Sydney Water Corporation Expenditure and Demand Forecast Review

Final Report

IPART

19 March 2020

Contains *sensitive* information

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Glossary

Term	Definition
ADWG	Australian Drinking Water Guidelines (2004), National Health and Medical Research Council and Agriculture and Resource Management Council
AER	Annual Equivalent Rate
AIR	Annual Information Return
BOM	Bureau of Meteorology
BOO	Build, Own and Operate
BxP	Business Experience Platform
CANDY	Cost Estimating tool
CBA	Cost Benefit Analysis
CBD	Central Business District
CMS	Customer Management System
COM	Civil operating model
CPI	Consumer Price Index
CxP	Customer Experience Platform
DABC	Delivery Approval Business Case
DPIE	NSW Department of Planning, Industry and Environment
ELL	Economic Level of leakage
ELWC	Economic Level of Water Conservation
EMS	Environmental Management System
EP	Equivalent Population
EPA	Environmental Protection Authority
EPCM	Engineering Project Construction Management
EPL	Environment Protection Licence
ERP	Enterprise Resource Planning
ESC	Energy Savings Certificates
FMI	Financial Management Information System
FRM	Field Resource Management
FTE	Full Time Equivalent
GIS	Geographical Information System
GL	Gigalitre
GPOP	Greater Paramatta and Olympic Peninsula
GSIP	Growth Servicing Investment Plans
HR	Human Resources
HSFM	Housing Supply Forecast Model
I/I	Infiltration and inflow
ILI	International Leakage Index
IM&T	Information Management and Technology
IoT	Internet of Things

Term	Definition
IPART	Independent Pricing and Regulatory Tribunal
IS	Information Services
ISO	International Organisation for Standardisation
IT	Information Technology
KPI	Key Performance Indicator
MDD	Max Day Demand
MEERA	Modern Engineering Equivalent Replacement Asset
MFBC	Multifunction Business Centre
MFP	Multi-Factor Productivity
MLD	Megalitres per Day
NABC	Needs Approval Business Case
NEC	New Engineering Construction
NPC	Net Present Cost
NPR	National Performance Report
NPV	Net Present Value
NSW	New South Wales
ODI	Outcome Delivery Incentive
OECD	Organisation of Economic Cooperation and Development
Ofwat	Water Services Regulatory Authority, England and Wales
OTS	Operational Technology Services
P4S	Partnering for Success
P_{50}	50th Percentile
P_{80}	90th Percentile
PCC	Per Capita Consumption
POEO	Protection of the Environment Operations
PRP	Pollution Reduction Program
RAB	Regulated Asset Base
RCM	Regulatory Cost Model
RFP	Request for Proposals
SaaS	Software as a Service
SCADA	System Control and Data Acquisition
SCIP	Strategic Capital Investment Plan
SDP	Sydney Desalination Plant
SIR	Special Information Return
STP	Sewage Treatment Plant
SWC	Sydney Water Corporation
SWPGA	South West Priority Growth Area
TDL	Trunk Drainage Land
TFP	Total Factor Productivity
TSS	Total Suspended Solids
UGI	Urban Growth Intelligence

Term	Definition
WFP	Water Filtration Plant
WMS	Water Modelling System
WNSW	WaterNSW
WSAA	Water Services Association of Australia
WWTP	Wastewater Treatment Plant

Executive Summary

This report is based on our review carried out in 2019 to derive and recommend efficient expenditure assuming business-as-usual. It also takes into account the drought planning and proposals made by Sydney Water in November 2019. It does not reflect the likely impact of bush fires and related emergency requirements which occurred in late 2019 and into 2020.

This report presents the findings of our review of the capital and operating expenditure for the regulated services of Sydney Water Corporation (SWC). It addresses the prudent and efficient expenditure in the current Determination period from 2016 to 2020 and for the future determination period 2021 to 2025.

We have based our findings on submission dated June 2019, the annual and special information returns presented to IPART by Sydney Water in October 2019, ten days of structured interviews with the agency managers and staff, information provided by the business and responses to subsequent written questions. We have also reviewed the updated submission from Sydney Water in November 2019. Our findings are also informed by our review of the long-term investment processes in September 2015. We reviewed functional activities and a representative number of capital projects in the current and future determination periods.

Our view of efficiency is based on the concept of a frontier company competing in an open market where it has strong internal cost controls. The frontier company will continue to seek efficiencies from technological development and innovation. Other companies or agencies will seek greater efficiencies to catch up with the frontier company. This concept has been applied in previous efficiency reviews of Sydney Water in 2008, 2012 and 2016 and for Hunter Water in 2011 and State Water in 2009.

Operating Environment

Sydney Water's supplies potable water to over 2.0m households and businesses. It purchases bulk water from WaterNSW and the Sydney Desalination Plant. A greater part of its bulk water is treated at four privately owned water treatment plants under BOO arrangements. It is directly responsible for the operation and maintenance of five water filtration plants, 250 service reservoirs, 164 pumping stations, 5,000km of critical mains and 21,300km of reticulation mains.

Sydney Water collects and treats wastewater from a similar number of customers through a network of 2,700km of critical sewer mains, 24,850km of reticulation sewer mains, 679 pumping stations, and 28 wastewater treatment facilities (including recycled water). Effluent is subject to a range of treatment processes depending on the disposal route; for example, primary treatment for ocean discharge at the Deep Ocean Outfall Plants, secondary treatment at other coastal discharge plants and tertiary treatment (nutrient reduction) to inland rivers. Effluent used for recycling is generally tertiary treated.. All biosolids from treatment is disposed to agriculture, composting or landfill.

Business Structure

Sydney Water has carried out a further restructuring following the 2016 Determination period. A new Service Delivery Division combines the previous Service Delivery and Customer Service Divisions. Support Divisions have been restructured resulting in further efficiencies although total support costs are increasing.

Efficiency initiatives have been promoted during the current determination period initiatives from the Production Improvement Program (PIP) and the Multi-Functional Business Centre (MFBC) and driving productivity savings in civil works activities to match best performers in the market.

Performance in the 2016 Determination period

We have reviewed performance against the 2015 - 2020 Operating Licence and EPA measures in the short and long term to understand the linkage with proposed capital expenditure. In the short term, the drought conditions have driven short term deterioration in performance; this is considered in relation to long term trends.

Sydney Water has complied with the ADWG requirements. There has been some seasonal deterioration in raw water quality which has resulted in increased treatment costs to address increasing colour and turbidity.

Performance against 2015- 2020 Operating Licence requirements have been mixed. The water pressure measure has been achieved with significant headroom indicating the potential to reduce pressures and lower leakage in some areas. The water continuity standard has been achieved, except for one large exceptional event, although there is little headroom. This deteriorating performance appears to be due to the increased number of bursts from ground movement attributable to current drought conditions. There is a short-term spike in burst numbers compared with the long-term downward trend.

Sydney Water reports annually on its water conservation performance. It is promoting water saving solutions to residential and business customers and modest savings are reported to date. It plans to significantly increase its activities in year 2020. The forecast increase in water saving requires a commitment from customers and a contribution to costs; there is therefore some uncertainty as to the achievability of forecast savings. Leakage significantly increased over the last three years and is over 20% above its mean economic level. This is in part because of delays in the repair of running leaks. The leakage response of the water network to adverse weather conditions suggests that there is likely to be further leakage which may not yet be visible.

Performance against the 2015 -2020 Operating Licence standard for wastewater single and repeat overflows to private properties appears to be satisfactory.

There is a recent increasing trend in sewer chokes approaching the licence limit although the long-term trend is reducing. These chokes very often lead to dry weather overflows. The increasing trend has been attributed by Sydney Water to the greater extent tree root entry into the sewers due to drought impact on soil moisture. However, other factors besides drought are driving the deterioration in performance as the decline in performance began before the onset of the drought. The trend is also likely related to the lower level of planned maintenance in years prior to the impact of the drought. Of the 23 wastewater systems, twelve met their limits and three exceeded their limits in three or more years out of seven. There has been a significant increase in EPA enforcement activities with the number of actions increasing from 24 in 2007 to 140 in 2019.

Sixteen systems met their current wet weather overflows performance limits and five were non-compliant. The EPA is changing the compliance rules for wet weather overflows to a points-based system which we discuss in Section 6; this change has significant impact on investment, particularly for the three largest systems.

Sydney Water has met pollution concentration and load limits from all but three of its treatment plants during the current period. Non-compliance to providing specified treatment capacity generally occurs during wet weather and for only a few process units within the treatment plant.

Performance consideration for future expenditure program

In developing our draft report and recommendations, we have relied upon our assessment of Sydney Water's performance in the current period and how the future expenditure program may impact on its performance in the future period, noting that some measures have changed due to the introduction of the 2019 – 2023 Operating Licence. We have also accounted for the information provided to us by Sydney Water in the area of environmental performance.

In our Draft Report recommendations, we proposed reductions to both renewals and growth programs. Sydney Water commented on our Draft Report, stating that it was concerned that the seriousness of the actual and potential future non-compliance with environmental performance requirements was not fully reflected in the recommendations. We are aware that Environmental Protection Licences are obligations based in law and that they are not discretionary or aspirational and breaches are leading to prosecution. We also recognise that the Protection of Environmental Operations Act obliges Sydney Water to prevent pollution to land and water for all its activities, not just those subject to an Environmental Protection Licences.

In finalising this report, we have revisited our assessment of the relationship between Sydney Water's environmental performance and its current and proposed expenditure. We recognise that the recently formalised Pollution Reduction Program for the Cronulla and North Head systems is a substantial compliance challenge that Sydney Water must respond to, and quickly, given the 30 June 2021 requirement for compliance.

One of the indicators we use to inform our view of proposed expenditure are trends in performance measures over time. We are aware that linking expenditure directly to performance measures and trends is not an exact science but it is indicative of how effective past and current expenditure has been in meeting its obligations.

For the avoidance of doubt, it is our role to look at the overall package of efficient expenditure and we are not approving or excluding specific schemes or projects. It is for Sydney Water to decide how it prioritises expenditure within its overall envelope to meet all of its obligations. Where Sydney Water gains better information on the circumstances it faces, it should respond to that better information.

Asset Management & Long-Term Planning

The long-term investment plan is appropriate for the purpose of long-term planning to inform Sydney Water's short to medium term expenditure plans. The approach to long term asset renewals planning is based on asset age which is inconsistent with the near-term planning which takes greater account of asset condition and risk. Using asset condition and risk is a more mature approach to planning compared with an aged based approach. However, the aged based approach is not unreasonable for determining a long-term expenditure envelope.

Sydney Water has had in place a long-standing asset management framework, as required by its Operating Licence, which complies with the *International Standard ISO 55001:2014 Asset Management System – Requirements*. Compliance was achieved in June 2019. Audit of Sydney Water's Operating Licence in 2018 concluded that Sydney Water was compliant with its licence requirement.

The planning framework is in the process of being implemented with all ten asset master plans developed; two of the four product master plans and two of the four regional master plans complete. While we understand that planning is an ongoing, evolutionary process this demonstrates that the planning framework is yet to be fully implemented.

Sydney Water has developed a line of sight from its corporate objectives through asset management objectives to the activities it undertakes. The asset management objectives include the System Performance Standards that Sydney Water's 2015 – 2020 Operating Licence obliges it to meet as well as environmental compliance conditions and other measures covering customers, financial management and the asset management system itself. These asset management objectives are then used to guide Sydney Water's planning for its assets.

For many of its investment decisions, Sydney Water adopts a risk-based approach. Sydney Water's risk processes are relatively mature; for example, it has risk appetite statements which vary based on the type of risk concerned. However, application of the risk management processes for decision making is varied and dependent on the availability of information. Sydney Water has undertaken considerable work to improve its knowledge of the condition of its assets to improve its risk-based decision making through Project See. This program will extend to water pumping stations, sewage pumping stations and reservoirs in coming years. We are concerned by the implications of the failure of the Northmead sewage pumping station with regards to Sydney Water's understanding of its asset related risks. This will require an increase in detailed condition assessments and Sydney Water to reassess its understanding of the criticality of the components of the pumping stations and pumping stations as a whole.

Sydney Water's forward program for renewals has largely been based on bottom-up build-up of activities costed through historic unit rates. These bottom-up programs of work have been subject to top-down challenge such that the $3,283 million forward program for renewals has been reduced by $591 million, representing 18% of the renewals program. These efficiencies are applied after a top-down reduction of $135 million due to scope challenge (representing 4% of the originally submitted program for renewals). We recognise the magnitude of this efficiency challenge but also note that all renewals programs increase in the future period compared with the current period.

Sydney Water is currently finalising and starting to implement a new planning and delivery model called '*Partnering for Success'* (P4S). While it considers that its existing model for delivery has matured and led to significant improvements, the expiry of these contracts presents an opportunity to realise increased value through increased economies of scope and scale, program coordination and decision making, and increased asset standardisation. This should drive capital efficiencies in the 2020 Determination period and beyond.

Demand forecast

We have reviewed the reasonableness of the long term growth projections underpinning Sydney Water's strategic capital investment plan and Sydney Water's sales and customer connection forecasts.

A number of general conclusions emerge from the review of long term growth projections:

- There is a general lack of rigour in identifying the source of projections;
- An absence of reference to the empirical basis for underlying assumptions;
- The basis for changes to key assumptions over time is often not clear;
- Standard assumptions are in many cases not adjusted to take account of the specific area they are being applied to. This appears to be particularly the case for wastewater forecasts.
- No mention is made of the effect of scale on peaking factors. This may a particular issue in areas expecting significant growth.

We recommend that Sydney Water increase the evidencing of the empirical validity of the assumptions made in growth planning and the source of projections and work to ensure that projections are anchored in the specifics of the area being studied wherever appropriate and possible. We also recommend that greater effort is made to link the projections to the demand forecast model and wider initiatives such as water conservation measures to ensure consistency across its plans.

The approach Sydney Water takes to incorporating weather in its demand forecasting model represents best practice. Our review finds that the residential demand model is a well-researched and robust tool for medium term forecasts. At present it appears to be used as a standalone tool which is not integrated into long term planning processes and strategies. This deprives Sydney Water of the coherent consistent basis for planning for demand growth which is best practice in the sector. We recommend that Sydney Water take advantage of the sophisticated modelling underlying its demand forecast by applying it to the growth planning it carries out across the business.

The non-residential demand forecasting model has not been substantially updated since 2013. It has been found to underpredict demand and Sydney Water has had to apply various adjustments to reconcile it to outturn demand. We consider that it would have been appropriate for Sydney Water to have carried out a more fundamental review of the model. We recommend that Sydney Water carries out a significant update of the model in the very near future to inform the planning processes such as the Water Masterplan and further iterations of GSIPs and similar documents. This should also help to increase confidence in the robustness of its projected sales volumes which are undermined by the adjustments which have had to be made and the lack of thorough investigation of time-related trends such as densification.

Sales volumes and new connections have been greater than expected in the current Determination period. We consider that:

- The higher number of outturn customer connections than assumed in the Determination is driven primarily by greater than expected rates of new development, which is inherently difficult to project with confidence.

- The higher than expected sales volumes have been driven by customer connection growth, weather, greater price elasticity than assumed in 2015, densification of non-residential customers and an error in the treatment of 'other' properties.
- There is an unusually high level of uncertainty in projected sales volumes in 2020 due to the combined impacts of demand restrictions, weather, SDP charges and the growth volatility.

Level 1 water restrictions were put in place in Sydney, the Blue Mountains and the Illawarra from 1 June 2019. Level 2 water restrictions then became effective from 10 December 2019. These significantly limit water use for garden watering, hosing of hard surfaces and vehicles and prohibit the use of hoses.

It is not possible to forecast with confidence how long these restrictions will be in place or if deeper restrictions will be announced in the 2020 Determination period. However, we note that water restrictions were in place for nearly six years during the last major drought (2003-2009), suggesting that it is quite possible restrictions will be in place for all or most of the 2020 Determination period.

We have prepared demand projections for representative 'drought' and 'non-drought' situations. The 'drought' demands assume a 15% saving relative to average conditions. There are a number of caveats around this figure such as the uncertainty in how the drought and associated responses will evolve, in the effectiveness of water conservation measures and communications, in the effect of changes in the customer base and in the rate of new development.

Approach taken to growth expenditure

Sydney Water has proposed a significantly larger program of water and wastewater growth capex in the next Determination period. The proposed 2021-24 expenditure would constitute a 108% increase in average water growth capex and 70% increase in wastewater growth capex compared to outturn.

As part of the Network Growth Capital Program Business Case, Sydney Water states that:

- candidate project investment was based on the GSIP CAPEX data up to the 2021 time horizon only; and
- a 20% reduction was applied to the GSIP CAPEX data to allow for efficiency and optimisation benefits arising from optioneering and detailed planning

Sydney Water also applied a 'risk-sharing' approach in the Treatment Growth Capital Program Business Case. Management applied a challenge termed a risk sharing approach. However, the mechanisms used to apply these challenges and the urgency of timing, project scope and basis of cost estimate that the challenges have been applied to is not always clear.

We note from the interviews and the reviews undertaken that the GSIPs, which are the source of some of these costs, are considered to be first cuts and "not highly optimised". We also note that some of the cost estimates in the GSIPs incorporate 30% Sydney Water risk contingency on top of 30% risk contingency on top of 35% scope contingency. Some of the GSIPs incorporate even higher levels of contingency. This indicates a low level of confidence in scope and cost estimation.

Rates of new development in the 2016-20 Determination period have been at unprecedented levels. Sydney Water sets out in Attachment 8 of its submission a number of reasons why development is expected to be lower than current levels. These reasons include declining dwelling approvals and housing-related lending.

Sydney Water is projecting a very similar average number of new connections in the next Determination period as during the current period. Given this, we consider it reasonable that 'general' water and wastewater growth capex should be at a similar average level. We have not been given a compelling justification for the scale of increase requested.

We have recommended an adjustment to proposed water and wastewater capex to match the average expenditure in the 2016-20 Determination period. This adjustment has been applied pro-rata to Sydney Water's proposed expenditure for 2021-24. As there is less certainty in 2025, the adjustment for this year has simply been applied to match the average level of spend in the 2016-20 period.

We have identified and separated out all major (>$100M capex non-bucket code) projects from this adjustment as a number of them have been reviewed in their own right and found to be prudent or subject to specific adjustments.

Sydney Water has proposed a program of $37.0M for stormwater growth which is a little lower ($1.9M p.a.) than the rate of spend in the current Determination period. We have not recommended any specific adjustments to Sydney Water's proposed stormwater growth expenditure.

Output Measures

In the current Determination period, Sydney Water delivered the majority of the output measures to, or above, the adjusted target it set itself. It spent less than the capital expenditure target it set itself for quite a significant number of output measures. However, this was predominantly a result of efficiencies achieved by Sydney Water to deliver the same service level performance with reduced outputs and at a lower cost. Integrated system planning was used to decommission rather than renew assets, renewals lengths were reduced, and better condition assessment resulted in some planned renewals not being required.

We are proposing a small number of output measures for the 2020 Determination period, so that the progress in delivery of the programs set out in the Sydney Water submission can be confirmed in the future and efficiencies assessed. These proposals for asset maintenance, delivery of projects and environmental drivers take into account comments from Sydney Water. Definitions may need further development before implementation in the future determination period. We are also suggesting an additional serviceability measure which could be developed as a high-level measure.

In its July 2019 submission Sydney Water proposed a series of specific output measures. We consider that tracking all of those outputs for those with number measures is not particularly meaningful or effective given the subjective nature of the outputs. We have provided recommendations on Sydney Water's specific output measures in the interim as we recognise the proposed move to outcomes-focused measures may take some time to implement.

Drought performance monitoring

We recommend quarterly reporting to provide visibility of short-term performance against targets to monitor the success of water conservation activities, using the measures of average monthly water distribution input sourced from both WaterNSW and the desalination plant(s) and in total, the percentage reduction in demand from a defined base which Sydney Water currently uses, compared with target reduction; the rolling annual average leakage in Ml/d at the end of the quarter compared with the ELL; and the quarterly average leakage value in Ml/d compared with target for the last five years. This data should be reported quarterly, within 28 days of the end of the quarter, and published clearly on the Sydney Water website with explanations for variances against targets.

Operating Expenditure

Operating expenditure in the 2016 Determination period

In the 2016 Determination period, Sydney Water was set an efficiency target of 3.4% of core operating expenditure. In 2017 and 2018 it has out-performed the Determination. Expenditure for 2019 and forecast for 2020 show expenditure increasing above the Determination with an average increase of 3.4% over the four-year period. This is partly explained by increases due to drought expenditure, in external business costs and electricity and some additional obligations such as strategic planning and enhanced water conservation measures defined in the 2015 - 2020 Operating Licence. This leaves a net increase of 1.4% above the Determination.

While total expenditure has increased above the Determination in 2019 and forecast for 2020, Sydney Water has demonstrated that efficiencies have been achieved within the business.

In setting the Determination, there is an assumption of average weather conditions through the period. Years 2017 and 2018 were generally consistent with this definition and performance was within defined targets or reference levels. The impact of drought conditions in 2019 and likely for 2020 appears to have resulted in a deterioration in performance and the need for Sydney Water to deploy additional resources to manage this event. Additional drought costs of $96m were reported for 2019. Sydney Water has identified further expenditure in 2020 although not included within the submission.

The drought appears to have had a performance impact on dry weather overflows where tree root ingress has been increasing concurrently with dry ground conditions. This has a subsequent impact on the water continuity measure. We found that Sydney Water had reduced the extent of planned maintenance in previous years including regular inspections and root clearance. We consider the reduction in planned maintenance contributed in part to the number of sewer blockages and increased dry weather flows. This was exacerbated by some poor clean-up responses with increased regulatory action by the EPA.

There has also been an increase in leakage as the water network has been stressed by ground movement, causing an increase in bursts. The response to timely detection of leaks has been slow due to the lack of continuous flow monitoring and remote detection techniques. Repairing increasing leaks has not been effective and the current level of leakage is well above the mean economic level. This shows an inefficiency which is untimely as the business is encouraging customers to conserve water. We consider that some of the recent performance, in both wastewater and water supply, is partly due to shortfalls in asset management.

There has been significant expenditure on IT Digital, both operating and capital expenditure, which should provide Sydney Water with the latest tools and systems compatible with a frontier company. These should enable further efficiencies to be driven through the business in future Determination periods.

We support the base water conservation program being implemented from 2020. Sydney Water is making some bold assumptions on the customer take-up of these activities and the level of savings achieved. If the program is scaled up to address level 1 and 2 restrictions, there is greater uncertainty in the delivery of enhanced savings as these are dependent on customer response. We found that the level of business activity, costs and savings need to be tested through further pilot work. Greater certainty and larger water saving benefits are likely to be gained through further leakage reduction where the company has greater control of activities, costs and benefits. At a time of drought, there is far greater need and benefit from reducing leakage to the mean economic level of leakage (ELL) compared with an enhanced water efficiency program.

We have formed the view that recycling activities at Rosehill Camelia and St Mary’s has not been given sufficient management attention. At a time of limited resource availability, greater use has not been made of the Rosehill Camelia facility. The St Mary’s plant, designed to offset abstraction from the Warragamba reservoir, is not working at its full output.

The renewables target set at the time of the 2016 Determination period has not been achieved partly due to plant not being available. Greater management focus should be given to increasing the extent of electricity sourced from renewables.

Operating expenditure in the 2020 Determination Period

Sydney Water’s proposed expenditure is similar to actual expenditure in the 2016 Determination period. Sydney Water states that it has assumed ‘average year’ conditions, although its updated pricing submission in November did include elements of drought-related expenditure.

Sydney Water has made a detailed assessment of its operating expenditure requirements. These have been subject to internal challenge as part of its budget process. It has also made a proactive assessment of efficiency savings which are being implemented in the 2016 Determination period and continue through the

2020 period. We have looked at the balance of risk between customers and Sydney Water and have found that it is adopting a risk averse approach

We conclude that additional expenditure is indeed required to return leakage to its mean economic level. However, the cost of water lost from the system above the ELL reflects inefficiency in operation which should not be included within the allowable expenditure.

Service Delivery - Wastewater maintenance

Sydney Water proposes increased expenditure to address increased occurrence of sewer chokes.. Our view is that this work needs to be done to meet expectations of customers, the EPA and licence requirements. However, we question whether some of the reactive expenditure could have been avoided by more effective asset management and a greater activity in proactive CCTV work during the 2016 Determination period, for example. In addition, reports of effective responses to incidents and clear-up may well be matters of more effective working, monitoring and timely clean-up. Customers should only be expected to fund efficient activities. With the Customer Hub now in place, we would expect the process to be more effective.

BOOT Water treatment

BOOT treatment costs are driven by volume and water quality. In an average year assumption, with reservoir storage above 60% the desalination plant would not be operating and all bulk supplies would be derived from WaterNSW with the filtration plants with high throughput and water quality would be expected to be good. There are small changes to the assumed volumes which we have based on our demand forecast discussed in Section 4. This results in a small reduction in treatment costs.

When the reservoir storage was below 60%, we assumed that the SDP plant would be operating and the extension may operate later in the period. Treatment capacity for both the BOOT and Sydney Water plants would be reduced. We assumed that the lower loading rates on the filters would allow them to operate with deteriorating water quality, turbidity and colour, but within the water treatment agreement. This scenario has not been included in the base operating expenditure but is discussed with the cost pass-through proposals in Section 8.3.

Sydney Water has stated that it has assumed that future costs should reflect 'average' conditions. Colour is a significant treatment cost driver, [redacted].

We found this to be a risk averse approach and results in significant increases in treatment works costs in an average year scenario which are likely to be overstated. We have accepted Sydney Water's revised proposals to share any increasing cost risk between it and customers.

[redacted]

Electricity

Sydney Water has an energy efficiency program which is forecast to deliver 13 GWh additional savings over the 2020 Determination period, equivalent to 0.75% per year. In addition, energy from renewables is forecast to contribute to 20% of total demand. While good progress has been made to manage grid energy within the 1998 level, further use of renewables should be explored. We suggest a stretched renewables target of 2% of grid supplies by the end of the 2020 Determination period should be set. This should help to offset potential increases in grid supplied after 2024.

City planning

Additional expenditure was included from 2020 to support the Department of Planning, Infrastructure and environment to provide strategic management and planning support for the Western Parkway City including the South Creek and airport. We had questioned whether elements of this expenditure, particularly related to stormwater drainage, should be funded by water and wastewater customers. As this input is for a specific requirement which might morph into a separate planning authority, we question whether this expenditure would continue through the whole of the 2020 Determination period. We have assumed that the $8m/a proposed would continue through to the end of 2022.

Water conservation - communications and advertising

Sydney Water is proposing $20m/a for communications and advertising. While the total expenditure is explained and activities are appropriate, we question the allocation between the base position, when there are no water restrictions and when these are introduced. We suggest that in the base case, with storage greater than 60%, communications and advertising costs should be $5m/a increasing to $20m/a when water restrictions are in place. The cost pass-through element would be $15m/a included in Section 8.5. Sydney Water has accepted this adjustment although suggested the trigger be 65% or 70%. We propose that this trigger be consistent with IPART's assumption on base and drought pricing scenarios.

Infrastructure resilience

There was no information provided to support the infrastructure resilience investigation proposals. We consider this activity to be business as usual and have adjusted the proposed expenditure. Sydney Water has accepted this adjustment.

Digital

Our review of the Digital projects identified significant operating expenditure and some capital efficiencies from the BxP and other projects.

Catch-up efficiency

We have carried out benchmarking to compare Sydney Water with similar large water utilities in Australia. This showed that it was ranked well above most other utilities in terms of efficiency. We also benchmarked Sydney Water against the econometric models currently used by Ofwat in England and Wales to determine efficient base totex. We input the Sydney Water operating and replacement expenditure into the England and Wales models used by Ofwat for the PR19 price review to compare with an efficient expenditure derived from the modelling. While the analysis is sensitive to assumptions on exchange rates, it provides an indicative comparison of Sydney Water against frontier companies. Sydney Water's wastewater service is within 4% of the modelled costs although sensitive to the corporate cost allocation. The water service costs are significantly greater than the modelled costs. Sydney Water's resources costs are significantly greater than UK companies; the England and Wales companies tend to have different resource characteristics and size with low resources costs.

From the results of our high-level benchmarking analysis with water utilities in England and Wales, the extent of catch-up efficiency is similar to the efficiency proposals included in the submission. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings

It is not possible, with the data provided by Sydney Water, to make a detailed assessment of what might be catch-up efficiency and continuing efficiency. The efficiencies included in the June submission include significant and documented productive efficiency initiatives and assumed efficiency from systems implementation such as the replacement of the ancient billing system which we consider predominantly as 'catch-up'. The additional business-wide efficiencies proposed in the November submission are not supported with any detail to show how these are to be delivered but we assume the target has been carefully considered and promoted by the Directors. In the absence of this detail, we have made a reasonable assumption that the November submission predominantly represents 'continuing' efficiency across the whole business from new technology (where we have seen a high level of ongoing investment) and innovation.

Frontier shift or continuing efficiency

Analysis of the Productivity Commission multi-factor productivity (MFP) data by IPART[1] suggests that a sustained average annual Multi-Factor (MFP) improvement[2] of between 0.6% and 0.8% p.a. is achievable in Australia. These results include performance from 1975-76 to 2017-18.

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[3] to undertake an assessment of 'Frontier Shift'; that is the scale of frontier shift that can be expected to achieve 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. A recommended frontier shift ranges is derived for botex, that is the combination of wholesale operating and asset replacement expenditure, of 0.6% to 1.4% per annum.

In its final determination in December 2019, Ofwat updated its assessment of Frontier Shift including the updated European Economics report and other reports to propose a level of Frontier Shift in its efficiency report forming part of its Final Determination[4]. In this document it comments on the responses it received from the UK water sector. It allocated a 1.1% p.a. 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, that a frontier efficiency of 0.8% per annum should be applied to proposed expenditure, applied to all base costs. This is consistent with the efficiency challenge that Sydney Water has set itself as explained below.

We compared the additional efficiencies proposed by Sydney Water in its Updated submission. Sydney Water proposed an increasing efficiency from 0.5% in 2021 to 1.5% in 2024 applied cumulatively. We found that there was little difference in the level of efficiency derived. Sydney Water proposed $87,2m (taking account our scope adjustments) in Frontier Shift over the 2020 determination period compared with $82.0m from our analysis. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings but we have assumed that all is attributable to continuing efficiency as much of this is dynamic efficiency.

Sydney Water commented on our Draft Report that that our approach double counted efficiency savings by applying 'bottom up' program-level cuts as well as 'top down' efficiency challenges. We disagreed with this comment. Program and project level adjustments are an essential part of an expenditure review. Without them, the frontier shift would be applied to whatever a utility proposed to spend whether it was efficient or not.

Sydney Water commented that we had made arbitrary and unjustified assumptions about whether savings included in its operating expenditure proposals represent catch-up or frontier shift efficiencies. Irrespective of this classification, Sydney Water has applied a greater efficiency challenge to its opex than we have recommended. We have accepted the operating efficiency savings that Sydney Water has proposed. The only reason that our recommended expenditure is lower than Sydney Water's is because of scope challenges which largely relate to changes in activities relative to the current base.

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[1] Ongoing productivity adjustment, IPART December 2019

[2] We consider that MFP is a more useful productivity indicator than labour productivity for a public water utility, which must make substantial capital investments efficiently.

[3] Real Price Effects and Frontier Shift, Europe Economics January 2018

[4] PR19 Final Determination -Securing cost efficiency technical appendix, OFWAT December 2019

A further comment was that we have failed to consider the countervailing effect of input price inflation. Sydney Water has not made a robust case for any real input price increases and as such, we do have not recommended any real input price adjustments.

Efficiencies have been applied to the base expenditure including the November Update submission. We conclude that the level of efficient operating expenditure is as presented in below Table 0-1.

Table 0-1 Efficient level of operating expenditure future determination period

SYDNEY WATER PROPOSED TOTAL OPERATING EXPENDITURE					
($m 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
Water	393.2	409.4	410.5	410.1	1623.2
Water BOOT	101.0	101.7	101.8	102.4	407.0
Wastewater	482.1	483.2	476.4	474.1	1915.7
Stormwater	14.5	14.8	15.0	15.2	59.5
Recycled Water	33.0	32.9	32.1	32.3	130.2
TOTAL CORE OPERATING EXPENDITURE (including base efficiencies)					
Total including base efficiencies	1023.8	1042.0	1035.8	1034.1	4135.6
Base efficiencies by Sydney Water	20.0	18.2	31.5	34.8	104.5
Total excluding Sydney Water efficiencies	1043.8	1060.2	1067.3	1068.9	4240.1
ATKINS RECOMMENDED SCOPE ADJUSTMENTS					
Total change in scope	-28.04	-33.19	-42.25	-42.27	-145.75
ATKINS RECOMMENDED EFFICIENCY ADJUSTMENTS					
Total efficiency adjustments	-8.13	-16.43	-24.60	-32.85	-82.01
ATKINS RECOMMENDED TOTAL ADJUSTMENTS					
Total adjustments	-36.17	-49.62	-66.85	-75.12	-227.76
ATKINS RECOMMENDED EFFICIENT BASE OPERATING EXPENDITURE					
Water	373.08	381.05	375.25	371.57	1500.95
Water BOOT	96.70	96.57	99.09	98.85	391.20
Wastewater	470.76	467.81	448.63	442.58	1829.78
Stormwater	14.35	14.59	14.64	14.76	58.35
Recycled Water	32.70	32.34	31.33	31.23	127.60
Total base opex	987.60	992.35	968.94	959.00	3907.88
ATKINS RECOMMENDED BULK WATER					
WNSW Bulk supply	189.18	193.73	199.58	202.78	785.27
SDP	180.62	178.81	178.81	178.81	717.05
ATKINS RECOMMENDED TOTAL EFFICIENT EXPENDITURE					
Total	1357.40	1364.89	1347.33	1340.59	5410.21

Note: Scope adjustments refer to the extent of proposed additional activities above the base; Efficiency adjustments refer to the cost savings to be achieved in delivering the whole operating expenditure program.

Cost pass-through operating expenditure

We propose a level of efficient expenditure for cost-pass through activities related to the implementation of drought restrictions is shown in Table 0-2. We have made an adjustment to water conservation activities where the uncertainties in costs questions the efficiency of measures at level 3 restrictions. We have also taken into account the savings from water treatment costs from reduced volumes when the SDP is in operation. A frontier shift efficiency has been applied from 2023.

Table 0-2 Efficient cost pass-through expenditure

SYDNEY WATER UPDATE SUBMISSION COST PASS THROUGH OPERATING EXPENDITURE					
$ 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	**Total 2021-24**
WATER SUPPLY RESILIENCE					
Network upgrades for extended SDP	0.0	0.5	0.5	0.5	1.5
NON INFRASTRUCTURE DROUGHT RELATED					
Water conservation	51.0	63.0	63.0	63.0	240.0
Water restrictions advertising	10.0	10.0	10.0	10.0	40.0
Water restrictions implementation	15.0	15.0	15.0	15.0	60.0
Drought management	1.6	1.6	1.6	1.6	6.3
Total drought related	77.6	89.6	89.6	89.6	346.3
ATKINS RECOMMENDED SCOPE AND EFFICIENCY ADJUSTMENTS					
Water conservation measures	0.0	-12.0	-12	-12	-36.0
Water restrictions advertising	5.0	5.0	5	5.0	20.0
Savings from BOOT plant operation	-10.30	-10.43	-15.92	-16.01	-52.66
Efficiency adjustment	0.0	0.0	-1.7	-2.5	-4.1
ATKINS RECOMMENDED TOTAL COST PASS THROUGH					
Total	72.3	72.6	65.5	64.6	275.0

Capital Expenditure

During the current determination period, 2016-2020, Sydney Water has delivered a significantly larger capital expenditure program relative to the 2013-2016 Determination period. In the previous period from 2013-2016, Sydney Water spent an average of nearly $764m per annum (19/20 prices).

Sydney Water had a regulated capital expenditure allowance of $2.695 billion ($2019–20) for the 2016–20 Determination period. By 2020, according to its November 2019 submission, Sydney Water expected to have invested $3.250 billion, around $555 million (c.20%) more than the IPART determination. The overspend has been attributed to significant expenditure on additional growth that was not included within the 2015 submission, and in particular for wastewater services.

In November 2019, Sydney Water submitted an updated SIR which made a number of changes affecting the anticipated capex in the 2016-20 period including:

- Addition of a number of drought response schemes (discussed in Section 8):
  - Prospect to Macarthur Link ($76.7M in 2020)
  - Blue Mountains Cascade Supply ($4.7M in 2020)

- Changes and rephasing of Digital Portfolio capex program, resulting in $12.6M increase in anticipated expenditure in 2020.

- Correction of the coding of $63.0M for 'South West Priority Growth Area (SWPGA) - SW Front Servicing' which was previously wrongly classified as a wastewater rather than water project.

All other elements remain unchanged. The recommended prudent and efficient expenditure is based on the November 2019 submission. Other tables and figures below are based on the November 2019 submission unless otherwise indicated.

2020 Determination Period

In the current determination period (2016-2020 inclusive) capital expenditure is $797m per annum. In its November 2019 submission, Sydney Water proposed to further increase this by 59% to $1,252m per annum for the 2020-2024 period.

Sydney Water's capital expenditure program for the forward period is generally based on bottom up evaluation of needs as documented in planning documents or analysis specific to the particular asset class and is documented in a series of 'Program Business Cases'. The total level of capital investment proposed through the bottom-up summation of Program Business Cases was $6,196 million as at June 2019 for the five year period from 2020 to 2025 (for infrastructure only, i.e. excluding information technology). Sydney Water then subjected this bottom-up program to top-down adjustments, efficiency challenges and rephasing.

In November 2019, Sydney Water submitted an updated SIR which made a number of changes affecting the anticipated capex in the 2020 Determination period including:

- Addition of a number of drought response schemes (discussed in Section 8):
    - Prospect to Macarthur Link ($484.2M in 2020-24)
    - Blue Mountains Cascade Supply ($41.1M in 2020-24)
- Rephasing of Critical Sewers, bringing expenditure forward but not affecting the overall proposed capex in 2020-24. The discussion of this expenditure below reflects these updated projections.
- Increase of $52.2M in proposed Wet Weather Overflow Abatement (WWOA) expenditure. The proposed increase in expenditure is discussed further below.
- Changes and rephasing of Digital Portfolio capex program resulting in a capex reduction of $26.9M in 2020-24. The discussion of this expenditure below reflects these updated projections.

All other elements remain unchanged. The recommended prudent and efficient expenditure is based on the November 2019 submission. Other tables and figures below are based on the June 2019 submission unless otherwise indicated.

We consider that Sydney Water's approach to program development in applying adjustments and efficiency challenges top-down demonstrates increased maturity and willingness to respond to its regulatory environment. However, we have noted significant variances between the approach Sydney Water has taken to apply efficiency challenges consistently across all major programs. While most programs are clustered around the average level of efficiency of 18% with little or no change between the initial and final levels of efficiency applied, two groups comprising four programs stand out which we interpret in terms of Sydney Water's appetite for taking on risk in realising efficiencies in the forward period as follows:

- Risk seeking – for the waterway health and wastewater treatment plants program, Sydney Water has applied both a high level of efficiencies (40% and 34% respectively) and increased these by 10-20% in its final review
- Risk averse – for the critical sewers and wet weather overflow programs, Sydney Water has reduced levels of applied efficiency. These were initially in line with the other programs (17% and 27% respectively) but have now been reduced to zero.

On this basis we recommend two specific catch-up efficiency adjustments for critical sewers and wet weather overflow programs, to reach the average 18% level that Sydney Water have applied themselves for the remainder of their asset renewals programs.

For existing mandatory standards, we have also noted a number of instances where improved evidence between asset condition and performance levels would better help to justify or strengthen the proposed expenditure requirements, for example reservoir and WWTP renewals. We have recommended some specific prudency adjustments on this basis. We have also suggested increasing expenditure in some areas where we considered expenditure is required to maintain service levels most notably wastewater pumping station renewals.

For capital expenditure linked to growth we have noted that new property numbers are expected to be very similar to the current Determination period, as such we consider it reasonable that general water and wastewater growth expenditure should be at a similar average level for both services.

For corporate capex we believe that there is good justification where Sydney Water is an outlier over the current and future determination periods and that it does not suggest an underlying inefficiency. However, we do not have full confidence in the capex forecast for 2021-24 determination period and there is a risk that this could lead to a significant increase in the outturn capital expenditure beyond the $348m in the IPART submission.

We conclude that the level of efficient capital expenditure is as presented in Table 0-3 below.

Table 0-3 Efficient level of capital expenditure future determination period

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - TOTAL PROGRAM							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Water	632.1	261.3	293.3	212.6	176.5	1399.3	1575.8
Wastewater	721.5	766.2	791.2	824.3	698.8	3103.1	3801.9
Stormwater	40.1	53.7	43.3	48.0	29.0	185.2	214.2
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1532.7	1200.9	1204.7	1148.9	959.5	5087.2	6046.7
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Water	426.2	420.4	207.6	190.2	163.7	1244.4	1408.1
Wastewater	727.3	709.5	716.1	684.1	805.2	2837.0	3642.2
Stormwater	41.7	49.6	40.3	44.2	40.8	175.9	216.6
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1334.1	1299.3	1040.9	982.6	1064.9	4656.9	5721.7
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-10.7	-20.8	-25.0	-31.4	-42.6	-87.9	-130.5
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Water	422.8	413.7	202.6	184.1	157.1	1223.2	1380.3
Wastewater	721.4	698.2	698.9	662.2	773.0	2780.7	3553.8
Stormwater	41.4	48.8	39.4	42.8	39.1	172.4	211.5
Corporate	137.8	117.9	75.0	62.0	53.0	392.7	445.7
Total Efficient Expenditure	1323.4	1278.5	1015.9	951.1	1022.3	4569.0	5591.3

1. Introduction

1.1. Terms of Reference

In July 2019 the Independent Pricing Tribunal of New South Wales (IPART) appointed the Atkins/Cardno consortium to carry out a detailed review of the Sydney Water Corporation's operating expenditure, capital expenditure and demand forecasts. The purpose of this review is to inform the Tribunal's Determination on prices for the upcoming price control period which applies from 1st July 2020 to 30th June 2024.

This report has been prepared in accordance with the Terms of Reference set out in the contract between Atkins/Cardno and IPART which commenced on 1 July 2019. The Terms of Reference were extended to review the Updated Submission from Sydney Water dated November 2019. These are reproduced in Appendix B.

The findings of this report form an important component of the overall price review process as set out in the IPART Issues Paper. The conclusions relating to prudence of expenditure in the 2016 Determination period inform what IPART includes in Sydney Water Corporation's opening Regulated Asset Base value. The conclusions relating to efficient operating and capital expenditure in the 2020 Determination period assist the Tribunal's assessment of what are justified requirements to be included in the 'building block' model for determining future prices.

The Terms of Reference state that the price control period is for a period of up to five years, 2021 to 2025.

1.2. Sydney Water's submission to IPART

IPART required Sydney Water Corporation to provide a submission outlining and substantiating its proposed prices for the period 2021 to 2025 and report on actual and forecast expenditure for the 2016 Determination period from 2017 to 2020. The following versions of this information have been used in the preparation of this report:

(i) Submissions to IPART dated June 2019 and November 2019;

(ii) Special Information Return (SIR) dated June 2019;

(iii) Annual Information Return (AIR) dated June 2019;

(iv) An updated version of the AIR and SIR received in November 2019 including actual expenditure for the year ending June 2019 and revised expenditure projections.

While we have endeavoured to satisfy ourselves as to the provenance and robustness of the data provided, a detailed audit of the completeness and accuracy of the submission lies outside the scope of this project.

1.3. Review Process

We, the Atkins/Cardno team, commenced our review on 2 July 2019. We submitted an Inception Report to IPART on 31 July 2019. Following initial review of available dates, we submitted an Information Request to Sydney Water on 24 July 2019. Documents were provided by Sydney Water from 1 August 2019. Our review team commenced the phase 1 review interviews from 12th to 20th August. The second phase of interviews focussing on project reviews, were carried out from 2nd to 10th September 2019. Subsequent interviews were held in late November 2019 following receipt of the November 2019 expenditure update.

