset management system and in turn make expenditure decisions. We consider that the relationship between customer expectations and the Strategy that has been developed is not clear in some areas. We also consider that the Strategy reflects objectives (e.g. innovation, using smart technologies and ‘leading the way’) that are not reflective of customer desires As stated, while we consider that an exercise such as this will always have some subjectivity, we consider that there is potential for this lack of clarity to impact on prudent decision making. We expand on this subject in Section 3.3.

3.2.2 Negotiation Forum

For the RD20 determination, the Commission has made changes to its decision making process, perhaps the most notable of which is the inclusion of a “Negotiation Forum” as shown in Figure 3-3. The Negotiation Forum is comprised of two committees – a Customer Negotiation Committee and an SA Water Negotiation Committee. Both committees have three members. The role of the Customer Negotiation Committee is to “elicit and represent the perspectives and preferences and priorities of SA Water’s diverse customer base in the Negotiation Forum to test SA Water as it prepares its proposed business plan”.

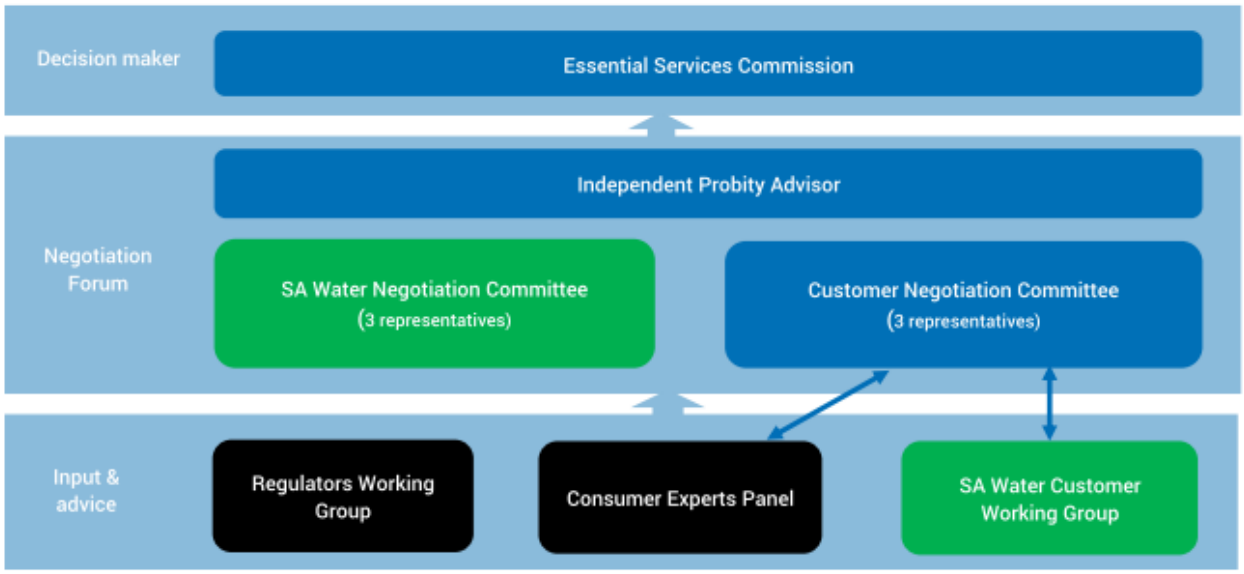


Figure 3-3 RD20 decision making framework

Source: SA Water Regulatory Determination 2020: Guidance Paper 1 – Overview of SA Water Regulatory Determination 2019

The Customer Negotiation Committee was informed by initial work undertaken by the Consumer Experts Panel. This Panel was comprised of the Commission's Consumer Advisory Committee and SA Water's customer advisory groups, sitting jointly as a Consumer Experts Panel. The Consumer Experts Panel received briefings and held workshops with SA Water and the Commission which led it to prepare a 'Priorities Report[1]' to guide the Customer Negotiation Committee when considering and testing SA Water's proposals.

The Customer Negotiation Committee met with regulatory agencies and held 20 joint Negotiation Forum meetings with SA Water. It also met 24 times separately to discuss SA Water's draft business plans. The Chair of the Customer Negotiation Committee has prepared a report[2] detailing the negotiation process undertaken and the conclusions drawn by the Customer Negotiation Committee.

The Customer Negotiation Committee had a different objective and scope than our review, yet there are some findings from the Customer Negotiation Committee that have relevance to our review. The key issues that are pertinent to this review are detailed following for completeness along with a reference to where this subject is discussed in this report:

> *The Committee considers the present approach to determining if a proposal is prudent on the grounds that customers want it and are prepared to pay for it, is unsatisfactory. Specifically, the Committee suggests that only direct utility benefits should be counted and that, in assessing those benefits, SA Water should engage extensively with the customers affected and their communities and limit the use of such tools as willingness to pay surveys, which we consider unreliable*.

  We discuss the drivers and justification for future capital expenditure in Section 5 of this report.

> *The Committee suggests that the Commission examine ways to insulate customers from the market risk associated with such projects as Zero Cost Energy Future (ZCEF) and the Northern Adelaide Irrigation Scheme, or at least reduce their exposure. In a competitive market, it is the owner of the business, not the customer, who carries these risks.*

> *In developing its business plan for the 2020-24 regulatory period, SA Water conducted quite a significant program of community engagement. The link between that activity and the subsequent business plan, however, was not always easy to detect. It was perhaps closest in the development of service standards and in certain expenditure proposals, but otherwise was confined to reaching agreement on half a dozen*

[1] SA Water Regulatory Determination 2020: Priorities Report, SA Consumer Experts Panel, January 2019.
[2] SA Water Regulatory Determination 2020:Report of Independent Chair of Customer Negotiation Committee, Mr John Hill, November 2019

or so high level customer priorities. These priorities (for example, safe water) were soundly based but so broad that they could be used to justify whatever projects SA Water decided to undertake.

We discuss the 'line of sight' between SA Water's stakeholders' (including customers) expectations and its expenditure plan in Section 3.2 of this report.

> *The Committee is supportive of the service standards proposed by SA Water and offers a few suggestions for others. The Committee would like to see the Commission monitor the means by which SA Water recompenses customers whose premises are flooded by breaks in water mains to ensure that they are fully compensated.*

We have provided an opinion on SA Water's current and proposed service standards in Section 3.2.4 and Section 3.2.5 of this report.

> *The only explicit expenditure savings offered by SA Water for the next regulatory period are those foreshadowed to arise from the ZCEF project. The Committee's support for ZCEF hinges on customers benefiting and we urge the Commission to consider ways of locking in an estimate of the savings for the future benefit of customers and leaving the market risk (both upside and downside) with SA Water.*

> *The Committee notes that SA Water has not offered any savings target for efficiencies in delivering capital projects comparable with the five per cent offered and exceeded in the current regulatory period. The Commission should consider requiring such savings.*

SA Water has now included a 5% top-down efficiency challenge for capital expenditure in its regulatory business proposal. We provide our opinion on the scope for efficiencies in delivering capital projects in Section 5.3.3.

> *The Committee notes that the only savings target for operating expenditure is an amount derived from efficiencies expected to flow from IT innovations. Since these efficiencies are offset by higher support costs for the IT innovations, they disappear like the magician's rabbit. The Commission should consider setting SA Water a target for efficiency savings in operating expenditure.*

We provide our opinion on the scope for efficiencies in operating expenditure in Section 4.5.

> *The Committee is not convinced that the case has yet been made for an increase in expenditure on water mains renewal to reduce the number of mains breaks, but is supportive of expenditure on new technology to detect weaknesses in the network and on more valves to reduce the impact of breaks when they occur. The Committee notes that a consultant's report on SA Water's procedures for maintaining the water supply network will be available soon and suggests that a decision on the appropriate level of expenditure await that report and further consultation with customers.*

We discuss expenditure on water mains in the current and future periods in Section 5 of this report.

3.2.3 Customer service standards

The Water Industry Act 2012 allows the Commission to establish customer service standards for SA Water's regulated water and sewerage services. Service standards were put in place for at the time of the RD16 determination and these will be revisited for the RD20 determination.

These service standards describe the quality and reliability of the water and sewerage services provided by SA Water to its customers. There is a balance between the level of service provided by SA Water and the cost of providing this level of service. As SA Water is a monopoly, there is no competitive market feedback on customer preferences and willingness to pay for services. The trade-off between service and cost therefore needs to be determined through other means. The balance between service and cost is an important part of the overall value that SA Water delivers to its customers, which we discuss further in Section 3.3.

3.2.4 Performance against service standards in RD16 period

The service standards that apply to SA Water in the RD16 period are in the following categories:

> Customer service and complaint handling

> Connection of services

> Field crew attendance at the site of service issues (separate for metropolitan and regional areas)

> Service restoration and clean up (separate for metropolitan and regional areas).

The standards for field crew attendance and service restoration relate only to the timeliness of the response and timeliness of the clean-up / service restoration. The Commission and SA Water recognise that the service standards should also cover the frequency of occurrence of service disruptions, and so are proposing to introduce standards in this area for the RD20 determination. SA Water's proposed service standard for RD20 period are detailed in Table 3-3.

The current service standard targets were set based on SA Water's performance over the two year period 2013-14 and 2014-15, as this was the limitation of the data available at the time. SA Water is required to use its best endeavours to meet these standards. During the RD16 period until the end of 2017/18, SA Water has met all service standards except for two:

> Water network breaks, leaks and bursts in the Adelaide metropolitan area attended to within the required timeframes – performance of 98% against a target of 99%

> Water network service restorations performed in the Adelaide metropolitan area within the required timeframes performance of 98% against a target of 99%

The Commission considers that SA Water's underperformance for these two standards is a "minor deviation" only[3]. We agree with this assessment.

We consider that the current standards, while providing a strong focus on the service experienced by customers, can be improved by providing more balanced measures and targets for the RD20 period. Specifically, these should be extended to cover the frequency of service interruptions and provide some focus on infrastructure performance in addition to customer experience. Also, we consider that targets should be assessed in light of current performance and customer expectations.

3.2.5 Proposed service standards for RD20 period

As part of the RD20 determination process, SA Water has proposed a set of new service standards. These service standards have been developed by SA Water through engagement with its customers and the Customer Negotiation Committee (see following section for a description of this committee). The standards proposed through this process are summarised in Table 3-3.

The Commission will consider these service standards and include a set of service standards in its draft determination for public consultation.

In conducting this review, it is important that we have had regard for the existing service standards and those proposed by SA Water for the RD20 period. Where SA Water proposes new service standards, these may be presented as maintaining existing service levels where SA Water considers that it now has better information on the service expected and experienced by customers. We also have to have regard for those areas where service standards have changed as these require different justification to satisfy the prudence condition compared with expenditure on areas where service standards are unchanged.

Table 3-3 SA Water's proposed service standards

Service area	Measure	2018-19 performance against 2016-20 targets*	2016-20 target	2020-24 target
Customer	Customer satisfaction	New measure	New measure	93%
	Telephone responsiveness	86% within 30 seconds	85% within 30 seconds	85% within 50 seconds for fault calls
	First contact resolution	New measure	New measure	85%
	Complaint responsiveness	96% (written complaints)	95% (written complaints)	95% (all complaints)
	Complaint escalation	11.20%	New measure	<15%
Reliability	Water service interruption frequency	2315	New measure	<1,750 by 2023-24**

[3] Regulatory Determination 2020: Guidance Paper No. 3, Service Standards. Essential Services Commission of South Australia, November 2018

Service area	Measure	2018-19 performance against 2016-20 targets*	2016-20 target	2020-24 target
	Water leakage performance	1.97	New measure	<2.06
	Sewer overflow frequency	32	New measure	<29
	Internal sewer overflow incidence	180	New measure	<190
Connections	Connection application responsiveness	97% within 20 working days	95% within 20 working days	95% within 15 working days
	Water network connection timeliness	96%	95%	95%
	Sewer network connection timeliness	98%	90%	90%
Response	Water quality responsiveness	97%	96% metropolitan Adelaide	96%
			99% regional	
	Water event responsiveness – high priority	98%	New measure	99%
	Water event responsiveness – low priority	New measure	New measure	95%
	Sewer event responsiveness	99%	99% metropolitan Adelaide	99%
			99% regional	
Restoration	Water service restoration timeliness	98%	99% metropolitan Adelaide	99%
			99% regional	
	Sewerage service restoration timeliness	96%	95% metropolitan Adelaide	95%
			99% regional	
	Sewer overflow clean-up timeliness	98%	98% metropolitan Adelaide	98%
			99% regional	

Notes:

* Interim data and subject to final confirmation.

** This is an incremental target – <1,975 in 2020-21, reducing to <1,750 by 2023-24.

3.2.6 Economic regulation expectations

The Commission has published a number of Guidance Papers to define its expectations and methodology for the RD20 Determination. Guidance Papers have been prepared for subjects including

> Revenue regulation and pricing principles

> Service standards

> Prudent and efficient expenditure

> Treatment of capital expenditure - addressing uncertainty.

The Guidance Paper on Prudent and efficient expenditure sets out that:

> *Broadly speaking, expenditure on an activity will be considered prudent where there is a clear justification for that activity. This will be informed by an assessment of whether the expenditure is driven by:*

> a legislative or regulatory obligation, which SA Water must comply with

> an expectation that the activity will deliver benefits to consumers that outweigh the costs, or

> a clear expectation from customers that an outcome should be achieved, and that they are willing to pay for that outcome.

> Expenditure is likely to be considered efficient where it represents the lowest sustainable (or 'long-term') cost of achieving the intended outcome.

3.3 Asset management objectives and line of sight

Under an ISO55001:2014 approach to asset management, SA Water is required to:

> Understand the requirements and expectations of stakeholders (ISO55001:2014, Clause 4.2). Stakeholders typically include customers, customer representative groups, environmental regulators, safety regulators etc. Expectations should include legislation, regulations, service standards, customer desires and willingness to pay, contracts, etc., and

> Define asset management objectives (Clause 6.2.1) which support the corporate objectives and reflect the stakeholder requirements.

By defining asset management objectives based on stakeholder expectations, asset management processes are then able to support technical and financial decisions, planning and activities to achieve these objectives. This is termed "alignment" within the standard and also commonly known as "line of sight" (although there are minor, technical differences between the two terms). SA Water's line of sight is depicted in Figure 3-4.

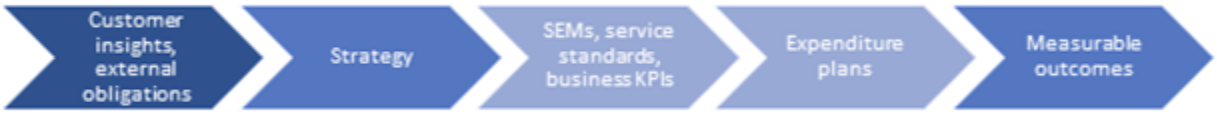


Figure 3-4 SA Water's line of sight

The process of obtaining customer insights to develop the strategy was detailed in Section 3.2.1. The external obligations which SA Water is required to meet derive from its regulatory environment, which was described in Section 2.2. Service standards in the RD16 period and RD20 period were discussed in Section 3.2.4 and Section 3.2.5. The next relevant component of the line of sight is SA Water's asset management objectives. The asset management objectives are detailed along with the measures and targets for these objectives in Table 3-4. The measures are termed "strategic element measures". The asset management objectives have been mapped to the strategic goals (organisational objectives) and it can be seen that there is consistency with the statements of intent set out previously in Table 2-3.

Table 3-4 Asset management objectives

Strategic goals	Asset management Objectives	Strategic Element Measure	Target
Getting the basics right every time	AMO1: Ensure SA Water provides safe, clean drinking water that is fit for purpose, cost effective, meets regulated public health responsibilities and consistently meets customer needs now and into the future at the lowest TOTEX cost	Compliance with Safe Drinking Water Act (SDWA)	100%
	AMO2: Ensure SA Water complies with all EPA and DEW Licence requirements now and into the future at the lowest TOTEX cost	Compliance with environmental protection obligations (including water resources)	100% by 2028
	AMO3: Undertake asset planning to support achievement of the customer service standards by maintaining asset reliability at required level and providing system redundancy where appropriate at the lowest TOTEX cost	Customer service standards	18/18 by 2028

Strategic goals	Asset management Objectives	Strategic Element Measure	Target
	AMO4: Minimise the number of customers experiencing three or more unplanned interruptions within a 12 month period to minimise risk of customer dissatisfaction and to SA Water's reputation as a world class water service provider	Number of properties experiencing 3 or more unplanned water supply interruptions per year	<1700 by 2028
	AMO5: Minimise internal sewerage overflows and thereby reduce or minimise risk to community health, private property damage, customer dissatisfaction and SA Water's reputation as a world class wastewater service provider	Sewerage – total number of internal overflows	<190 by 2028
	AMO6: Ensure SA Water meets future legislative, corporate and customer's requirements for water quality, including aesthetics, at the lowest TOTEX cost	Customer perception of overall quality of water	80% by 2028
	AMO7: Make the right decisions to keep prices as low and stable as possible whilst ensuring provision of world class services	Price affordability index	1.28% by 2028
	AMO8: Asset planning decision making to support continued financial viability and ensure sustainability for the long term	Return on assets	4% by 2028
Working together	AMO9: Ensure asset planning decisions address customer concerns and problems and prevent their reoccurrence	Customer satisfaction with service experience	95% by 2028
	AMO10: Ensure stakeholder expectations are understood and considered in every planning decision.	Stakeholder satisfaction	90% by 2028
	AMO11: Minimise asset related impact on the environment and thereby reduce or minimise customer dissatisfaction and maximise SA Water's reputation as a world class service provider	Perception of environmental protection	80% by 2028
Leading the way	AMO12: Inspire customer confidence in our expertise through utilising innovation and technology to support state development and continually improving what we do	Brand health index	7.5 by 2028
	AMO13: Deliver value to customers and the business through fresh and innovative thinking in asset decision making to support delivery of world class services and being 'smart water' leaders internationally	Innovation index	76% by 2028
Capable and committed team	AMO14: The health and wellbeing of our people and the community is a key strategic priority and the value to 'Put Safety Above All Else' underpins all our activities	Safety – all-inclusive injury rate	0 by 2028
Keeping it simple	AMO15: Deliver outcomes for customers by innovating for continual improvement applying technologies and using the right information at the right time to support decision making	Ease of customers interacting with SA Water	95% by 2028
	AMO16: Deliver value to customers and the business through seeking operating expenditure efficiencies in all asset planning decisions	Operating expenditure efficiency	1.5% by 2028
	AMO17: Deliver value to customers and the business through seeking capital expenditure efficiencies in all asset planning decisions	Capital expenditure efficiency	0.75% pa efficiency target by 2028

We consider that SA Water's asset management objectives soundly demonstrate alignment with SA Water's strategic goals. The asset management objectives also adequately capture SA Water's regulatory obligations including environmental protection and drinking water quality. The objectives are also consistent with SA Water's proposed service standards.

However, we consider that in two respects, the asset management objectives may not provide a clear line of sight between stakeholder expectations and asset management activities. These are:

1. Inclusion of a number of objectives which do not appear to be supported by stakeholders based on the information we have reviewed. These objectives are:
    a. AMO12: Inspire customer confidence in our expertise through utilising innovation and technology to support state development and continually improving what we do
    b. AMO13: Deliver value to customers and the business through fresh and innovative thinking in asset decision making to support delivery of world class services and being 'smart water' leaders internationally
    c. AMO15: Deliver outcomes for customers by innovating for continual improvement applying technologies and using the right information at the right time to support decision making
2. lack of clarity regarding what is within the scope of asset management and the asset management system, and what lies outside of these in the wider organisation. Specifically, we question the relevance of the brand health index and innovation index to asset management. The perception of brand health relies on many factors outside of the control of asset management. The risk is that the performance of the asset management system is being measured on factors outside of its influence.

While we consider that there is scope for SA Water to refine its asset management objectives, we are primarily interested in how the system has been applied to develop and deliver expenditure in the RD16 and RD20 periods. A demonstrated line of sight should help establish that expenditure is prudent. However, the asset management system line of sight is of itself not sufficient to meet the prudence test. This test is more specific in that it requires that expenditure must meet one of the following criteria:

> a legislative or regulatory obligation, which SA Water must comply with

> an expectation that the activity will deliver benefits to consumers that outweigh the costs, or

> a clear expectation from customers that an outcome should be achieved, and that they are willing to pay for that outcome.

Therefore, while SA Water has an asset management objective of "being 'smart water' leaders internationally", this does not meet the prudence test. This is not to say that SA Water should not innovate, but in doing so there is no justification for it being an international leader.

A feature of SA Water's capital expenditure program for the RD20 period is the amount of expenditure proposed under the "improve service" driver. Expenditure in this category comprises one-fifth of all expenditure. Improved service needs to be justified by either of the last two criteria for prudence – benefits outweighing the costs or that customers are willing to pay for the improvement. Even within the Maintain Service category, SA Water is proposing improved service in part, e.g. for water main and wastewater main renewals.

Based on our assessment of SA Water's line of sight and the findings from our review of a sample of capital expenditure projects and programs, we have applied a catch-up efficiency to SA Water's forward program as we consider that greater assurance over expenditure justification will lead to savings in delivery of the program while still meeting service requirements. We discuss this further in Section 5.3.3.

3.4 Asset Management Planning

After asset management objectives are defined, the next requirement of ISO55001:2004 is that:

> SA Water undertakes planning (Clause 6.2.2) to achieve the asset management objectives;

> Determine and document the method and criteria for decision making and prioritising activities and resources to achieve its asset management plan(s) and asset management objectives (Clause 6.2.2).

SA Water's asset planning framework sits within its overall asset management framework as shown in Figure 3-5. The main features of this planning framework are:

> Business Plans

> Asset Management Policy

> Strategic Asset Management Plan and Asset Management Objectives

> Asset Management Plans

> Implementation of Plans (Lifecycle activities).

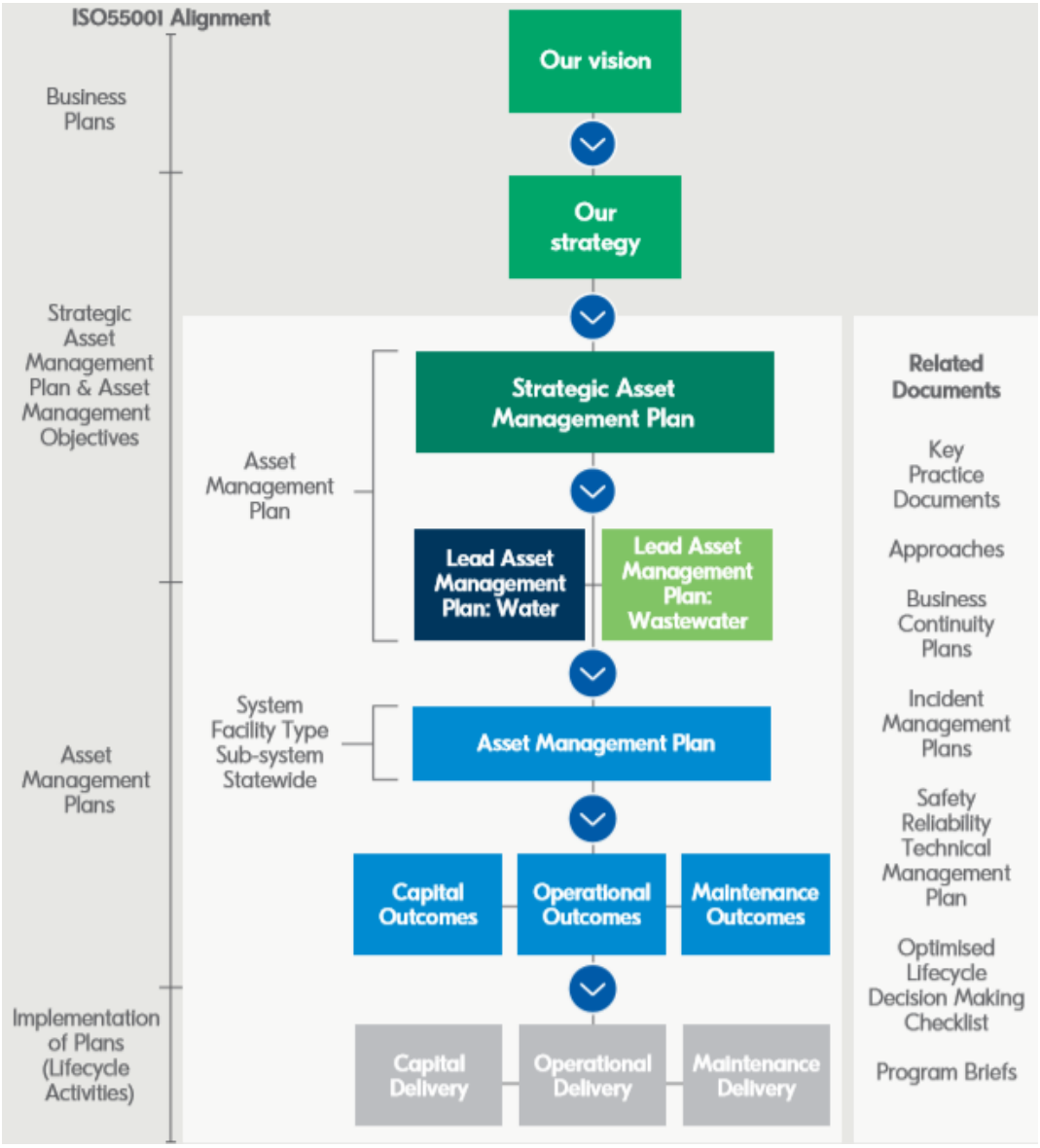


Figure 3-5 Current asset management system and Planning Architecture

Source: Our Plan 2020-24, Appendix O – 30 year asset planning, SA Water, November 2019

The asset management planning framework sets out that decision making criteria are determined from the risk assessment process. The 'approach' documents typically detail the planning and decision making approach for SA Water's various asset classes.

We consider that the planning framework is sound. The planning framework allows SA Water to undertake planning at different levels and through different lenses (e.g. lifecycle strategy, safety, emergency management).

In our review of operational expenditure activities and a sample of historical and future capital expenditure projects and programs we have reviewed the planning documents relevant to the expenditure to test their efficacy. We have found that SA Water generally has sound plans in place for the medium and long term. Examples of robust long term planning include:

> the long term planning, although still in its infancy, to deliver a staged approach to renewal of the Morgan to Whyalla Pipeline and to mature the risk based decision making over time with better information

> the ongoing dam Portfolio Risk Assessment activities and supporting detailed studies that have prioritised dam upgrade works and the timing of the Kangaroo Creek and Mt Bold dam safety upgrades.

Because of the relatively low rate of population growth in South Australia, only 12% of the forward capital program is driven growth. We have considered SA Water's approach to planning for growth through our reviews of its asset management planning and consider that the approach is sound but we have not considered specific growth driven projects in detail.

Long term planning for asset renewal is performed with varying degrees of maturity. Many of SA Water's assets (by proportion of total asset value) have relatively long expected useful lives. This does afford SA Water time to gather information and plan for long term needs. However, the asset base in total and a number of asset classes are moving out of 'middle age' (as measured by the fair value divided by the replacement cost) and into a period where long term planning needs to increasingly integrated with short term planning for renewal and replacement. The challenge is for SA Water to be able to understand the relationship between investment, asset deterioration, asset performance and service provided. These are not simple relationships. For water mains there are complementary models in place to assist SA Water's decision making which provides it with a balanced view of long term needs and integrated with the short term interventions proposed in the forward expenditure program. For sewer mains, we consider that SA Water has a sound understanding of long term needs across the asset class which will be improved as it observes and collects more information on asset deterioration and performance. However, there can be better integration with short term planning through an enhanced approach to assessing the consequence of failure of segments of mains. For water tanks, SA Water does not yet have a complete picture of the condition of the entire asset class (as 35% of all tanks have not been inspected to obtain condition assessment ratings and/or condition rating assessment data is not available for these WSTs) which limits the extent to which long term planning is informative.

A noted, a feature of SA Water's expenditure program is the proportion of expenditure proposed to improve service levels. This is the case for water main and sewer main renewals where expenditure is proposed to increase above that which is estimated as required by SA Water to maintain existing service levels. The additional expenditure where spent on renewals will intervene on some assets sooner than would have otherwise occurred under a less stringent level of service to proactively avoid a disruption to service. For water mains we consider that SA Water has sufficient level of understanding of the relationship between and investment and performance to have made a reasonable estimate of the additional funding required to achieve its proposed improved performance levels. We do not have the same confidence for wastewater mains (see Section 5.3.2). There is also inherent uncertainty in the performance of these asset classes and the impact on service in part due to factors outside of SA Water's control such as climate.

3.5 Risk Management and asset management decision making

SA Water has adopted the principles of risk management as set out in the International Risk Management Standard *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.*

SA Water has evolved its risk management framework to include greater consideration of opportunities and also now uses a ten point scale for likelihood and a ten point scale for each of threats and opportunities. In the development of the Asset Management Plans, this risk matrix approach has been enhanced with greater definition of risks before and after controls and the controls in place or proposed.

The risk based decision approach and its application in expenditure planning appears sound generally but in need of wider application and ongoing improvement. Our review of historical and future capital expenditure

(discussed in Section 6) included the following examples where we consider that the decision to proceed with a selected intervention was made on a sound risk basis:

> Hope Valley E170 Tank Structural Renewal, where the risk to water quality is the driver

> Kangaroo Creek Dam Safety Investigation and the Mt Bold Dam Safety project, where the risk to life downstream in the event of failure of the dam walls justifies the need for expenditure.

> Examples of where risk based decision making can be improved based on the sample of projects we reviewed include:

> Coverage of condition information for water tanks and at a component or sub-component level

> Increased sophistication in determining the consequence of failure of wastewater mains.

One application of risk based decision making is to determine critical assets for business continuity planning. SA Water has identified a 'State Critical Infrastructure list' and includes assets of high importance to the state. The list was reviewed in 2017 by a team of internal stakeholders, with the aim to improve the maturity of decision making and planning activities. Our understanding is that Business Critical Assets refer to resilience and business continuity.

SA Water also uses financial criteria for decision making, typically lifecycle costing, to determine the lowest lifecycle cost amongst options. In the historical and future capital expenditure projects reviewed, we identified a number of areas of concerns with lifecycle costing:

> Lifecycle costing not being undertaken for the CBD smart infrastructure project due to self-imposed time constraints

> Benefits not being monetised where information is available in the area (smart infrastructure)

> Inconsistent documentation of lifecycle costing assumptions and outcomes (O&M BI)

> Sensitivity testing being undertaken only within a narrow band (Zero Cost Energy Future) and limited use of scenario testing.

Based on our findings from both the historical and future capital expenditure projects reviewed, we consider that improved decision making will be a source of capital expenditure efficiency gains for SA Water in the RD20 period. Accordingly, we propose that a catch-up efficiency be applied to the future capital program to reflect these potential gains. We discuss this further in Section 5.3.3.

3.6 Performance evaluation and improvement

We are required to test the embeddedness of SA Water's asset management system within its business and the extent to which it has supported the development and delivery of prudent and efficient expenditure. Under a management system approach to asset management, there are requirements for the performance of the system, the performance of asset management practices and the performance of assets to be evaluated and improvements made in response to observed non-conformances and improvement opportunities. Testing these areas provides useful insight into the extent to which SA Water's asset management system is embedded.

3.6.1 Asset management system reviews and audit

SA Water has undertaken regular reviews and audits of its asset management system as it has undertaken further development and implementation. Self-assessed scores were assigned in 2014, to provide a benchmark assessment, and to identify the gaps that existed within the asset management system. From this benchmark assessment a roadmap of improvements was developed and these have been progressively implemented within the organisation.

Independent assessments have been undertaken periodically to assess the change in the maturity of the asset management system within SA Water and these are the primary evidence as to how well the asset management system is embedded. The 2017 independent review provides evidence that business processes relating to people and culture have improved considerably (moving from a score of two to a four (out of five)):

> People: All initiatives are well coordinated across the business, including the consideration of resourcing to add new initiatives to the business. The new business structure has enabled significant improvement of direction and coordination in AM activities. Previous silos appear to have been significantly reduced.

> Culture: SA Water has improved its understanding of its current culture and started to be able to demonstrate a marked shift in both engagement and attributes it requires to support its organisational

plan. There has been a significant shift in the ownership and commitment to management of assets at various levels of the organisation.

To have undertaken a number of maturity assessments is an indicator that SA Water is committed to the implementation and ongoing improvement of its asset management system. The increasing level of maturity demonstrated suggests that SA Water is improving its processes. While the initial assessments were self-assessments, the later assessment was undertaken by a third party.

However, the 2017 independent review notes in summary that:

> *Though, there has been considerable change, many of the practices are quite new and will take some time to fully embed within the business and be continuously improved. We suggest that over the next year, SA Water focuses on two key areas:*
>
> *1. Embedding many of the processes / procedures developed over the last couple of years and seek to leverage them for the not only the development of the RBP, but also seeking to drive better outcomes for customers. This includes management reviews, performance monitoring and other elements of the asset management system.*
>
> *2. Fully scoping and developing the asset management system assurance framework and ensuring that second line of defence reviews are implemented, and they are used to continuously drive further improvement, which will in turn enable the maturity level to continue to increase…*

Our review of SA Water's expenditure proposals aligns with this finding that more maturing of asset management processes is required so that there is greater confidence in the outputs of the asset management system. Increased assurance will also provide greater confidence. For capital expenditure in particular, we consider that there is a role for greater assurance over the justification for (prudence) expenditure proposals. Example of activities that may provide greater assurance over expenditure proposed include increased internal challenge at the needs identification stage (particularly by different internal stakeholders) and increased peer review of options analysis against corporate processes.

3.6.2 Internal audits

SA Water has a wide ranging program of internal audits, many of which are relevant to asset management. A sample of these are detailed in Table 3-5.

Table 3-5 Sample of internal audit reports relevant to the asset management system

Ref.	Project Title	Indicative Audit Objective and Scope
1701	CIMS Data Migration	To perform a review of the plans in place to ensure adequate and effective controls in place for the migration of data from legacy systems into the new CIMS system.
1707	Capital Projects & Programs Assurance	To assess the adequacy and effectiveness of controls exercised over capital projects, giving specific focus to the indirect costing methodology and capitalisation of Capital Programs.
1715	Pipe Break Response	To assess the adequacy and effectiveness of controls and practices around pipe break operational response to drive customer satisfaction and ensure legislative and regulatory compliance.
1717	Governance of Mission Critical Initiatives	To review the effectiveness of governance structures in place to manage mission critical initiatives.
1802	Financial Management Compliance Program 2016-17 Assurance	To assess the adequacy and integrity of the compliance self-assessments contained in SA Water's Financial Management Compliance Program.
1805	Water Mains Renewal Strategy	To assess the adequacy and effectiveness of the Water Main Renewal Strategy.
1806	Operational Administrative Review	To assess the adequacy and effectiveness of controls administered by a regional SA Water site, in particular to manage expenditure.
2007/1	Zero Cost Energy Future Assurance: Phase One	Site Selection. To review the models utilised to inform site selection.

These audits are evidence that SA Water is seeking to improve the assurance over its asset management practices as suggested by the November 2017 independent review.

3.6.3 Business KPIs

SA Water has a comprehensive business KPI reporting framework that includes service standards, strategic element measures and technical KPIs. We were provided with and reviewed an example monthly KPI report. On this basis, we consider that asset managers have the necessary information available on which to base decisions and determine when corrective actions are required.

3.6.4 Summary

We consider that SA Water has a sound approach to performance evaluation and improvement as evidenced by it undertaking periodic reviews of its asset management system, ongoing monitoring of asset and service KPIs and internal audits targeted at asset management topics. This helps to provide assurance that SA Water is applying its asset management framework in developing its expenditure proposals.

3.7 Expenditure program development

3.7.1 Program development and prioritisation

To develop its Regulatory business proposal, SA Water first prepared a “Technical Investment Plan”. This Technical Investment Plan is an unconstrained plan put forward by the asset managers which includes the activities considered necessary to achieve the required outcomes in the forward period (that is, to deliver the asset management objectives discussed in Section 3.3). To develop its Regulatory business proposal, SA Water first prepared a “Technical Investment Plan”. This Technical Investment Plan is an unconstrained plan put forward by the asset managers which includes the activities considered necessary to achieve the required outcomes in the forward period (that is, to deliver the asset management objectives discussed in Section 3.3). The Technical Investment Plan also includes the expenditure that SA Water assessed would be required to deliver on the areas where customers had expressed a desire for improved service. Therefore, the Technical Investment Plan is the sum of all known needs and wants across the business for the RD20 period.

The process of prioritisation is detailed in the Lead Asset Management Plans for water and wastewater. These plans detail the following investment scenarios (or stages in development of the proposed investment program:

- The ‘Technical Investment Plan’ which as noted, is the sum of all the needs and wants across the business and totals $2,079 million for both water and sewerage but excluding information systems capital expenditure. SA Water identified that this scenario would result in a price increase for customers. While not explicitly stated, it is implied that this price increase would not be acceptable.
- SA Water then identified scenarios to test for the water and wastewater program within an overall expenditure program of $1,280 million, which it is assumed would allow for current prices to be maintained or reduced in the RD20 period. It identifies the following scenarios:
    - Wastewater - a single ‘balanced’ program of $460 million. This program corresponds to a decrease in price but would “eliminate the majority of the service enhancements being considered”.
    - Water – three programs each of $820 million expenditure to be ‘price neutral’ over the RD20 period
        - Baseline – this program prioritises maintaining existing levels of service while reducing the risk profile across the portfolio but “under this scenario no enhancements are made to the service provided to customers”
        - Enhanced – this program prioritises investing in areas that are ‘new’ or significant improvements to existing service levels at the expense of asset renewals and maintaining existing service levels
        - Balanced – A balance between the baseline and enhanced service levels
- The program put forward to the Customer Negotiation Committee which totals $1,512 million, was a $232 million (11%) increase on the scenarios tested.

> The program within 'Our Plan' which totals $1,740 million[4], was a further $228 million (11%) increase on the program put forward to the Customer Negotiation Committee.

The different capital expenditure programs considered and proposed are illustrated in Figure 3-6.

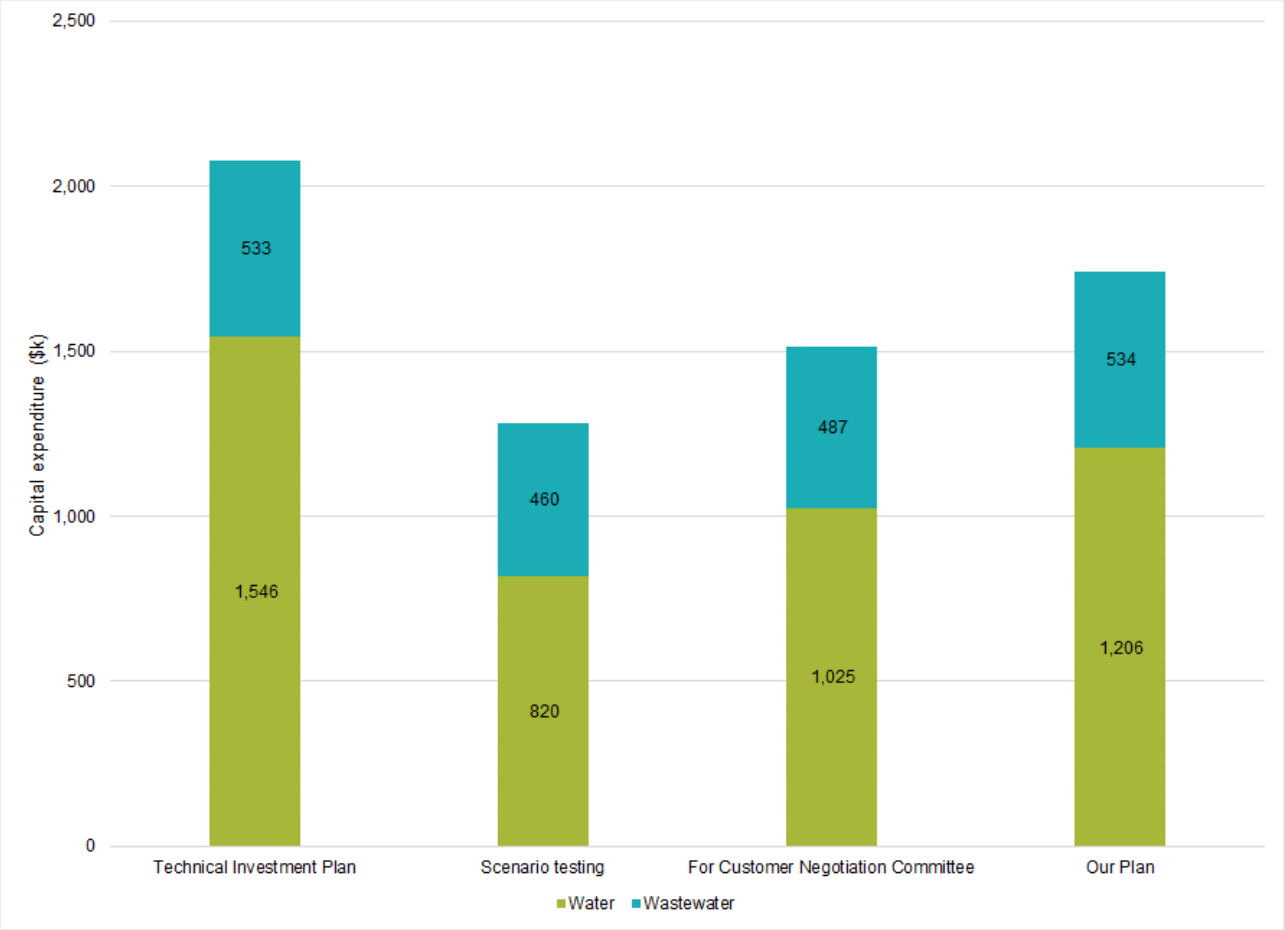


Figure 3-6 Comparison of different expenditure programs considered and proposed

We understand the logic of SA Water first developing an unconstrained program and then developing scenarios for testing. Based on the information provided, the scenarios suggest that a capital program of $1,280 million would be sufficient to maintain service although with SA Water assuming a higher risk profile than under the Technical Investment Plan.

In moving from the scenarios to the program put forward to the Customer Negotiation Committee, SA Water has in aggregate reduced expenditure on asset renewals and increased expenditure to improve service levels. By inference, the Technical Investment Plan has a more conservative risk profile than what the business is now willing to take for the RD20 period. SA Water has documented the relationship between risk and investment within each of its asset management plans. We have reviewed this for different asset management plans and also for the sample of projects and programs reviewed. We consider that the approach undertaken is valuable to SA Water to better understand cost, service and risk trade-offs and this has been used as an input into the prioritisation of expenditure for expenditure programs.

However, there are also limitations to what SA Water has undertaken in this area. These include:

> The level of risk acceptable to SA Water does not appear to have been robustly tested or calibrated to be related back clearly to levels of performance or potential types of events of certain frequency across

[4] This figure does not match the total of SA Water's Regulatory Business Proposal. The Regulatory Business Proposal totals $1,842 million which is $102 million (6%) higher than the sum of expenditure in the two Lead Asset Management Plans. This is in part due to the $143 million of capital expenditure for information systems but allowing for this, there is a $41 million difference.

programs. The water mains program is an exception as the renewals forecasting approach is more sophisticated. This is not a criticism of SA Water's approach as many utilities are in a similar position, only a note of the limitation.

> For some asset classes we don't consider that the expression of risk provides a sufficiently granular picture to enable prioritisation. For example, for sewer mains the risk prioritisation is essentially binary.

> The approach does not reflect timing considerations for some investments. For example, SA Water's dams and weirs asset management plan notes that the Mt Bold Reservoir is above the limit of tolerability for risks associated with its failure and expenditure has been sought within the RD20 period to address this risk. However, as will be detailed following, expenditure for this project has been more than halved in the RD20 period. This suggests that while the risk is above the limit of tolerability, SA Water is comfortable with taking longer to address this risk than initially considered in the Technical Investment Plan.

While noting the limitations above, we consider that this is generally a reasonable approach. We have identified areas where we think that adjustments to specific asset renewal programs are warranted to reflect a different perspective on the balance between cost, risk and performance.

We requested SA Water to demonstrate how the prioritisation and internal efficiency challenge had shaped the balance between cost and risk at the program level. We were provided by SA Water program level data for the water and wastewater service on which the following analysis is based. Figure 3-7 shows the variance between the total Technical Investment Plan and Regulatory business proposal expenditure by driver for the water service.

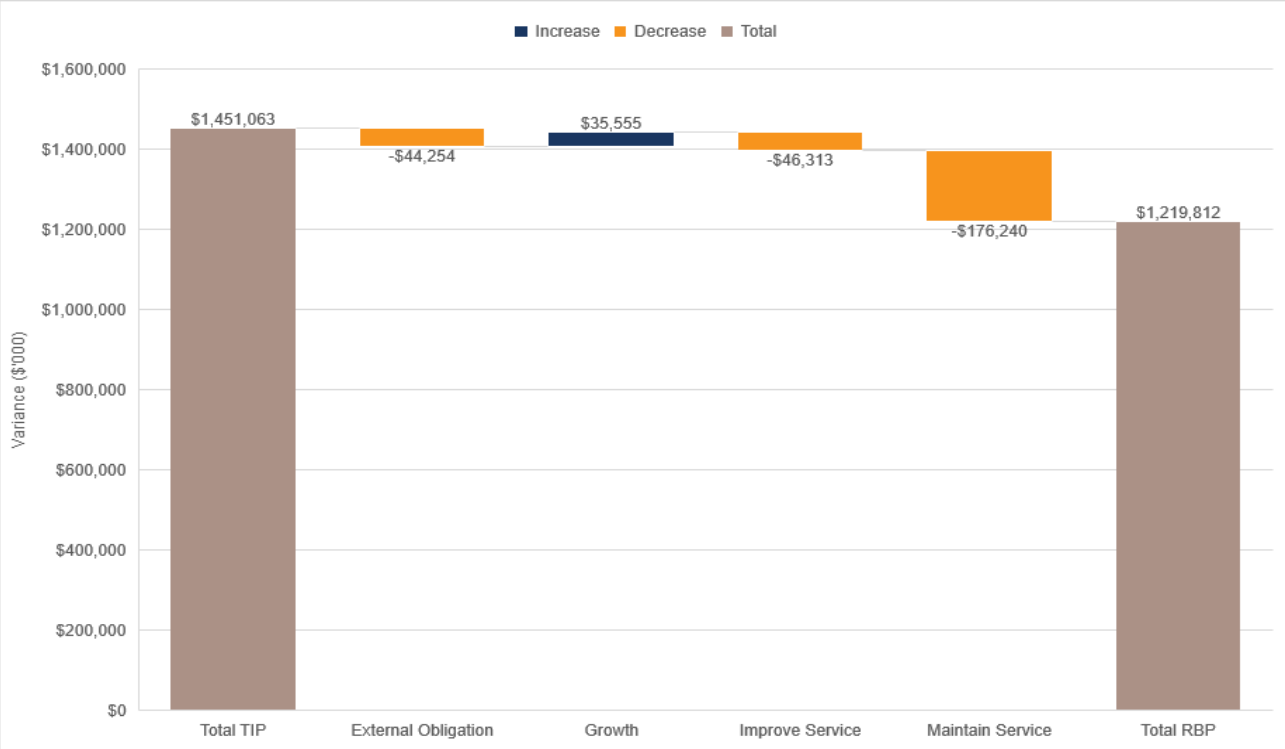


Figure 3-7 Variance between total Technical Investment Plan (TIP) and Regulatory business proposal (RBP) expenditure by driver

From the Technical Investment Plan to the Regulatory Business Proposal, the largest decrease ($176 million) in expenditure is observed in the Maintain Service driver. Within this driver, the most significant program contributing to this negative variance is the "A0009 – Major Pipelines Water Network" program, where total expenditure over the RBP20 period has halved. Conversely, expenditure on the Growth driver has increased (by $36 million), with two new projects being introduced as part of the Regulatory Business Proposal – the "Upper Spencer Gulf WS Augmentation" and the "87 Kangaroo Island MR Desalination LDMC" projects. These adjustments appear to reflect better information on the required timing of these water supply projects rather than an optimisation of the benefits and risk profile within the expenditure program.

Figure 3-8 shows the variance between the total Technical Investment Plan and Regulatory business proposal expenditure by program for the water service.

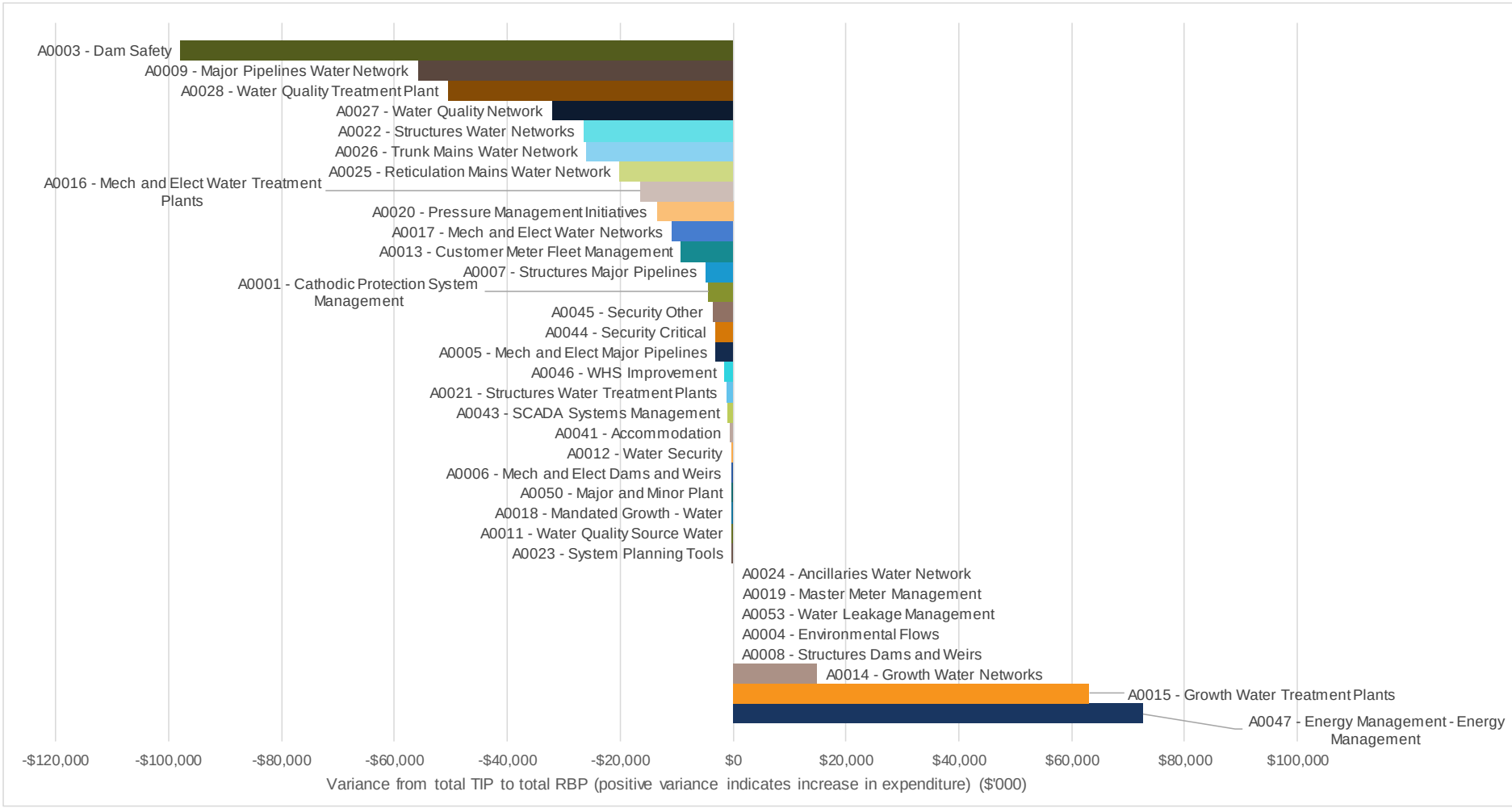


Figure 3-8 Variance between total Technical Investment Plan (TIP) and Regulatory business proposal (RBP) expenditure by program

By examining the variance in total expenditure at the program level (Figure 3-8), it can be seen that the “A0009 – Major Pipelines Water Network” program has experienced the second largest negative variance ($56 million, 34% of the original program). The largest negative variance occurs in the “A0003 – Dam Safety” program ($98 million, 52% of the original program), which is driven by more than half of the expenditure on the “Mount Bold Dam Safety Investigation” project being removed. At the other end of the scale, the largest positive variance occurs in the “A0047 – Energy Management – Energy Management” program ($73 million). This program solely comprises the ZCEF project (AP Energy Mgmt SP3 Project Zero” project).

Some of the largest variances at a program level detailed above are those that have occurred between the program for the Customer Negotiation Committee and the final program included in the regulatory proposal. These changes include $104 million for the ZCEF project and $124 million for growth projects (Kangaroo Island desalination, Eyre Peninsula desalination and the Upper Spence Gulf Augmentation). The emergence of new needs is not unusual but the magnitude of these expenditure items is given their timing. The late inclusion of relatively large additional expenditure in these areas calls into question the cost-service-risk balance presented to the Customer Negotiation Committee as no expenditure has been deferred or re-prioritised to off-set these new items, they have been simply added to the previously proposed program.

To summarise a number of important points regarding SA Water's proposed capital expenditure program and how it has been developed and prioritised:

> SA Water has identified that a $1,280 million expenditure program will meet required service levels and sustain or reduce asset risks

> SA Water's understanding of the trade-offs between costs, risks and performance is reasonable but there are limitation due to data and its methodology. We recommend some program specific adjustments to the forward expenditure program to reflect this (see Section 5.3)

> SA Water has proposed additional expenditure on top of the $1,280 million 'baseline' program to:

> Improve service in line with customer expectations (around a 35% increase on the baseline)

> Respond to growth drivers (around a 10% increase on the baseline)

> While improving service delivered to customers can often be demonstrated to be 'aligned' with overall corporate objectives within the asset management system, there is a need for SA Water to justify this expenditure against the requirements of the regulatory framework which includes tests to ensure that the benefits of this expenditure exceeds its costs and is supported by customers.

> We have reviewed a sample of projects and programs which includes some expenditure to improve service but we have not reviewed all expenditure for this driver. Where expenditure to improve service is informed by research into customer willingness to pay, it is not within our scope to comment on the veracity of the willingness to pay research but we have sought to make clear where expenditure (which is sub-components of some programs) is justified on this basis and the expected benefits (improved service) of this increased expenditure.

In Section 5.3 we provide further analysis of the forward capital expenditure program and detail our findings from our review of a sample of specific projects and programs.

While capital program development and prioritisation seeks to optimise benefits to customers with cost, circumstances will inevitably change during the delivery period. Therefore, monitoring the benefits realised by expenditure provides assurance to customers and stakeholders that an expenditure program continues to deliver value for money. 'Benefits realisation' is a standard process within expenditure governance or gateway frameworks. In this area, SA Water has identified a list of 172 "outcomes" that it desired to achieve during the RD16 period. These outcomes are a combination of outputs (i.e. activities undertaken or works delivered) and outcomes, as well as measures of outcomes. While this list of outcomes is comprehensive, it is difficult to map these to SA Water's line of sight within its asset management framework and the use of outputs and outcomes within the framework for the same purpose creates some confusion around the relationship between expenditure and performance.

We consider that there is benefit in SA Water revisiting this framework for the RD20 period and providing a more focused benefits realisation framework that distinguishes between outputs and outcomes, and has a more defined link to the asset management objectives and service standards. This is also consistent with improving the line of sight – the benefits realisation framework should demonstrate how the asset management objectives are being achieved. We consider that this is particularly important for the areas in which SA Water has proposed expenditure to improve service as there is an explicit regulatory requirement that the benefits of this expenditure exceed the costs. Therefore, benefits realisation should include scheme specific measurement of performance or benefits before expenditure occurs to establish a robust baseline and further measurement afterward to confirm that the anticipated benefits have been achieved. For some areas the assessment of benefits may be difficult to quantify but this should not preclude SA Water from evaluating the benefits as effectively as it can. Where benefits are unknown or uncertain, SA Water's customers are likely to benefit from a cautious approach that first verifies benefits through trials before wider expenditure programs are pursued.

3.7.2 Cost estimating

SA Water has a structured approach to cost estimating with different classes of estimates defined for different states of project development. Projects in the RD20 period will generally be estimated as a Target Outturn cost by contractors, which will be compared to internal rates and estimates. SA Water intends to strengthen its cost estimating function in the RD20 period by capturing more estimated and outturn costs in its cost estimating database. The data currently with the cost estimating database has not been subject to peer review and approval for use.

An internal audit of the cost estimating function was completed in October 2019. This audit concluded that:

> *At this stage, the Cost Intelligence team is in a transitional stage, having identified the key initiatives to improve its level of operating effectiveness, however has not yet had the time or resources to allow it to achieve these. As an example, we would consider the availability and use of cost intelligence software, a database, and modelling tools to be fundamental in driving consistent cost intelligence outputs and contributing towards a stronger control environment. However, the team has been subject to a previously failed system implementation and is currently working through prototype models in order to inform its business requirements.*

We note that improved cost intelligence has been nominated by SA Water as one source of efficiency gains in the RD20 period that support the 5% internal challenge it has imposed. We have not suggested any further catch-up efficiencies in this area (see Section 5.3.3).

SA Water is of the view that it is “outperforming the efficiency targets applied by ESCOSA” and has saved $148 million for customers compared with a target of $66 million. We requested a breakdown of the efficiencies achieved due to deferrals compared with reduced costs to deliver. “Reprioritisation” account for $93 million of the total (63%) and reduced costs to deliver $55 million (37%). We accept that reprioritisation of renewal projects may be considered an efficient outcome if service isn’t compromised in the long term but we do not think that deferral of growth projects due to lower than forecast demand represents a genuine efficiency.

SA Water has identified that areas in which it will be able to achieve capital delivery efficiencies in the RD20 period include improved internal cost estimating processes, early on boarding of its planning partner for RD20 and re-evaluation of supplier agreements for materials, equipment and services.

3.7.3 Procurement and delivery

In the current regulatory period, SA Water has had contracts with six major capital delivery partners. The contracts were generally based on asset classes and geographical areas. There is also in place a number of minor frameworks for specialist works such as SCADA. SA Water considers that this model has delivered efficiencies in the current period, particularly though reduced transactional activities.

For the RD20 period, SA Water has reduced the number of major delivery partners to three, with contracts in place for: water north, water north and wastewater networks. SA Water intends to commence work under these new contracts from January 2020, and is planning an early works program to bring forward works from the RD20 period, to provide a more consistent delivery profile to better utilise resources.

The RD20 model includes minor delivery frameworks and panels. The full framework is shown in Figure 3-9. We consider that the RD20 delivery model is sound for the expenditure program with a reduced number of major partners expected to lead to efficiencies due to economies of scale while retaining specialist services on minor panels. SA Water has identified that the new delivery model will also contribute to the 5% internal efficiency challenge it has applied to its capital expenditure program.

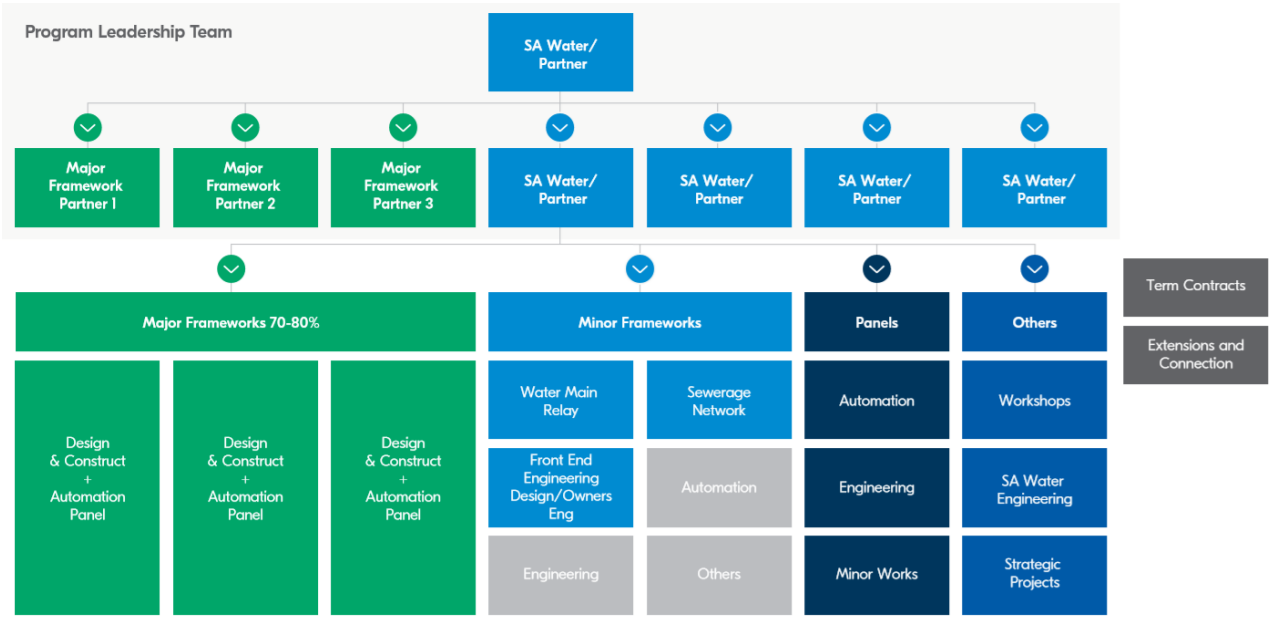


Figure 3-9 RD20 capital delivery model

Source: Our Plan 2020-24, Appendix N – Capital delivery, SA Water, November 2019

3.8 Conclusions

Task 1 of this review is an evaluation of whether SA Water's asset management framework is embedded in systems and processes, and that these processes are consistent with the principles set out in its asset management framework. The scope of this task details specific criteria for testing SA Water's asset management system. We conclude against each of these criteria drawing on the preceding observations and analysis:

> Does SA Water demonstrate an understanding of its critical asset systems and facilities, and have a mature approach to assessing risks and opportunities for managing those assets?

We consider that SA Water has a sound understanding of its critical assets and risk based decision making. However there was some evidence that risk based decision making is not being conducted thoroughly or consistently implemented across the different asset classes. Generally, investment decisions for renewals are made on a risk basis, although this appears to be more mature for water assets than wastewater assets. SA Water has in place a sound business continuity planning approach for business critical assets.

> Does SA Water have internal monitoring and reporting systems that are sufficient to actively manage expenditure and assess the effectiveness of its outcomes?

SA Water has effective monitoring and reporting systems in place for asset management and the asset management system. This includes business KPI reporting, asset management system reviews and ongoing internal audits. However, there was some evidence that the recommendations arising from reviews and audits had not been actioned.

> Does SA Water optimise use of capital and operating expenditure solutions for its core maintenance?

We have reviewed the lifecycle strategies adopted for various asset classes through the sample of capital projects reviewed. We consider that the capital and operating interventions strategies are broadly appropriate. However, our review of a sample of capital projects found that lifecycle costing can be improved. This means that the current balance between capital and operating expenditure is unlikely to be optimised where lifecycle costing has informed lifecycle strategies.

> Does SA Water conduct options analysis that includes a clear 'base case' and 'lowest lifecycle costing?

Options analysis is an area in which SA Water can improve. On numerous projects that we reviewed, the lifecycle costing fell short of good practice. Our observations include financial analysis not being undertaken to support options selection where benefits and costs should have been a key part of the project justification , limited sensitivity testing and scenario analysis and the analysis period not matching the expected life of the underlying assets. SA Water's approach to lifecycle cost analysis appears to be

inconsistent and lacking in rigour. . We also consider that sensitivity testing and scenario analysis can be strengthened. The findings from our review of capital expenditure projects is summarised in Section 5.2.2 and Section 5.3.2.

> Is there a clear line of sight from the drivers of the investment decisions through to the outcomes achieved through that expenditure?

There a defined line of sight from SA Water's strategic goals and its asset management objectives into business planning. The asset management objectives adequately capture SA Water's regulatory obligations including environmental protection and drinking water quality. The objectives are also broadly consistent with SA Water's proposed service standards.

However, we consider that there is scope for SA Water to refine its asset management objectives and line of sight so that there is greater recognition and integration with the regulatory framework in which SA Water operates. This will provide more assurance that expenditure is justified based on both stakeholder expectations and the regulatory framework that SA Water operates within. We are concerned that the asset management objectives include intentions that do not have stakeholder support and that are outside of the influence of the asset management system.

We identified multiple examples of expenditure being proposed where there was insufficient evidence to conclude that this was a prudent investment. Improved asset management decision making should result in the avoidance of expenditure that is not genuinely needed by SA Water to deliver its services. Is there an appropriate and timely feedback loop between planning processes, project delivery and the outcomes achieved considering expenditure trade-offs and the likely impact of deferrals and reprioritisation of expenditure across the entire organisation

SA Water tracks a number of indicators for project delivery including performance against KPIs and a suite of 'outcomes'. We consider that there is benefit in SA Water revisiting this framework for the RD20 period and providing a more focused benefits realisation framework that distinguishes between outputs and outcomes and has a more defined link to the asset management objectives and service standards.

> applying appropriate budget constraints at the asset portfolio/General Manager level.

We consider that governance and monitoring of expenditure is appropriate. Planning documents had appropriate levels of approval where reviewed and we saw that SA Water has in place systems for tracking expenditure delivery.

Based on our review of SA Water's asset management system, we consider that there is scope for SA Water to realise catch-up efficiencies in the RD20 period for capital expenditure in the areas of:

1. Improved assurance over expenditure justification – through a refined line of sight to provide greater assurance over expenditure justification. We recommend a catch-up efficiency in this area of 1.0% per annum over the RD20 period.
2. Improved asset management decision making – through improved lifecycle decision making and risk analysis to determine optimum intervention to assets to achieve the asset management objective. We recommend a catch up efficiency in this area of 0.5% per annum over the RD20 period, as decision making processes improve.

We discuss the scope for capital efficiencies in Section 5.3.3.

4 Operating expenditure

4.1 Approach taken by SA Water

The approach taken by SA Water in preparing its regulatory business proposal is summarised as follows:

> Firstly, SA Water has normalised its actual outturn operating expenditure in 2018/19 (the "base year") to adjust for factors which it considers to be atypical, such as higher than average water demand and electricity prices. SA Water's normalisation has reduced operating expenditure from $507.7 million to $479.0 million.

> It commissioned a benchmarking exercise and concluded that it is operating at the frontier of efficiency and therefore its normalised base year should be considered an efficient level of operating expenditure.

> It has then made a series of adjustments to base year operating expenditure to take account of anticipated savings from the ZCEF program and other capital investments. It has also applied a top-down efficiency challenge to these projections. This leads to operating expenditure of $445.0 million in 2020/21, increasing to $475.3 million in 2023/24.

This process is summarised graphically in Figure 4-1. We comment on each step in Sections 4.3 and 4.4.