Over the interview period we requested additional supporting documentation relating to a range of issues. We believe that the Corporation provided us with this information in a timely manner and to the best of its ability. We then requested further information and queries over the subsequent weeks to which Sydney Water was able to respond.

Atkins/Cardno would like to take the opportunity to thank Sydney Water for making its staff available for the interview days and for the professional manner in which the organisation responded to our challenges and requests for further detail.

1.4. Methodology

Our review and assessment of capital and operating efficiency is based on the hypothesis of a Frontier Company competing in an open market to deliver services to customers, the continuing efficiencies that a Frontier Company makes through innovation and technological development, and the catch up efficiency required of Sydney Water to achieve the performance of a Frontier Company over time. We use this approach to compare the business processes and systems with current best practice and to identify the extent of catch-up that may be required over time to reach an efficient level of operation. The approach is similar to that taken for the 2015 and 2011 efficiency reviews of Sydney Water, the 2016 review of SDP and the 2018 review of Central Coast Council.

We review the decision making processes for both operating and capital expenditure to test whether there is sufficient challenge and rigour to deliver total least cost solutions. We comment in Section 2 on Sydney Water's management systems and processes and identify areas with the potential to drive further efficiencies over the determination period.

Within the Expenditure Review we have considered the asset management practices, the capital investment appraisal, the estimating methodology and procurement process insofar as they are used to identify investment needs and timing, appraise solutions, prioritise projects within defined budgets and procure and manage timely delivery.

1.4.1. Strategic review

Task 1 of the Expenditure Review was to review the long-term investment planning and asset management practices and processes. We examined the longer term investment strategy and the key assumptions driving this expenditure. We checked that the price submission and SIR were consistent with this long-term investment program. We were able to compare asset management frameworks with best practice. Our analysis was focussed on the ability of the asset management systems and processes to deliver efficient expenditure. Our review is consistent with the IPART paper 'Regulatory Tests of past and forecast Capital Expenditure', December 2010.

1.4.2. Demand forecast

IPART requires us to assess the utility's forecast sales and customer connections used to support its proposed expenditure and prices. We undertake a review of:

- the reasonableness of the utility's long-term growth projections; and
- the reasonableness of the utility's demand and customer connection forecasts over the 2020 determination period

Our approach has been to examine the outturn growth in the 2016 Determination period and review the models underlying Sydney Water's projections for the 2020 period. In the context of the water restrictions recently put in place, we have also reviewed experience from previous restrictions to evaluate the potential effects on demand.

1.4.3. Operating expenditure

IPART requires us to assess:

- the efficiency of operating expenditure for the period from 1st July 2017 to 30th June 2020, to the extent necessary to assess the efficiency of the proposed operating expenditure; and
- the efficiency of proposed operating expenditure for the period from 1st July 2020 to 30th June 2025.

Our assessment is based on the actual operating expenditure in the Submission, the robustness and confidence of these estimates taking into account the basis of the estimates and confidence in the need, timing and scope of the requirements. We also take into account whether additional expenditure proposals have been through the internal approval and challenge processes.

Our approach to forward-looking operational efficiency is based on a combination of process-based qualitative and quantitative assessments. We consider how Sydney Water performed against the 2016 Determination period and the reasons for outperformance, whether due to exogenous factors or actions taken by the Company.

Looking forward we test how the efficiency gains in the current determination period will impact on opex in the future and the potential for further gains through improved processes. Our approach therefore includes an assessment of the agency's operating expenditure proposals and scope for further efficiencies by function and process. We focus on the material areas of expenditure such as energy, operations and maintenance activities. We also test the extent to which planned maintenance is able to extend the life of assets and defer capital expenditure.

We focus on risk management and the approach taken by Sydney Water in balancing risk between the agency and customers. We also sought to what extent customers are engaged in the development of the Business Plan. The extent to which customer views are taken into account is a good test of the Plan. There is an increasing customer engagement in developing business plans across many utilities including the frontier. We take account of any productivity benchmark analysis which may be applicable. Again, this is a guide to what extent the agency may be at or behind the frontier.

We recognise that a proportion of operating costs may not be directly controllable because they are driven by external factors. But this impact could be two-sided; for example, there could be potential savings in energy prices where the benefits may not be shared equitably with customers. We would normally exclude non-controllable costs but take a view on the risk taken by Sydney Water through their inclusion. We also identify areas where we consider operating costs are unduly low in relation to industry averages; we may suggest some increase in operating costs to reduce the risk of failure in service level provision.

We look to offset these efficiency targets with any efficiency programs demonstrated by Sydney Water. The evidence of such efficiency programs is indicative of an Agency which is looking to catch up with the frontier.

We interview the functional managers, review supporting reports and documents and asses the current position on the development and implementation of corporate systems used to set budgets, control and monitor costs and allocate expenditure to the IPART expense types.

We present our analysis of the future expenditure proposals contained and comment on each main activity in terms of the potential for efficiencies to be achieved through the robustness of estimates, the need and timing of expenditure and absorbing of some activities within base opex as a surrogate for the application of internal challenge and budget control.

In summary, our adjustments to Sydney Water's submission to derive a prudent and efficient level of expenditure comprises three steps

(i) adjustments for expenditure which is not considered prudent or the scope of work is greater than necessary to meet licence requirements;

(ii) a 'catch-up' adjustment to reflect the need for a utility to reach the efficiency of a frontier company; and

(iii) a 'continuing efficiency' (known as Frontier Shift) to reflect the scope for further efficiencies in the future period from new technology and innovation.

Sydney Water commented in the appendix to its comments on the draft report that

- *Atkins is double counting efficiency savings by applying a 'bottom up' program level cuts as well as top down 'frontier shift cuts;*

  Our adjustments are independent and we do not double count. Our adjustments for prudent expenditure are against the 'prudency test' where costs may not be necessary or appropriate to meet licence requirements. For example, additional funding of the City Planning work. We do not have the data to carry out econometric modelling to assess the efficient level of TOTEX for Sydney Water that Ofwat applies. This is their first cost normalisation analysis which it carries out. We have however compared Sydney Water's costs, after adjustments, with the econometric models and we report on this in later sections. Ofwat also applies a 'deep dive' review of large projects or areas of expenditure where it considers costs may be unclear or overstated. Our approach is consistent with Ofwat. Using the term 'bottom up' is not appropriate. The adjustments are for prudence and efficiency and there is no double counting.

- *Atkins makes arbitrary and unjustified assumptions about whether savings included in Sydney Water's opex proposals represent catch-up or frontier-shifting efficiencies;*

  It is not possible with the data provided by Sydney Water to make a detailed assessment of what might be catchup efficiency and continuing efficiency. The efficiencies included in the June submission include significant and documented productive efficiency initiatives and assumed efficiency from systems implementation such as the replacement of the out of date billing system which we consider predominantly as 'catchup'. The additional business-wide efficiencies proposed in the November submission are not supported with any detail to show how these are to be delivered but we assume the target has been carefully considered and promoted by the Directors. In the absence of this detail, we have made a reasonable assumption that the November submission is 'continuing' efficiency across the whole business from new technology (where there is a high level of ongoing investment) and innovation.

- *Atkins double-counts the scope for frontier shift in Sydney Water's capex, which are already calculated based on costs forecasts with embedded productivity gains*

  There is no double counting. We noted that Sydney Water has applied internal productive efficiencies in cost intelligence, delivery and procurement improvements, program and portfolio management improvements and improvements for optimised solutions. We considered these initiatives as catchup efficiencies when comparing the impact of these improved processes with those used by a frontier company. In addition, there is scope for new technology and further innovation to deliver solutions at lower cost as we see with frontier companies in England and Wales. Ofwat has been encouraging companies in this area and has set some appropriate efficiency targets. This is why we apply the continuing efficiency or frontier shift to the capital program. We believe that Sydney Water has the capacity and resources to bring further innovation to deliver these efficiencies.

- *Atkins fails to consider the countervailing effect of input price inflation when it assumes Sydney Water can achieve productivity gains above the level achieved by the economy as a whole as measured in economy-wide inflation indices*.

  The price review is based on 2019/20 constant prices. We are not aware of any submission on real price effects for any input cost. The analysis of data from the Australian Productivity Commission is based on the economy as a whole.

1.4.4. Capital expenditure

IPART requires us to assess:

- the efficiency and prudence of capital expenditure for the period from 1st July 2016 to 30th June 2020; and
- the efficiency and prudence of proposed capital expenditure for the period from 1st July 2020 to 30th June 2025 – in order to ensure that planned capital expenditure is directed to the most appropriate projects at an efficient cost.

Our assessment of the prudence of schemes in the current determination period is based on a review of a representative sample of projects. We reviewed the need for each project, its timing and the difference between actual costs and outputs against planned. We considered the basis of costs and the procurement route for implementation of sample projects. For the year 2020, we took a view of the most likely outturn expenditure based on the current status of schemes in the program.

Our approach to the assessment of allowable future expenditure is based on a review of the asset management and capital expenditure processes, project appraisal and decision processes and a review of a representative sample of schemes in the program. Our methodology involves the following steps which we apply to all expenditure at a real 2019/20 price base:

- Any inconsistencies in inclusions and allocation of capital expenditure by driver recorded in the SIR;
- Adjustments to the scope and assumed workload of asset replacement projects given
- Adjustments to the timing of some projects due to uncertainties in the implementation programs;
- Adjustments for specific scheme cost estimates; and
- The scope to gain efficiencies through the implementation of the appraisal and cost estimating process, the approach to procurement and the program management process discussed in Section 4.

Our previous reviews identified three business processes where there is an opportunity to lever efficiency savings on the expenditure proposals. These relate to investment and asset planning, cost estimates and procurement. We make an assessment of the extent of efficiencies that have been made since the previous review and the scope for further efficiencies to catch up with the frontier company.

In our review of investment and asset management planning, we test the assumptions underlying asset replacement expenditure in relation to service level outputs such as water continuity, sewer chokes and other measures. This is to confirm whether the most efficient and timely solution is identified to maintain or enhance current service levels.

We then confirm that the cost estimates in the submission reflect the likely cost of efficient solutions, and the extent to which risk contingencies may be applied. Good practice is to include some risk contingency where justified but at programme level rather than individual projects.

We test the procurement strategy to confirm whether the approach is the most effective and to what extent this reflects best practice compared with alternatives. Our experience shows that agencies have made good efficiencies through new and innovative procurement models.

We also test to what extent risk is shared between Sydney Water and customers. For example, where operating licence performance shows a healthy headroom below the reference levels, we question whether there is scope to take a greater risk on performance while reducing asset replacement activities and costs.

We comment in Section 1.4.4 on the basis of the scope and efficiency adjustments applied to both capital and operating expenditure.

We present our review of capital expenditure and present proposals for an efficient level of future expenditure in section 6.

1.4.5. Special Review Items

IPART requires us to review and report on Special Items which have a material impact on the Price Review. These are:

(i) Growth expenditure;
(ii) Drought response measures and water conservation projects;
(iii) Environmental licencing requirements;
(iv) Finance leases;
(v) Discretionary expenditure;
(vi) Land sales;
(vii) Information technology expenditure;
(viii) Avoided costs; and
(ix) Projects subject to government directions.

We report on these issues in Section 8.

1.4.6. Output measures

IPART requires us to assess Sydney Water's performance in the current determination period against outputs defined in the 2016 Determination period and to comment where any measures have not been achieved.

We also review and recommend output measures for the future determination period, taking into account the activities planned and any proposals made by Sydney Water in its submission to IPART.

We present our findings in Section 9.

2. The regulated business

2.1. Operating environment

Sydney Water's business is to supply potable water to a population over 5.1 million within 2.0 million households and businesses. It purchases bulk water from Water NSW and, under certain operating conditions, the Sydney Desalination Plant (SDP). A greater part of its bulk water is treated at a privately-owned water treatment plant under BOOT arrangements; it owns and operates a small number of water treatment works. It is directly responsible for the operation and maintenance of five water filtration plants, 247 service reservoirs, 151 water pumping stations, 5,000km of critical mains and 22,000km reticulation mains.

The extent of Sydney Water's supply area is shown in Figure 2-1.

Sydney Water collects and treats wastewater from a similar number of customers through a network of 2,100km of critical sewer mains, 25,000km of reticulation sewer mains, 690 wastewater pumping stations, and 28 wastewater treatment, water recycling and stormflow treatment facilities..

Effluent is subject to a range of treatment processes depending on the disposal route; for example, primary treatment for ocean discharge at the Deep Ocean Outfall Plants, secondary treatment at other coastal discharge plants and tertiary treatment (nutrient reduction) to inland rivers. Effluent used for recycling is generally tertiary treated.. All sewage sludge from treatment is disposed to agriculture, composting or landfill.

Sydney Water also manages 452 km of stormwater channels mainly in the Eastern Suburbs and South and South West of Sydney and trunk drainage land in Rouse Hill.

Asset Management

A key challenge to Sydney Water is to maintain assets in the long term to achieve a stable serviceability to meet Operational licence requirements. Our review of the asset management shows that the methods, processes and systems are in place to manage the assets. The challenge is to achieve an equitable balance of risk between Sydney Water and customers in relation to asset performance, cost and risk of failure.

Water Demand

In the current determination period, there has been an increasing demand from 551 Gl/a in 2016 to a forecast 568 Gl/a in 2020 over a period of population growth. New connections are forecast at 24,000 per annum over the future determination period. Total demand is forecast to increase to 595 Ml/a by 2024 driven mainly by an increase in household demand. Average per capita consumption is assumed to remain at the current level through to 2020.

Water Supply

There are no major increases in resource and treatment capacity over the future determination period. The SDP provides an additional resource should impounding reservoir levels fall below operational control curves. There is some evidence of deteriorating water quality impacting mainly on the BOOT plants where process enhancements are being implemented. These works are significant and have an impact on the RAB; these works are included in the efficiency review.

Growth

Growth in the current determination period has been higher than forecast. Higher growth rates driving major developments to the North West and South West of Sydney are expected in the future period to 2020 although the scope and timing is dependent on economic factors.

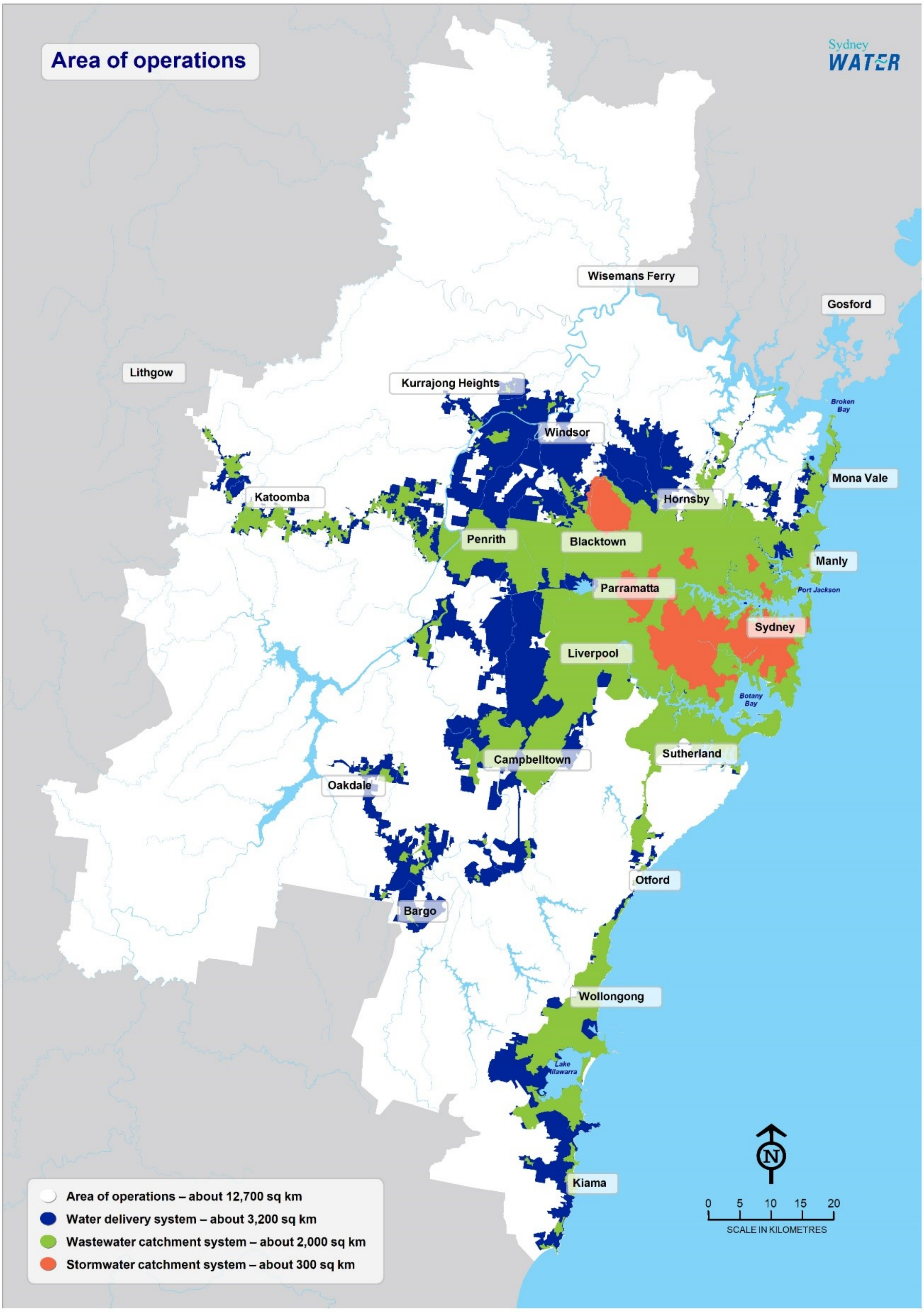


Figure 2-1 Map of the Sydney Water Corporation Area

2.2. Legislation

Sydney Water is a state-owned corporation, wholly owned by the New South Wales Government, under the *State Owned Corporation Act 1989.* The Corporation operates under the enabling legislation, the *Sydney*

Water Act 1994. Sydney Water's area of operations comprises the greater Sydney area, the Illawarra, and the Blue Mountains. The Corporation has three equal principal objectives, which are:

- to protect public health;
- to protect the environment; and
- to be a successful business.

Under the *IPART Act 1992,* IPART is responsible for setting prices for Sydney Water. The current determination review covers the period to June 2020. Sydney Water has proposed that the future determination period to cover a period of four years until June 2024.

2.3. Regulatory requirements

Sydney Water's Operating Licence is a requirement of the Sydney Water Act. It authorises the functions that Sydney Water can undertake and sets out the terms and conditions under which it functions. The Licence is granted by the Government of NSW. IPART is responsible for administering the Operating Licence. The form of the Licence was last reviewed in 2009 and a new Operating Licence was implemented in November 2019[5].

A Memorandum of Understanding is in place with each of NSW Health, the Office of Environment and Heritage, the Environmental Protection Agency and the Metropolitan Water Directorate.

The key contents of the Operating Licence insofar as it impacts on the efficiency review are:

i. Growth - drinking water and wastewater services must be available on request for connection to any property in the area of operations, subject to any conditions to ensure safe, reliable and financially viable supply to properties.
ii. Customer rights and complaint/dispute handling - customer contract, hardship procedures, rules on disconnection for non-payment.
iii. Asset Management and infrastructure performance: asset management requirements, system performance standards, service quality indicators, response times for water main breaks.
iv. Priority Sewerage: towns to be serviced under the Priority Sewerage Program;
v. Water Delivery Operations: water quality requirements for drinking water, recycled water, storm water.
vi. The economic level of water conservation: requirements to reduce the quantity of drinking water used and the level of leakage, water efficiency programs and recycling;
vii. The Environment: requirements to maintain an environmental management system certified to AS/NZS ISO 14001:2004 and report on environmental performance indicators; and
viii. Performance Indicators: these define service delivery performance for customers including water pressure, continuity and wastewater overflows.

Performance against the Operational Licence is audited annually and reported by IPART.

2.4. The regulated business

The regulated business of Sydney Water is responsible for:

- Water treatment;
- Drinking water distribution;

[5] The new Operating Licence applies for the period 2019 – 2023. This Licence came into force during the period of this review. We refer to the previous Operating Licence as the 2015 – 2020 Operating Licence and the new Operating Licence as the 2019 – 2023 Operating Licence.

- Wastewater collection;
- Wastewater treatment;
- Recycled water treatment in defined schemes
- Recycled water distribution in defined schemes; and
- Stormwater collection and treatment.

We comment in the following sections on the prudence and efficiency of expenditure in all these businesses.

2.5. The non-regulated business

Sydney Water undertakes some activities which fall outside the regulated business, defined as those activities not within the remit of the IPART price review. These activities relate mainly to some recycled water activities[6], radio transmission masts and are small when considered in relation to the regulated business. These non-regulated costs are excluded from the efficiency study. A proportion of Sydney Water's corporate expenditure is allocated to the non-regulated business.

2.6. Water sector relationships

2.6.1. Water NSW

WaterNSW was formed in 2015 from the previous Sydney Catchment Authority and the State Water Corporation. The Greater Sydney business of WaterNSW manages Sydney's storage dams and catchment areas. The WaterNSW role is to manage and protect the catchment areas and catchment infrastructure, to be a supplier of raw water and to regulate certain activities affecting the catchment areas. Sydney Water purchases bulk water from WaterNSW and is its major customer. IPART is also responsible for determining the maximum charges for bulk water services to customers within the Sydney Water Corporation regulatory business.

2.6.2. Sydney Desalination Plant

Sydney Water has an agreement with the separate SDP for the provision of potable water based on operating rules and dependent on the level of storage in the impounding reservoirs. The agreement includes an availability charge, and volumetric charge when the plant is operational. For the future price period, Sydney Water assumes an availability charge only. Where the operational rules require the SDP to be operational, there is a separate regulatory arrangement to address any volumetric related charges. The Sydney Desalination Plant is not included as part of this review. The most recent IPART Determination of the SDP was implemented from July 2017.

2.6.3. Independent water treatment plants

Sydney Water has agreements with independent water treatment contractors for the supply of potable water under Build, Own and Operate (BOOT) agreements. These treatment plants are located at Prospect, MacArthur, Illawara and Woronora and provide 93% of total water supply to Sydney Water. Operating costs are reported through Sydney Water's operating expenditure submission; non-operational costs are recovered from the RAB under arrangements set out in the 2016 Determination period.

2.7. Organisation, structure and functions

Sydney Water has carried out some restructuring of its business during the 2016 Determination period. This included combining the previous Service Delivery and Customer Service divisions into one Customer Delivery division which is the largest in the organisation. This division includes all the operational and maintenance functions of the business. The Liveable City Solutions division is relatively unchanged and includes asset management, planning and delivery activities. Other divisions have support functions and

6 Non- regulated recycled water activities includes for example the recycled water at the Sydney Olympic Park where recycled water is used for irrigation and other non-drinking purposes. Regulated recycled water activities as part of this review included the operating expenditure. For the s16a recycling facility at Rosehill Camilla.

have been re-labelled as Customer Strategy and Regulation, Finance Services, and Corporate and People and Corporate Services. The new Digital Business division brings together the previous, Information Technology division and other digital activities such as IICAPS into one centre. The result is a reduction of one division compared with the 2016 efficiency review. Responsibilities within the former Transformation Division have been moved to other divisions

The Customer Delivery function is responsible for the operation and maintenance of the water treatment plants, distribution networks, sewage treatment works, wastewater systems and stormwater assets. It comprises six functional areas including monitoring services, networks, treatment, hydraulic services, operational services and business management. The Division is responsible for managing bulk water supplies and disposal of biosolids. The Division is also responsible for managing Sydney Water's interaction with customers including meter reading and customer accounts, the Customer Hub, on-line services and looking after business customers.

2.8. Business systems, processes and services

The quality, extent and application of the Sydney Water business systems, processes and services provide an indicator of the effectiveness of the business and the potential for leverage of further efficiencies over time. Table 2-1 captures the key make-up of the digital landscape: it is not meant to be a comprehensive list as there are in fact a total of 147 systems or applications deployed by Sydney Water (as of September 2019), of which 54 were implemented in 2016-20 determination period alone.

The summary below is broken down by portfolio in order to align with Sydney Water's digital strategy and mirror its IPART submission. The landscape has changed significantly with the implementation of the SAP billing and customer relationship management systems in this determination period as well as other major initiatives like the Customer Hub and Internet of Things (IoT) programme. The majority of the remaining SAP capability, linked to new back office functions and referred to as BxP, is work in progress and forecast to be deployed early in the next determination period so the key business systems listed below will be subject to further change.

Table 2-1 Sydney Water Digital Portfolios and Capabilities (Source: Atkins/Cardno analysis)

Portfolio	Functional Area	System, Process or Service	Implementation	Comments
Foundation Systems	Cross-cutting	Data Centres (renewal of existing and new sites), end user performance, integration, information security and Cloud services	Multiple projects in 2016-2020 determination period	Systems and services include foundational infrastructure technologies (e.g. end user devices, services, networks) and enterprise services (connectivity, security and collaboration)
Systems of Record	Finance and Regulatory	Financial Management Information System (FMIS)	Last major update in 2012	Financial management and reporting using PeopleSoft packages: includes General Ledger, Fixed Assets, Project costing, expenses
	Customer Services	CxP SAP solution for billing, customer relationship management and real estate	Went live in June 2019	Replaced 32-year-old ACCESS mainframe billing system and Customer Management System (CMS)

Portfolio	Functional Area	System, Process or Service	Implementation	Comments
	Enterprise Asset Management	MAXIMO works management for civil, mechanical, electrical and asset management	In place 2011/12	In next determination period options under consideration include upgrade or replacement with an SAP solution
	Enterprise Asset Management	HYDRA GIS system for water mains and sewer asset records	2003	
	Enterprise Asset Management	Water Modelling System (WMS) for network modelling of water mains	2011	
Systems of Differentiation	Maintenance	SIRIUS Field Resource Management for job scheduling and despatch. Enables the delivery of reactive and programmed work orders to field personnel who report back on progress	2016	
	Maintenance Customer Services	Customer Hub	2017	Brings together a whole range of digital capabilities to allow Sydney Water to get ahead of incidents and proactively manage customer impact
	Operations and Maintenance	Multiple IoT data projects involving rollout of devices and transmitters	2016-2020	Internet of Things is a term related to capability in near real-time asset monitoring and analytics
	Operations Customer Services	Online trade customer and Developer CX	2016-2020	Developer projects
	Operations	Drawing Management electronic document management system	2016-2020	Drawing tool
	Operations	Water Quality Dashboard	2016	Water quality reporting and environmental data
	All	Business Intelligence used for internal data collection, collation and reporting	2012	Managed in house. Minor maintenance planned
	All	BMIS document control and SWIMS content management systems		Both upgraded in 2016-2020
Systems of Monitoring and Control	Operations	Multiple telemetry and SCADA systems and applications for operations resource management	2016-2020	On-going investment in renewals and enhanced capability

2.9. Information Technology capability

In previous determination periods, Sydney Water had brought in consultants to assess its digital capability and maturity level (2006 and 2009) or been subject to an independent review commissioned by the NSW Department of Finance and Services (2013). While we do not have any third party sources to draw on this time, we have the benefit of reviewing the IT expenditure for last three consecutive price submissions so we are reasonably placed to form a high level view of the maturity of the business.

In our view, Sydney Water continues to make great strides in its digital capability and maturity and it is likely to be considered as being a leading practice in the water sector in Australia, as well as comparing favourably with companies in other sectors in terms of its strategic direction of travel. The department is unrecognisable from 2011 and there are notable advances in the following areas since our 2015 review:

- **Strategic IT alignment:** There is strong evidence to support the statement that digital is now at the heart of Sydney Water
- **IT governance and solutions delivery:** There have been improvements in governance and processes for initiating, developing and managing digital projects, most notably with the adoption of the three speed factory model and the embedding of Agile Project Management that support delivery of more effective outcomes and lead to better risk management
- **Architecture and information management:** Sydney Water has made significant progress in addressing the fragmented and complex application landscape although Sydney Water would accept that it will not be as advanced as it had previously predicted by the end of the current determination period and that there is still much more to do by the end of the next determination period. Sydney Water has also moved on from the relatively passive activity of information management by commencing on a journey to mainstream the use of data and analytics to work smarter and drive more efficiencies in the business
- **Information and technology security:** This has been an area of rapid and unforeseen change which has resulted in re-prioritisation and additional investment to address an operating environment where risks have been increasing resulting in tougher standards so Sydney Water has had to react accordingly to strengthen its resilience
- **Workforce and resource management:** Sydney Water has recruited either directly or by accessing as services highly capable resources from Australia and further afield and, just as importantly, there is also evidence of a cultural shift in empowering people to deliver projects and to be “disruptors” in a positive way as opposed to the negative connotations historically associated with this term. The Operational Technology Services (referred to as OT or OTS), which manages telemetry, SCADA and other systems of monitoring and control, was also merged with the Digital Services IT group in July 2018 to form “Digital Business”. This is a logical step and should generate benefits by improving collaboration and creating synergies between operations and customer service as well as potentially creating some efficiencies.

There are some areas from a prudency and efficiency perspective in our opinion that Sydney Water could do better and which therefore inform our review. Total digital expenditure is increasing as a percentage of Sydney Water’s total expenditure over the future determination period. While Sydney Water puts this down to once-in-a-generation expenditure and the shift to the Cloud and Software as a Service (SaaS)[7] and predicts that this is likely to reduce from 2022/23, we believe that there are some significant investments

[7] Software as a Service (SaaS) is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted. It is also referred to as "on-demand software", “web-based software” or “hosted software”. SaaS is typically accessed by users using a thin client, e.g. via a web browser. SaaS has become a common delivery model for many business applications, including office, messaging, management, CAD, customer relationship management (CRM) and even enterprise resource planning (ERP) software.

which have not been considered and thus the evidence that the total cost of digital expenditure will fall is not compelling. Benchmarking can be difficult but there is the risk that if the level of expenditure is consistently over the average then this may suggest that there is an underlying inefficiency when compared with the level of equivalent expenditure in other water utilities. This raises the question whether a utility operating in the open market would take further steps to limit these increases through deferral, further prioritisation or by funding through efficiencies delivered elsewhere. This is discussed in more detail in Section 6.7.1.4.

In our 2015 review, we also commented that: *"…One area we would question is the validity or appropriateness of targets contained in IT Strategic Plan. It is stated that by 2018 SWC will be able to demonstrate: 25% improvement in customer value; 100% of information assets quantified and categorised; and 100% of IT systems life cycle and roadmaps documented. In our view, these do not appear to be critical targets to support the rest of the business in meeting service standards or customer outcomes and it was unclear what link they have to the proposed IT investments over the current and future price paths (e.g. T2020/CxP, ERP/BxP). We believe that the IT targets should better reflect the IT department's role as customer to the rest of the business as well as directly linking to the proposed investments".*

While we have seen no reporting against these original targets, this is not crucial given our observations at the time. However, the thrust of our comments still stand in our view. There needs to be a better line of sight between the business cases and then the tracking of the stated benefits to demonstrate robustly that digital investments are either directly leading to or indirectly contributing to the delivery of better services, such as improving operational performance or customer metrics as measured by Sydney Water's Operating Licence, and/or leading to financial efficiencies.

As we have previously observed, for some areas of digital expenditure, the business cases are not sufficiently developed to justify all of the proposed expenditure and thus to allow us to come to a view on the efficiency of future expenditure. In some ways, we recognise this is a dilemma specific to digital investments: it is difficult to develop robust and detailed business cases for new or innovative technology three or four years in advance but we would still expect there to be some more detail beyond that presented to justify the level of expenditure. We believe there is a balance to strike between being overly ambitious and an early adopter of new technologies or being a laggard that is operating inefficiently. The right place to be is ready to swiftly adopt proven technology not to be taking risks at customers' expense where either the potential benefits are not clear or not justified.

While there is some evidence that Sydney Water has improved, there are still examples where the original cost estimate and/or the first business case are significantly different from the final outturn costs. Cost management of digital initiatives is something of a minefield based both from our experience in the water industry and further afield. What it is difficult to assess is whether in hindsight the original "Go/No Go" approval would have been different if the final outturn costs of some of the projects would have been considered. There is therefore still room for improvement in cost estimating from a governance perspective.

Lastly, we repeat a previous recommendation made to Sydney Water and IPART that for IT expenditure we believe the IT submission should be on a total expenditure basis rather than the existing approach which focuses on capital expenditure. The levels of IT capital and operating expenditure are broadly similar and they are inter-connected, so any assessment of prudence and efficiency is most effectively assessed by reviewing the total expenditure, which is not currently how IPART request that it is presented.

2.10. Cost allocation

Sydney Water has continued to use the Regulatory Cost Model (RCM) to allocate operating expenditure by Division, product and activity. The RCM approach uses a 'bottom up' methodology where information for cost allocation is provided by line managers. Where possible the RCM process assigns the directly-attributable costs to the designated product and service. The direct allocation of costs is dependent on the level of disaggregation and confidence within each Division. The reliability of data depends on the staff within each Division and consistency across Divisions.

The shared or common costs such as planning, administration, financial management, IT Digital, human resources and property costs, where these cannot be directly attributable to a product, are allocated to the core water, wastewater and stormwater products in proportion to the direct costs.

For ease of analysis and to be consistent with the RFP, we have grouped these activities into Operations, Maintenance and Corporate. The mapping of functions to these principal activities is shown in Table 2-2.

Table 2-2 Allocation of Activity Codes to functions (Source: Atkins/Cardno analysis)

Primary Function	Function	Activity
Operation and Maintenance	Customer Delivery	Operation and maintenance of treatment works, distribution networks, sewerage systems, biosolids disposal Liaison with bulk water suppliers and BOOT treatment plants Customer Billing, Metering Customer Contact and Compliance.
	Liveable Cities	Asset management, development planning, asset plans, program management, solution delivery
Administration and Overheads	Office of the MD	Strategy, Governance
	People and Corporate Services	Corporate Affairs, Competition and Regulation, Corporate Strategy, legal
	Finance Services	Business Governance, Financial Accounting, Management Accounting, Procurement
	IT Digital	Strategy, Architecture and Solutions, Applications,
	Customer Strategy and Regulation	HR functions, Health and Safety,

RCM analysis is available from 2017 with forecasts to 2024. This data is used for populating the SIR and Sydney Water's submission.

Corporate costs are allocated to the main service areas: water, wastewater, stormwater and regulated recycled water activities; corporate costs are also allocated to non-regulated services.

Transfer of Costs between the regulated and non-regulated business

The RCM process allows separation of costs between the regulated and non-regulated business. The main areas of non-regulated business are parts of the recycled water program.

Capital Expenditure

The drivers of capital expenditure are shown in Table 2-3.

Table 2-3 Capital Expenditure Drivers

Function	Activity
Maintain mandatory standards	Expenditure to maintain assets to deliver current Operational Licence standards
New mandatory standards	Expenditure to meet new environment or licence standards
Growth	Expenditure to meet demand from new customers
Government Programs	Projects undertaken under Government Direction
Business Efficiency	Expenditure which is shown to be deliver clear efficiencies to the business

Source: SIR

3. Strategic Review

3.1. Scope of review

Task 1 of the Scope of Work is a strategic review of Sydney Water's long term investment planning and its asset management systems and practices. We are required to report on

- *whether the long-term capital investment strategy is the most efficient and whether the processes supporting this includes options analysis, procurement processes, customer engagement practices, whole-of-life cycle planning and assessment of capital and operating trade-offs are best practice and therefore likely to result in efficient investment decisions;*

- *the robustness of the systems for linking asset management decisions with current and future levels of service and performance requirements including customer preferences, service standards and environmental outcomes;*

- *the key assumptions that are driving expenditure such as asset replacements, growth assessments, environmental regulatory requirements, customer standards and preferences including comments on whether these assumptions are reasonable;*

- *the way in which Sydney Water manages the risks associated with asset failure or under-performance;*

- *any particular concerns or issues related to Sydney Water's strategic processes for determining and prioritising future infrastructure expenditure and asset management decisions.*

Section 3.2 addresses performance in terms of both licence standards and environmental performance measures. The long term investment plan which we discuss in Section 3.3 is closely linked to the asset management practices and processes on which we report in Section 3.4. Risk management and the relationship to asset management is reported within Section 3.4.4.

3.2. Performance

3.2.1. Customer performance measures

Sydney Water's operating licence 2015-2020 includes three 'System Performance Standards' for water quality, systems performance standards and water conservation measures. The Operating Licence has recently been reviewed and new or revised measures have been included in a new Operating Licence which commenced in November 2019[8].

The system performance standards in the 2015 – 2020 licence comprise

- *Water Pressure Standard* – this standard requires that, in any financial year, no more than 6,000 properties experience a Water Pressure Failure;

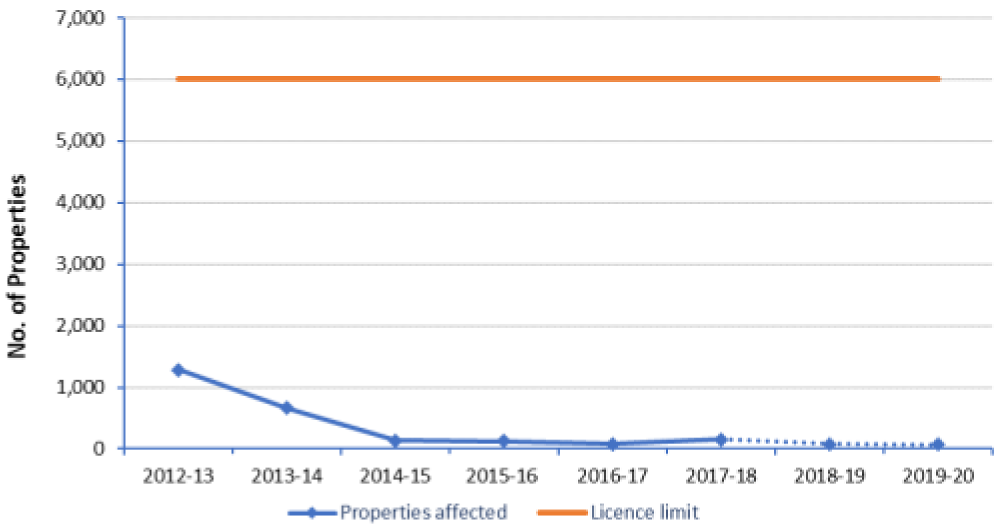
- *Water Continuity Standard* – this standard requires that Sydney Water must ensure that, in any financial year:
  (i) no more than 40,000 properties experience an Unplanned Water Interruption that lasts for more than five continuous hours; and
  (ii) no more than 14,000 properties experience three or more Unplanned Water Interruptions that each last for more than one hour
- *Wastewater Overflow Standard* – this standard required that) Sydney Water must ensure that, in any financial year:

[8] When this review commenced, the 2015-2020 was in force. The 2019-2023 Operating Licence was implemented before this review report was finalised and is now in force.

(iii) no more than 14,000 Properties (other than Public Properties) experience an Uncontrolled Wastewater Overflow in dry weather; and
(iv) no more than 175 Properties (other than Public Properties) experience three or more Uncontrolled Wastewater Overflows in dry weather.

Water pressure standard performance

Sydney Water has performed very well against the water pressure performance standard in the 2015 – 2020 licence as shown in Figure 3-1.



Source: Sydney Water submission attachment 2 Figure 2.1

Figure 3-1 Water pressure standard performance

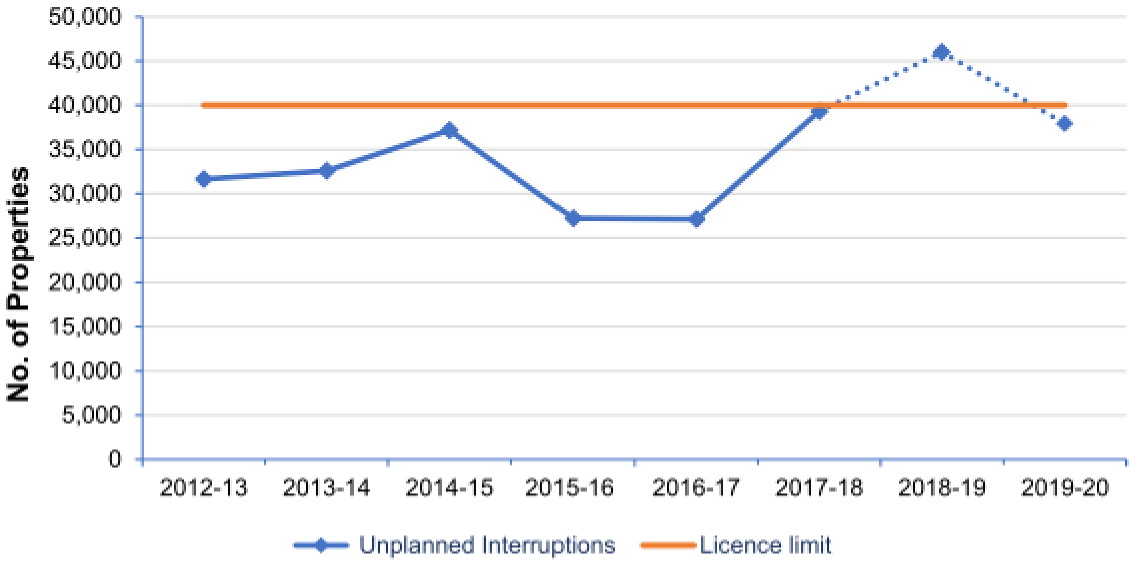
The 2019 -2023 Operating Licence has changed the standard as follows:

- The standard focuses on multiple failures (12 or more in a year) rather than single failures. This reflects customer feedback that some failure of the pressure standard is accepted but ongoing failures are less accepted.
- The duration of water pressure failures has been extended from 15 minutes to one hour which again reflects customer feedback.

The new standard will then be that at least 9,999 properties per 10,000 properties experience fewer than 12 water pressure failures. Sydney Water forecasts that it will comply with the new standard but that performance will be much closer to the new standard. The water pressure standard is not a substantial driver of expenditure in the forward period.

Water continuity standard

Performance against the measure in the 2015 – 2020 licence is shown in Figure 3-2.



Source: Sydney Water submission Attachment 2 – Figure 2-2

Figure 3-2 Water continuity standard performance

Sydney Water has performed under the licence reference level for the number of properties experiencing an unplanned interruption more than five continuous hours (licence limit 40,000) in the period from 2012/13 to 2017/18; however, in this last year performance was 39,308 properties and just under the reference level.

For year 2018-19, Sydney Water has breached the licence limit with 55,334 properties. This was due to one large interruption which affected up to 15,000 properties. This was considered an exceptional event and was the largest experienced for several years. Sydney Water forecasts that it will return to licence performance in 2019/20.

Sydney Water attributes the decline in performance in 2017/18 to increased water main breaks and an increase in the number of significant events requiring complex shutdowns. Our analysis of mains breaks suggests that there is a long-term reducing trend; we suggest the measure is driven more by the ability to respond quickly, isolate mains and repair. The 2018/19 performance is driven by a single event which impacted up to 15,000 properties. Sydney Water comments that, subject to no further exceptional events, performance should be below the reference level.

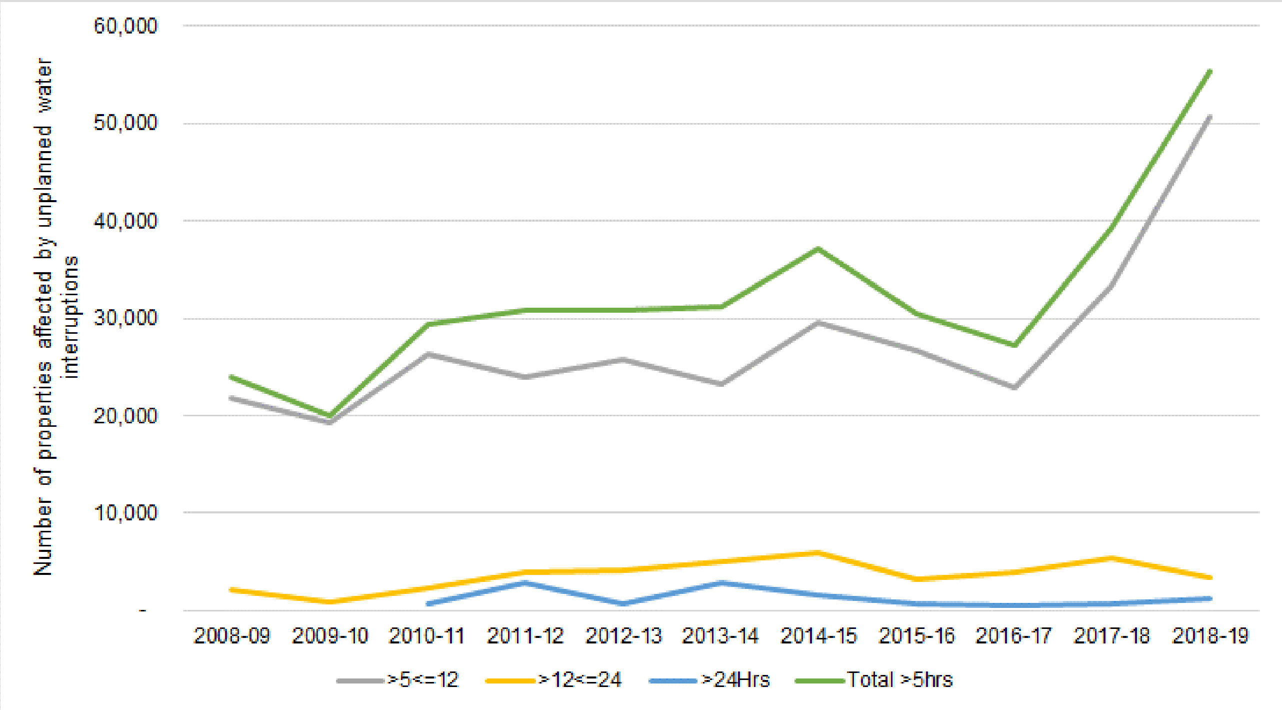
Sydney Water provided to us water interruption data for the period back to 2008/09 and broken down into the following categories for interruption duration:

- <1 hour
- 1-5 hours
- 5-12 hours
- 12-24 hours
- >24 hours

The properties impacted by interruptions lasting longer than five hours is shown in Figure 3-3. This figure shows that events with duration between five to 12 hours make up the majority of all events lasting longer than five hours.

Performance is mainly driven by the ability to respond quickly to mains bursts through isolation and rezoning to ensure continuing supplies before a repair commenced and during repair. The implementation of the Customer Hub should enable bursts to be identified quickly and a rapid response to customers provided. There may be an issue of sufficient valving to enable isolation of lengths of water main.

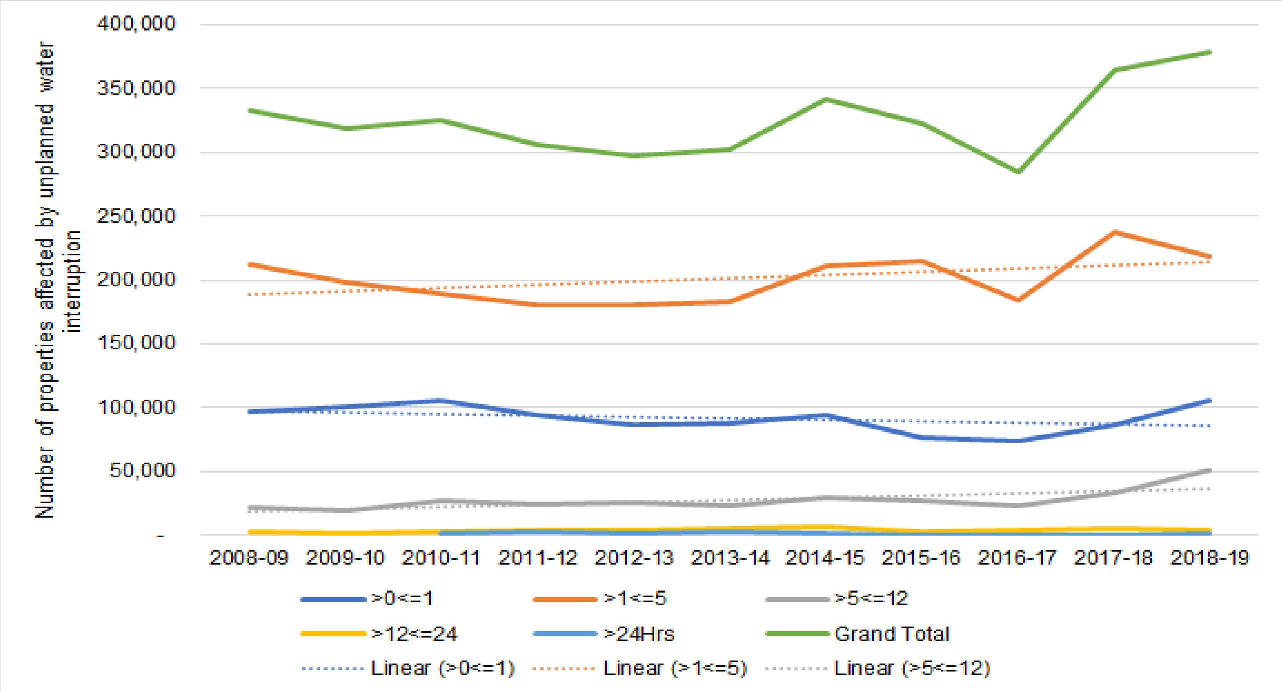
In the 2019 – 2023 licence, the limit has changed to a proportion of all properties so that the limit will increase as the total number of properties increases. The limit is intended to be equivalent to the existing limit. The 2019 – 2023 licence also requires Sydney Water to consider for water continuity the 'optimal level' and 'tolerance band' as inputs to decisions about asset management and service provision. The 'optimal level' was informed by customer engagement program and represents a small improvement in the average risk of water interruptions (assuming average conditions).



Source: Atkins/Cardno analysis of data provided by Sydney Water Corporation (113.1)

Figure 3-3 Number of properties impacted by unplanned water interruptions lasting >5 hours

When we consider water interruption events of all duration, summarised in Figure 3-4, the most significant category is interruptions with duration between one and five hours. These comprise between 58% to 67% of the total number of properties impacted over the period. Performance in this category appears to have been deteriorating since 2013/14 with an exception in 2016/17 where the number of properties impacted in this category declined which corresponded to an overall decline in the number of properties impacted.



Source: Atkins/Cardno analysis of data provided by Sydney Water Corporation (113.1)

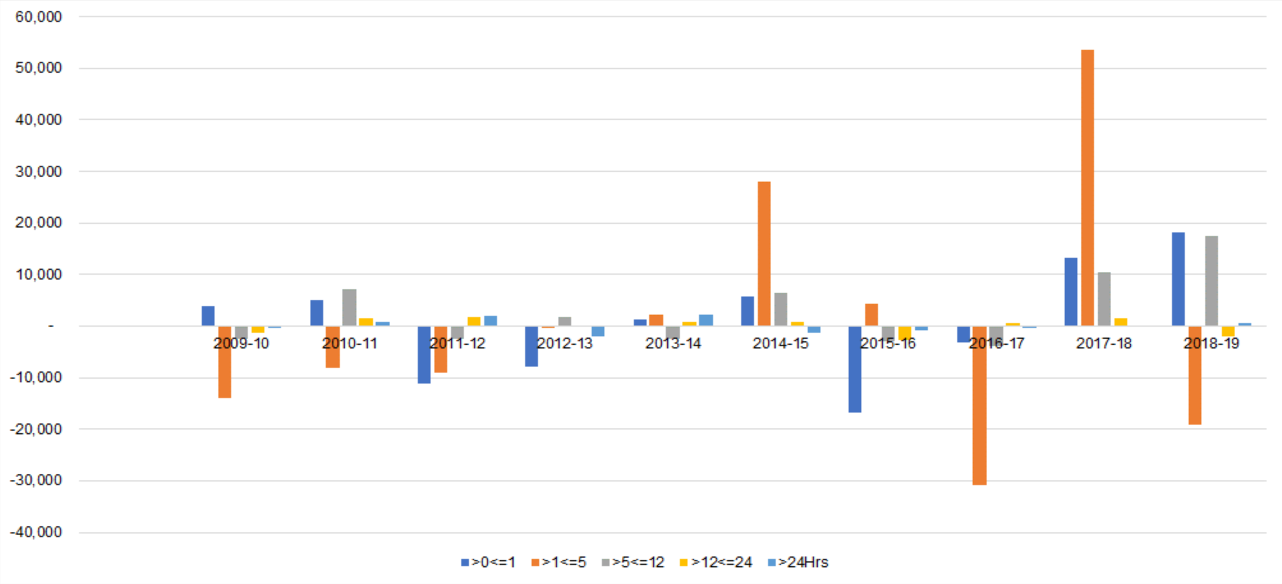
Figure 3-4 Number of properties impacted by unplanned water interruptions (all durations)

In its submission[9], Sydney Water states that:

> *In 2017–18, staff attended to increased water main breaks and leaks, plus a growing number of wastewater incidents, which contributed to a significant backlog. Having additional crews available will not necessarily reduce the duration of a single interruption (which depends on the location and complexity of the repair). However, staffing levels affect the overall backlog over time. As the backlog increases, smaller leaks can turn into bigger leaks or breaks.*

This can be seen in Figure 3-5 which shows the year on year change in the number of properties impacted by water interruptions in each duration category. The significant feature is the sharp increase (+53,566) in the number of properties in the one to five-hour duration category. This was accompanied by increases in the < one hour (+13,248) and five to 12 hour (+10,468) categories. However, these increases use 2016/17 as the starting point. In this year, the number of properties impacted by water interruptions was notably below the long term trend.

[9] Sydney Water 2020-24 price proposal Attachment 2, p10



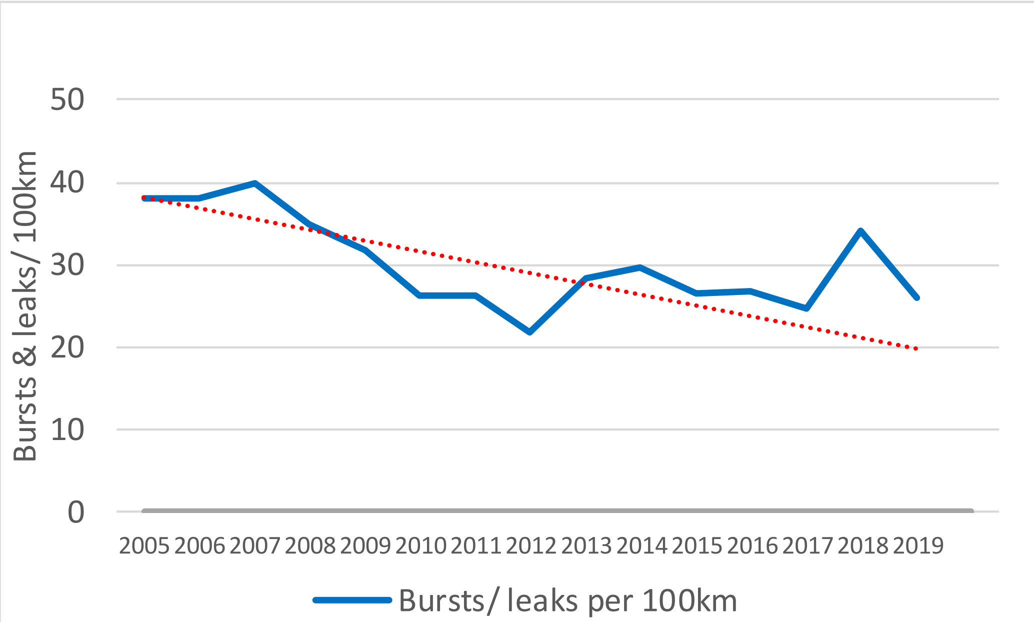
Source: Atkins/Cardno analysis of data provided by Sydney Water Corporation (113.1)

Figure 3-5 Year on year change in number of properties impacted in each duration category

Mains bursts and leaks

While not a reported performance measure, the rate of mains bursts and leaks is an indicator of asset performance and the impact of varying weather conditions on ground movement. In definition terms, bursts and leaks are both failures of a pipe asset although the consequences may differ. There is linkage between reported bursts and unplanned interruptions, although the duration of interruptions mainly relates to the operational response. For our assessment we have grouped together both measures.

Figure 3-6 shows the burst performance in terms of number per 100km over a period from 2005.



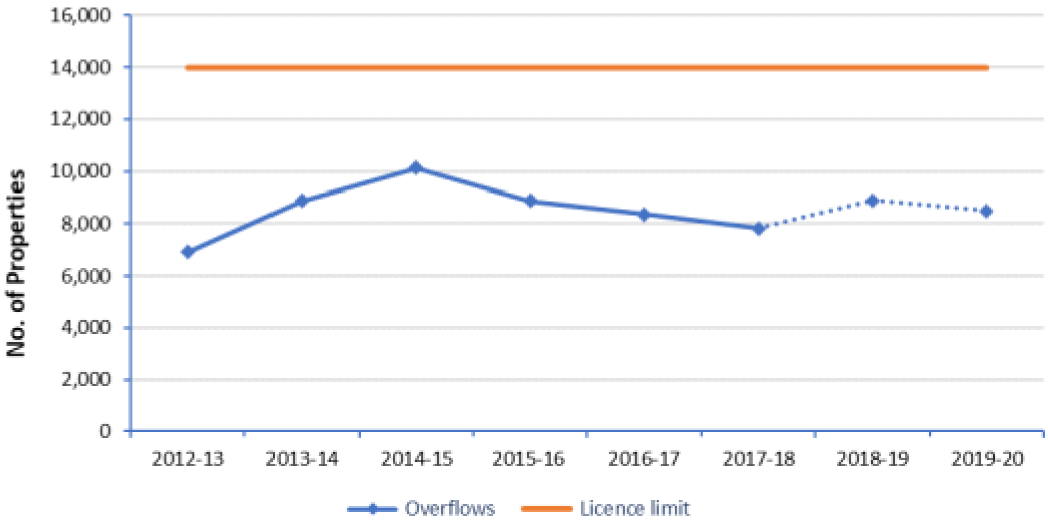
Source: Sydney Water doc 91.2, Atkins 2015 Efficiency report and analysis

Figure 3-6 Mains bursts and leaks

When we consider the full period from 2005, the annual data is variable although the trend line shows a reducing trend mainly because of the influence of the first four years. The analysis suggests that while there has been an increase in bursts in 2018, this may be considered as a local variation due to ground conditions which may not continue in future years. Our main finding from this analysis is that while greater operational inputs are likely to be needed to repair bursts, manage interruptions and reduce leakage, the long term trend suggests that the current level of renewal is appropriate.

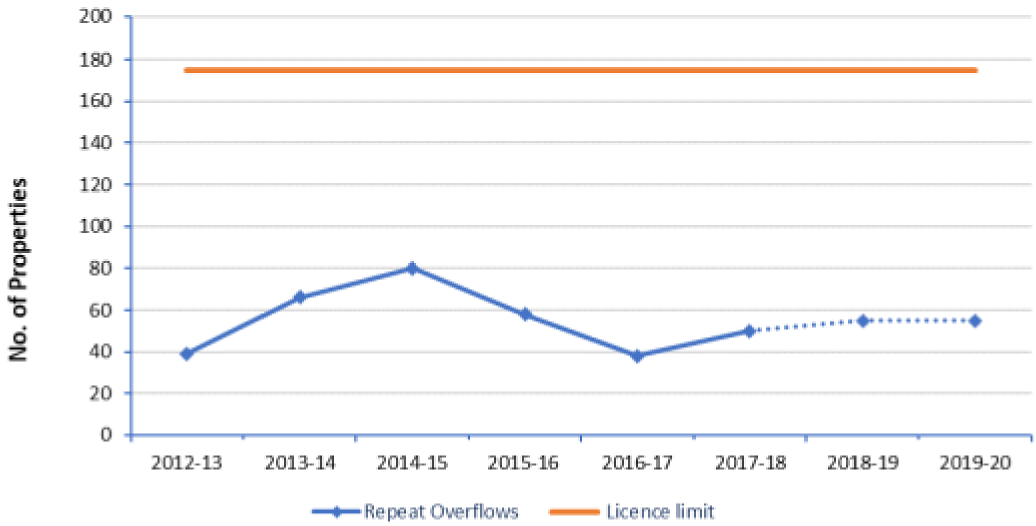
Wastewater overflow standard

Sydney Water has met the wastewater overflow standard in its 2015 – 2020 Operating Licence. This is shown in Figure 3-7 for the total number of properties impacted and in Figure 3-8 for properties impacted by multiple (three or more) interruptions. Note that both of these standards are for overflows that occur during dry weather.



Source: Sydney Water Corporation submission Attachment 2 – Figure 2-7

Figure 3-7 Wastewater overflows standard performance – number of properties



Source: Sydney Water Corporation submission Attachment 2 – Figure 2-8

Figure 3-8 Wastewater overflows standard performance – multiple overflows to property (≥3)

Note that the performance standard in the Operating Licence for wastewater overflows pertains to overflows to private properties only. Sydney Water's Environmental Protection Licences include requirements relating to all occurrences of wastewater overflows (i.e. not just to private properties). We discuss the Environmental Protection Licence requirements in Section 3.2.2.

Water conservation

Water conservation is an Operating Licence requirement. This has been enhanced in the 2019 – 2023 licence. The measures include

- water efficiency for residential and business customers: customer related - this program is dependent on reaction from customers to advertising and other promotions to reduce plumbing losses within a property;
- Leakage: asset-related - maintaining and reducing leakage is related to asset condition; reduction is within the direct control of Sydney Water;
- Water recycling: within the direct control of Sydney Water - unregulated schemes which can be used to offset potable water use.

We comment on details of the water conservation program in Section 5.3.11.

3.2.2. Environmental performance measures

Sydney Water's holds Environment Protection Licences (EPLs) issued by the Environment Protection Authority (EPA). The EPLs are granted under the Protection of the Environment Operations Act 1997 and are required to be reviewed every five years. The last review occurred in 2015. Sydney Water and EPA have been consulting on potential changes to the EPLs to be incorporated in the next review. These potential changes have been considered by Sydney Water in its submission and reflected based on the information available. This is particularly relevant to requirements relating to overflows from the wastewater network during wet weather.

Sydney Water holds 27 EPLs which cover:

- 23 for wastewater treatment systems;
- two for water filtration plants;
- one of an advanced recycled water filtration plant
- one to transport waste.

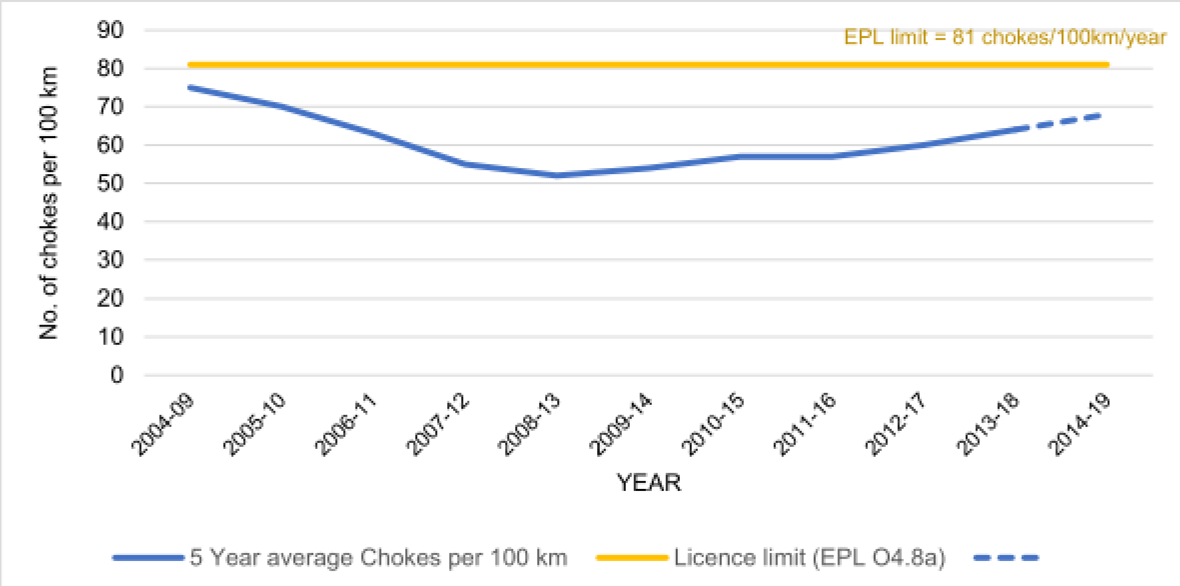
The EPLs for the wastewater treatment systems include the network of wastewater pipes, wastewater pumping stations and wastewater treatment plants and cover both effluent discharged from treatment plants and discharges from the network.

The conditions within each EPL vary depending on the nature of the system but some conditions apply across all Licences. These include conditions relating to preventing and minimising the impacts of overflows from the wastewater reticulation system. Condition O4.7 requires Sydney Water to deliver ongoing improvement in the environmental performance of the wastewater reticulation system which is partly assessed against by comparing the current five-year rolling average of chokes per 100km for all systems against the average choke rate between July 1995 and June 2000. The second measure for assessing long term improvement is the five-year rolling average of odour complaints. We note that these measures are assessed across all systems as a whole, not for individual systems.

Where an EPL is not in place for a facility or system, the general conditions of the Protection of the Environment Operations Act 1997 apply. This Act defines pollution of any waters (section 120) and any land (section 142(a)) as offences. Holding a relevant EPL is a defence against these pollution offences. While any overflow from the sewerage network outside of the parts of the network covered by an EPL should constitute an offence under the Act, Sydney Water has not been penalised for occurrence of overflows from these systems without EPLs ,

Chokes limit

Sydney Water's five year rolling average choke rate for the wastewater reticulation system is shown in Figure 3-9.



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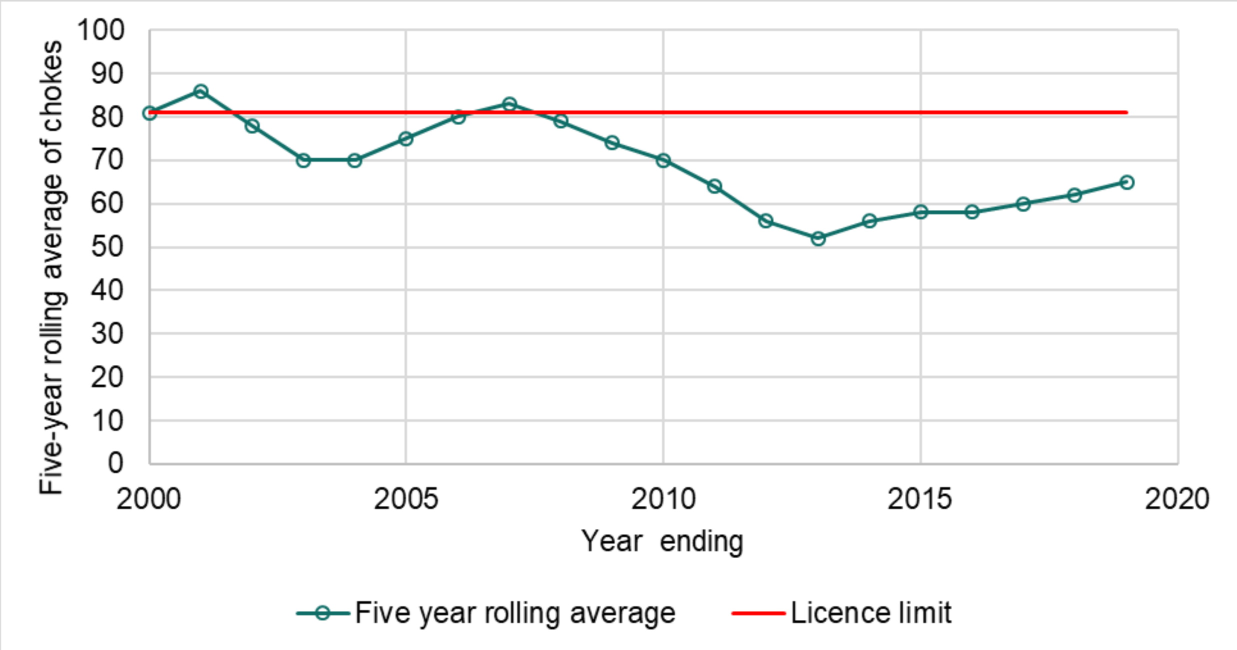
Source: Sydney Water Corporation submission Attachment 2 – Figure 3-1

Figure 3-9 Five year rolling average choke rate per 100km sewer

Recent years have seen a decline in Sydney Water's performance on this measure which Sydney Water attributes largely to the very dry conditions leading to increased root intrusions into the pipe network. While tree root intrusion accounts for around 80% of blockages in Sydney Water's sewerage network and there is evidence to demonstrate that root intrusion increases with the reduced soil moisture levels which occur during drought conditions, we note that the worsening performance has also occurred from 2015 which is before the onset of the current drought. This suggest that drought is one of multiple factors driving the deteriorating performance. Sydney Water considers that without a proactive intervention program, it will breach the five-year rolling average in 2021. However, wetter weather (i.e. a return to average weather) would also likely improve performance in this timeframe all else being equal.

While we note that sewer choke performance has declined in recent years, the longer term trend, shown in Figure 3-10, from 2000 shows that Sydney Water has made clear improvement in driving down the overall choke rate as measured by the five year rolling average. The long-term trend for the rolling five-year average reached a minimum of 52 chokes per 100km wastewater pipe in 2013 but has now increased to 65 chokes per 100km of wastewater pipe. As noted, Sydney Water attributes the increasing trend in recent years to the very dry conditions.



Source: Atkins-Cardno analysis of Sydney Water data

Figure 3-10 Long term trend for sewer chokes

Dry weather overflows to waterways limit

Of Sydney Water's 23 systems, the EPLs for 12 have limits (condition L7.4) for the number of dry weather overflows to waterways. The performance of each system against its licence limit for the last seven years is shown in Table 3-1.

Table 3-1 System level performance for dry weather overflow limit

EPL	Limit	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
North Head	142	Compliant	Compliant	Non-compliant	Compliant	Compliant	Non-compliant	Non-compliant
Malabar	122	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Wollongong	26	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Non-compliant
Bondi	19	Compliant	Compliant	Compliant	Compliant	Non-compliant	Compliant	Non-compliant
Cronulla	18	Compliant	Non-compliant	Compliant	Compliant	Non-compliant	Non-compliant	Non-compliant
Winmalee	12	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Warriewood	9	Compliant	Non-compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Penrith	8	Compliant	Non-compliant	Non-compliant	Compliant	Compliant	Non-compliant	Compliant
Quakers Hill	5	Non-compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Non-compliant
St Mary's	5	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Shellharbour	4	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
West Camden	3	Compliant	Compliant	Compliant	Compliant	Non-compliant	Non-compliant	Compliant
Total non-compliant		**1**	**3**	**2**	**0**	**3**	**4**	**5**

Source: Atkins-Cardno analysis of information provided by Sydney Water (155.1)

This analysis shows that:

- The North Head and Malabar systems have overflow limits an order of magnitude greater than the other system reflecting the size of these networks;
- There has been an increase in the number of non-compliant systems in the last three years with three, four and five non-compliant systems in 2017, 2018 and 2019 respectively;
- Four systems have been compliant in all of the last seven years. This includes the large system of Malabar with a limit of 122,

To provide insight into the level of non-compliance for each system we have ranked the number of non-compliant years for the last seven years (as a proxy for long-term performance) and the last three years (as a proxy for performance impacted by the dry conditions). This is shown in Table 3-2. Sydney Water has proposed considerable additional expenditure to target dry weather overflows to waterways. Our expectation is that this will be scoped and prioritised with regard to system level performance.

Table 3-2 Ranking of system level dry weather overflows to waterways performance

EPL	Limit	Non-compliances last 7 years	Rank in last 7 years	Non-compliances last 3 years	Rank in last 3 years
Cronulla	18	4	1	3	1
North Head	142	3	2	2	2
Bondi	19	2	4	2	2
West Camden	3	2	4	2	2
Penrith	8	3	2	1	5
Quakers Hill	5	2	4	1	5
Wollongong	26	1	7	1	5
Warriewood	9	1	7	0	8
Malabar	122	0	9	0	8
Winmalee	12	0	9	0	8
St Mary's	5	0	9	0	8
Shellharbour	4	0	9	0	8

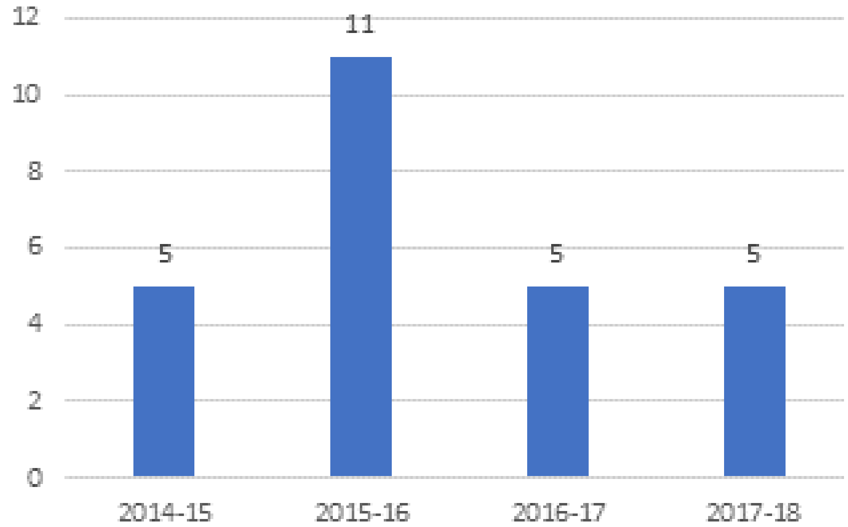
Source: Atkins-Cardno analysis of information provided by Sydney Water (155.1)

The EPLs also require Sydney Water to take all reasonable and feasible actions as soon as practicable to minimise the impact on the environment and public health of an overflow from the reticulation system or bypass from a wastewater treatment plant. The Protection of the Environment Operations (POEO) Act also requires Sydney Water to notify the EPA of a pollution incident that threatens material harm to the environment. In this areas, Sydney Water has been subject to increased regulatory oversight by the EPA. A targeted compliance campaign was undertaken between June 2017 and November 2018. Through this campaign, EPA has issued eight penalty notices, two advisory letters and one formal warning. The EPA then undertook a second campaign between May and June 2018 which resulted in the EPA issuing three penalty notices, seven formal warnings and three advisory letters. In addition to these targeted campaigns, the EPA has issued further regulatory responses relating to dry weather sewage overflows, including commencing three prosecutions with another two being contemplated. The regulatory activity described relates to Sydney Water's response to dry weather overflows. EPA considers that there are systemic shortcomings in Sydney Water's response to dry weather overflows. EPA has inserted a special clause into Sydney Water's EPLs that requires it to appoint an independent expert to investigate its response to dry weather overflows. This report is was completed in December 2019 and provided to EPA in March 2020.

Pollution concentration and load limits

Sydney Water has met pollution concentration and load limits from most of its treatment plants during the current period as shown in Figure 3-11 . There are some exceptions, such as:

- Oil and grease at Bondi WWTP
- Nutrient loads at Picton WWTP
- Oil and grease loads at North Head WWTP.



Source: Sydney Water Document – WWTP Business Case 72.1

Figure 3-11 EPL Concentration and Load Limit Exceedance

In 2017-18 there were four concentration non-compliances across three WWTPs (target was <5), (Bondi, Picton and Warriewood). In addition there was a show cause notice for effluent discharge at Rouse Hill. Non-compliance to providing specified treatment capacity generally occurs during wet weather and for only a few process units within the treatment plant.

New Environment Protection Licence (EPL) changes introduced load based bubble licencing to the Hawkesbury-Nepean in October 2019. These changes cover nitrogen and phosphorous loads and concentration limits.. Bubble licencing will enable polluters including Sydney Water to pursue a range of measure to contain nutrient loads such as increased treatment, recycling, trading and offsets.

Wet weather overflows

The Protection of the Environment Operations Act 1997 (POEO Act) is the key piece of environment protection legislation administered by the NSW Environment Protection Authority (EPA). The EPA issues environment protection licences (EPLs) to the owners or operators of various industrial premises under the POEO Act. Each of Sydney Water's 23 wastewater systems is licensed by the EPA. Sydney Water's EPLs contain limits for the number of dry and wet weather overflows that can occur.

In the late 1990s, Sydney Water prepared Environmental Impact Statements for each of its wastewater systems. This process determined a set of interim and long-term targets to be achieved by 2021. Most systems have always met their limits with periodic investments required to cater for growth or deterioration in performance. Sydney Water's largest coastal systems North Head, Malabar and Bondi which account for over 80% of wastewater by volume require significant investment to meet their long-term target of a frequency of 40 events/10 years (the limit is 20 in some catchments). Projects such as the Northside Storage Tunnel have made measurable improvements in parts of these systems.

Sydney Water has identified three high priority catchments of Upper Parramatta River Catchment; Lane Cove River Catchment and Mid Parramatta River Catchment. As well as high priority catchments, Sydney Water has five non-compliant systems where projects have been identified as shown in Table 3-3 below.

Table 3-3 Wet weather overflow non-compliant systems

System	Sub-system	Licence (L7.2) Limit (events/10yrs)	2017 events/10years
Wallacia	Wallacia	25	37
Shellharbour	Shellharbour	45	47
Wollongong	Wollongong Network	40	49
Quakers Hill	Quakers Hill	48 (19) *	40
West Hornsby	West Hornsby	27	27

Source: WWO business case

3.2.3. Performance considerations for future expenditure program

In developing our draft report and recommendations, we have relied upon our assessment of Sydney Water's performance in the current period and how the future expenditure program may impact on its performance in the future period, noting that some measures have changed due to the introduction of the 2019 – 2023 Operating Licence. We have also accounted for the information provided to us by Sydney Water in the area of environmental performance.

In our draft report recommendations, we proposed reductions to both renewals and growth programs. Subsequent to issuing our draft report, Sydney Water commented that it was concerned that the seriousness of the actual and potential future non-compliance with environmental performance requirements was not fully reflected in the recommendations of the draft report. We are aware that Environmental Protection Licences are obligations based in law and that they are not discretionary or aspirational and breaches are leading to prosecution. We also recognise that the Protection of Environmental Operations Act obliges Sydney Water to prevent pollution to land and water for all its activities, not just those subject to an Environmental Protection Licences.

In finalising this report, we have revisited our assessment of the relationship between Sydney Water's environmental performance and its current and proposed expenditure. We also recognise that the recently formalised Pollution Reduction Program for the Cronulla and North Head systems is a substantial compliance challenge that Sydney Water must respond to, and quickly, given the 30 June 2021 requirement for compliance.

One of the indicators we use to inform our view of proposed expenditure are trends in performance measures over time. We are aware that linking expenditure directly to performance measures and trends is not an exact science or a causal relationship but it is indicative of how effective past and current expenditure has been in meeting its obligations.

For the avoidance of doubt, it is our role to look at the overall package of efficient expenditure and we are not approving or excluding specific schemes or projects. It is for Sydney Water to decide how it prioritises expenditure within its overall envelope to meet all of its obligations. Where Sydney Water gains better information on the circumstances it faces, it should respond to that better information.

3.3. Long term investment plan

Sydney Water's asset planning framework (see Section 3.4.3) identifies that Strategic Capital Planning is informed by the regional, product and asset master plans. A Strategic Capital Investment Plan (SCIP) covering a 25-year, 2020 to 2044, planning horizon was developed and submitted to the State Government in May 2014. This SCIP, while incorporated within Sydney Water' asset planning framework, also responds to the State Infrastructure Strategy recommendation 92 that Sydney Water develop a "20-year Capital Plan for Sydney's water and wastewater systems". It is Sydney Water's intention to update the SCIP annually.

The SCIP covers the water, wastewater and stormwater services and considers drivers for future expenditure that include population growth, environmental standards, asset renewals, service enhancements and customer expectations. To then respond to these drivers, the Plan considers three potential approaches to servicing:

- Traditional approach – one use of water from bulk supply to use, capture and treatment of wastewater then disposal to rivers and the ocean;
- Localised water servicing – supplementing traditional systems with increased use of recycled water;
- Resilient city – supplementing traditional systems with alternative, integrated approaches.

While Sydney Water notes that the SCIP is 'consistent with' the expenditure forecasts put forward in its regulatory submission, there are also fundamental differences. Firstly, the SCIP is based on top-down assessment of long-term trends for different drivers such as population growth and asset degradation. This contracts to the regulatory submission which is largely based on a bottom-up assessment of needs. Secondly, renewals expenditure in the SCIP is based on asset age and useful life expectations only while the regulatory submission considers asset condition and risk to identify and prioritise needs for asset renewal. Lastly, the SCIP by its very nature will only identify high level responses to investment triggers while Sydney Water's actual infrastructure planning is at a lower level – the system level rather than the master plan level which the SCIP is developed at.

We consider that the long term investment plan is sound for the purpose of long term planning to inform Sydney Water's short – medium term expenditure plans. The approach is for asset renewals is based on asset age which is inconsistent with the near term planning which takes greater account of asset condition and risk. However, the aged based approach is suitable for determining a long term expenditure envelope.

We have reviewed the growth assumptions underlying the SCIP in Section 4.1.

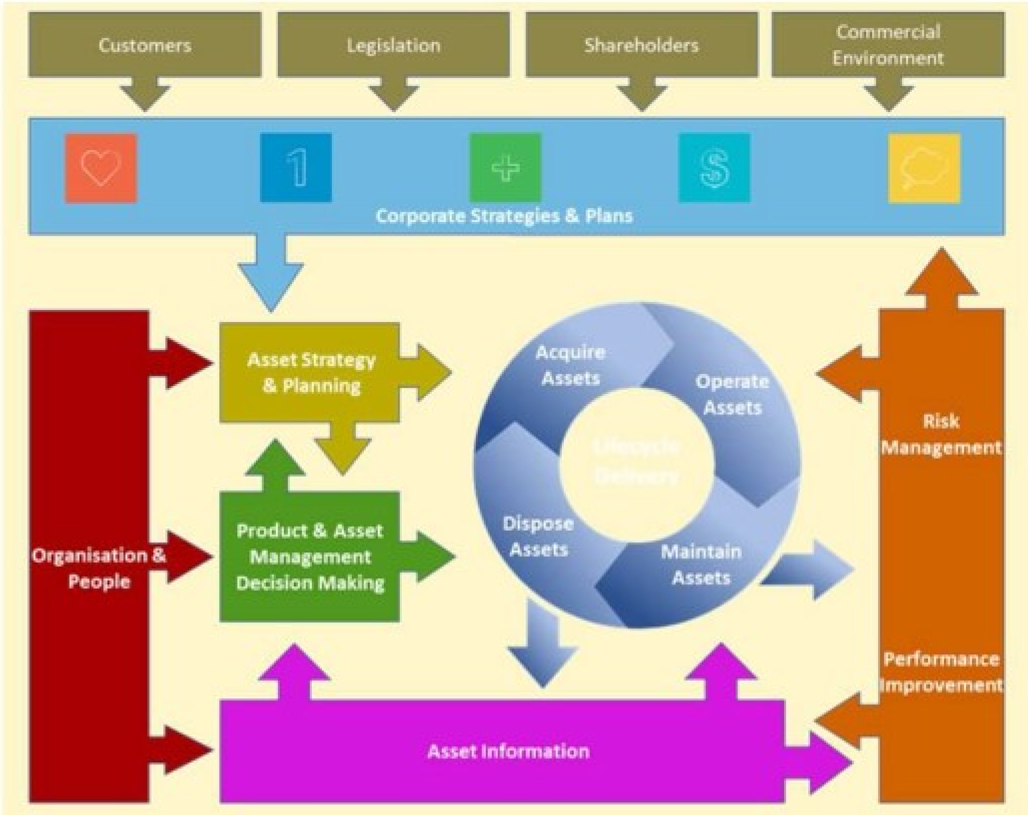
3.4. Asset management practices and processes

3.4.1. Overview

Sydney Water has had in place a long-standing asset management framework as required by its Operating Licence, although the current Operating Licence required that Sydney Water has in place an asset management system that was to be certified as meeting the requirements of the *International Standard ISO 55001:2014 Asset Management System* – Requirements by 30 June 2019. Sydney Water has achieved this certification and states that it has been consistent with the standard since June 2018. A management system approach to asset management requires greater discipline in processes and practices and to define performance and to respond to non-performance.

Audit of *Sydney Water's Operating Licence* in 2018 concluded that Sydney Water was compliant with its licence requirement to develop an asset management system (Clause 4.1.1) and the requirement to maintain its current asset management system (Clause 4.1.5) while implementing a system compliant with the requirements of ISO 55001:2014.

Sydney Water has adopted the Institute of Asset Management's (a professional body based in the United Kingdom) conceptual model for asset management as the framework for its asset management system as shown in Figure 3-12. Key features of the model are the translation of corporate strategies and plans into asset strategy and planning the breadth of asset management across the areas of: strategy and planning, decision making, lifecycle delivery, asset information, risk management and performance improvement.



Source: Sydney Water Corporation submission Attachment 15 – Figure 1-1

Figure 3-12 Sydney Water asset management system framework

3.4.2. Asset base and condition

Sydney Water's asset base has a Modern Engineering Equivalent Replacement Asset (MEERA) value of $66 billion. The asset that deliver water, wastewater, recycled water and stormwater services to greater Sydney include:

- Over 21,000 km of water mains
- Over 25,000 km of wastewater mains
- 440 km of stormwater channels and pipes
- 164 water and 680 wastewater pumping stations
- 251 water reservoirs
- Nine water filtration plants
- 28 wastewater treatment and water recycling plants
- System Instrumentation, Control and Telemetry (ICT) assets: (hardware and software)
- Water meters

Of the nine water filtration plants, four (Prospect, Macarthur, Illawarra and Woronora) were built and are owned and operated by private sector organisations. Prospect water filtration plant treats more than 65% of Sydney's water. The remaining give plants are owned and operated by Sydney Water.

The Sydney Desalination Plant at Kurnell is also privately owned and operated. This plant can supply up to 250 million litres of water a day which equates to around 15 per cent of demand.

3.4.3. Asset management objectives and planning

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

(i) 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.;

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

(iii) Sydney Water then needs to undertake planning (Clause 6.2.2) to achieve the asset management objectives;

(iv) 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).

We discuss following Sydney Water’s asset management objectives and planning. In Section 3.4.3 we discuss asset management decision making.

Sydney Water’s asset management objectives and the measures of these objectives are set out in Table 3-4. Under objective AM04, that programs of works (are designed to) achieve customer service outcomes at lowest lifecycle cost, Sydney Water captures the systems performance standards within its Operating Licence. Environmental requirements are captured under AM05 ‘We manage our assets to always comply with environmental regulatory objectives’.