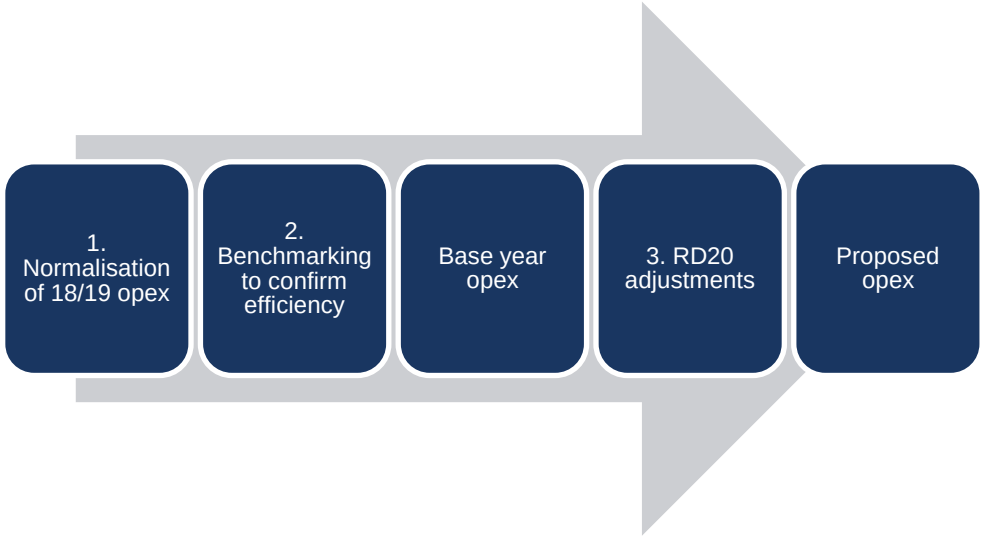


Figure 4-1 Approach taken to deriving operating expenditure projections

While ZCEF was originally part of the scope for this review, further investigation by the Commission revealed that the nature of this proposed investment meant that it did not meet the definition of a retail service under the Water Industry Act, and therefore was not relevant to the determination of prudent and efficient expenditure. We therefore have excluded this project from the analysis within this report and have removed it from our recommended prudent and efficient operating expenditure.

4.2 Cost allocation and capitalisation

We briefly discuss SA Water's approach to cost allocation and capitalisation below.

4.2.1 Cost allocation

As required by the Commission in Guideline No. 2[5], SA Water allocates expenditures between direct control, 'excluded services' and unregulated categories. Excluded services generally relate to unique services provided to specific customers, and those expenditures are recovered through customised charges rather than through general tariffs.

[5] Water Regulatory Information Requirements For Major Retailers, Water Industry Guideline No 2 (WG2/02), ESCOSA, October 2013.

We have not included 'excluded services' or unregulated expenditure in our assessment of efficient operating expenditure below.

SA Water's Regulatory Financial Statements for 2018/19 have been audited by PWC. PWC found the disaggregation of costs between direct control, 'excluded services' and unregulated services and regulated business segments (i.e. 'water' and 'sewerage and trade waste') to be in accordance with the principles of Guideline No. 2. As such we have not examined the allocation of costs between these cost types in detail.

The allocation of direct control costs between water and sewerage in the 2018/19 accounts is summarised in Table 4-1.

Table 4-1 Normalised regulatory operating expenditure in 18/19 ($M)

	Water $M	Water %	Sewerage $M	Sewerage %
Assets				
RAB at end of year	8,935,723,000	67%	4,374,242,000	33%
Additions	289,124,000	57%	219,079,000	43%
Depreciation	198,971,000	65%	105,828,000	35%
Operating expenses				
Operations and maintenance	167,234,000	76%	53,203,000	24%
Treatment costs	28,217,000	53%	25,011,000	47%
ADP operational costs	39,732,000	100%	-	0%
Customer services and billing	18,393,000	67%	9,110,000	33%
External fees, licenses and charges	33,101,000	70%	14,436,000	30%
Business support/Corporate costs	77,824,000	70%	33,749,000	30%
Business development/Other costs	5,182,000	67%	2,552,000	33%
Total operating expenses (mgt accounts)	369,683,000	73%	138,061,000	27%

Source: June 2019 regulatory accounts

From this we note that the split of RAB (67/33) appears to be used as the basis of the allocation of expenditure for customer services and billing and business development. However, an alternative split (70/30) appears to be used for business support/corporate costs. We recognise that there is no single correct way of allocating costs but find this difference unusual.

As a general observation, we have found it difficult to understand and reconcile the different ways in which operating expenditure has been presented.

We recommend that the Commission ask SA Water to provide clear details of its cost allocation approach on a line by line basis and a commentary on the year-on-year variances to make its regulated accounts easier to understand and aid future regulatory reviews.

4.2.2 Capitalisation

SA Water has stated that there have been no material changes in its capitalisation approach in the RD16 period. As such, we have not reviewed the guidelines in detail.

SA Water applies a number of tests to determine if an expenditure is considered capital expenditure (thus creating an asset) or operating expenditure. The assessment includes consideration of who controls/owns the end product, certainty of the project proceeding (for expenditures related to projects spanning multiple financial periods) and the expected duration of the benefits created by the expenditures. This is summarised in Figure 4-2:

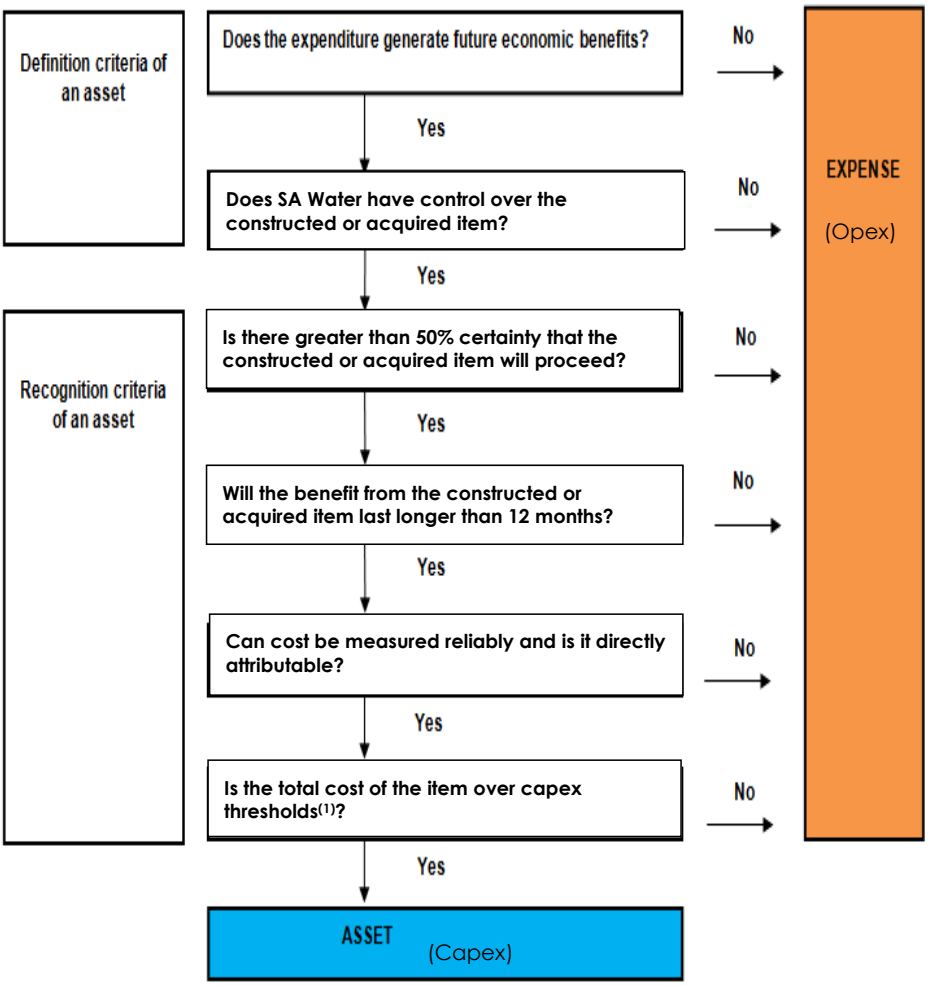


Figure 4-2 SA Water's capitalisation decision tree

Source : Expenditure Capitalisation Guideline, SA Water, June 2019

The following threshold criteria also informs the classification of expenditures for SA Water:

Exempt Items:	Regardless of value, the following two items must be capitalised: Mains Extensions, New Services and Water Meters. All mains replacement greater than 12m in length.
> $10,000:	Expenditure over this limit may be capital subject to meeting the Future Economic Benefit test, with the exception of mains replacement of less than 12m in length which are to be expensed.
$10,000 or less	Expenditure is regarded as immaterial and classified as operating expenditure.

The only examples of non-capitalisation which we found unclear concerned:

> the approach to ADP expenditures. SA Water informed us in interview that it treats all operator contract costs as operating expenditure. When queried how it would classify the hypothetical expenditure of the operator replacing $50k of hoses. We were informed that this would be treated as operating expenditure.

> we also asked how SA Water would classify the fictional expenditure of $20k for replacing skimmers at a wastewater treatment plant. We were told that this would also be treated as operating expenditure.

We consider this approach to expenditure classifications to be inconsistent with SA Water's Capitalisation Guideline. We suggest that SA Water reconsider if renewals and significant maintenance work on minor assets are being correctly classified, given that they are measurable, lead to benefits lasting more than 12 months and may cost more than $10k.

We recommend that the regulatory accounting treatment of these types of expenditure be incorporated in the cost allocation approach recommended in Section 5.2.1 above.

4.3 Efficiency of the base year

4.3.1 Components of base year operating expenditure

A majority (71%) of SA Water's regulated operating expenditure is comprised of four cost items:

> Labour costs (termed 'net' labour as some labour costs are capitalised). These make up 26% of normalised base year operating expenditure and are the largest single cost line.

> Metro Alliance Contract: this is an outsourcing contract covering elements of the operation and maintenance of the water and sewerage system in the metropolitan area and makes up 21% of normalised base year operating expenditure, making it the second largest cost line.

> Electricity costs make up 14% of SA Water's normalised base year operating expenditure at $65.5 million. We note that without normalisation, these costs would have been $79.7 million.

> External fees and charges make up 10% of normalised base year operating expenditure. The major constituents of this are the water planning & management fee, catchment levy fees, Water Industry Act licence fee, Valuer General fees and for sewerage, EPA licence fees.

The negative operating expenditure item 'internal costs' incorporates costs recovered from other sources or allocated to non-regulated activities.

These breakdown of normalised operating costs is summarised in Figure 4-3.

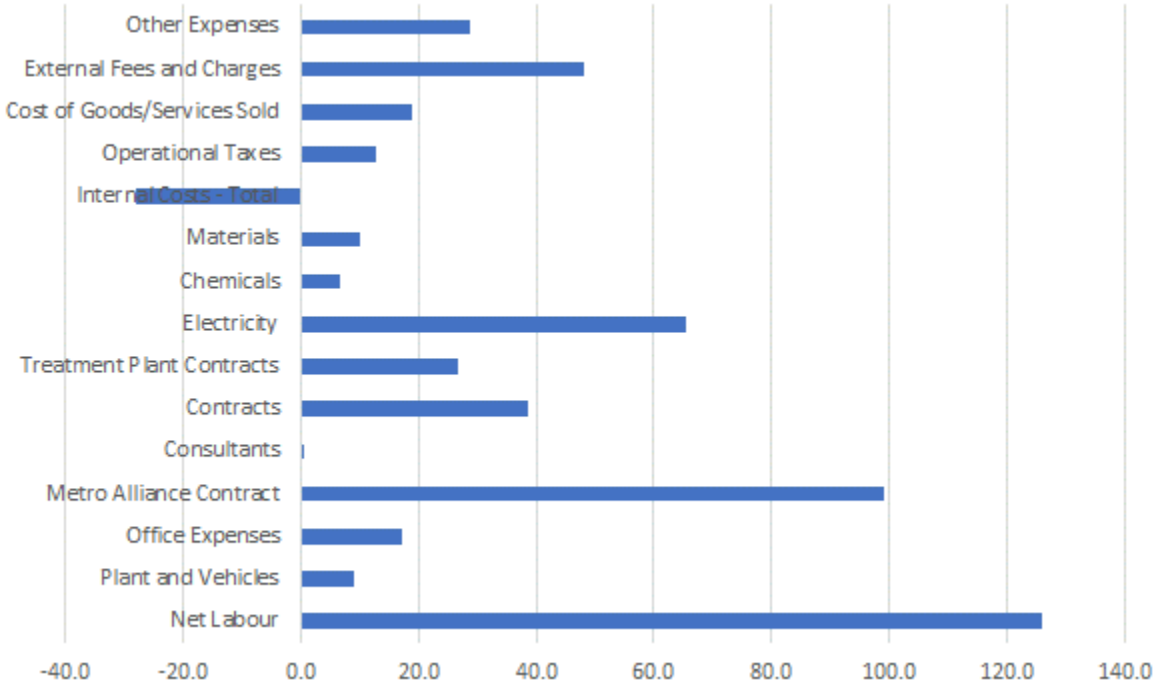


Figure 4-3 Breakdown of normalised water & sewerage operating expenditure in 18/19 ($M)

The make-up of water operating expenditure is broadly similar to sewerage operating expenditure with the main differences being a higher proportion of sewerage operating expenditure being related to labour costs. 'External fees and charges' are higher for water than sewerage due to the 'water planning & management' and 'catchment levy' fees.

Table 4-2 Normalised regulatory operating expenditure in 18/19 ($M)

	Water	% of water opex	Sewerage	% of sewerage opex
Net Labour	84.5	24%	41.5	31%
Plant and Vehicles	6.2	2%	2.9	2%

	Water	% of water opex	Sewerage	% of sewerage opex
Office Expenses	14.8	4%	2.5	2%
Metro Alliance Contract	70.7	20%	28.2	21%
Consultants	0.3	0%	0.1	0%
Contracts	23.1	7%	15.3	12%
Treatment Plant Contracts	22.8	7%	3.8	3%
Electricity	48.9	14%	16.6	13%
Chemicals	5.6	2%	0.9	1%
Materials	7.0	2%	3.0	2%
Internal Costs - Total	-18.5	-5%	-9.6	-7%
Operational Taxes	8.5	2%	4.2	3%
Cost of Goods/Services Sold	13.5	4%	5.4	4%
External Fees and Charges	38.7	11%	9.4	7%
Other Expenses	20.8	6%	7.9	6%
TOTAL	132.0		347.0	

Source: SA Water document "A. RD16 performance breakdown"

4.3.2 Normalisation

Operating expenditure in 2018/19 was unusually high, especially for the water service. This was a result of high water demand and a number of other factors discussed below. SA Water has carried out a 'normalisation' exercise to adjust operating expenditure to what it considers to be average conditions.

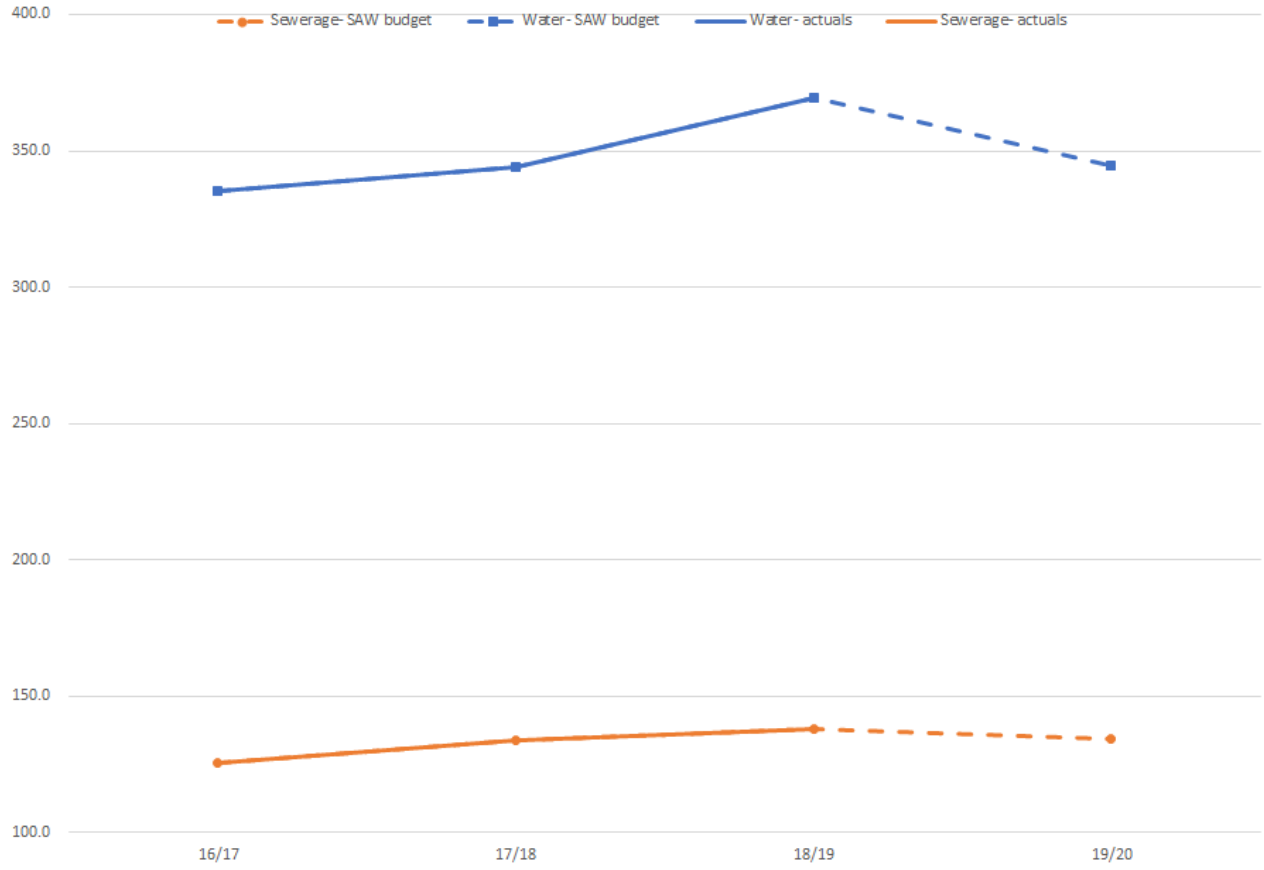


Figure 4-4 Trends in operating expenditure in RD16 ($18/19M)

Source : SA Water documents : 'A. RD16 performance breakdown' and 'ESCOSA - SA Water Reg Accounts 2018_19'

The largest adjustments applied by SA Water to derive the base year operating expenditure are summarised as follows:

> A $14.2 million reduction in electricity costs to take account of higher pumping volumes (i.e. higher kWh) and higher unit electricity costs in 2018/19. This is based on SA Water's assumption that major pipelines consumed an additional 113,000MWh at an average electricity price of $12 per MWh higher than the RBP20 base year expectations and all other assets consumed an additional 16,000MWh at an average electricity price of $26 per MWh higher than RBP20 base.

> Reduction to take account of a one-off $8.4 million charge for termination of a contract with AGL, leading to electricity cost savings. As discussed below, SA Water expects this to lead to savings of $8.4 million per year but has only applied a saving of $5.1 million for the base year rising to $5.2 million per year in the RD20 period.

> A $1.7 million increase to reflect SA Water's view that asset decommissioning and sludge disposal work was deferred to reflect the pressure on operating expenditure in that year.

> A $1.4 million reduction due to a one-off site restoration cost.

> SA Water has also made a number of other minor adjustments which result in a net $0.9 million reduction in operating expenditure.

> A balancing reduction of $4.3 million has then been made to make normalised operating expenditure equal to the RD16 Determination figure.

These adjustments are summarised in Figure 4-5 and examined in further detail in the text below.

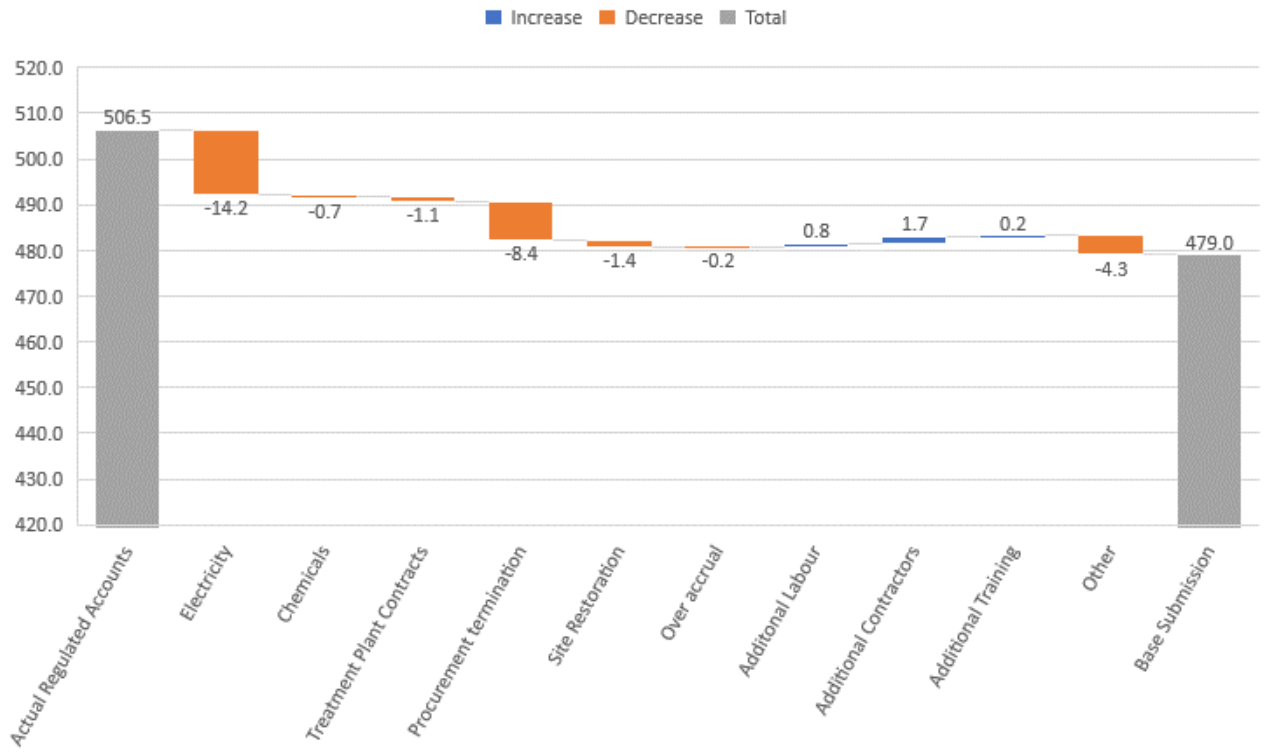


Figure 4-5 Normalisation adjustments applied by SA Water

We note that the normalisation was carried out against the draft regulatory accounts[6] on the assumption that regulated operating expenditure (minus 'excluded services') would be $506.5 million. The final accounts reported slightly higher regulated operating expenditure of $507.7 million. The difference is due to $1.3

[6] According to note in Consolidated Table tab of "Baseline 2018-19 -to Cardno-Final-29-11-19"

million of government radio networks (GRN) and engineering functional services expenditures being removed in error in the draft accounts[7].

SA Water submitted a revised normalisation in December 2019[8], to take account of IT savings in 19/20, Allwater accelerated works, Murray Bridge operating expenditure and GRN. However, it results in the same normalised operating expenditure of $479.0 million because SA Water simply reduced the balancing adjustment from a reduction of $4.3 million to $1.8 million.

Even after SA Water's normalisation, operating expenditure in 2018/19 was higher than in the previous two years. The main components of this variance are electricity costs, labour and Metro Alliance costs, partially offset by a higher negative 'internal cost', lower materials and lower 'other expense' costs. These variances and associated trends are summarised in Table 4-3 and Figure 4-6.

Table 4-3 Regulatory operating expenditure in RD16 period ($M)

	16/17	17/18	18/19 (normalised)	19/20 (forecast)	Variance between normalised 18/19 and average of previous years	Variance %
Net Labour	124.3	120.3	126.0	122.7	3.7	3%
Plant and Vehicles	10.3	9.3	9.1	6.7	-0.8	-8%
Office Expenses	13.4	19.2	17.3	23.4	1.0	6%
Metro Alliance Contract	95.0	98.4	98.9	96.9	2.2	2%
Consultants	0.5	0.4	0.5	-0.4	0.0	3%
Contracts	34.5	40.9	38.5	39.2	0.8	2%
Treatment Plant Contracts	28.3	27.1	26.7	26.4	-1.0	-4%
Electricity	55.4	61.2	65.5	71.3	7.2	12%
Chemicals	5.7	5.2	6.5	5.6	1.0	19%
Materials	10.5	12.1	10.0	9.8	-1.3	-12%
Internal Costs - Total	-19.5	-30.7	-28.1	-27.5	-3.0	12%
Operational Taxes	12.6	12.7	12.6	13.3	0.0	0%
Cost of Goods/Services Sold	17.6	19.3	18.9	16.3	0.4	2%
External Fees and Charges	44.1	50.7	48.0	48.4	0.7	1%
Other Expenses	27.9	31.9	28.7	27.2	-1.3	-4%
TOTAL	460.7	477.9	479.0	479.2	9.7	2%

Source: "A. RD16 performance breakdown"

Note: the denominator for variance % is the average expenditure in 16/17 and 17/18.

[7] Based on "Response to RD20.305". Note that the GRN adjustment is $1.256M and the figures above do not reconcile at one decimal place due to rounding.
[8] SAW response RD20.300

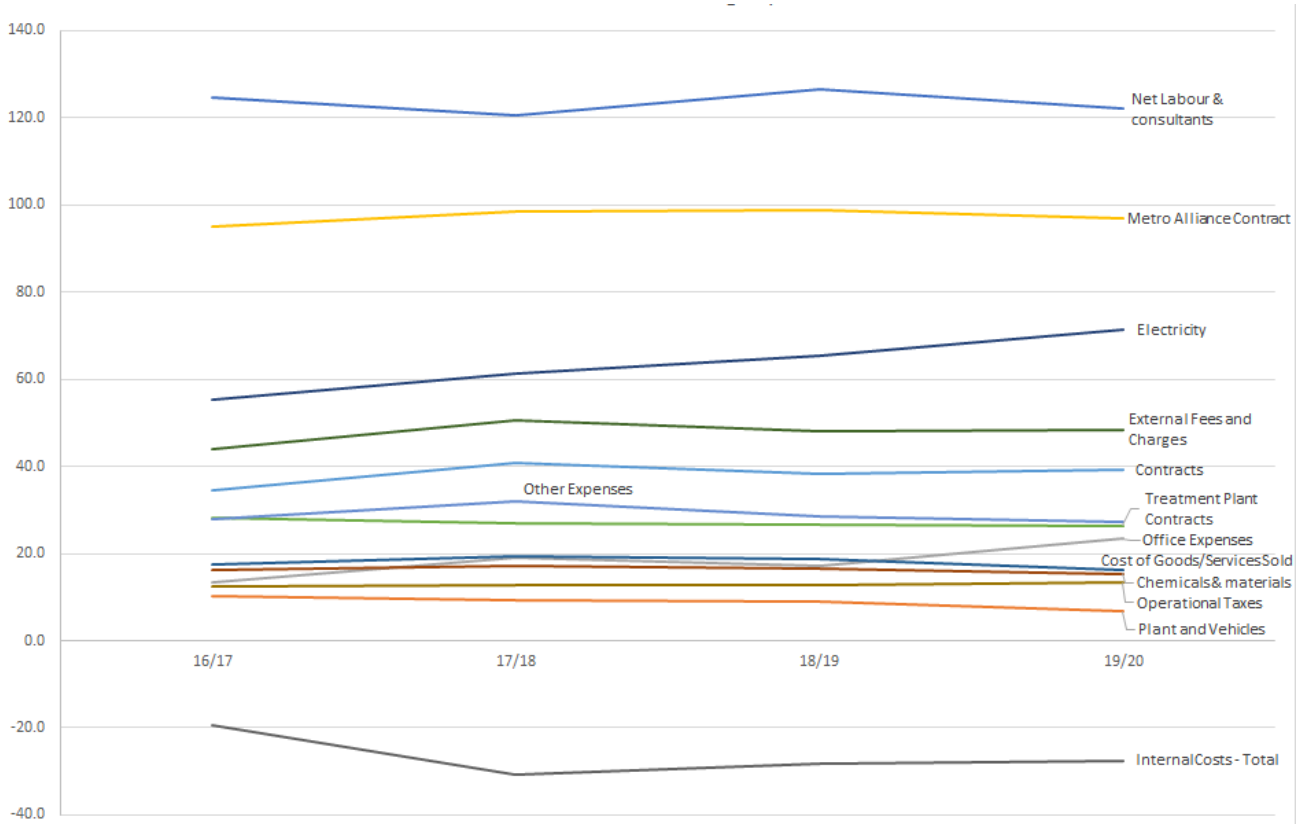


Figure 4-6 RD16 period components of operating expenditure

Note: 18/19 operating expenditure is normalised; 19/20 is SA Water's projection.

We set out our view of the appropriate level of normalisation for the major cost components below:

4.3.2.2 Electricity

The largest adjustment SA Water has made relates to the 37% higher than usual electricity costs in 18/19. It was a dry year leading to lower reservoir inflows and higher customer water demand. As a result, SA Water estimates that electricity use was approximately 130 GWh higher than normal[9].

SA Water estimates that the higher pumping volumes and electricity prices increased expenditures by $18.1 million. SA Water has then offset this by netting off the sale of $3.4 million of excess renewable energy certificates (RECs) purchased through the ADP AGL contract. The overall effect is to reduce operating expenditure by $14.7 million, of which $14.2 million (96.4%) has been allocated to regulated expenditure.

SA Water's adjustment leads to a regulated electricity expenditure of $65.5 million, which is still 12% higher than the average of the previous two years.

Wholesale prices play a significant role in SA Water's total electricity expenditure. We understand that approximately 61% of SA Water's electricity expenditure relates to wholesale prices, with the remainder relating to network charges and RECs[10].

The weighted average wholesale spot price for electricity in South Australia was unusually high in 16/17, 17/18 and 18/19 compared to historical averages (see Figure 4-7). Prices for electricity futures contracts suggest that the market is anticipating a drop in wholesale prices in the coming years, as seen below.

[9] SA Water document 'Baseline 2018-19 -to Cardno-Final-29-11-19'
[10] Based on the sum of benefits covering the ZCEF program modelling for both price scenarios in SA Water document "SA Water Modelling Results"

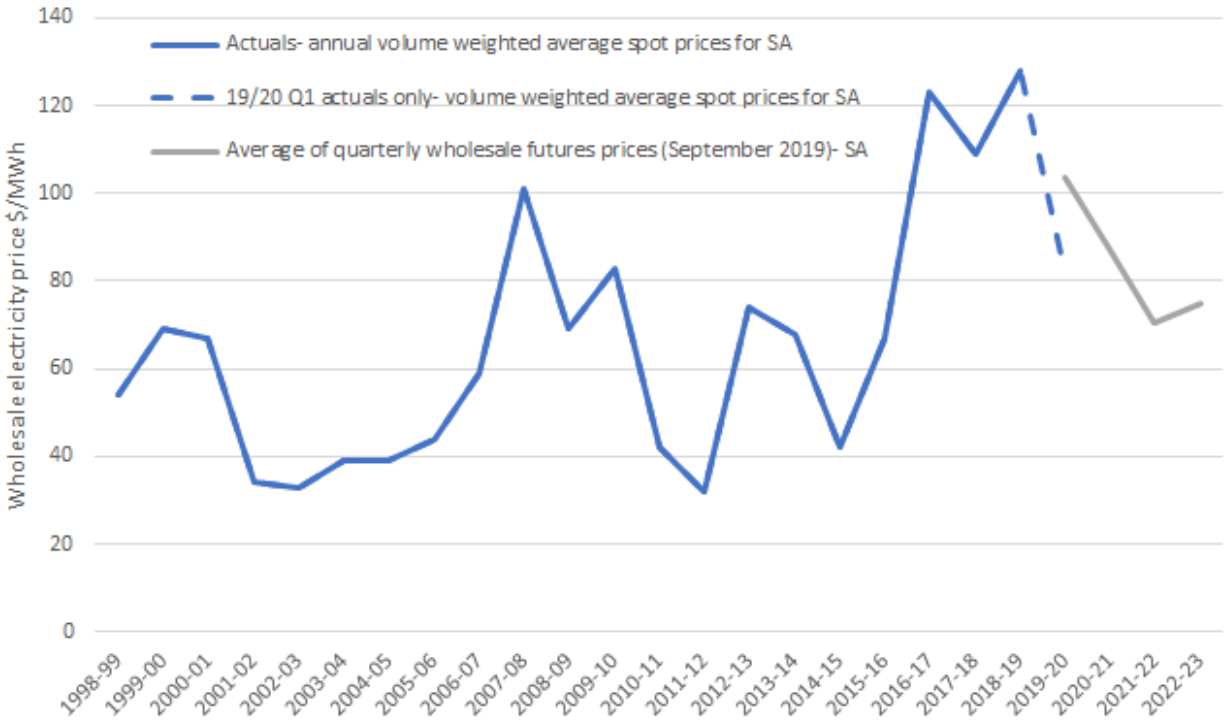


Figure 4-7 Annual volume weighted average spot prices in South Australia

Source: AER data set D19/178617, downloaded January 2020

The price of futures contracts suggests that wholesale electricity prices at the start of RD20, in 2020/21, may be approximately 25% below the average price in 2016/17 and 2017/18, when sales volumes were at more normal levels.

We have therefore recommended an adjustment to take account of the wholesale price being 25% lower in 2020/21 than the average in 2016/17 and 2017/18. This results in electricity expenditure which is 15% lower than in 2016/17 and 2017/18, a reduction of $30.2 million relative to 2018/19 actuals.

We have not incorporated an offsetting reduction in REC sales as we have based the adjustment on average expenditure in 2016/17 and 2017/18 rather than 2018/19 when these sales took place.

4.3.2.3 Contract termination charge

SA Water has incurred a one-off cost of $8.4 million in 18/19 associated with the early termination of the Renewable Energy Sales Agreement with AGL for the Adelaide Desalination Plant. The agreement had led to higher costs than would be available on the market. The termination of the contract is therefore expected to lead to savings which are discussed below.

We agree that SA Water's proposed $8.4 million adjustment for the payment to terminate this contract appears reasonable. The impact on operating expenditure in RD20 is discussed in further detail below.

4.3.2.4 Labour

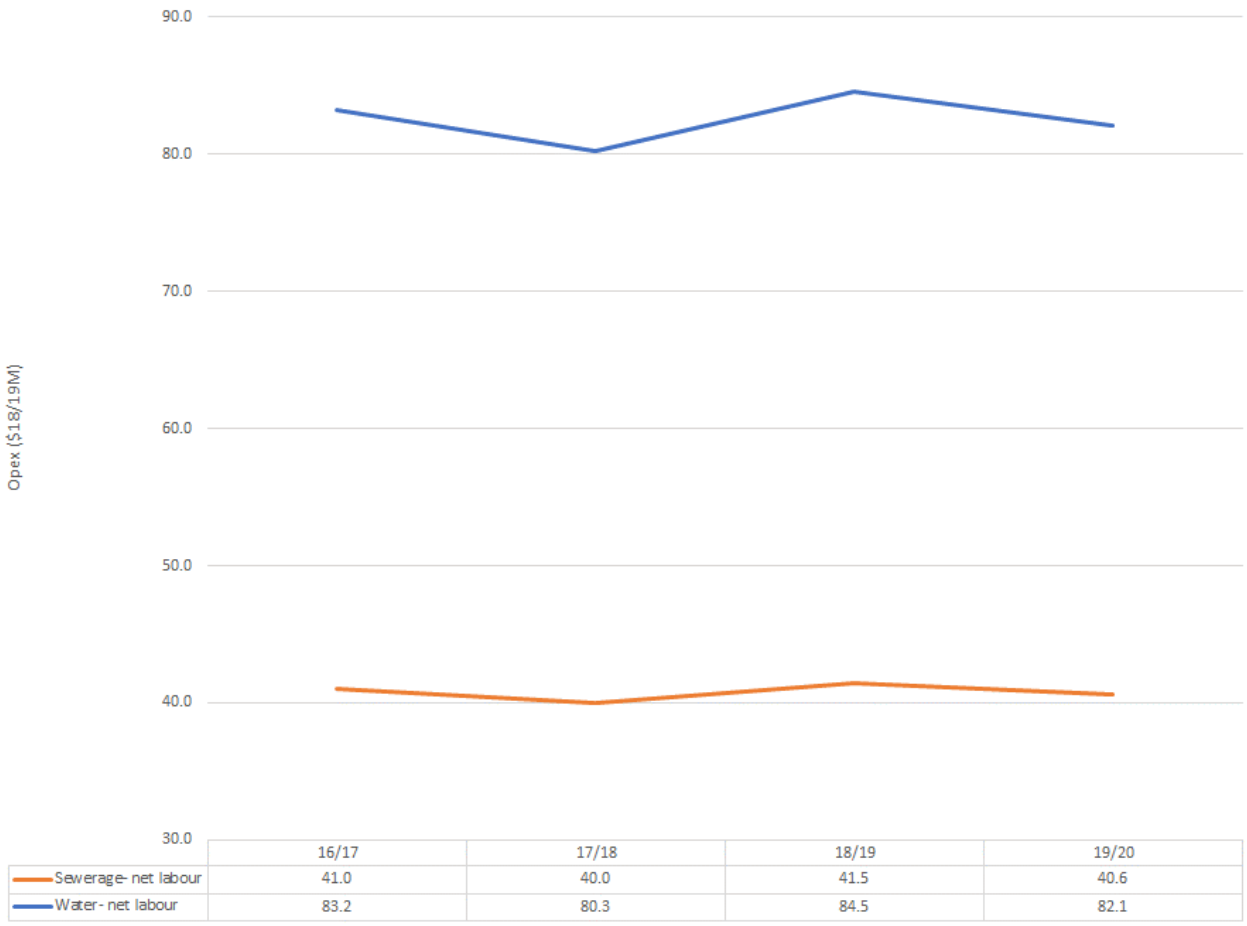
SA Water has made a normalisation adjustment to increase net regulated labour costs by $0.8million (or $0.9 million of total operating expenditure including unregulated). It has provided the following explanations:

- $400k adjustment for the Customer Delivery Group. SA Water has explained that the Customer Field Services Resourcing Project (Initiative 416) was approved by the SLT mid-way through 2018/19 and the budget entered for 2019/20 is $500k. The Customer Field Services recruited seven new Construction and Maintenance Workers to help reduce the fatigue and safety risks for field staff. These roles were recruited later in Q4 of 2018/19 so the costs for seven new staff are not reflected in the 2018/19 base.
- An additional increase of $200k for the Governance, Planning & Regulation Group due to vacant senior positions which SA Water expect to be filled in early 2019/20.
- $300k adjustment for the Customers, Strategy & Innovation Group due to:

- Increase in headcount for Remote Communities ($40k).
- An additional approved FTE in Media and vacancies from 2018-19 being filled in early 2019-20 ($260k).

We note that it is normal for a business to be under pressure to deliver within operating expenditure budgets and to have a number of staff vacancies. We are not convinced that these are, in themselves, strong justifications for an increase in base year operating expenditure.

We also note that after SA Water's proposed normalisation, 2018/19 net labour operating expenditure is higher than all other years in RD16, including its own budget for 19/20[11] (see Figure 4-8). It is not clear to us why normalisation should make net labour operating expenditure higher than budgeted in 2019/20.



	16/17	17/18	18/19	19/20
Sewerage- net labour	41.0	40.0	41.5	40.6
Water- net labour	83.2	80.3	84.5	82.1

Figure 4-8 Net labour costs (18/19 figures are SA Water normalised figures)

Source: SA Water document: "A. RD16 performance breakdown"

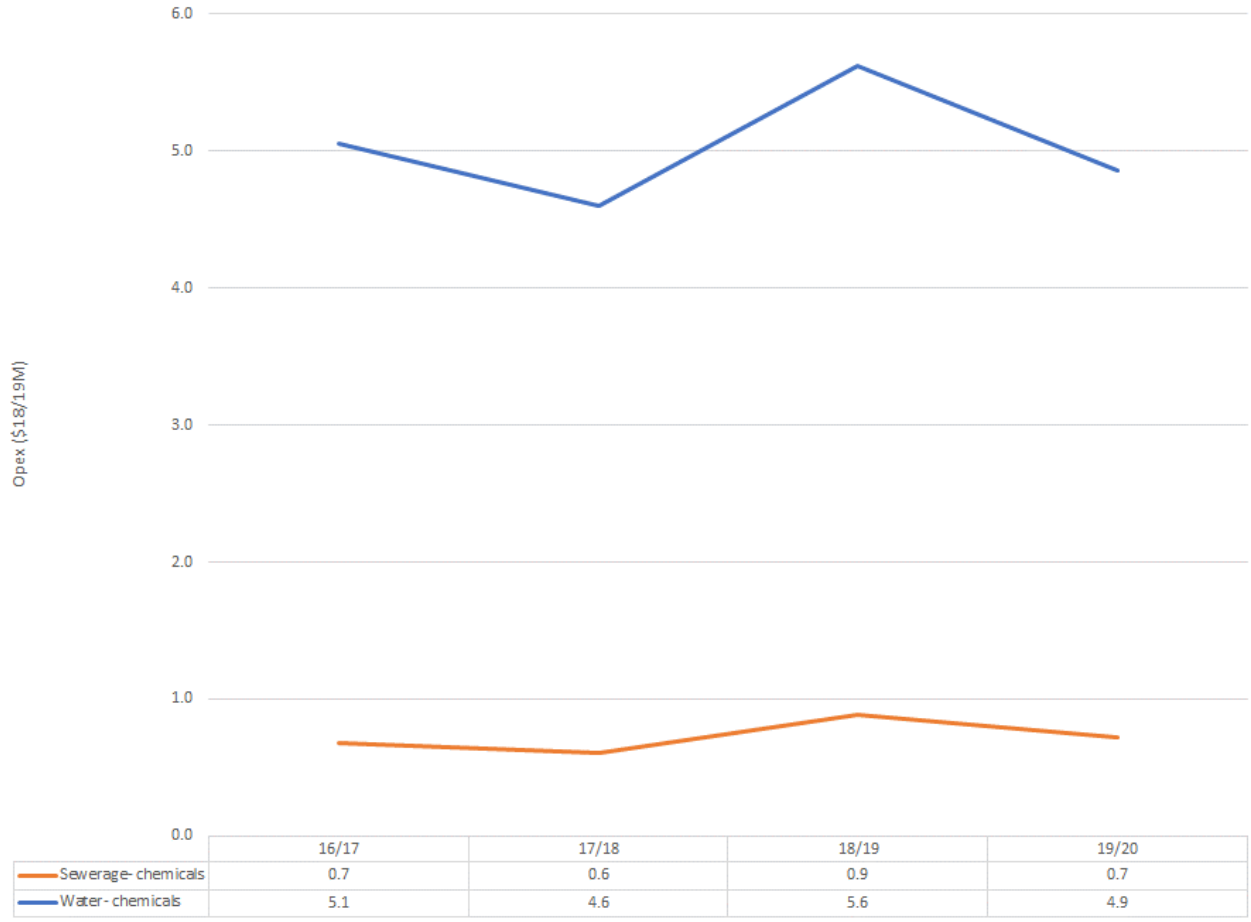
We do not consider that SA Water has made a robust case for an increase in net labour operating expenditure in the base year. Instead we propose an adjustment which reduces base year net labour operating expenditure to match SA Water's budget for 19/20 ($122.7 million). This is also similar to the average of the two prior years ($122.3 million). This results in a normalisation reduction of $2.5 million rather than an increase of $0.8 million.

[11] According to SA Water document 'A. RD16 performance breakdown'

4.3.2.5 Chemicals

SA Water has made a reduction of $0.7 million to take account of unusually high demand in 2018/19 (and therefore treatment volumes) and higher than normal disposal of black sludge from Happy Valley WTP.

However, we note that, as seen below, even after SA Water's proposed normalisation, 2018/19 chemical operating expenditure is higher than all other years in RD16, including its own budget for 2019/20[12].



	16/17	17/18	18/19	19/20
Sewerage- chemicals	0.7	0.6	0.9	0.7
Water- chemicals	5.1	4.6	5.6	4.9

Figure 4-9 Chemical costs (18/19 figures are SA Water normalised figures)

Source: SA Water document: "A. RD16 performance breakdown"

We propose an adjustment which reduces base year chemical operating expenditure to match SA Water's budget for 19/20 ($5.6million). This is also consistent with the average of the expenditures from 2016/17 and 2017/18 of $5.5 million.

This results in a normalisation reduction of $1.6 million rather than $0.7 million.

4.3.2.6 Deferral of asset decommissioning and sludge disposal work

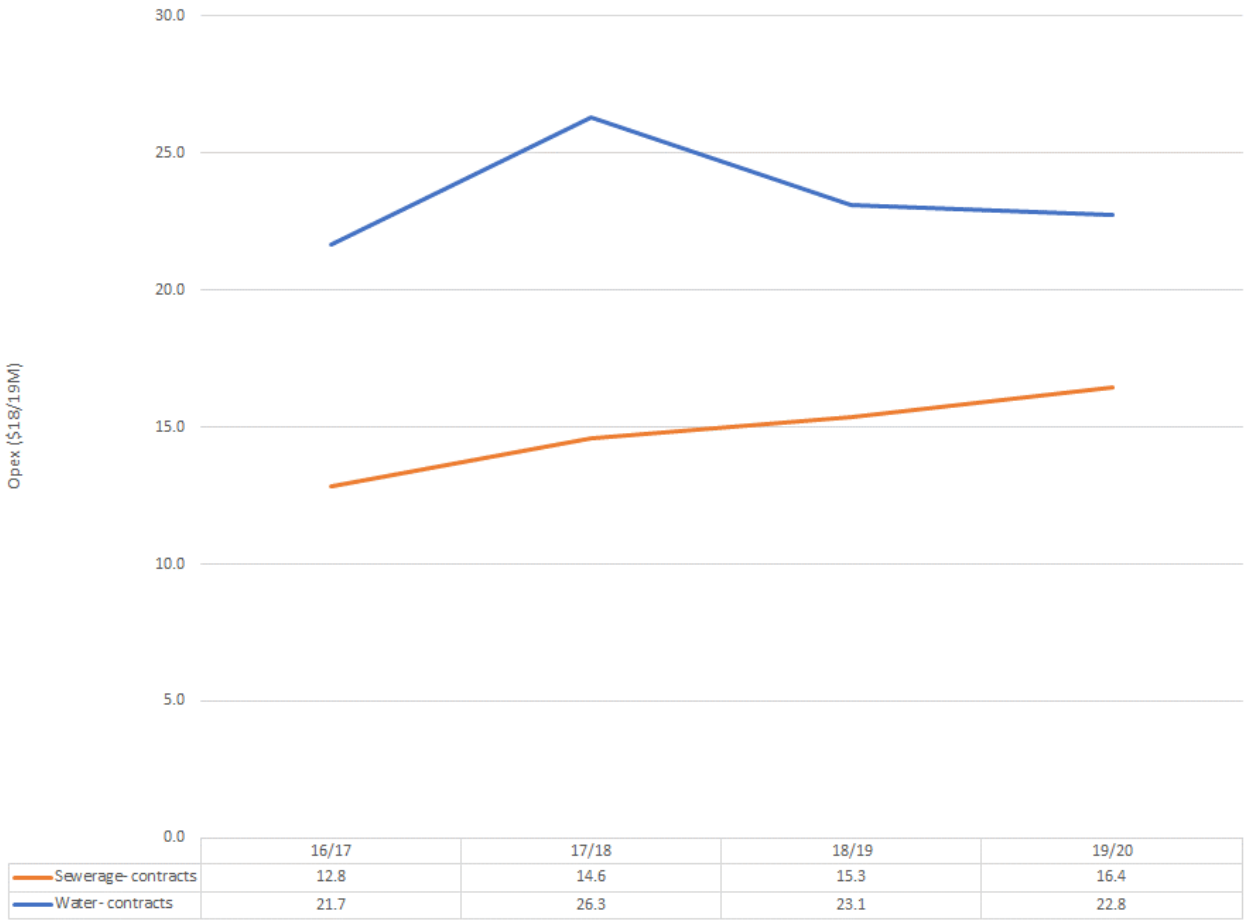
SA Water has applied a $1.7M adjustment to increase normalised 'contracts' expenditure to take account of deferred activities. It has provided the following explanations:

> Asset decommissioning was not undertaken during 2018/19 due to a focus on achieving "underlying operating expenditure". SA Water estimates that this program of works is normally (and budgeted) at about $800k per year.

[12] According to SA Water document 'A. RD16 performance breakdown'

> Sludge disposal costs were apparently rationalised during 2018/19 for the same reason. SA Water states that expenditure was $1m compared to normal (and budgeted) disposal costs of approximately $1.5m per year.

Contracts expenditures in 2018/19 were $36.8M (pre-normalisation) or $38.5M after normalisation. This compares to the average of expenditures from 2016/17 and 2017/18 of $37.7M (see Figure 4-10). Budgeted expenditures in 2019/20 are higher than this at $39.2M, presumably to take account of activities deferred in 2018/19.



	16/17	17/18	18/19	19/20
Sewerage- contracts	12.8	14.6	15.3	16.4
Water- contracts	21.7	26.3	23.1	22.8

Figure 4-10 Contracts operating expenditure (18/19 figures are SA Water normalised figures)

Source: SA Water document: "A. RD16 performance breakdown"

SA Water's proposed adjustment is based on two items of lower than normal spend. Instead of adopting SA Water's proposed adjustment of $1.7 million based on these two items, we recommend a normalisation adjustment increase of $0.9million. This adjusts contracts operating expenditure to be equal to the average expenditure in 2016/17 and 2017/18.

4.3.2.7 Treatment plant contracts

SA Water has proposed a reduction of $1.1 million for treatment plant contracts to take account of higher costs in the Riverland Treatment Plant Contracts due to increased production associated with higher customer demand.

This leads to lower normalised treatment plant contract expenditure ($26.7M) than in 2016/17 and 2017/18 (average of $27.7 million) but is still a little higher than SA Water's 2019/20 budget of $26.4 million. We therefore recommend accepting SA Water's proposed adjustment.

4.3.2.8 One-off site restoration cost

SA Water has proposed a reduction of $1.4 million for one-off site restoration. We have not reviewed this item in detail but recommend accepting SA Water's proposed adjustment.

4.3.2.9 Murray Bridge WWTP

In its revised normalisation SA Water proposed an additional base year adjustment of $1.0 million for Murray Bridge WWTP operating expenditure.

The additional operating expenditure is part of an Environmental Improvement Programme (EIP) scheme to cease operating Murray Bridge WWTP and move to an alternative site to better manage odour and to service population growth profile.

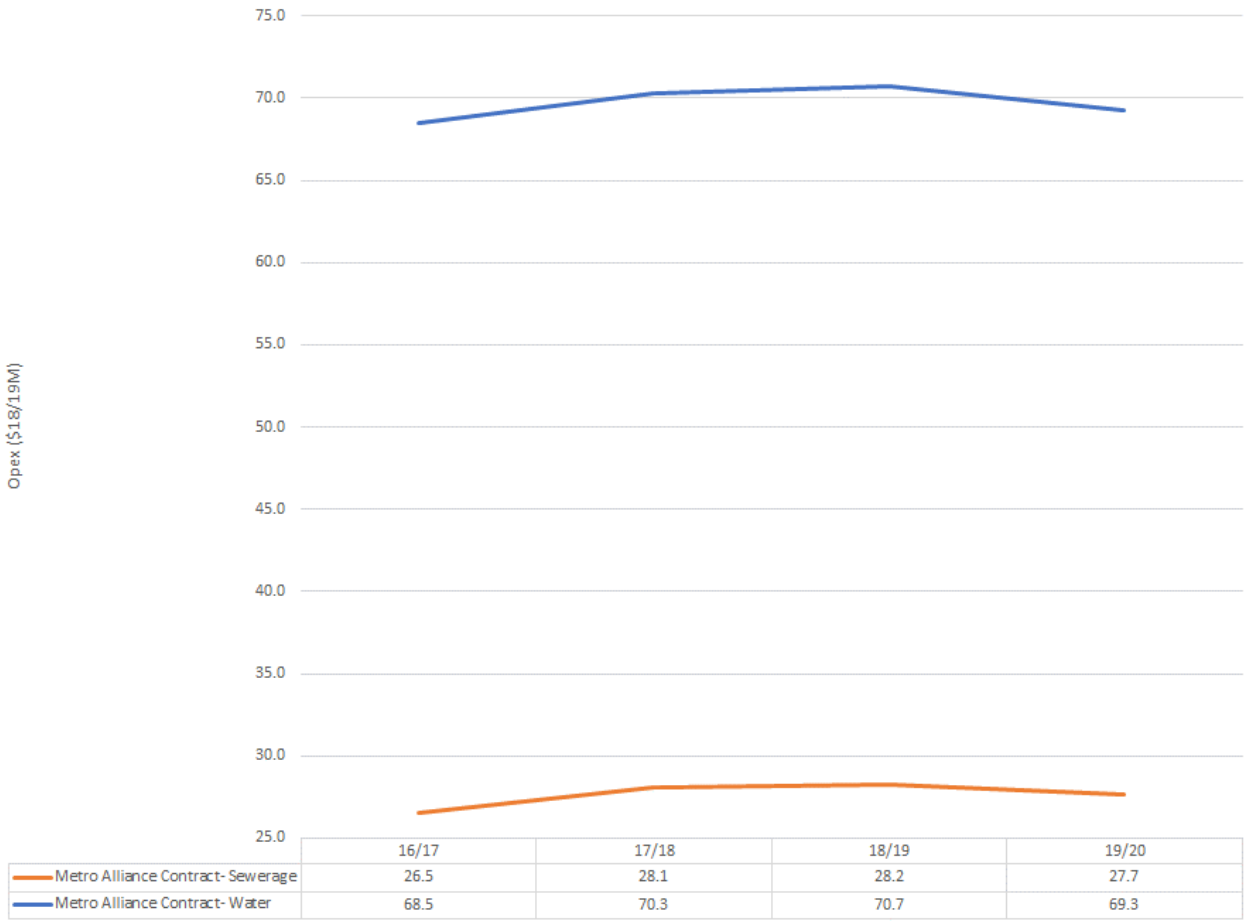
The capital expenditure procurement included a period of operation and maintenance for the new wastewater treatment plant for proving purposes.

The justification provided by SA Water has not clearly articulated why this higher operating expenditure should be carried forward to the RD20 base year, considering that there should be offsetting benefits from not having to operate the older Murray Bridge WWTP and the finite proving period. We therefore recommend not accepting this normalisation.

4.3.2.10 Metro Alliance

SA Water initially proposed no normalisation adjustment for the Metro Alliance costs. However, in its December 2019 revised normalisation, it proposed a reduction in base year operating expenditure of $1.0 million to take account of acceleration of Allwater works in 2018/19. It has explained that in 18/19 a number of works were accelerated through Allwater to improve customer outcomes in the CBD area.

It is difficult to reconcile the financial reports provided for the Alliance with the operating expenditure line "Metro Alliance Contract" provided in the SA Water document "A. RD16 performance breakdown", presumably because of the allocation of some costs to capital expenditure, other operating expenditure lines and non-regulated operating expenditure. However, we note that expenditures reported against the Metro Alliance Contract line in "A. RD16 performance breakdown" ($98.9 million) is $2.2 million higher than the average of the two prior years ($96.7 million) and $2.0 million higher than budgeted for 2019/20 ($96.9M) (see Figure 4-11).



	16/17	17/18	18/19	19/20
Metro Alliance Contract- Sewerage	26.5	28.1	28.2	27.7
Metro Alliance Contract- Water	68.5	70.3	70.7	69.3

Figure 4-11 Metro Alliance contract operating expenditure (no normalisation)

Source: SA Water document: "A. RD16 performance breakdown"

We recommend a $2.0 million reduction to make Metro Alliance operating expenditure equal to the 2019/20 budgeted figure from “A. RD16 performance breakdown” and at a similar level to the 2016 to 2018 average spend level.

4.3.2.11 Other changes

SA Water has also applied a number of other changes including:

- $0.2 million increase due to training budget underspend, allocated to “office expenses”
- $0.2 million reduction due to a monthly payment for Brookfields not having been accrued in 2017/18 leading to 13 months of the contract in 2018/19.

We do not consider that training budget underspend to be, in itself, a robust justification for a normalisation adjustment. We therefore recommend just allowing the $0.2 million reduction for the Brookfields accrual.

4.3.2.12 Balancing reduction

Initially SA Water applied a ‘balancing adjustment’ consisting of a $4.3 million reduction in operating expenditure to make normalised operating expenditure match the RD16 Determination figure of $479.0 million. In December 2019 it proposed a reduced adjustment of $1.8 million due to the additional normalisations applied.

We do not recommend incorporating this adjustment because a balancing adjustment is not justified in its own right and the adjustments we have recommended suggest normalised operating expenditure below the level SA Water was targeting.

4.3.2.13 Changes from 18/19 to 20/21

GRN adjustment

SA Water has highlighted[13] that there has been a change in the cost allocation methodology from RBP16 to RBP20. In RD16, expenditure on GRN was treated as regulated operating expenditure, therefore appearing in the final 2018/19 regulated accounts. However, a change in the methodology for RBP20 means that the associated revenue and expenditure is removed from the regulated business. In its revised December 2019 normalisation, SA Water proposed a reduction in base year operating expenditure of $1.3 million to take account of this removal from RD20 operating expenditure. We recommend accepting this adjustment.

Efficiencies between 18/19 and 20/21

In its RD16 Determination, the Commission applied an incremental general efficiency of $4.1M in 2019/20[14].

In RBP16, SA Water also proposed additional IS-enabled efficiencies of $2.2M[15]. This compares to a projected increase in IT opex between 2018/19 and 2019/20 of $0.5M[16], leading to a net saving from the IT program in 2019/20 of $1.8M.

We have applied these efficiencies to derive the base year 20/21 operating expenditure.

4.3.3 Benchmarking

SA Water has commissioned a study which uses the Bureau of Meteorology’s National Performance Report (NPR) data for 2017/18 to benchmark operating expenditure.

It compares SA Water’s expenditure to “Major Water Peers”. The same methodology is used as for the RD16 review, employing a metric called “CLD” which it defines as:

$$CLD = C^{0.5} \times L^{0.3} \times D^{0.2}$$

Where C is the number of customers, L is the length of infrastructure and D is customer demand.

[13] See RD20.300
[14] Incremental general efficiency between 2018/19 and 2019/20 taken from Table 7.3 of the Final Determination (June 2016) expressed as $3.8M in $ December 2014.
[15] SA Water proposed incremental savings of $2.1M (Dec14$M or $2.2M in $18/19M) from 2018-19 to 2019-20, see Table 7.2 of ESCOSA’s Final Determination, June 2016.
[16] Source: "DF0018_IT OPEX RBP 2016 uplift business case_confidential"

SA Water has not provided evidence as part of its submission that the CLD approach is the best way to take account of the drivers governing operating expenditure. The study demonstrates that there is correlation between each of the variables and operating expenditure. However, it is not clear if this is due to collinearity between the "independent" variables and if the powers and multiplication approach is the best way to take into account their combined effect. It is therefore difficult for us to have confidence in the CLD method, especially as multiplicative metrics may be vulnerable to instability and it is not clear that the length of assets is a key metric in all cases, compared to pumping requirements or water source type for example.

SA Water has also carried out some simple unit operating expenditure comparisons using 2017/18 National Performance Report[17] (NPR) data. We have carried out our own benchmarking of trends (2014/15 to 2018/19) in water and sewerage operating costs and high level benchmarking on a volumetric and per-customer basis using 2018/19 NPR data and SA Water's normalised 2018/19 operating expenditure.There are difficulties in benchmarking performance and cost data relating to Australia's water utilities. These include differing business structures and scope of services, inconsistent interpretation of the National Performance Report definitions and a lack of rigour in the data submitted for the NPR. Despite these limitations, some useful insights can be gained from comparisons using this dataset.

Figure 4-12 charts the combined water supply and wastewater operating costs for major Australian water utilities from 2014/15 to 2018/19. In the National Performance Report dataset, major water utilities are defined as those with more than 100,000 customers.

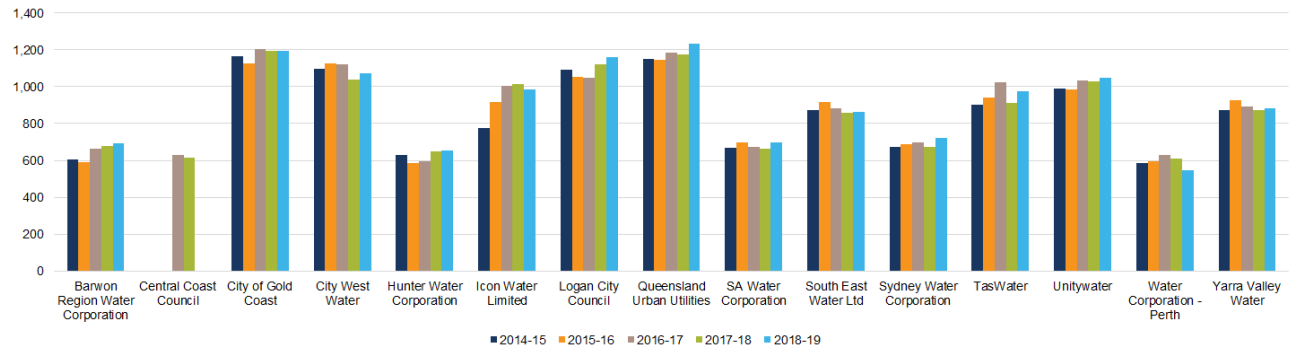


Figure 4-12 Combined water supply and wastewater operating cost per property for major water utilities 2014/15 - 2018/19 ($nominal/property)

In 2018/19, SA Water had the fourth lowest combined operating cost per property when compared to the comparator group of major water utilities. Throughout all five years shown, SA Water's combined operating cost per property has been in the lowest third of this comparator group. Its combined operating cost has also remained fairly steady over this period, at $666 to $734/property. W.

Figure 4-13 charts the water supply operating costs for major Australian water utilities from 2014/15 to 2018/19.

[17] Previously coordinated by the National Water Commission and now coordinated by the Bureau of Meteorology. More information and the latest reports can be obtained here: http://www.bom.gov.au/water/npr/

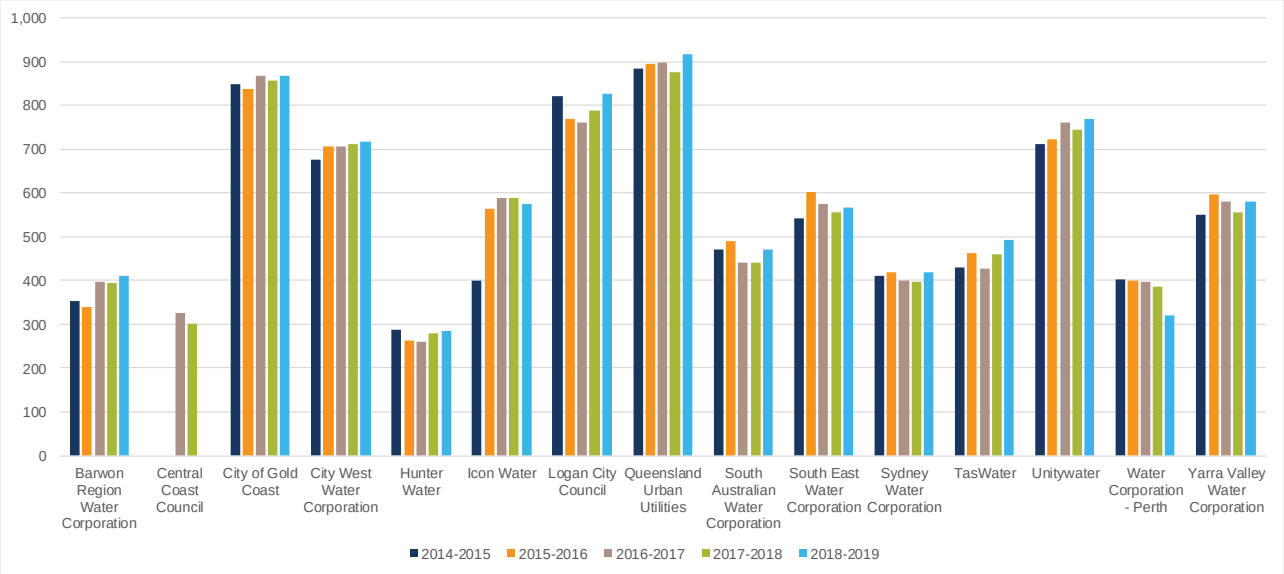


Figure 4-13 Water supply operating cost per property for major water utilities 2014/15 - 2018/19 ($nominal/property)

When considering water supply operating costs alone, SA Water had the fifth lowest operating cost per property in 2018/19. However, in the other four years, SA Water's water supply operating cost per property has been just outside the lowest third of this comparator group. Its water supply operating cost per property has remained fairly steady over this period, at $441 to $490 per property.

Figure 4-14 charts the wastewater operating costs for major Australian water utilities from 2014/15 to 2018/19.

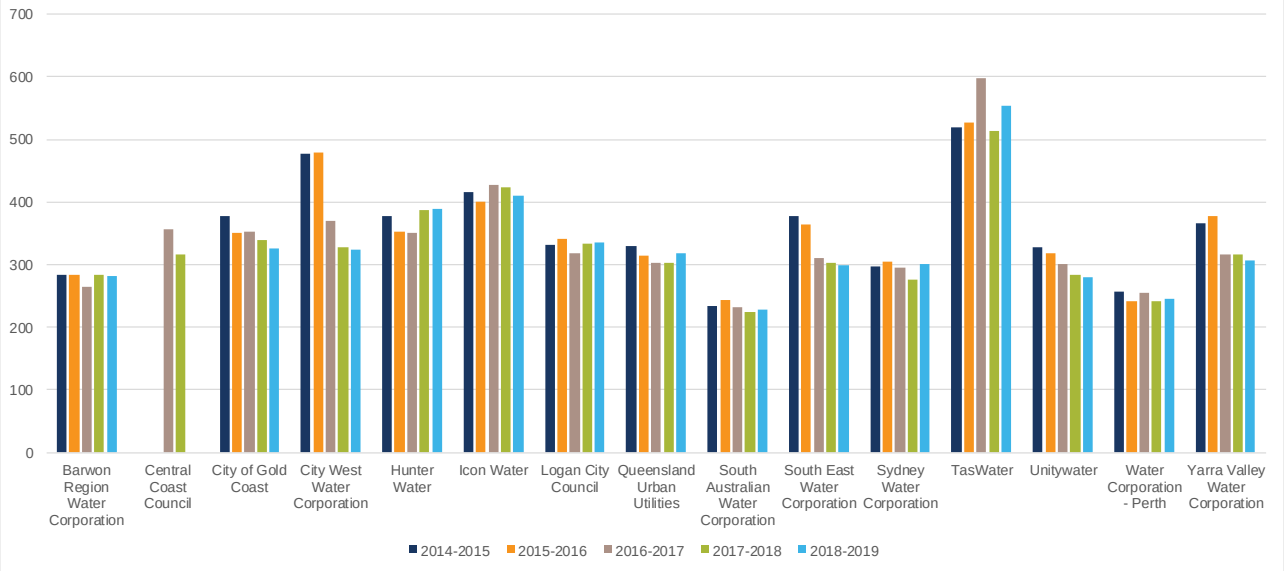


Figure 4-14 Wastewater operating cost per property for major water utilities 2014/15 - 2018/19 ($nominal/property)

When considering wastewater operating costs alone, SA Water has had the lowest operating cost per property in all five years except 2015/16, where it had the second lowest operating cost per property. Its wastewater operating cost per property has remained fairly steady over this period, at $225 to $244/property.

Given that SA Water currently has the lowest wastewater operating cost per property in this comparator group, its combined operating costs are largely driven by its water supply operating costs. Operating costs per property for both water supply and wastewater have remained fairly steady over this five-year period, although small peaks in expenditure have occurred in 2015/16 and 2018/19.

Based on this analysis, and the benchmarking presented by SA Water, we conclude:

> SA Water has generally low unit operating expenditure for both water and sewerage relative to its peers. However, it has above average capital expenditure per property for both water and sewerage (see graphs below) and this may be driving some of the apparent operating expenditure efficiency. This may be because some of the comparators face costs as operating expenditure which SA Water deals with as capital expenditure (e.g. bulk water supply or BOT contracts). It could also be because SA Water has tended to favour higher capital expenditure, lower operating expenditure solutions, or investment in capital expenditure for operating expenditure efficiency.

> On the low unit operating expenditure:

- SA Water's combined water and sewerage normalised operating expenditure appears to be efficient on both a volumetric (top ~10-15%) and per property basis (top ~5%). It appears more efficient on a per property basis than on a volumetric basis. This is probably because SA Water has lower average volume per connection (304 kL water and 200 kL sewage using NPR data) than the average of all utilities (326 kL water and 221 kL sewage).
- The sewerage service appears to be more efficient (top ~5%) than the water service (top ~20-40%). The reason for this is not clear. However, given that the basis of allocation of indirect costs between water and sewerage varies between utilities, the combined water and sewerage efficiency is a more reliable measure of overall efficiency than the individual service.

The unit operating expenditure analysis is summarised for water and sewerage separately in Appendix. A. The combined water and sewerage unit operating expenditure efficiency is summarised graphically below.

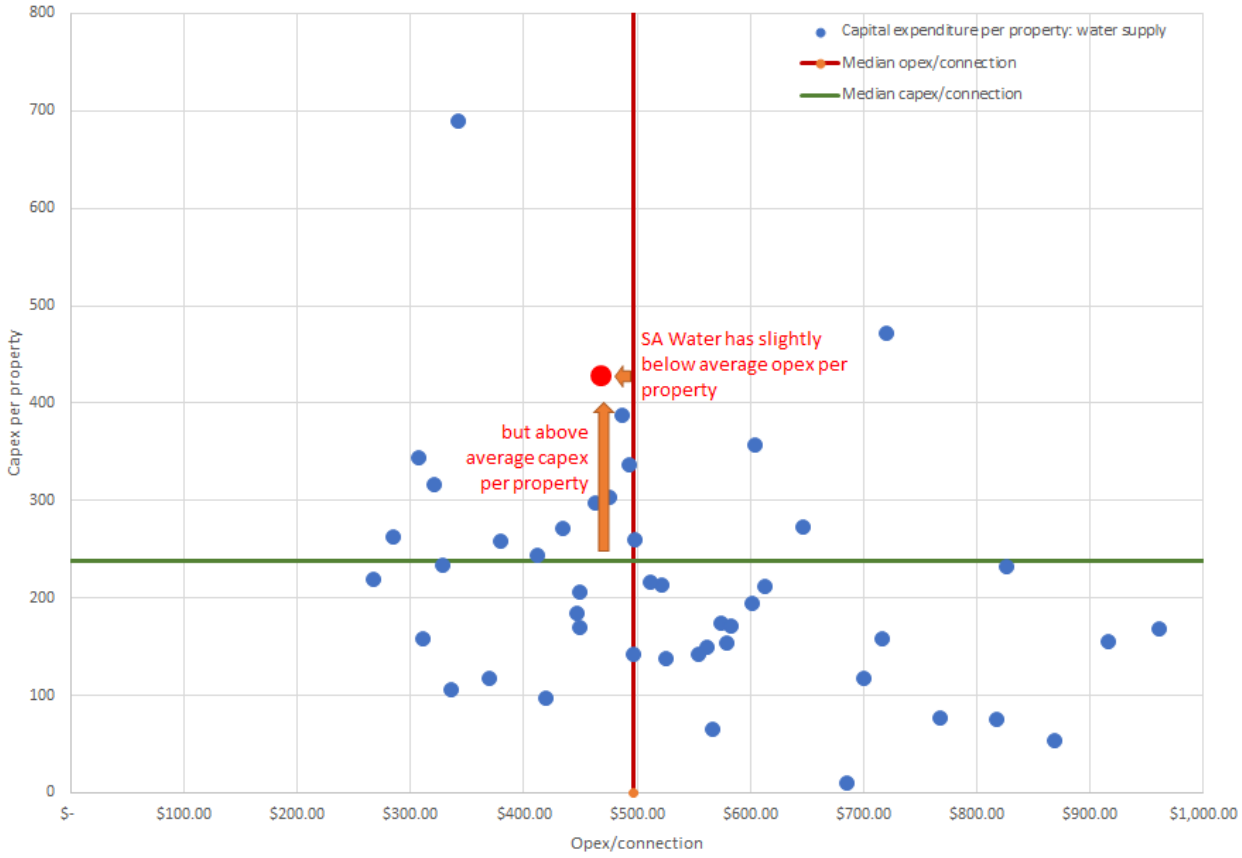


Figure 4-15 Comparison of water operating expenditure and capital expenditure per property

Note: All data from NPR dataset

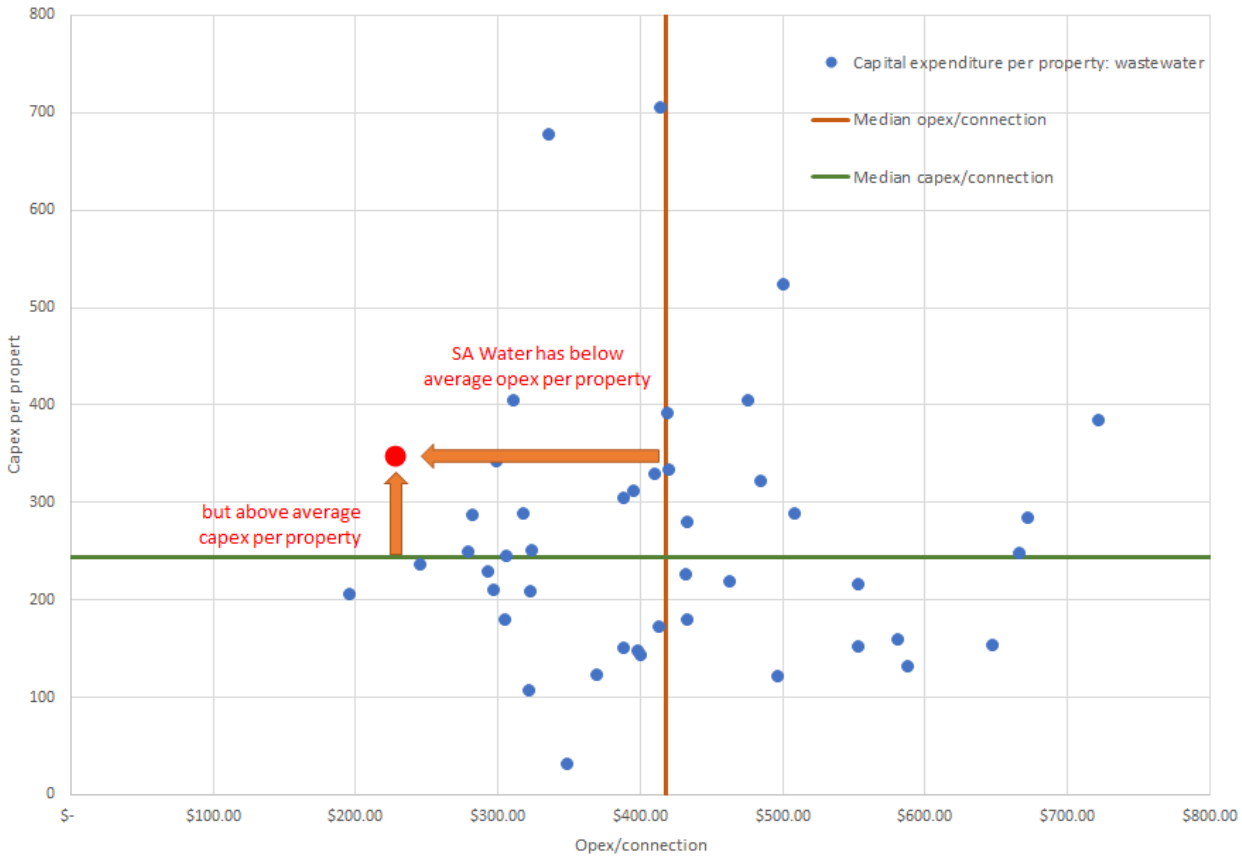


Figure 4-16 Comparison of sewerage operating expenditure and capital expenditure per property

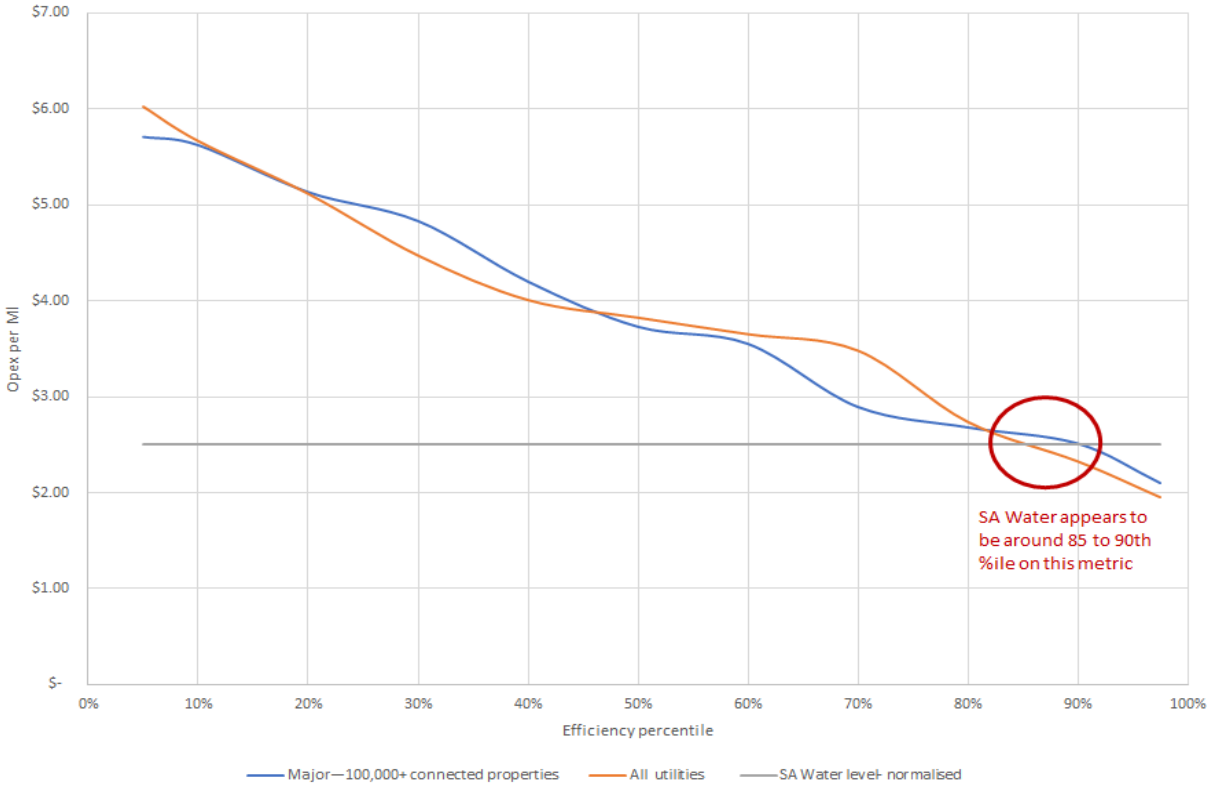


Figure 4-17 SA Water normalised total water and sewerage volumetric efficiency

Note: All data from NPR dataset

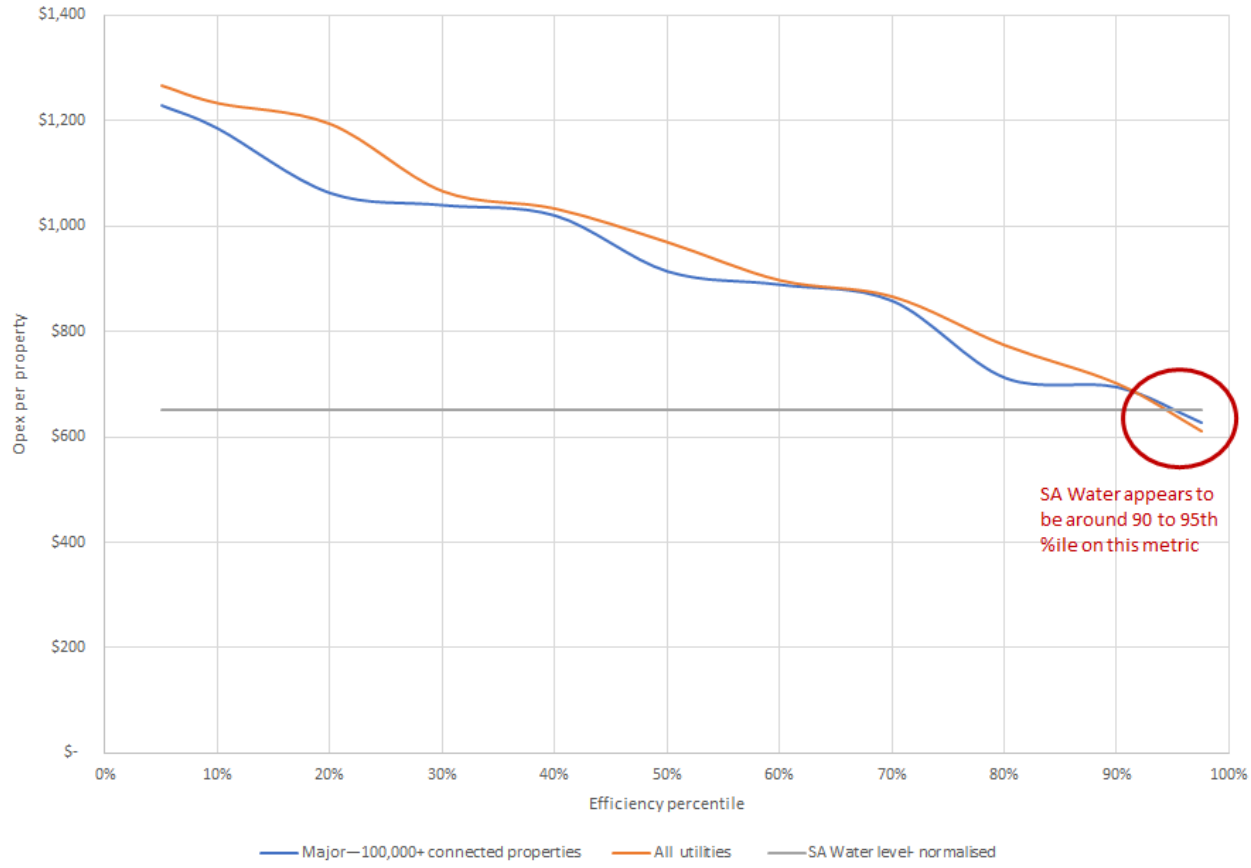


Figure 4-18 SA Water normalised total water and sewerage efficiency per property

4.3.4 Conclusion

Benchmarking is not a precise science and many factors which are not taken into account above, can affect the unit cost of providing water and sewerage services. On the basis of the simple benchmarking we have carried out it is clear that SA Water has low unit operating expenditure. However, it has above average capital expenditure per property for both water and sewerage and this may be driving some of the apparent operating expenditure efficiency.

We recommend a different basis to derive an efficient base year operating expenditure for the start of the RD20 period as set out below:

> We have applied an alternative normalisation which reduces 2018/19 operating expenditure to $462.7 million, below the figure of $479.0 million proposed by SA Water. We consider this a reasonable estimate for 'normal' operating expenditure. It is lower than the average operating expenditure from 16/17 and 17/18 of $469.3 million when wholesale electricity prices were unusually high.

> To project the normalised operating expenditure forward to the RD20 base year, we have also incorporated the efficiency savings expected in 2019/20. We have applied the Commission's RD16 Determination general efficiency saving of $4.1 million. We have also applied the net IT-enabled efficiency saving proposed by SA Water in RBP16[18]. These two efficiencies reduce RD20 base year operating expenditure by an additional $5.8 million to $456.9 million.

> We have also made an adjustment to take account of the change in accounting for GRN expenditure, reducing base year RD20 operating expenditure by a further $1.3 million resulting in an operating expenditure budget of $455.7 million.

[18] SA Water proposed incremental savings of $2.1M (Dec14$M or $2.2M in $18/19M) from 2018-19 to 2019-20, see Table 7.2 of ESCOSA's Final Determination, June 2016.

These adjustments are summarised in Table 4-4. The base year figures derived in this way do not include RD20 operating expenditure initiatives or other efficiencies which are dealt with in the following sections.

Table 4-4 Amended normalisation of operating expenditure ($18/19m)

	Water	Sewerage	Total
Final 18/19 regulatory opex	**369.7**	**138.1**	**507.7**
Adjustments to 18/19 opex			
Net Labour	-1.9	-0.6	-2.5
Metro Alliance Contract	-1.4	-0.6	-2.0
Contracts	2.1	-1.1	0.9
Treatment Plant Contracts	-0.8	-0.3	-1.1
Electricity	-22.6	-7.6	-30.2
Chemicals	-1.2	-0.4	-1.6
AGL contract termination	-8.4	0.0	-8.4
Brookfields accrual	-0.1	-0.1	-0.2
Normalised 18/19 opex	**335.3**	**127.5**	**462.7**
Adjustments to reflect changes between 18/19 and 20/21			
General Efficiencies in 19/20	-2.9	-1.1	-4.1
IT-Enabled Efficiencies in 19/20	-1.3	-0.5	-1.8
Normalised 20/21 opex	331.0	125.9	456.9
Adjustment for treatment of GRN expenditure	-0.6	-0.7	-1.3
Normalised 20/21 opex adjusted for GRN	**330.5**	**125.2**	**455.7**
For comparison: ***SA Water normalised opex***	***347.0***	***132.0***	***479.0***

4.4 Changes in the RD20 period

SA Water is proposing a reduction in operating expenditure relative to recent years, with an initial reduction (due to savings from the ZCEF program) followed by a steady increase back to $475.3 million by the end of the RD20 period. However, stripping out the savings associated with ZCEF, the underlying trend in SA Water's proposed operating expenditure is an average 1.7% p.a. increase relative to its normalised 2018/19 operating expenditure, as can be seen in Figure 4-19.

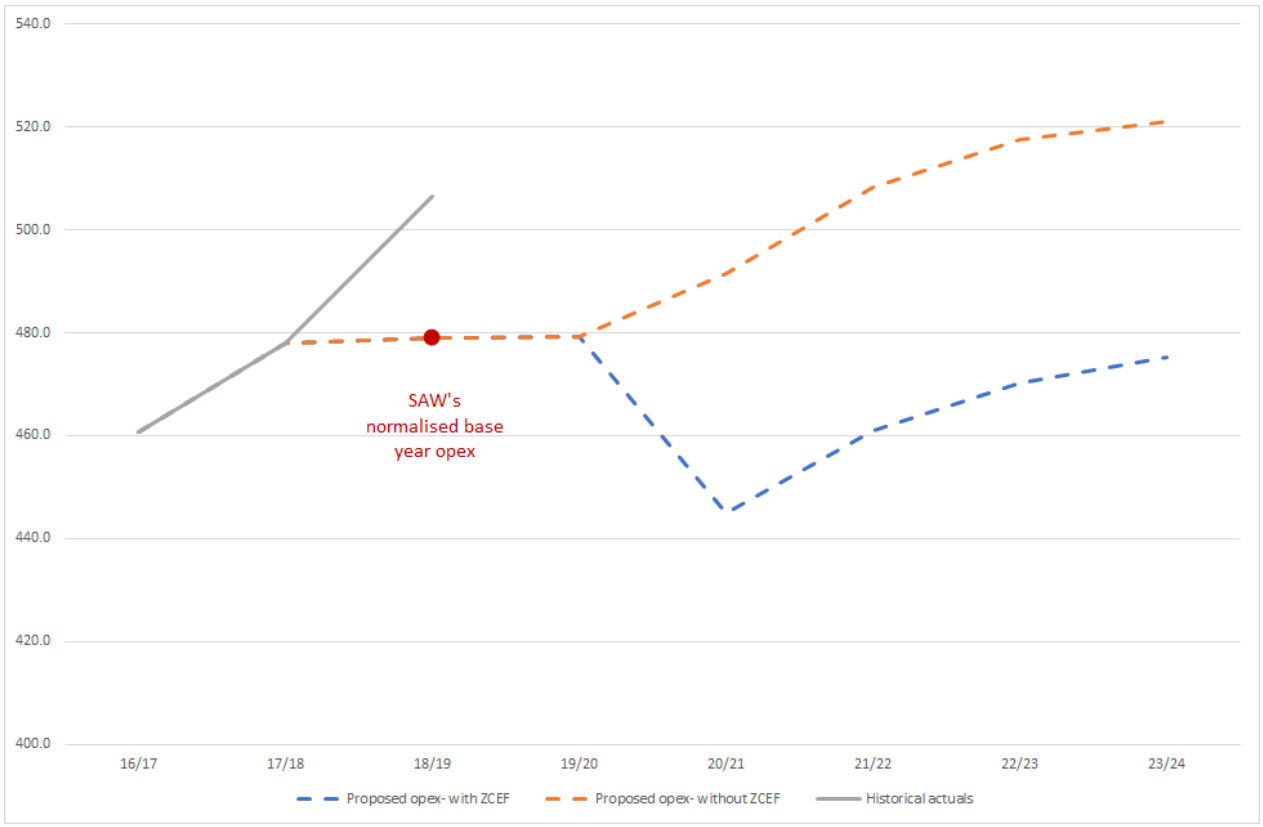


Figure 4-19 SA Water's historical and projected operating expenditure

Source: SA Water documents "A. RD16 performance breakdown" and "C. Ourplan2020 W and WW breakdown initiatives"

The major elements affecting SA Water's proposed change in operating expenditure relative to the base year are summarised in Figure 4-20 using SA Water's categorisation of expenditure.

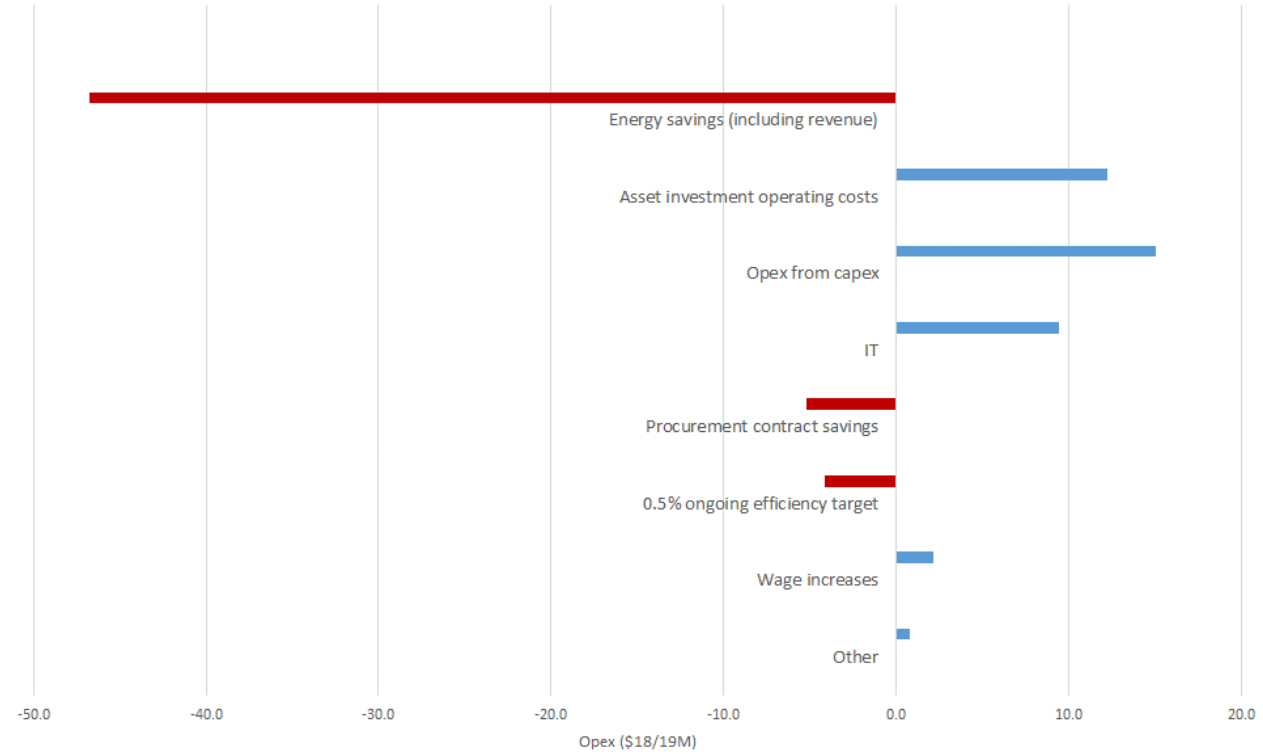


Figure 4-20 SA Water's proposed average variances in RD20 period relative to normalised base year

These variances are discussed one-by-one below.

4.4.1 Electricity costs and energy savings (ZCEF)

Although the electricity futures price trend set out in Section 5.3 suggests that there may be a further drop in wholesale prices in 2021/22 we have not recommended incorporating further reductions in electricity costs as the number of futures contracts declines to low levels from the start of 2022 onwards. This means we have limited confidence in futures prices as a guide to prices beyond this point. We have therefore assumed unchanged unit electricity costs from 2020/21 onwards.

SA Water has proposed significant savings associated with the ZCEF program (an average of $46.7 million per annum). As discussed above, we have excluded these savings from our recommended prudent and efficient operating expenditure.

4.4.2 Opex interventions

In its regulatory business proposal, SA Water has proposed an average increase of $12.2 million per year associated with what it terms 'asset investment operating costs'. The definition of this classification is not clearly set out by SA Water, but we interpret it as operating expenditure interventions.

It has provided a breakdown of what it has included in this category as follows[19]:

Maintain ($4.1m average p.a.)

- *Maintenance on ancillaries in sewerage network ($0.5*million*)*
- *Condition investigations across pumping mains ($0.2* million*)*
- *Prioritised investigations and maintenance of major non-pipeline assets (bores, tanks, wells) ($3.2* million*)*
- *Focus on major pipeline ancillary asset refurbishment ($0.2* million*).*

External obligations ($4.7 million, compared to $3.4 million in the RBP)

- *Sewerage reuse for compliance with Environmental Improvement Plans ($0.8* million*). We note that this is listed as a separate line item to 'asset investment operating costs' in the RBP breakdown[20] and assume it was included in the breakdown by mistake. We address this expenditure under Section 4.4.8 .*
- *Optimising WWTP performance ($1.2* million*)*
- *Sewerage odour reduction ($1* million*)*
- *Water dam and network operations ($0.5* million*)*
- *Non-electricity costs for Eyre ($1.2* million*).*

Improve ($3.7 million*)*

- *Mains cleaning to support reduction in type 1 and 2 overflows and sewerage gravity networks renewals ($2.2* million*)*
- *Water quality aesthetics improvements ($1.5* million*).*

Growth ($1 million*)*

- *This is an average value per year comprising initially of tankering costs in growth areas prior to full implementation of sewer network, following this the OPEX is associated with running the new infrastructure.*

In general, these increases were not supported by detailed business cases or alternative justifications. Therefore, it is difficult for us to review them with confidence.

[19] "Response to RD20.164 Part 1"
[20] Source: SA Water document "C. Ourplan2020 W and WW breakdown initiatives"

The list incorporates a number of proposed operating expenditure increases which SA Water has not demonstrated are justified increases relative to what it should already be carrying out as part of its regular business-as-usual operating activities.

We recommend allowing the following proposed increases in expenditure under 'improve' and 'growth'.

> We comment on the deterioration in Type 1 and Type 2 overflows from sewers in Section 6 and consider SA Water's proposed program to be prudent. We have also accepted SA Water's proposed operating expenditure increase.

> We also comment on the Metro Water Quality in Section 6, finding it to be prudent but recommending that it be profiled across six years rather than four. We have reprofiled the operating expenditure increases to reflect this longer implementation period.

> We have not been able to review the case for additional tankering in detail but accept that growth can lead to higher operating expenditure and therefore recommend accepting SA Water's proposed increase.

In its RBP 2020, SA Water explains that it proposes to invest $20 million in priority areas of the sewer network to reduce the impact of odour. It also proposes an additional $1 million per year "to optimise this investment and/or fund operational solutions where they will be more effective than an infrastructure solution". This project is not in the sample of capital expenditure projects reviewed. However, we consider that it is likely that the solutions will involve an increase in operating expenditure and recommend allowing SA Water's proposed increase for this.

We are not convinced that the proposed increases in 'maintain' expenditure, or the other items listed under 'external obligations', are additional activities which should lead to higher operating expenditure. We consider that these items should be part of 'business as usual' operating expenditure. In the absence of a new obligation or significant change in circumstance, simply identifying new activities is not in itself a justification for an increase in total opex. Whilst some new activities may be carried out in a period, other activities which took place previously may no longer be required, offsetting the increase in cost.

We note that Eyre has its own line item, examined below. We therefore recommend not allowing this increase in expenditure.

Our recommendations result in a $5.2 million per year average increase rather than SA Water's proposed $12.2 million per year.

4.4.3 Operating expenditure from capital expenditure

SA Water has proposed a number of operating expenditure increases linked to capital projects as summarised in Table 4-5. These lead to a $15.0 million average increase in operating expenditure in the RD20 period. We have recommended adjustments which limit this increase to a $10.3 million average increase.

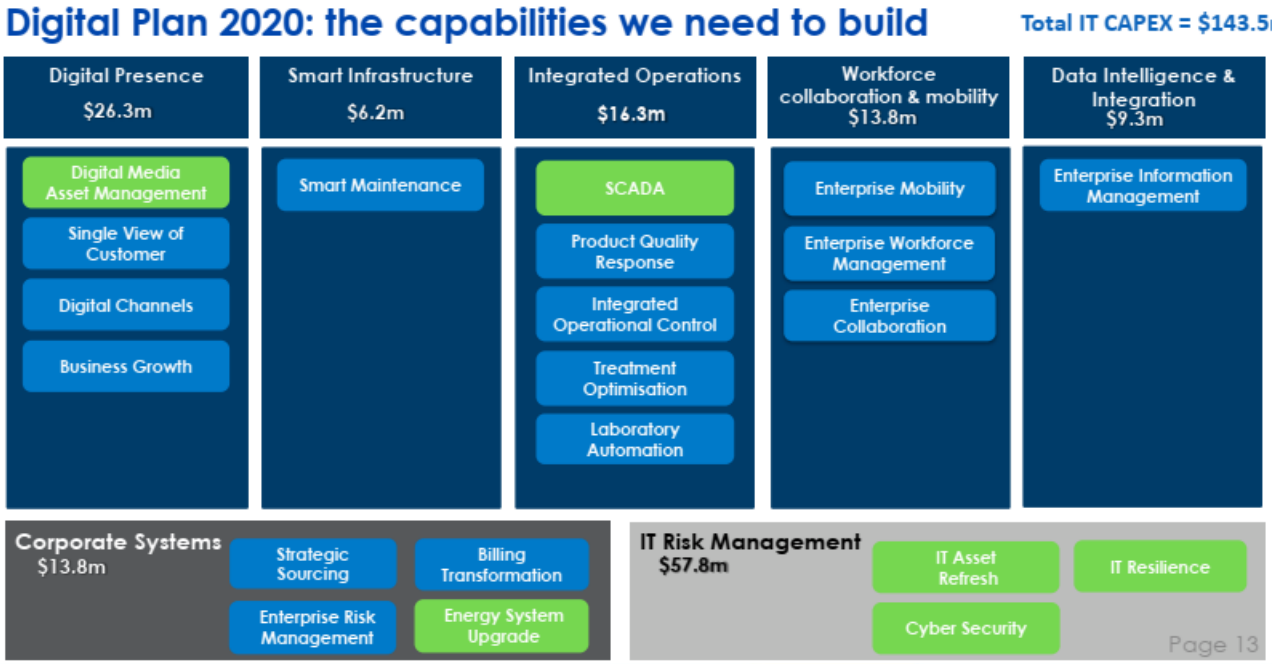
Table 4-5 Operating expenditure from capital expenditure ($18/19m)

	Average effect of SA Water proposed increase	Our view
Kangaroo Island desalination	0.8	This project is not in the sample of capital expenditure projects reviewed. The operating expenditure appears reasonable for the scale of scheme. We recommend accepting the operating expenditure increase if the scheme proceeds.
Upper Spencer Gulf capacity upgrade	1.6	This project is also not in the sample of capital expenditure projects reviewed and we do not have details underlying the proposed operating expenditure increase. However, we note that it is contingent on customer contracts being in place. The increase in operating expenditure ($2.7 million per year in 22/23) seems high given the scale of scheme, as it would be associated with very large increases in pumping or new assets out of proportion to the $23M capital expenditure. We recommend allowing a smaller increase of approximately $0.5 million per year if the scheme proceeds based on expert judgement in the absence of data. There was insufficient time to undertake further analysis of information supporting this increase.
Northern Adelaide	2.8	We recommend accepting this operating expenditure increase.

	Average effect of SA Water proposed increase	Our view
Irrigation Scheme		
Eyre Peninsula Desalination	5.2	As discussed in Section 5, we consider the project to be prudent and efficient. However, we have recommended an adjustment to reflect the fact that the proposed operating expenditure ($7.0M) is higher than indicated in the business case ($5.3 million per year.).
Recycled water expansion	0.1	As detailed in Section 5, we do not consider that this project (expansion of the Glenelg to Adelaide Parklands recycled water network to Tonsley Park) has been justified as prudent and efficient. This applies to the entire forecast capital expenditure. Accordingly, we have recommended adjusting operating expenditure to remove this increase.
Adelaide Desalination Plant contract	4.4	SA Water has proposed an increase in expenditure for the Adelaide Desalination Plant (ADP). Approximately half of this increase relates to energy costs (offset by sale of excess RECs). The other main element relates to increased expenditure on preventative maintenance in relation to aging assets[21]. The energy cost estimate was based on the assumption that the AGL contract remained in place[22]. Electricity costs are dealt with in Section 4.4.1. SA Water has not provided robust justification for the increase in energy costs for ADP. As such, we recommend accepting only the increase in preventative maintenance expenditure.

4.4.4 IT costs

SA Water has developed a "Digital Plan 2020W which incorporates $143.5 million of IT capital expenditure, summarised by Digital Theme as shown in Figure 4-21.



[21] Source: SA Water document "Response to RD20.275"
[22] Source: SA Water document "Response to RD20.313, RD20.315 and RD20.316"

Figure 4-21 Digital Plan 2020: IT capital expenditure

Source: "SA Water document "20190927 - response to RD20.64 - IT slide pack"

SA Water has identified the operating expenditure impact for each of these Digital Themes. Overall SA Water expect the additional operating expenditure of the program (just under $10.0 million) to be offset by the operating expenditure savings (approximately $10.0 million) as illustrated in Figure 4-22, leading to an operating expenditure neutral effect.

This is because some of the thematic areas are net operating expenditure saving (e.g. 'smart infrastructure' and 'workforce collaboration and mobilisation') counterbalancing the net operating expenditure cost themes (data intelligence and IT risk management for example).

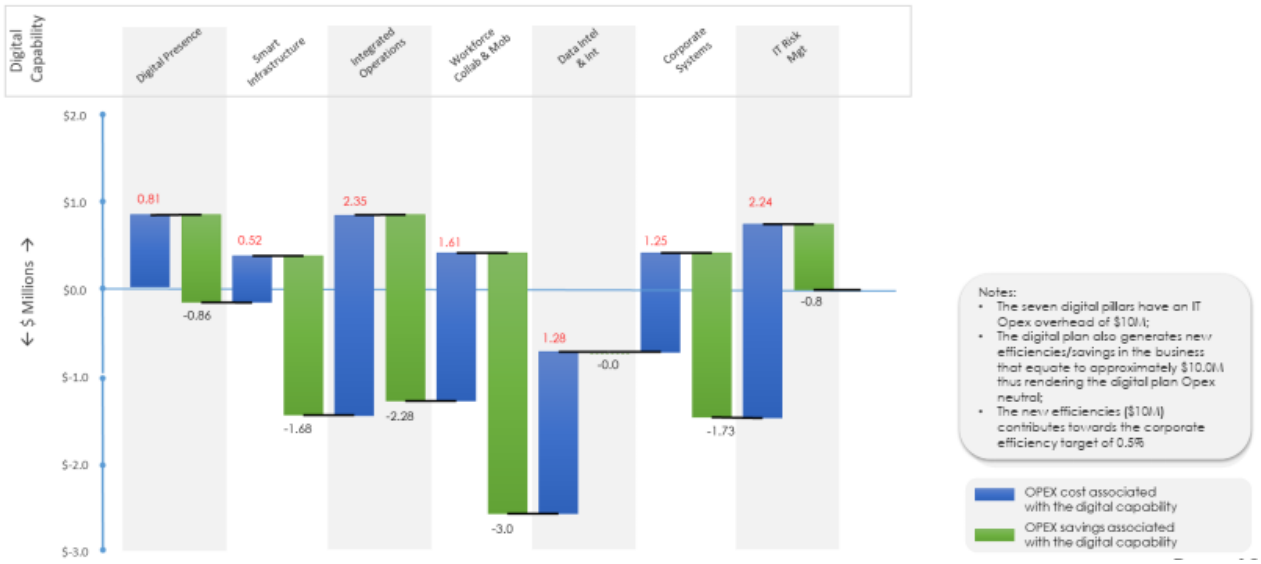


Figure 4-22 Digital Plan 2020: Net operating expenditure impact

Source: "SA Water document "20190927 - response to RD20.64 - IT slide pack"

We understand that the opex costs and savings in Figure 4-22 relate to 2023/24 when SA Water projects additional IT opex of $9.9 million p.a. associated with its RD20 program.

SA Water has stated that the $10.0 million of operating expenditure savings "contribute towards the corporate efficiency target of 0.5%"[23]. However, the RBP only incorporates an average of $4.2 million of "0.5% ongoing efficiency target" savings with a maximum savings of $6.6 million p.a. in 2023/24. It therefore appears that these operating expenditure savings have not been (fully) incorporated in the RBP, especially as we would expect other programs or initiatives to contribute to the "ongoing efficiency" savings.

We recommend accepting SA Water's proposed RD20 operating expenditure increases while also incorporating the operating expenditure savings to reflect the neutral operating expenditure impact that they have projected.

SA Water has also proposed an increase in opex associated with its RD16 IT program, under the titles 'IT licencing costs above inflation' and 'IT operating cost uplift (current capital program)'. SA Water's proposed increase in opex associated with its RD16 IT program results in $3.9 million p.a. average increase in opex. The largest component of this increase is the "IT operating cost uplift (current capital program)" with an average impact of $3.2 million p.a. SA Water has not provided robust justification for a near-doubling of IT opex relative to the base year and we have not recommended allowing for this increase.

Our recommendations are summarised below.

[23] Source: "SA Water document "20190927 - response to RD20.64 - IT slide pack"

Table 4-6 SA Water proposed increase in IT opex ($18/19m)

	Average effect of SA Water proposed increase	Our view
RD20 IT investment operating cost	5.6	Accept the opex increases, but also apply equal opex savings to take account of SA Water's stated opex neutral expectation
IT licencing cost above inflation	0.6	SA Water has provided reasonable explanation for these increases and we recommend allowing them.
IT operating cost uplift (current capital program)	3.2	SA Water has not provided robust justification for this increase. We have not recommended allowing it.

4.4.5 Procurement cost savings

SA Water has proposed a net saving of $5.1 million rising to $5.2 million per year in the RD20 period, which it has called a procurement cost saving. This relates to the decision to use the exit clauses in the Renewable Energy Sales Agreement relating to the purchase of grid electricity and Renewable Energy Certificates for the Adelaide Desalination Plant.

The decision led to a one-off $8.4 million charge for termination of the contract. This cost is more than outweighed by the anticipated gross savings of approximately $8.4 million per year[24].

The termination cost was taken in the 2018/19 accounts, as discussed under normalisation above, so adversely affects operating expenditure in the RD16 period whilst leading to benefits in the RD20 period. To take this into account SA Water has incorporated lower net savings than actually expected in order to claw back the termination cost.

We consider the principle of allowing SA Water to claw back operating expenditure costs in one period which lead to significant operating expenditure savings in the next by offering a lower saving in that next period to be reasonable, as it avoids creating adverse incentives around operating expenditure decision-making spanning different regulatory periods.

The analysis carried out by SA Water in support of the Board Paper suggests that the savings will be greater than incorporated in the RBPas it would claw back $12.9 million in the RD20 period, over-recovering the $8.4 million termination charge. We recommend applying savings of $25.6M as set out in Table 4-7. This enables SA Water to claw back the $8.4M termination charge in the RD20 period.

Table 4-7 Impacts of procurement cost saving ($M)

	20/21	21/22	22/23	23/24	Total
Savings incorporated in the RBP	-5.1	-5.2	-5.2	-5.2	-20.7
Savings set out in Board Paper	-8.4	-8.4	-8.4	-8.4	-33.6
Claw back of initial costs if the RBP savings are applied	3.3	3.2	3.2	3.2	12.9
Our recommended saving to apply	-6.3	-6.3	-6.3	-6.3	-25.2
Recommended claw back	2.1	2.1	2.1	2.1	8.4

4.4.6 Ongoing efficiency

SA Water has offered a top-down 'ongoing efficiency' saving of 0.5% per annum. The sources of the savings are undefined[25]. We discuss this under the terminology of continuous efficiency in Section 4.5.

[24] Source: SA Water Board Meeting No 276 Item No 4.1 figure of $8.5 million adjusted to $18/19.
[25] Source: SA Water document "Opex efficiencies-to Cardno"

4.4.7 Labour cost

SA Water has proposed an increase in labour costs due to wage growth, leading to an average of $2.1M higher operating expenditure in the RD20 period. The current Enterprise Agreement expires at the end of 2019/20 so there is some uncertainty in future salaries. SA Water's proposal assumes that salary rises will outturn at 0.5% higher than CPI.

Our view is that above inflation salary rises should pay for themselves in productivity gains. We therefore recommend no net increase in operating expenditure associated with net labour costs.

4.4.8 Other

SA Water has proposed a number of smaller changes leading to a $0.8 million average increase in operating expenditure summarised along with our opinion in Table 4-8.

We refer to some of these items being part of 'business as usual' operating expenditure. As explained in Section 4.4.2, this means that whilst some new activities may be required in a particular period, they do not all represent significant new obligations and other activities which took place in the base year may no longer be required, offsetting the increase in cost.

Table 4-8 Other proposed increases ($18/19m)

	Average effect of SA Water proposed increase	Our view
Reconciliation Action Plan	0.3	No net increase as this kind of activity should be part of business-as-usual operating expenditure.
Regional community support	0.7	We recommend allowing this operating expenditure increase as it is expected to improve service to customers. However, we strongly recommend that SA Water devises a means to robustly measure the impact of this initiative.
GIS Data Quality Improvement	0.1	No net increase as this kind of activity should be part of business-as-usual operating expenditure
Water industry licence fee reduction	-2.4	Accept this change.
Environmental improvement plans (including recycling)	0.8	This relates to additional opex for recycling water schemes to be agreed with the EPA. SA Water has identified priority locations for 2020-24 at Hahndorf, Millicent and Port Augusta East sewage treatment plants at a cost of $11 million in capex and an additional $0.8 million in operating expenditure. We have recommended accepting this proposed increase.
Network management	0.4	We have not recommended a net increase in opex for this item as this type of activity should be part of business-as-usual operating expenditure
Safety	0.7	SA Water states in its RBP that $0.7M p.a. additional safety opex relates to new requirements for asbestos removal. During the interviews it was explained that whilst some of the proposed increase in expenditure relates to higher spoil disposal costs due to changing regulation, some also relates to additional labour to support the roll out of the fire and asbestos program. It seems likely that some of the additional labour will be capitalised and that some of the change in disposal costs is already in place in the base year. We have therefore recommended accepting half of the proposed increase.
Technical training	1.0	SA Water has not provided a robust enough justification for this scale of increase in training expenditure per capita and how it will benefit the business (e.g. offsetting productivity gains). We recommend no net increase as it should either pay for itself through productivity gains or be part of business-as-usual activities, and not a step change from the base year.

4.4.9 Metro Alliance

SA Water has an alliance in place with Allwater to operate and maintain metropolitan Adelaide's water, wastewater and recycled water systems. The alliance is one of SA Water's largest operating expenditure items with average expenditure of $97.4 million p.a. in the first three years of the RD16 period.

A review of SA Water's water main management in 2019[26] identified a number of areas of improvement relating to the alliancing arrangement, in particular around resource management and work practices. It also identified that improvement in resource management would require a more integrated organisational approach.

The current alliance arrangement is coming to an end and SA Water is looking at different insourcing and outsourcing options. [redacted]

Note: SA Water has requested that this information be redacted on the basis that it considers it to be confidential

[redacted]

4.5 Efficiency – Continuing and catch-up considerations

SA Water has low unit operating expenditure, but it should still be possible to increase operating expenditure efficiency. We have identified a number of specific ways in which SA Water can make operating expenditure savings in the next period, including:

- Savings already identified by SA Water and incorporated in the RBP: ZCEF and procurement cost savings.
- Savings already identified by SA Water but not explicitly incorporated in the RBP: changes to the Metro Alliance and savings associated with the IT program.

There are also other, as yet undefined, savings which we expect an efficient utility to identify. Recognising this, SA Water has applied a 0.5% per annum ongoing efficiency.

We consider that some of these savings, notably the procurement cost and Metro Alliance savings, are clear specific actions which can be taken now to improve the efficiency of the business. As such we consider that these savings should be treated as 'catch-up' efficiencies. The same should apply to the savings from any prudent and efficient ZCEF schemes.

Even utilities operating at the efficiency frontier should continue to make efficiency gains. Continuing efficiency, or Frontier Shift, relates to the ability of even the most efficient firms in the sector, those at the efficiency frontier, to become more efficient over time. In this regulatory context, a frontier shift estimate should reflect the pressures to become more efficient that utilities face in an open market. It reflects the

[26] SA Water Water Main Management Independent Review, AMCL, 30 August 2019

[redacted]

continuing efficiencies being gained across all major sectors through process innovations, new systems and technologies.

A review conducted by the Organisation of Economic Cooperation and Development (OECD) in 2015 examined a wide sample of global firms and found that efficiency gains at the frontier have averaged 3.5% p.a. for firms in the manufacturing sector and 5.0% p.a. in the service sector across all firms.

Information from the Australian Productivity Commission[28] shows Multi-Factor Productivity (MFP) estimates for the Australian economy up to the year 2017/18. The MFP measure is an appropriate indicator of the potential productivity improvements for a public water utility as it captures the effect of capital productivity as well as labour productivity. We have taken the whole-economy indicators of MFP growth as these are more indicative of an efficient production frontier. In applying the forward-looking productivity growth, the MFP long term analysis indicates a range of productivity increases from 0.7% to 1.0% per annum.

In England and Wales, the regulator, Ofwat, undertakes econometric modelling of operating expenditure as part of its periodic review of prices. For the 2019 price review currently underway, Ofwat commissioned Europe Economics[29] to undertake an assessment of 'Frontier Shift'; that is the scale of frontier shift that can be expected to be achieved over the five-year determination period. The consultants use a TFP approach including a technical change component, a scale component and an allocative efficiency component. The recommended frontier shift range for botex (the combination of wholesale operating and asset replacement expenditure) was 0.6% to 1.4% per annum.

In its final determination in December 2019, Ofwat updated its assessment of Frontier Shift including the European Economics report and other reports to propose a level of Frontier Shift in its efficiency report forming part of its final determination[30]. In this document it comments on the responses it received from the UK water sector. It allocated a 1.1% per annum efficiency to be applied across the five-year price control period to include for ongoing efficiency improvements in the wider economy and further efficiency improvements from water companies making greater use of the totex and the outcomes framework.

Our view, based on the information set out above, is that a movement in frontier efficiency (continuing efficiency) of 0.8% per annum should be applied to proposed operating and capital expenditure (refer to Section 5.3.3). When compared with what has been applied by Ofwat in England and Wales and the long term MFP in Australia, this level of continuing efficiency should be achievable by SA Water through business as usual.

The frontier shift has been derived from an analysis of combined operating expenditure and capital expenditure efficiency. The operating expenditure savings associated with the IT program are at least partially derived from additional capital expenditure as well as operating expenditure. These additional costs will contribute to totex and customer bills. As such, we recommend that the savings should be treated as an addition to the continuous efficiency challenge.

4.6 Recommendation

We summarise our recommendations for the water and sewerage services combined in Figure 4-23. We have used SA Water's operating expenditure initiatives breakdown structure to allow like-for-like comparison.

Recommended operating expenditure is also summarised graphically in Figure 4-23. The recommended operating expenditure is lower than SA Water's proposed operating expenditure because of the lower level of normalised base year opex, the challenges applied to many of the proposed increases and the greater savings assumed from the IT program, procurement contract and continuous efficiencies.

[28] Productivity Bulletin 2019, Productivity Commission
[29] Real Price Effects and Frontier Shift, Europe Economics January 2018
[30] PR19 Final Determination -Securing cost efficiency technical appendix, OFWAT December 2019

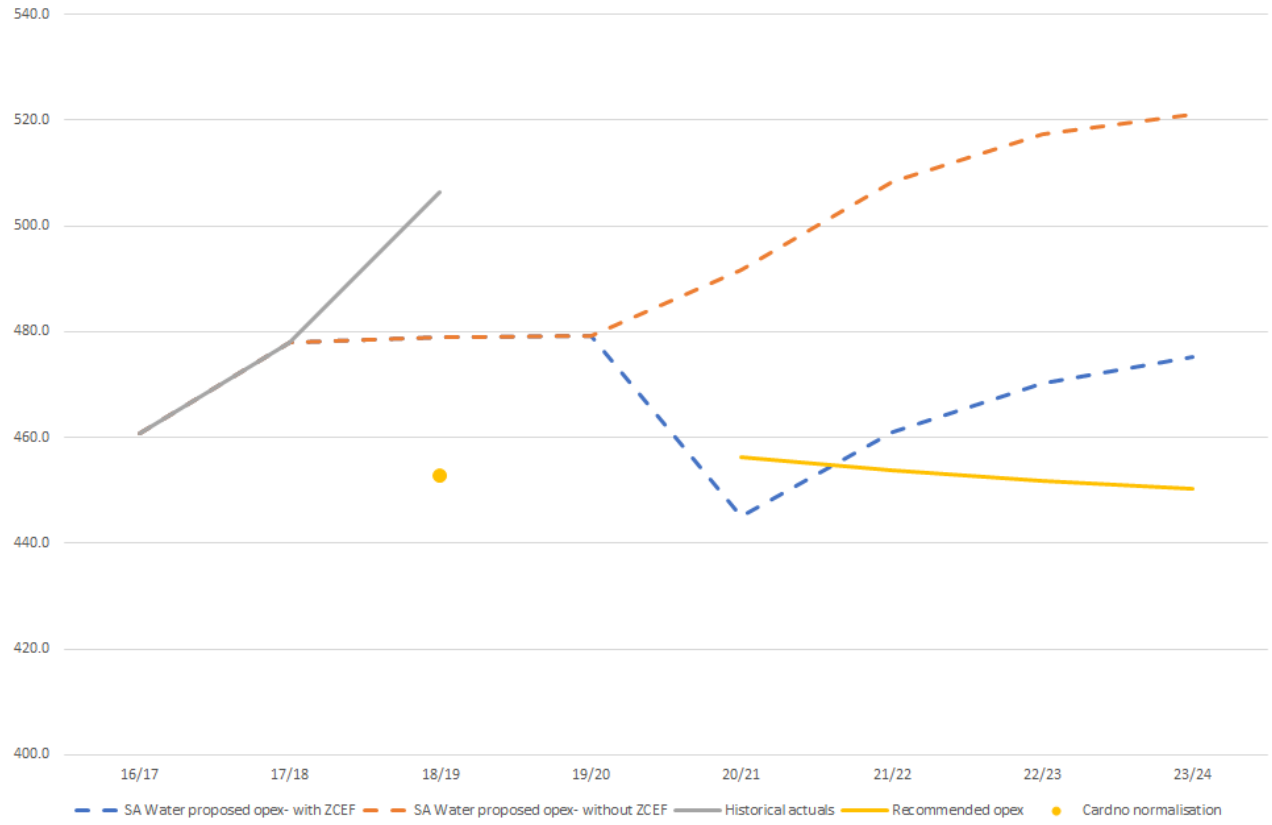


Figure 4-23 Proposed operating expenditure compared to historical actuals and SA Water's proposal

Table 4-9 Recommended operating expenditure in RD20 ($M)- water and sewerage combined

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
Base Year costs	455.7	455.7	455.7	455.7	455.7
Savings and efficiencies	**-7.5**	**-21.6**	**-29.6**	**-36.2**	**-23.7**
Energy savings (including revenue)	0.0	0.0	0.0	0.0	0.0
0.8% continuous efficiency	-3.6	-7.3	-10.9	-14.6	-9.1
Procurement contract savings	-6.3	-6.3	-6.3	-6.3	-6.3
Savings associated with the IT program	-1.5	-4.0	-6.9	-9.9	-5.6
Alternative arrangements to the Metro Alliance	4.0	-4.1	-5.4	-5.4	-2.7
Plus incremental change:					
Total Growth	***0.4***	***2.4***	***2.8***	***3.2***	***2.2***
Asset investment operating costs	0.4	0.8	1.2	1.6	1.0
Kangaroo Island desalination	0.0	1.1	1.1	1.1	0.8
Upper Spencer Gulf capacity upgrade	0.0	0.5	0.5	0.5	0.4
External obligations	***2.3***	***8.6***	***10.3***	***11.9***	***8.2***
Asset investment operating costs	0.5	0.7	1.2	1.7	1.0

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
IT investment operating costs	0.5	1.3	2.2	3.2	1.8
Water industry licence fee reduction	-2.1	-2.3	-2.5	-2.7	-2.4
Northern Adelaide Irrigation Scheme	2.3	2.6	3.0	3.3	2.8
Eyre Peninsula Desalination	0.0	5.3	5.3	5.3	3.9
Safety	0.4	0.4	0.4	0.4	0.4
Environmental improvement plans (including recycling)	0.7	0.8	0.8	0.8	0.8
Improve	***2.9***	***5.6***	***8.9***	***11.5***	***7.2***
Asset investment operating costs	1.3	2.5	4.0	4.9	3.2
IT investment operating costs	0.9	2.4	4.2	5.9	3.3
Regional community support	0.7	0.7	0.7	0.7	0.7
Sustain	***2.4***	***3.1***	***3.8***	***4.4***	***3.4***
IT investment operating costs	0.1	0.3	0.6	0.8	0.4
Adelaide desalination plant contract	1.7	2.2	2.6	2.9	2.3
IT licencing cost above inflation	0.6	0.6	0.7	0.7	0.6
Sub-total Incremental Change	**8.0**	**19.6**	**25.7**	**30.9**	**21.1**
Total costs	456.2	453.7	451.8	450.4	453.0

Source: SA Water document "C. Ourplan2020 W and WW breakdown initiatives" and Cardno analysis

Table 4-10 Recommended operating expenditure in RD20 ($M)- water

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
Base Year costs	**330.5**	**330.5**	**330.5**	**330.5**	**330.5**
Savings and efficiencies	**-7.1**	**-17.2**	**-22.7**	**-27.4**	**-18.6**
Energy savings (including revenue)	0.0	0.0	0.0	0.0	0.0
0.8% continuous efficiency	-2.6	-5.3	-7.9	-10.6	-6.6
Procurement contract savings	-6.3	-6.3	-6.3	-6.3	-6.3
Savings associated with the IT program	-1.0	-2.7	-4.6	-6.6	-3.7
Alternative arrangements to the Metro Alliance	2.8	-2.9	-3.9	-3.9	-2.0
Plus incremental change:					
Total Growth	***0.0***	***1.6***	***1.6***	***1.6***	***1.2***
Kangaroo Island desalination	0.0	1.1	1.1	1.1	0.8
Upper Spencer Gulf capacity upgrade	0.0	0.5	0.5	0.5	0.4
External obligations	***-0.4***	***5.3***	***5.8***	***6.3***	***4.2***

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
IT investment operating costs	0.3	0.8	1.5	2.1	1.2
Water industry licence fee reduction	-1.4	-1.6	-1.7	-1.8	-1.6
Eyre Peninsula Desalination	0.0	5.3	5.3	5.3	3.9
Safety	0.2	0.2	0.2	0.2	0.2
Environmental improvement plans (including recycling)	0.5	0.5	0.5	0.5	0.5
Improve	***1.6***	***2.9***	***4.7***	***5.9***	***3.7***
Asset investment operating costs	0.5	0.8	1.4	1.4	1.0
IT investment operating costs	0.6	1.6	2.8	4.0	2.2
Regional community support	0.5	0.5	0.5	0.5	0.5
Sustain	***2.1***	***2.8***	***3.4***	***3.9***	***3.1***
IT investment operating costs	0.1	0.2	0.4	0.5	0.3
Adelaide desalination plant contract	1.7	2.2	2.6	2.9	2.3
IT licencing cost above inflation	0.4	0.4	0.4	0.5	0.4
Sub-total Incremental Change	**3.3**	**12.5**	**15.5**	**17.6**	**12.2**
Total costs	**326.7**	**325.8**	**323.2**	**320.7**	**324.1**

Source: SA Water document "C. Ourplan2020 W and WW breakdown initiatives" and Cardno analysis

Table 4-11 Recommended operating expenditure in RD20 ($M)- sewerage

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
Base Year costs	**125.2**	**125.2**	**125.2**	**125.2**	**125.2**
Savings and efficiencies	**-0.4**	**-4.5**	**-6.8**	**-8.8**	**-5.1**
Energy savings (including revenue)	0.0	0.0	0.0	0.0	0.0
0.8% continuous efficiency	-1.0	-2.0	-3.0	-4.0	-2.5
Procurement contract savings	0.0	0.0	0.0	0.0	0.0
Savings associated with the IT program	-0.5	-1.3	-2.3	-3.3	-1.8
Alternative arrangements to the Metro Alliance	1.1	-1.2	-1.5	-1.5	-0.8
Plus incremental change:					
Total Growth	***0.4***	***0.8***	***1.2***	***1.6***	***1.0***
Asset investment operating costs	0.4	0.8	1.2	1.6	1.0
External obligations	***2.7***	***3.3***	***4.5***	***5.5***	***4.0***

($'m 18/19 real)	20/21	21/22	22/23	23/24	Average
Asset investment operating costs	0.5	0.7	1.2	1.7	1.0
IT investment operating costs	0.2	0.4	0.7	1.0	0.6
Water industry licence fee reduction	-0.7	-0.8	-0.8	-0.9	-0.8
Northern Adelaide Irrigation Scheme	2.3	2.6	3.0	3.3	2.8
Safety	0.2	0.2	0.2	0.2	0.2
Environmental improvement plans (including recycling)	0.2	0.2	0.2	0.2	0.2
Improve	***1.4***	***2.7***	***4.2***	***5.7***	***3.5***
Asset investment operating costs	0.9	1.7	2.6	3.5	2.2
IT investment operating costs	0.3	0.8	1.4	2.0	1.1
Regional community support	0.2	0.2	0.2	0.2	0.2
Sustain	***0.2***	***0.3***	***0.4***	***0.5***	***0.4***
IT investment operating costs	0.0	0.1	0.2	0.3	0.1
IT licencing cost above inflation	0.2	0.2	0.2	0.2	0.2
Sub-total Incremental Change	**4.7**	**7.1**	**10.3**	**13.3**	**8.8**
Total costs	**129.5**	**127.9**	**128.6**	**129.6**	**128.9**

Source: SA Water document "C. Ourplan2020 W and WW breakdown initiatives" and Cardno analysis

5 Capital expenditure

5.1 Overview

Figure 5-1 shows the profile of SA Water's actual and forecast capital expenditure by service over the period from 2013/14 to 2023/24. Over this period capital expenditure has averaged $403.1 million per year. Expenditure in the RD16 period was forecast to average $427.0 million per year. Capital expenditure in the RD20 period is forecast to increase by 10% to $470.7 million per year.

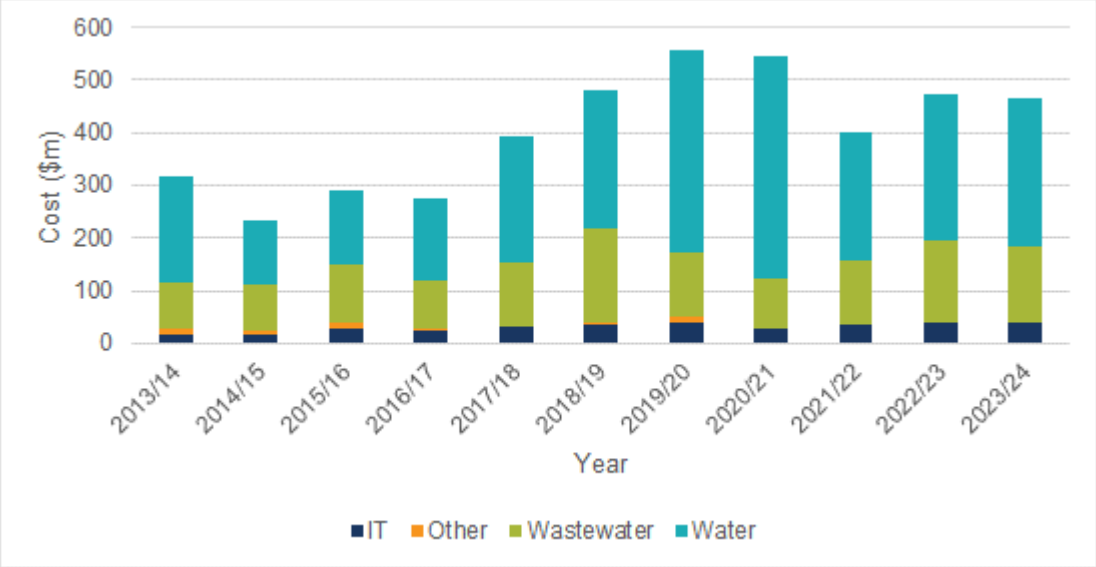


Figure 5-1 Actual and proposed capital expenditure 2013/14 to 2023/24 by service

The significant feature of this profile is the peak in expenditure between 2018/19 and 2020/21. This is driven by the ZCEF project. Figure 5-2 shows the profile of capital expenditure over this period exclusive of this project. While the peak in expenditure is no longer evident, the increase between the RD16 and RD20 period is more pronounced – an increase of $83 million per annum (23%).

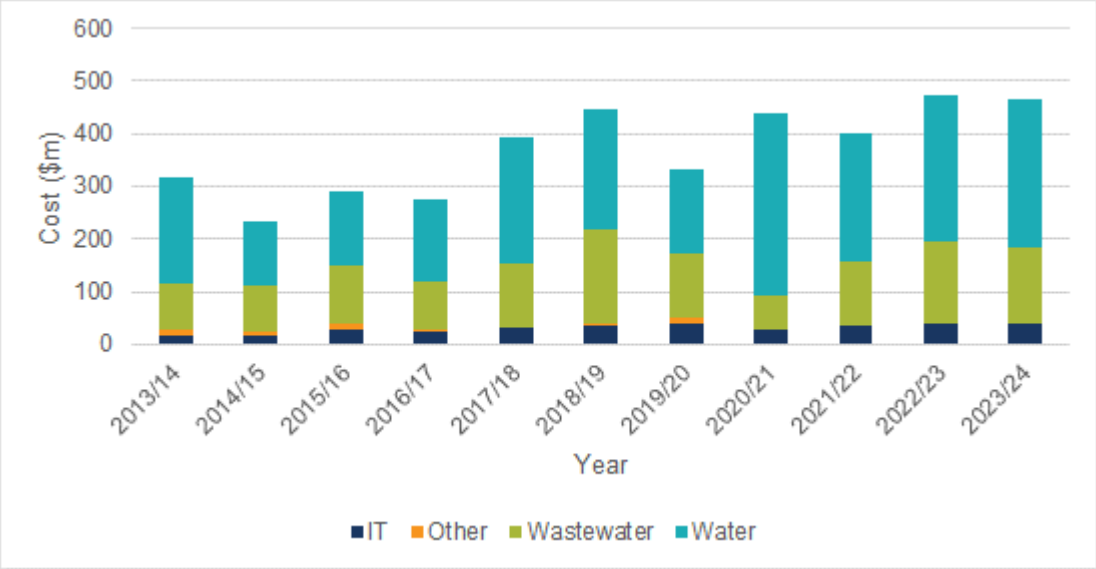


Figure 5-2 Actual and proposed capital expenditure 2013/14 to 2023/24 by service exclusive of ZCEF

5.2 Expenditure in the current period

5.2.1 Overview of expenditure in the current period

In the current regulatory period, SA Water is predicting that its capital expenditure will exceed the 2016 Regulatory Determination by around $410 million ($1.7 billion actual v $1.3 billion – see Figure 5-3). The overspend is largely due to expenditure on three projects that were not anticipated at the time of RD2016: Zero Cost Energy Future, Northern Adelaide Irrigation Scheme and additional water main relays. The overspend is large in both absolute and relative terms.

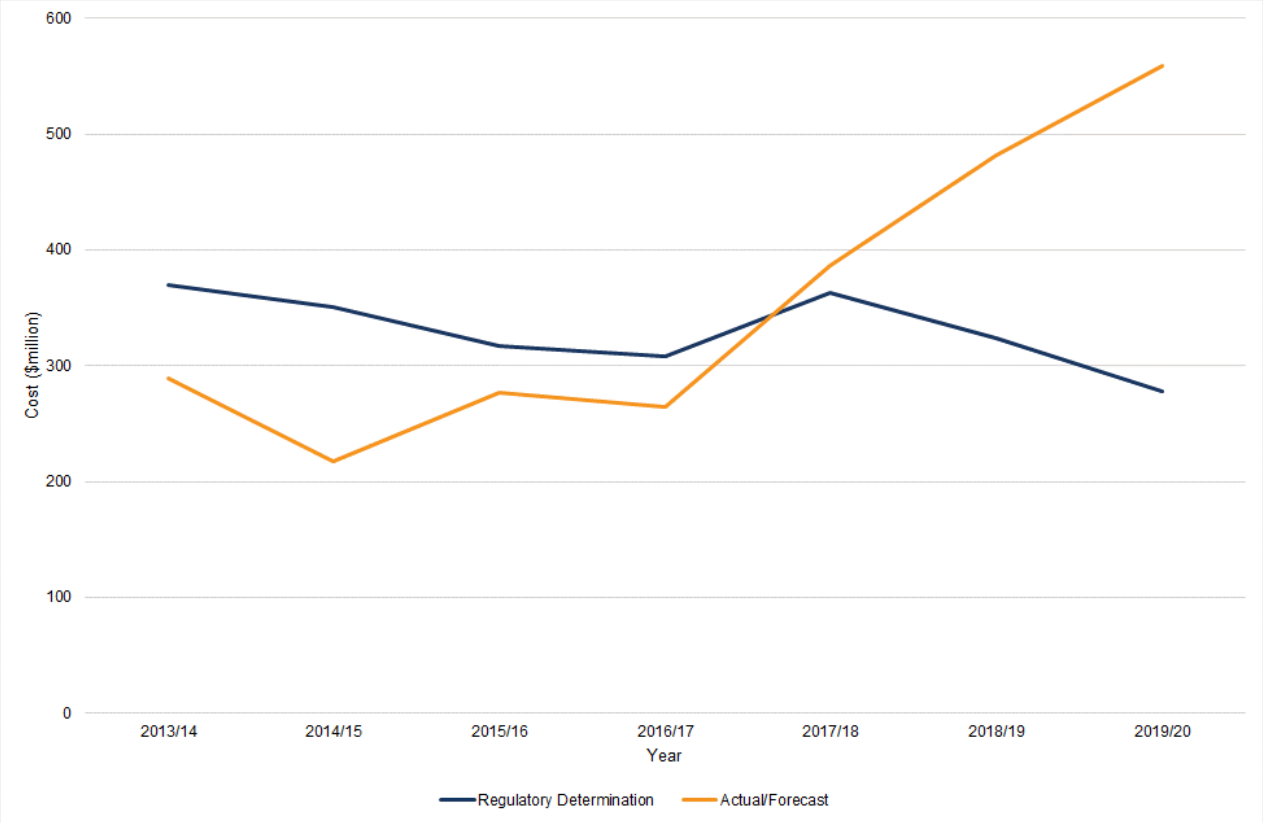


Figure 5-3 Variance of forecast and actual capital expenditure between 2015/16 and 2019/20 to Regulatory Determination

Table 5-1 presents the variance of actual expenditure in the RD16 period compared with the Determination inclusive and exclusive of the ZCEF project. This shows that net of ZCEF, actual expenditure has exceeded the Determination by $150 million or 12%.