Table 3-4 Sydney Water asset management objectives and measures

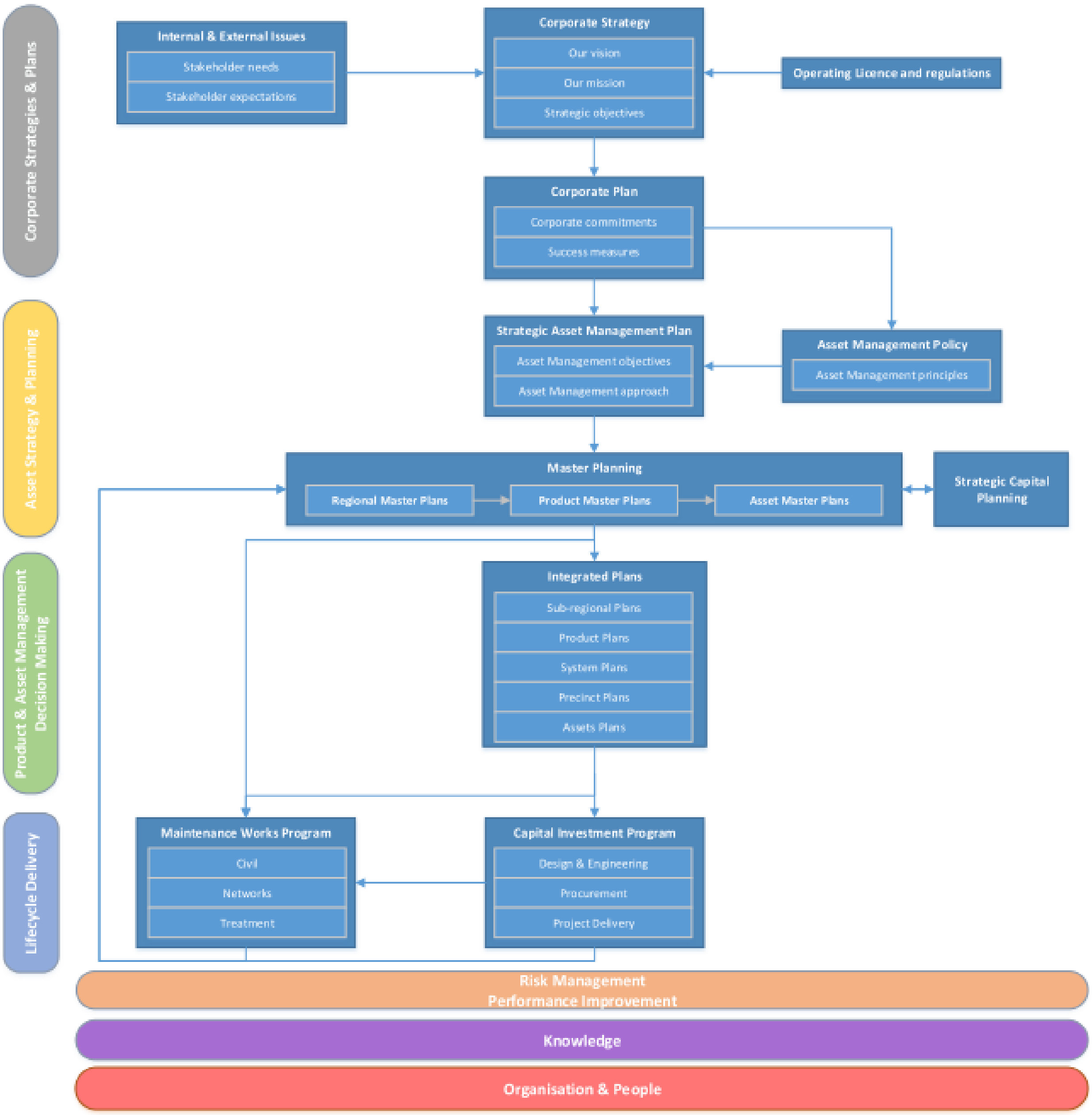
Category	SAMP Objective	Measure	Target
Asset Performance	AMO4: Programs of works (are designed to) achieve customer service outcomes at lowest life cycle cost	Operating Licence System Performance Standards:	
		- Number of properties experiencing a Water Pressure failure, in a FY	≤6,000
		- Number of properties experiencing an Unplanned Water Interruption for > 5 continuous hours, in a FY	≤40,000
		- Number of properties experiencing 3 or more Unplanned Water Interruptions that are each > 1hr, in a FY	≤14,000
		- Number of properties (other than Private properties) experiencing a dry weather overflow, in a FY	≤14,000
		- Number of properties (other than Private properties) experiencing ≥3 dry weather overflows, in a FY	≤175
		The Rate of Leakage is within the upper & lower limits of the Economic Level of Leakage (ELL)	ELL
Asset Management Performance	AMO1: We consistently deliver funded programs of investment (for our new and existing assets) achieving our outcomes sustainably	Current Financial Year Capex: % YE Forecast to Budget	
		IPART Period Capex: % Full period Forecast to Budget	
	AMO2: Improved safety performance and reduced risk profile associated with the creation, operation, maintenance, and utilisation of our assets	Enterprise risk (ER) - ER06 - Asset Planning & Delivery (BPRF)	Medium
	AMO3: Continually improving asset management capabilities and clear identification and allocation of roles and responsibilities	Regular participation in WSAA Asset Management Customer Value Benchmarking.	Regular and follow up agreed actions
	AMO5: We manage our assets to always comply with environmental regulatory objectives	WWTP Wastewater quality non- compliances	<18
		Non-compliant dry weather overflows	<300
		Networks exceeding dry weather overflow limits)	0
	AMO7: We have ready and timely access to trusted and relevant financial, customer, service, product, performance and asset info, to allow us to be	Data quality against data standards is measured, reported and actioned monthly.	

Category	SAMP Objective	Measure	Target
	responsive to changing needs or constraints		
	AMO8: Research & Innovation opportunities are actively explored and incorporated into our asset strategies and plans when appropriate	Research Projects align to Asset Management needs	
	AMO9: Clearly specified service outcomes that optimise value for our stakeholders	To be developed	
	AMO10: Internal and external stakeholders have the information and awareness levels they require, and their inputs and perspectives are appropriately considered	Service Incentive Mechanism	77
		Enterprise customer satisfaction/advocacy	8
		Corporate reputation	6.9
	AMO11: A standardised approach to risk and life-cycle costing is consistently incorporated in AMPs	Each asset class has the consequence of failure and condition information	7
		All key asset classes have decision frameworks to guide their renewals	7
Asset Management System Performance	AMO6: We have an Asset Management System that meets the requirements the ISO 55001:2014	1. Critical and Major Non-conformances	0
		2. Non-conformances / ISO overdue	<5%
		3. % Expired documents	<5%
		4. % Draft documents past guidelines	<5%
		5. Audits completed to plan	>90%

Source: Sydney Water Strategic Asset Management Plan (15.1)

Sydney Water's asset planning framework sits within its overall asset management framework as shown in Figure 3-13. The main features of this planning framework are:

- Corporate Strategy, the Corporate Plan and the Asset Management Policy guide the planning approach through establishing and informing the Strategic Asset Management Plan;
- Master planning covers three facets:
  - Regional master plans;
  - Produce master plans;
  - Asset master plans;
- Integrated plans bring together the master plan considerations and apply them to a specific geographical area.



Source: Sydney Water Corporation submission Attachment 15 – Figure 2-2

Figure 3-13 Asset planning framework

We requested Sydney Water to outline the extent to which the planning framework has been implemented and used to inform the development of its regulatory submission. Table 3-5 provides a summary of the status of Sydney Water's master planning documents. This shows that while all ten asset master plans have been developed, only two of the product master plans are complete and similarly, only two of the regional master plans are complete. While we understand that planning is an ongoing, evolutionary process this demonstrates that the planning framework is yet to be fully implemented.

Table 3-5 Summary of status of master planning documents

Master Plan	Scope	Total	Status
Regional	▪ Western Sydney ▪ Central Sydney ▪ Eastern Sydney ▪ Illawarra	4	▪ Two in preparation ▪ Two not commenced
Product	▪ Water ▪ Bioresources ▪ Waterways ▪ Energy	4	▪ Two complete ▪ One drafted ▪ One not complete
Asset	▪ Water mains ▪ Water Pumping Stations ▪ Water Reservoirs ▪ Water Filtration Plants ▪ Sewer mains ▪ Wastewater Treatment Plants ▪ Wastewater Pumping Stations ▪ Stormwater ▪ Reliability ▪ Control and Monitoring Systems	10	▪ All complete and due for revision my mid-2020

Source: Atkins-Cardno analysis of information provided by Sydney Water (115.1)

At the integrated planning level:

- 25 of 29 wastewater system integrated plans (blueprints) have been completed. The plans under development or to be developed are for Brooklyn, Riverstone and Picton;
- 11 of 12 water system integrated plans (blueprints) have been completed. The plan for the Illawarra water system is under development.

Sydney Water identifies that the integrated planning approach at system level allows it to better consider:

- A system holistically (e.g. network and treatment together);
- Multiple drivers and their interactions;
- System performance and optimisation;
- Risks and trade-offs.

Sydney Water considers that this integrated planning approach is a significant improvement on the 'traditional approach' of planning for assets and drivers in isolation. The system level integrated plans are to be reviewed.

3.4.4. Risk management and asset management decision making

Sydney Water's Strategic Asset Management Plan sets out that it has appropriate structures in place to support decision making including committees, forums and group as well as process council and working groups.

Decision making is guided by the following corporate level decision frameworks:

- Business Resilience Framework;
- Risk Framework;
- Safety Framework;
- Environmental Governance Framework;
- Quality Management System Framework.

The risk management framework is aligned with *AS/NZS ISO31000:2009 Risk management – Principles and guidelines*. The framework document described the processes for assessing risks and responding to them. The risk framework describes risk themes which map to Sydney Water's strategic objectives and define the areas of uncertainty to which they apply. Through this mapping of risk themes, Sydney Water is able to demonstrate alignment between its approach to risk management and its approach to asset management. The risk themes are detailed in Table 3-6.

Table 3-6 Risk themes

Strategic objectives	Enterprise risk themes	Content
Customer at the heart	Strategic customer	Uncertainties related to customer expectations.
	Public Health	Uncertainties related to significant harm to public health.
	Safety	Uncertainties related to significant harm to workers.
	Environmental	Uncertainties related to significant harm to environment
	Resilience	Uncertainties related to reasonably foreseeable business interruptions
	Legal and regulatory compliance	Uncertainties related to significant compliance breaches
	Reputation	Uncertainties related to stakeholder and customer trust, long term brand and corporate reputational impact
High performance culture	People	Uncertainties related to organisational culture, and people capabilities
	Organisation and change	Uncertainties related to major change and transformation
	Legal and regulatory compliance	Uncertainties related to shifting obligations and stakeholder expectations.
World class performance	Asset	Uncertainties related to infrastructure assets
	Third party	Uncertainties related to sole or critical suppliers.
	Technological	Uncertainties related to disruptions to IT systems.
	Financial	Uncertainties related to financial performance.

Source: Sydney Water Risk Management Framework (11.2)

A crucial consideration for a risk based decision making approach is the level of risk that the organisation is willing to pursue or retain whilst pursuing its organisational objectives. This is known as risk appetite. Sydney Water's Risk and Opportunity Management Policy describes the organisational risk appetite broadly aligned with the risk themes set out above and the policy requires that risk be identified, assed and managed in accordance with this risk appetite. Sydney Water's risk appetite is summarised in Table 3-7.

Table 3-7 Risk appetite

Risk appetite	Enterprise risk themes (broadly)	Risk appetite statement
Averse – opposed to risk taking	Public Health	Sydney Water must always protect public health.
	Safety	Sydney Water will make significant investments to avoid or address safety risks.
	Reputation	Sydney Water will maintain the trust and confidence of its external stakeholders by making transparent decisions and acting with integrity. Sydney Water may sometimes do things for customers that it is not obliged to do
Minimal – least possible risk taking	Environmental	Sydney Water will always strive to outperform environmental regulatory requirements where the customer expects it to and it can do so in a commercially responsible way (i.e. ensuring long-term financial sustainability).
	Regulatory standards	Sydney Water will always strive to meet regulated standards. When standards do not achieve the best customer outcomes and Sydney Water has the opportunity to influence them, Sydney Water should seek the necessary changes.
	Fraud / corruption	Sydney Water is an ethical organisation and expects and trusts its employees and service providers to be ethical. Sydney Water has no tolerance for fraud and corruption.
Cautious – calculated risk taking	Decision making	Sydney Water should always seek to gather the best available data and information. If data and information is poor or missing, Sydney Water will rely on appropriate expertise to guide its decisions. Where the expectations of success are low, Sydney Water should not proceed
Willing – engage with risk or pursue opportunities	Outsourcing and competition	Sydney Water welcomes competition and outsourcing, but if Sydney Water can do it better, then it should.
	Non-regulated standards	Sydney Water can exceed regulated standards but should stop meeting standards that go well beyond regulatory requirements that are not demonstrably in the customers' best interest.
	Innovation	Sydney Water should innovate as part of its responsibility as a water industry leader.
	Transformation	Transformational change is an important part of achieving Sydney Water's strategic objectives. Sydney Water will bring its workforce on the journey and it recognises that changing its culture will take time. Sydney Water will identify and manage its change impacts well.

Source: Sydney Water Risk and Opportunity Management Policy (11.1)

Sydney Water's documented approach to risk management is mature and relatively sophisticated. The risk appetite statements are a very useful reference point for asset management decision making.

The corporate level frameworks (such as risk management) are applied to specific asset classes and asset types within 'process level' decision frameworks. These process level decision frameworks include decision making approaches based on economics, finances and risk. Predominantly, decision making is on a least cost basis to meet a requirement or on a risk basis to achieve an acceptable level of risk. Examples of process level decision frameworks include:

- Planning Decision Framework;
- Facility Asset Decision Framework;
- Critical Water Main Renewal (AMQ0035);
- Avoid Fail Sewer Renewal (AMQ0015);

- Dry Weather Overflow Management (AMQ0139).

Decision framework are supported by various standards and tools tailored to the asset type or class. Our review of forward expenditure has evaluated the appropriateness of these frameworks to support the development of prudent and efficient expenditure forecasts.

Risk based decision making is particularly important for the renewal of existing assets. Broadly, Sydney Water determines a lifecycle management strategy for assets within each asset class depending on their assessed consequence of failure. Assets with a relatively high consequence of failure are classed as “avoid fail” and are managed accordingly while assets with a relatively low consequence of failure are classed as “plan to repair”. That is, the assets are allowed to fail and Sydney Water then reacts by repairing or renewing the asset. Supporting these two broad lifecycle strategies is an assessment of the risk of failure of the asset or asset class where the condition of the asset is a proxy for likelihood of failure and combined with the assessed consequence to determine risk. This approach is in line with industry practice.

Table 3-8 shows a high-level summary of the status of the implementation of the risk-based approach across asset classes through ”Project See”. Project See was commenced during the current period for this purpose. The approach is still to be applied to water pumping stations, sewage pump stations and reservoirs.

Table 3-8 Status of implementation of risk approach across asset classes

Major asset class	Condition grading	Consequence	Risk profile	Applied in program business case	Decision frameworks	Workflow
WWTP	✓	✓	✓	✓	Renewal planning standard	✓
WFP	✓	✓	✓	✓	Renewal planning standard	✓
Sewer mains	✓	✓	✓	✓	Avoid Fail Dry Weather	✓
Water mains	✓	✓	✓	✓	CWM reticulation	✓
SPS	Project See 4 Networks ~Dec 2021	By Dec 2019	✓	For renewal projects only	Facilities	✓
WPS			✓	For renewal projects only	Facilities	✓
Reservoirs			✓	For renewal projects only	Reservoir	✓

Source: Sydney Water presentation on Asset Renewal Planning (251.1)

Fundamental to this approach is Sydney Water’s assessment of the consequence of failure of its assets and the robustness of the condition information it holds. Sydney Water has undertaken considerable condition assessment in the current period to improve its knowledge of its assets. However, we have seen that for some asset classes, condition information is not sufficient to provide an informed view of the state of the asset base. For example, with respect to wastewater pump station civil assets which we discuss in more detail in Section 6.5.1.

Also, through our review of the wastewater pumping station renewal program, we were provided with Sydney Water's guideline for Level 1 (visual) condition assessment. This is the *Asset Life Cycle Grading for Condition Based Asset Valuation (161.1*) guideline. This guideline applies across asset classes. We make the following observations regarding this guideline:

- The guideline is based on the 2001 version of the International Infrastructure Management Manual. The latest revision of this document was released in 2015
- The condition grading table at section 2.4 assigns conditions grades on a 1 (very good) to 5 (very poor) scale. While a scale of this type is in line with industry practice and Sydney Water does provide different guidance for different disciplines (civil / mech/elec / maintenance), the descriptions for each level are generic and do not give good guidance for specific asset classes
- Further, each rating is aligned with an assessed remaining useful life. For example:
    - 4 (Poor) = Two years remaining useful life (for all civil and mechanical/electrical assets except for pipelines for which remaining useful life is 5 years)
    - 5 (very poor) = Zero years remaining useful life (as failed or failure is imminent)

  Contemporary practice is that remaining useful life is expressed as a proportion of the expected useful life to be more meaningful. Under Sydney Water's current approach, a communication asset with expected useful life of seven years is treated the same as a civil asset with expected useful life of 80 years.
- Good industry practice will consider multiple dimensions of asset condition including performance, functionality, integrity and compliance. This is a more mature approach that takes time to evolve.

Based on the above assessment, we consider that there is an opportunity for Sydney Water to substantially overhaul its approach to asset condition assessment, across all asset classes. Sydney Water has commenced "Project See" in the current period for this purpose.

Sydney Water has in place a Consequence of Failure Standard which defines how it determines the consequence of failure score (a score between one and six) for each asset. Assets are scored against each of the nine consequence categories of public health, safety, reputation, environment, compliance, financial, community, customer and performance. The highest scoring category is taken as the consequence score for the asset. The six level of consequence are: catastrophic or exceptional (6), critical (5), major (4), moderate (3), minor (2) and negligible (1). To apply the consequence of failure standard, Sydney Water has developed guidelines for each asset class which provide guidance on how each risk category should be assessed against the consequence ratings. An extract from the consequence of failure assessment guideline for gravity sewer mains is provided in Table 3-9.

Table 3-9 Extract from consequence of failure assessment guideline for gravity sewer mains

Consequence rating	Corporate consequence (Environment)	Interpretation used for consequence of failure assessment
Catastrophic or exceptional	Widespread, irreversible impact on a highly sensitive receiving environment.	Overflow volume > 500ML.
Critical	Widespread impact on a highly sensitive receiving environment. Requires extensive remediation, or >10 years to recover naturally.	Overflow volume between 10ML & 00ML
Major	Localised impact on highly sensitive receiving environment (including heritage sites), or Widespread impact on sensitive receiving environment. Requires substantial remediation, or 1-10 years to recover naturally.	Overflow volume between 1ML & 10ML.
Moderate	Localised impact on sensitive environment. Requires some remediation, or < 1 year to recover naturally.	Overflow volume between 500kL & 1ML.
Minor	Localised impact on natural environment. Short lived (less than 1 week).	Overflow volume between 100kL & 500kL.
Negligible	No impact on natural environment	Overflow volume up to 100kL

Source: Gravity Sewer Main Consequence of Failure Assessment Guideline (160.2)

We consider that this approach to risk based asset management decision making is sound. However, this approach relies on the availability of condition information (collected or assumed but it needs to be sufficient) and thorough application of the consequence of failure assessment. We challenged Sydney Water to demonstrate that the approach was giving robust results. Sydney Water responded that the approach has only been in place for around a year and therefore limited work has been undertaken to evaluate and enhance the methodology. Sydney Water noted that a review had been undertaken of the application to wastewater treatment plant but the results were not documented.

Our experience is that these methodologies take time to mature so that the modelled asset risk aligns with that perceived by the business. Areas that need to be tested and subject to continual improvement include:

- Calibration of the consequence of failure statements. This typically requires review of actual asset failures to assess whether each category is described appropriately relative to each other. This is difficult for the higher consequence categories which are less likely to occur
- Consideration of the ability for operational strategies to mitigate the consequence of failure
- Consideration of the ability of asset redundancy to mitigate the consequence of failure
- Comparison of the consequence of failure across asset categories.

We consider that Sydney Water has a good understanding of what it will take to embed and improve this approach and that these improvements are likely to be implemented over the coming regulatory period. However, we consider that a cautious approach needs to be taken when considering expenditure that is largely justified on a risk basis in Sydney Water's regulatory submission. In our project and program reviews we have sought to test the application of this methodology.

3.4.5. Program development and prioritisation

Sydney Water's capital expenditure program for the forward period is generally based on bottom up evaluation of needs as documented in planning documents or analysis specific to the particular asset class. The capital expenditure program for the forward period is documented in a series of 'Program Business Cases'. Program Business Cases typically apply to a particular asset class (or group of similar asset classes) and for a single driver. For example, the Reticulation Sewers Capital Program Business Case (Draft) applies to reticulation wastewater pipes (excluding critical sewers) and vent shafts for the corporate driver of existing mandatory standards.

The Program Business Cases document consistent content for the capital expenditure program including strategic alignment, scope and outputs, options analysis and finance and delivery strategy. Our review of Sydney Water's forward expenditure plans has relied on these Program Business Cases as the primary reference. Sydney Water considers that ongoing improvement to its processes and asset information (e.g. the introduction of integrated planning and more extensive asset condition information) have been reflected in the expenditure proposed in these Program Business Cases. The total level of capital investment proposed through the bottom-up summation of Program Business Cases was $6,196 million for the five-year period from 2020 to 2025 (for infrastructure only, i.e. excluding information technology). This total is for that proposed within the June 2019 SIR. The capital expenditure proposed through the November 2019 update was not subject to this same prioritisation process. The November 2019 expenditure (except for some rephasing of items) is in addition to that proposed through the June 2019 prioritisation.

While Sydney Water considers that the expenditure proposals submitted were optimised, it then subjected this bottom-up program to the following top-down adjustments, efficiency challenges and rephasing:

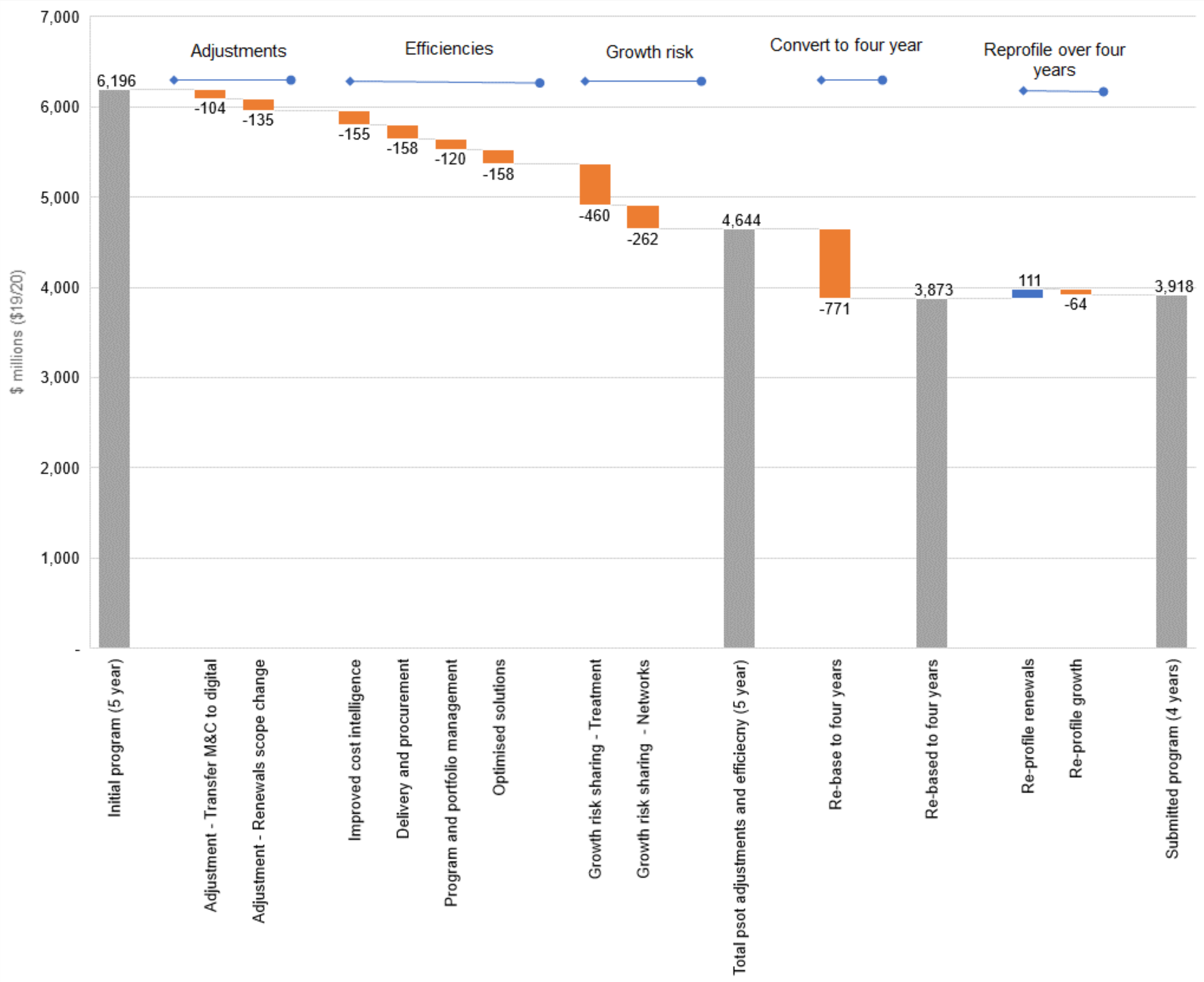
- Reassigning the monitoring and control program (e.g. SCADA) to digital and therefore not included in the infrastructure total
- Changes to the scope of renewals
- Application of expected efficiencies to be gained through improved cost intelligence, delivery and procurement improvements, program and portfolio management improvements and improvements for optimised solutions
- Reduction in growth expenditure for appropriate 'risk sharing'

Sydney Water has then re-profiled expenditure on renewals and submitted a four-year program only. These adjustments are shown in Figure 3-14.[10]

Of the initial starting infrastructure program of $6,196 million (June 2019), $3,283 million is for expenditure on infrastructure renewal and $2,808 million is for growth related expenditure. The total quantum of efficiencies applied to renewals expenditure is $591 million, representing 18% of the bottom-up program for renewals. These efficiencies are applied after a top-down reduction of $135 million due to scope challenge (representing 4% of the originally submitted program for renewals). The reduction in growth related expenditure forecasts is $722 million representing 26% of the originally submitted bottom-up program for growth. We discuss the treatment of growth-related expenditure in further detail in Sections 6.4.2.2 and 6.5.3.2.

Sydney Water then rephases growth expenditure so that $228 million is pushed back from 2020/21 and then spread across 2022/23, 2023/24 and 2024/25 with a net impact of a reduction of $64 million in the four year period. Renewals expenditure is rephased so that an additional $110 million is brought into the four year period.

[10] This figure and the accompanying discussion are based on item 220.1 Efficiency challenge breakdown. This figure is based on real $19/20 figures. Other references that discuss the efficiency challenge applied by Sydney Water are in $18/19 figures which leads to some small differences in reported figures.



Source: Sydney Water analysis 'efficiency challenge breakdown' (220.1)

Figure 3-14 Development of Sydney Water's proposed capital expenditure program

Each program business case details the adjustments and efficiencies applied to that component of expenditure. The level of efficiency applied varies between program depending on the expectation for being able to gain efficiency and the evaluation of the risk to delivering program outcomes with less expenditure. For all efficiencies applied, Sydney Water expects the same outcomes to be achieved. It has also applied some additional program specific efficiencies where it considers that further efficiencies may be gained, e.g. through improved lining techniques for water main renewal. The level of efficiencies applied to each program and the anticipated source of these efficiencies across each of the four drivers is shown in Table 3-10. This table also shows how Sydney Water adjusted the total level of efficiencies applied for each program from the initial assessment and its final step of recasting expenditure for a four year program.

Table 3-10 Summary of top-down efficiencies applied by program area

Program Area	% reduction applied through Top Down efficiency challenge				5-Year total	Notes on changes	4-Year total
	Cost Estimation	Delivery & Procurement	Prog & Port Management	Optimised Solutions			
Critical Water Main	4.90%	4.50%	5.60%	5.00%	20%		20%
Retic Water Main	5.90%	4.10%	5.20%	5.00%	20%		20%
Water Reservoirs	4.10%	4.20%	2.90%	5.50%	17%		17%
Water Pumping Stations	2.30%	4.20%	2.90%	5.20%	14%		14%
Critical Sewers	3.10%	4.10%	5.20%	5.00%	17%	Significant scope and dollars added to program.	0%
Retic Sewers	2.50%	6.30%	5.20%	5.00%	19%		19%
WW Pumping Stations	6.30%	6.20%	4.50%	5%	22%		22%
Wet Weather Overflow	10.40%	6.10%	5.30%	5.00%	27%	Uncertainty over regulatory points mechanism.	0%
Wet Weather Surcharge	0%	6.50%	4.40%	5.00%	16%		16%
Stormwater renewals	6.20%	4.10%	2.50%	5.00%	18%	Program re-profiling over 5 years.	21%
Waterway Health	6.10%	4.60%	4.60%	5.10%	21%	Prolongation of program post 2024.	40%
Flood Risk	6.40%	6.10%	2.00%	4.90%	20%	Program re-profiling over 5 years.	24%
Treatment – Wastewater Treatment Plant	8.30%	4.20%	3.20%	5.00%	21%	Reprofiling of embedded RBO's into 5th year.	34%
Treatment - Water Filtration Plant	3.20%	3.80%	3.80%	5.20%	16%		16%

Source: Sydney Water analysis 'efficiency challenge breakdown' (220.1)

It is instructive to compare the total level of top-down efficiencies applied to each program and the change in the applied level of efficiencies between the initial five year program and to finally arrive at the four year program. In Figure 3-15 these two values are compared for each program. While most programs are clustered around the average level of efficiency of 18% with little or no change between the initial and final levels of efficiency applied, two groups comprising four programs stand out which we interpret in terms of Sydney Water's appetite for taking on risk in realising efficiencies in the forward period as follows:

- Risk seeking – for the waterway health and wastewater treatment plants program, Sydney Water has applied both a high level of efficiencies (40% and 34% respectively) and increased these by 10-20% in its final review
- Risk averse – for the critical sewers and wet weather overflow programs, Sydney Water has reduced level of applied efficiency that were initially in line with the other programs (17% and 27% respectively) to zero.

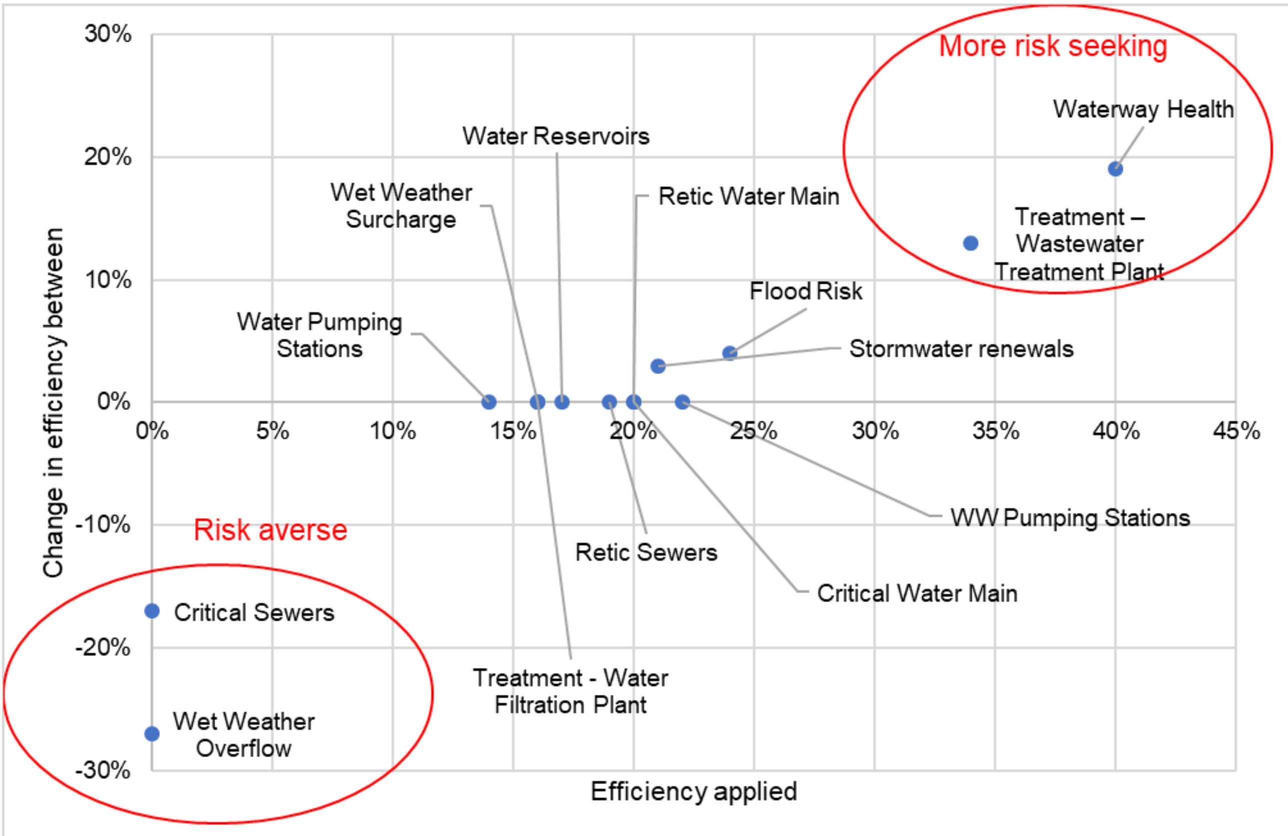
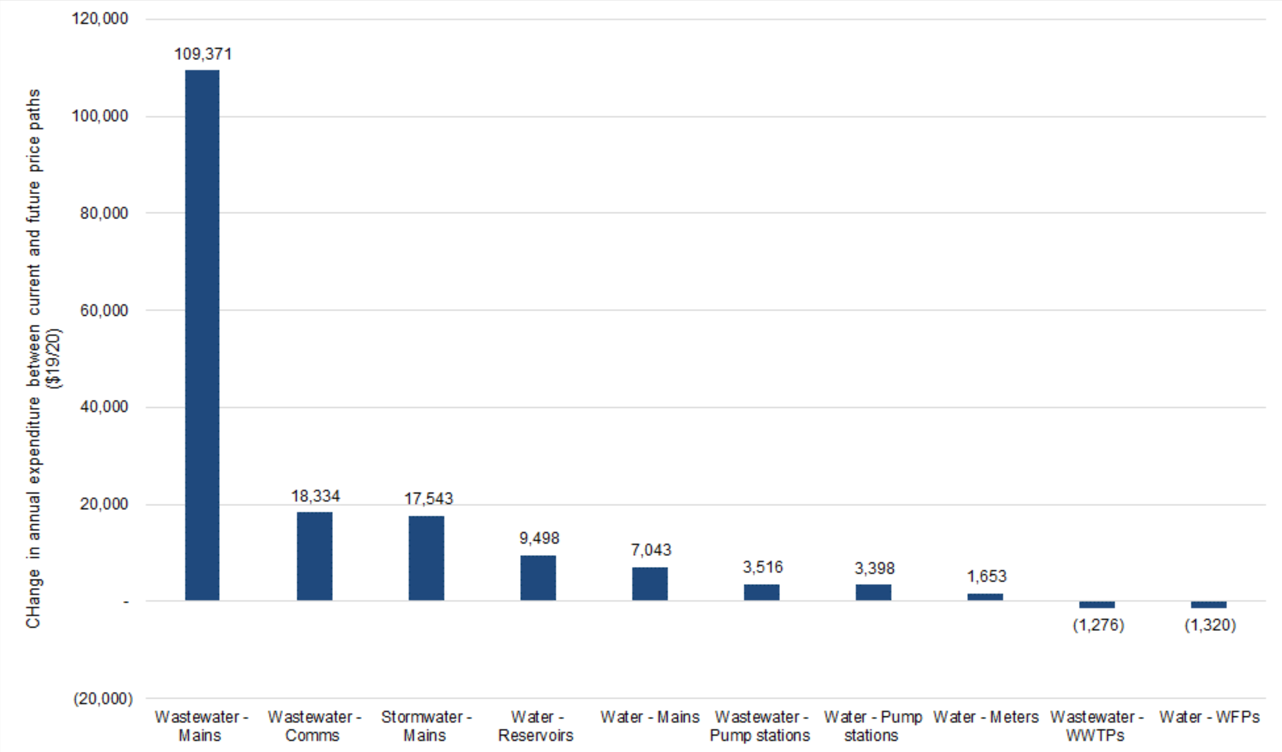


Figure 3-15 Comparison of efficiency challenge applied and change in efficiency between stages

We consider that Sydney Water's approach to program development in applying adjustments and efficiency challenges top-down demonstrates increased maturity and willingness to respond to its regulatory environment. We challenged Sydney Water as to what extent its assumed efficiency gains were quantified or based on judgement. Sydney Water responded that all efficiency challenges reflect some level of judgement but that it has considered the information available to it. For example, the 'delivery and procurement ' component of efficiency is founded on the introduction of the 'Partnering for Success' (P4S) model (discussed further in Section 3.4.7) which Sydney Water estimates will deliver efficiency gains of $35 million per year on a $770 million expenditure program (equating to 4.5% as typically applied). We confirmed that this level of efficiencies is consistent with Sydney Water's board papers for approval of P4S.

While we acknowledge the challenge applied by Sydney Water to its renewal expenditure, the reality is that most renewals program show an increase between the current period and the future period. This is shown in Figure 3-16. In total, Sydney Water proposes an increase in annual expenditure on renewal of infrastructure assets of $162 million per annum. Two-thirds of this total is for wastewater mains. We comment further on specific renewal programs in Section 6.



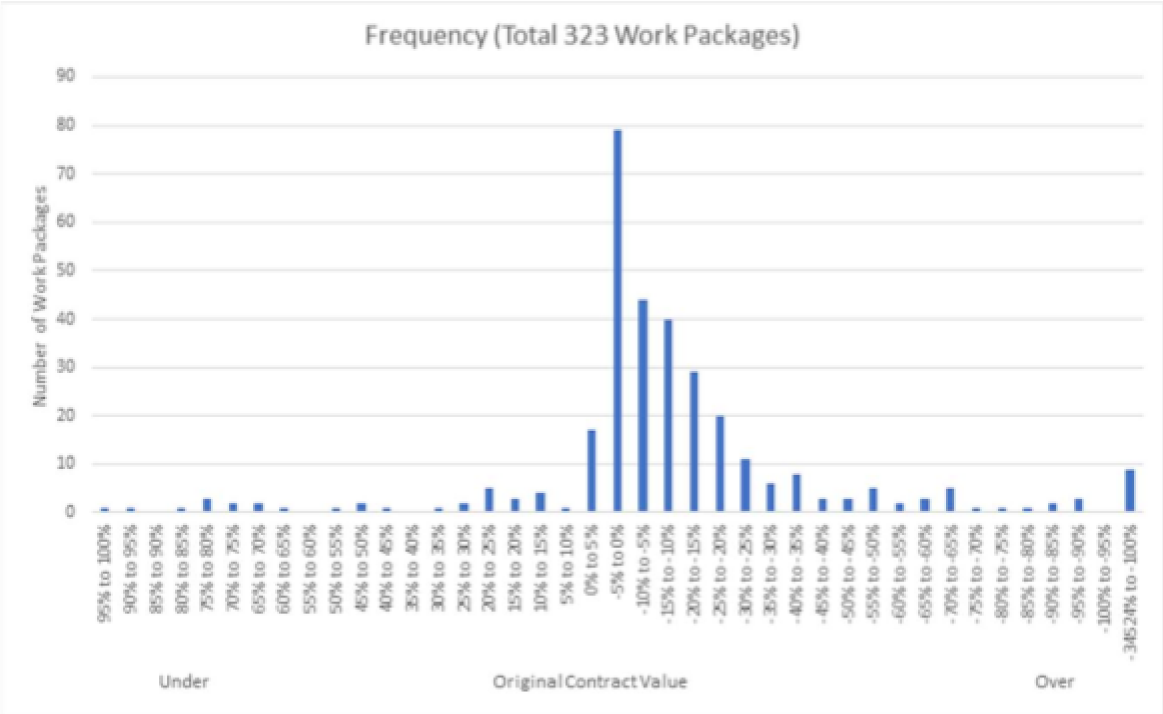
Source: Atkins-Cardno analysis of SIR

Figure 3-16 Change in annual expenditure on renewal of infrastructure assets between current and future determination period ($19/20, $ '000)

3.4.6. Cost Estimation

Sydney Water has identified in the current period that cost estimation is an area in which improvements could be made. It has increased its cost estimating resources and put in place a unit rates database, CANDY. It uses its internal cost estimating resources and database for developing estimates of contract outturn costs which are used for direct negotiation of contracts with its contractors. We challenged Sydney Water to demonstrate that this unit cost database was maintained with current data to inform estimating. Sydney Water responded that the database reflects contract rates for labour and plant and that material costs are included in the database when new information is received. For the last three years, Sydney Water has included around 1,000 additional cost data points in CANDY each year.

To test the robustness of its cost estimating processes, we requested Sydney Water to provide analysis showing the variance between awarded contract value and the outturn contract value for a sample of contacts. Sydney Water provided analysis for 2018/19 which showed an average of 15% increase in the outturn cost compared with the awarded contract cost. The distribution of variances in costs is shown in Figure 3-17. This figure shows a clear skew to outturn costs exceeding awarded contracts costs.



Source: Sydney Water analysis (combined response to 98, 125-128)

Figure 3-17 Analysis of variance between awarded and outturn contracts for 2018/19

Sydney Water notes that variances in contract value reflect how risk is allocated between its contractors and itself. Sydney Water considers that its current contracting approach has a largely one dimensional approach to risk management in that the awarded contracts are based on defined risks retained by Sydney Water and an assumption that all other risks are held by the contractor. Sydney Water is then responsible for the costs of the realization of any risks allocated to it. Analysis undertaken by Sydney Water of contract change events (variations) for 2018/19 show that the largest drivers for variations are as follows (out of a total of $38.32 million of variations):

- Scope changes - $18.6 million
- Latent conditions - $7.10 million
- Design - $5.41 million.

As detailed in Section 3.4.5, Sydney Water has applied a top-down efficiency for anticipated gains for improved cost estimating in the forward period. The level of efficiency applied to each program is between 0% and 10.4% per annum and averages 4.98% per annum.

3.4.7. Procurement and delivery

Sydney Water is currently finalising and implementing a new planning and delivery model called Partnering for Success. Sydney Water considers that while its existing model for delivery has matured and led to significant improvements, the expiry of these contracts presents an opportunity to realised increased value through:

- Increase economies of scope and scale
- Capex and opex program coordination and decision making
- Increased asset standardisation.

The procurement and delivery model has four components:

- **Planning**: to be delivered by an integrated team of resources from Sydney Water and a Strategic Partner (or consortium).
  - **Integrated Consortia**: three Regional Delivery Consortia will be responsible for Design, Construction and Maintenance (mechanical, electrical and facilities) in three specified geographical regions (civil maintenance will continue to be done by Sydney Water for the

foreseeable future) including an improved in-house capability and capacity in key areas such as delivery program management and project management.

- **Governance and assurance**: to be led by Sydney Water, including investment portfolio and program management and delivery assurance.
- **Shared Purchasing** function for specialist expertise across the value chain.

The planning partner role has now been awarded and tenders for the regional delivery consortia roles are under consideration.

Sydney Water undertook considerable research and market engagement to arrive at the structure and features of the contracts. The contract term is for five years with a five year extension contingent on achievement of performance metrics. The length of the contracts for the regional delivery consortia and scope across design, construction and maintenance have been designed to be attractive to the market and thereby elicit competitive tenders. Sydney Water intends the contracts to be collaborative and will use the New Engineering Construction (NEC) contracts developed by the Institution of Civil Engineers (United Kingdom) for this purpose.

The functions of Sydney Water, its planning partner and the Regional Delivery Consortia across the asset lifecycle are shown in Figure 3-18. While we consider that shared roles and governance has the potential to create some uncertainty and thereby potential inefficiency, we consider that the Partnering for Success model is a leading example of procurement and asset lifecycle delivery. We acknowledge that Sydney Water has incorporated in its submission anticipated efficiencies arising from this initiative.

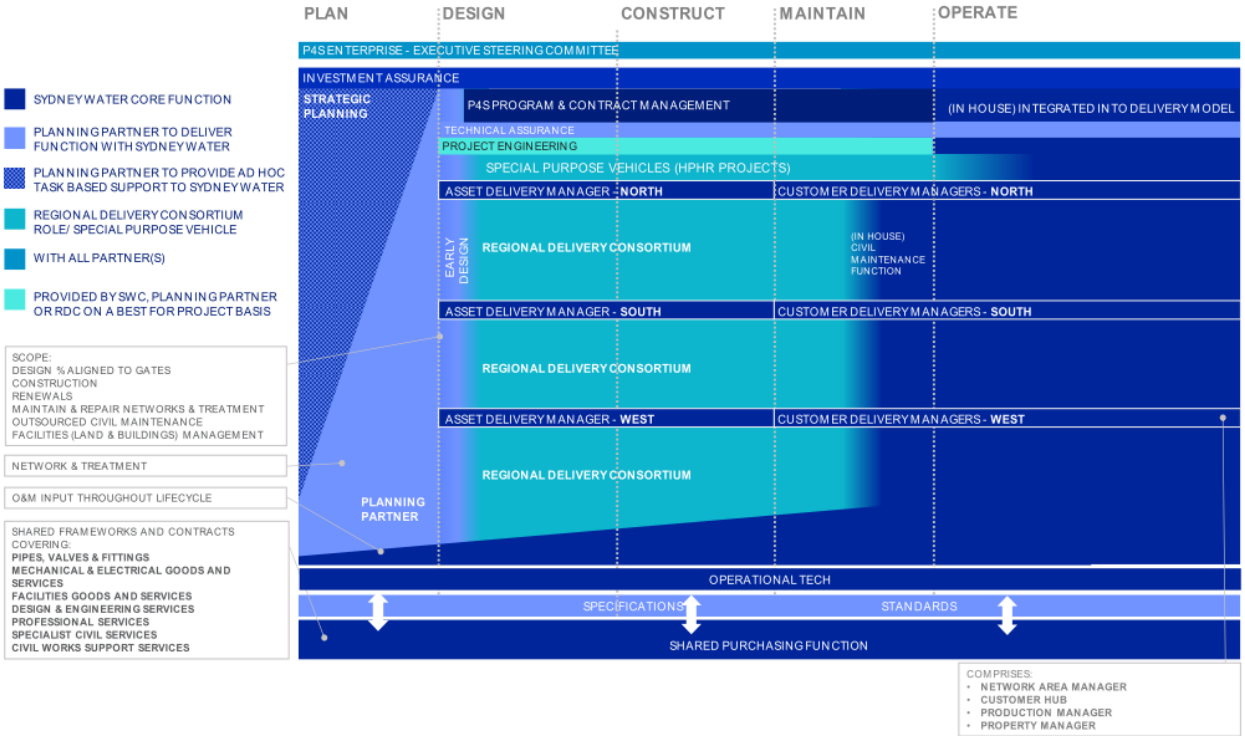


Figure 3-18 Partnering for Success overview

4. Demand Forecast Review

4.1. Task 1: Review of long-term growth projections

The terms of reference requires us to review the reasonableness of the long term growth projections underpinning Sydney Water's strategic capital investment plan.

Sydney Water has a number of long-term growth-linked plans under development or recently developed. They have summarised how the various strategy planning processes fit together as follows:

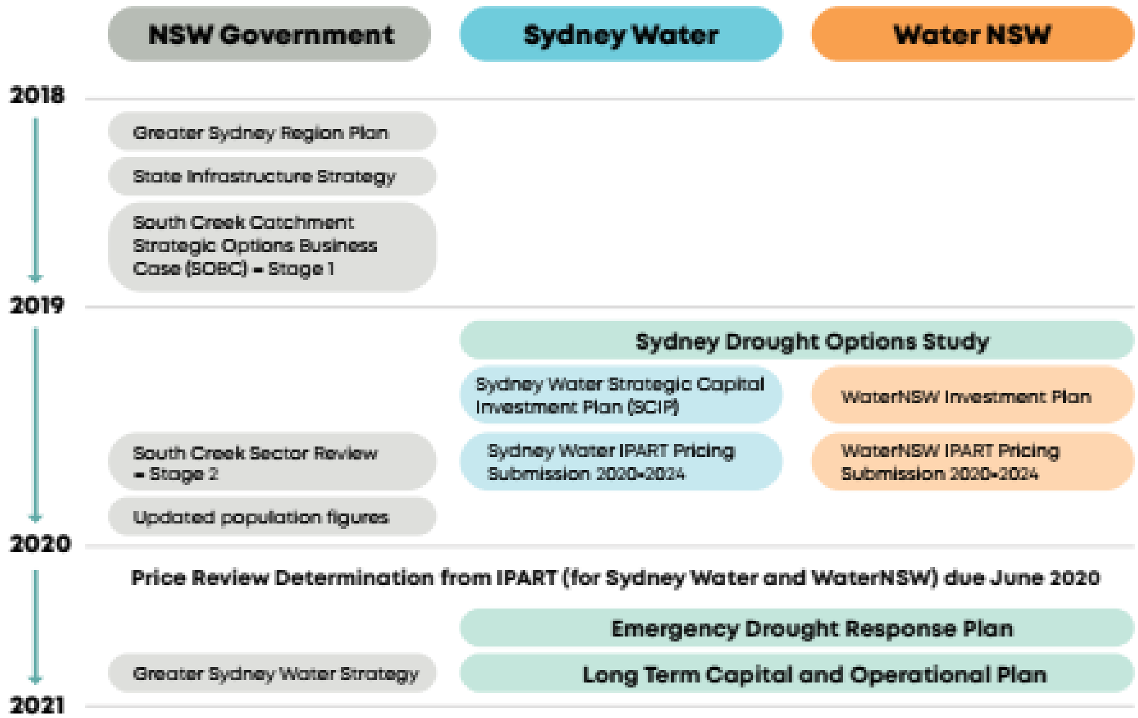


Figure 4-1 Summary of water strategy planning timelines

Source: Sydney Water Corporation submission. Sydney Water Strategic Capital Investment Plan 2020-2044 Figure 1

Infrastructure NSW's State Infrastructure Strategy 2018–38[11] made a number of recommendations relating to supporting growth in Sydney including:

- Development of a 20-year Strategic Capital Plan for Sydney's water and wastewater systems.
- Completion of the South Creek Corridor strategic business case.
- Develop options for the augmentation of Sydney's water supply, including the findings of the South Creek strategic business case, and provide advice to the NSW Government.

In response to this first recommendation, Sydney Water has developed a high level Strategic Capital Investment Plan (SCIP) to guide it long-term strategic decision-making. The SCIP examines investment needs across water, wastewater and some stormwater infrastructure from 2020 to 2044. Options considered include dams and desalination plants, recycled water and water reuse schemes. The SCIP is examined in further detail below.

Sydney Water is also working with Water NSW to prepare a more detailed Long-Term Capital and Operational Plan which will be submitted to NSW Government in 2020.

[11] http://www.infrastructure.nsw.gov.au/sis-2018

In response to the third recommendation above, these organisations are also working to prepare a Water Master Plan looking at options for augmentation of Sydney's water supply for submission to the NSW Government in 2020.

The SCIP

In developing the SCIP, Sydney Water has examined three scenarios: traditional, recycled water servicing and the "Resilient City" scenario. It identified the "Resilient City" scenario as the optimal approach, having a slightly lower NPV, albeit with a number of decision points which move between the different investment pathways.

Investment for growth forms a major component of the investment envisaged by the SCIP. Under Sydney Water's chosen scenario, investment requirements for growth are approximately $11.5bn over 25 years i.e. $0.5bn per annum on average or 39.6% of investment needs. This is in addition to $3bn for bulk water investment. Sydney Water expects investment for asset reliability to be slightly greater than this at $12.0bn over 25 years.

The SCIP assumes population growth of 1.4% per year[12]. It uses 2016/17 average residential and non-residential average usage (302 litres per day) and then applies water efficiency assumptions from the 2017 Metropolitan Water Plan. These assumptions result in a 42% increase in population from 2020 to 2044 and a significantly lower (17%) increase in demand due to lower per capita consumption.

Our view is that the population growth projections are reasonable, being broadly consistent with the level of population growth we infer from the public domain version of the DPIE's 2016 housing supply forecast projections[13].

The use of 2017 demand figures as the baseline may tend to exaggerate average demand a little as Sydney Water's own modelling suggests that demand was higher than usual due to weather conditions (see Table 4-5 below). However, the overall effect is likely to be small relative to other factors as Sydney Water's modelling suggests it led to 7.4GL (~1%) increase in overall system demand relative to an average weather year which is reasonable for a high level model.

The degree of water conservation savings (effectively a 25% demand saving by 2044) is ambitious but should be achievable given that Sydney Water's per capita consumption (PCC) in 2017 of 275 l/p/d is relatively high by some international standards. For example, PCCs in Denmark, Netherlands, England & Wales are approximately half of this value[14].

Sydney Water has carried out sensitivity analysis including +10%/-40% on population growth rate and zero change in per capita water consumption. In one case this does change the preferred scenario. If the population growth rate is 40% lower than projected, a rather extreme scenario, the 'traditional' approach has the lowest modelled net present cost (NPC). However, all other sensitivity tests the resilient city approach still presents the lowest, or equal lowest, NPC.

Demand forecasts in servicing plans, business cases and strategies

Sydney Water uses long term demand forecasts in many of its servicing plans, strategies and business cases.

[12] Source cited by SWC as "Population forecasts from NSW Department of Planning and Environment (September 2016)"
[13] The time steps available in the public domain version of the 2016 projections suggest an average population growth rate of 1.54% p.a. between 2021 and 2036. This is not inconsistent with 1.4% p.a. average between 2020 and 2044 as the 2016 projections incorporate a steady reduction in % growth rates over time.
[14] See International comparisons of domestic per capita consumption, Environment Agency, 2008

Sydney Water's general approach to long term forecasts is to either use Bureau of Transport Statistics (BTS) forecasts of employment or, for more aggregated forecasts, to extrapolate trends in non-residential consumption and customer numbers.

For residential customer numbers, Sydney Water uses a mix of data sets:

- DPIE's [redacted] housing supply forecasts. DPIE's forecasts are provided to Sydney Water [redacted]. Sydney Water makes adjustments to these projections to take account of new properties which are not connected to Sydney Water's systems (e.g. those served under a WICA arrangement);
- For smaller area (e.g. precinct level) planning, Sydney Water also cross-references its Urban Growth Intelligence (UGI) layer which has more detailed information on potential local development such as developer planning applications, councils, industry forums, Section 73 applications, Agency reports and Urban design strategies;
- As can be seen in a number of the examples reviewed below the difference between the Housing Supply Forecast Model (HSFM) and UGI data is assumed to be infill;
- Sydney Water also sometimes uses DPIE's population projections as the basis of projections, rather than using separate customer and per customer demand forecasts. This is particularly the case for projections beyond the 20-year horizon.

We have reviewed a number of long term growth forecasts used in Growth Servicing Investment Plans (GSIPs) which form the basis of many of the projects in the submission.

A number of general conclusions emerge from this review:

- There is a general lack of rigour in identifying the source of projections;
- An absence of reference to the empirical basis for underlying assumptions such as equivalent person conversion (EP) factors;
- The basis for changes to key assumptions over time (e.g. volumes per EP) is often not clear.
- Standard assumptions are in many cases not adjusted to take account of the specific area they are being applied to. This appears to be particularly the case for wastewater forecasts.
- No mention is made of the effect of scale on peaking factors. This may a particular issue in areas expecting significant growth.

We recommend that Sydney Water increases the evidencing of the empirical validity of the assumptions made in growth planning and the source of projections and work to ensure that projections are anchored in the specifics of the area being studied wherever appropriate and possible. We also recommend that greater effort is made to link the projections to the demand forecast model and wider initiatives such as water conservation measures to ensure consistency across its plans. The demand forecast model uses and produces location-specific demands which should be a valuable reference point for investment planning.

These changes would help to increase confidence in the robustness of investment plans related to growth. However, demand forecasts are only one element determining the type and scale of investments required to service growth. Other key factors include definition of capacity and headroom, solution definition, development uncertainty, costing, and staging/urgency of solutions. We have not seen evidence that the concerns we have raised around robustness of demand forecasts has, as a standalone issue, led to an increase in proposed expenditure. However, we have recommended an adjustment to proposed growth expenditure as set out in Section 6, because of broader concerns around the scale of investment required in the next Determination period.

Table 4-1 Comments on a number of long term growth forecasts

Source	Horizon	Data/approach	Atkins/Cardno Comment
Growth Servicing Investment Plan 2018: Wastewater Treatment	2046	Growth (residential population and non-residential volume) taken from relevant wastewater network GSIPs (see example below). 150 litres/EP/day "unchanged since 2013 GSS's" Standard EP production rates of 110 gCOD/EP/d, 60 gTSS/EP/d, 12 gTN/EP/d and 2 gTP/EP/d.	No empirical evidence provided or referenced to validate assumptions such as loads and volumes per EP. Standard assumptions not adjusted to take account of catchment specifics.
GSIP 2018 - North Richmond Wastewater Network	2046	Source of population projections and future employment is not clear, just quoted as a department of Sydney Water. Infill is assumed to be the balance between population projections and developments identified using UGI. Future flow assumptions: • Residential: – Existing discharge increased from 145.4 L/EP/d to 200 L/EP/d from 2021 – Future discharge = 150 L/EP/d • Commercial/Industrial: – 4% reduction to existing flows by 2021 – No reduction after 2021 •Infiltration and inflow(I/I): – No change for existing areas – 2% I/I for greenfield – Contributing area: 45 EP/Ha (capped at 100%)	Assumed significant increase in existing residential discharge from 2021 appears arbitrary and in need of justification especially in the light of water conservation measures. The assumptions also need to be reconciled to the assumption for "future discharge". Lack of empirical evidence for greenfield I/I and absence of tailoring for catchment specific factors.
GSIP 2018 - Rouse Hill Wastewater Network	2046	Source of population projections is not clear, just quoted as a department of Sydney Water. Future flow assumptions: · Residential: – Existing discharge increased from 176 L/EP/d to 180 L/EP/d from 2021 – Future discharge = 150 L/EP/d · Commercial/Industrial: – 4% reduction to existing flows by 2021 – No reduction after 2021 · I/I: – No change for existing areas – 2% I/I for greenfield	Assumed significant increase in existing residential discharge from 2021 appears arbitrary. The assumptions also need to be reconciled to the assumption for "future discharge".
Growth Servicing Investment Plan 2018: Water Treatment	2046	Growth (residential population and non-residential flows) taken from relevant water network GSIPs (see example below). Demand is primarily defined as Maximum Daily Demand.	None
GSIP 2018 - Potts Hill - Maroubra, Randwick Water Network	2046	Source of population projections is not stated. The source of the baseline maximum daily demand values is just cited as "Sydney Water" Infill is assumed to be the (very large in this case >90%) balance between population projections and developments identified using UGI. Employment forecast is based on BTS projections. Per capital demands are tailored to take account of low or high density development.	Source of population projections is not clear. The basis and statistical definition of maximum daily demand is not made clear. No reference is made to the effect of growth (i.e. scale) on peaking factors.
GSIP 2018 - Prospect North - Prospect Hill	2046	An adjustment has been applied to future demand from low density residential dwellings because the current measured consumption is judged too low:	The justification for the upward adjustment in per capital consumption appears weak/non-existent. If carried out

Source	Horizon	Data/approach	Atkins/Cardno Comment
Elevated Water Network		*"the calculated Residential LD per capita rate of 150 L/capita/day was too low. Therefore, it was agreed that the minimum value of 170 L/capita/day be adopted for the demand forecast."*	elsewhere this kind of adjustment could have a significant effect on projected demands as LD residential demand is a large component of demand.
Upper South Creek and West Camden Wastewater Servicing Plan (Phase 1)	2056	Data cited as: • HSFM 2016 • Employment data from Bureau of Transport Statistics • UGI data Wastewater generation based on 3 equivalent persons (EP) per low density dwelling, 2.5 EP per high density dwelling, 0.2 EP per job and 150 litres/EP/day	Unclear how the data sources have been consolidated to form the planning forecast No empirical evidence provided or referenced to validate assumptions such as EP/dwelling and volume per EP.
NWPGA Water Servicing Strategy 2017	2056	Coarse estimates of potential dwelling numbers (100,000) and jobs (70,000). No sources given. Source of Max Day Demand (MDD) is cited as "derived from gauge data over the last 10 years". As the area is expected to experience very significant new development (tenfold increase in dwellings) it is hard to understand how existing MDDs have been robustly applied (e.g. to take account of impact of scale of peaking factors). EP conversion factors: Residential Low Density: 3 EP/dwelling Residential High Density: 2.5 EP/dwelling Employment: 0.2 EP/job	Data sources and empirical basis of EP conversion factors is unclear.

Source: SIR and presentation "293.12 session 34 Lowes Creek WWTP and South Creek WRP"

Demand forecast models

As can be seen from the review of plans above, the demand forecast models are often not used in long term demand forecasts. However, we present a review of them here as it is applied by Sydney Water in both its current and future Determination projections.

Sydney Water had updated the residential demand forecast model it developed for the 2012 price review. The model is built using 34 segments representing different property types (single dwellings, vertical strata units, townhouse strata units, flats, dual occupancies), BASIX status, recycled water supply, tenure (tenant or owner-occupier) and lot size or number of units.

The 2012 model only used the best three weather variables. The revised model uses different combinations of variables for each segment, including up to 8 weather variables using different measures of rainfall, temperature and evaporation, three season flags and water usage price.

The updated model has been calibrated using 6.5 years of data. Sydney Water states that the calibration period has been chosen as it includes a wide range of weather conditions (wet year at the start through to dry years). It is built by applying panel regression analysis to quarterly data.

It incorporates the effects of BASIX but does not build in future water conservation measures or other time-trends such as appliance penetration or efficiency or occupancy rate shifts. This may not be a significant concern for forecasts used as the basis of the next price review but may be an area for improvement of the model in future to increase confidence in the longer-term forecasts. Sydney Water has tested for time trends in its 6.5 year data set but did not find a relationship which appeared to be statistically significant. This is not surprising given it was tested using such a short time series.

The model only uses BASIX properties that have been in place for 6.5 years or more, so should take account of any 'bounce back' in water usage.

The approach to weather modelling represents best practice. The model has been upgraded from using the weighted average for each property based on distance to 12 stations to use Bureau of Meteorology (BOM) weather data for grid cells approximately 5 x 5km. For demand forecasts: e.g. at water supply system level, the demand is based on the aggregation of forecasts per property using weather at a grid cell level.

The model doesn't use "average weather" as this wouldn't produce average demand (as there is an asymmetric response to weather; customers' demand response to cold weather is not as great as to warm weather). Instead average demand is based on 120 time series projections.

To take account of climate change the model uses NARCLIM data to replace rather than perturb long term averages. Sydney Water has carried out a hindcast of NARCLIM data to validate against downscaled BOM data. The demand forecast itself has been validated against approximately 34 quarters and performs reasonably well according to the graphs we have seen.

Our review finds that the residential demand model is a well-researched and robust tool for medium term forecasts. At present it appears to be used as a standalone tool which is not integrated into long term planning processes and strategies.

The non-residential demand forecast has not been substantially updated since 2013. It has been found to underpredict demand which Sydney Water considers to be due to 'densification', which is discussed below. Sydney Water has added a densification adjustment factor based on population growth since 2013. Even with this adjustment the model was still found to underpredict demand by 1.1 GL p.a. so Sydney Water has added this as a fixed adjustment. We note that this is a relatively small adjustment (0.9% of non-residential consumption) which does not in itself significantly affect the overall demand forecast.

Given the underprediction and apparent shifts in non-residential demand since 2013 we consider that it would have been appropriate for Sydney Water to have carried out a more fundamental review of the model rather than to apply adjustment factors and fixed adjustments. We recommend that Sydney Water carries out a significant update of the model in the very near future to inform the planning processes such as the Water Masterplan and further iterations of GSIPs and similar documents. The update could include use of more granular customer segmentation to better understand the drivers of demand change. This should also help to increase confidence in the robustness of its projected sales volumes which are undermined by the adjustments which have had to be made and the lack of thorough investigation of time-related trends such as densification.

More generally we also recommend that Sydney Water consider how the models can be used as long term forecasting tools which are routinely used in planning processes such as the GSIPs and SCIP reviewed above. This will help to improve consistency across its plans and strategies and improve confidence in the assumptions being used in these planning processes.

4.2. Task 2: Review sales and customer connection forecasts

4.2.1.1. 2016 Determination Period

Connections

Residential customer numbers in the current period have exceeded Sydney Water's 2015 projections and the assumptions set out in IPART's Determination. The only exception to this is 2016 where water customer numbers were 0.5% below the Determination assumption.

Average outturn growth rates have been 1.8% to 2.2% p.a. compared to 1.2% to 1.4% p.a. assumed in the Determination. This means that by 2018 (the last full year of actuals) customer numbers were 1.2% to 2.7% above the figures assumed in the Determination.

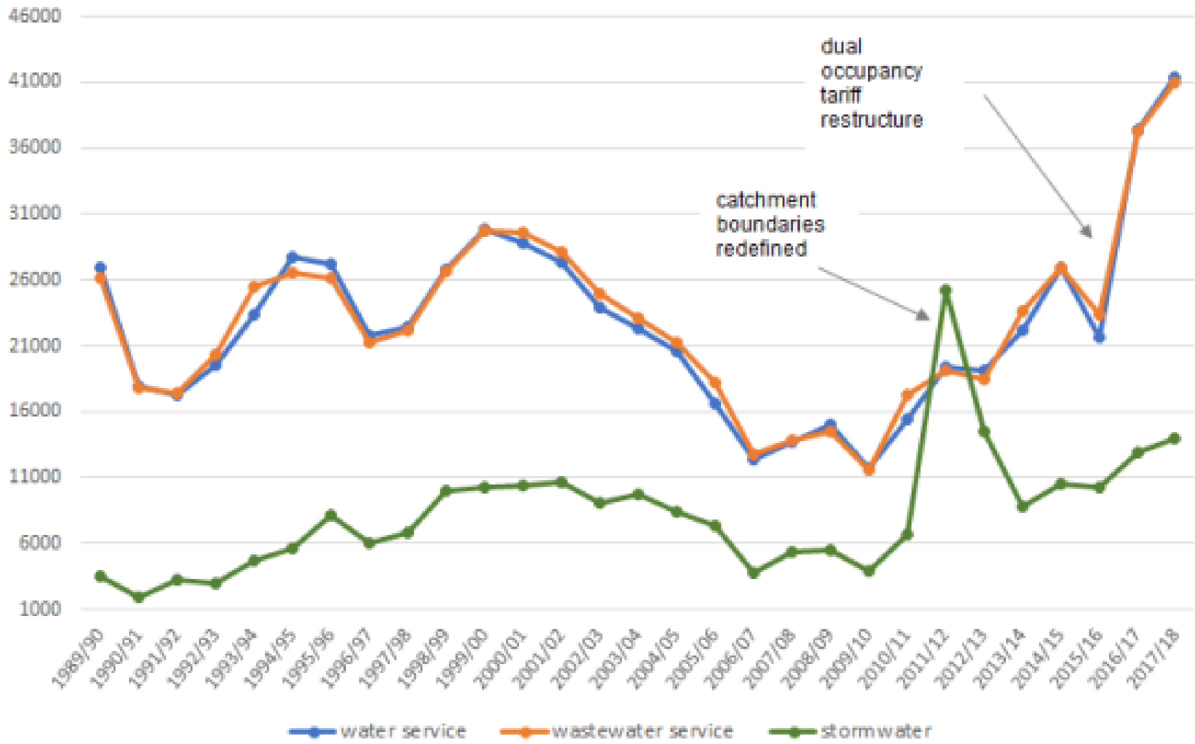
Table 4-2 Residential customers in 2016 Determination period

SYDNEY WATER RESIDENTIAL CUSTOMERS- CURRENT DETERMINATION PERIOD							
Year ending June	**2016**	**2017**	**2018**	**2019**	**2020**	**Average growth 2015-18 (actuals) % p.a.**	**Average growth 2015-20 % p.a.**
WATER CUSTOMERS							
Sydney Water 2015 Projections	1,787,800	1,798,015	1,821,927	1,846,412	1,871,303	1.3%	1.3%
Determination	1,787,800	1,801,706	1,825,618	1,850,103	1,874,994	1.4%	1.4%
Actual	1,779,007	1,805,149	1,848,094	1,888,841	1,927,268	1.8%	1.9%
Annual change	27,805	26,142	42,945	40,747	38,427	32,297	35,213
Annual change %	1.6%	1.5%	2.4%	2.2%	2.0%		
Actual > Determination	(8,793)	3,443	22,476	38,738	52,274		
Variance as % of Determination	(0.5%)	0.2%	1.2%	2.1%	2.8%		
WASTEWATER CUSTOMERS							
Sydney Water 2015 Projections	1,740,683	1,750,851	1,774,726	1,799,178	1,824,036	1.1%	1.2%
Determination	1,740,683	1,754,542	1,778,417	1,802,869	1,827,727	1.2%	1.3%
Actual	1,745,269	1,771,450	1,814,336	1,854,725	1,891,396	1.9%	2.0%
Annual change	30,151	26,181	42,886	40,389	36,671	33,073	35,256
Annual change %	1.8%	1.5%	2.4%	2.2%	2.0%		
Actual > Determination	4,586	16,908	35,919	51,856	63,669		
Variance as % of Determination	0.3%	1.0%	2.0%	2.9%	3.5%		
STORMWATER CUSTOMERS							
Sydney Water 2015 Projections	495,961	500,131	507,577	515,038	522,625	1.3%	1.4%
Determination	495,961	500,131	507,577	515,038	522,625	1.3%	1.4%
Actual	498,917	507,526	521,198	533,852	544,959	2.2%	2.2%
Annual change	10,452	8,609	13,672	12,654	11,107	10,911	11,299
Annual change %	2.1%	1.7%	2.7%	2.4%	2.1%		
Actual > Determination	2,956	7,395	13,621	18,814	22,334		
Variance as % of Determination	0.6%	1.5%	2.7%	3.7%	4.3%		

Source: SIR. Sydney Water submission and Atkins Cardno analysis

Note that, in June 2016, approximately 9,100 dual occupancy customers were reclassified from two dwellings to single dwellings. This adjustment led to lower water and wastewater customer numbers in 2017 and thereafter than otherwise would have been the case. Taking account of this adjustment growth in water and wastewater customer numbers in 2017 would have been approximately 35,000.

Sydney Water's explanation for the higher than expected growth rates in the current period is a surge in development and new properties completion to a historic high growth rate as can be seen below.



Source: Sydney Water Corporation submission Figure 3-2

Figure 4-2 Dwelling growth by service

Sydney Water's explanation is consistent with the pattern of dwelling completions reported by the Department of Planning and Environment as summarised below.

Source: Greater Sydney, Central Coast, Illawarra and Greater Newcastle Regions Local Government Area Housing Activity, Department of Planning and Environment, Housing and Population Insights[15] and ABS Residential Prices Indexes[16]

Figure 4-3 Greater Sydney Region Dwelling Approvals and Completions by Financial Year

2019 and 2020 residential dwelling numbers

During the interviews held in August 2019, Sydney Water indicated that the 2019 customer number growth in the SIR was based half on actuals (for the half year to December 2018) and half on growth projections from the NSW Government's 2016 Sydney Housing Supply Forecast Model (HSFM)[17] and the 2016 Illawarra Urban Development Program Update[18]. Sydney Water indicated that preliminary 2019 data suggested the number of new customers had been approximately 6% below the figures in the SIR. However, this does not significantly affect the annual growth rate which may be 2.1% for water customers rather than 2.2% for example.

The projected growth in Sydney Water's customer connections for 2020 is based on housing growth figures from the 2016 HSFM and Illawarra Urban Development Program Update. The projected growth in customer numbers is lower than in the previous two years. We consider this reasonable given the apparent slowdown in dwelling approvals and reduction in the residential property price index since 2017.

[15] http://www.planning.nsw.gov.au/Research-and-Demography/Research/Housing-Monitor-Reports
[16] 6416.0 - Residential Property Price Indexes: Eight Capital Cities, Jun 2019 https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6416.0Jun%202019?OpenDocument
[17]
[18] https://www.planning.nsw.gov.au/-/media/Files/DPE/Plans-and-policies/illawarra-shoalhaven-urban-development-program-update-2016.pdf?la=en

Non-residential customers

The picture is different for non-residential customers where water customer numbers exceeded the Determination by 0.4% p.a. but wastewater and stormwater customer numbers have consistently been below the Determination figures.

In explaining which growth has been higher for water customers, Sydney Water has indicated[19] that some new non-residential property types are connected to water only and that this is due to the significant growth in the number of standpipes and "occupied land" customers which pay a water service charge but not a wastewater charge. Some of these customers may then convert to different water and wastewater customer categories when building work on the land is complete.

The total number of non-residential customers is smaller and minor changes in customers numbers can therefore have a more significant proportional impact. In its submission, Sydney Water has explained that amalgamation of non-residential properties is one of the reasons for the reduction in customers in stormwater areas.

Table 4-3 Non-residential customers in 2016 Determination period

SYDNEY WATER NON-RESIDENTIAL CUSTOMERS- CURRENT DETERMINATION PERIOD							
Year ending June	2016	2017	2018	2019	2020	Average growth 2015-18 (actuals) % p.a.	Average growth 2015-20 % p.a.
WATER CUSTOMERS							
Sydney Water 2015 Projections	98,085	98,901	99,833	100,779	101,694	0.9%	0.9%
Determination	98,085	98,901	99,833	100,779	101,694	0.9%	0.9%
Actual	98,158	99,836	101,076	102,961	103,876	1.3%	1.3%
Annual change	876	1,678	1,240	1,885	915	1,265	1,319
Annual change %	0.9%	1.7%	1.2%	1.9%	0.9%		
Actual > Determination	73	935	1,243	2,182	2,182		
Variance as % of Determination	0.1%	0.9%	1.2%	2.2%	2.1%		
WASTEWATER CUSTOMERS							
Sydney Water 2015 Projections	82,611	83,427	84,359	85,305	86,221	1.0%	1.1%
Determination	82,611	83,427	84,359	85,305	86,221	1.0%	1.1%
Actual	81,951	82,501	83,088	83,790	84,705	0.5%	0.7%
Annual change	141	550	587	702	915	426	579
Annual change %	0.2%	0.7%	0.7%	0.8%	1.1%		
Actual > Determination	(660)	(926)	(1,271)	(1,515)	(1,516)		
Variance as % of Determination	(0.8%)	(1.1%)	(1.5%)	(1.8%)	(1.8%)		
STORMWATER CUSTOMERS							

[19] 352.1 Response to item 352 - Non-residential customers outturn

Sydney Water 2015 Projections	49,923	50,529	51,148	51,751	52,326	1.2%	1.2%
Determination	49,923	50,529	51,148	51,751	52,326	1.2%	1.2%
Actual	49,262	49,400	49,281	49,579	50,154	(0.0%)	0.3%
Annual change	(72)	138	(119)	298	575	(18)	164
Annual change %	(0.1%)	0.3%	(0.2%)	0.6%	1.2%		
Actual > Determination	(661)	(1,129)	(1,867)	(2,172)	(2,172)		
Variance as % of Determination	(1.3%)	(2.2%)	(3.7%)	(4.2%)	(4.2%)		

Source: SIR. Sydney Water submission and Atkins Cardno analysis

Sales volumes

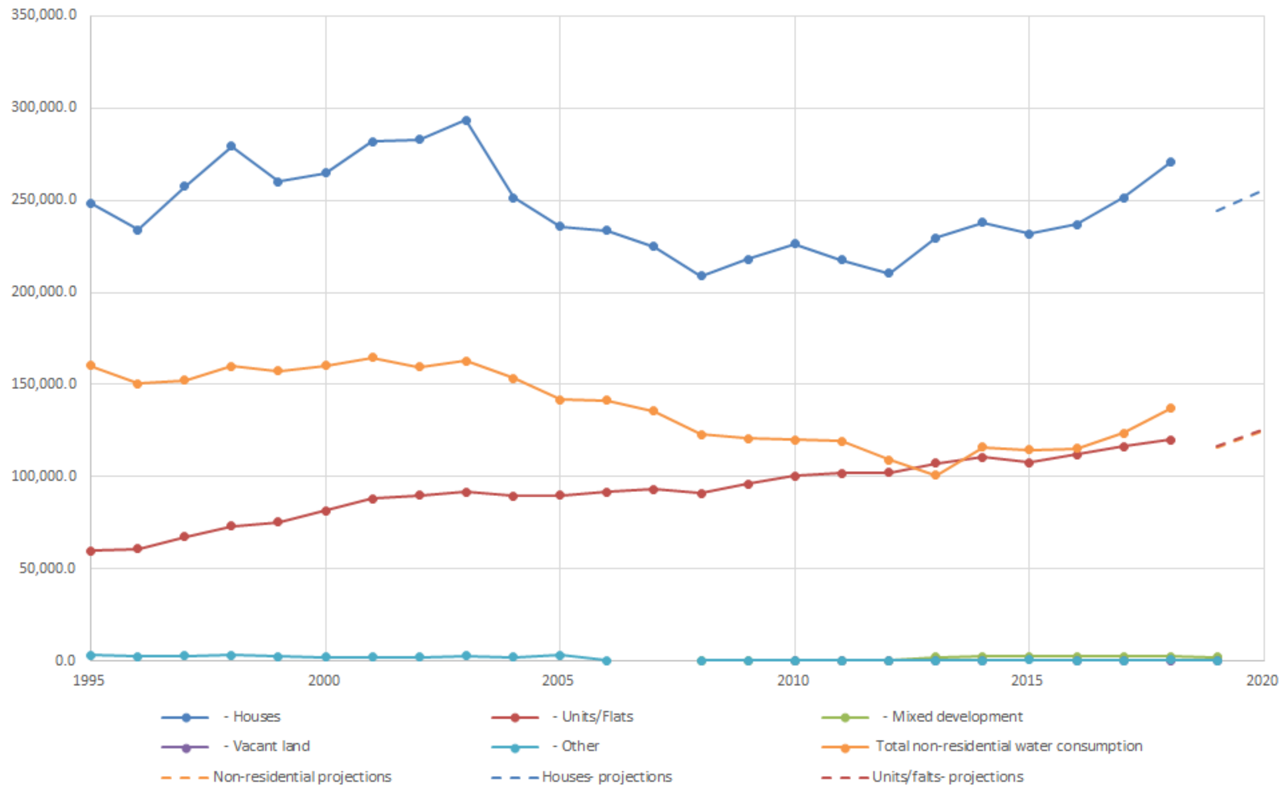
Water demand growth has outstripped the assumptions made in the Determination, with average increases of 4.7% p.a. (residential) and 6.2% p.a. (non-residential) between 2015 and 2018.

Table 4-4 Water demand in 2016 Determination period

SYDNEY WATER DEMAND- CURRENT DETERMINATION PERIOD							
Year ending June	**2016**	**2017**	**2018**	**2019**	**2020**	**Average growth 2015-18 (actuals) %p.a.**	**Average growth 2015-20 %p.a.**
RESIDENTIAL							
Sydney Water 2015 Projections	347	353	358	362	367	1.5%	1.4%
Determination	347	355	361	365	370	1.7%	1.5%
Actual	352	371	393	363	382	4.7%	2.2%
Annual change %	2.6%	5.4%	6.2%	(7.7%)	5.1%		
Actual > Determination	5	16	32	(2)	12		
Variance as % of Determination	1.3%	4.4%	9.0%	(0.5%)	3.2%		
NON-RESIDENTIAL							
Sydney Water 2015 Projections	115	115	115	115	116	0.2%	0.3%
Determination	115	117	118	118	118	1.0%	0.6%
Actual	115	123	137	116	125	6.2%	1.8%
Annual change %	0.7%	7.1%	11.1%	(15.5%)	8.1%		
Actual > Determination	0	6	19	(2)	7		
Variance as % of Determination	0.2%	5.5%	16.2%	(1.9%)	6.1%		

Source: SIR. Sydney Water submission and Atkins Cardno analysis

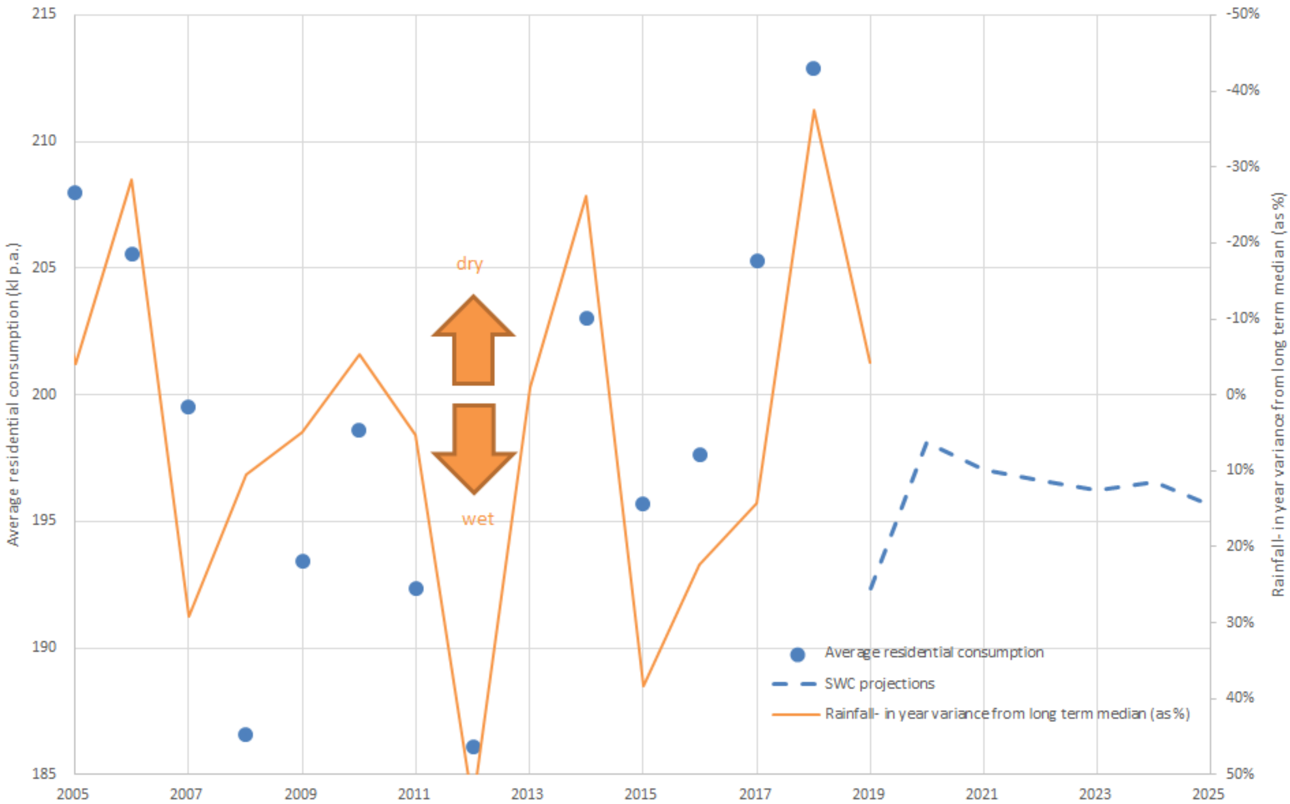
Whilst houses make up the largest element of water consumption, units/flats have been making up a steadily increasing component and are now at a level similar to non-residential consumption, which was on a generally reducing trend until 2013 and has subsequently increased. Other elements of consumption are minor.



Source: SIR. Sydney Water submission and Atkins Cardno analysis

Figure 4-4 Dwelling growth by service

Growth in demand since 2015 has outstripped the growth in property numbers examined above. This is because of an increase in consumption per property between 2015 and 2018. The single largest factor driving the increase appears to be weather. Whereas 2015 was a wetter year than average, 2018 was an unusually dry year as can be seen below. In its submission Sydney Water also highlights the significantly higher than average temperatures in 2016, 2017 and 2018. A similar pattern of demand is also apparent for non-residential consumption, with demand peaking in the dry year of 2018.



Source: SIR. Sydney Water submission and Atkins Cardno analysis of rainfall data at Randwick St and Parramatta North (Masons Drive) weather stations[20]
Note: average residential data missing from SIR for 2013

Figure 4-5 Average residential consumption and rainfall

Explanation for the variance

The increase in demand from 2015 to 2018 is primarily in houses (+38.7GL p.a. or 17%) than non-residential (+22.7GL p.a. or 20%) and units/flats (+12.3GL p.a. or 11%). The greater increase in house consumption than units/flats is likely to reflect the potential for warm dry weather to lead to higher external water use in houses.

Sydney Water has identified a process of 'densification' to explain the increase in non-residential demand which is significantly higher than the number of non-residential customers. This relates to factors such as lower vacancy rates and consolidation of smaller non-residential properties into larger ones.

Sydney Water has also identified a number of other factors leading to higher demand than expected including:

- Dwelling growth. As outlined above the number of residential water dwellings has grown by an average of 1.3% p.a. leaving a further 3.4% p.a. of growth due to other factors including the weather.
- Price effects. Water usage prices decreased from July 2016. All other things equal, lower marginal prices would be expected to lead to increased demand. This effect is measured through the 'price elasticity' of demand. The 2016-20 forecast was based on an effective elasticity for price reductions of -0.188, whereas the model created for Sydney Water's 2019

[20] See http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=066124 for example

submission found an elasticity of -0.218 for price decreases in single dwellings. This suggests that demand increased by more than was expected because of the price reduction. Our estimates suggest that this is likely to have had only a relatively minor effect of 0.3% greater consumption[21].

- Error in calculation for 'other properties', i.e. properties in Sydney Water's model, such as occupied land, which do not readily fit into residential or non-residential categories. Sydney Water mistakenly applied a consumption of 1 GL p.a. rather than 4 GL p.a. Against a total meter consumption of 538 GL in 2018 this may have had an impact of 0.6%.

Sydney Water has modelled these effects, using its demand forecast model to take account of the weather, and summarises the effects of the explanatory factors for the variance in 2017 and 2018 as follows:

Table 4-5 Sydney Water's explanations for variance from previous demand forecast (GL p.a.)

Year ending June	2017	2018
Higher dwelling growth	3.6	6.3
Hot dry weather	7.4	26.6
Price elasticity	1.5	2
"Other properties"	3.3	3.3
Undetermined (i.e. the remainder)	3.6	10.6

Source: SIR. Sydney Water submission Figure 2-4

These factors account for the vast majority of the variance. Sydney Water considers that the 'undetermined' element is due to densification of the non-residential sector.

To test for evidence of densification of the non-residential sector we have compared the number of employees in the Greater Sydney Region with the number of non-residential water customers connected at the property.

Table 4-6 Change in employment density

Year ending June	Greater Sydney: Total no employed people (000s)	Non-residential water customers connected at the property	Number of employees per non-residential property
2014	2447	96,823	25.3
2015	2500	97,282	25.7
2016	2569	98,158	26.2
2017	2646	99,836	26.5
2018	2748	101,076	27.2
2019	2825	102,961	27.4

Source: SIR and ABS Labour Force Statistics[22]

This supports the concept of densification, suggesting an increase of approximately 8.6% in number of employees per non-residential property from 2014 to 2019. For comparison with the modelling of variance undertaken by Sydney Water, the increase in in number of employees per non-residential property from 2015 to 2018 is 5.8% or 7.9 GL when applied to 2018 non-residential demand. This figure is a little lower than the

[21] Based on 9.2% reduction in combined water and wastewater usage charge
[22] 6291.0.55.001 Labour Force, Australia, Detailed - Electronic Delivery, , Aug 2019. https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6291.0.55.001Aug%202019?OpenDocument

10.6GL unexplained variance. However, it seems likely that the difference relates to a degree of inherent modelling or measurement uncertainty.