Table 5-1 Variance of RD16 actual capital expenditure to determination

$M (18/19)	2016/17	2017/18	2018/19	2019/20	Total
Actual capital expenditure	264.2	386.5	478.8	562.9	1,692.4
RD16 capital expenditure	320.5	369.5	322.3	269.9	1,282.0
Variance to RD16	-56.3	17.0	156.5	293.1	410.4
ZCEF capital expenditure		0.7	35.4	224.4	260.4
Variance to RD16 net of ZCEF	-56.3	16.3	121.2	68.7	150.0
Determination (nominal)	308.0	362.6	324.1	278.2	1,272.9

While ZCEF was originally part of the scope for this review, further investigation by the Commission revealed that the nature of this proposed investment meant that it did not meet the definition of a retail service under the Water Industry Act, and therefore was not relevant to the determination of prudent and efficient expenditure. We therefore have excluded this project from analysis and have removed it from our

recommended prudent and efficient expenditure. This impacts both the RD16 and RD 20 period. . The remainder of the capital expenditures analysis in this section is exclusive of the ZCEF project unless noted otherwise.

5.2.2 Findings from review of sample of RD16 capital expenditure projects

We were required to assess a sample of projects and programs selected from all of SA Water's activities undertaken in the current regulatory period, to inform an assessment of whether capital expenditure during the current regulatory period has delivered its intended prudent outputs efficiently, and if that led to the intended outcomes being achieved.

The capital expenditure projects reviewed for this assessment are detailed in Table 5-2. The sample was selected in consultation with the Commission, and covers a range of asset classes and drivers. The projects and programs total $339 million in capital expenditure, which is 17% of all expenditure in the RD16 period. Following we provide a summary of our observations and conclusions regarding the remaining projects in the sample. A detailed review of each project is included in Appendix B.

Table 5-2 Sample of capital expenditure projects from current period subject to review

C Number/ ID	Project Description	Program	Investment Driver	Total capital expenditure ($m)
		A0025 - Reticulation Mains Water Network	Maintain Service	158.7
C1614	Hope Valley EL170 Tank Structure Renewal	A0022 - Structures Water Networks	Maintain Service	20.4
C3051, C3052	Wastewater reticulation mains renewal (metro) - SP1, SP2	A0038 - Reticulation Mains Wastewater Network	Maintain Service	20.0
C2887	Western Adelaide Wastewater Network Upgrade	A0035 - Odour Management	Improve Service	11.5
C8800	CBD Smart Water Network Mgt	A0020 - Pressure Management Initiatives	Maintain Service	4.2
C7431	Kangaroo Creek Dam Safety Investigation	A0003 - Dam Safety	External Obligation	92.4
C8121	AP Water Quality WTP SP5 Morgan	A0028 - Water Quality Treatment Plant	External Obligation	4.0
C9586, C9666	O & M BI Program	A0059 - Business Change Technology Program - Other	Improve Service	1.5
33	Digital Program	A0059 - Business Change Technology Program - Other	Efficiency and Improvement	14.3
39	Field Process Reengineering	A0059 - Business Change Technology Program - Other	Efficiency and Improvement	11.9

A0025 - Reticulation Mains Water Network

The purpose of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water. The RD16 proposal was to target the renewal of around 275km of water mains for capital expenditure of $86.2 million. The renewals are meant to minimise unplanned interruptions and failures in the mains. SA Water has set targets for unplanned supply interruptions and mains failures in order to guide its maintenance strategy.

In 2015/16, the performance of SA Water's water reticulation network worsened with a spike in December 2016 or 2,6000 properties impacted by three or more unplanned interruptions (based on a 12 month rolling average) as shown in Figure 5-4.

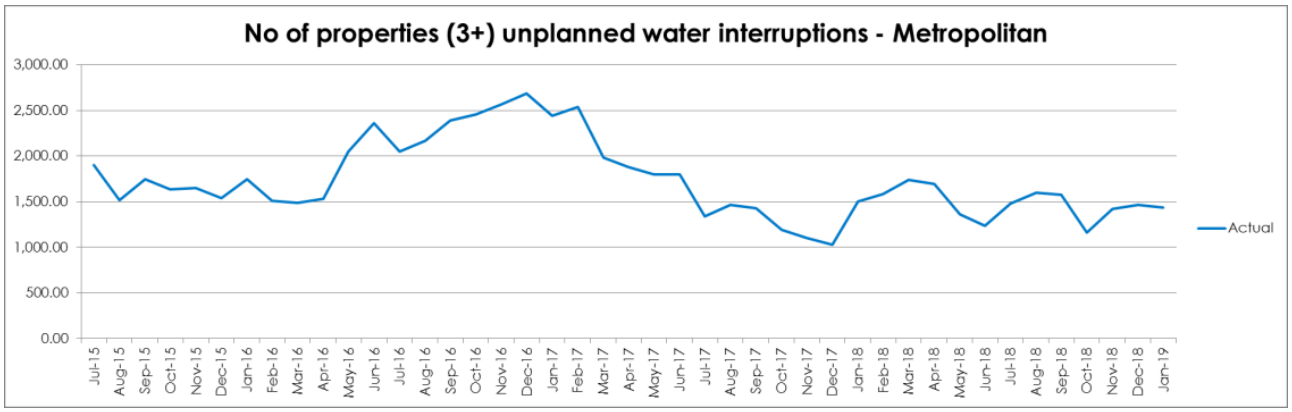


Figure 5-4 Number of properties experiencing three or more unplanned water interruptions

The underlying mains failure rate also worsened with a peak of 23 bursts/100km water main in the metro area as shown in Figure 5-5.

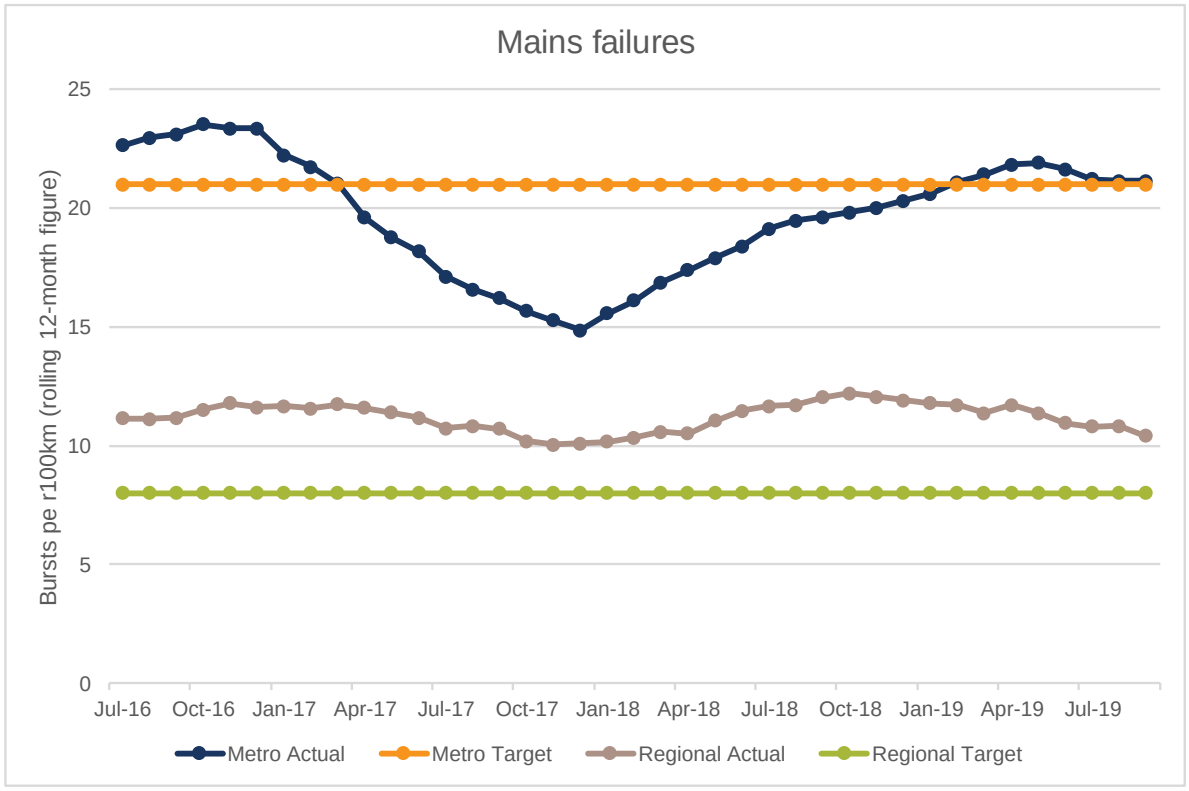


Figure 5-5 Water mains failure rate July 2016 to July 2019

At this time, there was also considerable public interest and coverage of the performance of the water reticulation network. This prompted SA Water to engage with customers and revisit its program. Customer research indicated a change in customers' views (as interpreted by SA Water). Customers raised concerns around the level of investment in water mains and they wanted to see more done about leaks. This included a greater number of replacements and a better response to failures (including isolation of mains post-burst). Customers stated affordability was still their key concern.

In response to the circumstances, SA Water reset its targets for performance of the metro water reticulation network as follows:

> Properties with 3 or more unplanned interruptions – reduced to 900 from 1,400

> Failure rate – reduced from 21 failures/100km water main to 17 failures/100km water main.

To achieve these improved targets, SA Water decided to implement the following additional activities:

> Investment to reduce the number of failures in the metropolitan area over the regulatory period by 20% – additional investment of $51 million to renew water mains

- Investment to reduce the size of shut-off blocks – opportunity to reduce the size of 500 of the largest shut-off blocks each of which contains more than 70 customers – investment of $3 million
- Find ways to reduce the time taken to fix main breaks – trials of new technologies and targeted replacement of broken valves in the network
- Proactively detect leaks through a smart network
- Investment in communication – for example the SA Water website now provides information on which water mains are being replaced and when.

The total additional investments in water reticulation mains under the changed strategy is $55 million.

Based on the observed spike in pressure-related bursts (an increase of 35% in 2015/16), it is reasonable for SA Water to undertake additional works to arrest this. However, we are concerned that the improved targets are arbitrary and that the customer engagement was limited. We note that SA Water has since revised these targets. We consider that a total $51 million increase in expenditure (mostly for mains renewals) on top of an established base $86 million program (an increase of greater than 60%) is disproportionate to the deterioration in performance and not warranted because:

- Failure rates for pressure and ground movement related bursts increased by only 35% compared to the previous five years
- A number of pressure related mains failures recorded in 2015/16 were a result of poor operational management and/or control.
- Mains renewal is only one element to controlling unplanned interruptions. With the exception of some additional investment to reduce shut-off block size and some investment in smart networks, there appears to be limited exploration into other techniques to reduce unplanned interruptions. Our experience is that pressure management is likely to have been a more cost effective approach (up to a point) than the magnitude of mains renewals proposed.

We consider that a prudent increase in the reticulation mains renewal program would have been around $30 million. We consider that the $3 million investment for additional shut off block works is also justified. We consider that a prudent additional program of work is $33 million (that is, in addition to the existing $86 million program). This is proportionate to the increase in pressure-related bursts. Note that the focus here is on pressure-related mains failures because these are ones SA Water can control to a degree.

We consider that SA Water processes are appropriate for selecting appropriate solutions. SA Water has a top-down deterioration modelling approach and bottom-up analysis for mains renewal identification which is likely to find high risk pipes to review. The process involves refinement of solutions considering economic impact and benefits while it also undergoes a number of stakeholder reviews. The procurement processes for identified solutions appear to follow typical utility infrastructure approaches.

C1614 - Hope Valley EL170 Tank Structure Renewal

The Hope Valley EL170 tank is a 136 ML storage tank within SA Water's water distribution system. The scope of the works originally proposed in the RD16 submission was corbel and column strengthening. The implemented solution is new columns along with an "Aramax" lightweight roof solution with new columns. The outturn cost is $21.0 million compared with $10.4 million anticipated at RD16.

The EL170 tank is an integral part of the system due to its significant size and as it supplies to hundreds of thousands of customers with 23,000 (including schools and hospitals) at risk of a significant water outage in the case of a full roof collapse. A portion of the trafficable Hope Valley Tank Roof collapsed in 2010. Following the collapse, a detailed condition assessment was undertaken. The evidence of a partial roof collapse and follow-up independent assessment confirming very high likelihood of further roof failure in the next 3-5years are sound drivers for the project.

While we have identified some shortcoming with the financial component of the options analysis, we consider that the outturn costs are efficient for the scope of works.

C3051, C3052 - Wastewater reticulation mains renewal (metro) - SP1, SP2

This program covers the renewal of both trunk (C3051) and reticulation wastewater gravity mains (37km in total). The works is predominantly relining. The RD16 business case proposed expenditure of $18.90 million over the period. Outturn expenditure is forecast to exceed this total by a small margin ($360k or 2%), to $19.26 million. This was approved by the SA Water Board in June 2016.

Renewal of sewer mains is required to prevent dry weather overflows from the network which have environmental, public health and service reliability impacts. The long term trend in Type 1 and Type 2 overflows is deteriorating from a total of 60 in 2012/13 to just over double that in 2018/19. This does include a relatively small number of overflows from pump stations. The rate of deterioration in the trend is concerning. SA Water identify multiple reasons for the observed trend including:

> Renewal of assets being insufficient or ineffective to address the rate of deterioration

> Prolonged periods of low soil moisture leading to increased root intrusion to sewers

> Changed reporting definitions or methodologies

> Changed preventive maintenance approach.

There is a clear need for SA Water to invest in the renewal of sewers to address end of life failure of assets and to avoid dry weather overflows. The deteriorating trend in overflows, and the rate of deterioration, are a cause for concern. The proposed program is prudent.

The approach to assess and reline prior to complete asset failure is logically and economically supported. SA Water takes a risk based approach to identifying mains for renewal. SA Water have opted to retain a contractor appointed in 2013 to deliver the sewer lining program. Extension to complete the full program of up to $19.86 million has had procurement arrangements reviewed. We consider the program approach to be efficient.

C2887 - Western Adelaide Wastewater Network Upgrade

The Western Adelaide Wastewater Network (WAWN) Upgrade has increased the wastewater capacity for Adelaide's CBD and inner southern and eastern suburbs. The project installed 2.5 kilometres of new gravity wastewater pipework through Adelaide's western parklands. This project was triggered by the presence of odour in the network identified during construction of the Royal Adelaide Hospital. However, odour is only a symptom; SA Water investigated further through hydraulic modelling which identified that the network in this area is at capacity with surcharging occurring within access chambers. SA Water considered that the risk of ongoing surcharges and odour with the (then) future construction of the Royal Adelaide Hospital was unacceptable. We consider that this conclusion is reasonable and consider that the project is prudent.

The procurement approach was early contractor involvement (ECI) and a risk sharing contract. The outturn cost was $11.966 million compared with a $11.384 million approved budget. The entire project contingency of $1.118 million had been committed at this time. The lessons learned report identifies numerous issues which would have likely contributed to these cost overruns. These include service location, trench shoring and "inaccurate boring direction, levels and depths". These appear to be partially or entirely within the control of the contractor and we therefore consider that only the approved budget of $11.384 million represent efficient costs. This represents a downward adjustment of $596,000 in 2018/19 prices.

C8800 - CBD Smart Water Network Mgt

The project is to deliver a smart water network for Adelaide CBD. The scope includes:

> Flow meters and pressure sensors on 11 of the CBD feeder mains

> Leak detection system – 305 loggers

> Customer smart meters - 100 meters selected

> Hydrophone/Transient pressure loggers – 23 loggers

> Water Quality sensors – Three sensors

> Networks communication / IoT platform

> Analytics package to analyse, collate and display the data collected above

> System Integration

> Stage 2 fixes, enhancements, upgrades and remediation of the analytics platform

> Handover to Business As Usual.

SA Water has nominated an "improve service" driver for this project. However, the stated outcomes and outputs maintain the status quo. If the status quo was to be maintained, then the base case should be selected as the lowest lifecycle cost option. The base case is however rejected as it does not deliver the "required" benefits. The specific benefits expected are unclear within the business case. These may be

inferred from the MCA analysis in the business case. However, the MCA is only used to justify the solution, not that there is a need. We cannot conclude that this project is prudent as there is no clear need for it to be undertaken, For an 'improve service" project, the improvements have not been identified nor quantified.

The business case is also very focused on the solution – the desired scope of smart infrastructure to be installed. There is little or no justification provided that this scope is the right scope needed to deliver on the desired outcomes and benefits (noting that we cannot see that the benefits have been established) and that these benefits exceed the costs. . We have no confidence that the proposed scope is prudent.

We challenged SA Water on the justification for the project given that there is no quantification of financial or economic benefits. SA Water noted that this was a 'reactive' opportunity to respond to customer concerns around the impact of water network failures, e.g. traffic congestion, lost water, interruptions to service. SA Water stated that it considers that this initial trial should be considered innovation to enable it to quantify the costs and potential benefits of these technologies.

We consider that the options analysis is flawed in that it focuses on the procurement approach only, not that SA Water is achieving benefits that exceed the costs.. For an improve service project financial or economic analysis should be undertaken. There is considerable literature in this area..

The preferred option is to procure best in class smart infrastructure. The business case then recommends restricted procurement. This conflicts with obtaining best in class solutions given that there is a global supply market for smart infrastructure. Again, the business case cites time pressures as one reason for restricted procurement.

We do not consider that the options analysis and procurement approach will have delivered efficient outcomes as they do not align with appropriate practice.

We consider that the prudent costs of this project are nil. There is scope for the project to be considered prudent where SA Water demonstrates that it has quantified the benefits realised from the trial and used these to inform future works. At the time of its submission, the RD20 program had not been justified based on the outcomes from this trial.

C7431 - Kangaroo Creek Dam Safety Investigation

Kangaroo Creek Dam is a concrete face rock fill dam located 20 km from Adelaide. Construction on the dam began in 1966 and was completed in 1969. The dam was modified in 1982, raising it 3.4 m. The operational storage capacity is 19,000 ML (total 24,200 ML). This project has been undertaken to address the risks associated with flood and seismic events. SA Water manages these risks in accordance with ANCOLD guidelines. The upgrade works included raising the embankment height from 63.5m to 69.4m, widening the spillway chute, extending the eastern ogee crest structure by 40.2m and raising the spillway walls.

The proposed solution was based on further detailed hydrologic and seismic investigations and options analysis reflecting the site constraints.

The ANCOLD guidelines represent good industry practice for managing the risk of failure of dams. SA Water has identified and assessed the risks associated with Kangaroo Creek Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified.

The Full Financial Approval was endorsed by the Board in March 2015 for $94 million (nominal). On a real basis (2018/19), the RD16 submission was for $100.8 million in expenditure and the current forecast outturn is $106.7 million, a 5.8% increase. The project has also been delivered over a longer period of time. We consider that the outturn costs are efficient as they reflect a competitive and appropriate procurement process. While the outturn costs exceed the cost estimate for Full Financial Approval, this approval was based on incomplete information regarding construction risks.

C8121 - AP Water Quality WTP SP5 Morgan

This project will deliver upgrades to disinfection and the backwash tank at the Morgan water treatment plant. This treatment plant is a large country plant with a capacity of 175ML/d. The plant treats water from the River Murray and distributes it across a wide region of the country operating areas, serving a typical population of 130,000.

We consider that the scope of works proposed is prudent based on the assessed water quality risks. The works are intended to keep water microbiologically safe and in line with health-based targets.

SA Water has considered multiple options and selected the lowest net present cost solutions. SA Water has undertaken a competitive procurement exercise for this project. It has appropriately bundled works on a site / geographic basis. We consider that the approach taken should lead to efficient costs.

C9586, C9666 - O & M BI Program

This project has two components:

1. C9586 Water and wastewater dashboards and reports
2. C9666 Grease arrestor maintenance app ("greasy tracker")

The scope of C9586 Water and wastewater dashboards and reports is to automate a possible 35 reports and consolidate existing tailored information systems. The scope of C9666 Grease arrestor maintenance app project is to develop a software system for recording maintenance and inspection/audit information for grease arrestors. This system uses the third party WasteID platform and is based on bar code scanning technology at grease trap locations.

The dashboard and reporting project has sought to incorporate reports into SA Water's PowerBI business intelligence platform. As for other information system initiatives, SA Water has committed to operating expenditure savings which generate a positive net present value on the capital expenditure. These savings have been committed top-down, not quantified based on a bottom-up evaluation of the initiatives.

33 - Digital Program

The Corporate IT Digital Program is a program of eight projects. This program has been identified by SA Water as a critical enabler of SA Water's Digital and Customer Strategies. The Program extends and enhances SA Water's previous technology investment from RD13-16 to improve service delivery and keep costs down for customers. The scope includes the following projects:

> SA Water Website
> Channel Management and Strategy
> Digital Fault communication
> Online Fault Reporting
> Online Customer Self Service
> eBilling and Online payments
> Digital Engagement, Insights & Research
> Customer Relationship Management

SA Water has identified qualitative benefits for the project and shown alignment with business drivers. At the program level, expenditure has increased from $10.1 million forecast at RD16 to a September 2019 forecast of $14.7 million. SA Water explained that this was due to a shift in business priorities to have a greater focus on customers and putting customers "at the heart". The individual project estimates have been largely developed through a bottom-up assessment of the inputs required.

SA Water anticipates operating expenditure savings of $1.026 million per annum for this program, an increase on the target of $0.978 million per annum initially forecast. SA Water has committed to operating expenditure savings of $1.4 million per annum arising from this program. On this basis, the expenditure is efficient.

39 - Field Process Reengineering

The field process reengineering program is the implementation of several technology investments that are meant to improve the delivery of field services for SA Water. The technologies are intended to allow the business to complete tasks in a safer and more efficient manner. This fits into SA Water's field delivery strategy. In addition, the projects are expected to deliver efficiency savings and improve customer service. The project scope includes vehicle/ resource tracking, electronic workflow management (dispatch) and mobile access to asset systems.

The solutions proposed are a mix of enhanced functionality and new products. The scope items have typically been developed as incremental initiatives. Vendors are sometimes involved in demonstrating and testing functionality. We were provided further documentation following our meetings which document the extent of solution development and testing undertaken.

On the basis that SA Water has committed to material operating expenditure savings that generate a positive net present value, this project is both prudent and efficient.

5.2.3 Conclusions and recommendation

SA Water's capital expenditure in the RD16 period has substantially exceeded that proposed through the Determination. The variance is explained by expenditure not foreseen at the time, being for the ZCEF project, Northern Adelaide Irrigation Scheme, and additional water main renewals.

We have reviewed SA Water's asset management processes to assess their adequacy to support the development and delivery of prudent and efficient capital expenditure. We have however identified expenditure on specific projects that we consider do not meet prudence and efficiency requirements. We make the following conclusions regarding the prudence and efficiency of specific projects:

> As the ZCEF project does not meet the definition of a retail service under the Water Industry Act, we have excluded all expenditure for this project from our recommendation

> We concluded that a prudent and efficient level of expenditure for the Water Network Mains Renewals program is $22 million less than that forecast by SA Water for the RD16 period.

> We concluded that the efficient expenditure for the Western Adelaide Wastewater Network project was $600k less than that recorded by SA Water

> We concluded that no expenditure was prudent and efficient for the CBD Smart Water Network Management program

Our recommended prudent and efficient expenditure for the RD16 period based on adjustments for these specific projects is summarised in Table 5-3.

Table 5-3 Recommended prudent and efficient capital expenditure for RD16 period

$M (18/19)	2016/17	2017/18	2018/19	2019/20	Total
SA Water RD16 actual and forecast capital expenditure	274.8	393.2	481.7	558.2	1,707.8
Adjustment for ZCEF	-0.7	-36.3	-227.1	-103.7	-367.8
Less adjustment for western Adelaide wastewater network	-	-0.6	-	-	-0.6
Less adjustment for CBD smart water networks	-3.0	-1.4	-0.0	-	-4.3
Less adjustment for water mains	-5.5	-5.5	-5.5	-5.5	-22.0
Recommended RD16 prudent and efficient expenditure	**265.6**	**349.4**	**249.1**	**449.0**	**1,313.1**

5.3 Expenditure in the future period

5.3.1 Overview of expenditure in the future period

SA Water's capital expenditure program for the RD20 period totals $1,842.0 million including ZCEF and $1,427.3 million excluding ZCEF. The water service accounts for 65% of all expenditure, wastewater 27% and IT 8%. The profile of expenditure by service across the period, excluding ZCEF, is shown in Figure 5-6. All following graphs are exclusive of ZCEF unless noted otherwise.

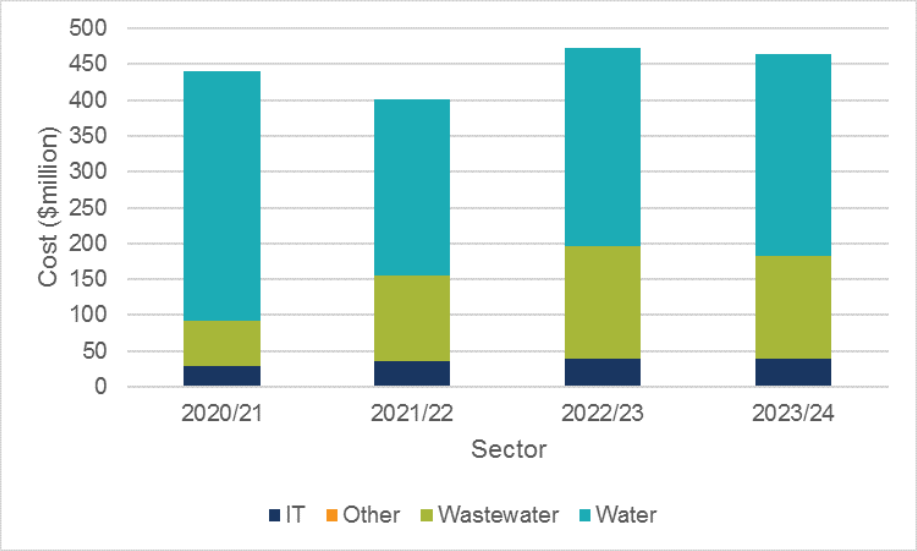


Figure 5-6 Forecast capital expenditure 2020/21 to 2023/24

Note: This chart does not include projected contributions for RD20 which are anticipated to be $40.9 million

Figure 5-7 shows expenditure by driver in the RD20 period. Maintain service is the most significant driver and accounts for just under half (46% of all capital expenditure). The improve service and external obligation drivers both account for 20% of the forward capital program. The magnitude of the 'improve service' program is notable. SA Water's submission for the RD16 Determination did not include any material expenditure to improve service. This is a significant shift in SA Water's response to customer expectations.

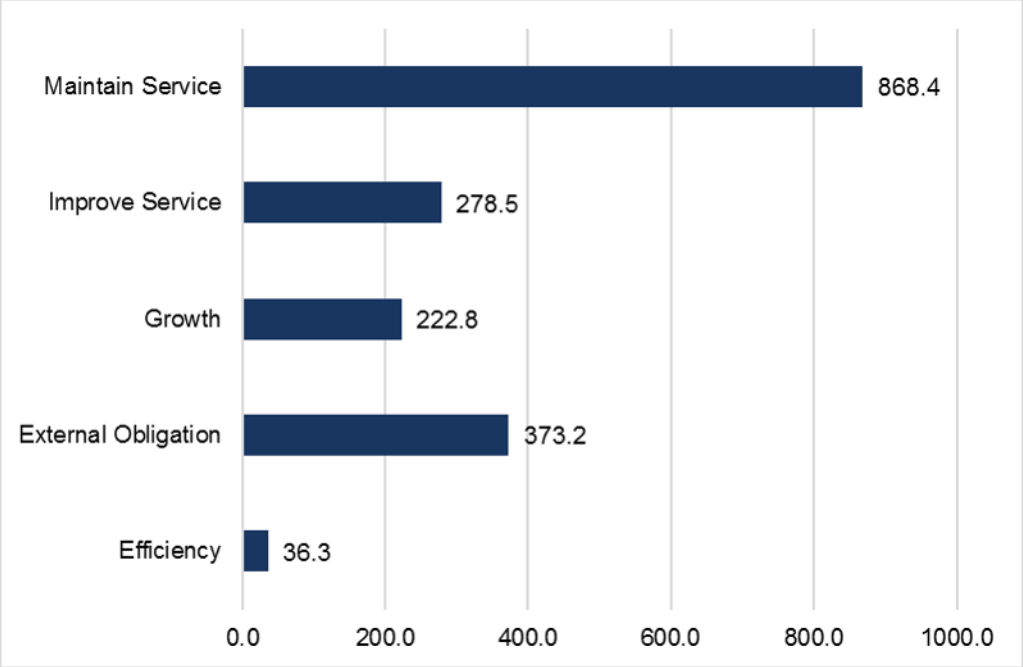


Figure 5-7 Forecast capital expenditure 2020/21 to 2023/24 by driver and service

To provide more insight into expenditure for the improve service driver in the RD20 period, Figure 5-8 provides a breakdown of expenditure for this driver by program. This shows that expenditure for the Water Quality Treatment Plant program accounts for 48% of all improve service expenditure. Business Change technology is 16% of the total. We have covered material aspects of the Water Quality Treatment Plant program, Business Change Technology Program and Water Quality Network program through our review of specific projects and programs in the next section.

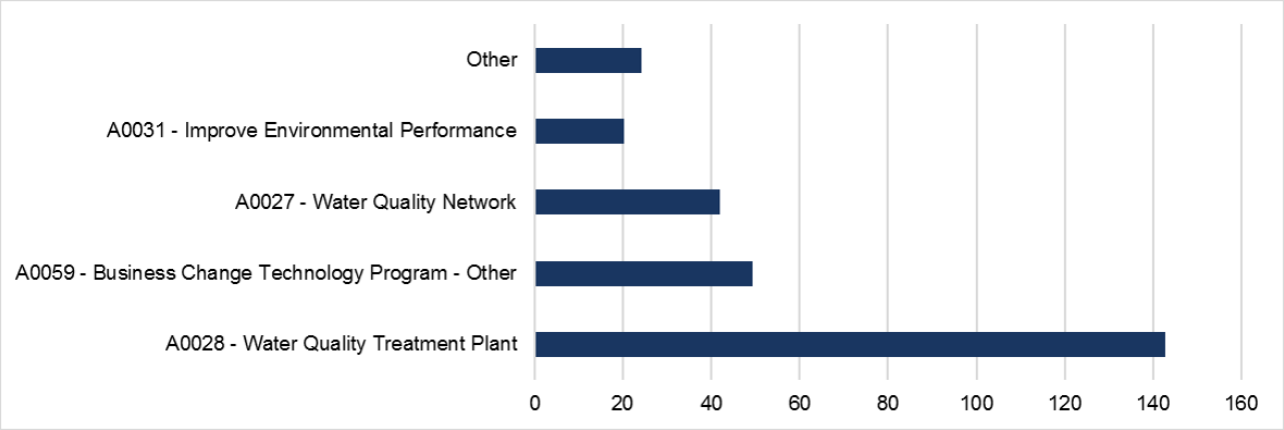


Figure 5-8 RD20 capital expenditure for the improve service driver by program

5.3.2 Findings from review of sample of RD20 capital expenditure projects

We are required to assess a sample of projects and programs proposed for RD20 to test the justification and proposed costs. The findings from this sample of projects is to inform our opinion on prudent and efficient expenditure in the future period.

The capital expenditure projects reviewed for this assessment are detailed in Table 5-4. The sample was selected in consultation with the Commission. The projects and programs reviewed total $681 million in capital expenditure, which is 43% of all expenditure in the RD20 period. In the following we provide a summary of our observations and conclusions regarding the remaining projects in the sample. A detailed review of each project is included in Appendix C except for the information systems related projects which are considered together within this section of this report.

Table 5-4 Sample of capital expenditure projects from future period subject to review

C Number/ ID	Project Description	Program	Investment Driver	Total capital expenditure ($m)
Various		A0025 - Reticulation Mains Water Network	Maintain Service	144
	-	A0038 - Reticulation Mains Wastewater Network	Maintain Service	68
		A0022 - Structures Water Networks	Maintain Service	20
RBP20_No_769	Morgan to Whyalla pipeline No. 1 replacement	A0009 - Major Pipelines Water Network	Maintain Service	62
C2255	Mount Bold Dam Safety Upgrade	A0003 - Dam Safety	External Obligation	87
C5235	Eyre Peninsula Desalination Augmentation	A0015 - Growth Water Treatment Plants	External Obligation	78
7a	IT - Risk Management	A0059 - Business Change Technology Program - Other	External Obligation	58
RBP20_No_1536	GAP Expansion	A0031 - Improve Environmental Performance	Improve Service	10
RBP20_No_1297 RBP20_No_1303 RBP20_No_1306	Metro Water Quality – Chloramine and Happy Valley WTP Upgrades	Metro Water Quality – Chloramine and Happy Valley WTP Upgrades	Improve Service	124
3, 4	IT - Integrated Operations and Workplace Corporation & Mobility	A0059 - Business Change Technology Program - Other	Efficiency	30

A0025 - Reticulation Mains Water Network

The purpose of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water.

The proposed scope of works in this program for RD20 includes:

- Renewal of water mains ($64 million metro, $48 million country)
- Installation of network valves to reduce impact of shutoffs in terms of affected property numbers (these are referred to as shutoff blocks) ($5 million)
- Extended use of smart networks approach to proactively improve network performance ($21 million)
- Pressure management to prevent bursts ($6 million)

SA Water has used the second iteration of its PARMS model to develop a 25 year renewals program. The model uses existing failure data and other information about the assets and their operations to predict ongoing failures. Different operating and maintenance regimes can be inputted to forecast future network failures which can be used to predict number of customers having unplanned interruptions. Modelling was undertaken to develop program that would reduce the number of properties experiencing three or more interruptions to under 1700.

In order to achieve this target by 2040, the outputs of the model indicated a level of renewal of $16 million per annum for Metro and $12 million per annum for Regional water reticulation pipes. The modelling suggests that spending $10 million per annum will maintain the status quo and spending $24 million per annum will achieve the 900 property target for Metro (i.e. 1700 overall) by 2029.

We consider that the scenario and level of expenditure adopted by SA Water is a reasonable approach to sustaining and gradually improving network performance over the coming period. However, this is strictly an improvement in service compared with the existing levels of service. This requires customer support demonstrated by willingness to pay which SA Water has sought to achieve. For a different performance target, a different level of expenditure would be appropriate. SA Water's understanding of the relationship between expenditure, asset performance and service performance is relatively sophisticated which provides increased confidence that the expenditure is prudent for the given performance target (noting that there will always be in inherent variability in performance due to factors outside of SA Water's control)..

Figure 5-9 shows total expenditure for the reticulation water mains network program over the period 2013/14 to 2023/24. This illustrates the moderation of expenditure compared with the spike in the RD16 period. A moderated approach will provide SA Water time to test and confirm the benefits of operational strategies and new technologies that may provide more cost effective solutions than mains renewal.

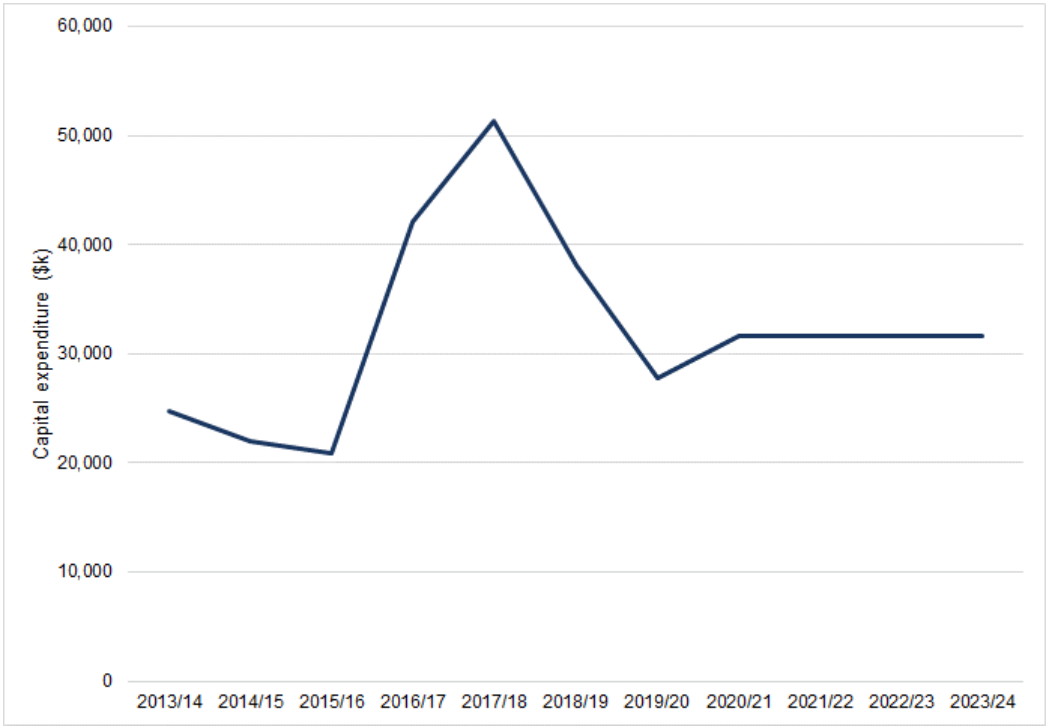


Figure 5-9 Reticulation Mains Water Network expenditure 2013/14 to 2023/24

SA Water also proposes substantial increases in activity for renewal of water valves, smart networks and pressure management. These activities should also deliver improvement in terms of the number of customers impacted by more than three supply interruptions. SA Water has not quantified expected benefits from the pressure management and smart network components but considers that taken together with renewals and valve installations, these will enable to reduce the number of properties experiencing three or more supply interruptions from 2,100 in 2020 to 1,750 in 2024.

The SA Water Board commissioned AMCL to undertake an independent review into SA Water's approach to water main management. The aim of the review was to assess and identify the level at which SA Water's asset management and operational approach aligns with international leading practice, and identify corresponding opportunities for improvement. The review report was finalised in August 2019.

The AMCL review found that SA Water "compares favourably on both the rate of water main breaks and the amount of leakage when compared to Australian and international peers, being in the best performing quartile for both measures". However, the review also found that SA Water's performance on its "average duration of an unplanned interruption" target "does not compare favourably with peers", with performance historically declining over several years. Ultimately, of the 24 capability areas assessed against SA Water's peers, 7 were found to be leading, 15 were found to be typical and 2 were found to not compare favourably with SA Water's peers. These two capability areas were identified as resource management and investment optimisation.

The AMCL review recommended the:

- Development of an objectives and incentives regime more closely aligned to total community impact
- Development of an end-to-end value chain to minimise disconnect and improve line-of-sight to customer needs
- Adoption of a culture that provides internal challenge and ongoing assurance throughout the value chain
- Continued development of innovative ways to reduce the total community impact of water main breaks.

The reticulation water main network program is discussed further below.

While we are supportive of the suite of measures that SA Water is pursuing and approach to developing scenarios to forecast the level of expenditure required on renewals to deliver performance targets, we consider that SA Water has been conservative in estimating the benefits arising from the program as a whole particularly the benefit from improved pressure management. Similarly, we cannot see how SA Water can

justify a ramp up in in Smart Network expenditure without having quantified the benefits. We consider that a prudent level of expenditure is lower than that proposed to account for these factors.

Our opinion is that a prudent program would be more cautious in pursuing smart networks and pressure management until their benefits are known and quantified to the extent necessary to justify and prioritise further work programs. The risk as it stands on the information provided by SA Water is that expenditure in these areas will not deliver real benefits for customers. We recommend that this program be adjusted so that only half of the proposed expenditure for Smart Networks and Pressure Management be considered prudent. This is a reduction of $13.3 million over the RD20 period. This recommendation should not be interpreted as being prescriptive as to where SA Water should allocate expenditure within this program. SA Water should prioritise expenditure between different activities as it obtains better information on the benefits and costs of the options at its disposal.

A0038 - Reticulation Mains Wastewater Network

This program includes the following activities to maintain the serviceability of the wastewater network reticulation mains:

> Wastewater Mains Renewal including ($3.9million general allowance, $51 million for specifically identified projects):

> Preventative sewer renewal program – identified through condition assessments

> Predictive maintenance – proactive program identifying sewers at risk of blockage and completing inspection and remedial works. This is a key change in strategy, as around 70% of sewer blockages are first time blockages.

> Major and Minor Third Party Works Metro (Regulated) ($8.0 million)

> A general allowance for rising mains renewal ($2.5 million)

> Recycled water mains renewal ($1.9 million)

SA Water's regulatory submission is based on assumed renewal of 88.8km of wastewater mains – 87.4km of relining and 1.4km of replacement.

The six year trend in wastewater main breaks and chokes (Figure 5-10) shows an improvement in the break and choke rate in 2016/17 and 2018/19. However, sewer breaks and chokes are inherently volatile due to the various causes of failure including pipe movement when the ground is dry, increased root intrusion when soil moisture is low, pipe degradation and the impact of contaminants in the sewer itself such as fats and oil and debris.

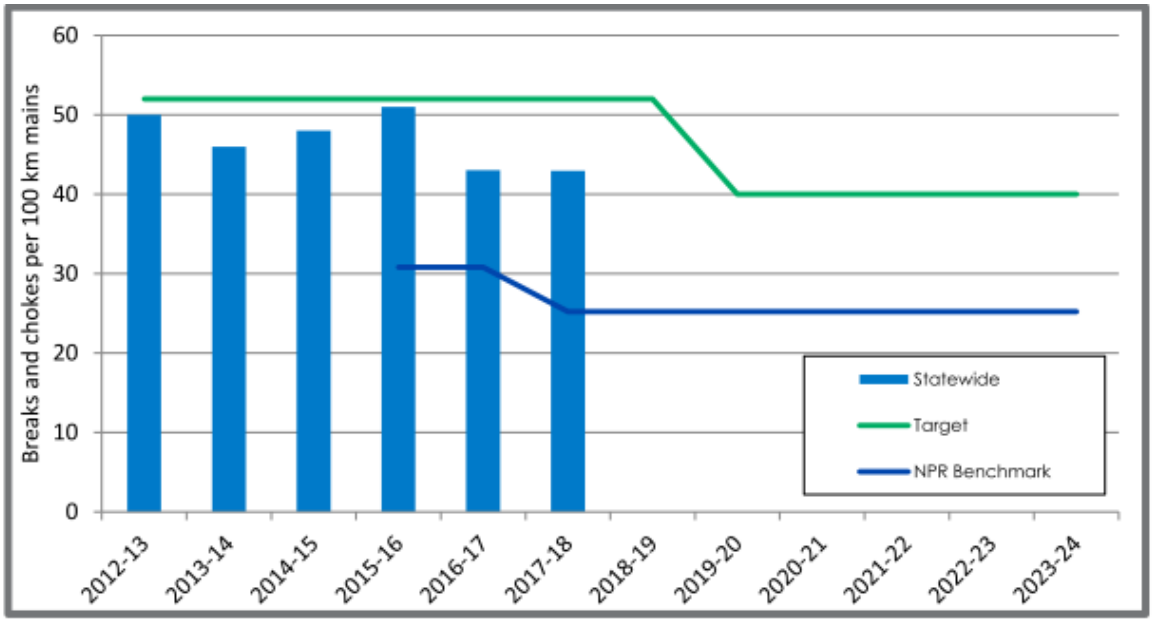


Figure 5-10 Six year trends in sewer main breaks and chokes per 100km main

The RD20 program is a 47% ($21.6 million) increase on the RD16 program (Figure 5-11). Expenditure in the RD20 period is heavily weighted to the last three years of the period.

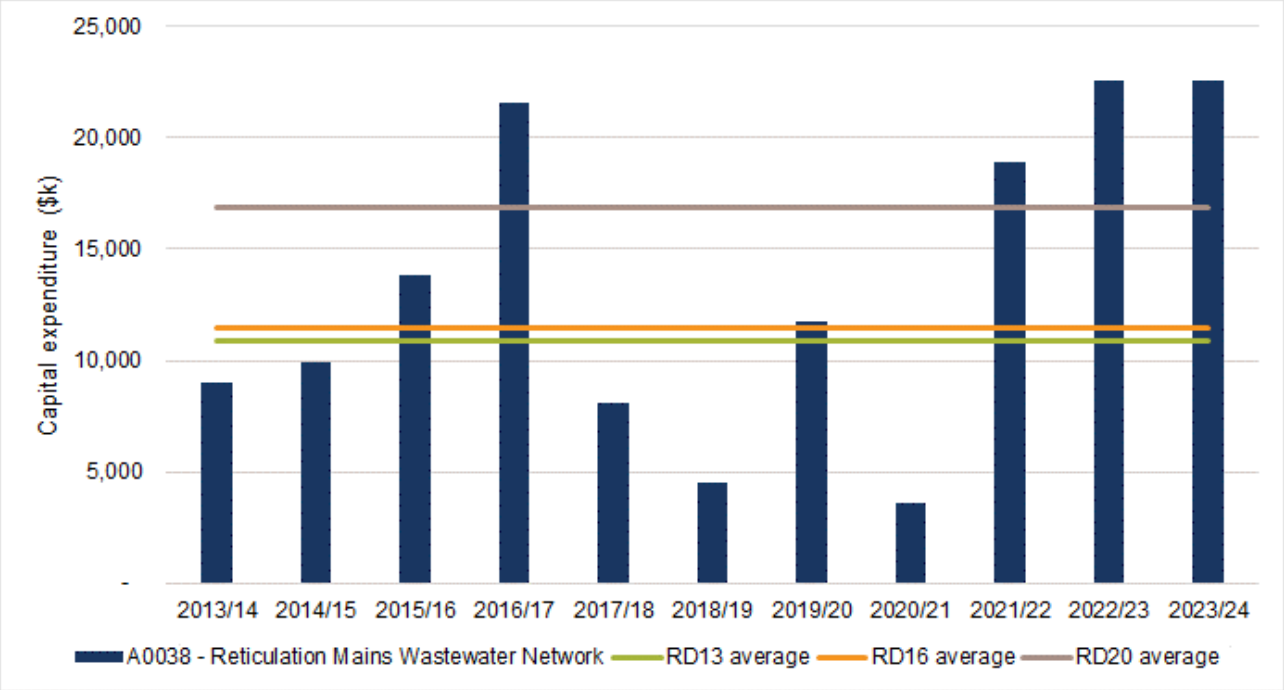


Figure 5-11 Reticulation Mains Wastewater Network expenditure 2013/14 to 2023/24

The magnitude of the proposed expenditure program is based on renewing all pipe sections known or estimated to be in condition grade 4 or 5 during the RD20 period. Consequence of failure is not considered in the decision making to set the expenditure level. We consider that this strategy is not appropriate as it does not establish what SA Water's risk threshold is for the assets. It does not determine an optimal intervention timing based on the varying criticality between pipes. We are not certain that SA Water is able to satisfactorily balance cost and risk, or reliably enhance performance. Within the program, a risk prioritisation approach is used but the consequence scoring is relatively unsophisticated and is essentially binary. This also leads to concern over SA Water's ability to balance cost and risk within the program .

We consider that a prudent level of expenditure for the RD20 period is in line with that undertaken in the current period. That is a total program of $46 million rather than the $68 million proposed. There has been improved performance in the current period at this level of expenditure, noting the natural fluctuations in performance. An improved understanding of risk for this asset class may lead to further improvements in performance (all else being equal) in the RD20 period without the need for a ramp up in expenditure.

We consider that the efficient costs for this program should reflect a 5% efficiency adjustment rather than the 3% applied by SA Water. This work is routine and repeatable and in an area where technology gains are evident. To make this adjustment, we have reversed out the 3% efficiency and then applied a 5% efficiency. The impact is to reduce the recommended total expenditure to $45 million over the RD20 period.

A0022 - Structures Water Networks

This program is for the renewal of water storage tanks within the water storage network. The scope includes 21 defined projects and one "general" line item. We note that there is a discrepancy between the business case and the regulatory submission capital expenditure model – in the business case the general line item was for $10,373k. The regulatory submission includes just over half this amount ($5,811k). We have used the regulatory submission capital expenditure model as our reference point. The total expenditure in the regulatory submission capital expenditure model is $19.7 million.

SA Water needs to renew its water tanks to manage risks to continuity of supply and risks to the quality of the water supplied. SA Water has established a technical level of service that reservoirs are in a condition grade of 3 (out of 5). SA Water identifies that 45.6% of Water Network Storage Tanks currently comply with the Technical level of service target and that 20.1% of Water Network Storage Tanks do not currently comply with the technical level of service target. For the remaining 34.3% SA Water does not know whether they comply or not.

The desired targets is for 100% of reservoirs to achieve the technical level of service target by 2028. We consider that the technical level of service is useful at a broad level but needs more granular information for forward planning. The reality is that a small defect on a reservoir that is otherwise in very good condition can

lead to water quality contamination while reservoirs that are in fair condition overall can function effectively. The technical level of service should be at a component and/or sub-component level.

It is concerning that SA Water's business case states that "Approximately 35% of all Water Network Water Storage Tanks (WSTs) have not been inspected to obtain condition assessment ratings and/or condition rating assessment data is not available for these WSTs". The importance of obtaining condition information, assessing consequence of failure and developing operational strategies to mitigate risks was known, discussed and acknowledged at the time of RD16 to be addressed during this period..

Experience suggests that SA Water has overestimated its risks relating to network water tanks. This is demonstrated by:

> Actual expenditure during the RD16 period being 26% lower than that forecast at the time of RD16

> The Hope Valley EL170 tank renewal project being delayed for many years demonstrating that the risk could be mitigated through operational measures that weren't considered when the original timing of the works was proposed

> SA Water not documenting a complete picture of the risk of these assets during the current period. This suggests that SA Water is comfortable with the level of risk across the portfolio to not proactively assess condition.

On the basis of the apparent historic overstatement of risk, we recommend that the "general" line item not be considered prudent. SA Water needs to better demonstrate the actual level of risk across its portfolio and particularly reflective of the potential for operational contingencies to mitigate these risks.

We consider that the solutions development and estimating approach is sufficient to deliver efficient forecasts.

RBP20_No_769 – Morgan to Whyalla pipeline works

This project is the first stage of renewals of the Morgan to Whyalla Number One Pipeline. This is one of two major pipelines that supply water between Morgan and the Upper Spencer Gulf region of South Australia. The No. 1 pipeline (MWPL1) is comprised of three major sections. The main is a 359km long cement lined steel pipe with a diameters ranging from 500 to 1,000mm. A parallel main, MPWL2, runs up until Baroota Storage when it splits to run West and under the sea to Whyalla.

It is anticipated that approximately $700 million will be spent over the next 40 years upgrading and replacing sections of this pipe. For RD20, 14km of MPWL1 pipeline is slated for replacement at a capital cost of $62 million. The sections to be replaced are in the poorest condition (condition 5 and 4 sections and some condition 3) as confirmed by condition assessment. Renewals have been based primarily based on condition with secondary consideration of consequence of failure. SA Water intends to move to a consolidated risk based model in coming years. Based on the evidence provided, the project is prudent.

A detailed options analysis has been performed. The options considered included current and future demand scenarios. The lowest lifecycle cost option that also meets future demand needs was selected. It also addresses all the high risk (based on condition assessment) sections of the pipe. While the forecast expenditure is at the upper end of benchmark costs, drivers for this may include the relative isolation of the work locations and diseconomies of scale. On balance, we consider the forecast costs are efficient.

C2255 – Mt Bold Dam Safety Upgrade

Mt Bold Dam came into service in 1938. The dam was later upgraded, with those upgrades being completed in 1968. The dams primary purpose is to supply water to Adelaide.

The scope of this project is to upgrade the Mt Bold reservoir to address risks associated with the failure of the dam in large floods and seismic events. Detailed optioneering is currently in progress but the preferred scope of work (Combination F) comprises:

> Buttressing of the central arch and installing post tensioned rock anchors to addressed deficiencies in the raised gravity sections

> Construction of an apron along the downstream toe to prevent erosion that may result from overtopping flows in the Probable Maximum Flood.

SA Water has identified and assessed the risks associated with Mt Bold Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified to bring these to an acceptable level. Mt Bold has the highest level of risk associated with its failure within SA Water's portfolio.

Several options were identified that would improve the dams resilience to seismic and flood events. A total of nine dam improvement options were identified, four that would improve flood capacity and five that would increase earthquake resilience. Installing a new dam that would meet current ANCOLD guidelines was also considered. A combination of these options would be necessary to address both deficiencies. A process was then undertaken to determine which combinations of these options could be implemented together. Financial assessment and multi criteria assessment identified four preferable options. However, further investigation identified that a previously discarded option (Combination F) was more feasible than first thought and this option currently appears the most preferable.

Currently, detailed cost estimates are being prepared to assist in selecting the preferred option. We are satisfied that the forecast submitted by SA Water represents the current best estimate of efficient costs of this project.

5235 - Eyre Peninsula Desalination Augmentation

This project proposes construction of a 4GL/annum desalination plant to serve the Eyre Peninsula and make up for a shortfall in water production volume from the Uley Basin. Some of the supporting infrastructure, such as intake and raw water pipeline, will be sized for 8GL for future expansion when additional demand materialises potentially from commercial and industrial customers.

The solution has been demonstrated as prudent because there is a need to meet the community's water security needs while maintaining sustainable abstraction from the Uley Basin. The project timing is driven by the expectation that current extractions will only be feasible for the next five years.

SA Water did explore the limited options available to provide alternative water sources. Reduction in consumption was considered inadequate. The lowest cost supply option was adopted. The size of the facility aligns with amount of water currently being extracted from groundwater supplies. Providing infrastructure for a future increase in plant size to 8GL increases costs by $5.3 million / 6%. We consider that this is a prudent approach to sizing.

The cost estimate is based on a bottom-up exercise which has been benchmarked against existing plants of different sizes. We consider that the proposed costs are efficient.

IT Projects: 7a – IT risk management (Cyber security program), 7b – IT risk management (Asset Refresh and Resilience), and 3,4 - IT - Integrated Operations and Workplace Corporation & Mobility

SA Water has proposed a $143.5 million IT capital expenditure program for RD20. There are two overarching programs that comprise the overall IT program:

> A0061 IT Assets Lifecycle Program – Other - $53.55 million

> A0059 – Business change technology program – Other - $89.93 million.

Figure 5-12 shows the expenditure on the overall IT program between 2013/14 and 2023/24. This figure shows that total IT expenditure in the RD20 period is forecast to average $35.9 million per year, a 12% increase on the $32.1 million of expenditure in the RD16 period. The RD16 period expenditure was in turn a 57% increase on the previous years. SA Water's total expenditure on IT has steadily and substantially increased over the last ten years.

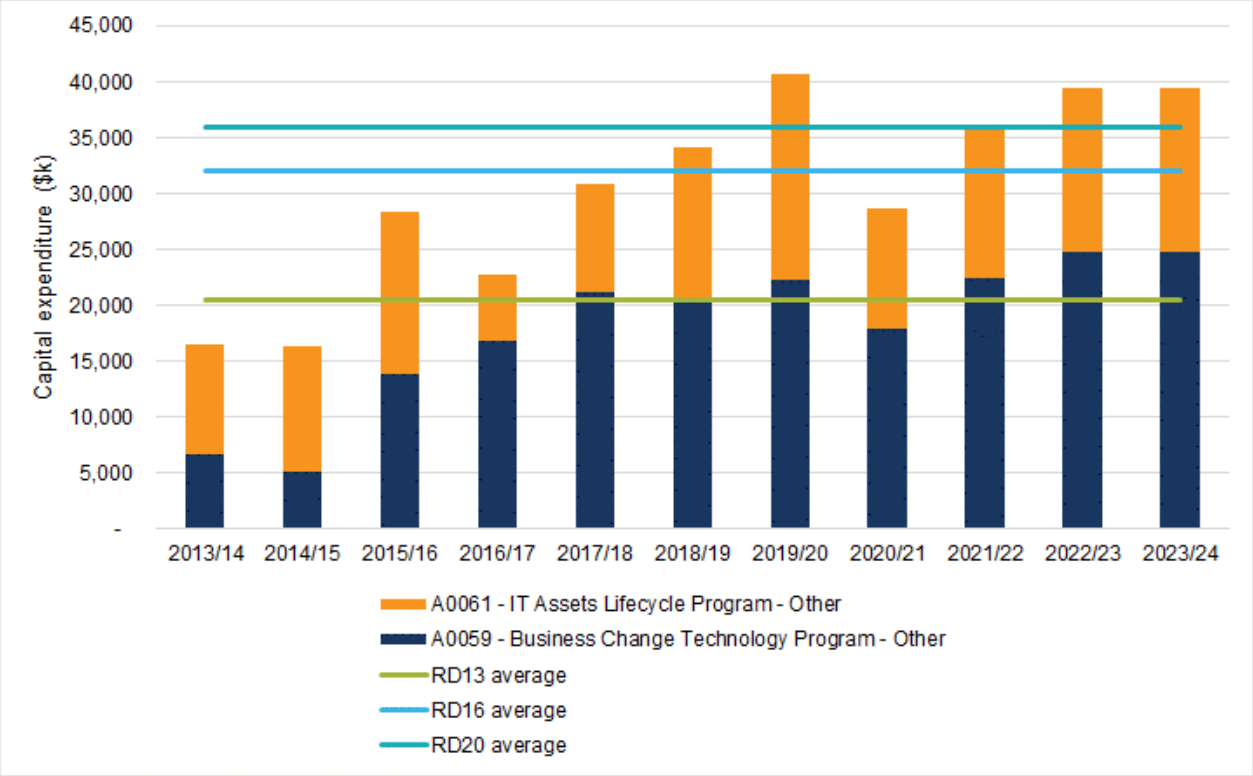


Figure 5-12 Total IT expenditure 2013/14 to 2023/24 by program

The breakdown of expenditure by driver for the overall IT program for the period from 2013/14 is shown in Figure 5-13. This figure shows that expenditure on external obligations has been a fairly steady and a minor part of the program. Expenditure to Maintain Service and Improve Service are the largest components of the program. These show variability but have generally been increasing. In the RD20 period, expenditure on the Maintain Service driver is 6% higher than the ten year trend and expenditure for the Improve Service driver is 4% higher than the 10 year trend. The most significant change in the drivers of expenditure is for the efficiency driver. RD20 expenditure on efficiency is 88% higher than that for RD16. It comprises 25% of the RD20 program compared with 16% of the RD16 program.

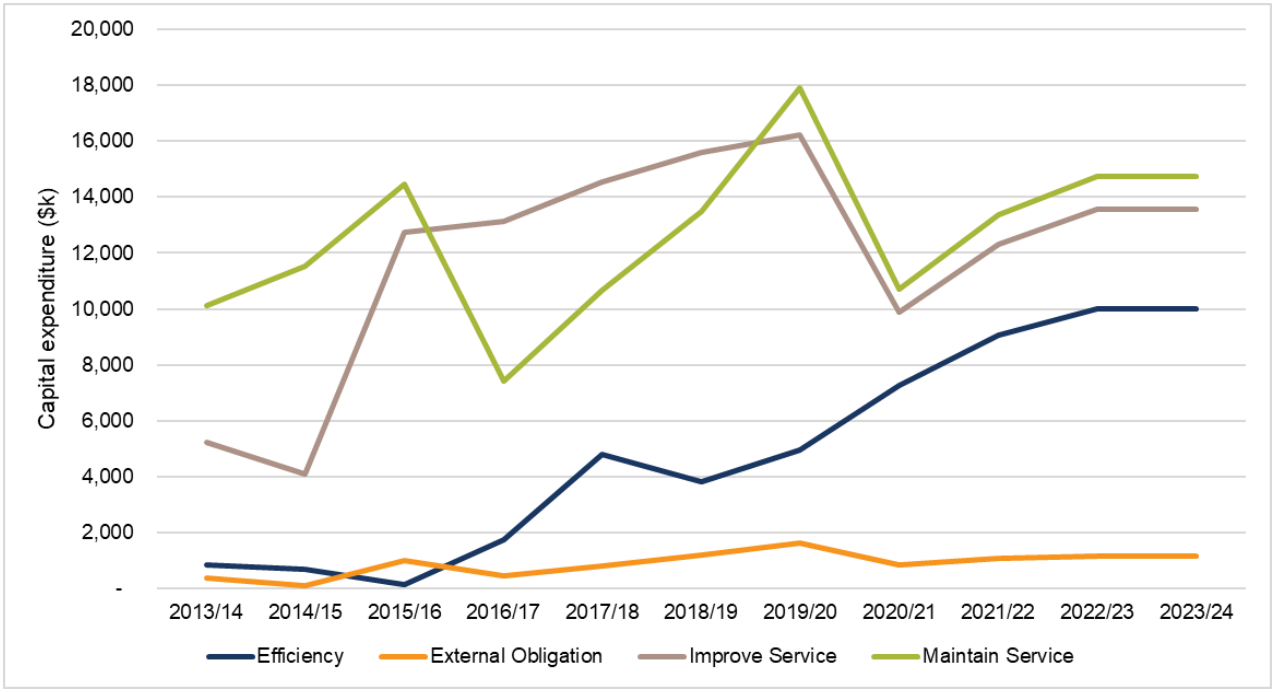


Figure 5-13 IT Capital expenditure by driver 2013/14 to 2023/24

We reviewed a sample of four expenditure items within the overall IT program. The four items have the following proposed scopes of work:

> 3 - Integrated Operations - Efficiency. The aim of this project is to capture, store and report on information to enable better decision making. The expenditure is expected to deliver operating expenditure savings of $1.28 million per annum.

> 4 - Workforce Collaboration & Mobility- Efficiency. This project includes activities relating to health and safety management for staff and contractors, field mobility and collaboration across platforms.

> 7a - IT Risk Mgt (Cyber Security Pgrm) - External Obligation. Works to comply with the anticipated new legislation relating to cybersecurity

> 7b- IT Risk Mgt (IT Asset Refresh & Resilience) - Maintain Service – renewal

We concluded that it is prudent for SA Water to invest in each of these four projects/themes.

SA Water explained that in developing solutions across its IT program, it doesn't start with preconceptions on technologies. It instead defines the future requirement and current capability to identify the gap that needs to be addressed. The gap may be addressed through strategies such as modification, replacement or new capability. The program was developed in consulting with the business and included a number or workshops supplemented by "deep dive" planning. The initial program was prioritised and then costed. Costing was undertaken in a workshop environment and involved application specialists, business partners and the overall program manager. The overall process is shown in Figure 5-14.

Figure 5-14 IT program development and costing process

SA Water advised that it is currently developing detailed strategies and plans to deliver the overall program. These will identify the specific software and hardware solutions that will meet the program and theme objectives. SA Water considers that a benefit of this approach is that it allows for new and emerging technologies to be considered as far as possible rather than being locked into a solution too early.

SA Water's approach is to define outcomes and have in place a planning process and governance framework to deliver on these objectives. This requires different processes compared with traditional planning. In particular, benefits realisation and overall program monitoring needs to be robust to ensure that the program delivers the cost savings and outcomes expected. SA Water advised that the benefits realisation approach is still being developed but that the monitoring and governance framework is in place. This includes an IT Governance Committee comprised of Senior Leadership Team and cross-business Senior Managers. Financial Delegations require Chief Executive approval for expenditure greater than $4 million and General Manager approval for expenditure greater than $1 million. We consider that the governance framework is appropriate but we are concerned that the benefits realisation approach needs to be robust and fully implemented for RD20 to provide assurance that the expected benefits (including risk mitigation and efficiency savings) are realised. SA Water acknowledged the importance of this.

We queried SA Water regarding the development of the IT Assets Lifecycle Risk Management program in particular. We consider that there is scope for SA Water to deliver the objectives of the IT risk management (IT Asset Refresh & Resilience) for a lower cost. The efficiencies are likely to be able to be achieved through greater challenge to the program needs and timing (including through benefits realisation), a more complete approach to risk assessment of the activities proposed and through further development of solutions to identify the most cost effective option. We consider that this program should be reduced to reflect these opportunities. We recommend that the program be reduced by $9.6 million which is half of the value of the expenditure items that have not had an importance rating assigned.

SA Water responded to the draft report to note that it considered that our analysis misinterpreted the "importance rating". SA Water states that (this field is):

> *…the importance of the asset lifecycle expenditure to other proposed business change initiatives being considered, not the importance of the system to the SA Water business. It appears that the field was interpreted by Cardno as the systems' importance to the operation of SA Water, and that because they had not been rated, they were considered to be of low importance.*

SA Water also raises its concerns that reduced expenditure in this area will increase the risk to its operations. We note that the importance rating has not been used to justify the proposed reduction in expenditure, the reduction is proposed based on our assessment of opportunities for "greater challenge to the program needs and timing (including through benefits realisation), a more complete approach to risk assessment of the activities proposed and through further development of solutions to identify the most cost effective option". We also note that within the spreadsheet there is no other measure of importance / criticality/ risk. Given the nature of the program development where SA Water has focused on outcomes rather than specific initiatives or capabilities, the importance rating was used as a proxy for applying this challenge, not to justify it. Given that the asset lifecycle program is outcomes focused, our understanding is that it shouldn't be directly linked to specific rows in the spreadsheet. We would anticipate that efficiencies will be delivered across the program as whole.

We note that SA Water has proposed operating savings from the IT program that make the overall program neutral for operating cost movements. This recommended adjustment should not impact this outcome as the efficiencies are anticipated through other programs.

RBP20 No 1536 - GAP expansion

SA Water is looking at expanding recycled water usage, and potentially production, amongst its customers. It is anticipating that future environmental regulations will reduce the amount of effluent (or the contaminants within the effluent) that can be discharged from its various wastewater plants. SA Water has also received input from its customers that there is an expectation that the usage of recycled water in public spaces within the region be increased. The regulatory proposal included $10 million for potential expansion of the Glenelg to Adelaide Parklands (GAP) recycled water network south to new development at Tonsley Park. Significant expenditure of $115 million is forecast for after 2024. SA Water is proposing three categories of projects over the long term:

- Investigations for additional reuse opportunities, free water for local councils for open space usage and expansion of the existing Glenelg Adelaide Pipeline
- Investigations on how reuse will assist SA water in meeting its compliance obligations
- Comprehensive recycled water network dynamic modelling.