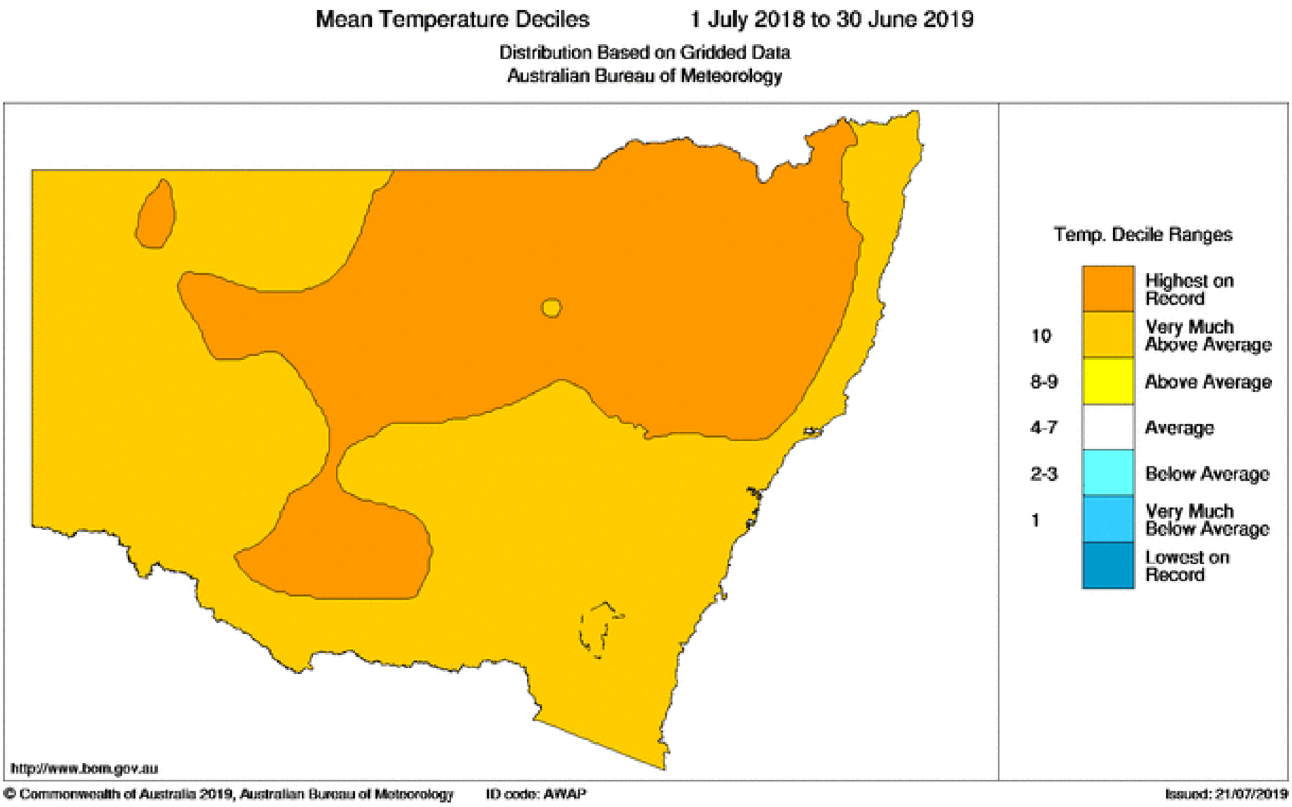
Forecast sales volumes in 2019 and 2020

Sydney Water has projected sales volumes for 2019 and 2020 by applying its demand forecasting model to the connection numbers set out above. The modelling assumes a return to average weather conditions. We discuss the demand forecasting model in more detail below.

However, a number of factors are likely to mean that the outturn sales volumes are different to the norm:

- The weather in 2019 was hotter than average (see figures below). However, it is not clear that it was significantly drier or wetter in Sydney itself. Whilst it is too early to conclude with confidence about the representativeness or otherwise of the weather in 2020, the BOM Climate Outlook[23] envisages below average rainfall and higher than average daytime temperatures for October to January 2020. Both of these factors will tend to increase water demand and therefore sales volumes; and

- Level 1 demand restrictions were put in place in Sydney, the Blue Mountains and the Illawarra on 1 June 2019. These limit how potable water can be used outdoors for both residential and non-residential customers. These are likely to suppress demand compared to what would otherwise be expected in similar weather conditions.

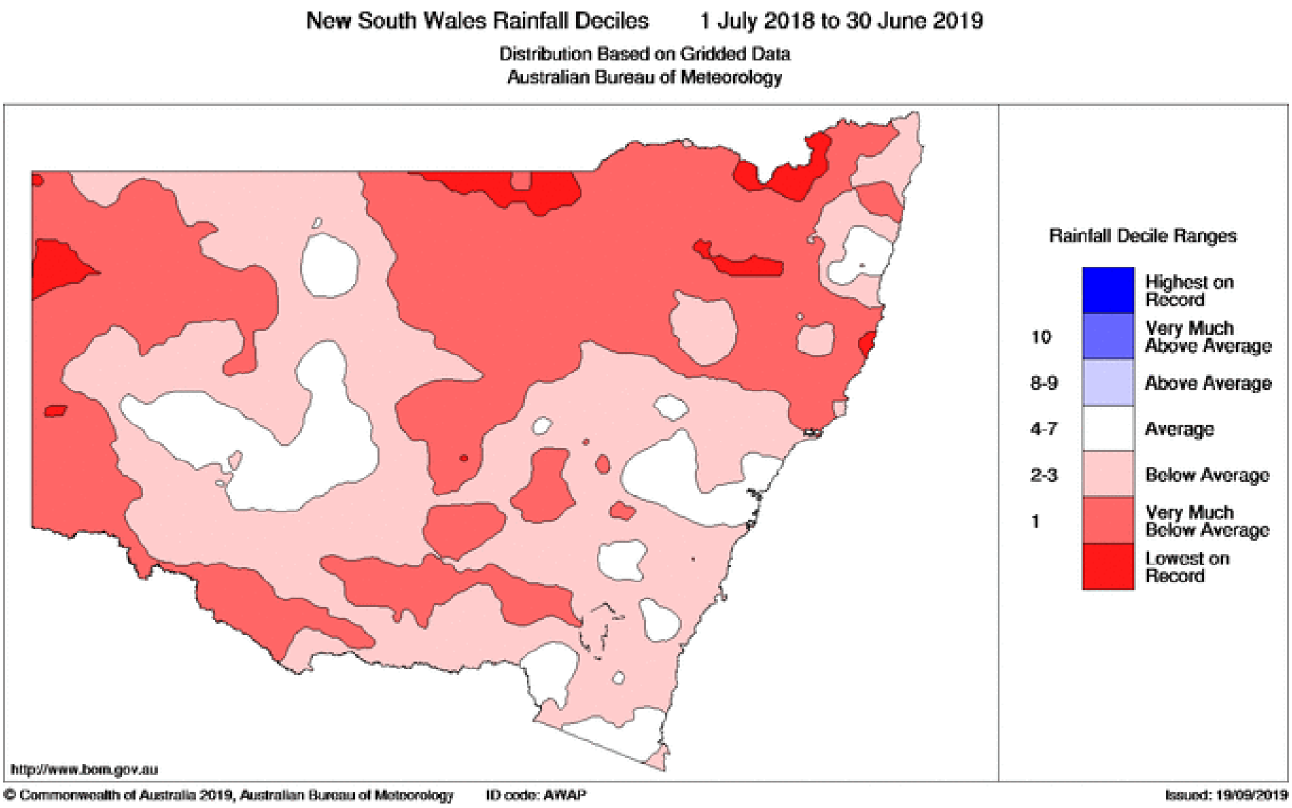


Source: Climate of the 2018–19 financial year, Bureau of Meteorology [24]

Figure 4-6 Temperatures in 2019 were hotter than average

[23]Climate outlook for October to January, Issued 26 September 2019. BOM http://www.bom.gov.au/climate/ahead/outlooks/

[24] Figure 3: Mean temperature deciles map for the 2018–19 financial year (based on all years of data since 1910). http://www.bom.gov.au/climate/updates/articles/a034.shtml.



Source: Climate of the 2018–19 financial year, Bureau of Meteorology [25]

Figure 4-7 Rainfall in Sydney in 2019 was not very different to average

Sydney Water's preliminary estimate of total system demand in 2019 is 567.8GL p.a.[26] This is only slightly (0.2%) above the projection in the SIR of 566.9GL and is significantly (5.2%) lower than in 2018 but still the second highest system demand since 2003. This appears reasonable given that customer numbers are at an all-time high and it was a hot but not especially dry year in Sydney.

There is a reasonably high level of uncertainty in projected sales volumes in 2020. In the SIR, Sydney Water has assumed that consumption per customer will reflect average weather and will not be affected by demand restrictions. In practice this means residential consumption per customer similar be similar to 2016 levels and non-residential consumption somewhere between 2017 and 2018 levels. The impact of the demand restrictions which are now in place is difficult to predict with confidence as it depends on outturn weather and factors such as public awareness levels.

We consider that:

- The higher number of outturn customer connections than assumed in the Determination is driven primarily by greater than expected rates of new development, which is inherently difficult to project with confidence.
- The higher than expected sales volumes have been driven by customer connection growth, weather, greater price elasticity than assumed in 2015, densification of non-residential customers and an error in the treatment of 'other properties'.
- There is an unusually high level of uncertainty in projected sales volumes in 2020 due to the combined impacts of demand restrictions, weather, SDP charges and the growth volatility.

[25] Figure 3: Mean temperature deciles map for the 2018–19 financial year (based on all years of data since 1910). http://www.bom.gov.au/climate/updates/articles/a034.shtml.

[26] Source: "Items 132, 133 & 134 Additional IPART Reviewer Questions - Demand and Customer". Figure is subject to change.

Non-revenue water

We examine leakage water performance in Section 5.4.11.

4.2.1.2. 2020 Determination Period

Connections

Sydney Water has based its projections of new residential water and wastewater connections on the DPIE's 2016 HSFM and Illawarra Urban Development Program Update. This has been profiled over time assuming the growth continues at average recent levels in 2020 then reduces during 2020-24 before remaining constant to 2030. Sydney Water has based its non-residential property growth on trends in the number of property meter connections, development approvals and proposed developments.

DPIE's forecasts are provided to Sydney Water [redacted] Sydney Water applies these projections to its service areas and makes adjustments to take account of new properties which are not connected to Sydney Water's systems (e.g. those served under a WICA arrangement).

Sydney Water has a seat on the Common Planning Assumptions Group which helps to sign off on DPIE's projections. Sydney Water considers that DPIE's projections are relatively robust and do not routinely overestimate development, as previous projections have been underestimates.

Sydney Water's projected new connections are presented in Table 4-8 and Table 4-9 below. The average growth rate is summarised and compared to recent actuals (2015-2018) and the current Determination period in Table 4-7.

Sydney Water is projecting higher new residential connection numbers per annum than the average actuals from 2015 to 2018. However, the new customer numbers are broadly similar to what Sydney Water is expecting to have experienced by the end of the current Determination period.

Table 4-7 Projected growth in connections compared to recent actuals and current Determination

VARIANCE IN SYDNEY WATER CUSTOMER PROJECTIONS FOR 2020 DETERMINATION PERIOD						
	Average growth in actuals in current period (2015-2018)	Sydney Water average growth projection from 2018 (actuals) to 2025	Variance	Average growth rate from 2015 to 2020	Sydney Water average growth projection from 2021 to 2025	Variance between Determination periods
RESIDENTIAL CUSTOMERS						
Water	32,297	36,583	4,285	35,213	35,381	168
	1.8%	1.9%	0.1%	1.9%	1.8%	(0.2%)
Wastewater	33,073	35,463	2,390	35,256	34,236	(1,019)
	1.9%	1.8%	(0.0%)	2.0%	1.7%	(0.2%)
Stormwater	10,911	11,259	348	11,299	11,011	(288)
	2.2%	2.0%	(0.2%)	2.2%	1.9%	(0.3%)
NON-RESIDENTIAL CUSTOMERS						
Water	1,265	1,267	2	1,319	1,214	(105)
	1.3%	1.2%	(0.1%)	1.3%	1.1%	(0.2%)
Wastewater	426	590	164	579	502	(77)
	0.5%	0.7%	0.2%	0.7%	0.6%	(0.1%)
Stormwater	(18)	311	329	164	261	97
	(0.0%)	0.6%	0.7%	0.3%	0.5%	0.2%

Source: SIR. Sydney Water submission and Atkins Cardno analysis

Table 4-8 Sydney Water's projected residential customers in 2020 Determination period

SYDNEY WATER RESIDENTIAL CUSTOMERS- 2020 DETERMINATION PERIOD							
Year ending June	2021	2022	2023	2024	2025	Average growth since 2018 (actuals)	Average growth 2021-25 % p.a.
WATER CUSTOMERS							
Sydney Water Projection	1,964,390	2,001,816	2,037,524	2,071,544	2,104,173		
Annual change	37,122	37,426	35,708	34,020	32,629	36,583	35,381
Annual change %	1.9%	1.9%	1.8%	1.7%	1.6%	1.9%	1.8%
WASTEWATER CUSTOMERS							
Sydney Water Projection	1,927,361	1,963,332	1,997,860	2,030,903	2,062,578		
Annual change	35,965	35,971	34,528	33,043	31,675	35,463	34,236
Annual change %	1.9%	1.9%	1.8%	1.7%	1.6%	1.8%	1.7%
STORMWATER CUSTOMERS							
Sydney Water Projection	556,407	567,776	578,770	589,402	600,012		
Annual change	11,448	11,369	10,994	10,632	10,610	11,259	11,011
Annual change %	2.1%	2.0%	1.9%	1.8%	1.8%	2.0%	1.9%

Source: SIR. Sydney Water submission and Atkins Cardno analysis

Table 4-9 Sydney Water's projected non-residential customers in 2020 Determination period

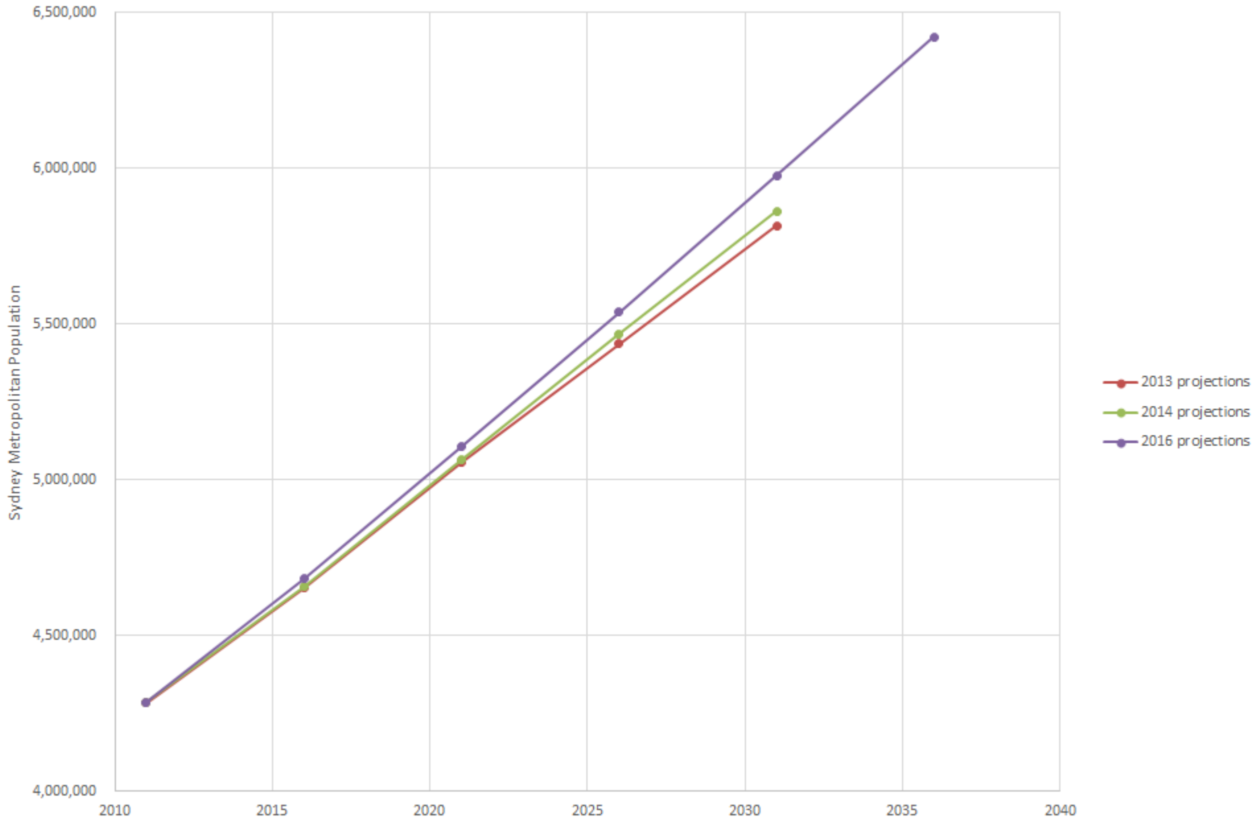
SYDNEY WATER NON-RESIDENTIAL CUSTOMERS- 2020 DETERMINATION PERIOD							
Year ending June	2021	2022	2023	2024	2025	Average growth since 2018 (actuals)	Average growth 2021-25 % p.a.
WATER CUSTOMERS							
Sydney Water Projection	105,090	106,304	107,518	108,732	109,946		
Annual change	1,214	1,214	1,214	1,214	1,214	1,267	1,214
Annual change %	1.2%	1.2%	1.1%	1.1%	1.1%	1.2%	1.1%
WASTEWATER CUSTOMERS							
Sydney Water Projection	85,207	85,709	86,211	86,713	87,215		
Annual change	502	502	502	502	502	590	502
Annual change %	0.6%	0.6%	0.6%	0.6%	0.6%	0.7%	0.6%
STORMWATER CUSTOMERS							
Sydney Water Projection	50,415	50,676	50,937	51,198	51,459		
Annual change	261	261	261	261	261	311	261
Annual change %	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.5%

Source: SIR. Sydney Water submission and Atkins Cardno analysis

There is significant uncertainty in growth forecasts, especially with such significant recent shifts in approvals, completions and house prices as seen in Table 4-3. However, the approach taken by Sydney Water in developing these projections does not appear unreasonable and we have not recommended any adjustments.

Growth forecasts have generally been on an increasing trend in recent years, with later forecasts projecting higher growth, as seen when comparing the 2013, 2014 and 2016 population projections below[27].

[27] Note: the public domain version of the 2018 projections does not provide this information.



Source: New South Wales State and Local Government Area Household Projections and Implied Dwelling Requirements (2013, 2014 and 2016).

Figure 4-8 Population forecasts for Sydney Metropolitan

When the 2018 HSFM projections became available in mid-2019 Sydney Water carried out a high level check against the 2016 HSFM figures. This analysis[28] found the two to suggest very similar new connection numbers with the 2018 projections giving only 1.5% higher new connection numbers, and the largest variance being in 2024. Given the level of confidence in these projections, the use of 2016 rather than 2018 figures does not appear likely to materially affect projected total customer numbers.

Sales volumes

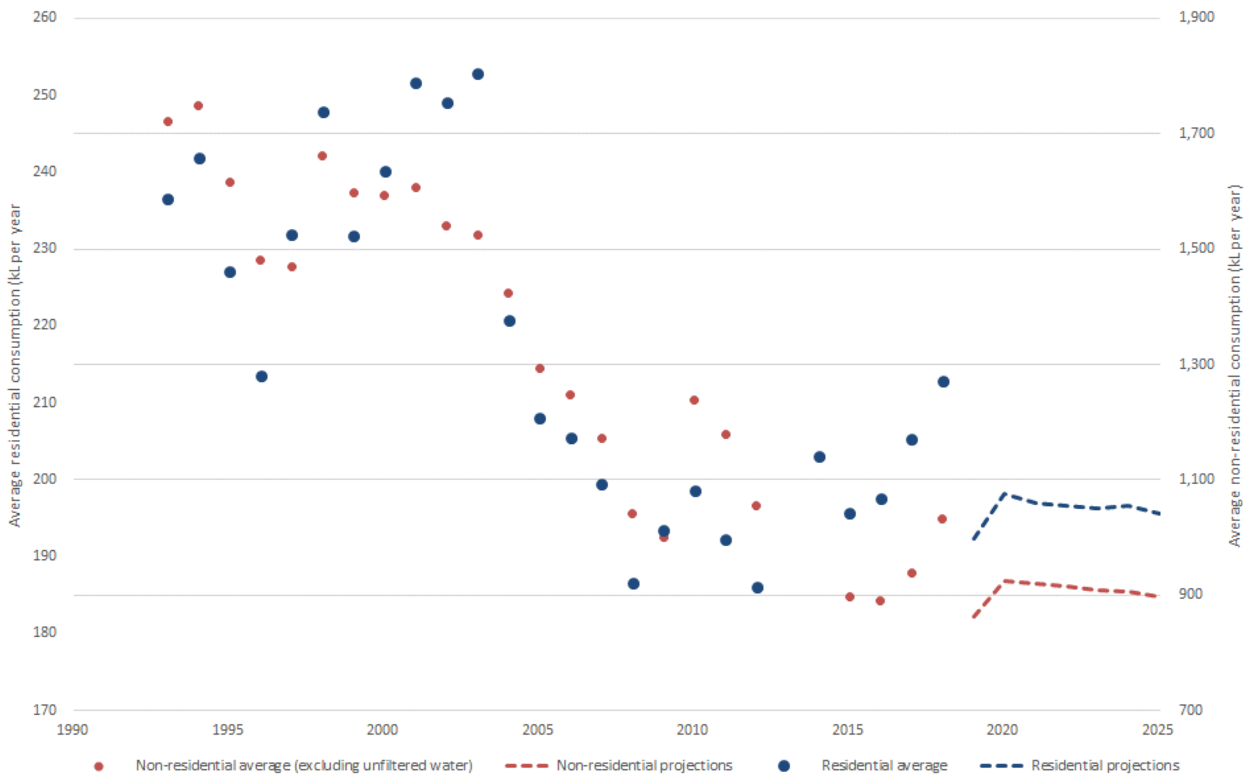
Sydney Water has applied its demand forecast models reviewed in Section 4.1 to the customer numbers outlined above to derive sales volume projections.

DPIE's HSFM projections do not match well with the segments used in the demand forecasting model. The projections provide high level numbers such as total dwellings. Sydney Water then convert these into the 34 residential segments based on UGI data.

Sydney Water has based its projected sales volumes on "business as usual" with average weather and no water restrictions. It also taken no account of the impact of tariff increases associated with the operation of the Sydney Desalination Plant (SDP) on demand.

The projected average demand per customer is therefore projected to be at low levels by historical standards for both residential and non-residential customers as can be seen below.

[28] Source: "293.1 Session 27 Update on Consistency of 2018 DPIE Forecast – 20190909"



Source: SIR

Figure 4-9 Average consumption per customer

As discussed in Section 4.1, we have limited confidence in the non-residential demand forecast given the lack of a recent review and the adjustments which have had to be applied to correct for the underestimation in demand. We have not recommended any specific adjustments, however, as it is difficult to know what scale and direction of adjustment would be appropriate without creating a detailed model.

We have significantly more confidence in the residential demand model. However, it is built on top of inherently uncertain development forecasts in a rapidly changing housing market. Recent weather conditions have also demonstrated the potential variability of demand. There therefore remains significant uncertainty in these sales volumes.

Level 1 water restrictions were put in place in Sydney, the Blue Mountains and the Illawarra from 1 June 2019. Level 2 water restrictions then became effective from 10 December 2019. These significantly limit water use for garden watering, hosing of hard surfaces and vehicles and prohibit the use of hoses.

The 2017 Metropolitan Water Plan (MWP) set out three levels of demand restrictions. Sydney Water has stated that under the Level 2 restrictions, it is targeting achieving a saving of 13.7% or 78.5 GL p.a. compared to forecast unrestricted demand for 2019-20 under average weather conditions. The savings which Sydney Water expect to achieve from the current restrictions suggest that they consider that the "Level 1" restrictions in place in 2019 are equivalent to MWP Level 2, and the "Level 2" restrictions in place in 2019 are equivalent to MWP Level 3.

Table 4-10 MWP restriction levels

MWP restriction level	Trigger storage level	MWP description	Demand saving assumed in MWP
1	50%	Enforcement of existing Water Wise Rules, with potential for further minor mandated measures limiting outdoor water use	3.7%
2	40%	Mandated measures will constrain water use, for example the number of days per week you can water gardens. May involve per person water use targets supported by extensive education and communication campaigns.	7.8%
3	30%	Emergency restrictions involve very limited or no outdoor water use. This could include no washing of outdoor surfaces or cars, only using greywater for garden watering, and lower per person water use targets to save water in and around the home	13.7%

Source MWP and Drought Management Options Study

It is not possible to forecast with confidence how long these restrictions will be in place or if deeper restrictions will be announced in the 2020 Determination period. However, we note that water restrictions were in place for nearly six years during the last major drought (2003-2009), suggesting that it is quite possible restrictions will be in place for all or most of the 2020 Determination period.

In the 2003-09 period, Level 1 restrictions were in force for approximately eight months, replacing the previous voluntary measures. Level 2 restrictions were then in place for a year, followed by more than four years of Level 3 restrictions. These Level 3 restrictions were maintained for approximately two years after storage levels recovered to above 50%.

Source: Water NSW[29]

Figure 4-10 Greater Sydney Storage Levels

Analysis carried out by Sydney Water's Demand Analyst[30] estimated that Level 1, 2 and 3 restrictions in 2003-09 led to 12%, 16% and 17% reductions in demand.

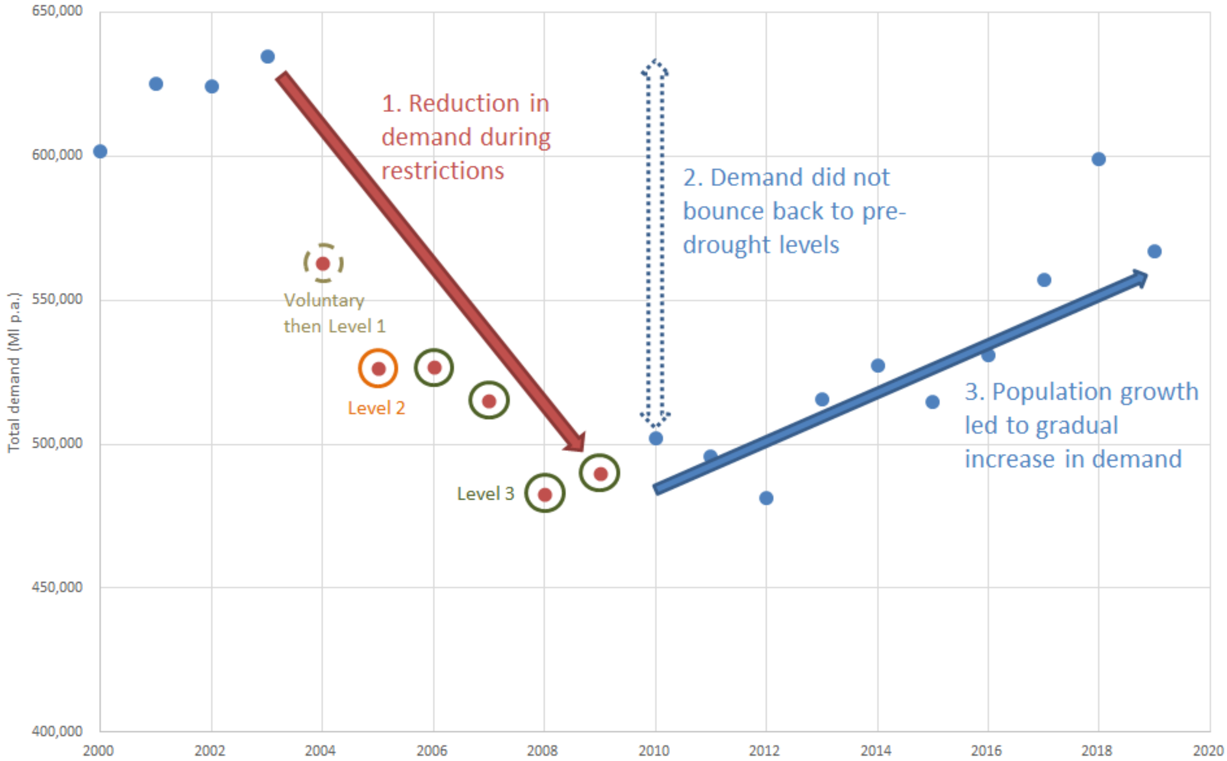
The impacts of the 2003-09 restrictions on Sydney Water's total demand are summarised below. After the restrictions were lifted, water demand did not bounce back quickly to pre-drought levels. Instead, demand climbed slowly back up after the restrictions were lifted, driven primarily by customer growth.

The response may be different following the lifting of the current restrictions, as the customer base has evolved in the last ten years, initiatives such as the Water Efficiency Labelling and Standards scheme have changed water use[31], and it is hard to predict customer behaviour change. However, the experience of the 2003-09 restrictions does suggest that demand restrictions can have long-lasting effects, especially after being in place for many years, as customers adjust to more efficient use of water (drought-resilient gardens for example).

[29] Greater Sydney water storage and supply report, 5 December 2019. https://www.waternsw.com.au/__data/assets/pdf_file/0017/151622/Thursday-5-December-2019.pdf

[30] From: Estimating the Savings from Water Restrictions in Sydney, F.Spaninks, Journal of the Australian Water Association, August 2010

[31] See for example, Institute for Sustainable Future (2018) Evaluation of the Environmental and Economic Impacts of the WELS Scheme, Prepared for: Australian Government Department of Agriculture and Water Resources



Source: Sydney Water SIR and Atkins/Cardno analysis

Figure 4-11 Impacts of 2003-09 restrictions on Sydney Water total demand

As seen in Table 4-10 above, the MWP envisages three levels of water restrictions. Level 1 & 2 restrictions were enacted at approximately 53% and 45% storage levels, i.e. 3-5% in advance of the MWP triggers. If this pattern continues, the next level of restrictions could be enacted at 33-35% storage. Storage levels have reduced by approximately 16% in the twelve months to early December 2019. If this rate of decline in storage continues, the next level of restrictions could commence in mid to late 2020.

Our view is therefore, that, if the drought continues, deeper restrictions could be in place early in the next Determination period. Experience from 2003-09 suggests that they may then be maintained at this level for a reasonable period of time. Only if the drought stabilises soon is it likely that the Level 2 restrictions will be maintained.

For the purposes of a representative 'drought' demand we have assumed that average savings of 15% will be achieved. We have proposed this level of saving as a **very approximately** probability-weighted estimate taking account of the probabilities that Level 2 restrictions continue, or deeper restrictions are put in place. The derivation is summarised below:

Table 4-11 Derivation of assumed drought demand saving

Restriction level	Probability assumed	Saving assumed
Level 2	20% Lower probability than Level 3 as, if the drought continues, it seems likely that deeper restrictions will be put in place relatively soon. Experience from 2003-09 that approximately 20% (1 year) of the Level 2/3 restrictions duration (5 years) was spent in Level 2	13.7% As per Sydney Water target
Level 3	80% Remainder from above	15.4% Mid-point of 13.7% and 17% savings (deepest savings achieved in 2003-09). The mid-point has been chosen rather than 17% as it seems likely to be harder to achieve the same savings as in 2003-09 because of the change in customer base and the chance that some of the savings from 2003-09 remain in place. NB: it is not yet known what the restrictions will consist of so this is a very high level estimate
Overall saving		15.0% (20% x 13.7% + 80% * 15.35%)

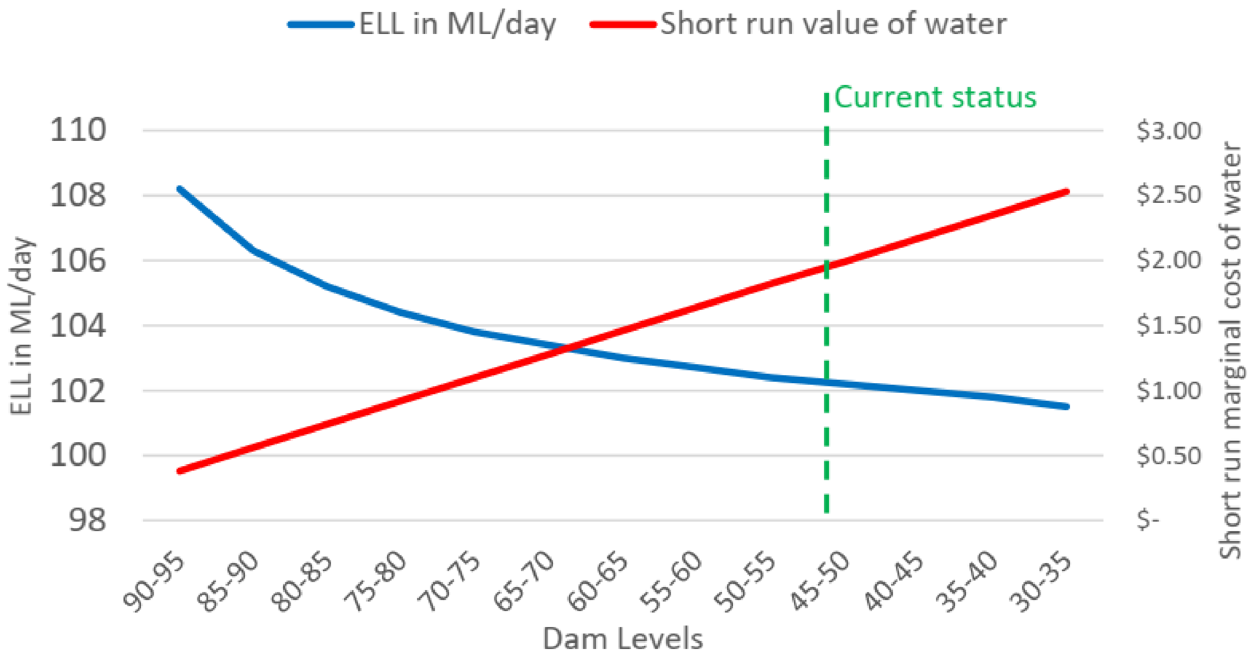
Source Atkins Cardno Analysis

There are a number of caveats around this figure:

- Drought is inherently unpredictable and is not a single state of affairs (e.g. there is a significant difference in customer perception and therefore demand responses between a ‘drought’ at 50% storage and 10% storage)
- The outturn savings depend on the effectiveness of water conservation measures and communications.
- The adjustment is built on uncertain new development projections and a non-residential model in which we have limited confidence.
- The customer base has changed significantly since 2003-09, and continues to do so, so care is required when extrapolating the impacts into the future.

Although there is a wide range of uncertainty around the assumption of a 15% saving, we consider it is reasonable when set against the savings achieved in 2003-09 (12, 16 and 17% for levels 1, 2 and 3) considering that we expect the savings to be a little harder to achieve this time.

We consider that some of the savings should be achieved through non-revenue water, or leakage, reduction, rather than just customer demand. Sydney Water's own analysis suggests that ELL reduces with storage levels as shown below.



Source: Sydney Water[32]

Figure 4-12 Economic level of leakage and dam levels

Assuming a representative drought ELL of 102Mld, and a representative non-drought ELL of 105Mld, implies that Sydney Water should be reducing leakage by approximately 3Mld in drought situations.

We have recommended two demand levels: a drought and non-drought demand. The key assumptions underlying these projections are summarised below.

Table 4-12 Key assumptions underlying recommended demand levels

Assumption	Drought Demand	Non-drought Demand
Leakage level (inferred from Figure 4-12)	102Mld (37,230 Ml p.a.)	105Mld (38,325 Ml p.a.)
Other elements of demand	3Mld leakage reduction applied then each remaining Sydney Water projection demand element is adjusted pro-rata to achieve 15% reduction against Sydney Water's projected total demand.	Sydney Water projection

Source Atkins Cardno Analysis

The recommended demands for drought and non-drought situations are summarised below.

[32] RFI response 385.1

Table 4-12 Recommended drought demand (Ml p.a.)

	2021	2022	2023	2024	2025
Total water available for sale to own customers	484,324	490,166	495,675	502,560	506,119
- billed metered consumption	431,665	437,387	442,782	449,516	453,009
- billed unmetered consumption	3,103	3,103	3,103	3,112	3,104
Billed authorised consumption	434,768	440,490	445,885	452,628	456,113
- unbilled metered consumption	269	269	269	269	269
- unbilled unmetered consumption	2,940	2,940	2,940	2,941	2,941
Unbilled authorised consumption	3,209	3,209	3,209	3,209	3,210
- unauthorised consumption	483	489	495	502	506
- customer metering inaccuracies	8,633	8,748	8,856	8,990	9,060
Real losses (i.e. leakage)	37,230	37,230	37,230	37,230	37,230
Treated water used for recycled water top-up	**825**	**582**	**601**	**619**	**638**

Source Sydney Water SIR and Atkins/Cardno analysis

Note: "treated water used for recycled water top-up" is a separate component additional to "total water available for sale to own customers"

Note that the drought demands are not exactly 15.0% lower than either Sydney Water's projections or the non-drought demands below, because of the recommended adjustment to Sydney Water's leakage levels.

Table 4-13 Recommended non-drought demand (Ml p.a.)

	2021	2022	2023	2024	2025
Total water available for sale to own customers	**570,565**	**577,482**	**584,006**	**592,170**	**596,378**
- billed metered consumption	513,874	520,648	527,038	535,023	539,155
- billed unmetered consumption	3,694	3,694	3,694	3,704	3,694
Billed authorised consumption	517,568	524,342	530,731	538,727	542,848
- unbilled metered consumption	320	320	320	320	320
- unbilled unmetered consumption	3,500	3,500	3,500	3,500	3,500
Unbilled authorised consumption	3,820	3,820	3,820	3,820	3,820
- unauthorised consumption	575	582	589	598	602
- customer metering inaccuracies	10,277	10,413	10,541	10,700	10,783
Real losses (i.e. leakage)	38,325	38,325	38,325	38,325	38,325
Treated water used for recycled water top-up	**982**	**693**	**715**	**737**	**759**

Source Sydney Water SIR and Atkins/Cardno analysis

Note: “treated water used for recycled water top-up” is a separate component additional to “total water available for sale to own customers”

5. Operating Expenditure

We are required to review actual operating expenditure incurred over the 2016 determination period. In undertaking we must:

- *Report and comment on the variations in operating expenditure from what was allowed in the 2016 determination period, including the extent to which these variations are justified or not.*
- *Identify and comment on the nature and size of operational savings realised (e.g. whether they are permanent or temporary in nature).*

We are also required to review the efficiency of forecast operating expenditure for the 2020 determination period. In undertaking this task, we must:

- *Provide recommendations as to the efficiency of the utility's forecast level of operating expenditure and provide annual estimates of the level of operating expenditure that is required to efficiently supply the regulated monopoly services.*
- *Identify the potential for and recommend efficiency savings to be achieved within the operating expenditure budget, and provide evidence and reasoning to support the recommended savings.*
- *Advise on the appropriateness of and recommend how shared operating costs (including overheads) are allocated to monopoly services, and the rationale for this allocation.*
- *Identify any consequential impacts on capital expenditure (i.e. increased or reduced costs) based on the assessment of operating expenditure.*
- *Where appropriate, have regard to productivity benchmarking analysis when identifying potential efficiency savings.*

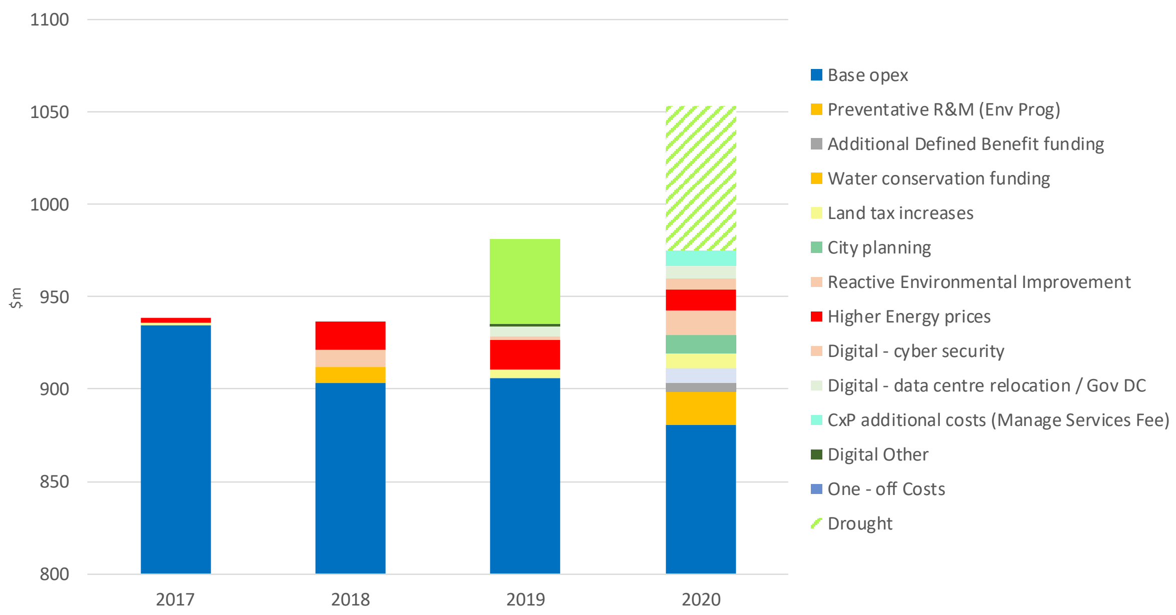
5.1. Summary

5.1.1. 2016 Determination period

Operating expenditure was below the Determination in 2017 and 2018 although significantly exceeded the allowed expenditure in 2019 and 2020. Total variance was $205.5m above the determination although $6.4m was due to bulk water expenditure. This latter variance may differ from the Sydney Water value as we have applied inflation factors advised by IPART. The $199.1m variance in core expenditure was mainly attributable to both water and wastewater services. Electricity expenditure, mainly outside the control of Sydney Water, has increased over the period which accounts for $39.9m of this variance.

The July SIR was subsequently updated in October 2019 to include actual expenditure for year 2019 with an unchanged forecast for year 2020. In 2019 the impact of the drought increased expenditure comprising mainly additional work to rectify dry weather overflows and increasing number of bursts. The expenditure also included some water conservation activities.

The year 2020 forecast core expenditure is $68.5m above the Determination excluding drought costs which Sydney Water has not included in the SIR. The increases are mainly due to additional planned and reactive infrastructure maintenance, IT Digital costs, water conservation costs, additional planning inputs to Western Sydney and other increases offset in part by a reduction in base operating expenditure. The expenditure variances are shown in Figure 5-17 below. We note that the 2020 expenditure is an estimate and Sydney Water advised us that a stretched efficiency target has been set by Directors although not included in the July 2019 SIR. This $12m efficiency target is not specific but is appropriate and reflects what a frontier company would do in response to market forces. We noted that Sydney Water is implementing efficiencies through the period, indicated by the reduction in base opex in Figure 5-1.



Source Sydney Water submission table 11

Figure 5-1 Increases in expenditure in the 2016 Determination period

We confirmed that performance measures, as defined in the Operating Licence and environmental performance measures, are generally being achieved although headroom is reduced. The measure for unplanned interruptions is marginally below the reference level and there is an increasing trend in sewer chokes although still below the reference level. These chokes have resulted in increased dry weather overflows and the need to clean up resulting in additional expenditure. Some sewerage catchments have exceeded their EPA licences for wet weather discharges.

We found that expenditure in the 2016 Determination period had been efficient with the exception of some shortfalls.

- the 2016 target to increase renewables was not fully achieved resulting in higher grid costs;
- the level of infrastructure planned maintenance reduced over the period; this has contributed to the increasing number of overflows emerging as soil moisture reduced and root intrusion increased. The level of subsequent reactive maintenance could have been reduced;
- leakage has been above the mean economic level for over two years; by definition this is not efficient. Sydney Water has not been effective in repairing leaks quickly;
- The base water conservation measures are appropriate although optimistic for business customer benefits. However, there should be much greater focus on leakage reduction which is within management control and greater benefits can be delivered earlier;
- It is unclear whether benefits from IT Digital projects are overstated or not being effectively tracked. There should be greater clarity in these benefits which are tracked across the business;
- The Rosehill-Camilla recycling plant is not efficient due to the lack of customers and an apparent lack of action by management to use recycled water more effectively, particularly in drought conditions;
- The St Mary's recycling plant has been operating well below full output and the benefits are not being delivered . This recycled water is a valuable resource to allow increasing abstraction upstream, particularly in drought conditions.

We found that operating expenditure was prudent with two exceptions;

- We question whether elements of the City Planning expenditure for a possible Stormwater drainage authority should be funded by water and wastewater customers;
- We question whether payments made to the SDP during the period when the desalination plant was damaged, and not able to fulfil its role under 'Water Security Mode', should be funded by customers;

5.1.2. 2020 Determination Period

Sydney Water submitted its proposals in a July 2019 SIR followed by an update submission in November 2019. The latter was mainly due to increasing requirements to meet drought conditions with increases in base expenditure and cost pass-through expenditure dependent on the implementation of water use restrictions.

We found that Sydney Water has made a detailed assessment of its operating expenditure requirements which have been subject to internal challenge as part of its budget process. It has also made a proactive assessment of efficiency savings which are being implemented in the 2016 Determination period and continue through the 2020 period.

We have looked at the balance of risk between customers and Sydney Water as this is important in defining work activities, assumptions and efficiency adjustments. We found that Sydney Water is taking a risk averse approach in some areas of operating expenditure resulting in higher costs to customers.