There is no demonstrated demand for recycled water to support the expansion to Tonsley Park on which the regulatory submission has been based. The preliminary financial analysis undertaken for this expansion concluded that it is not financially viable. Therefore, the expenditure is not prudent or efficient. In response to the draft report, SA Water stated that:

> *SA Water agrees that further information on prudency and efficiency is required before proceeding on an expansion as large as Tonsley Park GAP expansion…The allocation of funding however provides an investment portfolio for recycled water expansion, so that at the time that a business case has proven to be justified, for any recycled water initiative that may prove prudent and efficient during 2020-2024 there is aligned funding allocation, and provides alignment with customer expectations on SA Water's increased commitment to recycled water usage. Without allocation of funding, it is difficult for SAW to invest when a prudent and efficient business case occurs which means it cannot deliver on what customers wanted which was increased recycled water.*

We understand SA Water's position but we are required to make an assessment of prudence and efficiency based on the information available to us. Here, the key information is demand and potential demand. There

is no evidence that demand of this scale will occur in the RD20 period. This should not preclude SA Water from investigating and pursuing expansion of its recycled water supply where it can demonstrate that this is justified on financial or economic grounds.

Metro Water Quality – Chloramine and Happy Valley WTP Upgrades

The scope of this project comprises treatment upgrades at the Happy Valley WTP (ozone and filter improvements) and installation of five chloramination plants at treatment plants to convert the Adelaide metro water reticulation system to a chloraminated network rather than chlorinated. Chloramination offers benefits over a chlorine only disinfection approach in that is longer lasting, typically has less taste and odour and typically has less disinfection by-products.

The business case provide qualitative analysis to support that upgrades to Happy Valley WTP and a switch to chloramination are the best overall option in achieving the project's objectives and addressing the needs presented. In response to our information request, SA Water provided a semi-quantitative evaluation of options. The assessment ranks options based on a qualitive improvement score divided by net present cost. While we have not been provided with more detailed supporting information, we accept that SA Water has undertaken options assessment and solutions development to support the proposed program.

The upgrades to the Happy Valley WTP will increase the effectiveness of chloramination as it will remove organic carbon that would otherwise consume chloramine. The benefits of the upgrades to chloramination are:

> Reduced opex – reduced chemical dosing costs

> Reduced capex – the upgrades will allow a smaller chlorine contact tank to be installed at Happy Valley WTP of this may be able to be able to be avoided. The information provided does not quantify the avoided cost but a high level estimate of the avoided costs is between $5 million and $20 million. The actual costs will depend on the site footprint and configuration and ground conditions.

The upgrades to Happy Valley WTP will also avoid operating expenditure for dosing copper in the Happy Valley reservoir (which is around $355k per annum) and it will improve removal of viruses and bacteria.

The procurement approach for the Adelaide system chloramination and Happy Valley water quality improvement have yet to be determined. The high level program of work is:

> Myponga chloramination completion by Dec 2021.

> Adelaide system chloramination completion by June 2024

> Happy Valley water quality improvement completion by June 2024.

Customer willingness to pay and risks identified in the Drinking Water Quality Management Plan provide justification for this program. However, we consider that SA Water should revisit it's interpretation of the ADWG relating to aesthetic parameters and a scientific basis should be established for the pre and post position for investment at a scheme level. SA Water's intention to undertake focused customer surveys before and after the investment alongside water quality testing is a positive and important for documenting the benefits of this program.

Given that the previous scheme was for a small township (200 population) and that SA Water will face technical and customer engagement challenges in delivering this program, we consider that it is prudent for SA Water to deliver these works over a longer period of time to enable it to better learn from and overcome technical challenges and so that it is better able to define benefits and document how these have been realised for each component of work. This is also supported by the options assessment undertaken to support the program being semi-quantitative based on an assessed water health and aesthetic score. We consider that a more robust evaluation of program benefits be undertaken so that the health and aesthetic score better reflects customer perceptions pre and post works and observed improvements in water quality.

We therefore recommend that the prudent expenditure profile occurs across six years rather than the four proposed by SA Water.

The forecast costs are based on the best information available to SA Water. Due to the relatively bespoke nature of the works, efficient costs will not be known until an appropriate procurement process is undertaken. We do not consider that there is any bias in SA Water's forecast costs.

5.3.3 Scope for efficiency

In developing its capital expenditure program, SA Water has applied a 5% top-down efficiency adjustment. SA Water considers that improvements in the future period that will enable it to deliver this level of efficiency gains are[31]:

- Early on-boarding of a client organisation partner to support the planning, market approach, evaluation, award and implementation of contracts
- Re-evaluation of our supplier agreements for materials, equipment and services
- Workforce planning
- Scope prioritisation modelling
- Improved scope definitions using Front End Engineering Design services
- Improved project controls
- Improved systems and processes, including competitive target outturn cost development, value for money work practices, work allocation practices, performance management, and reporting and governance.

In formulating our recommended efficiencies, we have had regard for SA Water's anticipated level of efficiency gains and the avenues in which it anticipates that it will achieve these efficiencies. We have sought to identify if further efficiency gains are possible over and above those identified by SA Water and this has been informed by our reviews of SA Water's asset management practices and the application of these practices to develop the forward expenditure program.

As detailed in our methodology (Section 1.4), we have made adjustments for two types of efficiency gains to arrive at a recommended level of prudent and efficiency expenditure – continuing efficiency and catch-up efficiency. We discuss how we have arrived at the recommended level of efficiency adjustments in each of these areas following.

The scope for continuing efficiency for capital expenditure is in line with that proposed for operating expenditure as set out in Section 4.5. We consider that continuing efficiency of 0.8% per annum is achievable by SA Water based on long term MFP in Australia and the recent analysis by Ofwat as part of its PR19 Final Determination which was released in December 2019.

Based on our assessment of SA Water's asset management practices and the sample of capital expenditure projects reviewed, we have applied our judgement to determine the level of catch-up efficiency that could be achieved by SA Water in the RD20 period. We have identified two areas where SA Water should be able to make material improvement to its processes to move towards the efficiency frontier utility level over time and deliver material efficiencies over the next determination period. These are:

1. Improved assurance over expenditure justification
2. Improved asset management decision making.

A third area in which SA Water is likely to be able to make material efficiency gains in the RD20 period is cost estimating (refer to Section 3.7.2). We have not applied any catch-up efficiency for this improvement area as SA Water has identified that improved cost intelligence will support it to achieve the 5% efficiency gain it has already applied to the capital expenditure program.

Each of the two areas nominated for catch-up efficiencies is discussed following.

Improved assurance over expenditure justification

We have set out in Section 3.2 that we consider that there is scope for SA Water to refine its asset management objectives and line of sight so that there is greater recognition and integration with the regulatory framework in which SA Water operates. This will provide more assurance that expenditure is justified based on both stakeholder expectations and the regulatory framework that SA Water operates within. This view was confirmed by our review of a sample of capital expenditure projects where we identified multiple examples of expenditure being proposed where there was insufficient evidence to conclude that this was a prudent investment. For example:

[31] Our Plan 2020-24, Appendix N – Capital Delivery

> SA Water proposing to increase expenditure in Smart Networks to $21 million in the RD20 without quantifying the benefits. A trial has been completed so this information is available.

> The water network structures program proposing a level of expenditure to mitigate an unconfirmed level of asset failure risk despite SA Water being aware of the benefits of quantifying this risk during the RD16 period but not doing so.

> The wastewater networks program has been developed with limited consideration of consequence of failure. A more sophisticated approach will provide more assurance that cost and risk are being balanced.

Improved asset management decision making should result in the avoidance of expenditure that is not genuinely needed by SA Water to deliver its services.

We recommend a catch-up efficiency in this area of 1.0% per annum over the RD20 period.

Improved asset management decision making

Asset management decision making refers to lifecycle cost and risk analysis to determine optimum intervention to assets to achieve the asset management objectives. On numerous projects that we reviewed, the lifecycle costing fell short of good practice. Our observations include financial analysis not being undertaken to support options selection where benefits and costs should have been a key part of the project justification, limited sensitivity testing and scenario analysis and the analysis period not matching the expected life of the underlying assets. SA Water's approach to lifecycle cost analysis appears to be inconsistent and lacking in rigour. Improved decision making should realise the following benefits:

> Selection of options that are more favourable than what may be identified through less robust analysis

> Avoidance of projects where the decision making criteria are not met

> Better appreciation of the lifecycle cost impacts across the entire program and over the long term to inform better decisions regarding totex and affordability.

We recommend a catch up efficiency in this area of 0.5% per annum over the RD20 period, as decision making processes improve.

Our assessment of the level of continuing and catch-up efficiencies achievable in the future price path by SA Water is detailed in Table 5-5.

Table 5-5 Recommended continuing and catch-up efficiencies

	2020/21	2021/22	2022/23	2023/24
Continuing efficiency	**0.8%**	**1.6%**	**2.4%**	**3.2%**
Catch-up efficiency: Improved assurance over expenditure justification	1.00%	2.00%	3.00%	4.00%
Catch-up efficiency: Improved asset management decision making	0.50%	1.00%	1.50%	2.00%
Total catch-up efficiency	**1.50%**	**3.00%**	**4.50%**	**6.00%**

To avoid the potential for double counting in the application of catch-up efficiencies, we have applied them to the capital expenditure program net of the value of the projects and programs that were included in the sample reviewed. This is a conservative approach as many of the adjustments made to the projects and programs were to achieve a prudent scope rather than adjustments to efficiency. However, this approach provides additional assurance to SA Water that the recommendations do not overstate the potential for efficiency. We have applied the continuing efficiency adjustment to the entire capital expenditure program net of adjustments to specific projects and programs.

5.3.4 Conclusions and recommendation

Our recommended prudent and efficient expenditure for the RD20 period based on adjustments for specific projects and programs and continuing and catch up efficiency is summarised in Table 5-6.

Table 5-6 Recommended prudent and efficient capital expenditure for RD20 period

$M (18/19)	2020/21	2021/22	2022/23	2023/24	Total
SA Water RD20 actual and forecast capital expenditure	**527.6**	**394.3**	**466.4**	**453.8**	**1,842.0**
Project and program level adjustments					

Adjustment for ZCEF	-103.7				-103.7
Adjustment for Happy Valley WQ and chloramination	-10.35	-10.35	-10.35	-10.35	-41.4
Adjustment for network water structures	-1.45	-1.45	-1.45	-1.45	-5.8
Adjustment for GAP expansion	-1.50	-2.50	-3.00	-3.00	-10.0
Adjustment for reticulation water mains	-3.33	-3.33	-3.33	-3.33	-13.3
Adjustment for reticulation wastewater mains	7.65	-7.61	-11.32	-11.32	-22.6
Adjustment for IT risk management (IT Asset Refresh and Resilience) program	-2.41	-2.41	-2.41	-2.41	-9.6
Total expenditure after adjustments	**412.5**	**366.6**	**434.6**	**421.9**	**1,635.6**
Continuing and catch-up efficiency					
Continuing efficiency					
Continuing efficiency factor	0.80%	1.60%	2.40%	3.20%	
Continuing efficiency adjustment	-3.3	-5.9	-10.4	-13.5	-33.1
Catch-up efficiency					
Sample of project and programs reviewed (linear)	170.3	170.3	170.3	170.3	
RD20 program net of projects and programs reviewed	253.5	224.0	296.1	283.4	
Catch-up efficiency: Needs identification and justification	1.00%	2.00%	3.00%	4.00%	
Catch-up efficiency: Decision making	0.50%	1.00%	1.50%	2.00%	
Total catch-up efficiency	1.50%	3.00%	4.50%	6.00%	
Catch-up efficiency adjustment	-3.8	-6.7	-13.3	-17.0	-40.9
Total efficiency adjustment	-7.1	-12.6	-23.8	-30.5	-73.9
Recommended prudent and efficient expenditure	**405.4**	**354.0**	**410.8**	**391.4**	**1,561.6**

The recommended prudent and efficient capital expenditure profile for RD20 is shown in Figure 5-15.

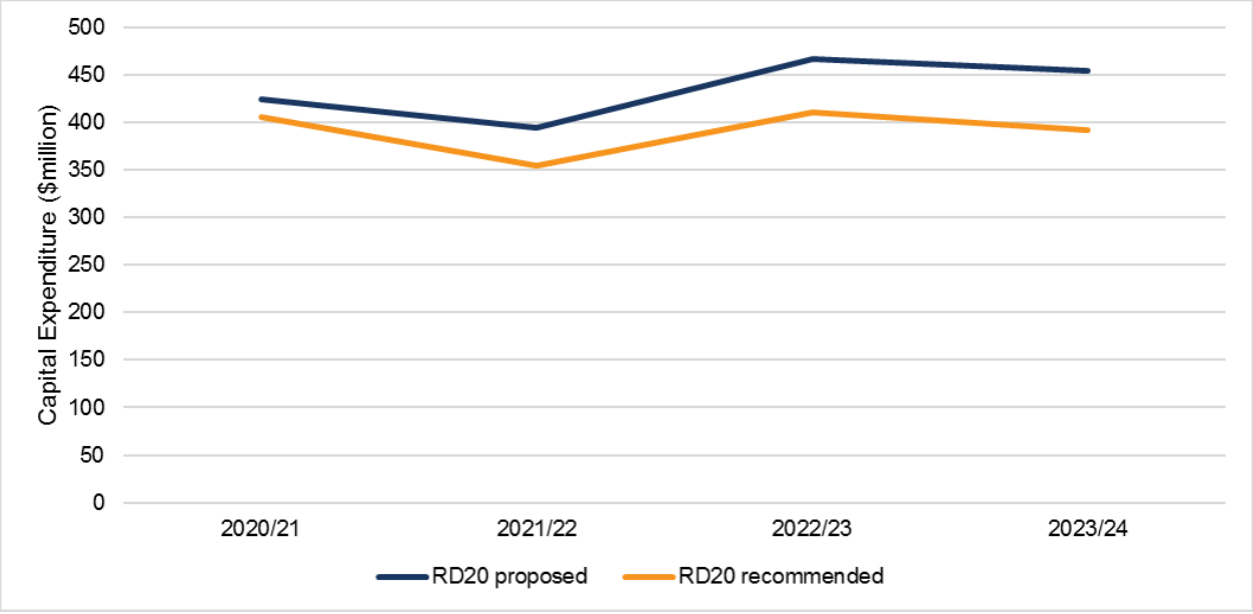


Figure 5-15 Recommended prudent and efficient capital expenditure for RD20 period

APPENDIX

A

ADDITIONAL BENCHMARKING

The following graphs demonstrate SA Water's relative efficiency. Note that the scatter graphs only compare SA Water to average 'expected' operating expenditure for that one variable. Being below the line suggests that the utility is more efficient than expected.

Sewerage

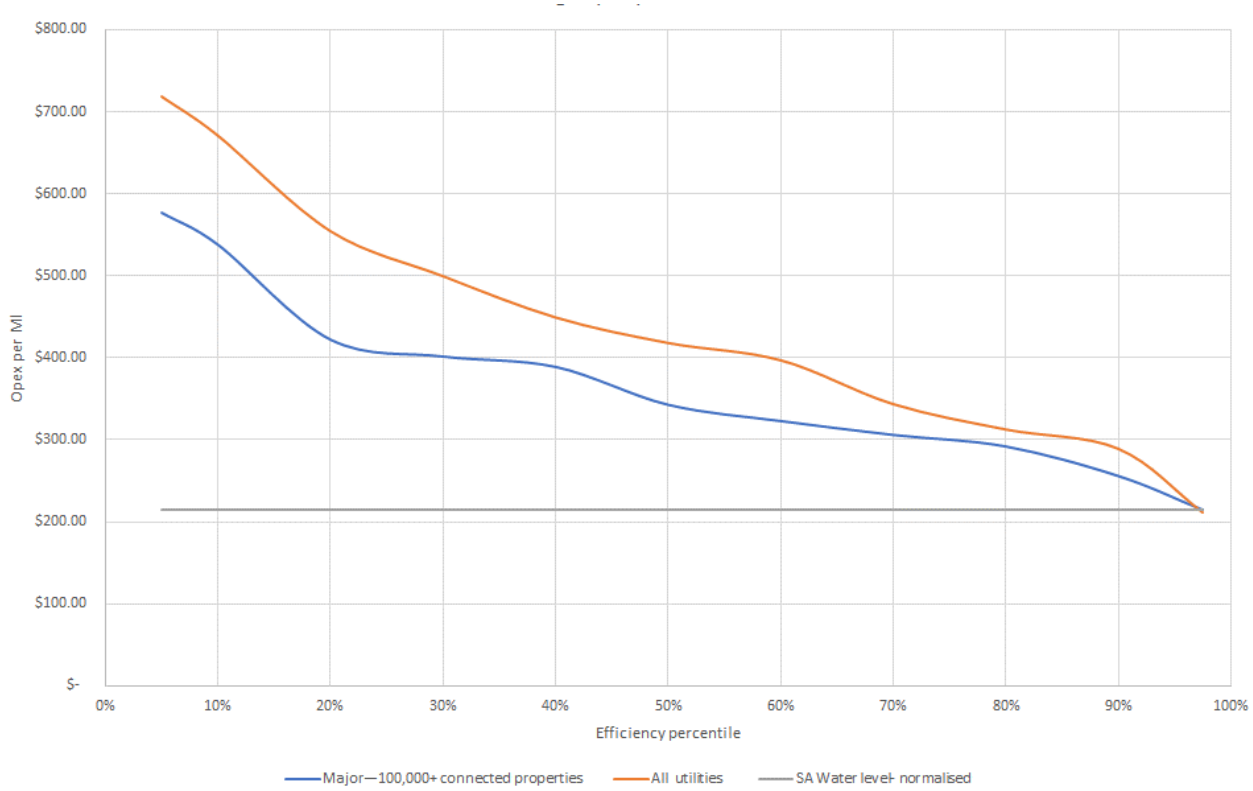


Figure A-1 Sewerage operating expenditure efficiency per property

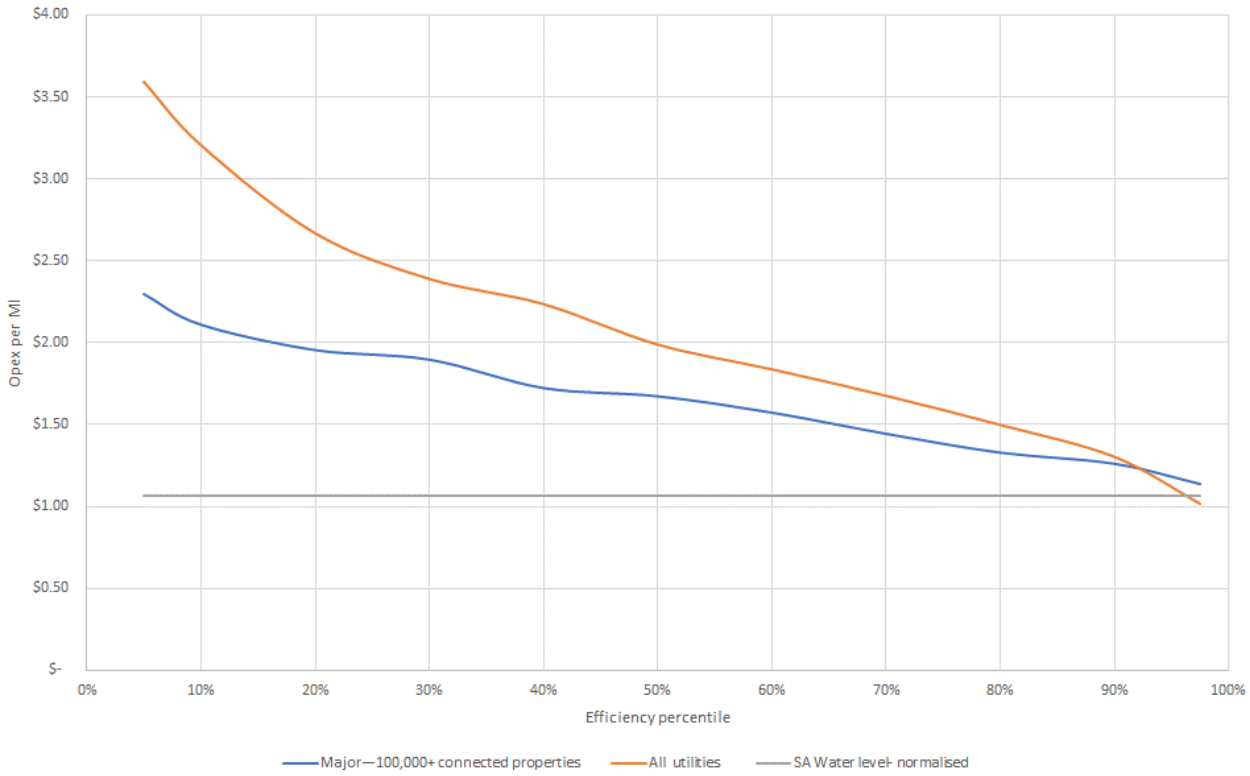


Figure A-2 Sewerage operating expenditure efficiency per volume collected

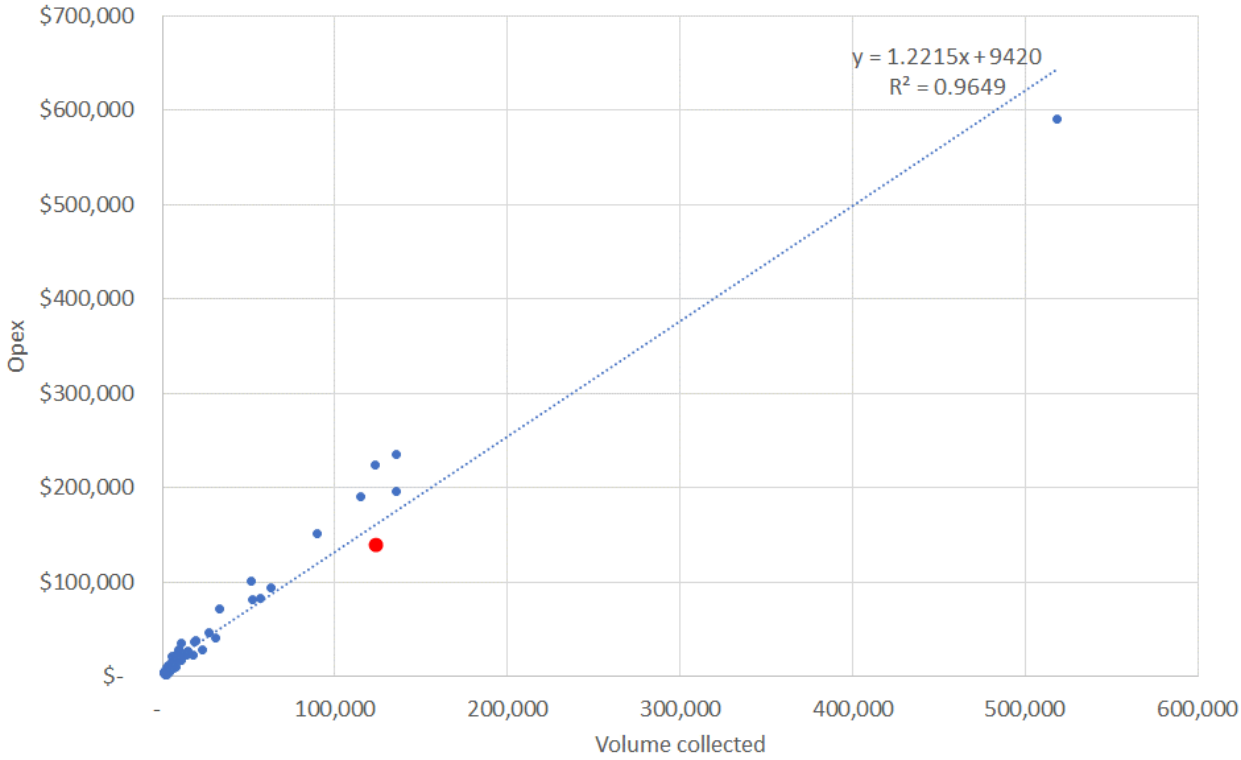


Figure A-3 Sewerage operating expenditure against volume collected (all utilities)

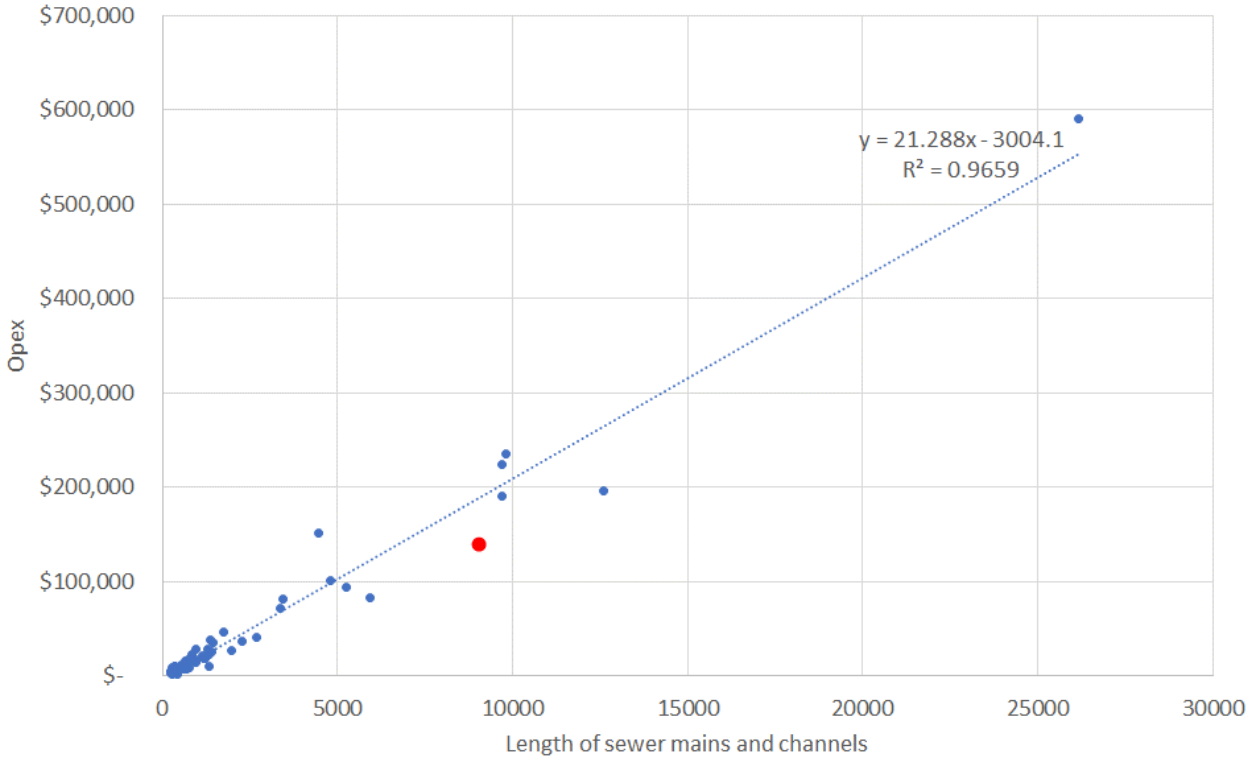


Figure A-4 Sewerage operating expenditure against length of sewers (all utilities)

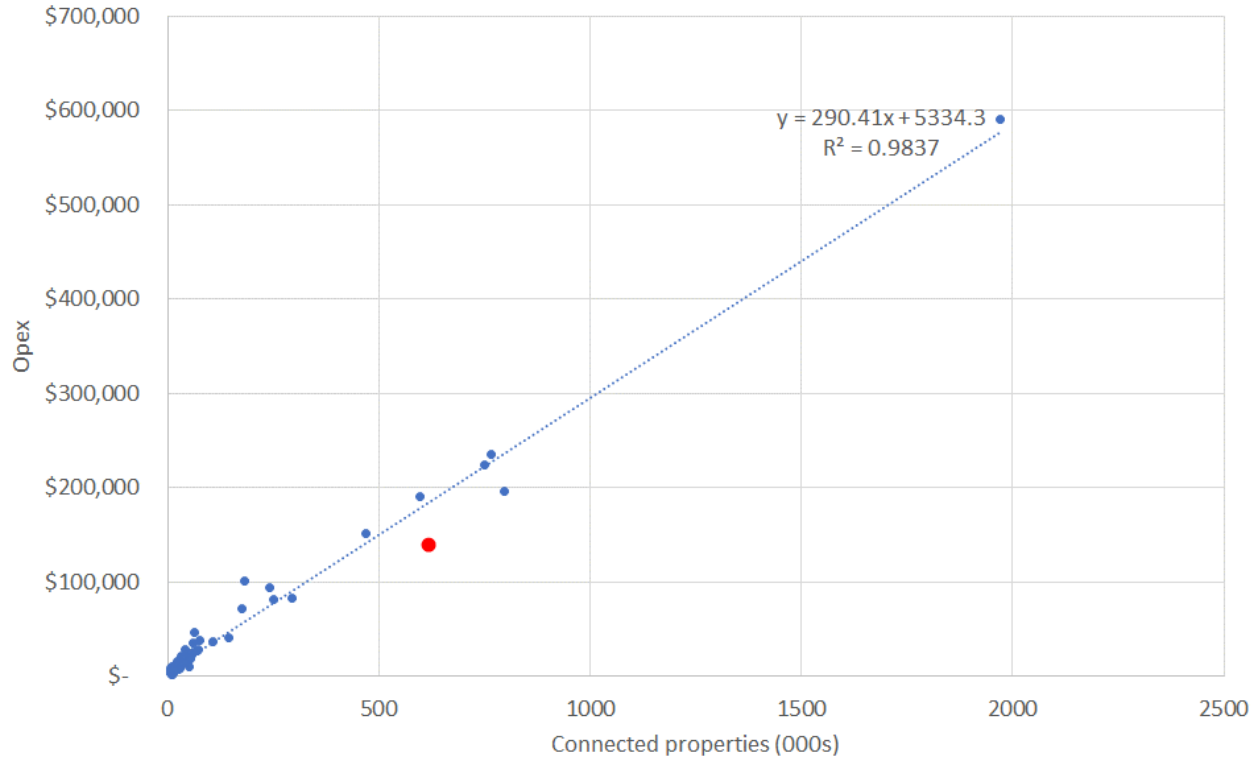


Figure A-5 Sewerage operating expenditure against connected properties (all utilities)

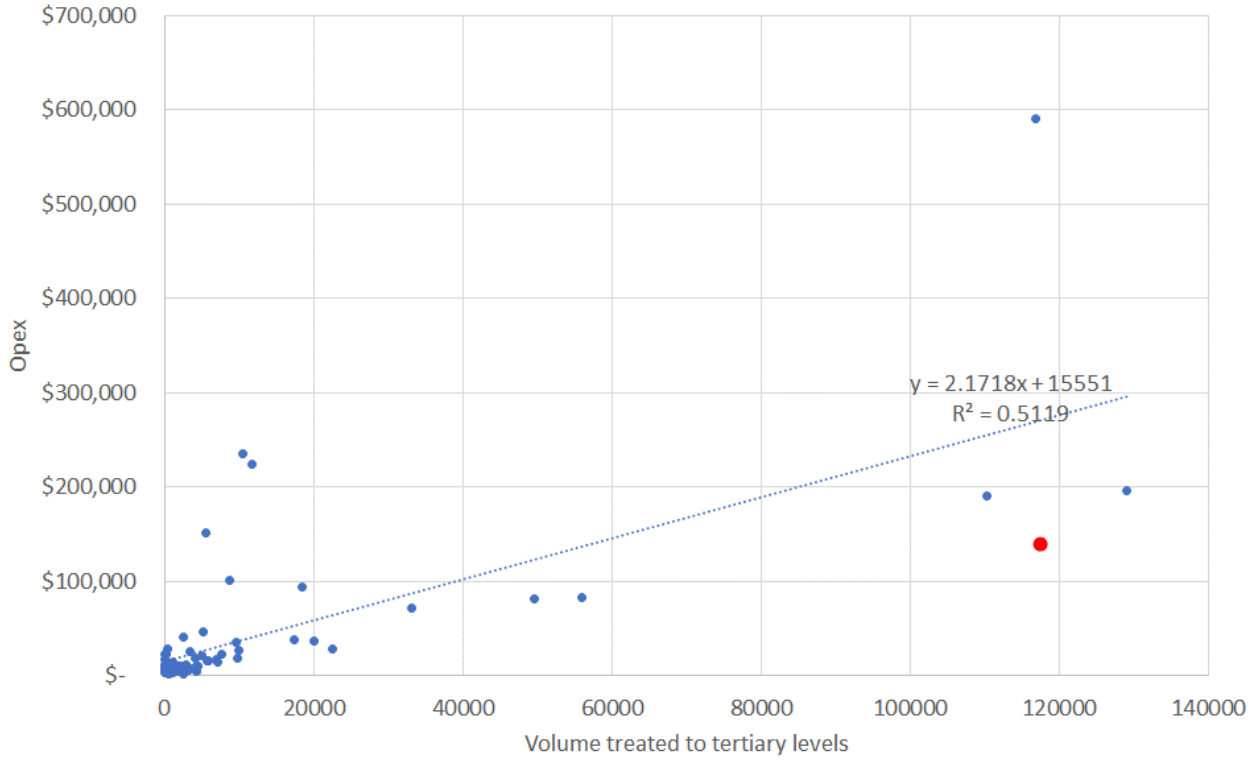


Figure A-6 Sewerage operating expenditure against volume of sewage treated to tertiary level (all utilities)

Water

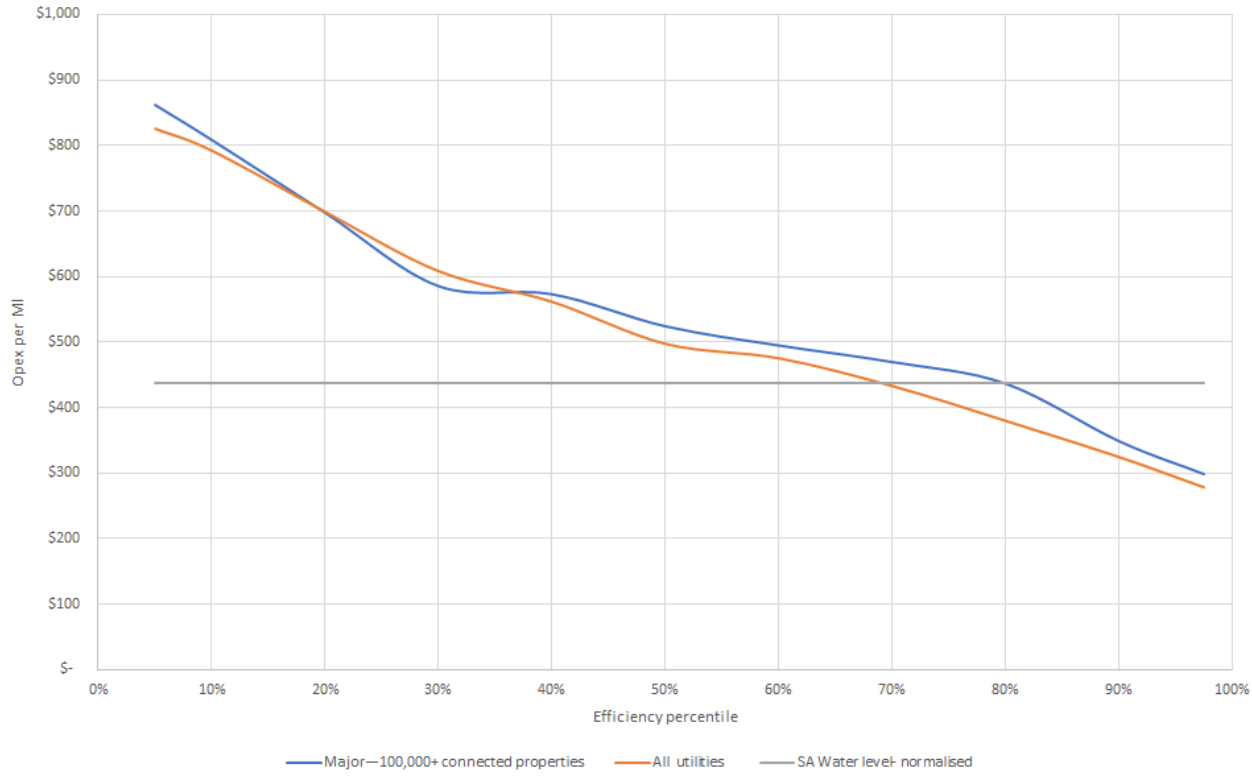


Figure A-7 Water operating expenditure efficiency per property

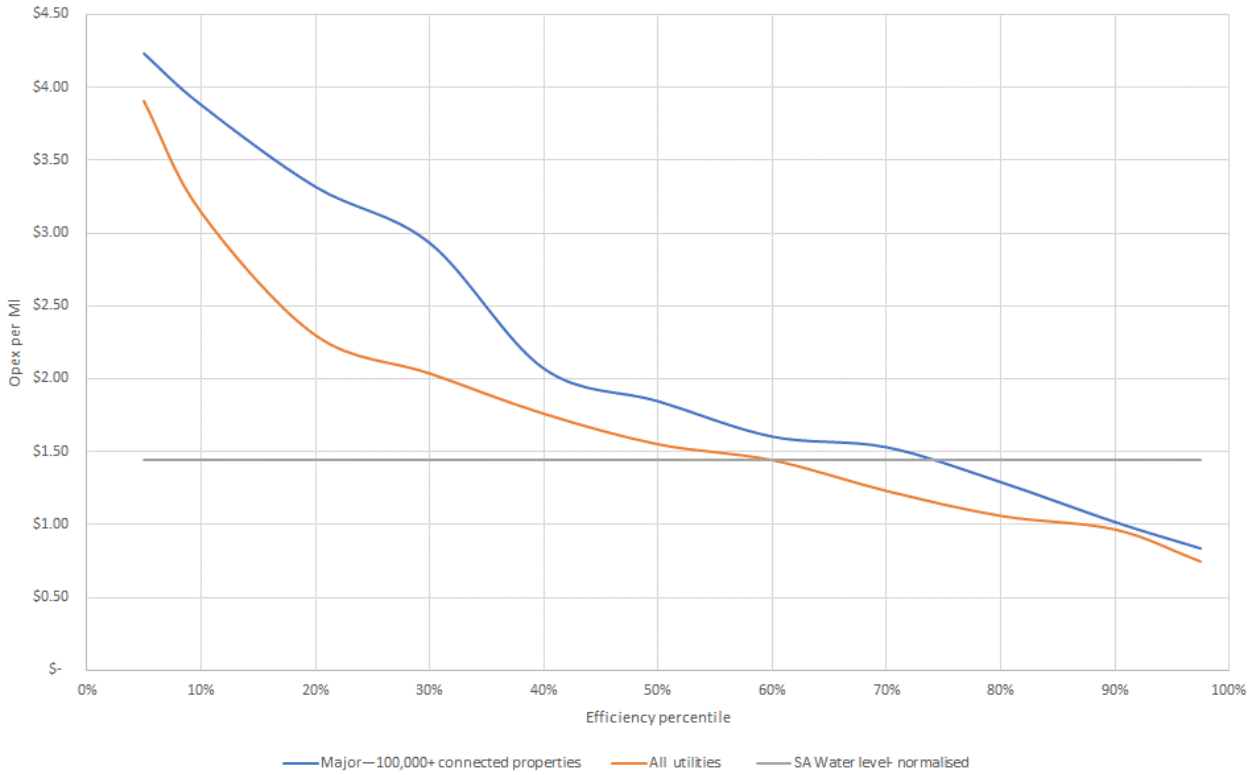


Figure A-8 Water operating expenditure efficiency per volume collected

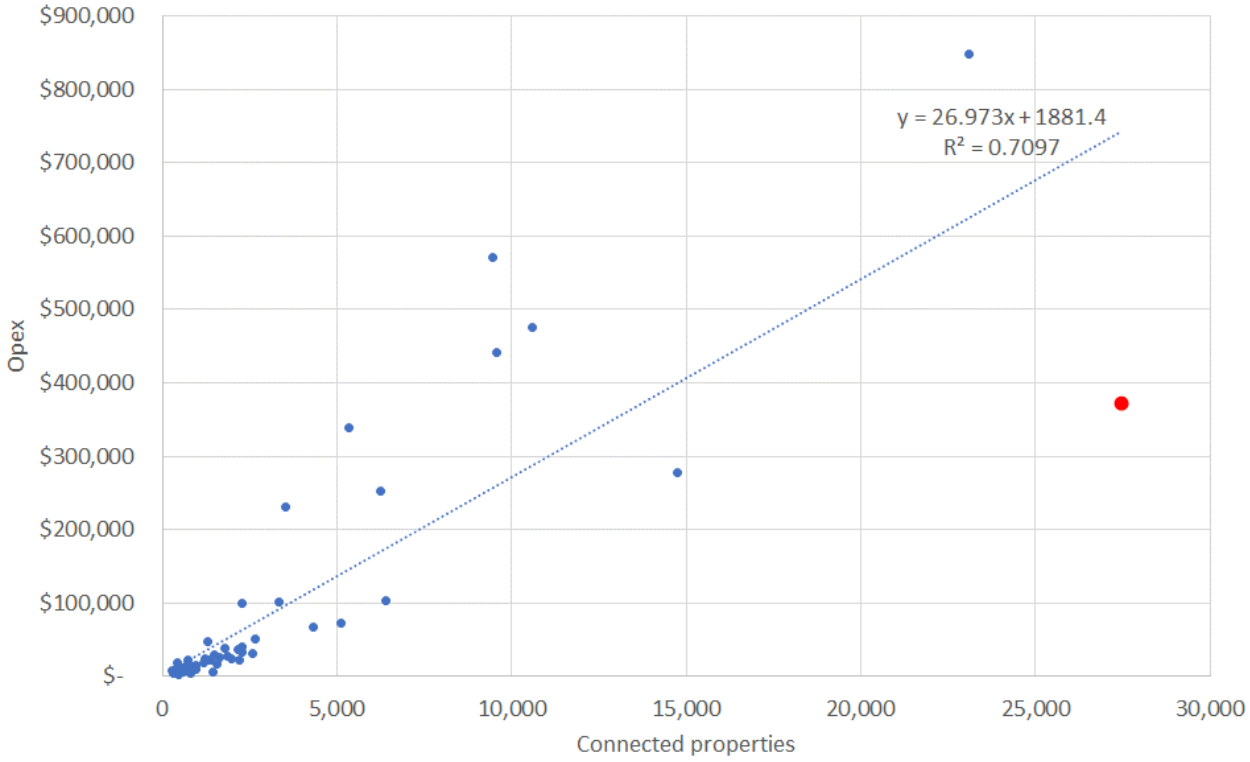


Figure A-9 Water operating expenditure against connected properties (all utilities)

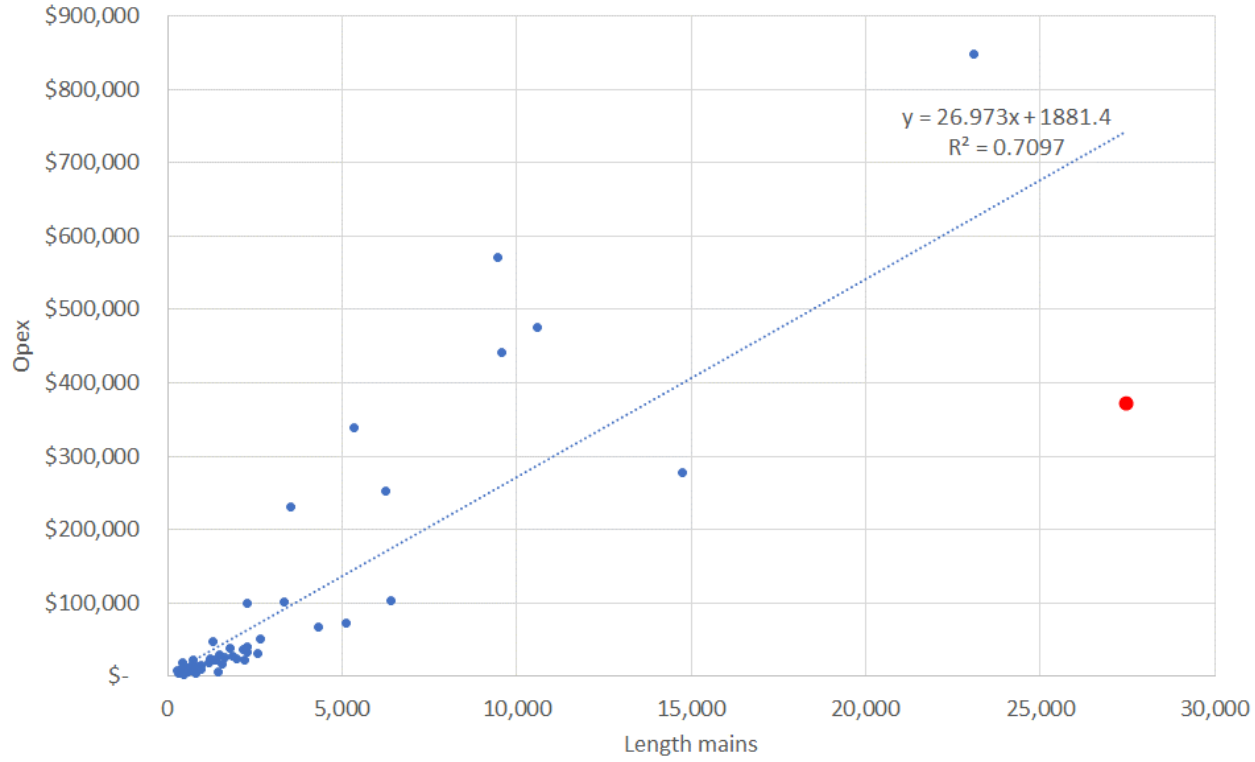


Figure A-10 Water operating expenditure against length of mains (all utilities)

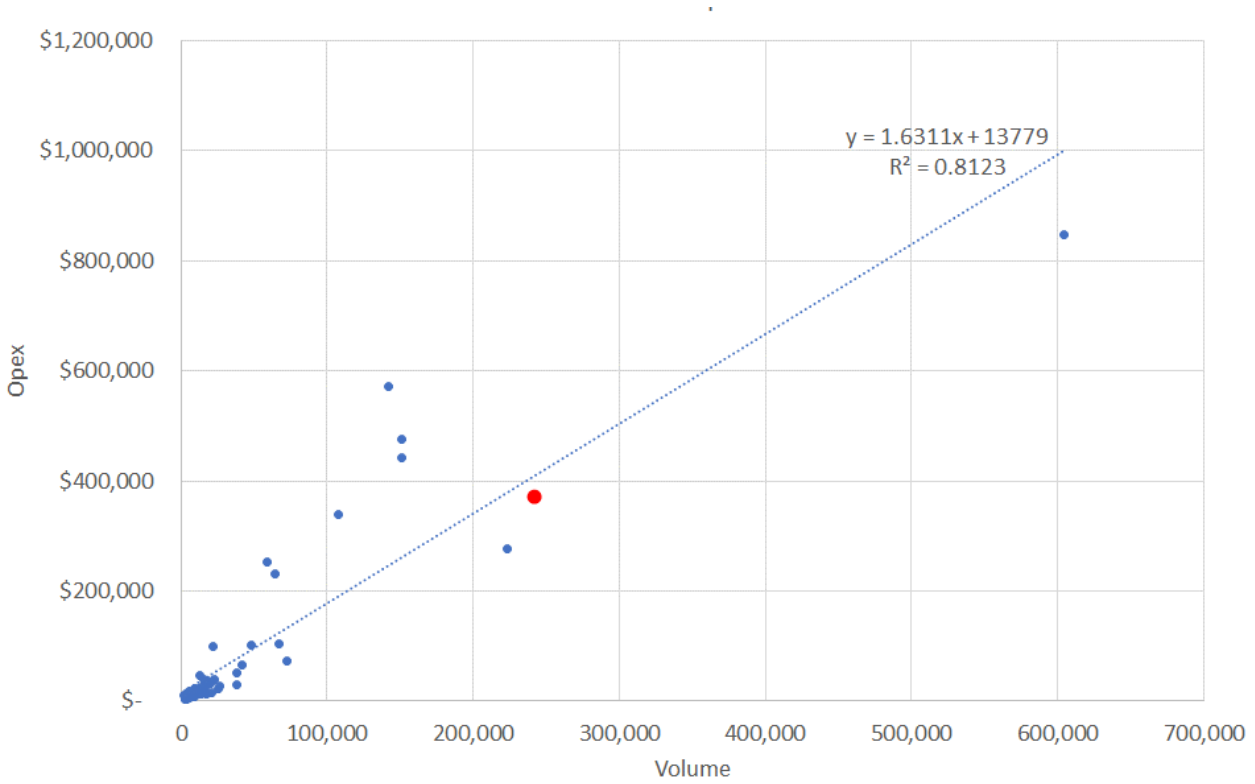


Figure A-11 Water operating expenditure against volume supplied (all utilities)

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APPENDIX

B

SUMMARIES OF PAST CAPEX PROJECTS

Water Network Mains Renewal - Reticulation

PROJECT DETAILS

Project Name	Water Network Mains Renewal - Reticulation		
Project Number	N/A Program (*9671/C3639 = AP Mains SP! Metro Retic Mains*)	Project Stage	Delivery
Primary Expenditure Driver Category	**Renewal**		

PROJECT DESCRIPTION

The purpose and outcome of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water. The RD16 proposal was to target the renewal of around 275km of water mains at a capex value of $86.2M.

This was amended partway through RD16 following a series of significant water main breaks in 2015/16 which attracted ongoing media attention. Additional customer research was interpreted by SA Water as customers wanting to see more done on leaks, including a greater number of replacements and a better response to failure (including isolation of mains post-burst). Customers also stated that affordability was still their key concern.

As a result of this, the program was extended by $55M to just over $148M. This included additional spending on:

- An additional 197 water main relays completed in 119 suburbs (no length in km specified). These relays have benefited 10,827 properties with 52 critical customers. (Additional cost $51M)
- 114 valves have been installed and another 64 are to be installed in 2018/19 (This has decreased shut off block sizes and has already prevented unplanned interruptions to 1,565 properties) (Additional cost $3M)
- Smart networks technology – see separate project review (Cost $4.6M)

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

Water Network Retic	2016/17	2017/18	2018/19	2019/20	Total
RD16[1]	20,814	20,314	21,838	23,199	**86,165**
Actual / Forecast[2]	36,254	48,635	33,778	29,438	**148,105**

[1] Business Case – Water Network Retic Mains Program Final
[2] Q3 1819 RD16 Capex Forecast – current SA Water forecast

DRIVERS AND STANDARDS OF SERVICE

At the time of RD16, the water mains renewals program was based on the following targeted outcomes:

- Maintain ≤ 1900 properties experiencing '3 or more' unplanned interruptions per annum
- Maintain the current number of high/low pressure complaints (≥27 L/minute at the meter – performance standards).
- Operations meet required attendance and restoration times.
- Metro failure rate: <21 failures/100km/year
- Country failure rate: <8 failures/100km/year

However, research completed after a series of main break issues in 2015/6 indicated a change in customers' views (as interpreted by SA Water). Customers raised concerns around level of investment in water mains and they wanted to see more done about leaks. This included a greater number of replacements and a better response to failures (including isolation of mains post-burst). Customers stated affordability was still their key concern.

The long-term mains failure trend for Metro is shown in Figure 1. Although failures showed a peak in 2015/16, this was after general decline from 1997/98. While failures rates in 2015/16 were at~23 per 100km which is above the RD16 service level (21 per 100km per annum), they were not significantly out of step with longer term averages – see Figure 1.

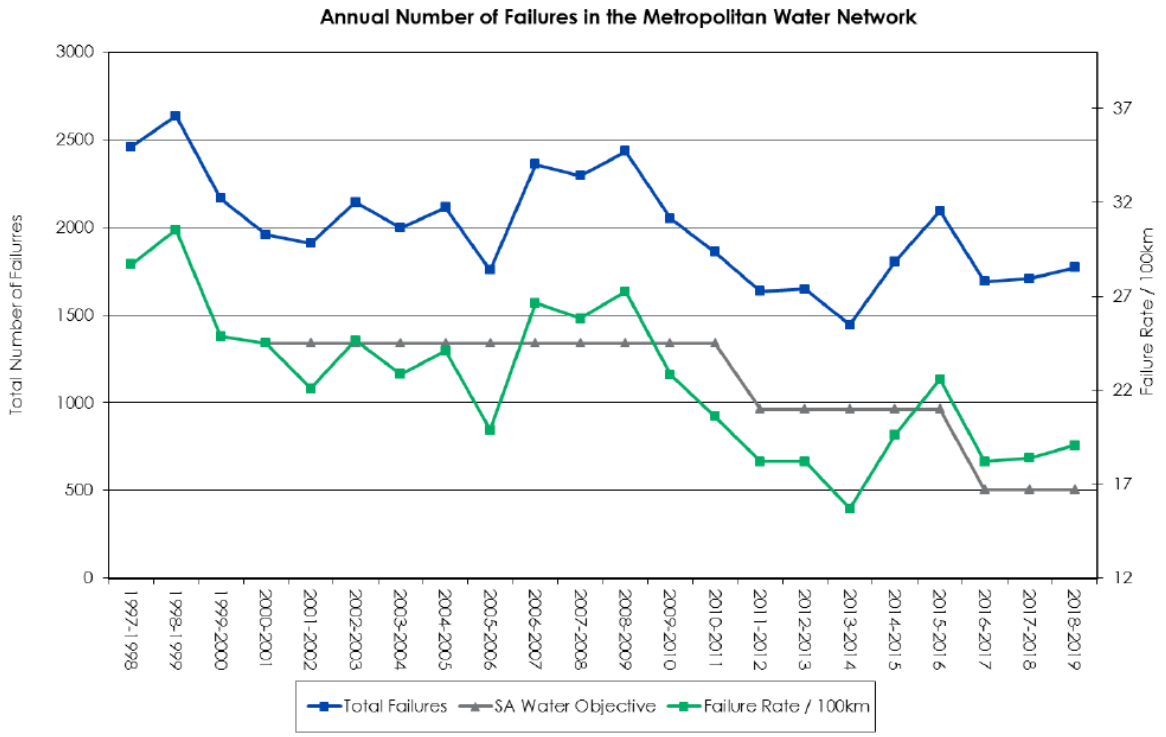


Figure 1 Historical numbers of mains failures per annum (Metro)

Based on the provided CE-AM monthly performance reports from August and September 2019, SA Water has proposed a change in its unplanned interruptions service levels (Table 1). Given the level of increased investment, improved service levels across both mains failures and unplanned interruptions metrics would have be envisaged.

Table 1 Service level for measures related to reticulation mains

Service Level	July 16 – Jan 17	Feb 17 – Jun 18	Jun 18 onwards
Mains Failures per 100km (Metro)	21	17	17
Mains Failures per 100km (Regional)	8	8	8
Properties with 3 or more unplanned interruptions (Metro)	1,400	900	1,400
Properties with 3 or more unplanned interruptions (Regional)	500	500	1,000

In the ex-post capital review business case for $55 million Water Network Improvement (Document not dated – estimate March 2019), SA Water has reported reductions in network failure rates and numbers of properties experiencing three or more unplanned interruptions. Performance has also been reported to be affected by ground movement, usually pronounced in drier conditions, which can have a significant effect on underlying burst numbers. For the Metropolitan Area, mains failures are reported in this document at 18.4/100km after being 22.6/100km before the change in strategy. Numbers of properties experiencing three or more water interruptions are reported in the same document has reduced to 1,543 (February 2019) from 2,687 (December 2016).

However, current performance figures to September 2019 (12-month rolling figures) extracted from CE-AM reports shows a significant worsening in performance over the past 12-18 months (see Figures 2 and 4) for mains failures and to a lesser extent, water supply interruptions.

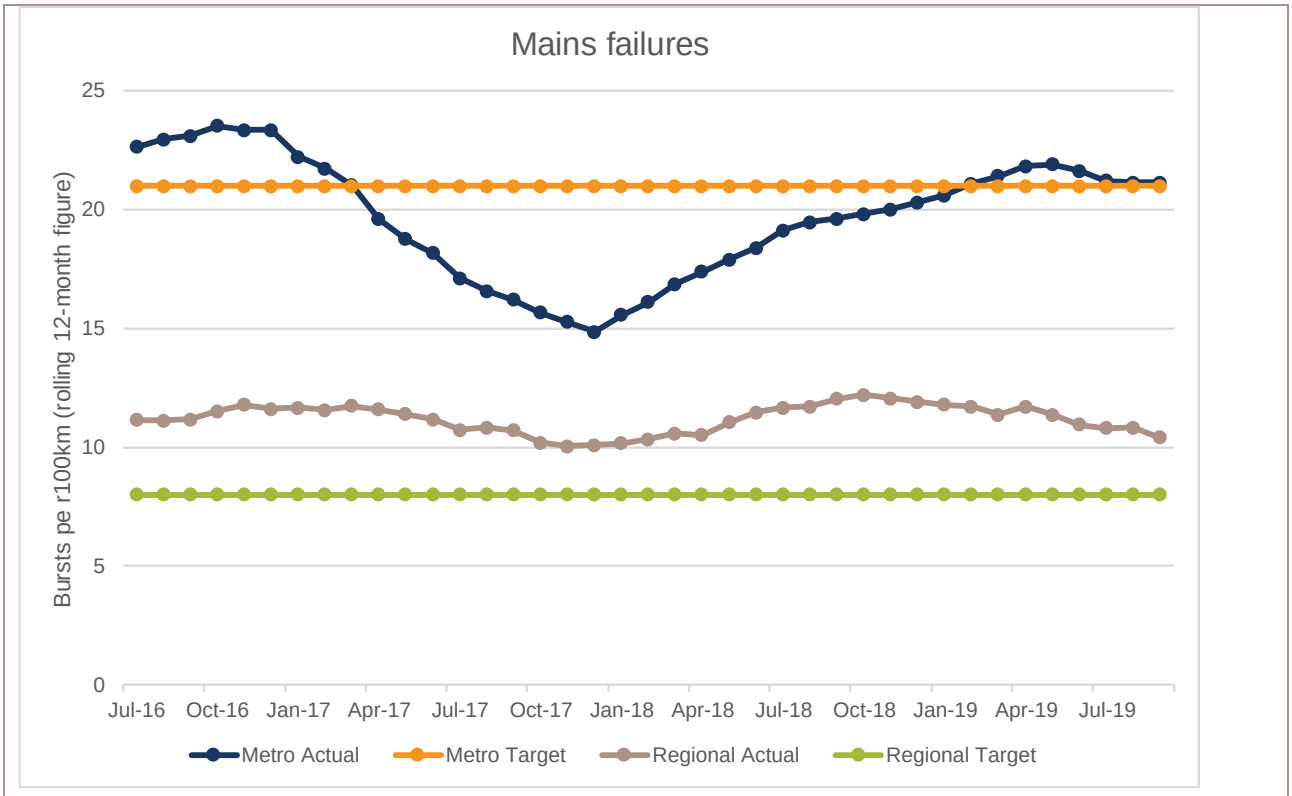


Figure 2 Mains failures per 100km rolling 12-month figures

Further investigation into burst types is also telling, in particular for pressure-related bursts which are more representative of network operations and asset condition as opposed to those related to ground movement, which are often weather-related and out of a utility's control.

Examining the trend in Figure 3, there is evidence of some short-term deterioration of mains bursts to the peak in 2015/16. The level experienced in 2015/16 is approximately 35% higher than the average of the previous 5 years (2010/11 – 2014/15). However, from 2009/10 to present pressure-related bursts are relatively stable. This is especially the case considering that there were four major failure events in 2015/16 which contributed to the spike in failures. These included surge events, boundary connection management issues, a pump station operational change and an issue with PRV operation.

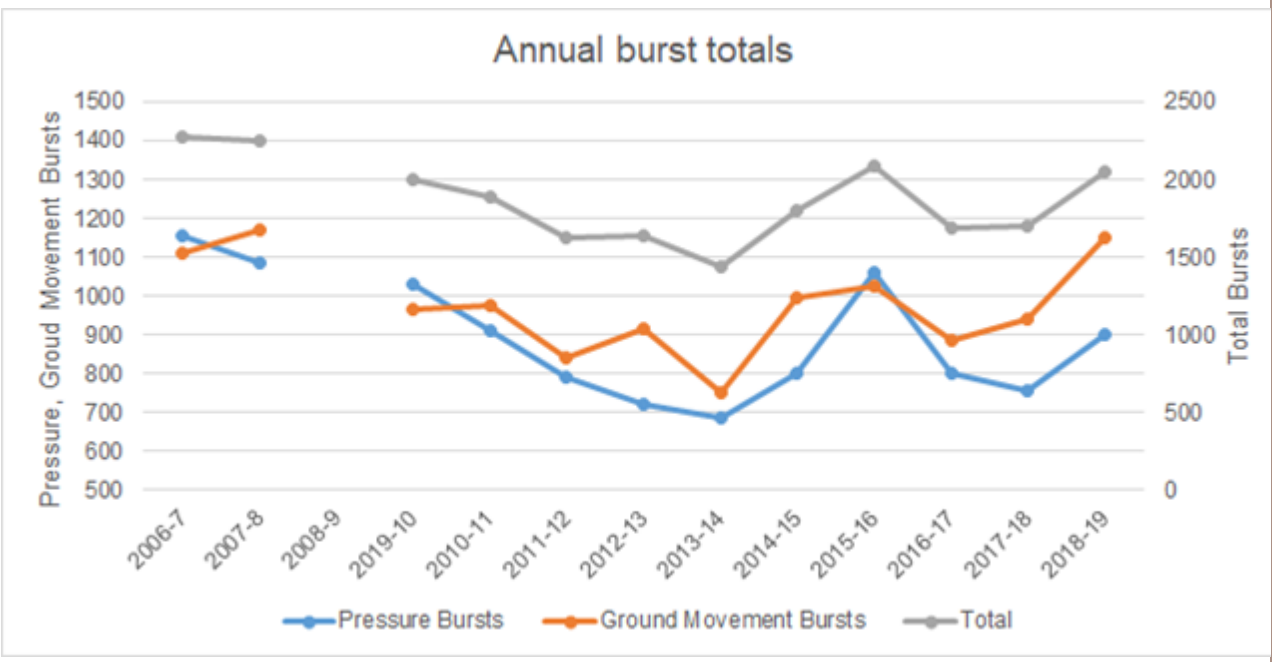


Figure 3 Pressure related bursts breakdown per annum

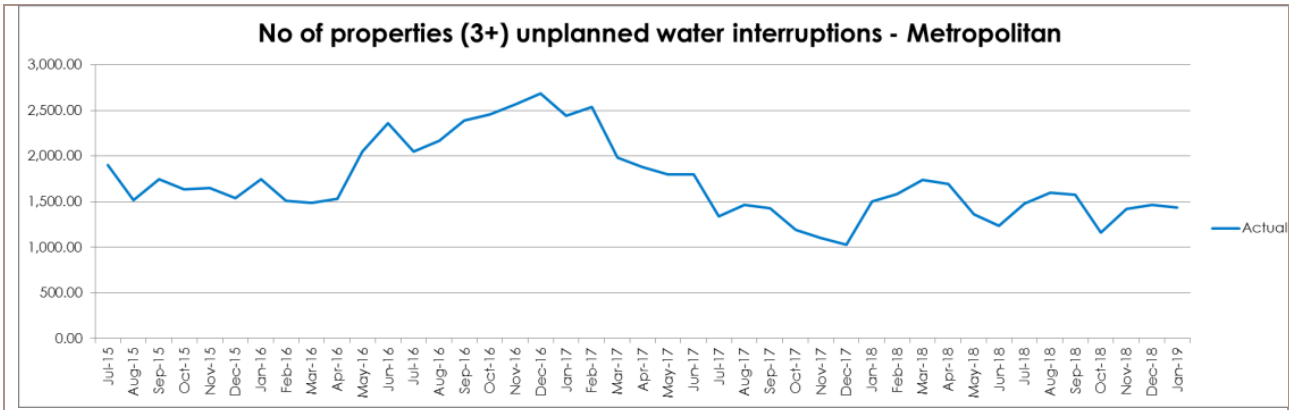


Figure 4 Properties with 3 or more unplanned interruptions – rolling 12-month figures

The corresponding trend in properties with 3 or more water supply interruptions peaks in December 2016 at around 2,600, up from a typical average of 1,600-1,700 (see Figure 4). Unplanned interruptions are a function of mains failure but the number of properties affected are a function of network flexibility and the management of and response to a failure. SA Water have not provided a breakdown of unplanned interruptions and identified any specific themes explaining the interruptions. In interviews with SA Water they identified improvements in shut-off block data, increases in infill development leading to larger shut-off blocks and changes in repair strategies driven by safety as major causes of the larger supply interruption numbers.

SOLUTIONS DEVELOPMENT

Original RD16 Program

The Water Reticulation Asset Program uses two long term models (Nessie and PARMS) to prioritise renewals over a 25 year renewals program. SA water averages the two models to set the 25 year program. A short term prioritisation model is used for decision making within the bounds of the overall program. These are used to guide SA Water's management of the water reticulation main class.

PARMS (Pipeline Assessment Risk Management System) was developed through CSIRO and WSAA in 2001. Failure curves are used to calculate the probability of failure of each pipe segment. Such curves are based on factors including pipe material, diameter, age, soil, hydraulic pressure and traffic loading. Scenarios or policies are then applied based on levels of service options provided to customers. Frequency of failures and length of main required to be replaced is extracted from the model and used to set the required budgets. Overall company failure rates are plotted as averages of the policies employed per material type to derive budgets per level of service.

SA water also has a short term model, which was developed in house, to prioritise the capital works identified by the long-term models. Initially prioritised for relays and repair costs, as the regulatory environment has developed, the model has changed to a customer focus. Weightings now reflect customer requirements to ensure that relays with larger customer benefits are given higher priority.

The short term modelling and prioritisation activity is completed on a periodic basis to develop the detailed mains renewal program. This uses a number of criteria related to water main failures per street, shut-off block size, their causes of interruptions and listing of sections previously identified for possible relays to develop a subset of mains for possible mains renewal. This is carried out separately for metro and country areas.

Once the subset is developed, a series of data is collected for the mains including interruptions, relay costs, special factors (shut off blocks with unusually high numbers) and another shut-off block factor for where a main spans only part of the block. These are combined to create a customer score. An economic score is then calculated through summation of failure cost / relay cost multiplied by a score for unlined cast iron. The customer and economic scores are summed to provide a total score.

Once the water mains have been ranked based on the total score, checks are made to confirm there are no data peculiarities e.g., very short relays which may score highly but do not truly reflect total renewal cost. A final check compares the selection in question to PARMS model outputs for this set of pipes across the state to bring in a top-down perspective. It is not very clear how the PARMS pipe cohort look up activity influences the overall ranking. It appears that the pipe selected is compared against equivalent pipes in PARMS for failures avoided, cost effectiveness, and economic NPVs. SA Water states that "through assessing the performance of the pipe cohort across the rest of the network, the probability of future failure is better informed. With this new information the prospective water main relay list rankings are adjusted. If the pipe is justified for renewal it is ranked relative to the rest of the group." High priority pipes/definitely relays are omitted from this final step.

Updated Strategy

In identifying the need to revise the original RD16 strategy for reticulation main renewal and wider network SA Water reviewed key contributors to the mains break and interruptions performance including water main failure rate, size of area affected by shut-offs, restoration times, surge management and detection of pipe failure.

As part of the additional focus on mains breaks and interruptions the revised strategy also looked at standards of service and examined different scenarios in the PARMS failure rate model. Starting with a Metro three or more interruption value of 1,400 properties and a failure rate of 21 properties/100km/year, the PARMS failure rate model was used to predict the work required to deliver a 20% reduction in the pressure related failures by 2020, which was predicted to achieve a change in the 2020 3+ interruption target. Further work to improve the accuracy of the modelling led to SA Water anticipating that it would achieve approximately 1200 properties experiencing 3+ interruptions by 2020.

SA Water chose to implement the following additional activities:

- Investment to reduce the size of shut-off blocks – opportunity to reduce the size of 500 of the largest shut-off blocks each of which contains more than 70 customers – investment of $3 million
- Find ways to reduce the time taken to fix main breaks – trials of new technologies and targeted replacement of broken valves in the network
- Proactively detect leaks through a smart network
- Investment to reduce the number of failures in the metropolitan area over the regulatory period by 20% – additional investment of $51 million to renew water mains
- Investment in communication – for example the SA Water website now provides information on which water mains are being replaced and when.

The total additional investments in water reticulation mains under the changed strategy is $55 million. A Board paper for additional funding was presented and approved in 2016/17.

Based on the observed spike in pressure-related bursts (an increase of 35% in 2015/16), it is reasonable for SA Water to undertake additional works to arrest this. However, a total $51 million increase in expenditure (mostly for mains renewals) on top of an established base $86 million program is an increase of greater than 60%. This is disproportionate to the improvement in performance sought, especially when it is observed that a number of the bursts are from poor operation, not asset degradation. We also consider that pressure management is likely to provide a more cost-effective approach to improving performance than mains renewal. We consider that a prudent increase in the reticulation mains renewal program would have been around $30M (that is, in addition to the existing $86 million program). This is proportionate to the increase in pressure-related bursts. Note that the focus here is on pressure-related mains failures because these are ones SA Water can control to a degree.

PRUDENCE ASSESSMENT

It is prudent that SA Water invests in the water reticulation network to maintain continuity of supply. Based on the observed spike in pressure-related bursts (an increase of 35% in 2015/16), it is reasonable for SA Water to undertake additional works to arrest this. However, we are concerned that the improved targets are arbitrary and that the customer engagement was limited. We note that SA Water has since revised these targets. We consider that a total $51 million increase in expenditure (mostly for mains renewals) on top of an established base $86 million program (an increase of greater than 60%) is disproportionate to the deterioration in performance and not warranted because:

- Failure rates for pressure and ground movement related bursts increased by only 35% compared to the previous five years
- A number of pressure related mains failures recorded in 2015/16 were a result of poor operational management and/or control.
- Mains renewal is only one element to controlling unplanned interruptions. With the exception of some additional investment to reduce shut-off block size and some investment in smart networks, there appears to be limited exploration into other techniques to reduce unplanned interruptions. Our experience is that pressure management is likely to have been a more cost effective approach (up to a point) than the magnitude of mains renewals proposed.

We consider that a prudent increase in the reticulation mains renewal program would have been around $30 million. We consider that the $3 million investment for additional shut off block works is also justified. We consider that a prudent additional program of work is $33 million (that is, in addition to the existing $86 million program). This is proportionate to the increase in pressure-related bursts. Note that the focus here is on pressure-related mains failures because these are ones SA Water can control to a degree.

COST ASSESSMENT

The Procurement Recommendation Report for this project provides some detail of the process undertaken to select a framework contractor for the 2017/2020 Metro Water main Reticulation Program Works and Framework Agreement.

The report recommended a Framework Agreement award to SEM Utilities Pty Ltd for an initial value of $4 million excluding GST. Subject to the framework award being approved, a paper would be put forward to the SA Water Board to increase the Framework Agreement to $10 million and endorsement to see Cabinet approval to increase the Framework Agreement to its full approval value of $60 million.

The process consisted of a pre-selection process, tender briefing meeting, tender submission, tenderer presentations and submission assessment. Unweighted and weighted criteria were used to assess the submissions. Unweighted criteria including compliance and acceptance of SA Water terms of contract and rates and prices compared to industry benchmarks.

This is a typical procurement approach for a large utility infrastructure contract.

EFFICIENCY ASSESSMENT

The PARMS model with bottom-up analysis of failing pipes does appear to present an overall effective way to identifying the pipes in greatest need of replacement when used to complement the other checks and balances SA Water has in place. Mains identified for renewal undergo a further economic and customer performance analysis as repair schemes are developed. There is also a good level of stakeholder consultation internal and external to SA Water.

We consider that there is an opportunity for SA Water to use PARMS outputs as an input to the bottom up process rather than a check against this model. The way the program is developed it is reactive acting on past burst history first as a major driver. Other organisations have used their failure scenario models to identify cohorts before burst rates and/or customer service metrics have been significantly affected.

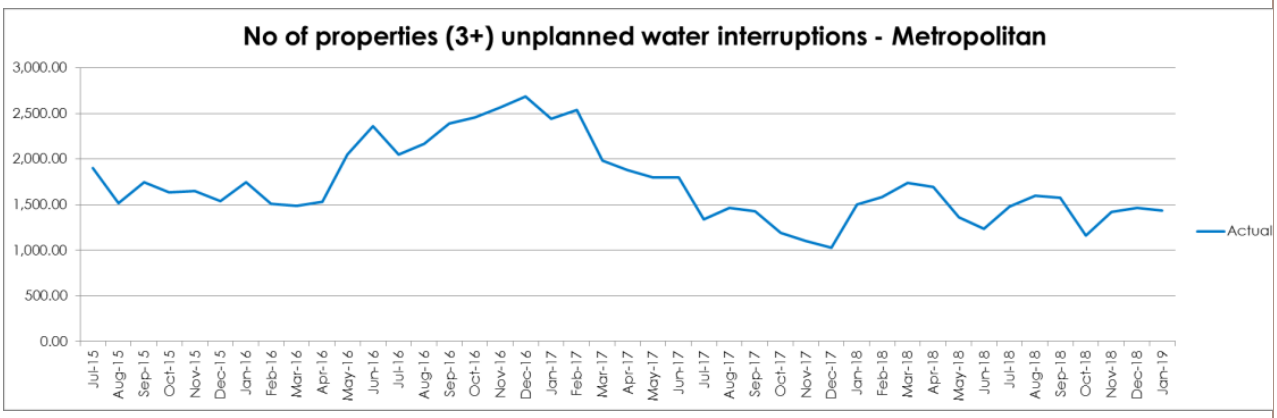
Despite this, it is a fair way to develop a mains renewal program targeting those pipes which are likely to generate the most failures in future regulatory periods, thus having the most customer impact.

Other responses looking to manage mains failures and supply interruptions such as increased valve installations to reduce valve shut off block size and a pressure monitoring trial are at a much smaller scale of investment but worth using in a basket of intervention measures.

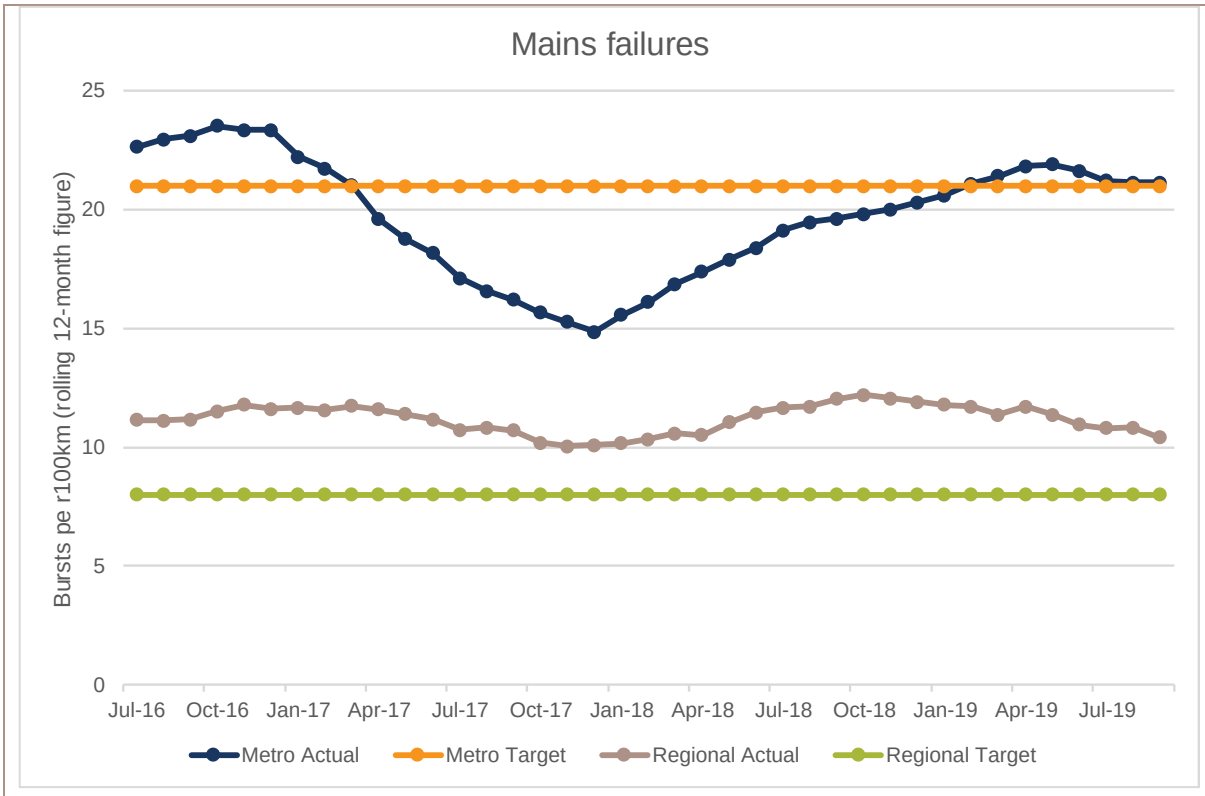
CONCLUSION

The purpose of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water. The RD16 proposal was to target the renewal of around 275km of water mains at a capex value of $86.2 million. The renewals are meant to minimise unplanned interruptions and failures in the mains. SA Water has set targets for unplanned supply interruptions and mains failures in order to guide its maintenance strategy.

In 2015/16, the performance of SA Water's water reticulation network worsened with a spike in December 2016 or 2,6000 properties impacted by three or more unplanned interruptions (based on a 12 month rolling average) as shown in the figure below.



The underlying mains failure rate also worsened with a peak of 23 bursts/100km water main in the metro area as shown in the figure below.



At this time, there was also considerable public interest and coverage of the performance of the water reticulation network. This prompted SA Water to engage with customers and revisit its program. Customer research indicated a change in customers' views (as interpreted by SA Water). Customers raised concerns around the level of investment in water mains and they wanted to see more done about leaks. This included a greater number of replacements and a better response to failures (including isolation of mains post-burst). Customers stated affordability was still their key concern.

In response to the circumstances, SA Water reset its targets for performance of the metro water reticulation network as follows:

- Properties with 3 or more unplanned interruptions – reduced to 900 from 1,400
- Failure rate – reduced from 21 failures per 100km water main to 17 failures per 100km water main.

To achieve these improved targets, SA Water decided to implement the following additional activities:

- Investment to reduce the number of failures in the metropolitan area over the regulatory period by 20% – additional investment of $51 million to renew water mains
- Investment to reduce the size of shut-off blocks – opportunity to reduce the size of 500 of the largest shut-off blocks each of which contains more than 70 customers – investment of $3 million
- Find ways to reduce the time taken to fix main breaks – trials of new technologies and targeted replacement of broken valves in the network
- Proactively detect leaks through a smart network
- Investment in communication – for example the SA Water website now provides information on which water mains are being replaced and when.

The total additional investments in water reticulation mains under the changed strategy is $55 million.

Based on the observed spike in pressure-related bursts (an increase of 35% in 2015/16), it is reasonable for SA Water to undertake additional works to arrest this. However, we are concerned that the improved targets are arbitrary in the level set (although supported by modelling) and that the customer engagement was limited. We note that SA Water has since relaxed these targets. We consider that a total $51 million increase in expenditure (mostly for mains renewals) on top of an established base $86 million program (an increase of greater than 60%) is disproportionate to the deterioration in performance and not warranted because:

- Failure rates for pressure and ground movement related bursts increased by only 35% compared to the previous five years
- A number of pressure related mains failures recorded in 2015/16 were a result of poor operational management and/or control.
- Mains renewal is only one element to controlling unplanned interruptions. With the exception of some additional investment to reduce shut-off block size and some investment in smart networks, there appears to be limited

exploration into other techniques to reduce unplanned interruptions. Our experience is that pressure management is likely to have been a more cost effective approach (up to a point) than the magnitude of mains renewals proposed.

In response to the preceding comment in the draft report regarding pressure management, SA Water responded that:

> *Pressure management was being investigated at the same time as the additional main renewals for the new EL75 and EL140 pressure zones through a separate project. However, impacts to commercial and industrial fire systems were making it no longer economical viable for these larger pressure modulation zone to be installed and give significant reductions to the failure rate in a short time period required to bring the network performance back to an acceptable level. Hence the scope change to reduce pressure in smaller areas of Athelstone and Kadina networks as a trial to manage and understand customer issues/benefits while still measuring and understanding the benefits of pressure modulated zones*

We acknowledge that these trials have been occurring but this does not alter our assessment that pressure management can often be a lower cost alternative to mains renewal.

We consider that a prudent increase in the reticulation mains renewal program would have been around $30 million. We consider that the $3 million investment for additional shut off block works is also justified. We consider that a prudent additional program of work is $33 million (that is, in addition to the existing $86 million program). This is proportionate to the increase in pressure-related bursts. Note that the focus here is on pressure-related mains failures because these are ones SA Water can control to a degree.

We consider that SA Water processes are appropriate for selecting appropriate solutions. SA Water has a top-down deterioration modelling approach and bottom-up analysis for mains renewal identification which is likely to find high risk pipes to review. The process involves refinement of solutions considering economic impact and benefits while it also undergoes a number of stakeholder reviews. The procurement processes for identified solutions appear to follow typical utility infrastructure approaches.

KEY DOCUMENTS REVIEWED

WC_0077_WaterNetworkRetic-CONFIDENTIAL

Q3 1819 RD16 Capex Forecast – current SA Water forecast

2010912 – Q3 1819 RD16 Capex Forecast – current SA Water forecast.xlsx

Ex-post capital review business case $55m Water Network Improvement (not dated)

Approach to the Water Reticulation Mains Asset Lifecycle Version 1.00 January 2019

Board paper on $55m additional mains relay spend (not dated)

CE-AM Monthly Performance Report 15102019

Water Pipe Network Facility AMP

Water Reticulation Main Failure Analysis with Increased Expenditure 2019

PCW8634 Procurement Recommendation Report II

Hope Valley EL170 Tank Structure Renewal

PROJECT DETAILS

Project Name	Hope Valley EL170 Tank Structure Renewal		
Project Number	7189/C1614	Project Stage	Delivery
Primary Expenditure Driver Category	Renewal		

PROJECT DESCRIPTION

The Hope Valley EL170 tank is a 136 ML storage tank within SA Water's water distribution system. The scope of the works originally proposed in the RD16 submission was to renew the tank roof. The scope proposed in the RD16 business plan was to complete a corbel and column strengthening activity which involved the use of load transfer brackets (LTB) to be designed to support the existing corbels and transfer loading from the roof structure to the columns. Costs for this project at RD16 submission were stated as $10.320 million (nominal).

Current forecast costs to complete the project are $21.0 million (18/19). The originally selected corbel and column strengthening solution, which formed the RD16 submission, has not been followed through to delivery. It was identified during scoping that WHS risks during delivery, uncertainty of solution success and the time required to complete this solution were unacceptable to SA Water. Costs also significantly increased based on original RD16 submission. As an alternative, SA water have delivered an "Aramax" lightweight roof solution with new columns.

PROJECT EXPENDITURE PROFILE ($k, excluding GST) (Real 18/19)

	2016/17	2017/18	2018/19	2019/20	Total
RD16	1,041	3,057	3,000	3,320	**10,418**
Actual / Forecast	10,523	10,012	460	24	**21,019**

DRIVERS AND STANDARDS OF SERVICE

The purpose of this project is to reduce the risk of structural failure of the Hope Valley EL170 tank. and in doing so reduce the risk of:

Widespread drinking water supply outages to tens of thousands of customers downstream of the tank

Contamination of the drinking water supply

Health and Safety incident to an SA Water staff member, contractor or member of the public.

The EL170 tank is an integral part of the system due to its significant size (136ML) and as it supplies to hundreds of thousands of customers with 23,000 (including schools and hospitals) at risk of a significant water outage in the case of a full roof collapse.

A portion of the trafficable Hope Valley Tank Roof collapsed in 2010. Following the collapse, SA Water engaged GHD to undertake a thorough assessment of the condition of the Hope Valley tank site. This assessment shows that in addition to the failed corbel, 10 corbels are in very poor condition and expected to fail within approximately 3 years. A further 40 corbels were in poor condition and expected to fail within approximately 5 years.

The evidence of a partial roof collapse and follow-up independent assessment confirming very high likelihood of further roof failure in the next 3-5years are solid drivers for the project to be proposed.

PRUDENCE ASSESSMENT

The detailed condition assessment reports provided by SA Water confirm the need for SA Water to act to maintain the structural integrity of this tank. We consider that it is prudent for SA Water to renew this roof structure.

SOLUTIONS DEVELOPMENT

Three options were initially investigated to address the risks caused by the poor condition of the roof of the Hope Valley Tank.

1) Corbel and Column Strengthening - This option proposes brackets to be installed at the top of each column to support the corbels and therefore prevent the corbels from failure in the future. By strengthening the concrete corbels, the likelihood of a concrete column failure reduces significantly.
2) Lightweight Steel Roof - Under this option the existing concrete columns, concrete superstructure and cladding would be demolished and replaced with a lightweight steel support structure of prefabricated steel columns and beams. The reduction in weight of the tank roof would reduce the likelihood of a structure failure to being "unlikely" and therefore mitigating the risks to within acceptable levels
3) Floating Cover - this option involves replacing the existing concrete columns, concrete superstructure and cladding with a floating cover. Floating covers are flexible materials which are designed to lay flat onto the surface of the water regardless of the water level. The major advantages of the floating covers include:
    - Lower initial capital cost due to elimination of structural elements as compared to metal or concrete structural roofs
    - Significant reduction in risk of failure due to elimination of risk seismic events is removed and therefore significantly reducing the likelihood of failure. Has the lowest residual risk profile of all three options.

The key disadvantage is that floating covers have a typical design life of approximately 20 years compared to concrete or metal roofs which are typically 40 years. Therefore this option requires a more frequent renewal compared to the other options

Upon completing scoping works for the column and corbel strengthening solution known as "Option 1 load transfer brackets" in C1614 Revised Options Endorsement Submission" the following issues were identified:

- Installing the load transfer brackets involved high WHS, environmental and community engagement risks which could not be managed through appropriate controls
- Requirement to complete work across winter and summer supply windows creating operational supply risks.
- Increased costs not included/ foreseen in the original solution – widening and encapsulation of columns, replacement of roof and unknown amount of remediation work to additional girders, rafters and purlins.

Options 2 and 3, lightweight steel roof and floating roof respectively were revisited. Option 2 was preferred due to the floating cover's 20 year asset life, potential impact on downstream THM levels and lessons learnt from the Upper Paskeville Liner and Cover (issues with vandalism, structural integrity and compromised asset life) were of concern.

All options, including a base case which responds to a further roof collapse with reactive repair / replacement were considered in an updated NPV Analysis. These four options are included the table below.

	Base Case – Collapse and Repair / Replace	Option 1 – Load Transfer Brackets	Option 2 – Lightweight Steel Roof	Option 3 – Floating Cover
Review period (years)	30	30	30	30
Total capital expenditure ($k)	22,691	17,529	17,501	13,682
Total revenues ($k)	(215)	(327)	(220)	(315)
Total residual value ($k)	0	0	0	0
Total operating expenditure ($k)	7	7	7	10
Total NPV ($k)	(22,912)	(17,863)	(17,727)	(14,007)
NPV incremental to Base Case ($k)	0	5,049	5,185	8,906
NPV ranking	4	3	2	1

The floating cover has the lowest net present cost but as noted above, is not preferred. We question the validity of the NPV analysis given the different useful lives of the options and the zero residual values. A different assessment period could have been used or residual values included to overcome this problem. Options 2 and 3 have insignificant

differences in the estimated net present cost. Based on the shorter construction period, lower WHS and delivery risks, SA Water chose to implement Option 2 – lightweight steel roof.

This option was presented and signed off by the SA Water Board on 15 December 2016.

COST ASSESSMENT

Tender evaluation information including a recommendation report (PCO8344 Recommendation Report) have been provided for enabling works ahead of design and construction of the solution selected (Lightweight Roof). This comprises a standard assessment for a relatively typical infrastructure renewal works project. Tenderers were assessed on price (40%) and non-price (60%) criteria. The roof construction works were awarded to York Civil Pty Ltd with a delegated approval of $17.64 million. Both contracts were sourced competitively.

EFFICIENCY ASSESSMENT

SA Water has undertaken considerable optioneering and evaluation to arrive at the implemented solution of a lightweight roof. We consider that the selected option is appropriate but that the options analysis supporting this option could be improved. In particular, the financial analysis includes an already excluded option and does not include residual values for options with varying useful lives. The final option was preferred based on non-financial reasons which could have been better documented within the justification documents.

The outturn costs are more than double that anticipated at RD16 which reflects a change in the scope of works required to address the risks. The works were procured through two separate contracts. We consider that the outturn costs are reasonable.

CONCLUSION

The Hope Valley EL170 tank is a 136 ML storage tank within SA Water's water distribution system. The scope of the works originally proposed in the RD16 submission was corbel and column strengthening. The implemented solution is new columns along with an "Aramax" lightweight roof solution with new columns. The outturn cost is $21.0 million compared with $10.4 million anticipated at RD16.

The EL170 tank is an integral part of the system due to its significant size and as it supplies to hundreds of thousands of customers with 23,000 (including schools and hospitals) at risk of a significant water outage in the case of a full roof collapse. A portion of the trafficable Hope Valley Tank Roof collapsed in 2010. Following the collapse, a detailed condition assessment was undertaken. The evidence of a partial roof collapse and follow-up independent assessment confirming very high likelihood of further roof failure in the next 3-5years are sound drivers for the project.

While we have identified some shortcoming with the financial component of the options analysis, we consider that the outturn costs are efficient for the scope of works.

KEY DOCUMENTS REVIEWED

Major Project Justification - Hope Valley EL170 Tank Structure Renewal

20190612 – Q3 1819 RD16 Capex Forecast – current SA Water forecast

C1614 Board Approval

C1614 Hope Valley Terminal Storage Structures Renewal Project Brief 17-3-201 v4.1

1708-25-455 Weekly Report

Hope Valley Terminal Storage EL170 – Roof Upgrade Project Lessons Learned Report

C1614 Evaluation scores and adjusted prices

C1614 Revised Options Endorsement Submission

Item 4.5 – Design and Construction Award Approval

Signed Approval – Board Approval of final solution

Reticulation Mains Wastewater Network Program

PROJECT DETAILS

Program Name	Reticulation Mains Wastewater Network		
Program Number	A0038	Project Stage	Ongoing program
Primary Expenditure Driver Category	Maintain service		

PROJECT DESCRIPTION

This program covers the renewal of both trunk (C3051) and reticulation wastewater gravity mains (37km in total). The program principally covers sewer mains which can be lined. An allowance of $1.7M of direct costs has been included for mains which require emergency repair following break/chokes.

Program expenditure at the time of RD16 was $13.70 million. The C3050-P1920 business case proposed expenditure of $18.90 million over the period. Outturn expenditure is forecast to exceed this total by a small margin ($360k or 2%), to $19.26 million. This was approved by the SA Water Board in June 2016.

PROJECT EXPENDITURE PROFILE (excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
RD16[1]	4,852	5,566	6,015	2,463	**18,896**
Actual / Forecast[2]	12,727	6,419	111	0	**19,257**

[1]C3050-P1920 Business Case – note only $13.70M initially approved as part of ESCoSA submission. Includes trunk, retic and contingency – require inflation.

[2]2019 Q3 1819 RD16 Capex forecast – current SA Water forecast. Includes trunk and retic projects. C3053 contingency no longer in actual/forecast report.

DRIVERS AND STANDARDS OF SERVICE

Renewal of sewer mains is required to prevent dry weather overflows from the network which have environmental, public health and service reliability impacts. The service levels applicable to this program are summarised in the table below.

Table 1 Sewer renewal drivers

Driver	Outcome	Outputs
Reliability - Customer	Achieve <86 total wastewater overflows Type 1 and 2 reportable incidents per annum (77 per annum by 2019-20)	Lining 304 outputs (line segments) equating to 37 kms as prioritised by Asset Management "Decision Support Tool".

The primary service measure is the number of type 1 and 2 overflows.

Figure 1 shows the long term trend in Type 1 and Type 2 overflows from sewers. This figure shows a deteriorating trend from a total of 60 in 2012/13 to just over double that in 2018/19. This does include a relatively small number of overflows from pump stations. The rate of deterioration in the trend is concerning. SA Water identify multiple reasons for the observed trend including:

- Renewal of assets being insufficient or ineffective to address the rate of deterioration
- Prolonged periods of low soil moisture leading to increased root intrusion to sewers
- Changed reporting definitions or methodologies
- Changed preventive maintenance approach.

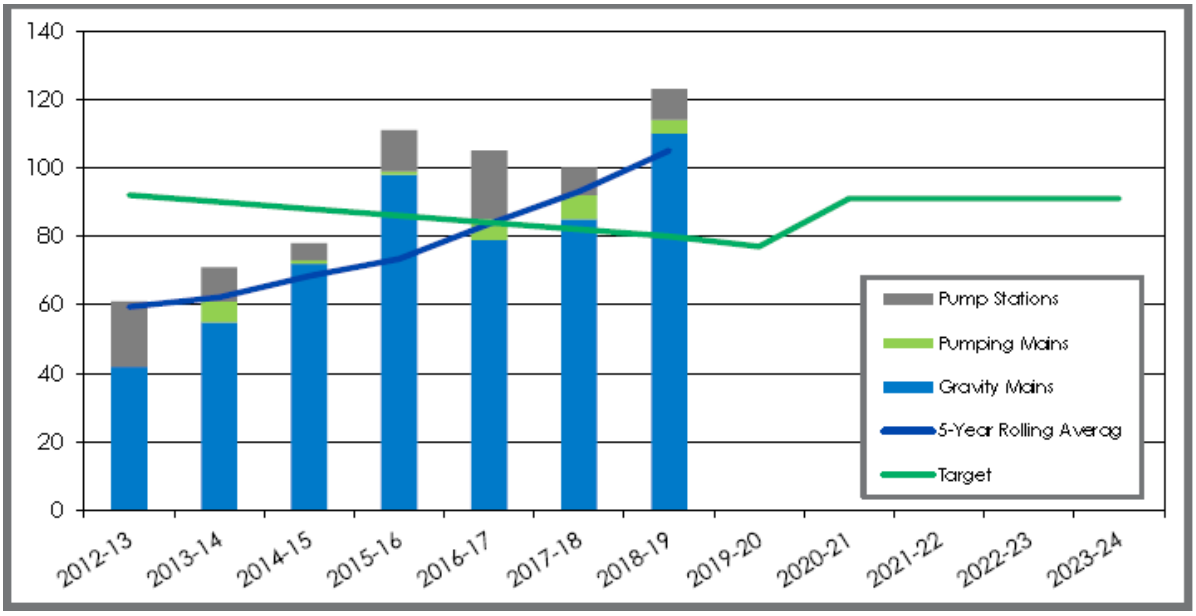


Figure 1 Long-term trend in Number of Type 1 & Type 2 environmental incidents caused by wastewater network overflows over a 5-year rolling average

PRUDENCE ASSESSMENT

There is a clear need for SA Water to invest in the renewal of sewers to address end of life failure of assets and to avoid dry weather overflows. The deteriorating trend in overflows, and the rate of deterioration, are a cause for concern. This provides sufficient evidence (notwithstanding that this has been in part contributed to by a change in reporting definition) to increase investment in sewer mains. The program of works is considered prudent.

SOLUTIONS DEVELOPMENT

Mains are identified for intervention based on CCTV inspection results. SA Water considers that sewer mains assessed as having condition in Category 4 or 5 typically fail within 10 and 5 years respectively. Additional analysis to identify sewer mains with the highest consequence of failure – those which mains impact waterways, hospitals etc. is also undertaken. In this way, SA Water is taking a risk based approach to prioritising renewal of sewer mains. Results are produced by a prioritisation model which has been provided (Wastewater Gravity Mains Decision Support Tool).

SA Water has found that the cost to relay collapsed sewers is substantially more than lining the sewer prior to failure. Net present costs have been assessed on base case (relaying) and relining scenarios for both trunk and reticulation mains. The results are provided in Table 2.

We note that the analysis has a period of 30 years which is shorter than the typical design life for a liner of 50-100 years but SA Water have confirmed this is a standard approach for all asset intervention assessments. We note that the financial analysis does not factor in any change in operational costs e.g. repairs, managing an overflow incident and sewer cleaning. These avoided costs would not have affected the outcome in this case but would have been better practice and give a more realistic result.

Table 2 Financial analysis of options

Asset	Base Scenario – Trunk	Reline Scenario - Trunk	Base Scenario - Retic	Reline Scenario - Retic
Total net present cost ($k)	-43,240	-11,410	-92,159	-5,773

The risk of rising groundwater in the Port Adelaide area is also considered and although common to both, a lining based solution is recognised as being significantly safer than trenching and shoring in collapsing sands.

COST ASSESSMENT

The business case for the wastewater mains renewal initially suggests an extension of the previous pricing period arrangement with Interflow who were already engaged under an existing contract framework until 2017/18. This was supported by previous Interflow performance, their approach to new products and innovation and willingness to respond to SA Water's call during emergency works.

At the time of business case approval, it was anticipated that already identified works would take at least two years to deliver in line with the length of the framework agreement.

In 2013, a competitive tender process was undertaken in which Interflow was selected to perform the renewals works. This arrangement was later reviewed and SA Water carried forward the Interflow arrangement into RD16.

The initial tender which Interflow won for wastewater relining was from 2013. This followed a typical procurement approach with a 60-40 qualitative-quantitative approach. This was for a contract sum of $5,350k. Qualitative criteria as follows:

- Relevant company experience
- Personnel, experience and organisational structure
- Methodology
- Technical data
- Industry participation plan

Further documentation was provided which:

- Confirmed cabinet approval of the wastewater renewal program to its extended value of $19.86M
- Confirmed extension of Procurement arrangements

EFFICIENCY ASSESSMENT

We consider that SA Water's approach to identifying and prioritising works is appropriate.

SA Water have opted to retain a contractor appointed in 2013 to deliver the first two years of the sewer lining program at least and then extended this following challenge and further assessment. SA Water state that efficiency savings of 5% are expected through the review of the contract.

CONCLUSION

This program covers the renewal of both trunk (C3051) and reticulation wastewater gravity mains (37km in total). The works is predominantly relining. The RD16 business case proposed expenditure of $18.90 million over the period. Outturn expenditure is forecast to exceed this total by a small margin ($360k or 2%), to $19.26 million. This was approved by the SA Water Board in June 2016.
Renewal of sewer mains is required to prevent dry weather overflows from the network which have environmental, public health and service reliability impacts. The long termlong-term trend in Type 1 and Type 2 overflows is deteriorating from a total of 60 in 2012/13 to just over double that in 2018/19. This does include a relatively small number of overflows from pump stations. The rate of deterioration in the trend is concerning. SA Water identify multiple reasons for the observed trend including:

- Renewal of assets being insufficient or ineffective to address the rate of deterioration
- Prolonged periods of low soil moisture leading to increased root intrusion to sewers
- Changed reporting definitions or methodologies
- Changed preventive maintenance approach.

There is a clear need for SA Water to invest in the renewal of sewers to address end of life failure of assets and to avoid dry weather overflows. The deteriorating trend in overflows, and the rate of deterioration, are a cause for concern. The proposed program is prudent.

The approach to assess and reline prior to complete asset failure is logically and economically supported. SA Water takes a risk based approach to identifying mains for renewal. SA Water have opted to retain a contractor appointed in 2013 to deliver the sewer lining program. Extension to complete the full program of up to $19.86 million has had procurement arrangements reviewed. We consider the program approach to be efficient.

KEY DOCUMENTS REVIEWED

- C3050-P1920 Business Case – note only $13.70M initially approved as part of ESCoSA submission. Includes trunk, retic and contingency
- 2019 Q3 1819 RD16 Capex forecast – current SA Water forecast. Includes trunk and retic projects. C3053 contingency no longer in actual/forecast report.

- Procurement Recommendation Report – Waste Water Mains Rehabilitation Program (Contract No. PPC7302)
- Wastewater Network Environmental Overflows Approach Version 2.0, 11/09/19
- PPC7302 Recommendation Contract Extension
- Board Approval June 2016 Item 5.7
- Wastewater Gravity Main Decision Support Tool

Western Adelaide Wastewater Network Upgrade

PROJECT DETAILS

Project Name	Western Adelaide Wastewater Network Upgrade project		
Project Number	9304/C2887	Project Stage	Practical Completion has been awarded
Primary Expenditure Driver Category	Growth		

PROJECT DESCRIPTION

The Western Adelaide Wastewater Network (WAWN) Upgrade has increased the wastewater capacity for Adelaide's CBD and inner southern and eastern suburbs. In locations near North Tce and War Memorial Drive the wastewater network is already at capacity and surcharging occurs on a daily basis. Surcharging refers to the operation of the pipe above its design capacity but not to the degree that an overflow of access chambers is likely. The surcharging is also generating odour nuisances at the existing Torrens River crossing and in the rail yards near the new Royal Adelaide Hospital.

The project installed 2.5 kilometres of new gravity wastewater pipework through Adelaide's western parklands. The upgrade proposes to add a new connection to the existing wastewater main at West Tce, travel through the western parklands, and reconnect to the wastewater main at War Memorial Drive.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	Prior	2016/17	2017/18	2018/19	2019/20	Total
Project Budget	482	6,864	4,039			**11,385**
Actual / Forecast	482	9,675	1,805			**11,962**

DRIVERS AND STANDARDS OF SERVICE

This project was triggered by the presence of odour in the network identified during construction of the Royal Adelaide Hospital. However, odour is only a symptom; SA Water investigated further through hydraulic modelling which identified that the network in this area is at capacity with surcharging occurring within access chambers but that this does not currently lead to discharges from the network.

SA Water has a risk based approach to managing network capacity and potential upgrades. When hydraulic loading on the network exceeds 60% of the Peak Dry Weather Flow (PDWF), a hydraulic study is triggered. For loading between 60-80% of PDWF, SA Water's approach is to tolerate the loading based on an assessment of the risks (e.g. odour and overflows in different loading scenarios).

The hydraulic modelling indicated the occurrence of surcharging which was confirmed through monitoring. In considering whether to accept the risk, SA Water took into account the occurrence of odour complaints in the area and that the Royal Adelaide Hospital would be completed in coming years creating a large, sensitive receptor for potential odour.

PRUDENCE ASSESSMENT

Existing loading of the network has exceeded SA Water's trigger for further investigation of the hydraulic capacity of the network. This has been confirmed through modelling and monitoring. The presence of odours and the development of this area to include the Royal Adelaide Hospital has created a level of risk that is unacceptable to SA Water. We consider that the hydraulic capacity and odour issues are sufficient justification for the works.

SOLUTIONS DEVELOPMENT

The options considered included infrastructure and non-infrastructure options. The non-infrastructure options included odour treatment and chemical dosing. However, infrastructure options were preferred as these would address long term capacity issues. The options were constrained by the presence of railway lines that required crossing. The shortlisted infrastructure options considered were:

1. Pipe relaying
2. Pipe jacking
3. Network augmentation

The network augmentation option included three sub-options of varying capacity augmented.

Option 3C (network augmentation of the largest capacity) was endorsed by Project Review Committee (PRC) as the preferred option despite being financially non preferred compared to other options as it presented the lowest delivery and corporate risks providing greatest flexibility for growth augmentation with potential deferral of investment (when greater diversion for growth or network resilience is required) whilst mitigating odour and surcharge risks. We consider this decision is sound and note that the comparison is not like for like as each option is providing substantially different benefits. The adopted option is the only option that provides long term network capacity.

COST ASSESSMENT

The procurement approach was early contractor involvement (ECI) and a risk sharing contract. The EOI evaluation has scoring for three contractors – Fulton Hogan, Leed and York. Leed was selected through multi-criteria assessment against the EOI criteria of project experience, nominated team and methodology. We note that the difference between the first and second placed tenderers is 1.7% on the semi-qualitative scoring approach which seems inconsequential but we accept that the process was competitive.

The December 2017 Quarterly Report to the Public Works Committee details that the outturn budget was $11.966 million compared with a $11.384 million approved budget. The entire project contingency of $1.118 million had been committed at this time. The lessons learned report identifies numerous issues which would have likely contributed to these cost overruns. These include service location, trench shoring and "inaccurate boring direction, levels and depths". These appear to be partially or entirely within the control of the contractor and we therefore consider that only the approved budget of $11.384 million represent efficient costs. This represents a downward adjustment of $596,000 in 2018/19 prices.

EFFICIENCY ASSESSMENT

We consider that the preferred option is appropriate for addressing the immediate odour issues while providing long term network capacity and resilience. The preferred option also had the most favourable constructability considerations which is important given the risks associated with working near and under railways. SA Water undertook a competitive procurement approach with three established contractors. The outturn costs exceeded the Full Financial Approval by 5% noting that the Full Financial Approval includes a contingency. The lessons learned report for the project identifies that the factors contributing to the overrun were within the control of the contractor and could be reasonably avoided. We therefore consider that the efficient costs should only be at the Full Financial Approval being a downward adjustment of $596,000 (2018/19 real).

CONCLUSION

The Western Adelaide Wastewater Network (WAWN) Upgrade has increased the wastewater capacity for Adelaide's CBD and inner southern and eastern suburbs. The project installed 2.5 kilometres of new gravity wastewater pipework through Adelaide's western parklands. This project was triggered by the presence of odour in the network identified during construction of the Royal Adelaide Hospital. However, odour is only a symptom; SA Water investigated further through hydraulic modelling which identified that the network in this area is at capacity with surcharging occurring within access chambers. SA Water considered that the risk of ongoing surcharges and odour with the (then) future construction of the Royal Adelaide Hospital was unacceptable. We consider that this conclusion is reasonable and consider that the project is prudent.

The procurement approach was early contractor involvement (ECI) and a risk sharing contract. The outturn cost was $11.966 million compared with a $11.384 million approved budget. The entire project contingency of $1.118 million had been committed at this time. The lessons learned report identifies numerous issues which would have likely contributed to these cost overruns. These include service location, trench shoring and "inaccurate boring direction,

levels and depths". These appear to be partially or entirely within the control of the contractor and we therefore consider that only the approved budget of $11.384 million represent efficient costs. This represents a downward adjustment of $596,000 in 2018/19 prices.

KEY DOCUMENTS REVIEWED

- Project Brief - Adelaide RAH Sewer Network Odour Reduction (17/3/2015)
- Full Financial Approval Submission - Western Adelaide Wastewater Network Upgrade (18/07/2016)
- Ministerial Approval (07/11/2016)
- Quarterly Report December 2016
- Quarterly Report December 2017
- Lessons Learned January 2019

CBD Smart Water Network Management Project

PROJECT DETAILS

Project Name	CBD Smart Water Network Management Project		
Project Number	9891 / C8800	Project Stage	Delivery
Primary Expenditure Driver Category	Improve service		

PROJECT DESCRIPTION

The project is to deliver a smart water network for Adelaide CBD. The scope includes:

- Flow meters and pressure sensors on 11 of the CBD feeder mains
- Leak detection system – 305 loggers
- Customer smart meters - 100 meters selected
- Hydrophone/Transient pressure loggers – 23 loggers
- Water Quality sensors – Three sensors
- Networks communication / IoT platform
- Analytics package to analyse, collate and display the data collected above
- System Integration
- Stage 2 fixes, enhancements, upgrades and remediation of the analytics platform
- Handover to Business As Usual.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
RD16[1]	3,656	914			**4,570**
Actual / Forecast[2]	2,845	1,325			**4,170**

Notes:

[1] Smart Water Network Management – A Business Case for the CBD

[2] 20190612 – Q3 1819 RD16 Capex forecast – current SA water forecast

DRIVERS AND STANDARDS OF SERVICE

The business case states that the objective of this project is to

> *"enable greater customer service through better management of the water network assets by building a smart water network management capability within SA Water".*

The implementation of a smart water network in the CBD is a trial to "allow the business to learn and improve as the project and wider roll out progress. Scope to learn and innovate is key to the success of smart water network management".". The overall driver of the project is to improve the service delivered to customers. The business case identifies the following drivers, outcomes and outputs expected of the project.

ID #	Driver	Outcome	Output	Output Amount	Beneficiaries
12.	Water reliability customer	Maintain asset reliability in order to meet or exceed customer reliability expectations	Maintain ≤ 1900 properties experiencing 3 or more unplanned interruptions per annum	Implementation of a smart network in the Adelaide CBD as defined in the scope of this proposal	Customers
			Maintain current number of high / low pressure complaints at 1500 on Metro		Customer
			Maintain current failure rate for Metro at <21 failures / 100km		Customers
13.	Water quality customer	Maintain water quality	Compliance with ADWG is 100% for metro		Customers
14.	Water reliability customer	Meet or exceed customer service expectations	Operations meet required attendance and restoration times		Customers
15.	Water reliability community	Support SA Water achieving a customer satisfaction score of >87.5%	Customer satisfaction score of >82.5%		Community / SA Water

The following standards of service are stated in the document “Smart Water Network Management – A Business Case for the Central Business District v0.02”.

Table 1 Service Standards applicable to Smart Networks Development

Driver	Outcome	Outputs
Water reliability customer	Maintain asset reliability in order to meet or exceed customer reliability expectations	Maintain < 1,900 properties experiencing 3 or more unplanned interruptions Maintain current number of high / low pressure complaints at 1,500 on Metro Maintain current failure rate for Metro at <21 failures per 100km
Water quality customer	Maintain water quality	Compliance with ADWG is 100% for Metro
Water reliability customer	Meet or exceed service expectations	Operations meet required attendance and restoration times
Water reliability community	Support SA Water achieving a customer satisfaction score of >87.5%	Customer satisfaction score of >82.5%

While the stated aim of the project is to improve service, the expected outcomes and outputs merely maintain the status quo. There is no justification in the business case that this project will improve service against these drivers, outcomes and outputs.

It is possible that this project should be justified on 'maintain service' grounds. That is, that it is the least cost or best cost-risk approach to deliver existing levels of service. Within the business case the base case is defined as "…the status quo is maintained, the current asset management and operational strategies remain unchanged resulting in no benefits being achieved". The base case is rejected in the business case because, despite having a lower life cycle cost, it does not achieve the "required benefits and outcomes". This statement makes clear that SA Water's justification for the project is that it is expected to deliver a step change in benefits.

The section on "Project Outcomes and Benefits" within the business case does not provide clarity on what the expected improvement in benefits will be. It only has the table reproduced above that shows that outcomes and outputs will maintain the status quo. The closest statement of expected project benefits is Table 19 in the business case which details the MCA criteria. The stated objective of the MCA is to "To arrive at an optimal solution that is sustainable for the long term, a structured approach to the design and implementation of a smart network in the CBD." That is, to determine the optimal solution for a smart water network not to justify whether a smart network is needed at all.

The business case states that the standard NPV model has not been used to compare the options and base case as it was not possible to collate sufficient cost information on all the potential options in the timeframe allowed for development of this base case. An NPV has been developed for the preferred option only.

The regulatory requirement for improve service expenditure is that it is demonstrated that the benefits outweigh the costs or that there is a clear expectation from customers and that they are willing to pay for this outcome. Willingness to pay has not been used by SA Water to justify this project. We challenged SA Water on the justification for the project given that there is no quantification of financial or economic benefits. SA Water noted that this was a 'reactive' opportunity to respond to customer concerns around the impact of water network failures, e.g. traffic congestion, lost water, interruptions to service. SA Water stated that it considers that this initial trial should be considered innovation to enable it to quantify the costs and potential benefits of these technologies.

PRUDENCE ASSESSMENT

The information provided provides no evidence as to why this project is required to be undertaken. The stated outcomes and outputs maintain the status quo. If the status quo was to be maintained, then the base case should be selected as the lowest lifecycle cost option. The base case is however rejected as it does not deliver the "required" benefits.

The regulatory requirement for improve service expenditure is that it is demonstrated that the benefits outweigh the costs or that there is a clear expectation from customers and that they are willing to pay for this outcome. The benefits are unclear within the business case and have not been quantified. These may be inferred from the MCA analysis in the business case. However, the MCA is only used to justify the solution, not that these benefits exceed the costs and would therefore would meet the regulatory test. We cannot conclude that this project is prudent as there is no clear need for it to be undertaken, For an 'improve service" project, the improvements have not been quantified not compared to costs.

The business case is also very focused on the solution – the desired scope of smart infrastructure to be installed. There is little or no justification provided that this scope is the right scope needed to deliver on the desired outcomes and benefits (noting that we cannot see that the benefits have been established). The business case presents a scope looking for a problem to solve. While we do not think that the need for the project is established we consider that the lack of justification for the scope also calls into question the prudence of the works. We have no confidence that the proposed scope is prudent.

SOLUTIONS DEVELOPMENT

As noted, the solutions set out in the business case are focused on procurement of the smart infrastructure. The base case is improperly defined. The scope in the business case is taken as a given. Our expectation is that solution development for an improve service project would focus on varying levels of scope with varying levels of benefit. The optimal scope that delivers the maximum net benefit would then be selected. This has not been undertaken by SA Water. The focus of the business case on procurement and not establishing the need and that the scope is appropriate is also inconsistent with recognised good practice for project assurance. For example, the South Australia Government's *Construction Procurement Policy Project Implementation Process* includes at Step 3 project substantiation and at Step 4 agreement on the procurement model.

The procurement options considered by SA Water in the business case are:

Table 2 Smart Networks options assessed by SA Water

Option	Sensors	Data and Communications	Analytics Platform	Delivery
1 – Do nothing / base case	n/a	n/a	n/a	n/a
2 – Sole supplier	Sole supplier			
3 – Bespoke / commercial	Go to market – best in class	Go to market – best in class	Go to market – best in class	SA Water
4 – Bespoke – in-house	Go to market – best in class	Go to market – best in class	SA Water	SA Water

The business case states that *"The standard NPV model has not been used to compare the options and base case as it was not possible to collate sufficient cost information on all the potential options in the timeframe allowed for development of this base case. An NPV has been developed for the preferred option only"*.

It is concerning that time pressure prevented a meaningful financial analysis from being undertaken to inform option selection. As detailed above, we consider that financial and/or economic analysis should have been undertaken to justify the scope of this project. There is substantial amounts of literature available in these areas.

While we do not think that it is appropriate for the options analysis to focus on procurement only, we discuss the options analysis further following.

Multi-criteria analysis (MCA) was completed. This approach is based on an impact / risk minimisation and benefit maximisation with the tool combining qualitative and quantitative criteria. Results were also subject to a sensitivity analysis which was based on all MCA factors (social, environmental, financial and technological) being given the same weighting. Both results identified option 3 bespoke/commercial as their preferred option. The outcomes of the MCA analysis are summarised in the tables below.

Option	1 – Base case / do nothing	2 – Sole supplier	3 – Bespoke / commercial	4 – Bespoke – in-house
1 Overall weighted score	0.99	0.62	0.38	0.43
Final Rank	4th	3rd	1st	2nd

Option	1 – Base case / do nothing	2 – Sole supplier	3 – Bespoke / commercial	4 – Bespoke – in-house
1 Overall weighted score	0.98	0.63	0.44	0.49
Final Rank	4th	3rd	1st	2nd

A risk analysis was also undertaken which also concluded that Option 3 was the preferred option.

We are concerned about the arbitrary nature of MCA in assigning weights and scoring perceived benefits and risks. As noted, we consider that economic and financial analysis should have and could have been undertaken to determine a preferred scope (and possibly procurement option as a secondary consideration). We consider that the options analysis is inappropriate.

COST ASSESSMENT

The business case concludes that Option 3, to obtain "best in class" elements of the smart infrastructure is the preferred option. The business case then outlines the following procurement strategy:

> *Due to the tight timeframe and specialist nature of the elements of this project the following procurement strategy is proposed:*
>
> - *Documentation of the reasons why it is impractical or imprudent to invite public offers (refer 'Reasons for waiver of public tender' below), to be prepared by the project team and approved by a Procurement Officer with the appropriate Procurement Delegation level.*
> - *The requirement to invite public offers (>$200,000) to be waived by the Senior Manager Procurement or General Manager Business Services irrespective of value, or a delegate independent of the procurement and within their Procurement Delegation as defined in the Delegations of Financial and Procurement Authority, CP034*
> - *Where feasible offers will be obtained from suppliers under existing Standing Offers, however where this is not possible the intention is to invite tenders for each element of the implementation from at least three selected suitable suppliers to ensure whilst the competition is limited there is some comparison of similar products an d services to assess competitiveness of rates and also ability to meet the specified requirements*

This procurement strategy by restricting the procurement approach is at odds with the preferred option. We also note that:

1. The procurement strategy lists "tight timeframes" as a reason for the procurement approach. We do not understand why there are time pressure on what is a "nice to have" project
2. The procurement strategy refers to "reasons for waiver of public tender" but we cannot see that these are detailed
3. Our understanding is that there is considerable interest in smart networks across the world and there are many providers of technologies in Australia and world wide
4. Unless SA Water has an existing panel arrangement that strongly covers smart networks, it appears to be poor procurement practice to undertake restricted procurement for something that there is wide capability for globally. There is a risk that SA Water sets a path through this trial based on a narrow understanding of the market and opportunities that leads to stranded assets or inefficient costs in the future.

We do not consider that the procurement strategy outlined in the business case will lead to efficient costs.

Tender evaluation scores have been provided for "C5859C IoT and Comms" and "C5859D Water Analytics. The tender evaluation criteria used such as cost, methodology and program, business requirements, training and warranty support, technical data and value add elements, experience and personnel and employee contribution test are appropriate for this type of investment.

We make the following specific observations on the tender price ranges which are reflective of a diverse range of bid prices and not just outliers – see tables below:

- Tender C5895C IoT and Comms – the tendered prices range from <$200k to >$2.7M

  Tender C5859D Water Analytics – the tendered prices range from < $100k to >$6M.

Table 5 Tender bids for C5859C IoT and Comms

Tenderer	A	B	C	D	E
Cost of bid ($k)	355	2006	194	759	2791

Table 6 Tender bids for C5859D Water Analytics

Tenderer	A	B	C	D	E	F	G	H	I	J
Cost of bid ($k)	652	355	4,206	410	1,554	6,633	550	1,635	4641	1,305
Tenderer	K	L	M	N	O	P				
Cost of bid ($k)	252	3,000	1,808	95	670	911				

The large variation in tendered prices raises substantial concerns about how clear the specification of the required outcomes.

The latest available monthly reports from August and September 2017 showed that the project had moved into a 6-monthly phase of enhancements from July-December 2017. SA Water are on track to deliver the trial for around $4.2M, lessM, less than the RD16 determination ($4.7M) – based on 2018/19 Q3 figures. However, without a clear report of workpackage delivery target versus actual delivery versus cost it is not possible to make an efficiency assessment.

EFFICIENCY ASSESSMENT

We consider that the solution development and options analysis is flawed in that it focuses on the procurement approach only, not that SA Water is achieving the greatest benefit for its investment. For an improve service project the regulatory requirement is that benefits should be demonstrated to exceed costs. We consider that financial analysis could have been undertaken as there is considerable literature in this area.

The preferred option is to procure best in class smart infrastructure. The business case then recommends restricted procurement. This conflicts with obtaining best in class solutions given that there is a global supply market for smart infrastructure. Again, the business case cites time pressures as one reason for restricted procurement.

We do not consider that the options analysis and procurement approach will have delivered efficient outcomes as they do not align with appropriate practice.

CONCLUSION

The project is to deliver a smart water network for Adelaide CBD. The scope includes:

- Flow meters and pressure sensors on 11 of the CBD feeder mains
- Leak detection system – 305– 305 loggers
- Customer smart meters - 100 meters selected
- Hydrophone/Transient pressure loggers – 23 loggers
- Water Quality sensors – Three sensors
- Networks communication / IoT platform
- Analytics package to analyse, collate and display the data collected above
- System Integration
- Stage 2 fixes, enhancements, upgrades and remediation of the analytics platform
- Handover to Business As Usual.

SA Water has nominated an “improve service” driver for this project. However, the stated outcomes and outputs maintain the status quo. If the status quo was to be maintained, then the base case should be selected as the lowest lifecycle cost option. The base case is however rejected as it does not deliver the “required” benefits. The specific benefits expected are unclear within the business case. These may be inferred from the MCA analysis in the business case. However, the MCA is only used to justify the solution, not that there is a need. We cannot conclude that this project is prudent as there is no clear need for it to be undertaken, For an ‘improve service” project, the improvements have not been identified nor quantified.

The business case is also very focused on the solution – the desired scope of smart infrastructure to be installed. There is little or no justification provided that this scope is the right scope needed to deliver on the desired outcomes and benefits (noting that we cannot see that the benefits have been established) and that these benefits exceed the costs. . We have no confidence that the proposed scope is prudent.

We challenged SA Water on the justification for the project given that there is no quantification of financial or economic benefits. SA Water noted that this was a ‘reactive’ opportunity to respond to customer concerns around the impact of water network failures, e.g. traffic congestion, lost water, interruptions to service. SA Water stated that it considers that this initial trial should be considered innovation to enable it to quantify the costs and potential benefits of these technologies.

We consider that the options analysis is flawed in that it focuses on the procurement approach only, not that SA Water is achieving benefits that exceed the costs.. For an improve service project financial or economic analysis should be undertaken. There is considerable literature in this area.

The preferred option is to procure best in class smart infrastructure. The business case then recommends restricted procurement. This conflicts with obtaining best in class solutions given that there is a global supply market for smart infrastructure. Again, the business case cites time pressures as one reason for restricted procurement.

We do not consider that the options analysis and procurement approach will have delivered efficient outcomes as they do not align with appropriate practice.

We consider that the prudent costs of this project are nil. There is scope for the project to be considered prudent where SA Water demonstrates that it has quantified the benefits realised from the trial and used these to inform future works. At the time of its submission, the RD20 program had not been justified based on the outcomes from this trial.

KEY DOCUMENTS REVIEWED

- Smart Water Network project presentation
- Smart Water Network Management – A Business Case for the Central Business District v0.02, October 2016
- Smart Networks Project C8800 August 2017 report
- Smart Networks Project C8800 August 2017 report
- C8800 FFA Minister Approval
- 8800 CS8595C Eval Summary
- 8800 CS8595D Eval Summary
- 20190612 – Q3 1819 RD16 Capex Forecast – current SA Water forecast

Kangaroo Creek Dam Safety Investigation

PROJECT DETAILS

Project Name	Kangaroo Creek Dam Safety		
Project Number	C7431	Project Stage	Construction
Primary Expenditure Driver Category	Compliance		

PROJECT DESCRIPTION

Kangaroo Creek Dam is a concrete face rock fill dam located 20 km from Adelaide. Construction on the dam began in 1966 and was completed in 1969. The dam was modified in 1982, raising it 3.4 m. The operational storage capacity is 19,000 ML (total 24,200 ML).

Several investigations have been completed to understand the ability of the dam to handle flood and seismic events. It was determined that the dam needed to be upgraded to ensure it can manage the risk associated with flood and seismic events.

To manage the risks, the following works have been undertaken

- Raising the embankment height from 63.5m to 69.4m.
- Extending the concrete face slab.
- Providing a full height downstream rockfill berm with suitable transition zones.
- Upgrading the vertical and perimetric joint waterstops.
- Widening the spillway chute.
- Extending the eastern ogee crest structure by 40.2m.
- Raising the spillway walls.
- Anchoring the existing spillway ogee crest structure.

Modifying the outlet works to accommodate the embankment raise and construction of a new seepage measuring weir.

PROJECT EXPENDITURE PROFILE ($,000 excluding GST) (Real 18/19)

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Total
RD16		2,302	2,793	37,914	35,244	22,594			100,846
Actual / Forecast		1,154	2,540	9,393	15,275	29,069	37,474	11,770	106,674

DRIVERS AND STANDARDS OF SERVICE

SA water undertakes regular reviews of the potential risks and safety measures required to manage the risk at their large dams. This occurs through four-yearly Portfolio Risk Assessments. Kangaroo Creek Dam is one of the largest dams in the portfolio. South Australia does not have specific safety regulations for dams requiring SA Water to understand and manage the risks relating to dams itself. SA Water has chosen the Australian National Committed on Large Dam (ANCOLD) guidelines to assess and manage the risks associated with its dams. The SA Water board has committed to meeting the requirements of these guidelines.

Several investigations were performed to determine the compliance of SA Water's dams with the guidelines. The initial investigations, as they relate this project, began in 1998. This investigation recommended a series of phases to reduce the risks at the dams as they relate to human life and economic losses.

Phase 1 included a safety review (2006), hydrology report (2005) and a consequence of dam failure report (2005). These investigations determined that, per the guidelines, the dam would suffer some structural damage under maximum design earthquake seismic loading and would be unable to manage peak flood flows. Therefore, this project was initiated to upgrade the dam to meet peak earthquake seismic loading and flood flows.

The hydrology report which identified potential flood flows was a detailed investigation. Models were developed to predict catchment flow patterns for multiple possible rain events. The model was tested and calibrated with actual data

from multiple rain events. Therefore, the details of potential flow events have been developed using a sound methodology. Similarly, the ability of the dam to withstand a seismic event was determined after survey of the surrounding geology and review of the construction of the dam. This data was used in industry accepted models to determine the durability of the dam.

PRUDENCE ASSESSMENT

The ANCOLD guidelines represent good industry practice for managing the risk of failure of dams. SA Water has identified and assessed the risks associated with Kangaroo Creek Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified.

SOLUTIONS DEVELOPMENT

The solution development was part of Phase 2 works. The Phase 2 works included a safety review investigation and concept design report (2009).

The safety review revisited the findings of the previous reports that evaluated the capacity of the Kangaroo Creek Dam to manage peak flood and seismic events. The safety review confirmed that, to manage a peak flood event, spillway improvements were required. The concept design report developed several options for increasing the capacity of the dam as it relates to managing a peak flood event. However, the review did not recommend dam improvements in order to withstand a peak seismic event. The review confirmed that the dam would be damaged during such a seismic event but the damage would be above the water level and the dam would continue to perform its primary function of withholding water. Therefore, no options were developed in the concept design report to improve the durability of the dam as it relates to a seismic event.

Option development was limited by the constraints of the topography and infrastructure. There were 12 options for upgrade of the spillway were considered in the concept design report. A cost estimate was developed with advantages and disadvantages considered for each option. These options were reduced to the best four based on inputs from SA Water. The selected options had to maintain the existing full supply level, maintain flood mitigation capacity for the 1 in 400 event and pass PMF of 6200 m^3/s (as compared to the existing capacity of 1960m^3/s) without overtopping the embankment. The selected four options were further developed which meant improved cost estimates. The four options were:

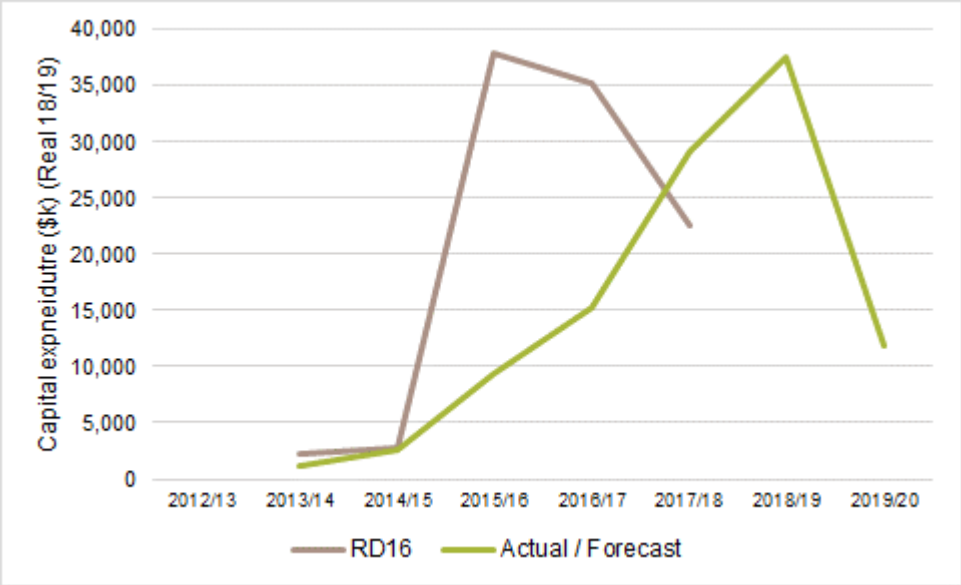
- Enlarge existing spillway
- Provide second spillway
- Raise crest level of the embankment
- Lengthen crest, install fusegates and widen chute

A multi-criteria analysis was used to evaluate the options. The analysis compared the advantages and disadvantages and estimated cost for each option. The preferred option was to raise the crest level of the embankment. This was the lowest cost option.

COST ASSESSMENT

The Full Financial Approval was endorsed by the Board in March 2015 for $94 million (nominal). On a real basis (2018/19), the RD16 submission was for $100.8 million in expenditure and the current forecast outturn is $106.7 million, a 5.8% increase.

At the time of RD16, SA Water anticipated that construction would occur largely in 2015/16 and 2016/17. This did not occur and the project was delivered over a longer period as shown in the figure below. The project is largely complete except for some minor close out works.



Construction was procured through a competitive process which identified two contractors to be taken forward through an Early Contractor Involvement model. The early involvement enabled SA Water to identify and mitigate construction risks. We consider that this is appropriate for a project of this scale and complexity.

EFFICIENCY ASSESSMENT

We consider that the outturn costs are efficient as they reflect a competitive and appropriate procurement process. While the outturn costs exceed the cost estimate for Full Financial Approval, this approval was based on incomplete information regarding construction risks.

CONCLUSION

Kangaroo Creek Dam is a concrete face rock fill dam located 20 km from Adelaide. Construction on the dam began in 1966 and was completed in 1969. The dam was modified in 1982, raising it 3.4 m. The operational storage capacity is 19,000 ML (total 24,200 ML). This project has been undertaken to address the risks associated with flood and seismic events. SA Water manages these risks in accordance with ANCOLD guidelines. The upgrade works included raising the embankment height from 63.5m to 69.4m, widening the spillway chute, extending the eastern ogee crest structure by 40.2m and raising the spillway walls.

The proposed solution was based on further detailed hydrologic and seismic investigations and options analysis reflecting the site constraints.

The ANCOLD guidelines represent good industry practice for managing the risk of failure of dams. SA Water has identified and assessed the risks associated with Kangaroo Creek Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified.

The Full Financial Approval was endorsed by the Board in March 2015 for $94 million (nominal). On a real basis (2018/19), the RD16 submission was for $100.8 million in expenditure and the current forecast outturn is $106.7 million, a 5.8% increase. The project has also been delivered over a longer period of time. We consider that the outturn costs are efficient as they reflect a competitive and appropriate procurement process. While the outturn costs exceed the cost estimate for Full Financial Approval, this approval was based on incomplete information regarding construction risks.

KEY DOCUMENTS REVIEWED

- Kangaroo Creek Dam Seismic Hazard Assessment Report (2013)
- Kangaroo Creek Dam Safety Upgrade Cost Estimate note (2012)
- Stage II Safety Review Investigation and Conceptual Design of Remedial Works for Kangaroo Creek Dam (2009).
- Full Financial Approval Submission (2015)
- Kangaroo Creek Dam Safety Upgrade Monthly Report August 2019
- Kangaroo Creek Dam Safety Upgrade Monthly Report September 2019
- Kangaroo Creek Dam Safety Upgrade Project-Construction Contract Award Notice (2015)
- Tender Evaluation (2015)
- Lessons Learned Register (2019)
- Asset Program Summary: Dam Safety Improvement (2012)
- ANCOLD Guidelines on Dam Safety Management (2003)
- Portfolio Risk Assessment of SA Water's Large Dams (1998)
- Kangaroo Creek Dam Flood Hydrology Study (2005)
- Preliminary Assessment of Dambreak Consequences (2005)
- Stage I Safety Review (2006)

AP Morgan Water Quality WTP SP5 Morgan Project

PROJECT DETAILS

Project Name	Asset Program (AP) Morgan Water Quality WTP SP5 Morgan		
Project Number	9851/C8121	Project Stage	Delivery
Primary Expenditure Driver Category	Renewal / Compliance		

PROJECT DESCRIPTION

Morgan water treatment plant (WTP) is a large country treatment plant with a capacity of 175ML/d. This treatment plant treats water from the River Murray and distributes it across a wide region of the country operating areas, serving a typical population of 130,000.

There are two separate elements to this project:

CO8638B – Disinfection improvement upgrades.

C08638C – Backwash tank upgrade

PROJECT EXPENDITURE PROFILE (excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
RD16[1]					4,311
Actual / Forecast[2]	301	438	3,290	0	4,029

[1]A0028 Water Quality Treatment Plants: Business Case – this figure is for Disinfection Improvements and the Backwash Tank project.

[2] 20190612 – Q3 1819 RD16 Capex forecast – current SA Water forecast

DRIVERS AND STANDARDS OF SERVICE

The overall Water Quality (Treatment) Program address water quality compliance drivers as set out in Table 1

Table 1 Service Levels applicable to this program

Driver	Outcome	Outputs
Water Supply Quality (Reliability of supply to Customer)	Compliance with ADWG 100% Metro 99.8% Country Achieve ≤ 2 Priority Type 1 WQ incidents per annum Achieve ≤ 35 Type 1 WQ incidents per annum Achieve ≤ 60 Type 2 WQ Incidents per annum. 100% of assets below “high” risk on corporate heat map	Enhancement of 9 water quality assets at metropolitan and country water treatment plants guaranteeing that there are no intolerable water quality risks associated with SA Water’s drinking water treatment assets.

SA Water’s Water Treatment Water Quality Risk Assessment states that Morgan WTP has a high residual risk rating as the filtration and disinfection processes are inadequate to address microbiological risks. Process investigations have revealed:

- Issues with filter flow control backwash which impacts on available LRV (log removal value) across the process by 0.5 units.
- Insufficient CT during disinfection – 8mg/L.min versus a required value of 15mg/L.min

It was also confirmed in the C4020 Morgan WTP Backwash Tank Submission – Options Endorsement Submission that the backwash tank scheme delivery was required with another scheme (06532 WTP Balancing Storage Project) to address water quality and health-based target risks.

PRUDENCE ASSESSMENT

The documentation provided outlines that the works are required to address unacceptable microbiological risks at the treatment plant. The scope of works to address the risks are appropriate for the risks and the nature of the plant. This project is considered prudent.

SOLUTIONS DEVELOPMENT

For both elements of the scope (filtration and disinfection improvements), separate Options Endorsement Submissions were undertaken which include a series of option investigations and NPV assessments.

For both upgrades, SA Water have selected the lowest net present cost option. The lowest net present cost option is typically considered the most efficient option. However non –financial considerations need to also be evaluated. It should be highlighted that the base case in each scenario is not really feasible – it would lead to failures of water quality standards.

Table 1 NPV for filtration improvement options

Options	Base Case	Option 1 – Pumped backwash tank	Option 2 – Gravity backwash tank
Review Period	30	30	30
Total capex ($k)	0	2,660	1,956
Total residual value ($k)	0	289	212
Total opex ($k	47	51	6
Total NPV ($k)	-47	-2.422	-1.750
NPV incremental to base case ($k)	0	-2,375	-1,7031
NPV ranking	1	3	2

A multi-criteria analysis (MCA) was used in the selection of the preferred filtration improvement option. The MCA included an understanding on how this project would integrate with another project (06532 WTP Balancing Storage). The backwash improvement, with new 30ML storage tank delivers the best MCA score.