Sydney Water has changed the allocation of corporate expenditure to include an apportionment to bulk water supplies. While we can understand the logic in this approach, as it is conventional practice to allocate overheads to all purchased services, the quantum of these costs and the relatively low level of corporate input to manage this, does question this approach. The impact has been a significant increase in costs in the water service with a corresponding material reduction in wastewater. Our analysis separates corporate costs to clear trends can be seen for both water and wastewater services.

We noted that while direct expenditure in the water and wastewater services is consistent through the period, the support costs are increasing. These costs comprise about 25% of the total expenditure, including bulk water costs, compared with 17% in the 2016 Determination period. While some of this expenditure can be related to increases in IT Digital, this percentage has increased for other reasons.

We have identified scope for efficiency savings in several areas. We also take note of the efficiencies proposed by Sydney Water either explicitly or inferred from IT Digital projects.

Drought resilience projects

We have reviewed the operating expenditure proposals for the Prospect to Macarthur pipeline project. We found these expenditures are overstated because the method used to estimate these components is not appropriate. We have based our level of efficient expenditure on the actual costs incurred by Sydney Water across its whole network to derive incremental costs.

Service Delivery – Water maintenance

Sydney Water proposes additional water maintenance expenditure to repair leaks and return leakage to the mean ELL. We confirm that this reactive leakage activity is required to return leakage to its mean economic level as soon as practical. Sydney Water was not able to respond to increasing leakage because it did not have the flow monitoring and leakage detection systems that most other frontier companies normally use. This results in delays in locating leakage at an early stage. Leaks were mainly reported when water had reached the surface. This has resulted in total leakage being well above the economic level. Customers are asked to pay for both water lost from the system and the cost of repairs. We conclude that the additional expenditure is required to return leakage to its mean economic level. However, the cost of water lost from the system above the ELL reflects inefficiency in operation which should not be included within the allowable expenditure.

Service Delivery - Wastewater maintenance

Sydney Water proposes increased expenditure to address sewer chokes arising in part by the impact of drought conditions. Our view is that this work needs to be done to meet expectations of customers, the EPA and licence requirements. However, we question whether some of the reactive expenditure could have been avoided by more effective asset management and a greater activity in for example in proactive CCTV work during the 2016 Determination period. In addition, reports of effective responses to incidents and clear-up may well be matters of more effective working, monitoring and timely clean-up. Customers should only be expected to fund efficient activities. With the Customer Hub now in place we would expect the process to be more effective.

BOOT Water treatment

BOOT treatment costs are driven by volume and water quality. In an average year assumption, with reservoir storage above 60% the desalination plant would not be operating and all bulk supplies would be derived from WaterNSW with the filtration plants with high throughput and water quality would be expected to be good. There are small changes to the assumed volumes which we have based on our demand forecast discussed in Section 4. This results in a small reduction in treatment costs.

With lower reservoir storage, below 60%, we assume that the SDP plant would be operating and the extension may operate later in the period. Treatment for the BOOT plants would be reduced. The lower loading rates on the filters would allow them to operate with deteriorating water quality, turbidity and colour, but within the water treatment agreement. This scenario has not been included in the base operating expenditure but is discussed with the cost pass-through proposals in Section 8.3.

Sydney Water has an underlying assumption that future costs should reflect 'average' conditions. Colour is a significant treatment cost driver, [redacted]

We found this to be a risk averse approach and results in significant increases in treatment works costs in an average year scenario which are likely to be overstated. We have accepted Sydney Water's revised proposals to share any increasing cost risk between it and customers.

[redacted].

Electricity

Sydney Water has an energy efficiency program which is forecast to deliver 13 GWh additional savings over the 2020 Determination period, equivalent to 0.75% per year. In addition, energy from renewables is forecast to contribute to 20% of total demand. While good progress has been made to manage grid energy within the 1998 level, further use of renewables should be explored. We suggest a stretched renewables target of 2% of grid supplies by the end of the 2020 Determination period should be set. This should help to offset potential increases in grid supplied after 2024.

City Planning

Additional expenditure was included from 2020 to support the Department of Planning, Infrastructure and environment to provide strategic management and planning support for the Western Parkway City including the South Creek and airport. We had questioned whether elements of this expenditure, particularly related to stormwater drainage, should be funded by water and wastewater customers. As this input is for a specific requirement which might morph into a separate planning authority, we question whether this expenditure would continue through the whole of the 2020 Determination period. We have assumed that the $8m/a proposed would continue through to the end of 2022.

Water conservation - communications and advertising

Sydney Water is proposing $20m/a for communications and advertising. While the total expenditure is explained and activities are appropriate, we question the allocation between the base position, when there are no water restrictions and when these are introduced. We suggest that in the base case, with storage greater than 60%, communications and advertising costs should be $5m/a increasing to $20m/a when water restrictions are in place. The cost pass-through element would be $15m/a included in Section 8.5. Sydney Water has accepted this adjustment although suggested the trigger be 65% or 70%. We propose that this trigger be consistent with IPART's assumption on base and drought pricing scenarios.

Infrastructure resilience

There was no information provided to support the infrastructure resilience investigation proposals. We consider this activity to be business as usual and have adjusted the proposed expenditure. Sydney Water has accepted this adjustment.

Digital

Our review of the Digital projects in Section 6 identified significant operating expenditure efficiencies from the BxP and other projects. We have assumed that these efficiencies are included in Sydney Water's efficiency proposals although it is not entirely clear where these are.

Catch-up efficiency

We carried out some benchmarking to compare Sydney Water with similar large water utilities in Australia. This showed that it was ranked well above most other utilities. We also benchmarked Sydney Water against the econometric models currently used by Ofwat in England and Wales to determine efficient base totex. We input the Sydney Water operating and replacement expenditure into the UK Ofwat models used for the PR19 price review to compare with an efficient expenditure derived from the modelling. While the analysis is sensitive to assumptions on exchange rates it provides an indicative comparison of Sydney Water against frontier companies. Sydney Water's wastewater service is within 4% of the modelled costs although sensitive to the corporate cost allocation. The water service costs are significantly greater than the modelled costs. Sydney Water's resources costs are significantly greater than UK companies; the England and Wales companies tend to have different resource characteristics and size with low resources costs, and invest in multi-barrier treatment processes rather than the single barrier treatment applied by Sydney Water.

From the results of our high-level benchmarking analysis with water utilities in England and Wales, the extent of catch-up efficiency is similar to the efficiency proposals included in the submission. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings but we have assumed that all is attributable to catch-up efficiency as much of this is productive efficiency.

Continuing Efficiency (Frontier Shift)

Analysis of the Productivity Commission multi-factor productivity (MFP) data by IPART[33] suggests that a sustained average annual Multi-Factor (MFP) improvement[34] of between 0.6% and 0.8% is achievable in Australia. These results include performance from 1975-76 to 2017-18. They reflect economy-wide performance:[35] all industry sectors and all firms in each sector. In that sense, this range is conservative. Recognising this conservatism, we recommend the top end of that range: 0.8% per annum be adopted.

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[36] to undertake an assessment of 'Frontier Shift'; that is the scale of frontier shift that can be expected to achieve 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. A

[33] Ongoing productivity adjustment, IPART December 2019

[34] We consider that MFP is a more useful productivity indicator than labour productivity for a public water utility, which must make substantial capital investments efficiently.

[35] While productivity estimates are available for the combined energy and water utility sector, we prefer to examine productivity changes across the entire Australian economy. The productivity of the energy sector has been impacted by market restructuring, overinvestment in networks and policy uncertainty for the past twelve years.

[36] Real Price Effects and Frontier Shift, Europe Economics January 2018

recommended frontier shift ranges is derived for botex, that is the combination of wholesale operating and asset replacement expenditure, of 0.6% to 1.4% per annum.

In its final determination in December 2019, Ofwat updated its assessment of Frontier Shift including the updated European Economics report and other reports to propose a level of Frontier Shift in its efficiency report forming part of its final determination[37]. In this document it comments on the responses it received from the UK water sector. It allocated a 1.1%/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, that a Frontier Efficiency of 0.8% per annum should be applied to proposed expenditure, applied to all base costs.

We compared the additional efficiencies proposed by Sydney Water in its Updated submission. Sydney Water proposed an increasing efficiency from 0.5% in 2021 to 1.5% in 2024 applied cumulatively. We found that there was little difference in the level of efficiency derived. Sydney Water proposed $87.0m (taking account our scope adjustments) in Frontier Shift over the 2020 determination period compared with $82.0m from our analysis. For consistency between operating and capital expenditure, and other efficiency reviews, we have applied our 0.8%/a continuing efficiency across all expenditure. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings but we have assumed that all is attributable to continuing efficiency as much of this is dynamic efficiency

Efficiencies are applied to the base expenditure including the November Update submission. We conclude that the level of efficient operating expenditure is as presented in Table 5-1 below.

[37] PR19 Final Determination -Securing cost efficiency technical appendix, OFWAT December 2019

Table 5-1 Efficient Expenditure in the 2020 Determination period

SYDNEY WATER PROPOSED TOTAL OPERATING EXPENDITURE					
($m 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
Water	393.2	409.4	410.5	410.1	1623.2
Water BOOT	101.0	101.7	101.8	102.4	407.0
Wastewater	482.1	483.2	476.4	474.1	1915.7
Stormwater	14.5	14.8	15.0	15.2	59.5
Recycled Water	33.0	32.9	32.1	32.3	130.2
TOTAL CORE OPERATING EXPENDITURE (including base efficiencies)					
Total including base efficiencies	1023.8	1042.0	1035.8	1034.1	4135.6
Base efficiencies proposed by Sydney Water	20.0	18.2	31.5	34.8	104.5
Total excluding Sydney Water efficiencies	1043.8	1060.2	1067.3	1068.9	4240.1
ATKINS RECOMMENDED SCOPE ADJUSTMENTS					
Total change in scope	-28.04	-33.19	-42.25	-42.27	-145.75
ATKINS RECOMMENDED EFFICIENCY ADJUSTMENTS					
Total efficiency adjustments	-8.13	-16.43	-24.60	-32.85	-82.01
ATKINS RECOMMENDED TOTAL ADJUSTMENTS					
Total adjustments	-36.17	-49.62	-66.85	-75.12	-227.76
ATKINS RECOMMENDED EFFICIENT BASE OPERATING EXPENDITURE					
Water	373.08	381.05	375.25	371.57	1500.95
Water BOOT	96.70	96.57	99.09	98.85	391.20
Wastewater	470.76	467.81	448.63	442.58	1829.78
Stormwater	14.35	14.59	14.64	14.76	58.35
Recycled Water	32.70	32.34	31.33	31.23	127.60
Total base opex	987.60	992.35	968.94	959.00	3907.88
ATKINS RECOMMENDED BULK WATER					
WNSW Bulk supply	189.18	193.73	199.58	202.78	785.27
SDP	180.62	178.81	178.81	178.81	717.05
ATKINS RECOMMENDED TOTAL EFFICIENT EXPENDITURE					
Total	1357.40	1364.89	1347.33	1340.59	5410.21

Source: Atkins analysis

Note: Scope adjustments refer to the extent of proposed additional activities above the base; Efficiency adjustments refer to the cost savings to be achieved in delivering the whole operating expenditure program.

5.2. Methodology

In this section, we present the results of our review of the efficiency of Sydney Water's operating expenditure. We identify the major cost drivers and explain the variances in the current determination period expenditure against the 2016 Determination period. We comment on the prudence and efficiency of operating expenditure in the 2016 Determination period which is used to inform our view of future efficiency. We comment in Section 3 on the strategic management of the business and the structures and systems used to plan and manage expenditure.

We then make an assessment of an efficient level of expenditure for the period 2021 to 2025 taking into account our discussions with Sydney Water, documents presented and subsequent answers to questions we raised. We note the efficiencies proposed by Sydney Water. We discuss the cost drivers and efficient cost level recommendations for operational and support activities.

The methodology for the review of operating expenditure has focused on an evaluation of:

(i) Actual expenditure for financial years ending 2017 to 2019;

(ii) The current budget for year ending 2020; and

(iii) The projected costs for the financial years ending 2021 to 2025.

The evaluation of operating expenditure was undertaken using Sydney Water's 2019 Submission and supporting AIR and SIR spreadsheets dated July 2019 and updated in November 2019. Our assessment is based on the actual operating expenditure in the Submission, the robustness and confidence of these expenditures taking into account the basis of the estimates and the confidence of the need, timing and scope of the requirements. We also take into account whether additional expenditure proposals have been through the internal approval and challenge processes.

We have interviewed the functional managers, reviewed supporting reports and documents and assessed the current position on the development and implementation of corporate systems used to set budgets, control and monitor costs and allocate expenditure to the IPART expense types.

We have taken particular attention to the efficiency proposals at functional level made by Sydney Water in its submission.

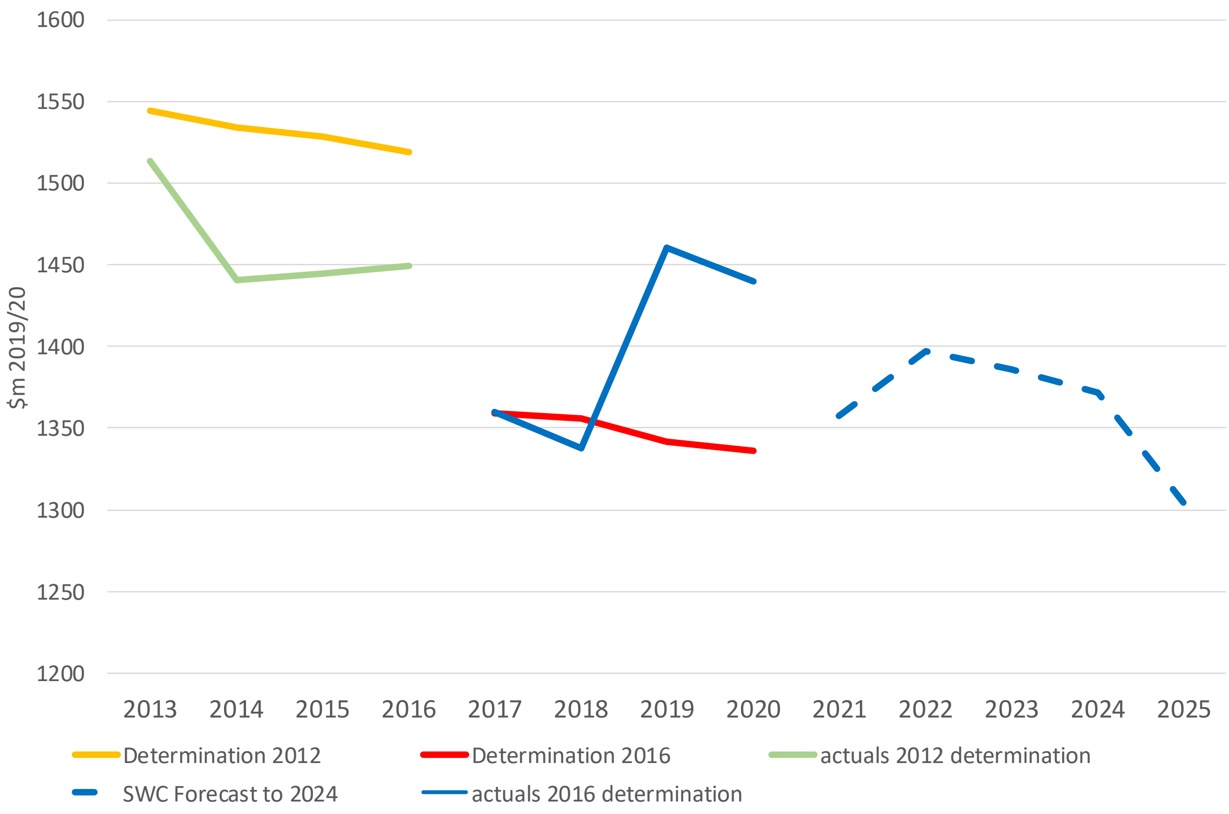
We present our analysis of the future expenditure proposals by Sydney Water and comment for each activity on the potential for efficiencies through the robustness of estimates, the need and timing of expenditure and absorbing of some activities within base opex as a surrogate for the application of internal challenge and budget control.

Our views on future efficiencies are based on the hypothesis of a Frontier Company, the continuing efficiencies that it makes through innovation and technological development and the catch-up efficiency required of Sydney Water to achieve the performance of a Frontier Company over time.

5.3. Overview

In the 2016 Determination period[38], Sydney Water was set an efficiency target of $54m lower than its 2015 proposal, comprising $46m (1.3%) of its core operating expenditure and $8m (0.5%) of bulk water costs. Sydney Water has exceeded the efficient expenditure set for the current determination period. Figure 5-2 below compares actual, (and forecast for 2020) expenditure over the years 2017 to 2020 with the Determination. A comparison of actual expenditure against the 2012 Determination is shown as a comparison. Figure 5-2 also shows forecasts of operating expenditure for 2021 to 2025 for comparison of trends.

[38] Review of Prices for Sydney Water Corporation's Water, Sewerage and stormwater and other services, IPART June 2016.



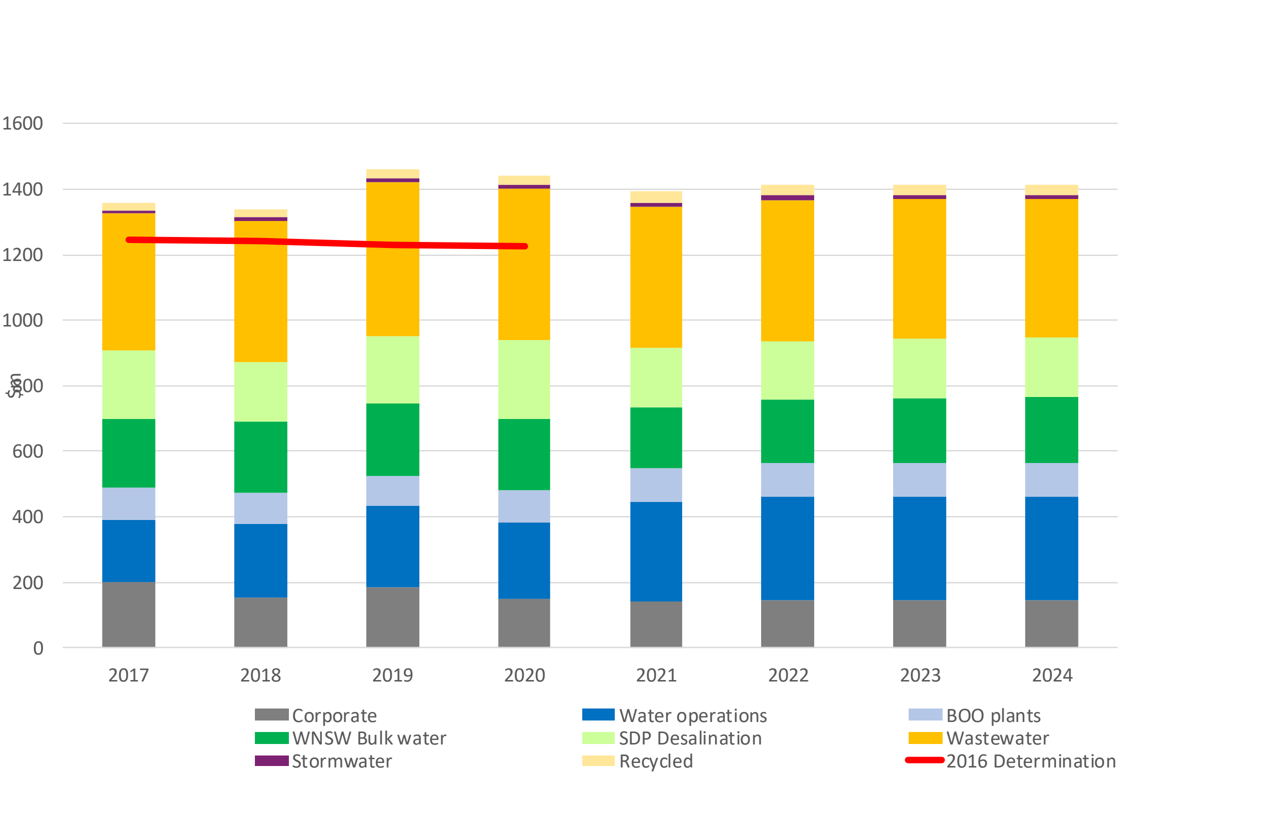
Source: SIR, IPART Determination report and Atkins Cardno 2016 report and analysis

Figure 5-2 Expenditure comparisons 2008, 2012 and 2016 Determinations

Figure 5-2 includes expenditure for bulk water and desalination water which are pass-through costs. Year 2020 in the current Determination period is a forecast. Expenditure in the 2012 to 2016 Determination period is impacted by an increase in desalination costs when the plant was in operational mode during 2020. Actual expenditure from 2017 and 2018 is marginally below the 2016 Determination period although increases significantly in year 2019 and forecast for 2020. Actual expenditure for the 2016 Determination period is $205.5m (3.8%) above the determination, comprising $6.4m (0.1%) bulk water costs and $199.1m (5.4%) core costs. We discuss the reasons for this variance in Section 5.3.

Sydney Water/s Update submission[39] has proposed a level of operating expenditure for 2021 to 2025 below the forecast 2020 base year. This is shown in Figure 5-3 below which presents expenditure by service over the current and future determination period. The Figure includes bulk water costs for completeness although these do not form part of the Sydney Water controllable costs. The 2016 Determination period operating expenditure is shown for comparative purposes.

[39] Price proposal 2020-24 Update to July 2019 proposal, Sydney Water Nov 2019



Source: SIR, IPART Determination report and Atkins Cardno 2016 report and analysis

Figure 5-3 Actual and Proposed Operating Expenditure 2017 to 2025

Assumptions applied to these forecasts include

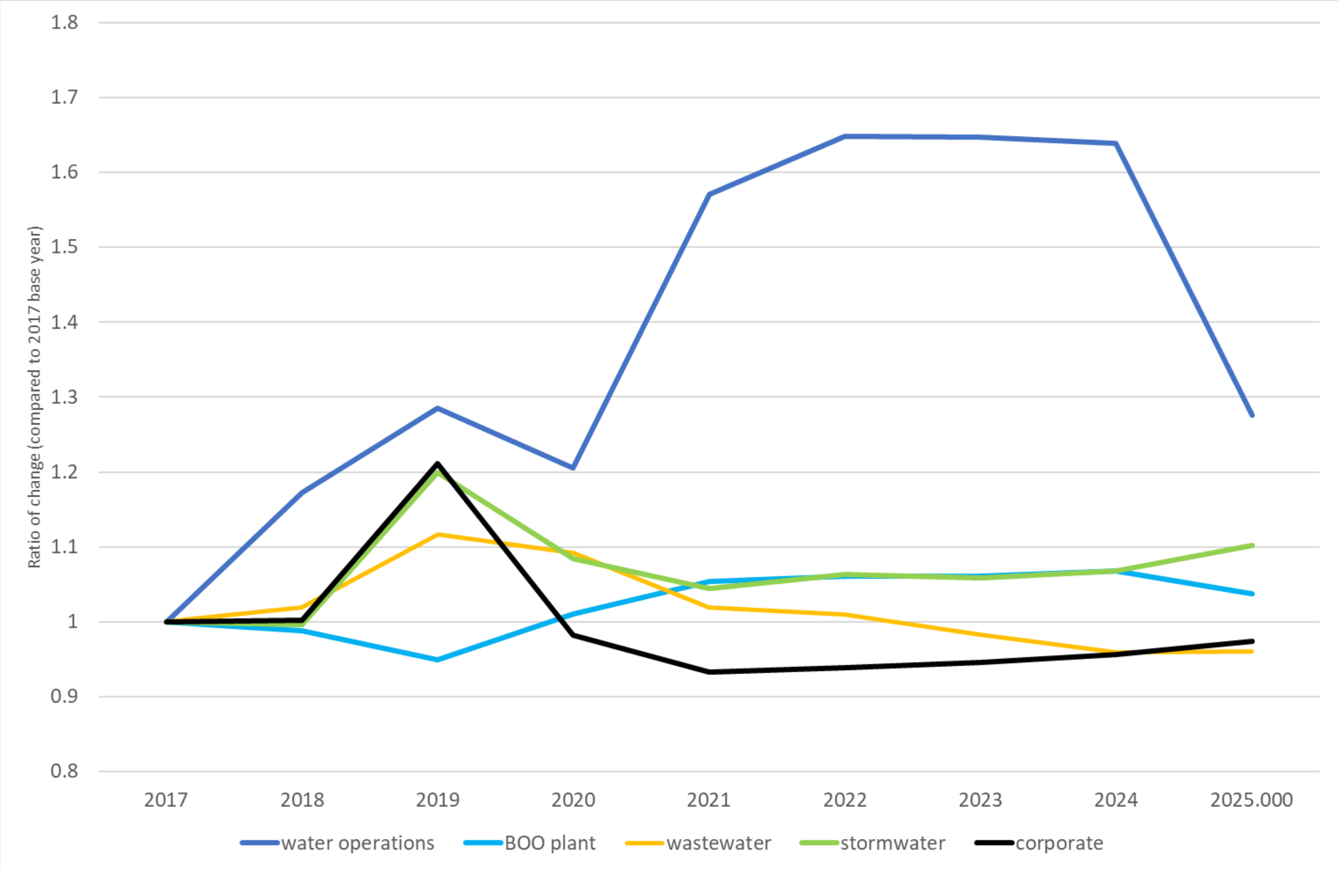
(i) the Sydney Desalination Plant (SDP) is operational for the minimum period set out in the IPART Determination;

(ii) The allocation of corporate overheads to each service changes from 2021 to include bulk water supplies within the apportionment. This results in an increase in water service costs from 2021 and a corresponding reduction in wastewater service costs. We have separated corporate expenditure in Figure 5-3 above as a separate component to avoid discontinuity of trends, particularly in the water and wastewater services.

(iii) Expenditure for the 2020 determination period includes base expenditure in the Sydney Water updated submission including proposed efficiencies.

Expenditure Trends by Service

Figure 5-4 below shows the trend in service expenditure from 2017 at the start of the 2016 Determination period. All trends exclude allocation of corporate costs as the assumptions made are changing from 2021. We have included the trend in BOOT costs as these are indirectly controlled by Sydney Water but have excluded bulk supply costs from WNSW and the SDP. The stormwater trend has been rebased to 2018 due to apparent inconsistencies in 2017 data.



Source: SIR and Atkins Cardno analysis

Figure 5-4 Expenditure Variance by Service from 2017 base

The water service expenditure, excluding corporate, shows a 5% increase over the 2016 Determination period followed by a significant increase from 2020 to 2024 driven mainly by drought-related activities and reactive maintenance. The BOOT plant costs show a reducing trend in the 2016 Determination period followed by continuing increases over the period 2020 to 2024 of up to 7%. The wastewater service shows an increasing trend over the 2016 Determination period to nearly 10% but falling back below the 2017 base year value over the 2020 Determination period. The variances for stormwater and recycled water are shown to increase over both determination periods by over 10% although are not as material as the larger service expenditures.

5.4. Operating Expenditure in the 2016 Determination period

5.4.1. Overview

Sydney Water's submission compares actual expenditure in the current determination period against the 2016 Determination period and explain the reasons for cost variances. We have analysed the operating expenditure by service area or product and identify and comment on material variances. We identify cost savings and increases as a result of external factors and Sydney Water's management actions. We comment on the efficiency of expenditure in the current determination period and identify any areas of expenditure which are not consistent with the definition.

Sydney Water has continued to use the established RCM process, an activity-based costing process applied at the 2016 Determination period, to allocate costs for all years to each service and sub-service and to the regulated and non-regulated businesses. The SIR submission and outcome from the RCM analysis provides the basis for our analysis and presentation.

We have taken actual and forecast expenditure for the current Determination period from 2017 to 2020 and compared these values with the Final Determination 2016 brought up to the 2020 price base using indices provided by IPART. We have calculated the variance at service level or product level as shown in Table 5-2.

Table 5-2 2016 Determination period Variance Analysis by Product

SYDNEY WATER OPERATING EXPENDITURE - 2016 DETERMINATION PERIOD					
$m 2019/20 Year ending June	2017	2018	2019	2020	variance actual to determination
TOTAL OPERATING EXPENDITURE (including S16A recycling costs)					
2016 Determination	1359.07	1355.80	1341.63	1336.18	
Actual	1359.9	1337.9	1460.5	1439.9	
Actual > Determination	0.8	-17.9	118.8	103.7	205.5
BULK WATER OPERATING EXPENDITURE					
2016 Determination	420.7	422.9	427.2	429.4	
Actual	419.5	399.2	426.6	461.4	
Actual > Determination	-1.2	-23.6	-0.7	32.0	6.4
CORE OPERATING EXPENDITURE (Including S16A recycling costs					
2016 Determination	938.4	932.9	914.4	906.8	
Actual	940.4	938.7	1033.9	978.5	
Actual > Determination	2.0	5.8	119.5	71.8	199.1
WATER OPERATING EXPENDITURE (including S16A recycling costs)					
2016 Determination	376.0	374.9	368.4	366.2	
Actual	372.0	396.2	426.5	405.0	
Actual > Determination	-4.0	21.2	58.1	38.8	114.1
WASTEWATER OPERATING EXPENDITURE					
2016 Determination	549.3	543.8	531.9	526.4	
Actual	557.9	527.2	588.8	557.2	
Actual > Determination	8.6	-16.6	57.0	30.8	79.8
STORMWATER OPERATING EXPENDITURE					
2016 Determination	13.1	14.2	14.2	14.2	
Actual	10.5	15.3	18.6	16.4	
Actual > Determination	-2.5	1.1	4.5	2.2	5.3

Source: SIR. Sydney Water submission and Atkins Cardno analysis

Source: 2016 IPART Determination, indices advised by IPART, Sydney Water submission

There is a total $205.5m variance of actual expenditure against the 2016 Determination period of which $6.4m relates to bulk water supplies and $199.1m in core operating expenditure. The difference in bulk water variance with the costs shown in the Sydney Water submission is that a different index was used by them to inflate bulk water costs to the 2016 price base.

5.4.2. Bulk water costs

Bulk water is supplied to Sydney Water from WaterNSW impounded water and the SDP under existing supply agreements. The agreement with WNSW comprises a fixed and volumetric charge. The agreement with SDP includes charges depending on the mode of operation. When in the Water Security mode, Sydney Water incurs a fixed charge to the SDP as determined by IPART and is reflected in the costs. The variance of bulk water charges is presented in Table 5-3. The variance analysis shown is against the 2016 Determination of Sydney Water.

Table 5-3 2016 Determination period bulk water variance analysis

SYDNEY WATER OPERATING EXPENDITURE - 2016 DETERMINATION PERIOD					
$m 2019/20 Year ending June	2017	2018	2019	2020	variance actual to determination
BULK WATER OPERATING EXPENDITURE					
2016 Determination	420.7	422.9	427.2	429.4	
Actual	419.5	399.2	426.6	461.4	
Actual > 2016 Determination	-1.2	-23.6	-0.7	32.0	6.4
WNSW BULK WATER OPERATING EXPENDITURE					
2016 Determination	214.0	216.6	220.9	223.1	
Actual	211.7	217.6	222.5	220.3	
Actual > Determination	-2.3	1.0	1.6	-2.8	-2.5
SDP OPERATING EXPENDITURE					
2016 Determination	206.7	206.3	206.3	206.3	
Actual	207.8	181.7	204.0	241.1	
Actual > 2016 Determination	1.1	-24.6	-2.3	34.8	9.0

Source: SIR. Sydney Water submission and Atkins Cardno analysis

There was a Determination for SDP from July 2017 which reduced the charges payable by Sydney Water. The impact of the SDP Determination was to reduce charges to Sydney Water by $82.1m[40] if the SDP remained in Water Security mode.

The trigger for the SDP to Restart was in January 2019. This explains the reduction in actual costs in 2018 and increases in 2019 and forecast for 2020. Sydney Water assumes that the SDP will operate for the minimum 14-month operational period and then return the Water Security mode. The net cost increase to Sydney Water from the SDP in the 2016 Determination period is $9.0m. With a saving of $2.5m on WNSW bulk water charges, the net variance is $6.4m or 0.3%.

We noted that the SDP was severely storm-damaged on 16th December 2015 up to a period in late 2017 when the plant was not available. We asked Sydney Water why it continued to pay an availability charge when the plant was not effectively in a Water Security mode. Sydney Water explained that

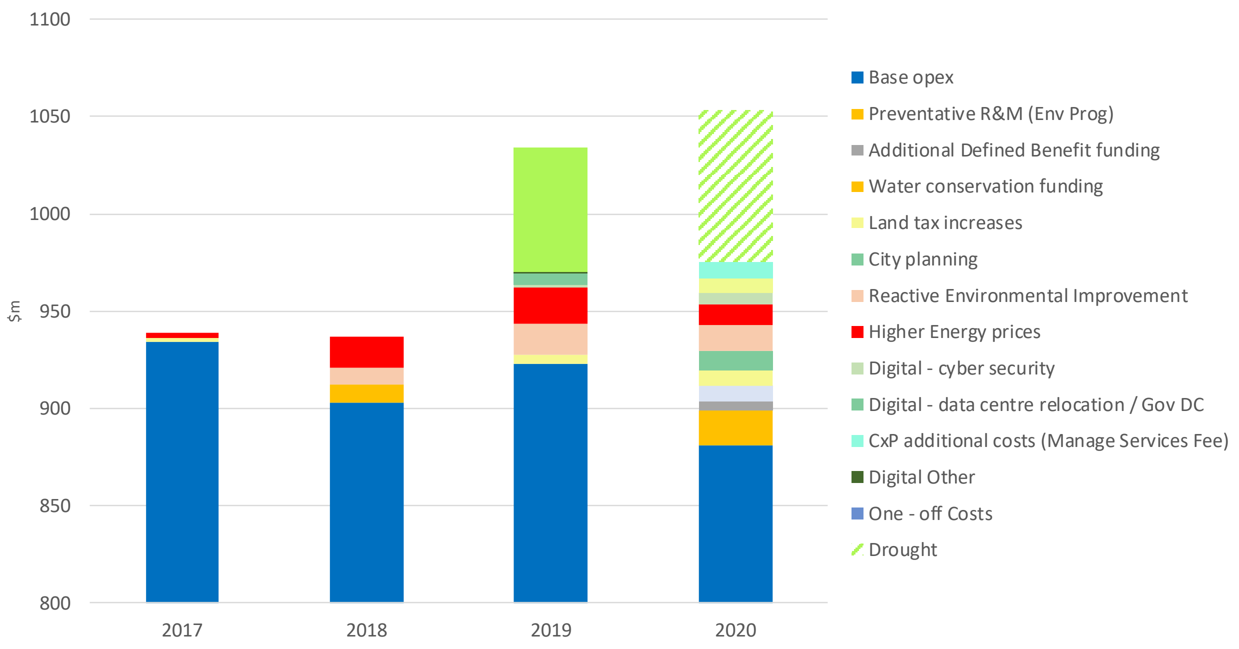
> *During the storm event that occurred on 16th December 2015 making the plant unavailable for a period of time, Sydney Water was still required to continue paying water security charges to the Sydney Desalination Plant because*
>
> *(i) The charges payable under the IPART price determination during a Water Security shutdown (which the desalination plant was in immediately before the storm event and continued to remain in during reinstatement) are not abated under the terms of the IPART price determination if the desalination plant is not available; and*
>
> *(ii) The Water Supply Agreement (WSA) with the SDP requires SWC to pay SDP the maximum charges payable for the provision of the service in accordance with the IPART price agreement*

We question whether customers should pay for the SDP water security costs during the period when the plant was not available for use and whether such costs should be covered from other sources such as insurance.

[40] SWC Submission Table 2.5

5.4.3. Variance in core operating expenditure

Sydney Water has identified several reasons for the $139.8m variance in expenditure above the 2016 Determination period and reported in Table 5.1. Reasons for increases which occur in 2019 and are forecast for year 2020 are shown in Figure 5-5 and Table 5-4.



Source Sydney Water submission table 11

Figure 5-5 Increases in expenditure in the 2016 Determination period

The expenditure profile for the determination period shows an even trend in 2017 and 2018 followed by a significant increase in 2019 due mainly to drought expenditure. The forecast for 2020 is at a similar level as 2019 including drought expenditure; Sydney Water state that the 2020 additional drought expenditure, shown hatched in Figure 5-5, is not included in the SIR operating expenditure. Specific reasons for these increases are summarised in Table 5-4 below and detailed in the following sections. These increases are partly offset by efficiencies gained in the determination period which are discussed in Section 5.4.4.

Table 5-4 Increases in expenditure in the 2016 Determination period

SYDNEY WATER OPERATING EXPENDITURE - 2016 DETERMINATION PERIOD					
$2019/20 Year ending June	**2017**	**2018**	**2019**	**2020**	**Total 2017-2020**
CORE OPERATING EXPENDITURE (Including S16A recycling costs}					
2016 Determination	938.4	932.9	914.4	906.8	3692.5
Actual	940.4	938.7	1033.9	978.5	3891.5
Actual > Determination	2.0	5.8	119.5	71.8	199.1
REASONS FOR EXPENDITURE INCREASES					
Base opex	934.4	903.0	923.0	880.8	3641.2
Preventative R&M (Env Prog)	0.0	9.1	0.0	17.8	26.9
Additional Defined Benefit funding	0.0	0.0	0.0	5.0	5.0
Water conservation funding	0.0	0.0	0.0	8.0	8.0
Land tax increases	1.6	-0.3	4.8	7.9	14.0
City planning	0.0	0.0	0.0	10.0	10.0
Reactive Environmental Improvement	0.0	9.0	16.0	13.3	38.3
Higher Energy prices	2.8	15.7	18.0	10.9	47.4
Digital - cyber security	0.0	0.0	1.5	6.0	7.5
Digital - data centre relocation / Gov DC	0.0	0.0	5.8	7.2	13.0
CxP additional costs (Manage Services Fee)	0.0	0.0	0.0	8.5	8.5
Digital Other	0.0	0.0	1.0	0.0	1.0
Drought related costs	0.0	0.0	63.9	0.0	96.0
Total Core Opex (drought excluded in 19/20)	**938.8**	**936.5**	**1034.0**	**975.4**	**3884.7**

Source: SIR. Sydney Water submission and Atkins Cardno analysis of July 2019 submission. Actual costs for 2019 were reported in November 2019

Specific cost increases listed here and discussed in subsequent sections are

- Preventive repair and maintenance increases by $26.9m, mainly in the year 2020 (Section 5.4.5);
- Additional defined benefit funding commences from 2020 and is supported by independent reports from actuaries (5.4.9);
- Land tax increase through the period related to higher land values (5.4.9);
- City planning: increase in planning staff to address growth planning needs in Western Sydney (5.4.7);
- Reactive maintenance driven by the environment improvement plan (5.4.5);
- Energy: increases in energy prices over the period (5.4.6);
- IT Digital: increasing expenditure for cyber security, data centre relocation, CxP and other mainly forecast for year 2020 (5.4.8);
- Drought related costs: increase of $76.0m due to weather-related network repairs and maintenance in 2019 (5.4.5)

Sydney Water submitted a revised SIR in November 2019 to report actual expenditure for the year ending 2019. There has been a $52m increase in reported expenditure from the previous forecast. The increase included further expenditure for the environment improvement program (EIP), an $11.0m expenditure for earthing and bonding and $6.0m attributed to the failure of the Northmead pumping station (although these costs are being recovered from insurance). Other increases related to electricity costs and a lower capitalisation of labour.

Year 2020

The forecast expenditure is $58m less than 2019. However, total expenditures are similar when drought costs are excluded. The SIR includes drought expenditure for 2019 although excludes this expenditure in 2020. We have received detailed explanations for each element of forecast cost increase from a 'bottom up' approach. While these are reasonably based, we question whether a utility operating in the market would take further steps to limit these increases through absorbing some of the costs, for example not backfilling posts, and reduce the impact of these increases. We note a stretched efficiency target of $12.1m has been proposed for 2020 which is a surrogate for market pressure.

5.4.4. Efficiencies reported in core operating expenditure

Sydney Water reports on efficiencies made in the 2016 Determination period as a result of specific initiatives. The outcomes and targets for the year 2020 are shown in Table 5-5.

Table 5-5 Efficiency gains made and forecast in the 2016 Determination period

SYDNEY WATER OPERATING EXPENDITURE - 2016 DETERMINATION PERIOD EFFICIENCIES					
$ 2019/20 Year ending June	**2017**	**2018**	**2019**	**2020**	**Total efficiencies in period**
SPECIFIC INITIATIVES					
Production Improvement Program (PIP)	0.00	8.80	8.90	15.20	32.90
Civil operating model (COM)	0.00	0.00	0.00	1.30	1.30
Network reorganisation	0.00	0.00	0.00	1.60	1.60
Supply chain	0.00	0.00	0.00	2.10	2.10
Multi-functional business centre (MFBC)	0.00	1.20	3.70	4.50	9.40
Total initiatives	0.00	10.00	12.60	24.70	47.30
EFFICIENCY TARGET					
2020 Target efficiency	0.0	0.0	0.0	12.1	12.10
Total efficiency target	0.0	10.0	12.6	36.8	59.4
Percentage of 2016 Determination period	0.0%	1.1%	1.4%	4.1%	

Source: SIR. Sydney Water submission and Atkins Cardno analysis

The production improvement program (PIP) includes savings at 28 treatment plants and 12 work hubs The savings are from efficiency in outsourced maintenance suppliers, efficiency and prioritisation in Major Periodic Maintenance program, materials reductions at plants, biosolid reduction projects and plant initiated front line efficiency projects. In the current price path 30% of savings are labour based and 70% contractors, materials and electricity.. The initial reduction was in 2018 and a further step reduction is planned in 2020.

The Civil operating model (COM) is a restructuring of the civil works labour team with about 60 retirements and a change to working arrangements, giving a step efficiency in 2020 and carried into the future period.

The network reorganisation brings a reduction in the management team as a step efficiency in 2020 and carried into the future period. There is a planned reduction of 16 FTEs as the business restructures into a new Networks unit in Customer Delivery. The gross saving is $3.2m of which half will be used to reinvest in frontline staff.

Supply chain efficiencies are in place or planned for material supplies and contractors. In the 2020 period, the impact of the P4S procurement process is assumed to deliver further efficiencies.

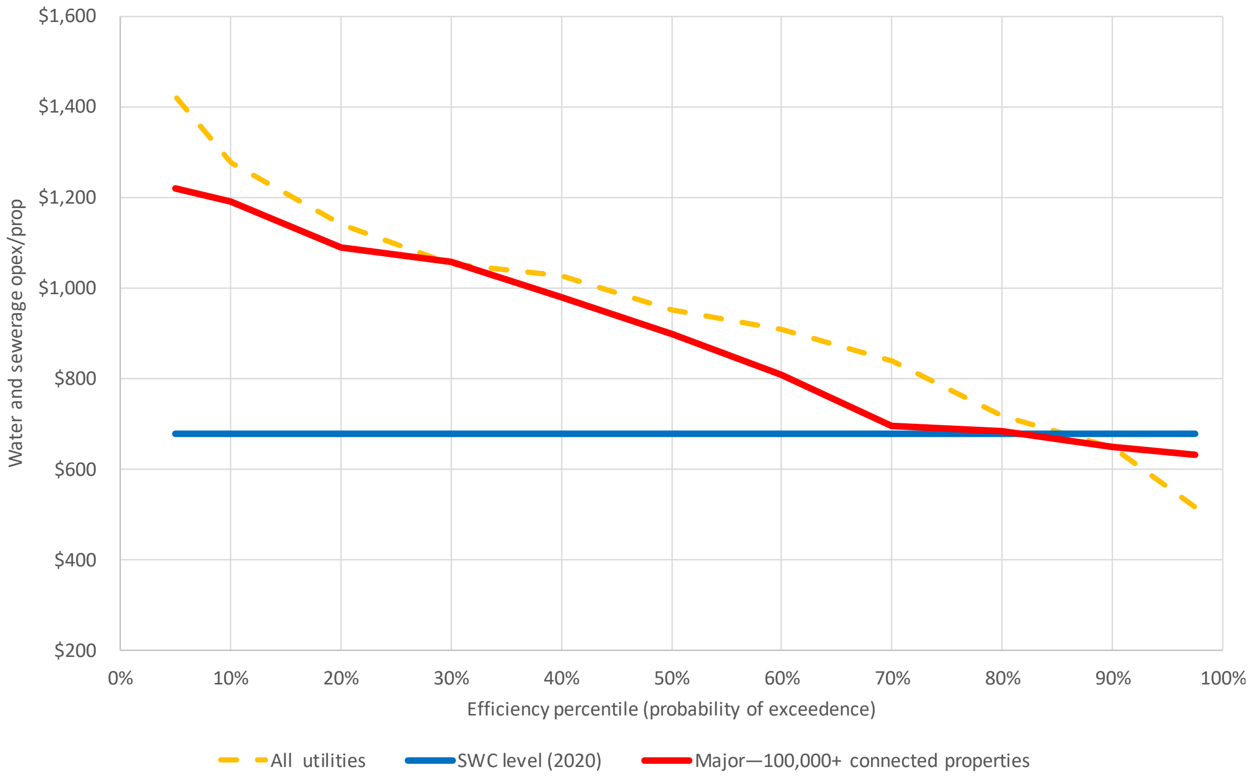
The multi-functional business centre (MFBC) is now known as Business Connect and provides transactional support for corporate support services. Actual and forecast FTE reductions are planned within Business Connect, agency (contractor) hire and recruitment with a start in 2018 through to 2020. The main savings come from Business Connect with consolidation of shared services, a central contractor workforce and outsourcing recruitment.