Table 2 NPV for disinfection improvement options

Options	Base Case	Option 1 – Stand-alone contact tank	Option 2 – Serpentine pipe	Option 3 – New contact tank inside 12ML FWS tank
Review Period	30	30	30	30
Total capex ($k)	0	3,730	1,716	2,423
Total residual value ($k)	0	0	0	0
Total opex ($k	0	0	0	0
Total NPV ($k)	0	-3,102	-1,372	-2,414
NPV incremental to base case ($k)	0 / N/A	-3,102	-1,372	-2,414
NPV ranking	1	4	2	2

We consider that the options analysis undertaken is sound.

COST ASSESSMENT

A Procurement exercise was completed to identify suitable contractors for the disinfection improvements and backwash tank projects. A third project, earth bank storage, was also tendered during the same exercise.

The Procurement strategy invited three selected bidders and two bids were received. Bids were assessed 55%-45% on qualitative criteria/price. Qualitative criteria were methodology and program, key personnel and organisation structure, company experience and industry participation plan. Non-weighted criteria were also part of the assessment – acceptability of subcontractors, acceptance of SA Water terms and conditions and company financial viability rating.

SA Water undertook further negotiations with the highest scoring bidder, who scored significantly better on price but marginally worse on qualitative scores. Issues covered included the winning bidder's subcontractor capability with regards to liner/cover design, financial viability and foreign exchange risk (significant amount of materials purchased from overseas). The leading bidder satisfactorily answered follow-up questions with regards to liner-cover capability and provided assurances from their holding company regarding financial capability. The leading bidder also agreed to take on the foreign exchange risk. The contract was awarded for a total value of $11.3M excluding contingencies.

From a cost perspective, SA Water has undertaken a standard procurement exercise for a project of this type and although not stated, bundling of three projects within one contract, should lead to delivery efficiencies. The follow-up queries with the leading bidder represent good due diligence with regards to technical and financial risk.

EFFICIENCY ASSESSMENT

SA Water has considered multiple options and selected the lowest net present cost solutions. SA Water has undertaken a competitive procurement exercise for this project. It has appropriately bundled works on a site / geographic basis. We consider that the approach taken should lead to efficient costs.

CONCLUSION

This project will deliver upgrades to disinfection and the backwash tank at the Morgan water treatment plant. This treatment plant is a large country plant with a capacity of 175ML/d. The plant treats water from the River Murray and distributes it across a wide region of the country operating areas, serving a typical population of 130,000.

We consider that the scope of works proposed is prudent based on the assessed water quality risks. The works are intended to keep water microbiologically safe and in line with health-based targets.

SA Water has considered multiple options and selected the lowest net present cost solutions. SA Water has undertaken a competitive procurement exercise for this project. It has appropriately bundled works on a site / geographic basis. We consider that the approach taken should lead to efficient costs.

KEY DOCUMENTS REVIEWED

- A0028 Water Quality Treatment Plants: Business Case
- 20190612 – Q3 1819 RD16 Capex forecast – current SA Water forecast
- Monthly Progress Report 20181019
- C1821-1928 Board Approval
- C08638 Morgan WTP Upgrade Tender Recommendation
- Moran WTP Review
- C6532 Chlorine Contact Options Endorsement Submission
- C4020 Morgan Backwash Tank OES (1)
- C8121 AP Water Quality WTP Morgan – Disinfection Upgrade FFA Rev 2
- C8121 AP water Quality WTP Morgan – Backwash Tank FFA Rev 1

Corporate IT: Operations and Maintenance BI Program

PROJECT DETAILS

Project Name	Operations and Maintenance BI Program		
Project Number	RD16 – CX0020 – 41 Now to initiatives: C9586, C9666	Project Stage	Delivery
Primary Expenditure Driver Category	Improvement		

PROJECT DESCRIPTION

At the time of RD16 a single business case was provided for project 41 "O&M Business Intelligence Program". This business case identifies that the scope is an "information management solution for all critical water and wastewater information". Data was proposed to be centralised into a single database enabling efficient monitoring, analysis and reporting. The information management solution was proposed to facilitate intelligent decision making using critical water and wastewater quality data.

For delivery in the current period, the O&M BI program comprises two separate projects:

1. C9586 Water and wastewater dashboards and reports
2. C9666 Grease arrestor maintenance app ("greasy tracker")

The scope of C9586 Water and wastewater dashboards and reports is described in the project brief as:

1. Implementation of a solution that provides a single source of water and wastewater information from disparate sources to facilitate reporting. The brief at Section 8.3.1 details 35 possible reports to be included in the solution pending further analysis and prioritisation.
2. Automated generation of reports
3. Load of historical data from the "Quick'n'Dirty" access database and other sources
4. Train nominated SMEs in analysis and reporting

We understand that the scope of C9666 Grease arrestor maintenance app project is to develop a software system for recording maintenance and inspection/audit information for greases arrestors. The system will enable waste haulers to enter maintenance activities directly into SA Water's information system. The system is intended to enable SA Water to determine whether customers have been meeting their obligations regarding grease arrestors and will support reporting and analysis for compliance activities.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

Corporate IT: O&M BI Program	2016/17	2017/18	2018/19	2019/20	Total
RD16	673	674			**1,347**
Forecast – C9586	574				**574**
Forecast – C9666		417	157		**574**
Actual	561	194	693	66	**1,514**

DRIVERS AND STANDARDS OF SERVICE

The drivers for the C9666 Grease arrestor maintenance app project are:

- Business Change – Improved Customer Experience
- Business Change – Improved Business Efficiencies

The project brief does not identify any operating cost savings to offset the capital costs.

The driver for the C9586 Water and wastewater dashboards and reports is:

- Business Change – Improved Business Efficiencies

This project brief in the financial analysis section does not identify any operating costs savings. However, in the outcomes section it states that reduced operation costs of $795k by 2019/20 are expected for this project and that this "amount is the original total figure included in the business case minus the savings attributed to the 'Greasy Tracker' component. The Greasy Tracker component will be submitted under a separate project brief".

On this basis, the annual operating cost savings attributable to each project are:

- $795k per annum for C9586 Water and wastewater dashboards and reports
- $186k per annum for C9666 Grease arrestor maintenance app.

PRUDENCE ASSESSMENT

These projects intend to improve customer experience and realise operating expenditure efficiencies. On the basis that SA Water has committed to operating expenditure savings that generate a positive net present value, these projects can be considered prudent.

SOLUTIONS DEVELOPMENT

For the water and wastewater dashboard/reporting component, four options were considered in the development of the proposed solution. These were:

- BI Platform Implementation
- Delayed BI Platform Implementation
- Increased Manual Reporting
- Do nothing / stay as is.

The preferred option identified as BI Platform Implementation as it "minimises the risks of reporting non-compliance occurring compared to all other options. It also provides greater reporting and analysis capability than Options 2 and 3, and delivers the capabilities earlier than Option 1b. The reporting and analysis capabilities are required for delivering the operational savings committed to by the Corporation".

At our meetings with SA Water we reviewed the schedule of reports proposed and the tracking of what had been implemented, deferred or abandoned.

The grease arrestor maintenance application has been developed to integrate with WasteID platform. This is a web based platform hosted by a private company. WasteID uses the QR2id scanner technology to enable maintainers to scan bar codes located at the grease arrestor at the time that they are undertaking maintenance to record that the activity has been complete.

COST ASSESSMENT

SA Water provided information on how the IS Planning team develop solution costs using a spreadsheet tool. A variety of inputs and tools / techniques are used to determine the suitable variables within the cost estimation excel model. The key inputs to the estimation are vendor research and the business needs / solution approach that are captured prior to commencing the cost estimation workshops. The output of this is a completed cost model that breaks the costs down into the various project delivery management costs, delivery resource costs, vendor costs and expected ongoing operating costs.

Based on the information available, the forecast cost in the project briefs is less than that in the RD16 business case.

EFFICIENCY ASSESSMENT

As for other information system initiatives, SA Water has committed to operating expenditure savings which generate a positive net present value on the capital expenditure. These savings have been committed top-down, not quantified based on a bottom-up evaluation of the initiatives.

CONCLUSION

This project has two components:

1. C9586 Water and wastewater dashboards and reports
2. C9666 Grease arrestor maintenance app (“greasy tracker”)

The scope of C9586 Water and wastewater dashboards and reports is to automate a possible 35 reports and consolidate existing tailored information systems. The scope of C9666 Grease arrestor maintenance app project is to develop a software system for recording maintenance and inspection/audit information for greases arrestors. This system uses the third party WasteID platform and is based on bar code scanning technology at grease trap locations.

The dashboard and reporting project has sought to incorporate reports into SA Water’s PowerBI business intelligence platform. As for other information system initiatives, SA Water has committed to operating expenditure savings which generate a positive net present value on the capital expenditure. These savings have been committed top-down, not quantified based on a bottom-up evaluation of the initiatives.

KEY DOCUMENTS REVIEWED

- RD20.73 Response to ESCoSA
- CX0020_BC41 OM BI Progf-CONFIDENTIAL.pdf
- Investing for You: Part 3 – IT Investment.pdf
- CX0001 - Technology Capital Planning Approach - 2016 to 2020-CONFIDENTIAL.pdf
- C9666 Grease Arrestor Maintenance App-07062019.pdf
- C9666 Grease Arrestor Maintenance App-07072019.pdf
- C9666-BRIEF.pdf
- C9586 Water Waste Water BI Reporting Analysis-03022017.pdf
- C9586 Water Waste Water BI Reporting Analysis-28032017.pdf
- C9586-BRIEF.pdf
- C9586-Performance report.pdf

Digital Program

PROJECT DETAILS

Project Name	Digital Program		
Project Number	33	Project Stage	Delivery
Primary Expenditure Driver Category	Efficiency and Improvement		

PROJECT DESCRIPTION

The Corporate IT Digital Program is a program of eight projects. This program has been identified by SA Water as a critical enabler of SA Water's Digital and Customer Strategies.

The Program extends and enhances SA Water's previous technology investment from RD13-16 to improve service delivery and keep costs down for customers.

The scope includes the following projects:

- SA Water Website
- Channel Management & Strategy
- Digital Fault communication
- Online Fault Reporting
- Online Customer Self Service
- eBilling and Online payments
- Digital Engagement, Insights & Research
- Customer Relationship Management

These projects are listed in the BC33 Business change Technology Program – Digital Program (Regulatory Business Proposal 2016). The list of projects in the capital program actual forecast is slightly different – see table below.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
RD16[1]	3,944	3,449	1,921	850	**10,164**
*Actual / Forecast[2]	1,354	5,289	6,818	875	**14,336***
*Breakdown of RD16-20 Delivery[2]	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**Total***
C9581 Website and my SA Water Enhancement	315	479	472	0	1,266
C9655 Outage Information and Notifications	0	1,525	327	0	1,852
C9656 CRM Stage 1	18	2,327	1,917	0	4,262
C9657 Bill Smoothing and Enhance Direct Debit	0	946	926	0	1,872
C9658 IVR Enhancements	0	405	44	0	449
C9659 Customer Intel and Operational Analytics	0	118	764	119	1,001
C9669 Customer Transformation Roadmap	247	0	0	0	247
C9680 Self Service Flexible Payment Plans	0	0	615	450	1,065

C9717 Customer Portal Platform	774	-511	935	306	1,504
C9720 CRM Optimisation	0	0	818	0	818

[1] CX0016_BC33 Business change Technology Program – digital Program (Regulatory Business Proposal 2016)

[2] 20190612 – Q3 1819 RD16 Capex forecast – current SA Water forecast –based on project details provided by SA Water in documentation request*

**These figures may show marginal differences to those presented in SA Water's Response to RD20.73 slides.*

DRIVERS AND STANDARDS OF SERVICE

Key Digital Program objectives align the Digital Strategy priorities of "Channels and Choice", "Service that Saves" and "information drive" as follows:

- Channels and choice: Meet the changing expectations of our customers through the provision of digital services that are valued and provide a better experience
- Services that save: Drive enhanced operational efficiency through the implementation of integrated technology that streamlines process and removes manual handling
- Information driven: Optimise the capture and management of customer data to support decision making, prioritise investment and improve experience design

The overall Program drivers and standards of service in the table below.

Business Drivers		
RISK	**Customer Driven** - Required to respond to a specific customer requirement	Reduction in risks associated with customers including: ▪ Inability to retain existing / acquire new customers in a competitive environment through the introduction of services comparable with like organisations. ▪ Inability to respond in an effective and timely way to a major incident or emergency because communication platforms are not flexibly designed or offered across the channels customers use. ▪ Customer dissatisfaction and complaints arising from inconsistent customer information through the provision of services that customers value and want. ▪ Our inability to manage end-to-end lifecycle of customer interaction through the introduction of technology to support better management of customer information
	External Obligations - Required to improve or maintain quality to a standard consistent with externally imposed obligations	Reduction of the risk of non-alignment with whole of South Australian Government Digital by Default Commitment. ▪ Reduction in risk of non-compliance with regulatory reporting requirements.
	Financial	Reduction in risk of failing to meet our saving commitments (reduction of cost to serve) through the introduction of process and technology enhancement.

EFFICIENCY	**Business Efficiency** - Deliver improvements in efficiency, with benefits quantified and incorporated into forecasts	Reduced costs to serve as customers are migrated from traditional, resource-intensive channels like phone, fax, and email and face-to-face to lower cost channels such as self-service. ▪ Overall efficiency gain for key customer service processes as systems are automated and duplication is removed. ▪ Allows customer data and information to be managed and stored in one place. ▪ Generates fewer complaints and supports improved handling of customer concerns as they arise.

Whilst a number of sound qualitative drivers for the investment are put forward to support the Digital Program, there is only limited quantitative evidence presented, e.g. actual customer surveys, benchmarking, spend to save estimations, to provide a basis for the program. The “Investing for you – Part 3: IT Investment” slides do present a summary overview of customer priorities which provide some quantification of how these projects meet priorities. We consider that a stronger approach to benefits realisation could have been taken to provide greater transparency over the business benefits associated with this expenditure.

However, SA Water has committed to operating expenditure savings of $1.4 million per annum in the RD16-20 period and ongoing. This would lead to a positive net present value from the investment. We queried whether SA Water undertook more granular financial analysis for each of the larger initiatives and SA Water confirmed that it does.

However, there are no end goals/targets for the Digital Program in terms of performance outputs and only an overall opex saving target of $1.4M over the RD16-20 period. For the total capital investment, this level of savings should generate a positive NPV and reasonable rate of return.

PRUDENCE ASSESSMENT

SA Water has identified qualitative benefits for the project and shown alignment with business drivers. While we consider that greater benefits mapping could have been undertaken to demonstrate the value of this expenditure, the committed operating expenditure savings justify the investment on a net present value basis.

SOLUTIONS DEVELOPMENT

As a continuation of the RD13-16 Program, options presented are straightforward around continuing into RD16 (preferred), delay to RD20 (not preferred) and do nothing (not preferred) are explored and considered. However, this analysis is nearly all qualitative and subjective e.g. “Falling behind industry peers”.

There is no comparison NPV or MCA analysis for different options. At a program level, Option 1 (invest in RD16-20) is described at an NPV level costed out to 2020 and 2030 but there is no comparison to options 2 and 3 or detail of what costs are included in this.

Cost estimation has been based on internal SMEs assessing the likely inputs required to deliver the initiatives – labour, materials, vendor products and support etc. to form a bottom-up cost estimate. This approach has been subject to third party review. We consider that the approach is reasonable but note that bottom-up approaches may not adequately identify efficiencies.

In individual project briefs, there is no financial analysis to select the best course of action from a range of options. SA Water notes that it does not consider opex savings at project level. We understand this approach given that savings may only appear when aggregated or when thresholds are reached. Therefore financial analysis may not be appropriate at the specific project level but there is opportunity for SA Water to improve its options assessment for digital projects.

A summary of the solutions approach for each project was documented in the business change technology program. In the Business Change Technology Program – 33. Digital Program (Regulatory Business Proposal 2016). The documented solution approach for each project is very brief. Each project has an individual project brief, yet further

information about solution development was difficult to find. At our interviews, SA Water provided further detail on solution development but we found that this was disparate for the different initiatives.

COST ASSESSMENT

At the program level, expenditure has increased from $10.1M forecast at RD16 to a September 2019 forecast of $14.7M. SA Water explained that this was due to a shift in business priorities to have a greater focus on customers and putting customers “at the heart”. The individual project estimates have been largely developed through a bottom-up assessment of the inputs required.

EFFICIENCY ASSESSMENT

SA Water anticipates operating expenditure savings of $1.026 million per annum for this program, an increase on the target of $0.978 million per annum initially forecast. SA Water has committed to operating expenditure savings of $1.4 million per annum arising from this program. On this basis, the expenditure is efficient.

CONCLUSION

The Corporate IT Digital Program is a program of eight projects. This program has been identified by SA Water as a critical enabler of SA Water’s Digital and Customer Strategies. The Program extends and enhances SA Water’s previous technology investment from RD13-16 to improve service delivery and keep costs down for customers. The scope includes the following projects:

- SA Water Website
- Channel Management & Strategy
- Digital Fault communication
- Online Fault Reporting
- Online Customer Self Service
- eBilling and Online payments
- Digital Engagement, Insights & Research
- Customer Relationship Management

SA Water has identified qualitative benefits for the project and shown alignment with business drivers. At the program level, expenditure has increase from $10.1M forecast at RD16 to a September 2019 forecast of $14.7M. SA Water explained that this was due to a shift in business priorities to have a greater focus on customers and putting customers “at the heart”. The individual project estimates have been largely developed through a bottom-up assessment of the inputs required.

SA Water anticipates operating expenditure savings of $1.026 million per annum for this program, an increase on the target of $0.978 million per annum initially forecast. SA Water has committed to operating expenditure savings of $1.4 million per annum arising from this program. On this basis, the expenditure is efficient.

KEY DOCUMENTS REVIEWED

Business Change Technology Program – 33. Digital Program (Regulatory Business Proposal 2016)
20190612 – Q3 1819 RD16 Capex forecast – current SA Water forecast
C9655 Outage information and notifications – VC2 Performance Review Report
C9581 Website and my SA Water Enhancements
RFI RD20.73 – Response to ESCoSA (Three IT Programs)
C9657-BRIEF.pdf
C9657-Performance Review.pdf
C9658 IVR enhancements steering 20180725.pptx
C9658-BRIEF.pdf

C9658-Performance Report.pdf
C9659 Customer Intel and Operational Analytics-05042019.pdf
C9659-BRIEF.pdf
C9659-Performance Review 2.pdf
C9669-Performance Report.pdf
C9680 Self Service Flexible Payment Plans-01102019.pdf
C9680-BRIEF.pdf
C9717 Customer Experience Platform-09102019.pdf
C9717-BRIEF.pdf
C9720 Fortnightly Project Update - WE 20190712.pptx
C9720-BRIEF.pdf
Response to RD20 114.msg
C9581-BRIEF.pdf
C9581-Performance Report.pdf
C9655-BRIEF.pdf

Field Process Reengineering

PROJECT DETAILS

Project Name	Field Process Reengineering		
Project Number	39	Project Stage	Planning and Investigation
Primary Expenditure Driver Category	Efficiency		

PROJECT DESCRIPTION

The field process reengineering program is the implementation of several technology investments that are meant to improve the delivery of field services for SA Water. The technologies are intended to allow the business to complete tasks in a safer and more efficient manner. This fits into SA Water's field delivery strategy. In addition, the projects are expected to deliver efficiency savings and improve customer service. The project scope includes:

- Vehicle/ Resource tracking
- Electronic workflow management (dispatch)
- Mobile access to asset systems
- Mobile access to safety systems
- Automated scheduling and dispatch
- Integrated logistics and supply chain

The project was delivered as eight separate activities:

- dispatch and scheduling
- in vehicle tracking and lone worker
- access to information from field – advanced
- enhancement of Field of Asset and Works Mobility
- inventory management
- field communications
- enable SCADA field access
- extend Field Worker Platform to additional user groups.

PROJECT EXPENDITURE PROFILE (excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
Business proposal	5,944	4,733	2,405	796	**13,878**
RD16	5,955	4,727	2,403	795	**13,880**
Actual / Forecast	1,657	4,703	3,685	1,883	**11,928**

DRIVERS AND STANDARDS OF SERVICE

The project is intended to improve business efficiency and customer satisfaction. The specific drivers for this project are in the following table. The projects are meant to ensure a more efficient delivery of repairs and better documentation of those repairs. In addition, the IT solutions being adopted will allow more efficient communication about the status of ongoing repairs which can then be communicated to customers.

KPI category	KPI	Project outcome
Risk	Asset Renewal/Replace - Required to maintain existing assets to ensure continued operations and reduce risks of outage	▪ Reduction of the risk of service failures by improved asset data collection leading to improved asset investment decisions.

	Customer Driven - Required to respond to a specific customer requirement	▪ Reduction of the risk of non-compliance with customer service standards by optimising the use of field resources.
	External Obligations - Required to improve or maintain quality to a standard consistent with externally imposed obligations	▪ Reduction of the risk of non-compliance with regulatory reporting requirements for water customer service interruptions by improving the accuracy and timeliness of data. ▪ Reduction of the risk of non-compliance with Work Health & Safety (WHS), Drinking Water Quality Management Systems (DWQMS) and Environmental Management Systems (EMS) standards by improving access to the management systems in the field.
Efficiency	Business Efficiency - Deliver improvements in efficiency, with benefits quantified and incorporated into forecasts	▪ Achievement of the O&M savings targets identified for RBP2016. This program is expected to contribute $4,867,000 worth of savings / year.

SA Water has identified several IT solutions that they note will improve efficiency. In particular, they are looking at solutions that integrate into their existing Maximo software. The solutions are meant to improve how resources are deployed, the safety of the workers once they are deployed, the type and accessibility of information available to individuals when they are in the field and their ability to document what they find in the field. SA Water have documented how the overall program and the individual programs aligned with the stated KPIs.

PRUDENCE ASSESSMENT

The drivers for the project as detailed in the KPIs table are a mix of sustaining existing information systems functions, adding new capability and delivering operating costs efficiencies. For information systems projects, this is not unusual as business processes are digitised.

Considering efficiency alone, SA Water has “committed” opex savings of $5.55 million per annum associated with these initiatives. This generates a positive net present value. On this basis, the project can be considered prudent. The commitment of operating expenditure savings occurred top down through the budget process and do not reflect a precise bottom up quantification of the savings expected from this program.

SOLUTIONS DEVELOPMENT

Originally, the project was managed by Allwater with a focus on Metropolitan field services. It then expanded to include SA Water’s wider operations. A summary of the solutions approach for each project was documented in the business change technology program and is provided following.

Project name	Solution approach
Dispatch and Scheduling	▪ Implementation of changes to Maximo ▪ Implementation of a scheduler optimisation solution. Based on analysis the potential vendors include TOA Technologies (owned by Oracle), Click Software and IBM iLog CPLEX. As the IBM solution is pre-integrated with the Maximo product it has been selected for cost estimation purposes. The iLog CPLEX solution is available as either a standalone Decision Optimisation Centre or as a component within the latest version of Maximo Scheduler. It is therefore recommended to implement the latest version of the Maximo Scheduler which will require an upgrade of Maximo to 7.5 (or later).
O&M Inventory Management	▪ Manage vehicles as stores / bins to track inventory when it is issued from A or B stores. Will require integration to Ellipse as the inventory management system.
In-Vehicle Tracking and Lone Worker	▪ Cloud based hosted solution with integrations to SA Water system
Access to info from field	▪ SharePoint connector / document mobility application
Extend Field Worker Platform to support Trade Waste	▪ Mobile works management application extended to support Trade Waste

Enhancement to Field A&W Mobility	▪ Expose other applications on the mobile platform for field users
Enable SCADA Field Access	▪ None
Field Communications	▪ None

The documented solution approach for each project is very brief. Each project has an individual project brief, yet further information about solution development was difficult to find.

The options considered are described in the following table. Different options were not necessarily considered instead two different program deliveries were considered and a reduction in scope. In the documents reviewed alternative software packages were not considered.

1a	(Preferred) – Field Process Reengineering program as articulated in this business case	Program Implementation – the technology solution as articulated in this business case.
1b	Field Process Reengineering program as articulated in this business case, but deferred to the third regulatory period.	Delayed Program Implementation – the technology solution is required as identified under option 1a but is deferred to the third regulatory period.
2	Business process improvements	Incremental business process improvements – changes limited to business processes, procedures, and policies with minor changes (Opex – BAU requests) to existing technology infrastructure.
3	Do nothing	No change – The business processes and existing technology infrastructure remains unchanged.

The business case documents initially provided by SA Water did not detail well how specific solutions were developed or selected. We discussed this with SA Water and were informed that the nature of the projects is that they have typically been delivered as incremental initiatives to improve or create functionality and that vendors are sometimes involved in demonstrating and testing functionality. We were provided further documentation following our meetings which document the extent of solution development and testing undertaken.

COST ASSESSMENT

The capital cost of each scope item included in the brief is summarised below.

Project	Total cost estimate
Dispatch and Scheduling	$1,800,000
O&M Inventory Management	$2,520,000
In-Vehicle Tracking and Lone Worker	$2,710,000
Access to info from field	$2,430,000
Extend Field Worker Platform to support Trade Waste	$796,000
Enhancement to Field A&W Mobility	$1,890,000
Enable SCADA Field Access	$1,140,000
Field Communications	$580,000

SA water believes that this project has the potential to reduce operating costs in the order of $17.8 million over the next regulatory period. How the savings will be achieved is not described in detail and as noted, the corresponding operating cost adjustment was made top down.

EFFICIENCY ASSESSMENT

The solution development undertaken is detailed in a range of internal reports and vendor proposals. The solution development process is iterative. SA Water has stated that annual savings will be approximately $4.9 million with a

total savings of $17.8 million over the next regulatory period. A top down operating expenditure saving of $5.55 million per annum has been recognised in forward budgets. On this basis, we consider the project efficient.

CONCLUSION

The field process reengineering program is the implementation of several technology investments that are meant to improve the delivery of field services for SA water. The technologies are intended to allow the business to complete task in a safer and more efficient manner. This fits into SA water's field delivery strategy. In addition, the projects are expected to deliver efficiency savings and improve customer service. The project scope includes vehicle/ resource tracking, electronic workflow management (management (dispatch) and mobile access to asset systems.

The solutions proposed are a mix of enhanced functionality and new products. The scope items have typically been developed as incremental initiatives. Vendors are sometimes involved in demonstrating and testing functionality. We were provided further documentation following our meetings which document the extent of solution development and testing undertaken.

On the basis that SA Water has committed to material operating expenditure savings that generate a positive net present value, this project is both prudent and efficient.

KEY DOCUMENTS REVIEWED

Regulatory Business Proposal 2016 (2015)

Response to ESCOSA (2019)

Project status reports

- C9561 Advanced Scheduling Dispatch Capability (31/10/2018 and 30/11/2018)
- C9578 Enhanced Network access and WiFi (30/04/2018 and 31/05/2018)
- C9579 Mobile Work and Safety Tools (30/04/2019 and 31/01/2019)
- C9580 Field Worker Safety (31/08/2019 and 30/09/2019)
- C9654 Field Force Application Extensions (31/07/2018 and 31/08/2018)
- C9708 Digital Field Service Tools (31/05/2019 and 30/06/2019)
- C9718 Dispatch Capability Extensions (31/08/2019 and 30/09/2019)

Advanced Scheduling Dispatch Capability

- Option Endorsements Submission (2016)
- Additional Full Financial Approval Submission (2018)
- Project Performance and Closeout Report (2018)

Enhanced Network access and WiF

- Full Financial Approval Submission (2016)
- Project Performance Report (2018)

Mobile Work and Safety Tools

- Project Brief (2016)
- Agile value cycle 3A performance review (2018)

Field Worker Safety

- Project Brief (2017)

Field Force Application Extensions

- Project Brief (2017)
- Project Performance and Closeout Report (2018)

Digital Field Service Tools

- Project Brief (2018)
- Project Performance and Closeout Report (2019)

Dispatch capability extensions

- Agile Project Vision (2018)
- RD20.73 – Response to ESCOSA question on IT program efficiency
- C9561 Advanced Scheduling Dispatch Capability Options Endorsement.pdf
- C9561 Advanced Scheduling Dispatch Capability SC 22 May 18.pptx
- C9561 Click Rollout Schedule.xlsx

- C9579 Mobile Field Office - Solution Options Definition - Value Cycle 4 - Field Forms - Signed.pdf
- C9579 Mobile Field Office - Value Cycle 3 - Spatial Tool PoC - AAM Report.docx
- C9579 Mobile Field Office - Value Cycle 3 - Spatial Tool PoC - Wipro Report.docx
- C9579 Mobile Field Office - Value Cycle 5 Performance Review - Approved.pdf
- C9579 Mobile Field Office Agile Value Cycle 3B Performance Review - Approved.pdf
- C9580 Field Worker Safety - VC5 Field Forms - On the Job Safety Planning - SOD.pptx

APPENDIX

C

SUMMARIES OF FUTURE CAPEX PROJECTS

Water Retic Network Management Program

PROJECT DETAILS

Project Name	Water Retic Network Management Program		
Project Number	A0025 – Reticulation Mains Water Network	Project Stage	Ongoing program
Primary Expenditure Driver Category	Maintain service		

PROJECT DESCRIPTION

The purpose of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water.

The proposed scope of works in this program for RD20 includes:

- Renewal of water mains ($64 million metro, $48 million country)
- Installation of network valves to reduce impact of shutoffs in terms of affected property numbers (these are referred to as shutoff blocks) ($5 million)
- Extended use of smart networks approach to proactively improve network performance ($21 million)

Pressure management to prevent bursts ($6 million)

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total
RD20 Proposal Capex	35,900	36,700	35,800	35,800	**144,200**
RD20 Proposed Opex	-156	-156	-156	-156	**-624**

Note: This expenditure is that included in the Business Case for Reticulation Network Management and does not align with that for the A0025 program line as the Business Case includes additional expenditure items.

DRIVERS AND STANDARDS OF SERVICE

As noted in review of expenditure for water mains renewals in the RD16 period, SA Water has adjusted its targets for the number of customers impacted by three or more interruptions and for the rate of mains failure. The current state-wide target for customers receiving three or more unplanned supply interruptions is 1,900. This target will be reduced for the 2020-2024 period to 1,750 and further reduced in 2028 to 1,700. SA water's current performance is 2,417 customers receiving more than three unplanned interruptions per annum which has worsened somewhat since the spike of effort to address this metric in the RD16 period but performance is well below the 2016 peak.

SA Water have completed a sound level of analysis to understand the causes of water mains failures. However, there is limited analysis of the root causes of supply interruptions and why customer interruption durations are steadily increasing. At interview, SA water commented that better data on shut-off block numbers, infill development within shut-off blocks and a move to ensure safety of operators (mains being shut down for repair verses mains being repaired under pressure) were driving the increased in supply interruption numbers seen over the second-half of the 2016/17 to 2017/18 period – see Figure 1.

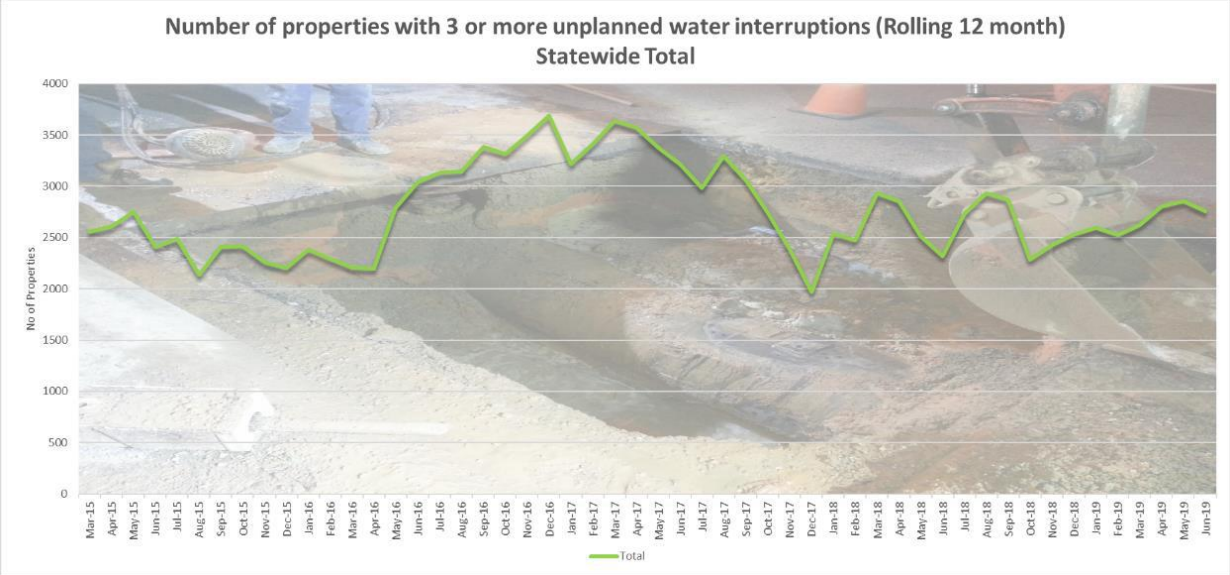


Figure 1 From Business Case for Reticulation Management – numbers of properties with 3 or more interruptions

There are two main categories for the cause of network pipe bursts: pressure burst and grounded movement bursts. Pressure burst occur when water surges occur in the network or pipes fatigue after being exposed to high pressure over extended periods of time and ground movement failures occur for many reasons including inclement weather (i.e. soil movement as a result of intense rain). Acknowledging some pipe failures are weather-influenced, failures are still a useful of indicator of how well the network is being operated (i.e. proper operating pressures) and the effectiveness of the network maintenance.

We evaluated the water reticulation bursts over the last several years. Excluding the spike in pressure bursts in 2015/16, the pressure burst trend seen in Figure 2 is relatively flat from 2019/10 to present. This indicates a water network that is relatively stable and may not be a major contributor to the unplanned water supply interruptions metric. Lower water supply interruptions would be anticipated with greater and more targeted mains renewal but renewal is only one solution and should be considered with others in a holistic approach.

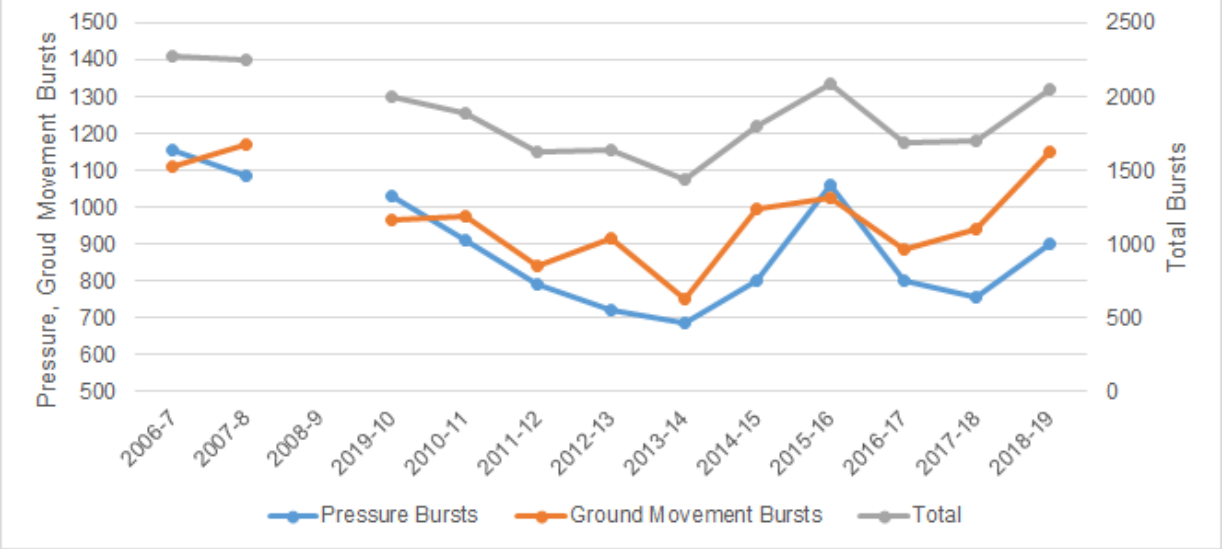


Figure 2 Breakdown of mains failures – from Water Reticulation Mains Failure Analysis 2019

The proposed end-2023//24 target of 1,750 properties with three or more unplanned interruptions is dependent on a continued reduction in unplanned interruptions from 2019/20. This performance improvement per activity is relatively conservative for the RD20 Reticulation Management Program (reduction of 300 from start position). We consider that upper and lower bounds (e.g. +/- standard deviation) may be a more useful way to monitor performance rather than a single metric as the number of supply interruptions year-to-year is inherently volatile.

The analysis of the historical reticulation renewal programs has shown that a level of reticulation renewal of 15km/year has been effective at maintaining a stable burst rate – see Figure 3. While more SA water customers are experiencing more unplanned outages the number of pressure burst has remained relatively constant outside of 2015/16. The increase in failure events in 2015/16 were a result of surge events, boundary connection management issues, pump station operational change and PRV operation. SA Water have acknowledged that these factors contributed to the 2015/16 mains failure numbers.

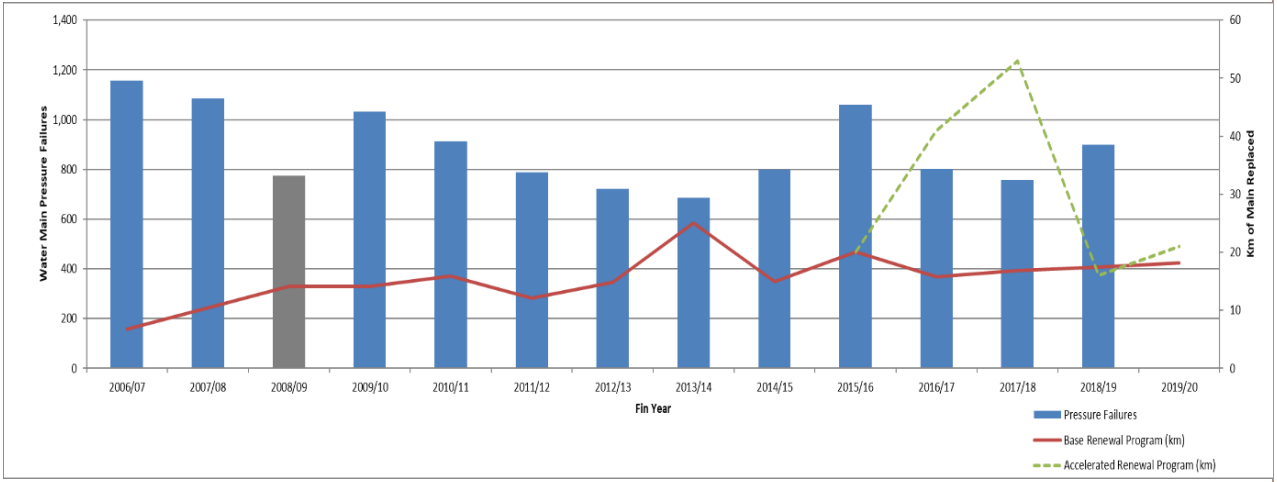


Figure 3 Analysis of mains pressure-related failures v main renewal rates

SOLUTIONS DEVELOPMENT

SA Water has used the second iteration of its PARMS (pipeline asset and risk management system) model to develop a 25 year renewals program. The model uses existing failure data and other information about the assets and their operations to predict ongoing failures. Different operating and maintenance regimes can be inputted to forecast future network failures which can be used to predict number of customers having unplanned interruptions. Modelling was undertaken to develop program that would reduce the number of properties experiencing three or more interruptions to under 1700.

In order to achieve this target by 2040, the outputs of the model indicated a level of renewal of $16 million per annum for Metro and $12 million per annum for Regional water reticulation pipes. The modelling suggests that spending $10 million per annum will maintain the status quo and spending $24 million per annum will achieve the 900 property target for Metro (i.e. 1700 overall) by 2029.

We consider that the scenario and level of expenditure adopted by SA Water is a reasonable approach to sustaining and gradually improving network performance over the coming period. Figure 4 shows total expenditure for the reticulation water mains network program over the period 2013/14 to 2023/24. This illustrates the moderation of expenditure compared with the spike in theRD16 period. A moderated approach will provide SA Water time to test and confirm the benefits of operational strategies and new technologies that may provide more cost effective solutions than mains renewal.

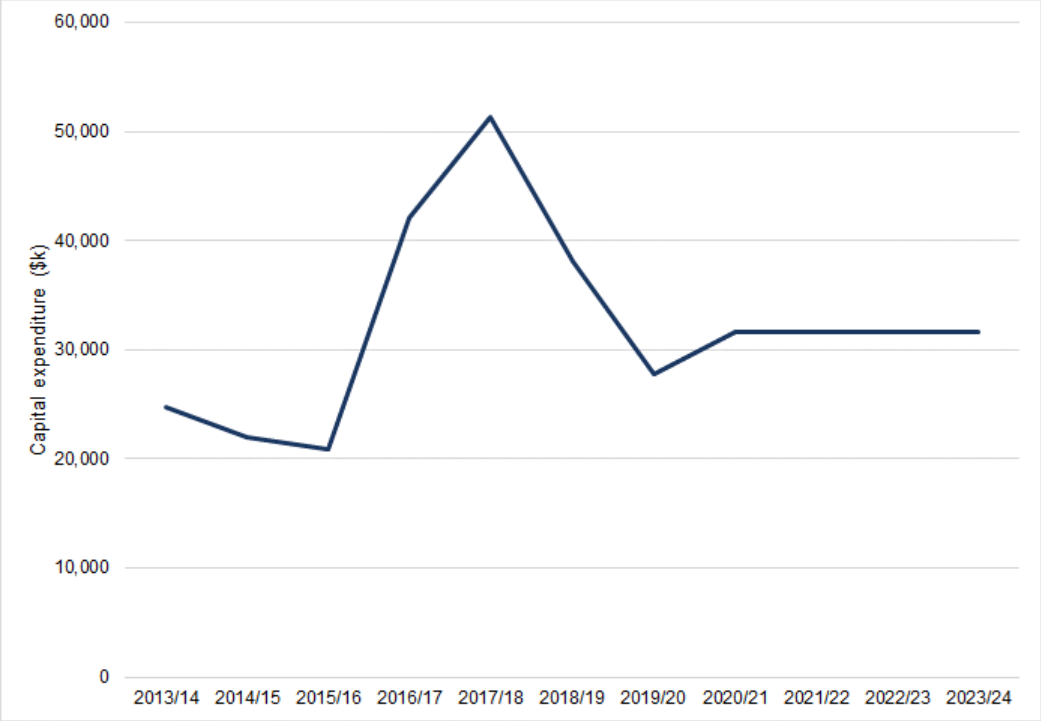


Figure 4 – Reticulation Mains Water Network expenditure 2013/14 to 2023/24

SA Water proposes substantial increases in activities that will support performance of the main network as detailed in Table 1.

Table 1 – Other water mains renewal activities

Intervention	RD16 Actual/Forecast	RD20 Proposal
Reticulation Water Valves	$2.5m	$5.6m
Smart Networks	$8.4m	$20.9m
Pressure Management	$0.5m	$5.7m

The valve installation program is proposed to more than double to $5.6 million. This should directly contribute to reduced supply interruption risk and achieve a reduction in the maximum shut-off block size to 50 properties over the next two regulatory investment periods. Pressure Management is proposed to increase to $5.7 million program from a successful trial and this should reduce mains failure risk and supply interruptions as a secondary benefit. Pressure reduction is well-established method undertaken by a number of water utilities as a means to offset mains renewal and also control leakage. SA Water has not quantified any expected benefits from this program as it does not yet have sufficient information.

SA Water proposes a substantial increase in expenditure on Smart Networks. However, its business case states that "Due to the limited data to date it is not fully understood yet what impact this program is going to have on our 3+ interruptions performance in the future. However this will be monitored in the coming years". We cannot understand why significant expenditure should be proposed with no benefits committed or understood. Smart Networks trials have been commenced in the RD16 period and this should provide sufficient information to SA Water on which to assess the costs and benefits of future programs.

PRUDENCE ASSESSMENT

SA Water has determined a level of expenditure on mains renewal through scenario testing. It has tested the relationship between performance and different levels of expenditure and proposes expenditure to improve properties experiencing three or more supply interruptions to 1,700 (metro and regional) by 2029. We consider that the scenario and level of expenditure adopted by SA Water is a reasonable approach to sustaining and gradually improving network performance over the coming period. For a different performance target, a different level of expenditure would be appropriate. SA Water's understanding of the relationship between expenditure, asset performance and service performance is relatively sophisticated which provides increased confidence that the expenditure is prudent for the

given performance target (noting that there will always be in inherent variability in performance due to factors outside of SA Water's control).

It also proposes substantial increases in activity for renewal of water valves, smart networks and pressure management. These activities should also deliver improvement in terms of the number of customers impacted by more than three supply interruptions. SA Water has not quantified expected benefits from the pressure management and smart network components but considers that taken together with renewals and valve installations, these will enable to reduce the number of properties experiencing three or more supply interruptions from 2,100 in 2020 to 1,750 in 2024.

While we are supportive of the suite of measures that SA Water is pursuing and approach to developing scenarios to forecast the level of expenditure required on renewals to deliver performance targets, we consider that SA Water has been conservative in estimating the benefits arising from the program as a whole particularly the benefit from improved pressure management. Similarly, we cannot see how SA Water can justify a ramp up in in Smart Network expenditure without having greater confidence in the benefits. We consider that a prudent level of expenditure is lower than that proposed to account for these factors.

Our opinion is that a prudent program would be more cautious in pursuing smart networks and pressure management until their benefits are known and quantified to the extent necessary to justify and prioritise further work program. The risk as it stands on the information provided by SA Water is that expenditure in these areas will not deliver real benefits for customers. We recommend that this program be adjusted so that only half of the proposed expenditure for Smart Networks and Pressure Management be considered prudent. This is a reduction of $13.3 million over the RD20 period. This recommendation should not be interpreted as being prescriptive as to where SA Water should allocate expenditure within this program. SA Water should prioritise expenditure between different activities as it obtains better information on the benefits and costs of the options at its disposal.

COST ASSESSMENT

SA Water has used the second iteration of their PARMS model to identify what they considered the most cost effective water mains renewals program as it relates to unplanned interruptions is a function of renewals costs. Costs are built-up from unit rates from previous mains relay jobs with input from numerous stakeholders. Stakeholders were also consulted between the development of a renewals program from PARMS to a solution ready for capital delivery. Historic costs and unit rates have been used to build up the other program components.

EFFICIENCY ASSESSMENT

We consider that the costs forecast be SA Water are a reasonable estimate of efficient costs.

CONCLUSION

The purpose of this program is to ensure that the water reticulation assets deliver the required level of service for an optimised life cycle cost at an acceptable level of risk. This program covers the 24,000km of water mains with a diameter <375mm that are owned by SA Water.

The proposed scope of works in this program for RD20 includes:

- Renewal of water mains ($64 million metro, $48 million country)
- Installation of network valves to reduce impact of shutoffs in terms of affected property numbers (these are referred to as shutoff blocks) ($5 million)
- Extended use of smart networks approach to proactively improve network performance ($21 million)
- Pressure management to prevent bursts ($6 million)

SA Water has used the second iteration of its PARMS (pipeline asset and risk management system) model to develop a 25 year renewals program. The model uses existing failure data and other information about the assets and their operations to predict ongoing failures. Different operating and maintenance regimes can be inputted to forecast future network failures which can be used to predict number of customers having unplanned interruptions. Modelling was undertaken to develop program that would reduce the number of properties experiencing three or more interruptions to under 1700.

In order to achieve this target by 2040, the outputs of the model indicated a level of renewal of $16 million per annum for Metro and $12 million per annum for Regional water reticulation pipes. The modelling suggests that spending $10 million per annum will maintain the status quo and spending $24 million per annum will achieve the 900 property target for Metro (i.e. 1700 overall) by 2029.

We consider that the scenario and level of expenditure adopted by SA Water is a reasonable approach to sustaining and gradually improving network performance over the coming period. For a different performance target, a different level of expenditure would be appropriate. SA Water's understanding of the relationship between expenditure, asset performance and service performance is relatively sophisticated which provides increased confidence that the expenditure is prudent for the given performance target (noting that there will always be in inherent variability in performance due to factors outside of SA Water's control).

SA Water also proposes substantial increases in activity for renewal of water valves, smart networks and pressure management. These activities should also deliver improvement in terms of the number of customers impacted by more than three supply interruptions. SA Water has not quantified expected benefits from the pressure management and smart network components but considers that taken together with renewals and valve installations, these will enable to reduce the number of properties experiencing three or more supply interruptions from 2,100 in 2020 to 1,750 in 2024.

While we are supportive of the suite of measures that SA Water is pursuing and approach to developing scenarios to forecast the level of expenditure required on renewals to deliver performance targets, we consider that SA Water has been conservative in estimating the benefits arising from the program as a whole particularly the benefit from improved pressure management. Similarly, we cannot see how SA Water can justify a ramp up in in Smart Network expenditure without having greater confidence in the benefits. We consider that a prudent level of expenditure is lower than that proposed to account for these factors.

Our opinion is that a prudent program would be more cautious in pursuing smart networks and pressure management until their benefits are known and quantified to the extent necessary to justify and prioritise further work program. The risk as it stands on the information provided by SA Water is that expenditure in these areas will not deliver real benefits for customers. We recommend that this program be adjusted so that only half of the proposed expenditure for Smart Networks and Pressure Management be considered prudent. This is a reduction of $13.3 million over the RD20 period. This recommendation should not be interpreted as being prescriptive as to where SA Water should allocate expenditure within this program. SA Water should prioritise expenditure between different activities as it obtains better information on the benefits and costs of the options at its disposal.

KEY DOCUMENTS REVIEWED

- Business Case for Reticulation Network Management
- Smart Networks Expansion Business Case
- Water Pipe Network Facility AMP
- Water Reticulation Main Failure Analysis with Increased Expenditure 2019
- Operational Initiatives to Manage Supply Interruptions

Reticulation Mains Wastewater Network Program

PROJECT DETAILS

Program Name	Reticulation Mains Wastewater Network		
Program Number	A0038	Project Stage	Ongoing program
Primary Expenditure Driver Category	Renewal		

PROJECT DESCRIPTION

This program includes the following activities to maintain the serviceability of the wastewater network reticulation mains:

Wastewater Mains Renewal including ($3.9million general allowance, $51 million for specifically identified projects):

- Preventative sewer renewal program – identified through condition assessments
- Predictive maintenance – proactive program identifying sewers at risk of blockage and completing inspection and remedial works. This is a key change in strategy, as around 70% of sewer blockages are first time blockages.
- Major and Minor Third Party Works Metro (Regulated) ($8.0 million)
- A general allowance for rising mains renewal ($2.5 million)
- Recycled water mains renewal ($1.9 million)

SA Water's regulatory submission is based on assumed renewal of 88.8km of wastewater mains – 87.4km of relining and 1.4km of replacement.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total
General allowance for main renewal	604	972	1,155	1,155	3,886
Specific mains renewals	7,695	12,825	15,390	15,390	51,301
Third party works	-5,476	3,961	4,754	4,754	7,994
Rising main renewal	386	621	738	738	2,483
Recycled water main renewals	388	485	535	535	1,944
Total	3,598	18,865	22,573	22,573	67,607

DRIVERS AND STANDARDS OF SERVICE

Renewal of wastewater mains is required to maintain serviceability of the network and to prevent overflows of sewage which can cause impacts to the environment and public health. The mains targeted within this program are mostly Reinforced Concrete (RC) mains assessed to be in poor or very poor condition which pose a risk of structural failure and interruption to the customer. SA Water is proposing two new performance standards in this area for RD20:

- Sewer overflow frequency: target <29 repeat customer (internal) wastewater overflows in a 5-year period. Current performance <32
- Internal sewer overflows: target <190. Current performance 180

The six year trend in wastewater main breaks and chokes per 100km of main is shown in Figure 1. This shows an improvement in the break and choke rate in 2016/17 and 2017/18. However, sewer breaks and chokes are inherently volatile due to the various causes of failure including pipe movement when the ground is dry, increased root intrusion when soil moisture is low, pipe degradation and the impact of contaminants in the sewer itself such as fats and oil and debris. In response to the draft report, SA Water noted that:

> *This statement is factually correct however there is no implication given here that an improvement in years 2016/17 and 2017/18 was as a result of investment on or improvement in the asset base, rather there is a direct link in performance to environmental factors. Updated graph to include 18/19 and 19/20 data illustrates*

that long term performance has remained consistent, declining in 18/19 and 19/20. This supports {the above} statement that performance is volatile and will fluctuate due to changes in environmental factors (weather patterns) assuming no change to investment on the asset base

SA Water goes on to note that the driver for investment in these assets is the observed poor condition of these assets.

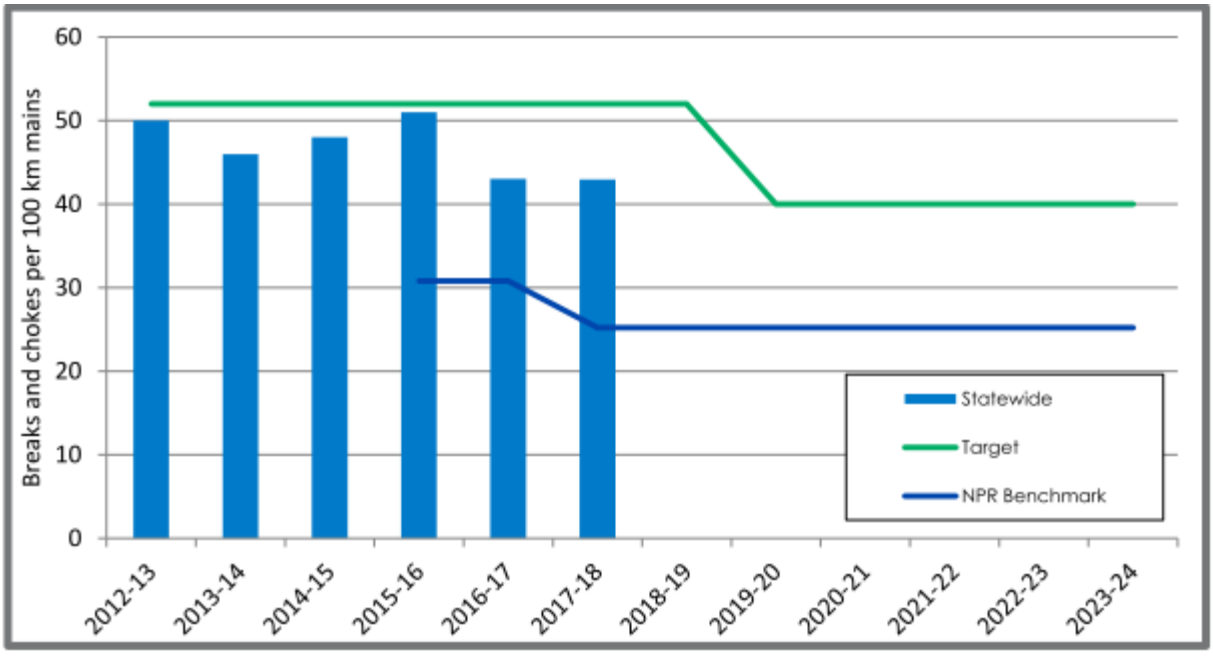


Figure 1 – Six year trends in sewer main breaks and chokes per 100km main

SA Water has a legislated responsibility, as defined in the Water Industry Act 2012 (SA) and under the Environment Protection Act 1993 (SA), to operate the wastewater networks in accordance with the Code of Practice for Wastewater Overflow Management, EPA 2017 (Code). The trend in Type 1 and Type environmental incidents resulting from wastewater network overflows as shown in Figure 2, is increasing. As noted, this is in part due to a change in reporting definition.

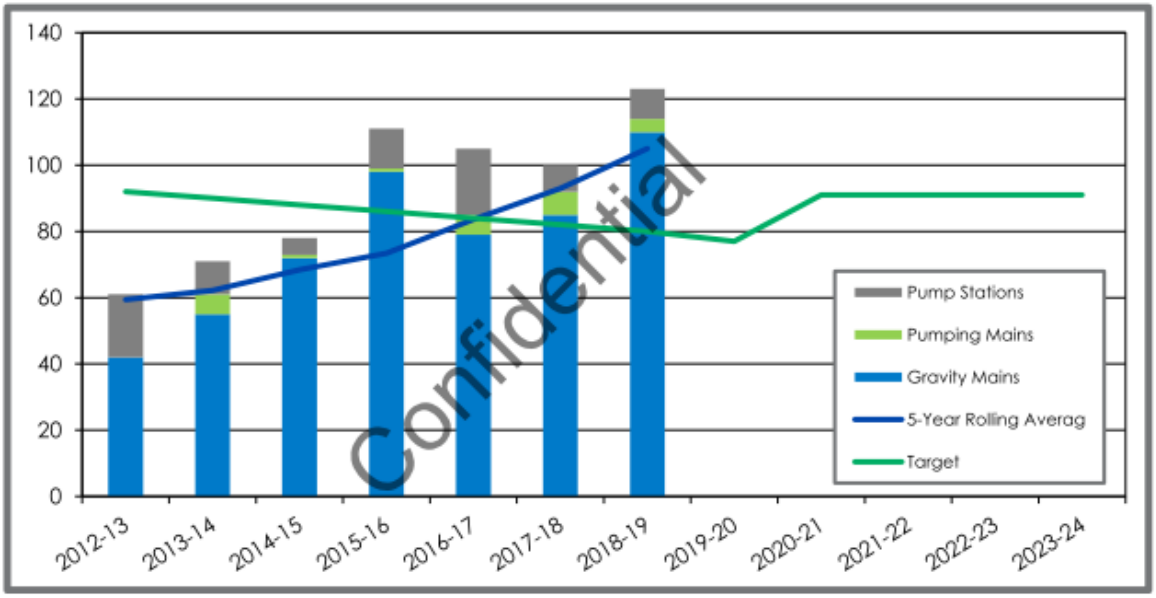


Figure 2. Environmental overflows by asset type (SA Water Wastewater Gravity Mains Approach)

Customers have stated a willingness to pay for reduce environmental overflows. Data in the SA Water customer willingness to pay survey (Marsden Jacob Associates) states that for reducing sewer overflows to the environment SA Water "wants to invest $33 million between 2020 and 2024 to reduce the number of sewage overflows that impact on South Australia's environment, particularly in the Adelaide Hills area. SA Water's proposed investments could reduce

the number of sewer overflows to the environment from around 110 events a year now to less than 90 overflows each year by 2024 (an 18% reduction). SA Water can reduce overflows by increasing rates of sewer cleaning, upgrading sewer infrastructure and using more smart technology". SA Water has proposed an enhanced preventive maintenance program to reduce environmental overflows. This is operating expenditure and outside the scope of this specific project review.

SA Water proposes an increase in the wastewater mains renewal program for RD20 as shown in Figure 3 at the whole of program level to address the level of assets observed to be in poor condition. The RD20 program is a 47% ($21.6 million) increase on the RD16 program. Expenditure in the RD20 period is heavily weighted to the last three years of the period.

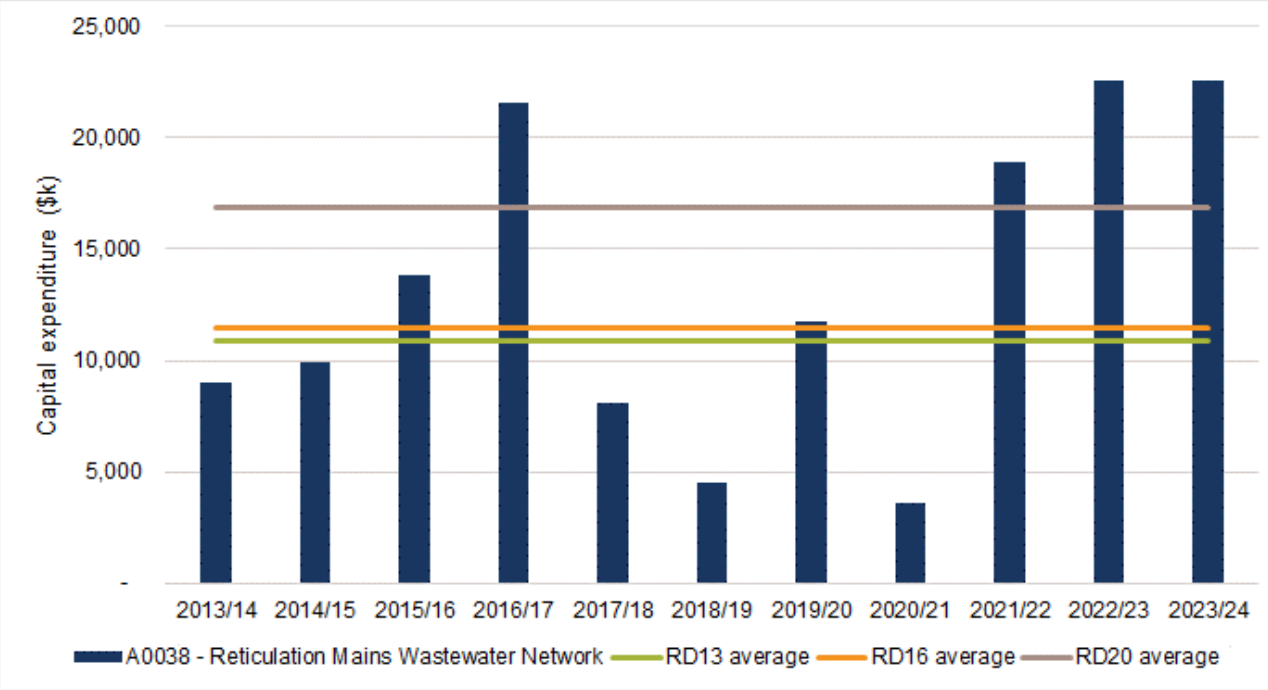


Figure 3 – Reticulation Mains Wastewater Network expenditure 2013/14 to 2023/24

SOLUTIONS DEVELOPMENT

SA Water has a decision matrix and a decision support tool to help determine appropriate interventions to renew wastewater mains. The intervention matrix is shown in Table 2. We consider that the interventions are appropriate for the root causes.

Table 2. Options considered for sewer renewal following CCTV inspection

		OPEX Solutions						CAPEX Solutions		
		Monitor	Quick Lock Pipe Repair	Dig & Repair	Routine Cleaning (jet-rod)	Chemical Treatment	Install Reflux Valve	Structural Liner	Pipe Bursting	Trench & Full Replacement
Root Cause	Tree Root Intrusion	✓	✓	✓	✓	✓	✗	✓	✓	✓
	Fats, oils and grease (FOG)	✓	✗	✗	✓	✗	✗	✗	✗	✗
	Minor collapse or misaligned pipe/joints	✓	✓	✓	✗	✗	✗	✗	✓	✓
	Uniform concrete deterioration	✓	✗	✗	✗	✗	✗	✓	✓	✓
	Complex fractures, without misaligned pipe/joints	✓	✗	✗	✗	✗	✗	✓	✓	✓
	Complex fractures, with misaligned pipe/joints	✓	✗	✗	✗	✗	✗	✗	✓	✓
	Pipe capacity exceeded	✓	✗	✗	✗	✗	✓	✗	✓	✓

Source: Wastewater Gravity Mains Approach

The Wastewater Pipe Network AMP states that SA Water's decision criterion for renewal of wastewater mains is that all pipe sections known or estimated to be in condition grade 4 or 5 have been put forward for renewal in the RD20 period. Consequence of failure is not considered in the decision making. Therefore, this is not a risk based approach (noting that risk is considered for prioritisation within the program). We consider that this strategy is not appropriate as it does not establish what SA Water's risk threshold is for the assets. It does not determine an optimal intervention timing based on the varying criticality between pipes.

The Wastewater Gravity Main Decision Support Tool is used to prioritise renewals within the overall program determined based on condition. This tool assesses the risk associated with failure of the sewers considered for the program. The tool includes attributes such as sewer material, diameter, inspection result, risk spatial factors, score and recommended solution which are stored in a spreadsheet. A copy of the tool has been provided.

We consider that the tool is broadly sound. However, we note that the risk scoring of the specific pipe sections identified for renewal lacks definition. All projects have an "after" risk score of 31 or 41 and all have a delta risk of 30 or 40 as summarised in the table below.

Table 3 – Before, after and delta risk for wastewater mains renewal program

Risk before	Risk after	Project (delta) risk	Length
71	41	30	18,067
61	31	30	59,804
75	31	44	7,760
85	41	44	10,971
			96,602

The underlying cause of this is that the consequence of failure scoring lacks definition. All pipes with nominal diameter equal to and between 150mm and 375mm nominal have been assigned a consequence of failure score of "R5 moderate" and all mains with nominal dimeter equal to or greater than 450mm have been assigned a consequence of failure score of "R7 Major". SA Water's consequence matrix has ten categories of negative consequences – this is not driving the uniformity in consequence rating. Good practice is to introduce multiple variables into the scoring of consequence. Diameter is a useful starting point as a proxy for population served. Other factors typically used by other utilities to assess the consequence of failure of wastewater mains include proximity to environmentally sensitive receptors such as waterways and the proximity to public spaces where public health may be impacted. Even if diameter was used in isolation, SA Water could introduce more distinction between the consequence of failure for different pipe categories. SA Water's "approach" document for wastewater mains notes that it intends to move to more sophisticated consequence scoring in future.

Based on this approach and the preceding discussion on the lack of understanding of the consequence of failure of wastewater mains leads us to conclude that SA Water's ability to balance cost and risk for this asset class is limited.

PRUDENCE ASSESSMENT

SA Water needs to maintain the wastewater network to maintain service and mitigate risks to public health and the environment caused by sewage overflows. It has a legislated responsibility to protect the environment but there are no regulated performance targets. SA Water is proposing two new performance standards in this area for RD20:

- Sewer overflow frequency: target <29 repeat customer (internal) wastewater overflows in a 5-year period. Current performance <32
- Internal sewer overflows: target <190. Current performance 180

SA Water is already meeting the internal sewer overflow target. The overflow frequency target is a 10% improvement on current performance.

The magnitude of the expenditure program is based on renewing all pipe sections known or estimated to be in condition grade 4 or 5 during theRD20 period. Consequence of failure is not considered in the decision making. We consider that this strategy is not appropriate as it does not establish what SA Water's risk threshold is for the assets. It does not determine an optimal intervention timing based on the varying criticality between pipes. We are not certain that SA Water is able to satisfactorily balance cost and risk, or reliably enhance performance.

Within the program, a risk prioritisation approach is used but the consequence scoring is relatively unsophisticated and is essentially binary. This also leads to concern over SA Water's ability to balance cost and risk within the program .

We consider that a prudent level of expenditure for the RD20 period is in line with that undertaken in the current period. That is a total program of $46 million rather than the $68 million proposed. There has been improved performance in the current period at this level of expenditure, noting the natural fluctuations in performance. An improved understanding of risk for this asset class may lead to further improvements in performance (all else being equal) in the RD20 period without the need for a ramp up in expenditure.

COST ASSESSMENT

Costs are based on previous contract unit rates. Different rates are used for the intervention type (replacement v relining) and the relining rates vary with pipe diameter. The rates for relining projects by diameter are shown in Figure 3. The bulk of the program by length is for 150mm and 225mm pipes which average $296/m. This is a little above benchmark rates held by us for similar work. We do not have benchmark rates for large diameter relining but note that the profile is linear suggesting little economy of scale. This may be an opportunity for efficiency gains in coming years as technology develops in this area.

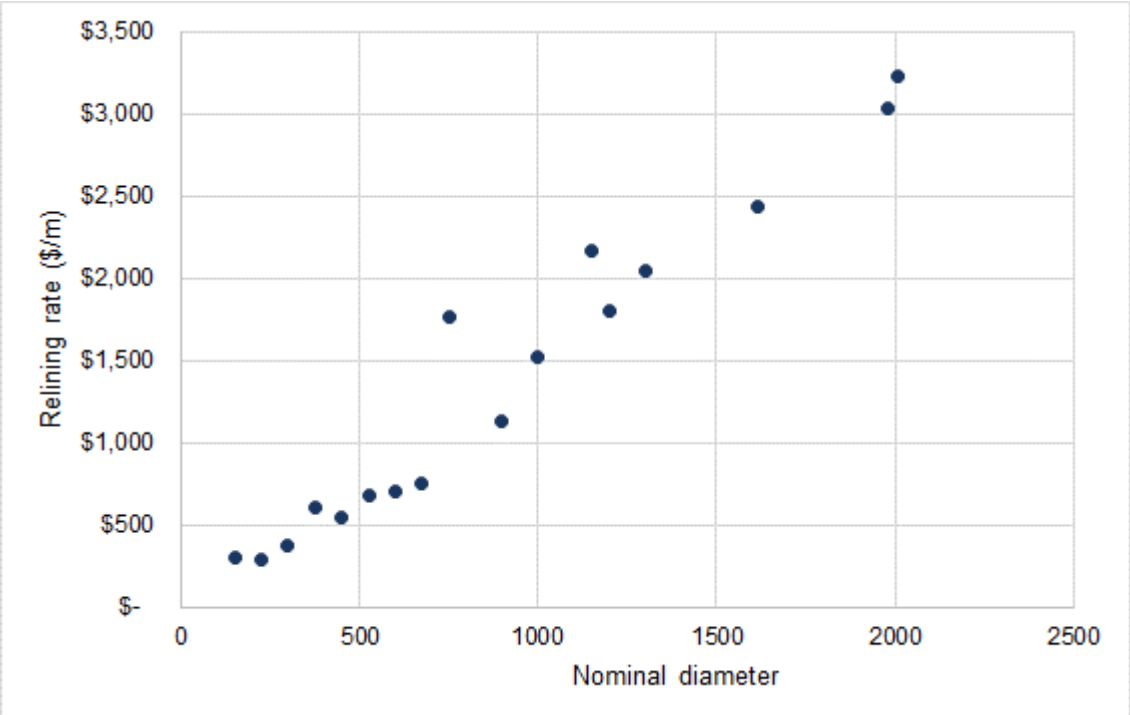


Figure 4 – Units rates for wastewater main relining by diameter

No decision has been made to date on how the program will be procured in 2020/21 to 2023/24.

It was confirmed in discussion that a program efficiency of 3% has been applied to wastewater renewal capex lines. As this work is relatively simple and repeatable we recommended that an efficiency of 5% is applied to the program as a whole in line with other programs. To make this adjustment, we have reversed out the 3% efficiency and then applied a 5% efficiency. The impact is to reduce the recommended total expenditure to $45 million over the RD20 period.

EFFICIENCY ASSESSMENT

We consider that the efficient costs for this program should reflect a 5% efficiency adjustment rather than the 3% applied by SA Water. This work is routine and repeatable and in an area where technology gains are evident.

CONCLUSION

This program includes the following activities to maintain the serviceability of the wastewater network reticulation mains:

Wastewater Mains Renewal including ($3.9million general allowance, $51 million for specifically identified projects):

- Preventative sewer renewal program – identified through condition assessments
- Predictive maintenance – proactive program identifying sewers at risk of blockage and completing inspection and remedial works. This is a key change in strategy, as around 70% of sewer blockages are first time blockages.
- Major and Minor Third Party Works Metro (Regulated) ($8.0 million)
- A general allowance for rising mains renewal ($2.5 million)
- Recycled water mains renewal ($1.9 million)

SA Water's regulatory submission is based on assumed renewal of 88.8km of wastewater mains – 87.4km of relining and 1.4km of replacement.

The six year trend in wastewater main breaks and chokes shows an improvement in the break and choke rate in 2016/17 and 2018/19. However, sewer breaks and chokes are inherently volatile due to the various causes of failure including pipe movement when the ground is dry, increased root intrusion when soil moisture is low, pipe degradation and the impact of contaminants in the sewer itself such as fats and oil and debris.

SA Water proposes an increase in the wastewater mains renewal program for RD20 at the whole of program level to address the level of assets observed to be in poor condition. The RD20 program is a 47% ($21.6 million) increase on the RD16 program. Expenditure in the RD20 period is heavily weighted to the last three years of the period.

The magnitude of the proposed expenditure program is based on renewing all pipe sections known or estimated to be in condition grade 4 or 5 during theRD20 period. Consequence of failure is not considered in the decision making. We consider that this strategy is not appropriate as it does not establish what SA Water's risk threshold is for the assets. It does not determine an optimal intervention timing based on the varying criticality between pipes. We are not certain that SA Water is able to satisfactorily balance cost and risk, or reliably enhance performance. Within the program, a risk prioritisation approach is used but the consequence scoring is relatively unsophisticated and is essentially binary. This also leads to concern over SA Water's ability to balance cost and risk within the program .

We consider that a prudent level of expenditure for the RD20 period is in line with that undertaken in the current period. That is a total program of $46 million rather than the $68 million proposed. There has been improved performance in the current period at this level of expenditure, noting the natural fluctuations in performance. An improved understanding of risk for this asset class may lead to further improvements in performance (all else being equal) in the RD20 period without the need for a ramp up in expenditure.

We consider that the efficient costs for this program should reflect a 5% efficiency adjustment rather than the 3% applied by SA Water. This work is routine and repeatable and in an area where technology gains are evident. To make this adjustment, we have reversed out the 3% efficiency and then applied a 5% efficiency. The impact is to reduce the recommended total expenditure to $45 million over the RD20 period.

KEY DOCUMENTS REVIEWED

- DF0023_Business Case - Our Plan 2020 - Network Overflows Management_confidential.pdf
- DF0023C_Wastewater Network Environmental Overflows Approach_confidential.pdf

- DF0023A_Wastewater Gravity Mains Approach_confidential.pdf
- DF0023b_2019 Wastewater Networks AMP
- DF003B Wastewater Lead Asset Management Plan
- Response to RD20_277 and RD20_278 as well as clarification between the two programs of work (different outcomes_ different effec.msg
- SA Water customer willingness to pay survey (Marsden-Jacob Associates review)
- Response to RD20.200, RD20.201, RD20.202. RD20.2013 and RD20.204.msg

Structures – Water Networks

PROJECT DETAILS

Project Name	Water Storage Tanks Renewal Reliability Program 2020 to 2024		
Program Number	A0022	Project Stage	Ongoing program
Primary Expenditure Driver Category	Maintain service		

PROJECT DESCRIPTION

This program is for the renewal of water storage tanks within the water storage network. The scope includes 21 defined projects and one "general" line item as detailed in table below. We note that there is a discrepancy between the business case and the regulatory submission capex model – in the business case the general line item was for $10,373k. The regulatory submission includes just over half this amount ($5,811k). We have used the regulatory submission capex model as our reference point. The total expenditure in the regulatory submission capex model is $19.7 million.

C NO./ID	Project description	Total (20-24)
RBP20_No_1097	AP Water Network Tanks Reliability Renewal General	5,811
RBP20_No_1098	LDMC 545 Woodcroft EL227 2.4ML Surface Concrete Tank	1,618
RBP20_No_1099	LDMC 542 Sellicks Hill EL126 0.23ML Surface Concrete Tank	559
RBP20_No_1100	LDMC 539 Hallett Cove EL172 0.25ML Surface Concrete Tank	491
RBP20_No_1101	LDMC 515 Wudinna 0.909ML Surface Concrete Tank	743
RBP20_No_1102	LDMC 514 Tooligie 0.136ML Surface Concrete Tank	595
RBP20_No_1103	Streaky Bay (Gibsons Peninsular) 0.45ML Surface Concrete Tank	125
RBP20_No_1104	Penneshaw (Duffy's) 0.20ML Surface Concrete Tank Number 3	506
RBP20_No_1105	LDMC 510 Peterborough 1.136ML Surface Concrete Tank	288
RBP20_No_1106	LDMC 509 Owen 0.227ML Surface Concrete Tank	318
RBP20_No_1107	LDMC 501 Moorook 0.16ML Surface Concrete Tank	257
RBP20_No_1108	LDMC 495 Elliston 0.136ML Surface Concrete Tank Number 3	204
RBP20_No_1109	LDMC 494 Elliston 0.136ML Surface Concrete Tank Number 2	204
RBP20_No_1110	LDMC 493 Elliston 0.136ML Surface Concrete Tank Number 1	204
RBP20_No_1111	LDM 563 Angas Hill 0.136ML Concrete Surface Tank	330
RBP20_No_1112	LDMC 566 Barabba 2.273ML Concrete Surface Tank	841
RBP20_No_1113	LDMC 570 New Mt Wudinna 0.12ML Concrete Surface Tank	215
RBP20_No_1114	LDMC 571 Normanville Heights 2.273ML Concrete Surface Tank	1,103
RBP20_No_1115	LDMC 572 Karoonda 0.273ML Elevated Steel Tank	79
RBP20_No_1116	LDMC 573 Port MacDonnell 0.273ML Elevated Steel Tank	233
RBP20_No_1119	LDMC 597 Ceduna Supply System and Tanks Rationalisation	4,841
RBP20_No_1121	Ridge EL472 Concrete Surface 9.09ML Tank Renewal	100

The scope includes for identified renewal works, follow-up reservoir inspections and an allowance for reactive work to maintain the serviceability of water storage tanks. These works are based on previous reservoir inspections undertaken during cleans or via other means e.g. inspected by divers or via remotely operated vehicles.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Business case	6,169	6,051	6,051	6,051	**24,332**	
RD20 capex model	4,916	4,916	4,916	4,916	**19,665**	
RD20 Proposed Opex	25	25	25	25		
RD20 Proposed Total						

DRIVERS AND STANDARDS OF SERVICE

Reservoirs provide storage within the network to maintain continuity of supply. Reservoir integrity also mitigates against water quality risks by preventing the ingress of contaminants. The primary level of service identified for this program is properties experiencing 3 or more interruptions in a 12-month period. In this program it relates to level of services of supply due to a reservoir being offline because of a structural issue e.g. roof, wall or floor.

A technical level of service has been defined and this is that reservoirs are in a condition grade of 3 (out of 5). SA Water identifies that 45.6% of Water Network Storage Tanks currently comply with the Technical level of service target and that 20.1% of Water Network Storage Tanks do not currently comply with the Technical Level of service target. For the remaining 34.3% SA Water does not know whether they comply or not. The desired targets is for 100% of reservoirs to achieve the Technical Level of service Target by 2028. In discussion, SA water, commented that an estimated 70% of reservoirs would comply with the technical Level of service by end of 2023/24 (end of RD20 period) if this program was implemented. We consider that the technical level of service is useful at a broad level but needs more granular information for forward planning. The reality is that a small defect on a reservoir that is otherwise in very good condition can lead to water quality contamination while reservoirs that are in fair condition overall can function effectively. The technical level of service should be at a component and/or sub-component level.

It is a little surprising that water quality and safety are only mentioned in the risk analysis of the Capital Program Brief and not as upfront level of service measures. These are included as possible consequences in the risk analysis as follows:

- *an increased safety risk for the group of operators maintaining the tank operations (up to 3 personnel at any one time) and/or an actual safety incident*
- *non-achievement of the greater than 80% positive public perception of water quality and/or a non-compliance with the ADWGs*

Reservoirs were monitored via tracking spreadsheets but are now tracked in a Maximo-based dashboard which comprises operational team external inspections during routine visits and specifically-arranged internal inspections. In the longer term, other data such as water quality samples, SCADA trends where available, should be available for addition to this. A copy of this was shared and it shows good functionality to interrogate reservoir asset condition and other useful asset planning information – see Figure 1.

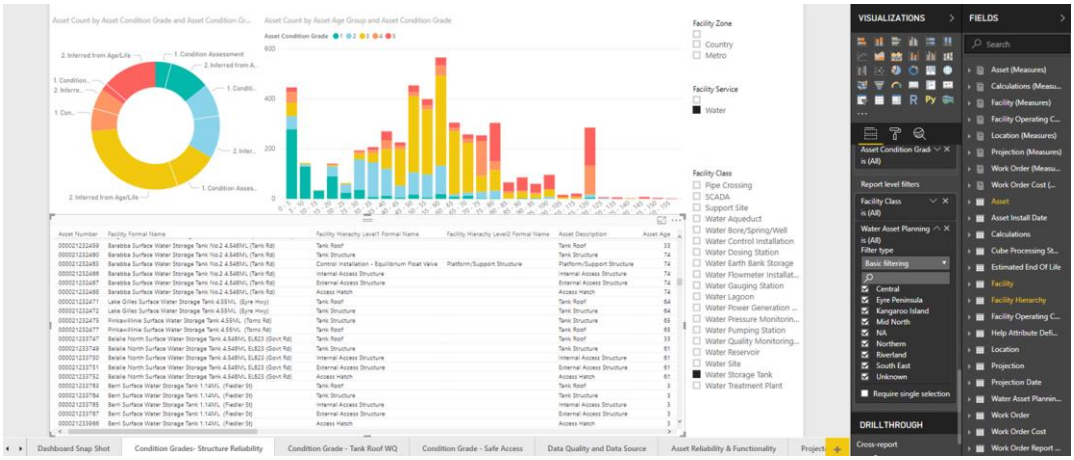


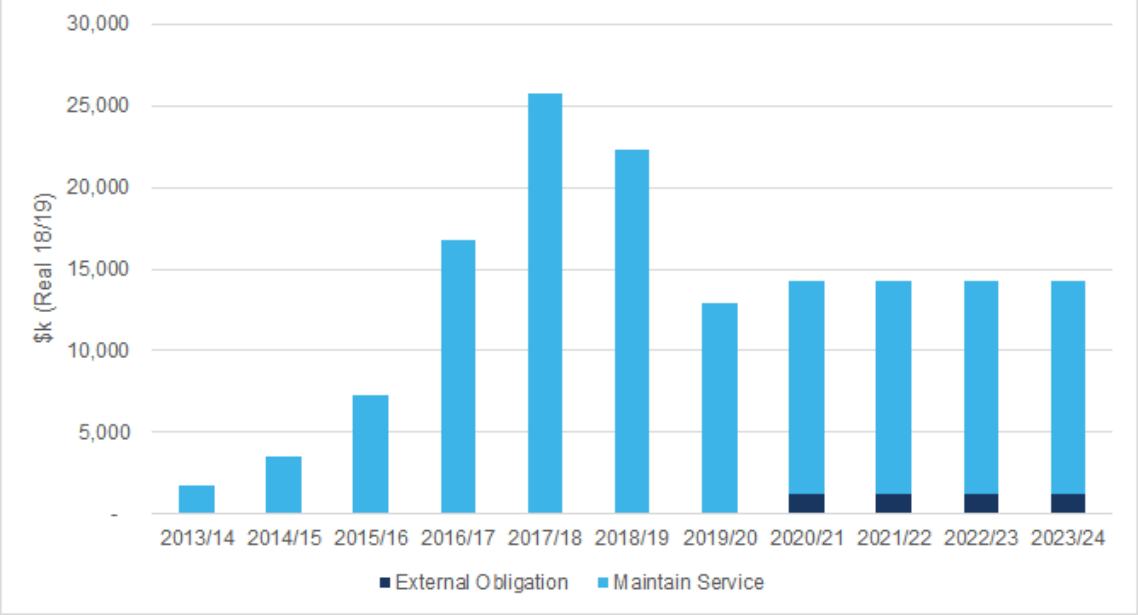
Figure 1. Maximo reservoir dashboard example

We reviewed this program at the time of the RD16 review and noted that the program:

…was 51% by value focused on the smaller (≤10ML) storage facilities: Metro Storages (35 No.) and Country Storages (24 No.) at $53.3M. These have been identified as having intolerable risk of failure and condition grades 4 and 5. The Metro Storages (16 No.) and Country Storages (44 No.) that have been inspected and found to have tolerable risks of failure and condition grades 4 and 5 at ($33.4M of potential work) have not been included in the program. We believe that this is a prudent approach. The use of a risk matrix approach to scheme prioritization was explained and demonstrated. The level of sophistication applied to the development of the Structures WN Renewal SFL project is adequate for the RBP2016 period when the focus will be on resolving the backlog. The build-up of a backlog puts into question the earlier asset management practices, and it is comforting to see the effort that has been put into inspecting these key assets in order to identify and prioritize expenditure.

Within the work identified, there needs to be urgent consideration of the criticality of the assets, as potentially offset by mitigation measures. Where network vulnerability is confirmed, operational response plans should be developed to be used in the event of failure before the backlog has been resolved. For the development of future programs, the risk matrix needs to consider mitigation and a full range of options.

The RD16 program proposed $105 million of expenditure for this program (including the separately reviewed Hope Valley EL170 tank renewal) but only $77.7 million of expenditure was delivered. Note that this is for the entire A022 water network structure program as analysis isn't possible at a lower level. The RD20 total program for all water network structures is $52.3 million which is a third lower than tat delivered within the RD16 period. The RD16 expenditure came off a low base of expenditure in the RD13 period.



It is concerning that SA Water's business case states that "Approximately 35% of all Water Network Water Storage Tanks (WSTs) have not been inspected to obtain condition assessment ratings and/or condition rating assessment data is not available for these WSTs". The importance of obtaining condition information, assessing consequence of failure and developing operational strategies to mitigate risks was known, discussed and acknowledge at the time of RD16 to addressed during this period as reflected in the excerpt provided above.

Experience suggests that SA Water has overestimated its risks relating to network water tanks. This is demonstrated by:

- Actual expenditure during the RD16 period being 26% lower than that forecast at the time of RD16
- The Hope Valley EL170 tank renewal project being delayed for many years demonstrating that the risk could be mitigated through operational measures that weren't considered when the original timing of the works was proposed
- SA Water not documenting a complete picture of the risk of these assets during the current period based on consistent and complete condition information (as evidenced by 35% of tanks not having this information). This suggests that SA Water is comfortable with the level of risk across the portfolio to not proactively assess condition.

On the basis of the apparent historic overstatement of risk, we recommend that the "general" line item not be considered prudent. SA Water need to better demonstrate the actual level of risk across its portfolio and particularly reflective of the potential for operational contingencies to mitigate these risks.

PRUDENCE ASSESSMENT

SA Water need to renew its water tanks to manage risks to continuity of supply and risks to the quality of the water supplied. SA Water has established a technical level of service that reservoirs are in a condition grade of 3 (out of 5). SA Water identifies that 45.6% of Water Network Storage Tanks currently comply with the Technical level of service target and that 20.1% of Water Network Storage Tanks do not currently comply with the Technical Level of service target. For the remaining 34.3% SA Water does not know whether they comply or not. It is concerning that SA Water's business case states that "Approximately 35% of all Water Network Water Storage Tanks (WSTs) have not been inspected to obtain condition assessment ratings and/or condition rating assessment data is not available for these WSTs". The importance of obtaining condition information, assessing consequence of failure and developing operational strategies to mitigate risks was known, discussed and acknowledge at the time of RD16 to addressed during this period as reflected in the excerpt provided above.

Experience suggests that SA Water has overestimated its risks relating to network water tanks. On the basis of the apparent historic overstatement of risk, we recommend that the "general" line item not be considered prudent. SA Water need to better demonstrate the actual level of risk across its portfolio and particularly reflective of the potential for operational contingencies to mitigate these risks. The adjustment to reflect prudent expenditure for RD20 is a reduction of $5,811k.

SOLUTIONS DEVELOPMENT

Solutions are developed based on the results of tank inspections. The approach is documented in an asset Lifecycle Decision Making Checklist and we were provided an example for Wattle Park EL278 2.273ML concrete tank. Asset Management Planners will work with operational teams to confirm the correct solution and operational actions needed ahead of capital works e.g. to facilitate the reservoir being offline for work.

We consider that the solutions development process is sound.

COST ASSESSMENT

Costs are estimated by Asset Management based on unit rates. An example of a cost estimate for a completed scheme / RD20 planned scheme has been provided for a 2016/17-2019/20 reservoir renewal (Gulnare Tank No.1 Refurb) and one planned for 2020/21 (Baroota 4.54ML Tank ID OLM171 Checklist and Estimate LDM-171).

Contractors visit the site based on the brief provided and confirm the initial scope/cost or propose potential changes. Sometimes the contractor is required to conduct a more detailed inspection and finding further works is anticipated. It has not been identified at this stage if one reservoir contractor will manage the whole program or it will be split into North and South programs as per the proposed SA water Capital Delivery commercial model. The approach of using unit rates to initially cost jobs and contractors being allowed to complete site inspections refine costs is logical.

EFFICIENCY ASSESSMENT

We consider that the solutions development and estimating approach is sufficient to deliver efficient forecasts.

CONCLUSION

This program is for the renewal of water storage tanks within the water storage network. The scope includes 21 defined projects and one "general" line item. We note that there is a discrepancy between the business case and the regulatory submission capex model – in the business case the general line item was for $10,373k. The regulatory

submission includes just over half this amount ($5,811k). We have used the regulatory submission capex model as our reference point. The total expenditure in the regulatory submission capex model is $19.7 million.

SA Water needs to renew its water tanks to manage risks to continuity of supply and risks to the quality of the water supplied. SA Water has established a technical level of service that reservoirs are in a condition grade of 3 (out of 5). SA Water identifies that 45.6% of Water Network Storage Tanks currently comply with the Technical level of service target and that 20.1% of Water Network Storage Tanks do not currently comply with the Technical Level of service target. For the remaining 34.3% SA Water does not know whether they comply or not.

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It is concerning that SA Water's business case states that "Approximately 35% of all Water Network Water Storage Tanks (WSTs) have not been inspected to obtain condition assessment ratings and/or condition rating assessment data is not available for these WSTs". The importance of obtaining condition information, assessing consequence of failure and developing operational strategies to mitigate risks was known, discussed and acknowledge at the time of RD16 to addressed during this period as reflected in the excerpt provided above.

Experience suggests that SA Water has overestimated its risks relating to network water tanks. This is demonstrated by:

- Actual expenditure during the RD16 period being 26% lower than that forecast at the time of RD16
- The Hope Valley EL170 tank renewal project being delayed for many years demonstrating that the risk could be mitigated through operational measures that weren't considered when the original timing of the works was proposed
- SA Water not documenting a complete picture of the risk of these assets during the current period based on consistent and complete condition information (as evidenced by 35% of tanks not having this information). This suggests that SA Water is comfortable with the level of risk across the portfolio to not proactively assess condition.

On the basis of the apparent historic overstatement of risk, we recommend that the "general" line item not be considered prudent. SA Water need to better demonstrate the actual level of risk across its portfolio and particularly reflective of the potential for operational contingencies to mitigate these risks.

We consider that the solutions development and estimating approach is sufficient to deliver efficient forecasts.

KEY DOCUMENTS REVIEWED

- Water Storage Tanks Renewal Reliability Program 2020 to 2024 - RBP2020 Asset Capital Program Brief
- Asset Management – Approach – Water Storages
- Asset Management – Approach – Water Quality Health
- Asset Lifecycle Decision Making Checklist – Structural Rehabilitation of Wattle Park EL278 Concrete 2.2.73ML Surface Tank
- Gulnare Tank No.1 Refurb
- Baroota 4.54ML Tank ID OLM171 Checklist
- Estimate LDM-171

Morgan to Whyalla Pipeline Works

PROJECT DETAILS

Project Name	Morgan to Whyalla Pipeline Renewal (MPWL1)		
Project Number	RBP20_No_769	Project Stage	Delivery
Primary Expenditure Driver Category	Maintain service		

PROJECT DESCRIPTION

This project is the first stage of renewals of the Morgan to Whyalla Number One Pipeline. This is one of two major pipelines that supply water between Morgan and the Upper Spencer Gulf region of South Australia. Installed in the 1940s, the No. 1 pipeline (MWPL1) is comprised of three major sections. The main is a 359km long cement lined steel pipe with a diameters ranging from 500 to 1,000mm. A parallel main, MPWL2, runs up until Baroota Storage when it splits to run West and under the sea to Whyalla.

For RD20, 14km of MPWL1 pipeline is slated for replacement. This section is in the poorest condition (condition 5 and 4 sections and some condition 3). There will also be some ancillary renewals and opex funding for additional condition assessments.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Proposal Capex	8,613	21,665	21,665	9,980	61,923	686,160
RD20 Proposed Opex	1,000	2,500			3,500	
RD20 Proposed Total	9,613	24,165	21,655	9,980	65,423	

DRIVERS AND STANDARDS OF SERVICE

The Business Case sets out the following drivers for this project:

maintain the technical level of service requirement (failure rate < 4 failures/100km/year)

minimise outage times.

This pipeline is the only source of water for the Upper Spencer Gulf Townships. In order to maintain water security and continue to deliver safe drinking water this pipeline needs to be in operation.

Asset performance data in terms of burst numbers was provided which confirms that Section 3 has been above the major pipeline technical standard used by SA Water of 4/100km/year for the past five years. See Figure 1.

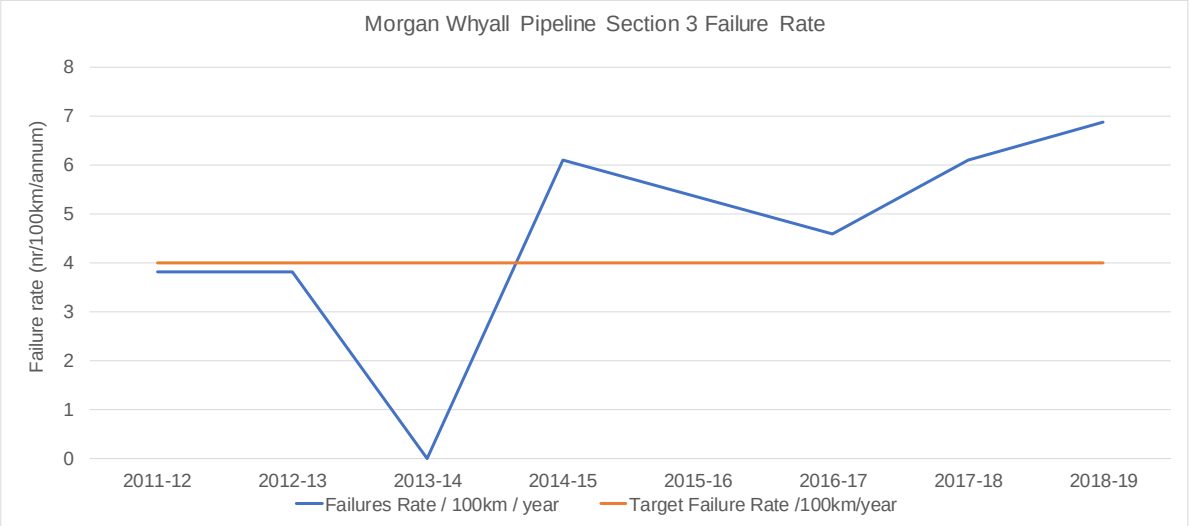


Figure 1 Morgan to Whyalla MPWL 1 Section 3 Failure Rate per annum

Analysis of repairs shows that typically one in every four failures require a mains shutdown to complete the repair. Depending on the location of the failure, supply to the Whyalla Steel Works maybe impacted. On three occasions in the past 18 months, the steel plant's primary supply has been disrupted by bursts on MPWL1 Section 3. This puts the steel works at risk of an unplanned shutdown or restricted working.

PRUDENCE ASSESSMENT

SA water needs to maintain this pipeline in a functional condition to ensure a secure water supply. A lack of redundancy in the system requires proactive interventions.

The pipeline is at risk of failure based on several condition assessments. The inspections were thorough and covered the full length of the pipe. We consider that the condition assessments justify replacement of condition 4 and 5 sections during the next period. Of the 14km of pipeline proposed to be replaced in the forward period, 12km is within Section 3. Section 3 supplies the Upper Spencer Gulf region with limited other supply options. A further 1km of MWPL has been identified for renewal based on its high consequence of failure as it runs under the Port Lincoln Highway.

Despite the above, the business case is almost exclusively based around condition. Consequence of the main along different sections are touched on and a consequence model will be built during the next regulatory period to ensure future renewals are prioritised on a consolidated picture of risk.

Based on the evidence provided, the project is prudent.

SOLUTIONS DEVELOPMENT

Solution development looked at options that would balance renewals that would meet current demand and upgrading the pipe to meet potential future demands. It is anticipated that approximately $700 million will be spent over the next 40 years upgrading and replacing sections of this pipe. Therefore, in the replacement of pipe sections should include a consideration of future demand needs. However, future proofing the pipe comes at a cost that may not always be justified.

The solutions development was part of a wider project look at longer term water supply solutions for the area fed by the No.1 and No.2 Morgan to Whyalla Pipeline. The option selected as part of this wider assessment looks to decommission section 2 of the No.1 pipeline in future regulatory periods.

No options analysis specifically focusses on the RD20 project specifically related to the main and alternative solutions to renewal are not explored. The following sections are identified for replacement during 2020/21 to 2023/24:

- 4km Section between 4 mile and 7 mile replacement due to increase pressure
- 5km Section near Lincoln Gap
- 2km localised gullets in Whyalla and Port Augusta
- 1km on Rising Main
- 1 km on Section 2 related to Port Lincoln Highway crossing.
- Detailed Inspections for stage 2

COST ASSESSMENT

On interview, SA Water confirmed the costs were built-up from standard unit rates. Comparisons with typical costs for similar mains for 500-1000mm pipelines which could vary from $2,000 - $5,500 per metre, the costs provided based on 14km scheme at $66M are at the upper end of this band. The upper range may be justified due to completing the work in sections and the relative isolation of the work locations. Procurement packages are yet to be established.

EFFICIENCY ASSESSMENT

A detailed options analysis has been performed. The options considered included current and future demand scenarios. The lowest lifecycle cost option that also meets future demand needs was selected. It also addresses all the high risk (based on condition assessment) sections of the pipe. While the forecast expenditure is at the upper end of benchmark costs, drivers for this may include the relative isolation of the work locations and diseconomies of scale. On balance, we consider the forecast costs are efficient.

CONCLUSION

This project is the first stage of renewals of the Morgan to Whyalla Number One Pipeline. This is one of two major pipelines that supply water between Morgan and the Upper Spencer Gulf region of South Australia. The No. 1 pipeline (MWPL1) is comprised of three major sections. The main is a 359km long cement lined steel pipe with a diameters ranging from 500 to 1,000mm. A parallel main, MPWL2, runs up until Baroota Storage when it splits to run West and under the sea to Whyalla.

It is anticipated that approximately $700 million will be spent over the next 40 years upgrading and replacing sections of this pipe. For RD20, 14km of MPWL1 pipeline is slated for replacement at a capital cost of $62 million. The sections to be replaced are in the poorest condition (condition 5 and 4 sections and some condition 3) as confirmed by condition assessment. Renewals have been based primarily based on condition with secondary consideration of consequence of failure. SA Water intends to move to a consolidated risk based model in coming years. Based on the evidence provided, the project is prudent.

A detailed options analysis has been performed. The options considered included current and future demand scenarios. The lowest lifecycle cost option that also meets future demand needs was selected. It also addresses all the high risk (based on condition assessment) sections of the pipe. While the forecast expenditure is at the upper end of benchmark costs, drivers for this may include the relative isolation of the work locations and diseconomies of scale. On balance, we consider the forecast costs are efficient.

KEY DOCUMENTS REVIEWED

- DF0049 Morgan-Whyalla Pipeline Business Case
- 2019 Water Pipe Network Facility Type AMP
- MWPL1 Failure Data 2011 to 2019
- MWPL1 Cardno - Discussion Presentation

Mt Bold Reservoir

PROJECT DETAILS

Project Name	Mt Bold Dam Safety Upgrade		
Project Number	C2255	Project Stage	Design
Primary Expenditure Driver Category	External obligation		

PROJECT DESCRIPTION

Mt Bold Dam came into service in 1938. The dam was later upgraded, with those upgrades being completed in 1968. The dams primary purpose is to supply water to Adelaide.

The scope of this project is to upgrade the Mt Bold reservoir to address risks associated with the failure of the dam in large floods and seismic events. Detailed optioneering is currently in progress but the preferred scope of work (Combination F) comprises:

- Buttressing of the central arch and installing post tensioned rock anchors to addressed deficiencies in the raised gravity sections
- Construction of an apron along the downstream toe to prevent erosion that may result from overtopping flows in the Probable Maximum Flood.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Proposal Capex	1,193	2,700	33,000	50,000	**86,893**	**215,477**
RD20 Proposed Opex						
RD20 Proposed Total	1,193	2,700	33,000	50,000	**86,893**	**215,477**

PREVIOUS PERIOD EXPENDITURE (if applicable, $k excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total	
RD16 Actual / Forecast – Capex			1,157	1,296	**2,453**	
RD16 Actual / Forecast - Opex						
RD16 Actual / Forecast - Total			1,157	1,296	**2,453**	

DRIVERS AND STANDARDS OF SERVICE

SA Water has been reviewing the potential risks and safety measures required to manage the risk at their large dams. This occurs through four-yearly Portfolio Risk Assessments. South Australia does not have specific safety regulations for dams requiring SA Water to understand and manage the risks relating to dams itself. SA Water has chosen the Australian National Committed on Large Dam (ANCOLD) guidelines to assess and manage the risks associated with its dams. The SA Water Board has committed to meeting the requirements of these guidelines.

SA Water has progressively been addressing the risk associated with failure of its dams. In the RD16 period SA Water has completed or progressed works to address the risks at Kangaroo Creek, Hope Valley, Warren and Baroota. Mt Bold is the highest risk dam that exceeds the acceptable risk tolerance. The primary driver for this project is compliance with the guideline which decreases the likelihood of a catastrophic failure of the dam.

Several investigations were performed to determine the compliance of SA Water's dams with the guidelines. The initial investigations, as they relate this project, began in 1998. This investigation recommended a series of phases to

reduce the risks at the dams as they relate to human life and economic losses. This led to a series of investigations with the most recent being a consequence of failure investigation completed in 2014.

The population at risk from Mt Bold Dam failing is around 883. The potential loss of life from a failure at Mt Bold Dam ranges from 23 to 61.

PRUDENCE ASSESSMENT

The ANCOLD guidelines represent good industry practice for managing the risk of failure of dams. SA Water has identified and assessed the risks associated with Mt Bold Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified to bring these to an acceptable level. Mt Bold has the highest level of risk associated with its failure within SA Water's portfolio.

SOLUTIONS DEVELOPMENT

There are two modes of failure for the dam that were considered exceptional with the failures being one caused from a seismic event and the other caused by a flooding event. Separate solutions were needed that would address the seismic and flood concerns. For example, the capacity of the spillway would need to be increased to accommodate potential flood flows and the strength of the dam would need to be increased to handle potential seismic events.

A Ground Motion Study was completed for the Mt Bold Site and this determines the loads which need to be designed for under the Operating Basis Earthquake (OBE) and the Safety Evaluation Earthquake (SEE) in accordance with the ANCOLD Guidelines. The OBE requires that the dam and appurtenant structures should remain functional. The SEE requires that the dam does not fail and release water, but that damage to the structure will occur. In determining the SEE both deterministic and probabilistic approaches have been used.

Several options were identified that would improve the dams resilience to seismic and flood events. A total of nine dam improvement options were identified, four that would improve flood capacity and five that would increase earthquake resilience. Installing a new dam that would meet current ANCOLD guidelines was also considered. A combination of these options would be necessary to address both deficiencies. A process was then undertaken to determine which combinations of these options could be implemented together. It was determined that there is eight feasible combinations. Cost estimates were developed for all eight but four of these were considered more suitable which led to more detailed examinations for those items. The other four were not further considered because the identified solution while technically feasible would require post-tension anchors that are not currently commercially available. It was determined that this would cause difficulties when future maintenance activities were undertaken.

The four options that were considered for a more detailed examination were:

Combination G: New dam;

Combination M: Full downstream buttress, downstream and apron, retain gated spillway, saddle dam;

Combination M3 (a further developed version of M2): Full downstream buttress, downstream apron, new gated spillway with primary slot for one in 100 AEP flood attenuation, saddle dam; and

Combination M4: Full downstream buttress, downstream apron, new gated spillway saddle dam

The examinations were still considered to be preliminary and would require further details before they become more exact. However, they were detailed enough provide some confidence in selecting a preferred option. The preferred option at the time of writing the Business Case (DF0056) was combination M3 (this was in October 2019).

However, further investigation subsequent to the business case revisited Combination F which determined that this option was more favourable than first considered due to the large post tensioning anchors being more feasible than first thought. This was determined through engagement with other large dam owners and anchor suppliers.

COST ASSESSMENT

Two separate cost estimates were provided. The business case appears to have more current numbers than the Dam Safety Review Stage 3 Report. However, the detailed costs were originally developed in the dam safety review report. Both cost estimates have been included in the table below. Combination in three is the preferred option if separate funding is provided for flood attenuation which equates to the difference between option M4 and M3.

The cost estimates for the options were essentially the same (except the new dam which was twice the price of the other options for the dam safety review report) but SA water has gone with the lowest cost estimate as presented in their business case. Cost estimates for options are in the table below

Preferred options	Business Case	Mt. Bold Dam Safety Review Stage 3 (Oct 2019)

This Combination G	$338m	$345m
Combination M	$320m	$179m
Combination M2/M3	**$314m**	**$187m**
Combination M4	$309m	Not costed

Cost estimates for the excluded options are provided in the table below. No cost estimates for the excluded options were included in the business case.

Excluded options	Business Case	Mt. Bold Dam Safety Review Stage 3 (Oct 2019)
Combination A		$286m
Combination C		$181m
Combination D		$181m
Combination F		$172m

SA Water advised that three options have been provided to a cost estimator to provide detailed cost estimates to assist in selecting the preferred option.

While the cost of the preferred option is likely to change, there is no better information available at this time on which to infer a likely outturn cost and that submitted by SA Water is still considered the best available estimate.

EFFICIENCY ASSESSMENT

SA water have selected a solution that will reduce the risks to an acceptable level. It has evaluated multiple options including revisiting previously discarded options to select the lowest cost option based on the information available. All of the options have similar ongoing maintenance costs, therefore the lowest capital cost option is the lowest lifecycle cost option. Currently, detailed cost estimates are being prepared to assist in selecting the preferred option. We are satisfied that the forecast submitted by SA Water represents the current best estimate of efficient costs of this project.

CONCLUSION

Mt Bold Dam came into service in 1938. The dam was later upgraded, with those upgrades being completed in 1968. The dams primary purpose is to supply water to Adelaide.

The scope of this project is to upgrade the Mt Bold reservoir to address risks associated with the failure of the dam in large floods and seismic events. Detailed optioneering is currently in progress but the preferred scope of work (Combination F) comprises:

- Buttressing of the central arch and installing post tensioned rock anchors to addressed deficiencies in the raised gravity sections
- Construction of an apron along the downstream toe to prevent erosion that may result from overtopping flows in the Probable Maximum Flood.

SA Water has identified and assessed the risks associated with Mt Bold Dam and sought better information through more detailed investigations to confirm the need to act. We consider that it is prudent for SA Water to act to manage the risks identified to bring these to an acceptable level. Mt Bold has the highest level of risk associated with its failure within SA Water's portfolio.

Several options were identified that would improve the dams resilience to seismic and flood events. A total of nine dam improvement options were identified, four that would improve flood capacity and five that would increase earthquake resilience. Installing a new dam that would meet current ANCOLD guidelines was also considered. A combination of these options would be necessary to address both deficiencies. A process was then undertaken to determine which combinations of these options could be implemented together. Financial assessment and multi criteria assessment identified four preferable options. However, further investigation identified that a previously discarded option (Combination F) was more feasible than first thought and this option currently appears the most preferable.

Currently, detailed cost estimates are being prepared to assist in selecting the preferred option. We are satisfied that the forecast submitted by SA Water represents the current best estimate of efficient costs of this project.

KEY DOCUMENTS REVIEWED

- Mt. Bold Dam safety upgrade business case (SA water, no date)
- Mt. Bold Dam Safety Review Stage 3 (GHD 2019)
- Water Dams and Weirs - Dam safety and reliability – Approach (SA water 2019)
- Response to RFI RD20_222 and RD20_223.msg

Eyre Peninsula Desalination

PROJECT DETAILS

Project Name	Eyre Peninsula Desalination Augmentation		
Project Number	C5235	Project Stage	Proposal
Primary Expenditure Driver Category	Growth		

PROJECT DESCRIPTION

The Eyre Peninsula relies on groundwater sourced from the Uley South Basin. 75% of the water consumed by the community is from groundwater with the balance of the water being supplied by the River Murray. The amount of groundwater extracted annually is approximately 5 GL while modelling suggests that the groundwater supplies can only support 3.8 GL/year. This level of extraction is unsustainable and it has been estimated that this level of extraction will permanently damage the groundwater resources. An alternative water supply is required.

This project proposes construction of a 4GL/annum desalination plant to serve the Eyre Peninsula and make up for shortfall in water production volume from the Uley Basin. Some of the supporting infrastructure, such as intake and raw water pipeline, will be sized for 8GL for future expansion when additional demand materialises potentially from commercial or industrial customers.

As secondary benefits, the desalination plant will provide a more consistent quality of water to SA Water customers on the Eyre Peninsula and reduce the amount of water extracted from the River Murray making that water available for other uses.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Proposal Capex	78,140				**78,140**	
RD20 Proposed Opex		5,266	5,266	5,266	**15,798**	**5,266/a**

PREVIOUS PERIOD EXPENDITURE (if applicable, $k excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total
RD16 Actual / Forecast – Capex			2,490	14,630	**17,120**
RD16 Actual / Forecast - Opex					
RD16 Actual / Forecast - Total			2,490	14,630	**17,120**

DRIVERS AND STANDARDS OF SERVICE

The primary driver for this project is the inability of the existing groundwater supplies to supply demand in the long-term (and possibly near-term). An alternative source is required to ensure ongoing water security. A Long Term Plan for supply to the Eyre Peninsula was completed in 2008 in conjunction with Natural Resources Eyre Peninsula and involving community engagement. This study flagged desalination as a likely future supply option and investigations and engagement has continued since this time.

An additional benefit is that the water will be of a higher and more consistent quality than the current water sources. The water quality parameters that will be improved are aesthetic. The project will also likely free up allocation from the River Murray for other uses.

PRUDENCE ASSESSMENT

The 4 GL/year option is prudent based on the provided data as this is needed in the short-term to prevent damage to the Uley Basin aquifer. The 8 GL/yr option is seen as potentially required in future periods to supply commercial and industrial customers who have been in discussions with SA Water.

Continuity of water supply is a standard of service that cannot be met if additional water sources are not introduced, such as a desalination plant. Therefore this project is considered prudent.

SOLUTIONS DEVELOPMENT

The options considered were:

- do nothing
- water restrictions
- desalination plant.

The do nothing option was not considered because of the long-term damage that may occur to the groundwater table. Water restrictions may not reduce consumption enough to bring groundwater extractions to a sustainable level. Considering there is some urgency in reducing the demands on the groundwater this option, is it failed to reduce extraction sustainable level, would only postpone the need for an alternative supply while possibly damaging the groundwater table.

Extracting additional water from the River Murray was determined to cost approximately $207 million and may not always be a viable alternative as the amount of water available from this source is climate dependent.

The estimated capital cost for desalination is between $94 million and $100 million. We queried SA Water whether lifecycle costing had been completed that included operating costs for the options. SA Water responded that no lifecycle cost comparison had been undertaken because the River Murray Pipeline was significantly more expensive than desalination and because placing further reliance on this source was considered difficult.

Widespread stakeholder consultation occurred during the development of the scope for the desalination option.

The cost of supplying enabling infrastructure (e.g. large inlet works, larger diameter marine pipeline) to support a future extension to 8GL increase cost of the plant from $94.3M to $99.6M.

COST ASSESSMENT

The desalination plant cost estimate has been calculated using a bottom-up approach through engineering consultants and would sit reasonably on a cost curve with other, much larger plants e.g. Gold Coast, Sydney. Mining companies with smaller desalination plants were also consulted on the cost estimates.

The plant is proposed to be modular in construction allowing for extensions to be added is required cost-effectively. This is understandable as there will not be a need for additional pipelines, land acquisition and connection to network reconfiguration to be undertaken if the capacity of the facility is expanded. Especially considering some of the major flow-through components are already being size for 8GL.

EFFICIENCY ASSESSMENT

SA water did explore the limited options available to provide alternative water sources. Reduction in consumption was considered inadequate. The lowest cost supply option was adopted. The size of the facility aligns with amount of water currently being extracted from groundwater supplies. Providing infrastructure for a future increase in plant size to 8GL increases costs by $5.3M / 6%. We consider that this is a prudent approach to sizing.

The cost estimate is based on a bottom-up exercise which has been benchmarked against existing plants of different sizes. We consider that the proposed costs are efficient.

CONCLUSION

This project proposes construction of a 4GL/annum desalination plant to serve the Eyre Peninsula and make up for shortfall in water production volume from the Uley Basin. Some of the supporting infrastructure, such as intake and raw water pipeline, will be sized for 8GL for future expansion when additional demand materialises potentially from commercial and industrial customers.

The solution has been demonstrated as prudent because there is a need to meet the community's water security needs while maintaining sustainable abstraction from the Uley Basin. The project timing is driven by the expectation that current extractions will only be feasible for the next five years.

SA water did explore the limited options available to provide alternative water sources. Reduction in consumption was considered inadequate. The lowest cost supply option was adopted. The size of the facility aligns with amount of water currently being extracted from groundwater supplies. Providing infrastructure for a future increase in plant size to 8GL increases costs by $5.3M / 6%. We consider that this is a prudent approach to sizing.

The cost estimate is based on a bottom-up exercise which has been benchmarked against existing plants of different sizes. We consider that the proposed costs are efficient.

KEY DOCUMENTS REVIEWED

- DF0011 Eyre Peninsula Desalination Business Case
- DF0058 Water Eyre System AMP
- Board Paper RFI RD20.25.pf
- Eyre Peninsula Regulator Workshop
- RD20.227 Eyre Peninsula desalination cost estimate
- SA Water's Long Term Plan for Eyre Region (2008)
- 20190108 - Response to RD20.19.msg
- 20190405 - Uley South slides from Neil Power (DEW).msg

Glenelg to Adelaide Parklands Recycled Water Upgrade

PROJECT DETAILS

Project Name	Glenelg to Adelaide Parklands (GAP) expansion		
Project Number	RBP20_No_1536	Project Stage	Planning
Primary Expenditure Driver Category	Improve services		

PROJECT DESCRIPTION

SA Water is looking at expanding recycled water usage, and potentially production, amongst its customers. It is anticipating that future environmental regulations will reduce the amount of effluent (or the contaminants within the effluent) that can be discharged from its various wastewater plants. SA Water has also received input from its customers that there is an expectation that the usage of recycled water in public spaces within the region be increased. Currently, SA Water and its customers reuse 31.8 GL/year of water which is 28% of the effluent being generated.

The regulatory proposal included $10 million for potential expansion of the recycled water network south to new development at Tonsley Park. Significant expenditure of $115 million is forecast for after 2024. SA Water is proposing three categories of projects over the long term:

Investigations for additional reuse opportunities, free water for local councils for open space usage and expansion of the existing Glenelg Adelaide Pipeline

Investigations on how reuse will assist SA water in meeting its compliance obligations

comprehensive recycled water network dynamic modelling.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Proposal Capex	1,308	5,042	4,514			**115,070**
RD20 Proposed Opex	145	145	145	145		**2,522**

DRIVERS AND STANDARDS OF SERVICE

The drivers for recycled water expansion are:

- compliance with environmental protection obligations
- customer expectations
  - customer satisfaction with service experience
  - perception of environmental protection
- brand health index

SA Water considers future environmental standards are likely to require them to reduce their discharges which can only occur through expanded reuse. SA Water has also stated that customers are expecting an expansion of water reuse and SA Water believes that its reputation is at risk if they do not meet this expectation. Finally, SA Water has stated that there is a desire for recycled water from the local councils and other customers. However, such demand has not been demonstrated in the information provided.

While it is likely that more restrictive effluent regulations are possible, they have yet to be articulated or implemented. At the same time, SA Water has not demonstrated any demand for additional recycled water. The discussions for the Tonsley Park expansion on which the forecast capital expenditure is based are at an early stage with no commitment on demand. Without a demand and/or viable end use, expenditure for developing additional capacity for recycled water is not prudent. A better understanding of where the water is needed is required to be presented before expanding the capacity of the pipeline. Expenditure could also be justified on an economic basis where SA Water demonstrated that it had quantified the benefits of recycled water use.

In response to the draft report, SA Water stated that:

> *SA Water agrees that further information on prudency and efficiency is required before proceeding on an expansion as large as Tonsley Park GAP expansion…The allocation of funding however provides an investment portfolio for recycled water expansion, so that at the time that a business case has proven to be justified, for any recycled water initiative that may prove prudent and efficient during 2020-2024 there is*

aligned funding allocation, and provides alignment with customer expectations on SA Water's increased commitment to recycled water usage. Without allocation of funding, it is difficult for SAW to invest when a prudent and efficient business case occurs which means it cannot deliver on what customers wanted which was increased recycled water.

We understand SA Water's position but we are required to make an assessment of prudence and efficiency based on the information available to us. Here, the key information is demand and potential demand. There is no evidence that demand of this scale will occur in the RD20 period.

SA Water have stated that in order to understand their capacity to deliver recycled water they need to develop a recycled water network model. Having an informed model of the recycled water network would be required if and when the network is be upgraded. It would also allow SA water to maximise their existing network capacity. Therefore, a project limited to recycled water network modelling could be considered prudent when demand for expansion is confirmed. As this demand is not demonstrated at this time, we do not consider that expenditure on network modelling is prudent at this time.

PRUDENCE ASSESSMENT

There is no demonstrated demand for recycled water to support the expansion to Tonsley Park on which the regulatory submission has been based. Therefore, the expenditure is not prudent.

SOLUTIONS DEVELOPMENT

SA Water details three work streams to expand water reuse:

- investigations and/or new reuse based on what is important to customers
- investigations and/or new reuse to protect the environment
- developing a recycled water network dynamic model.

Options were developed for each category of project. No cost estimates were developed for the individual options, and only "protect the environment" category included more than one option.

As the actual problem of additional uptake is not well understood, the solutions for solving this problem are limited. Additionally, a key driver for expanded reuse is the understanding that there is a need to reduce effluent discharges. There is no current requirement for this, therefore the magnitude of reuse expansion required cannot be defined.

In order for the solutions provided to be considered efficient, life cycle costing and non-financial assessment should be included to confirm their efficiency.

COST ASSESSMENT

The regulatory proposal included $10 million for potential expansion of the recycled water network south to new development at Tonsley Park. This is a high level cost estimate only. The preliminary financial analysis undertaken for this expansion to Tonsley Park concluded that it is not financially viable. However, the discussions with the proponent are at a very early stage. In discussions with SA Water, they indicated that this project was included as an indication of the type of project that would likely to be pursued in the coming years as it gained a better understanding of demand.

EFFICIENCY ASSESSMENT

The regulatory proposal is for a $10 million upgrade which analysis suggests is not financially viable. This cannot be considered efficient.

CONCLUSION

SA Water is looking at expanding recycled water usage, and potentially production, amongst its customers. It is anticipating that future environmental regulations will reduce the amount of effluent (or the contaminants within the effluent) that can be discharged from its various wastewater plants. SA Water has also received input from its customers that there is an expectation that the usage of recycled water in public spaces within the region be increased. The regulatory proposal included $10 million for potential expansion of the recycled water network south to new development at Tonsley Park. Significant expenditure of $115 million is forecast for after 2024. SA Water is proposing three categories of projects over the long term:

- Investigations for additional reuse opportunities, free water for local councils for open space usage and expansion of the existing Glenelg Adelaide Pipeline
- Investigations on how reuse will assist SA water in meeting its compliance obligations
- comprehensive recycled water network dynamic modelling.

There is no demonstrated demand for recycled water to support the expansion to Tonsley Park on which the regulatory submission has been based. The preliminary financial analysis undertaken for this expansion concluded that it is not financially viable. Therefore, the expenditure is not prudent or efficient.

This should not preclude SA Water from investigating and pursuing expansion of its recycled water supply where it can demonstrate that this is justified on financial or economic grounds.

KEY DOCUMENTS REVIEWED

- Business Case for Water Recycling Portfolio Expansion. SA Water.
- 2019 Asset Management Plan-Glenelg Wastewater System. SA Water
- Recycled Water Pipe Networks. SA Water
- Recycled Water Approached Document. SA Water
- South Australia Water Corporation sewer treatment license number 1560. South Australia EPA

Metro Water Quality Chloramine and Happy Valley Upgrades

PROJECT DETAILS

Project Name	Metro Water Quality Chloramine and Happy Valley Upgrades		
Project Number		Project Stage	Proposal
Primary Expenditure Driver Category	Compliance / Enhancement		

PROJECT DESCRIPTION

The scope of this project comprises treatment upgrades at the Happy Valley WTP (ozone and filter improvements) and installation of five chloramination plants at treatment plants to convert the Adelaide metro water reticulation system to a chloraminated network rather than chlorinated. Chloramination offers benefits over a chlorine only disinfection approach in that is longer lasting, typically has less taste and odour and typically has less disinfection by-products.

The program is proposed to be delivered over four years and follows on from a successful but much smaller scale trial completed at the Myponga WTP where the ~200 person-population township has been converted from chlorination to chloramination and improvement in customer satisfaction with respect to water taste has been recorded.

PROJECT EXPENDITURE PROFILE ($k, excluding GST)

	2020/21	2021/22	2022/23	2023/24	Total	Post 2024
RD20 Proposal Capex[1]	30,554	30,554	30,554	30,554	**122,200**	
RD20 Proposed Opex	40	80	130	150	**400**	**5,760**
RD20 Proposed Total						

PREVIOUS PERIOD EXPENDITURE (if applicable, $k excluding GST)

	2016/17	2017/18	2018/19	2019/20	Total	
RD16 Actual / Forecast – Capex			500	3,475		
RD16 Actual / Forecast - Opex						
RD16 Actual / Forecast - Total						

DRIVERS AND STANDARDS OF SERVICE

The Water Quality Aesthetics – Approach document details the following key strategic elements and relevant service levels that the proposed water quality improvements will support

Strategic Element	LoS Statement	Business (Customer) LoS Performance Measure	System Technical LoS Performance Measure
Getting the Basics Right Every Time	Ensuring our water quality is consistently good and we work to improve aesthetics.	Customer perception of overall water quality 80%	Number of customers (sum) being supplied outside each Aesthetics Parameter Measure “good” quality target range. Number of customers (sum) affected by the

			"unacceptable" quality target range of each Aesthetics Parameter Measure. Number of WQ complaints per 1000 customers per year. % of customer supplies that meet static pressure design guidelines. Number of Water Pressure complaints per 1000 customers per year.
Leading the Way	Protecting public health and safety through provision of world class water and sewerage services is our core business and priority. We are accountable for evidence-based decisions that consider risks (including safety) to all interested parties.	Brand Health Index Customer perception of SA Water's innovation	

Willingness to Pay

Customers have indicated a willingness to pay to "level 3" to have water with a better taste with respect to chlorine and musty taste and odour as documented in the SA Water Strategic Asset Management Plan. The Marsden-Jacob Associates report on the SA Water customer willingness to pay research states as an outcome that "SA Water could make a $124 million investment across the Adelaide metro areas to improve the taste and smell of the water for around 1.2 million people". This estimate equates to the overall cost of the scheme proposed by SA Water.

Scientific Basis

SA Water has defined ranges of values of water quality aesthetic parameters which they consider as being "good" or "acceptable". This covers parameters such as hardness, chlorine, MIB/geosmin and others against ADWG guidance levels as set out in Table 1. The ADWG is clear in this area stating "the physical guideline values are not absolute; they are value judgments determined from an often wide range of values that may be broadly classed as acceptable – that is, there is no one right answer. Consequently, small, short-term excursions beyond a physical guideline value do not necessarily mean that the water will be unacceptable. What is aesthetically acceptable or unacceptable depends on public expectations, and must ultimately be determined by water authorities in consultation with consumers, taking into account the costs and benefits of further treatment. The Australian Drinking Water Guidelines (ADWG) provide a starting point for this process".

The ADWG goes on to provide references and appropriate commentary for these standards. There appears to be some difference in values expressed in the ADWG and those used by SA Water to determine water quality aesthetics as good or acceptable as detailed in this analysis. The differences have been highlighted in yellow.

Table 1 – Comparison of SA Water targets and ADWG guideline aesthetic values

Parameter	SA Water **"Good" Quality Target Range** (average unless stated)	SA Water **"Acceptable" Quality Target Range** (average unless stated)	ADWG – *Table 10.6 Guideline values for physical and chemical characteristics (aesthetic)*	Comment
Ammonia	≤ 0.5 mg/L	≤ 1.5 mg/L	0.5mg/L	SA Water acceptable value reflects worse quality than the

				ADWG guideline
Chlorine	≤ 0.6 mg/L (75th %ile)	≤ 1.5 mg/L (95th %ile)	0.6mg/L	SA Water acceptable value reflects worse quality than the ADWG guideline
Monochloramine	≤ 3.5 mg/L	≤ 4.0 mg/L	5mg/L	SA Water values for "good" and acceptable quality reflect better quality than the ADWG
Colour (True)	≤ 10 HU (ave)	≤ 15 HU	15 HU	SA Water value for "good" quality reflects better quality than the ADWG
Copper	≤ 1.0 mg/L	≤ 2.0 mg/L	1-2mg/L	In line with ADWG
Iron	≤ 0.05 mg/L	≤ 0.1 mg/L	0.3mg/L	This is the taste threshold. SA Water values for "good" and acceptable quality reflect much better quality than the ADWG
Manganese	≤ 0.02 mg/L	≤ 0.1 mg/L	0.1 mg/L	SA Water value for "good" quality reflects better quality than the ADWG
PH	6.5 ≤ X ≤ 9.5 (95%)	6.5 ≤ X ≤ 9.5 (50%)	6.5-8.5 pH units	The upper limit value used by SA Water could be lower.
Sulphate	≤ 150 mg/L	≤ 250 mg/L (95th %ile)	250mg/L	SA Water value for "good" quality reflects better quality than the ADWG

Total Dissolved Solids	≤ 600 mg/L	≤ 1200 mg/L (95th %ile)	600-1,200mg/L	Fair interpretation
Total Hardness	≤ 100 mg/L (as CaCO3) 95%ile	≤ 200 mg/L (as CaCO3) 95%ile	200mg/L	ADWG advise good range is 60-200mg/L as CaCO3. Too low may be corrosive
Turbidity	≤ 1 NTU	≤ 5 NTU	1-5NTU	Fair interpretation
MIB/Geosmin (combined) measured at plant outlet	≤ 6ng/L (95%ile)	≤ 10 ng/L (95th %ile)	No equivalent value	Fair interpretation
Calcium Carbonate Precipitation Potential (scaling)	≤ 0	≤ 5	No equivalent value	
Langelier Saturation Index (potential to scale or corrode)	-0.5 ≤ X ≤ +0.2 (95%)	-1.0 ≤ X ≤ +0.5 (95%)	No equivalent value	
Larsons Index (corrosion)	≤ 0.8	≤ 1.2	No equivalent value	

The conclusion drawn from this table is that SA Water is generally applying higher standards than the ADWG requires. The exceptions are for ammonia and chlorine. Where SA Water proposes investment that is higher than the ADWG "acceptable" values, this should be supported by a sound understanding of the benefits of the improvements and the value customers place on these benefits. The justification of any investment that is above the ADWG "acceptable levels" should include an option for complying with the ADWG as a refence point.

SA Water also provided customer satisfaction surveys and customer taste and odour complaint numbers in discussion to justify the business case for Metro WQ / Happy Valley WTP Upgrades. This is in addition to the customer willingness to pay for improved water quality in this area. We challenged SA Water as to what measures will be used to monitor the success of this program. SA Water responded that:

> *The key customer parameters that will be monitored are our customer's perception of water quality. We will likely do bespoke customer perception surveying before and after the technical improvements, with a particular focus on improvements to taste. In addition, the quarterly Brand Health Survey will also capture changes in customer perception of water quality. We have a customer perception target of 80% by 2028 which we aim to achieve both through our technical investments as well as social programs. In terms of water quality parameters, we will be measuring levels of mono-chloramine (target of 1.5 to 2.0 mg/l) as well as levels of algal derived taste and odour compounds such as Geosmin (target of <10 ng/l).*

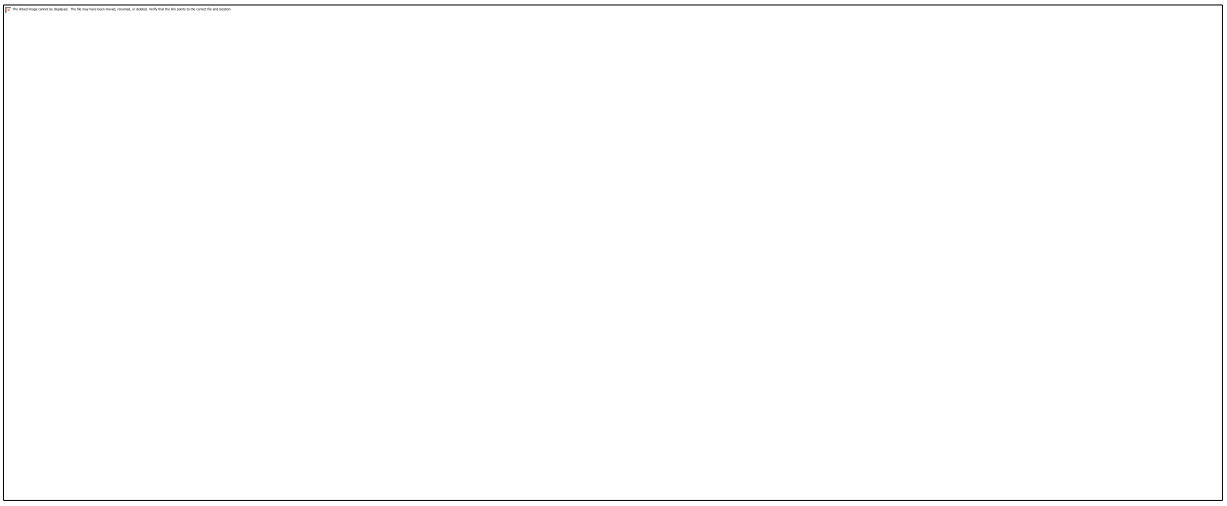
It is positive that SA Water will undertake focused customer surveys for water quality. The Brand Health Survey may be too broad to capture the impacts of these schemes.

Water Quality Compliance

In the business case for this program, SA Water details that its Drinking Water Quality Management Plan has identified high or extreme risks for disinfection by-products, naegleria and bacteriological / viral risk-types that will be mitigated by these works in part. These do require appropriate management and SA Health are reportedly supportive of the proposed scheme without currently applying any enforcement at this stage.

SOLUTIONS DEVELOPMENT

The business case provides qualitative analysis to support that upgrades to Happy Valley WTP and a switch to chloramination are the best overall option in achieving the project's objectives and addressing the needs presented. However, there was limited information available on lifecycle costs and benefits. In response to our information request, SA Water provided the following excerpt from a document demonstrating a semi-quantitative evaluation of options. The assessment ranks options based on a qualitive improvement score divided by net present cost.



While we have not been provided with more detailed supporting information, we accept that SA Water has undertaken options assessment and solutions development to support the proposed program.

We queried SA Water on the proposed programming of works. SA Water responded that the procurement approach for the Adelaide system chloramination and Happy Valley water quality improvement have yet to be determined. The high level program of work is:

- Myponga chloramination completion by Dec 2021.
- Adelaide system chloramination completion by June 2024
- Happy Valley water quality improvement completion by June 2024.

The upgrades to the Happy Valley WTP will increase the effectiveness of chloramination as it will remove organic carbon that would otherwise consume chloramine. The benefits of the upgrades to chloramination are:

- Reduced opex – reduced chemical dosing costs
- Reduced capex – the upgrades will allow a smaller chlorine contact tank to be installed at Happy Valley WTP of this may be able to be able to be avoided. The information provided does not quantify the avoided cost but a high level estimate of the avoided costs is between $5million and $20 million. The actual costs will depend on the site footprint and configuration and ground conditions.

The upgrades to Happy Valley WTP will also avoid operating expenditure for dosing copper in the Happy Valley reservoir (which is around $355k per annum) and it will improve removal of viruses and bacteria

PRUDENCE ASSESSMENT

The customer willingness to pay and risks identified in the Drinking Water Quality Management Plan provide justification for this program. However, we consider that SA Water should revisit its interpretation of the ADWG relating to aesthetic parameters and a scientific basis should be established for the pre and post position for investment at a scheme level. SA Water's intention to undertake focused customer surveys before and after the investment alongside water quality testing is a positive and important for documenting the benefits of this program.

Given that the previous scheme was for a small township (200 population) and that SA Water will face technical and customer engagement challenges in delivering this program, we consider that it is prudent for SA Water to deliver these works over a longer period of time to enable it to better learn from and overcome technical challenges and so that it is better able to define benefits and document how these have been realised for each component of work. This is also supported by the options assessment undertaken to support the program being semi-quantitative based on an assessed water health and aesthetic score. We consider that a more robust evaluation of program benefits be undertaken so that the health and aesthetic score better reflects customer perceptions pre and post works and observed improvements in water quality.

We therefore recommend that the prudent expenditure profile occurs across six years rather than the four proposed by SA Water.

COST ASSESSMENT

At the interview for this it was confirmed the scheme has been built-up from bottom-up estimates. This has been in part informed by the trial at Myponga. However, the costs of the works will not be known with certainty until procurement is undertaken.

EFFICIENCY ASSESSMENT

The forecast costs are based on the best information available to SA Water. Due to the relatively bespoke nature of the works, efficient costs will not be known until an appropriate procurement process is undertaken. We do not consider that there is any bias in SA Water's forecast costs.

CONCLUSION

The scope of this project comprises treatment upgrades at the Happy Valley WTP (ozone and filter improvements) and installation of five chloramination plants at treatment plants to convert the Adelaide metro water reticulation system to a chloraminated network rather than chlorinated. Chloramination offers benefits over a chlorine only disinfection approach in that is longer lasting, typically has less taste and odour and typically has less disinfection by-products.

The business case provides qualitative analysis to support that upgrades to Happy Valley WTP and a switch to chloramination are the best overall option in achieving the project's objectives and addressing the needs presented. In response to our information request, SA Water provided a semi-quantitative evaluation of options. The assessment ranks options based on a qualitive improvement score divided by net present cost. While we have not been provided with more detailed supporting information, we accept that SA Water has undertaken options assessment and solutions development to support the proposed program.

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KEY DOCUMENTS REVIEWED

- DF0005_2019 Water Treatment Plants Facility AMP_confidential.pdf
- DF0021D_Water Quality Aesthetics Approach_confidential.pdf
- DF0022_Metropolitan Water Quality Improvement Business Case_confidential.pdf
- DF0022A_WSAA Perceptions Research Presentation December 2017_confidential.pdf
- DF0022B_Water Aesthetics_Report_220917_confidential.pdf
- DF0022C_SA Water What's important to our customers_confidential.pdf
- DF0022D_Metro WQ Improvement Prioritisation_confidential.docx
- DF0057_2019 Water Central System AMP_confidential.pdf
- Response to RD20_285.msg
- Response to RD20_286.msg
- Response to RD20_287.msg
- Response to RD20_288.msg
- Response to RD20_289.msg
- Response to RD20_290.msg

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

Contact

Level 11
515 St Paul's Terrace
Fortitude Valley QLD 4006
Australia

Phone +61 7 3369 9822
Fax +61 7 3369 9722

Web Address
www.cardno.com