A further stretched target has been set for 2020 with a forecast $9.5m from contractor costs and $2.5m from labour. Specific details have yet to be developed by the business units.

The efficiency saving over the period excluding the stretched target is 2.7% and equivalent to 0.7% per annum of the core operating expenditure in the 2016 Determination period. With the stretched target this increases to an average of 1% per annum.

Relative efficiency

We used the NPR data for year 2017/18 to compare Sydney Water with other large water utilities in Australia. We inflated costs to the 2019/20 price base applied to unit opex per property. The comparison with 'all utilities' is also made. This analysis is shown in Figure 5-6.



Source: NPR data 2017/18 and Atkins analysis

Figure 5-6 Efficiency on unit cost per property – Sydney Water and other large utilities in Australia

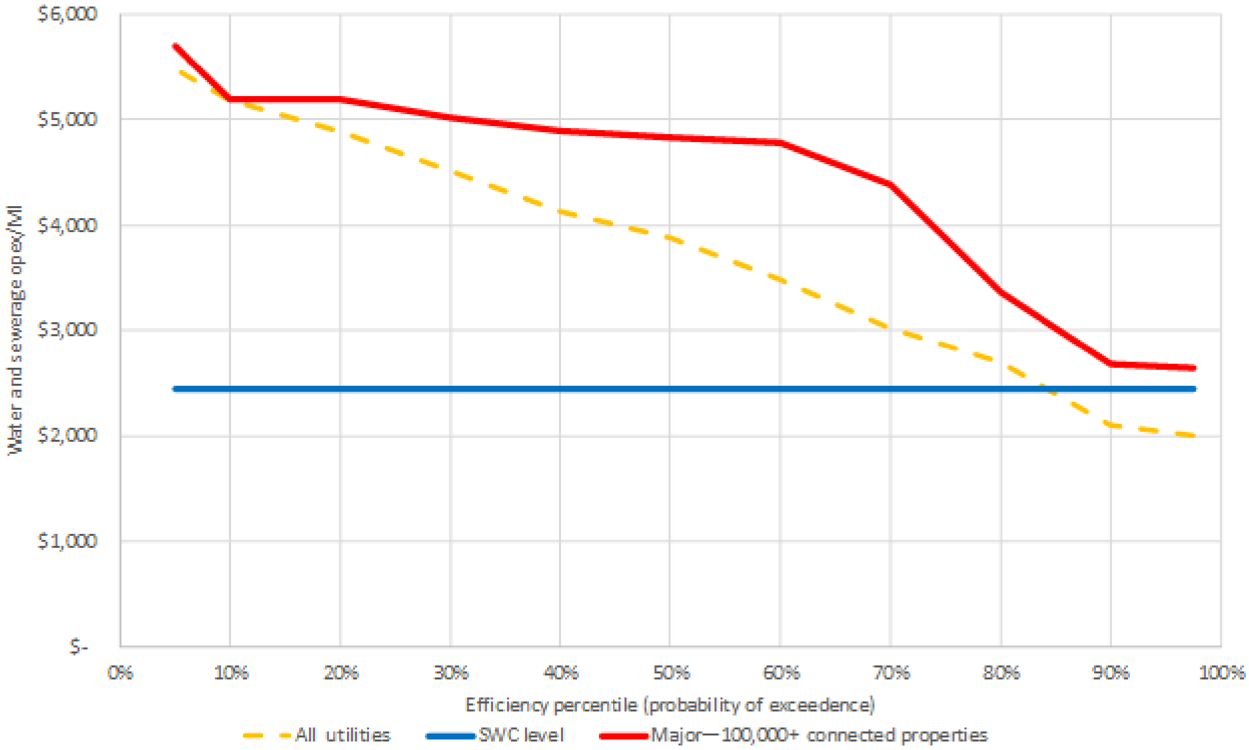
The purpose of benchmarking is to help to understand Sydney Water's relative efficiency. Given the limitations of benchmarking, it is not used in a deterministic manner to derive expenditure recommendations. Limitations of benchmarking using NPR data include the differences between utilities in terms of:

- Service levels, customer types, scale, local factors, geographies and asset configurations. These factors can have significant effects, particularly on unit costs (if costs are per unit volume or connection for example);
- Level of vertical integration. For example, some purchase bulk water, whereas others provide this service themselves;
- Definitions and approaches to classification of expenditure as opex versus capex. For example, some utilities lease vehicles, whilst others own them; some procure significant capex projects using outsourced contracts which are accounted for as opex rather than capex, others do not.

Another limitation of benchmarking using the NPR data is that expenditure is only available at aggregate level and does not allow deep understanding of the drivers of expenditure or of difference between utilities.

Based on the NPR data, Sydney Water's water and sewerage opex appears to be operating at above average efficiency for the sector. The Figure shows that it is ranked 82% on its 2020 data in relation to other large (>100k properties) in Australia when compared in terms of the combined water and wastewater cost per property. Stormwater costs are excluded.

Comparisons using the $ per unit volume delivered is shown in Figure 5-7.



Source: NPR data 2017/18 and Atkins analysis

Figure 5-7 Efficiency on unit cost per volume – Sydney Water and other large utilities in Australia

Sydney Water's performance is out of the range of large water utility efficiency curve so the analysis has limited value. The analysis is biased by the relatively high unit cost of water for Sydney Water We tested the sensitivity of reducing unit consumption by 10% from water conservation measures and leakage. A 10% reduction in water delivered would show a 90% efficiency percentile.

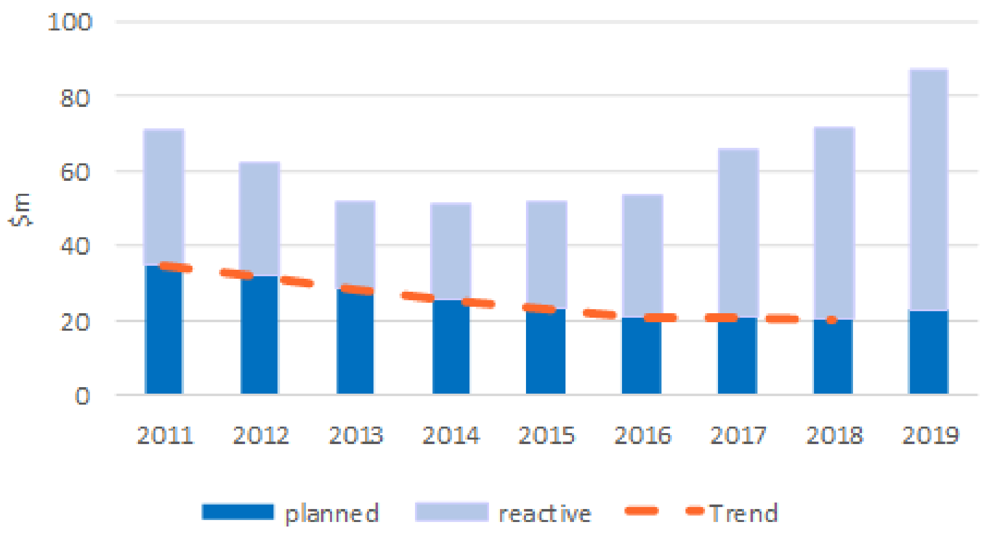
At the level of efficiency percentile derived from this analysis and the shape of the curve, the analysis is sensitive to small changes in expenditure, property numbers and volumes. Nevertheless, the analysis shows that Sydney Water is an efficient performer when compared with other water utilities in Australia. We discuss relative efficiency with other sectors and UK water utilities in Section 5.7.

5.4.5. Customer Delivery

This division of the business includes water treatment and distribution, sewerage, sewage treatment and customer services.

Water networks

Planned and reactive maintenance expenditure on water networks is shown in figure 5.8.



Source: Sydney Water document 265.1

Figure 5-8 Trend in water network planned and unplanned maintenance

Average expenditure in the 2012 period was $52m/a with about 50% being planned maintenance. In the 2016 Determination period to 2019, total expenditure increased to an average $76m although planned maintenance reduced from $28.4m in 2013 to a minimum $21.1 in 2017 increasing to $22.8m in 2019. Figure 5.8 indicates this reducing trend in preventive maintenance while reactive work was increasing. This reducing trend in planned maintenance is likely to impact of the extent of reactive maintenance. Put another way, the increase in reactive maintenance could have been reduced through a continued level of planned maintenance through the 2012 and 2016 Determination periods.

Planned maintenance expenditure is to increase by $6.8m in 2020, an increase of 9% above the average of 2017 to 2019. This goes some way in addressing the imbalance between reactive and planned maintenance.

The interruptions performance measure is close to the licence limit and was exceeded in 2018 due to one exceptional and large event which was atypical of the nature of interruptions over recent years. The operational response is to undertake valve inspections and repairs and to install additional valves to minimise the number of customers impacted during any shutdown. The use of the Customer Hub should enable a more focused response with fewer properties impacted in any interruption.

A second tranche of work is to increase active leakage detection activity to identify leaks before breakout. An increase in leak detection activity was triggered in 2019 with an increase in expenditure in that year. This enhanced activity is planned to ensure that leakage does not increase above the defined economic level of leakage. We question whether the current leak detection work is efficient and consider a more comprehensive approach to leakage management is required; we discuss this in Section 5.4.12.

Wastewater networks

The environment improvement plan is to address the increasing number of wastewater dry weather overflows caused by sewer blockages related to tree root intrusion and an increasing trend in fats, oil and grease (FOG). In the 2016 Determination period, expenditure for wastewater planned and reactive maintenance was an average $46m/a, with 60% reactive, and choke performance was a rolling 5-year average of about 60 per 100km. The trend in planned and reactive maintenance is shown in Figure 5-9 below. The reducing trend in planned maintenance is shown in green.

Source: Sydney Water document 265.1

Figure 5-9 Trend in dry weather overflow planned and unplanned maintenance

In 2016 and 2017, expenditure increased to an average $54m/a with nearly 70% reactive. By 2019 total expenditure had increased to $78.5m with 82% reactive. Planned maintenance, as shown in Figure 5.7, experiences a reducing trend from $29.8m in 2011 to $12m in 2018. Performance was showing an increasing trend to nearly 70 chokes per 100km; the licence limit is 80 chokes/100km.

Sydney Water showed that over 2017 and 2018 the soil moisture deficit fell from an average 50% for the previous ten years to a value of about 35% and similar to the drought period 2001 to 2006.

The data suggests that Sydney Water was having difficulty responding to the increase in overflows; the low level of planned maintenance, including CCTV inspections and proactive root clearance could have contributed to the increasing numbers of overflows emerging as soil moisture content reduced and root intrusion increased.

Had the level of planned maintenance continued at the 2012 period level of expenditure, some of the reactive maintenance might have been avoided.

Sydney Water plans to increase reactive expenditure for 2020 from $65.4m to $78.7m, an increase of 20%. This is to increase the number of frontline staff to respond to incidents and carry out more proactive repair work and increase the number of reporting staff. The work is mainly by contractor with some direct labour included.

In year 2020, planned maintenance is forecast to increase by $11.0m from $14.1m to $25.1m, an increase of 78% and restores the level of maintenance to the 2012 period level. Reactive maintenance is also to increase by $13.1m

While this work needs to be done to meet expectations of both the public and the EPA, we question whether some of the reactive expenditure could have been avoided by more effective asset management and a greater activity in for example in proactive CCTV work. In addition, reports of effective responses to incidents and clear-up may well be matters of more effective working, monitoring and timely clean-up. With the Customer Hub now in place we would expect the process to be more effective.

Drought-related expenditure

Sydney Water shows that expenditure in 2019 for water main and sewer repairs was significantly greater than the average of the last three years. For water main repairs, expenditure was $9.7m and for sewer repairs was $15.8m above the average; this gives a total $25.5m as a one-off expenditure related to the drought.

Drought related expenditure in 2020 is reported as $78m but not included in the SIR.

Drought expenditure in 2019 is related to additional reactive maintenance to address increasing mains bursts and leakage, and sewer blockages.

This heading also includes expenditure on water conservation measures in 2019. We discuss this in Section 5.4.11.

BOOT Filtration

Independent water treatment businesses provide potable water from four works at Prospect, Macarthur, Woronora and Illawarra under water filtration agreement in place. Direct operating costs are included within operating expenditure. Other costs are reflected, for regulatory purposes, within the RAB. In the agreements; this change was implemented at the start of the 2016 Determination period. The operating agreements includes payment for treatment of varying water quality, particularly colour and turbidity.

Actual expenditure and volumes for the four filtration plants are compared with the 2016 Determination period in Table 5-6 .

Table 5-6 BOOT treated volumes in the 2016 Determination period

SYDNEY WATER OPERATING EXPENDITURE - BOOT COSTS					
$m 2019/20 Year ending June	**2017**	**2018**	**2019**	**2020**	**Total**
$ VARIANCE WITH DETERMINATION					
Determination	97.22	97.33	95.58	96.02	386.14
Actual	95.90	94.70	92.60	96.90	380.10
Variance actual >determination	-1.32	-2.63	-2.98	0.88	-6.04
Variance (%)	-1.4%	-2.7%	-3.1%	0.9%	-1.6%
VARIANCE WITH DETERMINATION (GL)					
Determination	489.90	494.90	499.10	504.90	1988.80
Actual	516.80	555.30	522.60	458.60	2053.30

Variance actual >determination	26.90	60.40	23.50	-46.30	64.50
Variance (%)	5.5%	12.2%	4.7%	-9.2%	3.2%

Source: 2016 Final Determination, Sydney Water presentation/ email 26 Nov and Atkins analysis

There is an overall marginal reduction in expenditure and a small increase in volume treated. The volume increase in 2017 to 2019 was partly offset by operation of the desalination plant in 2020. The increase in volume-related costs is offset by a lower $6m escalation for the Macarthur plant reflecting an earlier inconsistency. Expenditure is sensitive to raw water quality; the net saving in 2017 to 2019 is offset by a marginal forecast increase for 2020. There are other minor cost variations. Sydney Water comment that the impact of the SDP operation is to reduce BOOT costs by about $1.5m.

5.4.6. Electricity

A comparison of electricity demand from the grid and renewables and related expenditure is shown in Table 5-7 below. The table compares demand and expenditure against forecast in 2016.

Table 5-7 Electricity load and expenditure in the 2016 Determination period

SYDNEY WATER OPERATING EXPENDITURE: ELECTRICITY					
($m 2019/20) year ending June	**2017**	**2018**	**2019**	**2020 Forecast**	**Variance Actual to Determination**
ELECTRICITY DEMAND -TOTAL (GWh)					
2016 Determination period	434.0	438.0	442.0	446.0	
Actual	409.0	426.6	441.6	434.1	
Actual > Determination	-25.0	-11.4	-0.4	-11.9	-48.7
ELECTRICITY DEMAND -RENEWABLES (GWh)					
2016 Determination period	78.5	81.0	83.5	86.0	
Actual	60.6	71.7	69.5	75.8	
Actual > Determination	-17.9	-9.3	-14.0	-10.2	-51.4
ELECTRICITY DEMAND -GRID (GWh)					
Grid Purchase Determination	354.0	355.5	357.0	368.5	
Actual Grid	348.4	355.0	372.1	358.3	
Variance	-5.6	-0.5	15.1	-10.2	-1.2
POWER OPERATING EXPENDITURE ($M)					
2016 Determination period	41.3	42.8	43.0	40.8	
Actual	40.8	60.6	57.5	48.9	
Actual > Determination	-0.5	17.8	14.5	8.1	39.9

Source Sydney Water document172.1

Total demand is 2.8% less than forecast; Sydney Water reports annual reductions in demand due to energy efficiency to be a similar order of this reduction. The expected load from renewables forecast in 2016 has not been achieved with a 15% shortfall compared with planned.

Sydney Water explained that the market rates for energy purchases has increased in 2018 due to closure of some large power stations and increasing domestic demand although had reduced from the 2018 peak in subsequent years.

We note that tariff increases have had a material Impact on the electricity costs although offset in part by the reduction in energy efficiency to maintain grid load at 1998 levels. However, the shortfall in planned renewable energy could have further reduced grid demand and increased expenditure.

5.4.7. City Planning

Sydney Water has been requested by the Department of Planning, Infrastructure and Environment (DPIE) to provide strategic management and planning support for the Western Parkway City including the South Creek and airport. The focus is on stormwater drainage with some input on key water infrastructure and land requirements to facilitate early planning. A shadow Storm Water Authority is being developed to take responsibility for this work.

Sydney Water has forecast an input of $10m in 2020 to include for staff costs, modelling work and contractors. This work is assumed to continue through the 2020 Determination period but at a marginally lower level of expenditure. We question whether elements of this expenditure, particularly related to stormwater drainage, should be funded by water and wastewater customers.

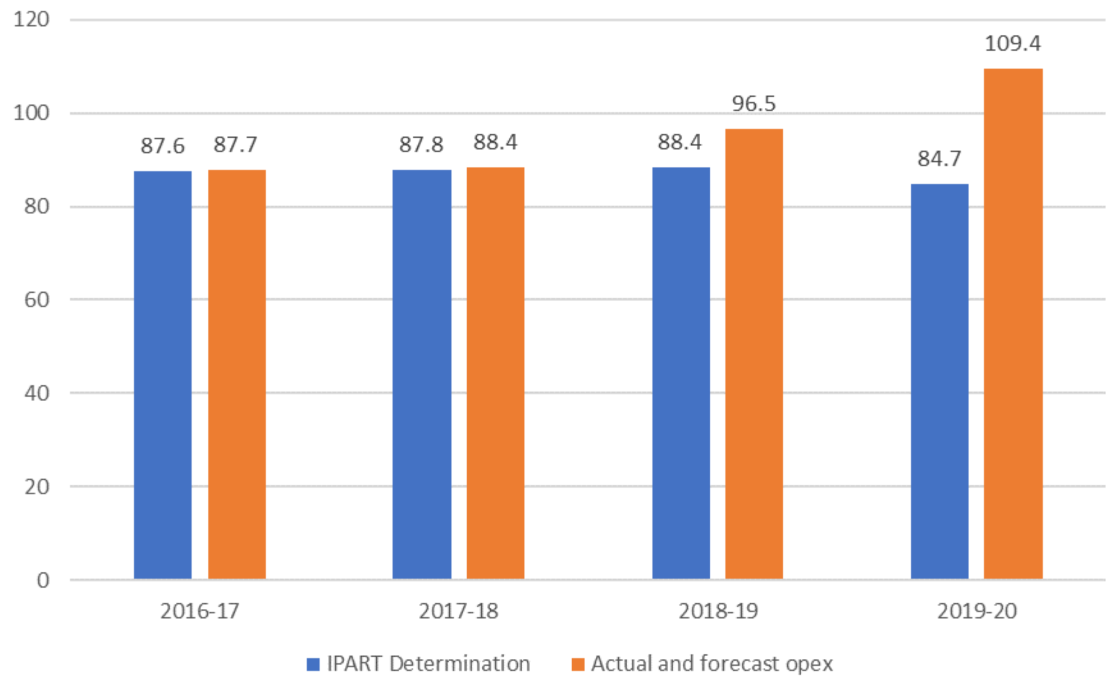
5.4.8. IT Digital

The actual expenditure for 2017 and 2018 was very close to the Determination. The increase was only $0.8m, $176.1m versus $175.4m, so not a material variance. On the other hand, expenditure in the last two years is significantly higher than the Determination. The total expenditure variance to the IPART determination is 9.7% (+$33.7m)

Table 5-8 IT Opex summary 2016-20

SYDNEY WATER OPERATING EXPENDITURE: IT DIGITAL					
($m 2019/20) year ending June	**2017**	**2018**	**2019**	**2020**	**Total 2017-20**
IPART Determination	87.6	87.8	88.4	84.7	**348.4**
Actual and forecast opex	87.7	88.4	96.5	109.4	**382.2**
Variance	0.1	0.7	8.2	24.8	**33.7**
Variance (%)	0.2%	0.8%	9.3%	29.2%	**9.7%**

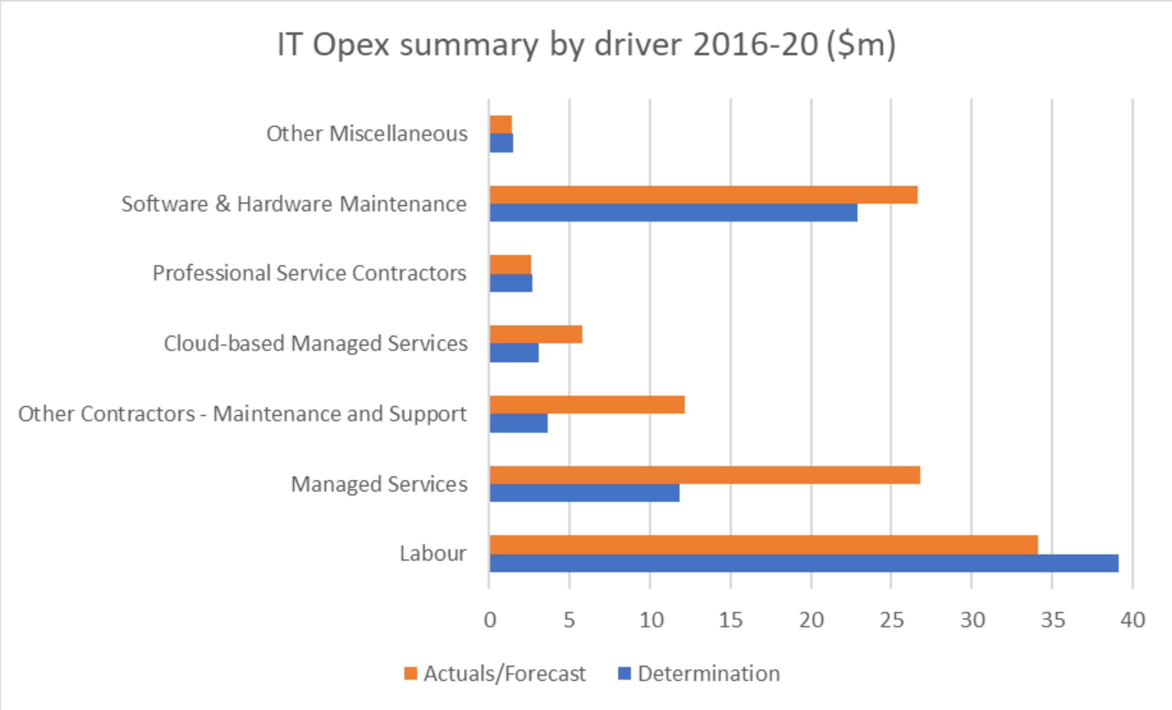
Source: Sydney Water Operating Expenditure presentation cross-referenced with SIR



Source: Sydney Water Operating Expenditure presentation

Figure 5-10 IT Opex summary by year 2016-20

The increase in opex expenditure at a high level was driven by much significant costs for managed services as well as maintenance and support both for hardware and software and by third parties such as SAP, IBM, Oracle and Microsoft enterprise level agreements software costs, hardware maintenance and SCADA, Manage and Protect support. The only significant movement in the other direction was a saving of $5m on labour costs associated with FTEs, although this was likely just a shift away from FTE to sourcing external support and managed services.



Source: Sydney Water Operating Expenditure presentation

Figure 5-11 IT Operating expenditure summary by driver 2017-20

The 2019 increase in expenditure is driven by:

- $6.5m Government Data Centres – commencement of the operating lease;
- $2.6m Software costs – increase in costs due to higher levels of SAP (CxP) and Microsoft licencing costs.

The 2019/20 increase is driven by:

- $13.9m Government Data Centres – operating lease and SAP managed services;
- $6m Manage and Protect investment – addressing increased cyber and non cyber risks to address resilience;
- $1m Hyper-connectivity – growth-related expenditure;
- $3.8m Higher software costs.

As discussed elsewhere, the changes around data centre infrastructure and cyber security could not have been foreseen at the time of preparing the 2016 submission. This expenditure relates to a mixture of leasing costs, hardware requirements, rack and electricity costs and costs of hosting managed services including SAP. This is not a like for like replacement for the Homebush Data Centre facility and the disaster recovery site at Paramatta; it is a significant enhancement from the existing Tier 1 to a Tier 3 facility, the highest standard. The preferential rates for this facility secured by the Government due to their significant purchasing power would not be available on the open market. In the short-term, across this and the next determination period, there is an increase in costs as the Corporation shifts from its existing Homebush and Parramatta sites to the Government Data Centres.

The original recurrent opex costs estimated for CxP were $22m over the 10 years for licensing and support. However, in the revised business case this increased to $59m: this has converted to $10m of opex in the current determination period and $34m in 2020-24. This is because the SAP licencing costs were identified but the Application Vendor support costs, which are nearly double, were not factored in. The cost has been market tested via an open tender and is based on a signed contract; Sydney Water also argue that the costs for support for an alternative application would be of similar magnitude so these costs cannot be avoided.

5.4.9. Corporate and other cost variances

Table 5-9 summarises the variance in corporate or support service expenditure compared with the 2016 Determination period.

Table 5-9 Support expenditure variance

SYDNEY WATER OPERATING EXPENDITURE – CORPORATE AND SUPPORT			
$m 2019/20 Year ending June	IPART Determination	Actual expenditure	Variance Actual > Determination
SUPPORT EXPENDITURE			
Office of the MD	3.00	20.80	17.80
CxP Program	20.70	40.20	19.50
Liveable city solutions	139.30	150.80	11.50
People & Corporate services	183.40	197.70	14.30
Finance	257.20	273.80	16.60
Customer Strategy & Regulation	171.30	167.00	-4.30
Corporation Level Adjustments	56.00	67.80	11.80
TOTAL EXPENDITURE			
Total	**830.90**	**918.10**	87.20
			10.5%

Source: Sydney Water

There has been a 10.5% increase in support expenditure compared with the determination. Sydney Water explained the reasons for these variances:

- Office of the MD: actual expenditure includes $18.1m of drought-related costs held in this budget for years 2019 and 2020. Activities include advertising, planning for water restrictions and options planning;
- CxP program: an additional $19.5m for under-estimation of costs for Storm and Surge, SME support and associated support costs although we note that the successful launch means that resources are being reduced earlier than forecast so this figure should reduce;
- Liveable City Solutions: an over-expenditure of $11.5m although much of this has been recovered from other bodies and services to developers;
- People and Corporate Services: a $14.3m increase including Business Connect where savings are shown elsewhere, compliance and due to costs not compliance and monitoring costs, some of which were included in the Customer Delivery business as well as savings from the HR graduate program
- Finance: the $16.6m mainly driven by land tax payments and partly offset by restructuring of the division;
- Customer Strategy and Regulation: $4.3m savings from disbandment of the Strategic Portfolio Management Office

- Corporate level adjustments: an $11.8m increase in contractor costs and redundancy payments.

5.4.10. Recycled Water

Sydney Water provides recycled water facilities at Rosehill Camilla and St Mary's under S16a government direction.

The recycling facility at Rosehill Camilla is a BOOT plant owned and operated by Aquanet, a joint venture between Jemena and Veolia. Sydney Water provides secondary effluent to Aquanet who then supply recycled water to Sydney Water and Aquanet customers. Under the agreement, Sydney Water is required to purchases a fixed volume of 10.5 Ml/d to supply its recycled water customers even if this is not used.

The recycling facility at St Mary's is owned by Deerubin WaterFutures and operated by Deerubin Water Futures and accepts tertiary treated effluent from Penrith, Quakers Hill and St Marys plants. The output of the plant is to enhance flows in the Hawkesbury Napean river basin by discharging into the Boundary Creek. The capacity of the plant is 50 Ml/d consistent with the government direction to deliver 'up to 18 Gl/a (50 Ml/d)' which would otherwise be released from Warragamba. With allowances for essential maintenance, maximum average daily production would be 43.3 Ml/d which equates to 15.8 GL/a. The average annual output through the 2016 Determination period has been 10.4 GL/a which is below the level of output in the government direction for replacement flows.

Sydney Water explained that this reduction in output was because the plant was offline for rectification of construction defects and unanticipated maintenance. Operating costs were reduced following the introduction of a revised maintenance strategy.

Actual expenditure outputs against the determination are shown in Table 5-10.

Table 5-10 Recycled Water variances in costs and outputs

[redacted]

Source: SIR. Sydney Water submission and Atkins Cardno analysis

The Rosehill Camilla scheme expenditure shows an underspend of $3.7m mainly as a result of the plant not being available in 2018. The St Marys scheme shows a reduction of $7.3m as the plant was not operating at its required output.

Both recycling schemes are not efficient for different reasons. The Rosehill Camilla BOOT plant requires a payment for recycled water whether used or not. With the reduction in customers, the facility is not used to best effect at a time of drought when recycled water can provide a valuable resource. While Sydney Water has looked at options, and referred to a Board paper dated November 2016, there is little recent evidence to show that this facility is put to best use.

The St Marys plant has not been running to design output with a significant loss of production. This plant is to enhance flows in the Napean Hawkesbury basin to offset flows which would otherwise have been discharged from Warragamba and is clearly not delivering the full benefits it was designed to provide. This is a particular concern at a time of drought when significant costs are being expended on water conservation.

5.4.11. Water conservation

A requirement of the 2015 to 2020 operating licence[41] is to undertake water conservation measures following a methodology to define the economic level of these activities including water conservation and leakage.

Water conservation

Sydney Water has reported on its water conservation activities in annual reports, the most recent for 2018 and 2019.

In the year ending June 2018, a saving of 0.30 Ml/d for water conservation activities including ‘Plumb assist’ and ‘Water-Fix’ initiatives at a cost of $1.06m. Leakage expenditure was $1.1m for a saving of 3 Ml/d.

In the year ending June 2019, a saving of 0.44 Ml/d for water conservation was reported for similar activities as 2018 and council partnerships at a cost of $1.4m, and $0.9m on unregulated recycled water activities.

A further $1.6m was spent to maintain baseline leakage although if this is just to maintain at or reduce leakage to its economic level then such expenditure should be considered as maintenance expenditure.

For the forecast year ending June 2020, Sydney Water plans to significantly increase water conservation activities. The submission proposes an $8m program of conservation measures which increases to a $10m/a baseline program in the 2020 Determination period. The activities include

- Water-fix residential: this is a subsidised service where Sydney Water responds to requests from customers to reduce their water use. A plumber is used to survey and repair leaking taps and toilets, installation of showerheads, dual flush toilets and flow regulators. This produces savings of an average 65 l/property/day. Forecasts assume a saving of 46 l/property. Costs relate to the subsidy provided and customers fund the difference. The activity is dependent on customers responding to this service;
- Waterfix strata: this is similar to the residential service but applied to strata buildings such as blocks of flats. A similar level of saving per property has been assumed. Costs are recovered through water bills; the water bill for the account is held at the pre-water saving level until the costs of the service are recovered. This is estimated to be two to four years.
- Plumb assist: this is the continuation of the emergency and essential plumbing repairs service to customers experiencing hardship and is offered through the Customer Care team. In 2019 there were 315 participants with a saving of nearly 0.1 Ml/d at a cost of $0.4m;
- Business to business: there were no specific business customer proposals in 2019. The baseline program includes for 100 business at a subsidy of $40,000 per business. There is little data to justify

[41] Sydney Water Operating Licence Section 3.2 Economic Level of Water Conservation, 2015 to 2020

- the level of expenditure and whether this cost will be recovered from businesses on a similar basis as the Water-fix strata program;
- Council participation: this initiative started in 2020 where partnerships with five local councils to deliver a water efficiency program to business customers and residential strata;
- Schools: a water efficiency program has been implemented in nine schools;
- Leakage on customer premises: this program identifies customers with excess consumption as recorded on meter measurements.

We formed the view that the base water conservation plan includes appropriate activities to target losses on residential customers. The activities, costs and savings to date provide a good basis for forecasts. An $8m program for 2020 is appropriate given the current drought position. Some of these activities require contributions from customers.

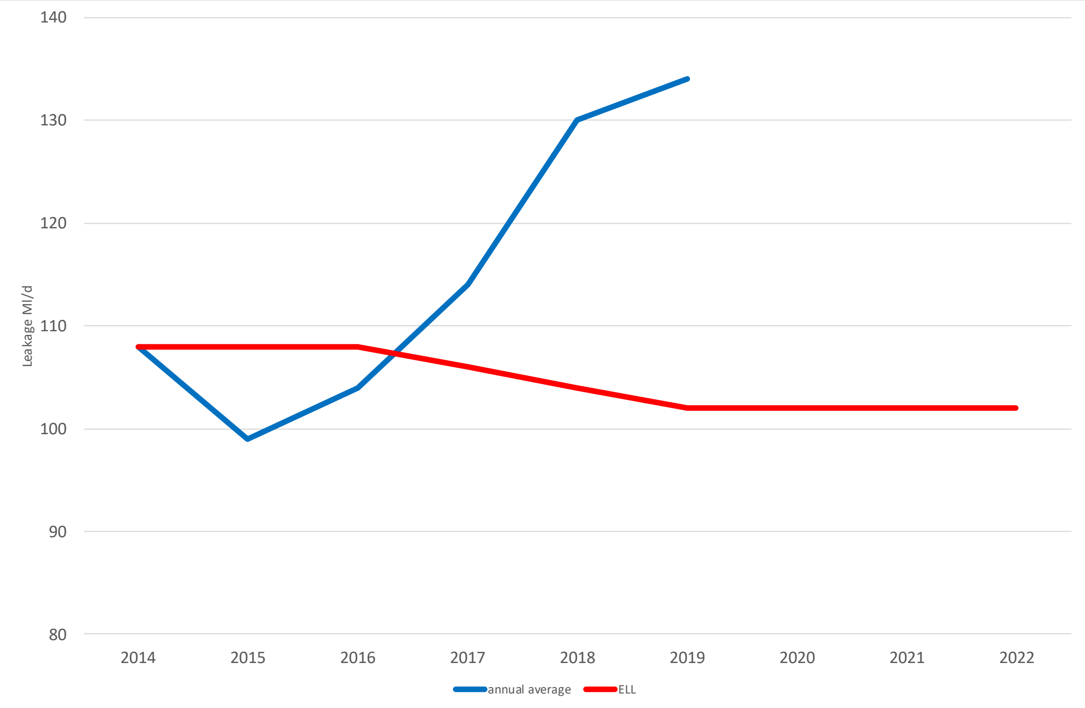
Our opinion on the base water conservation program is that

- There is a need to promote water conservation to residential and business customers and monitor uptake and savings. These savings require a commitment from customers and a contribution to costs; there is therefore some uncertainty as to the delivery of the savings forecast. If the program is scaled up in year 2000 to address 'level 1' restrictions, there is uncertainty in the delivery of enhanced savings as these are dependent on customer response.
- the assumptions for the level of business activity, costs and savings is not justified. We agree that potential savings in this sector should be promoted although the level of savings is likely to be overstated or achieved. We suggest the program is scaled back to $1m in 2019 to focus on pilot work;
- greater certainty in water saving benefits are likely to be gained through further leakage reduction where the company has greater control of activities, costs and benefits. For example, in 2018 there was a reported ten-fold increase in savings from leakage control compared with customer water efficiency measures;
- at a time of drought, there are far greater need and benefit to reduce leakage to the mean ELL other than an enhanced 'level 1' water efficiency program

We do not propose to make any adjustments to the $8m water conservation program although the balance of activities should be revisited. The business to business program assumed benefits are untested and we consider are overstated. There should be greater expenditure on leakage reduction (see section below) where Sydney Water has greater control over the costs and benefits.

5.4.12. Leakage

Leakage performance against the economic level of leakage (ELL) over the period from 2014 is shown in Figure 5-12.



Source: Sydney Water: Water conservation reports

Figure 5-12 Leakage performance

Average annual leakage has increased significantly over the period to 2019 and above the economic level of leakage from 2017. Sydney Water attributes this leakage increase due to the greater number of leaks and breaks in the network as a result of hotter and drier weather compared with the average. This resulted in higher backlog in repair jobs and hence an increase in leak run times.

Sydney Water has commented that it has engaged additional resources for water mains repairs. It has increased its active leakage control activities to detect leakage in the network.

Our view is that leakage breakout occurs in most distribution networks during very hot or cold weather and utilities have to manage their response to limit the impact of increase in bursts. It appears that there were insufficient resources available to repair these leaks in a timely manner and the long leak run times contributed to a continuing high level of leakage. There were indications that leakage was increasing from 2017 and additional resources are now being brought in. We comment further in Section 5.6.7.

The leakage response of the water network to adverse weather conditions suggests that there is likely to be further leakage which may not be visible. The active leakage detection program should help to detect and then repair leakage but a comprehensive approach should be implemented. This could combine the conventional leakage approaches of district metering and pressure reduction. This would allow leakage to be detected early in its life and before breakout.

The economic level of leakage shown in Figure 5-12 is derived from a methodology agreed between Sydney Water and IPART; this is part of the water conservation measures within the 2019 Operating Licence. The ELL calculation is sensitive to the value of water assumed. This is based on the current aggregate storage level in the impounding reservoirs. As the storage falls, the value of water increases and the mean ELL reduces. A short run approach is taken.

Our view, given the current water resources situation, is that a long run methodology should be applied which assumes a value of water based on the cost of the next resource development. This is a common approach applied by many large water utilities who need to develop further resources to meet long term resource development or manage drought. Applying this methodology is likely to reduce the ELL.

Leakage comparisons

Sydney Water states that it has an International Leakage Index(ILI)of 1.63 and is classified as band A in the World Bank classification of water utilities[42]. However, it demonstrates a similar performance with the England and Wales water companies as shown in Figure 5-13 below.

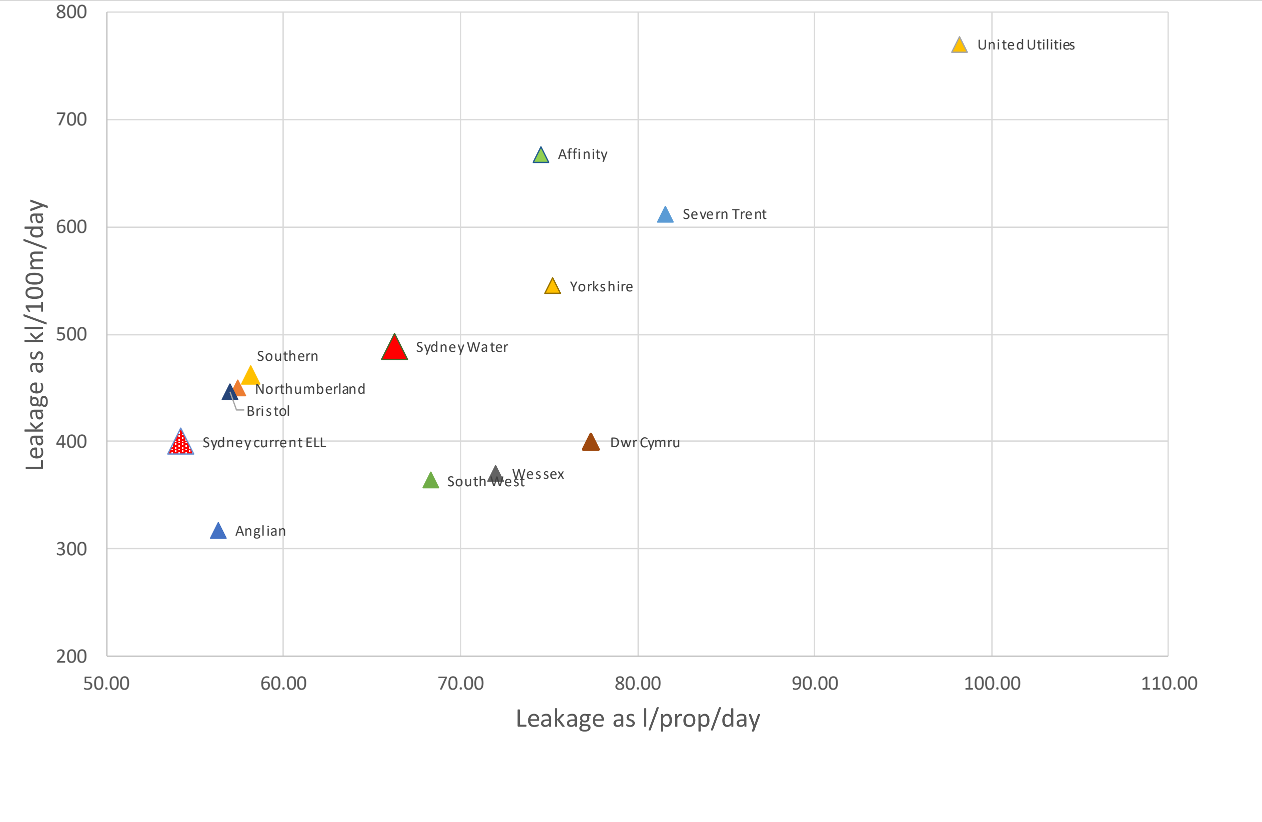


Figure 5-13 Leakage performance; Sydney Water in comparison with England and Wales companies

The comparison is for distribution leakage as Sydney Water measures leakage on its own assets to the meter, only. The E&W companies report total leakage including customer's supply pipes which is estimated to be about 30% of distribution leakage. The position of E&W water companies assumes a position at 2025 when a target15% leakage reduction has been delivered.

The Sydney Water position is shows as current (c132Ml/d) and the mean ELL at 108 Ml/d. The leakage comparison in Figure 8-2 of the Updated Submission is not a true comparison because the E&W data includes for supply pipe losses.

Figure 5-13 shows Sydney Water's current leakage position and its estimated ELL. The comparison shows that Sydney Water (large triangle) is in a similar position as Anglian Water, Southern Water and Northumberland Water. In its current position it is close to South West and Wessex Water. This broad analysis indicates that Sydney Water is in a similar position as well performing companies in England and Wales and there is scope for improvement.

We compared the technology and methods used by Sydney Water in monitoring and detecting leakage with current good practice utilities. Current good practice is to use continuous flow and pressure monitoring into discreet distribution areas. This is to enable daily monitoring of night flows to detect any significant changes that are indicative of a leak rather than a change in consumption. Monitoring discreet areas also allows water balances to be carried out regularly. The monitoring enables more efficient targeting of detection resources.

[42] Water Conservation Report 2018-19, Sydney Water, 2019

New technologies such as extensive use of acoustic loggers help detection teams to pinpoint likely leakage.at an early stage in development; otherwise leaks ‘grow’ until they are visible on the surface. We understand that Sydney Water is developing plans to implement these technologies which is welcomed.

An important first step for Sydney Water is to return leakage to its ELL using base expenditure. To put the leakage reduction in context, returning leakage to mean ELL is some 24 Ml/d when annual water conservation measures are forecast to deliver less than half this figure.

5.5. Prudent and Efficient Expenditure in the 2016 Determination period

Efficient Expenditure
Our view of efficient expenditure in the 2016 Determination period is whether the performance to customers has been delivered to the expenditure allowed in the determination.

Performance is reported in the operating licence and environment performance measures. Sydney Water’s performance against the operating licence has been mixed: details are reported in Section 39.

- the measure of unplanned interruptions is marginally below the reference level except for one large incident in 2019;
- the number of multiple unplanned water interruptions is well below the reference level;
- wastewater overflows onto private properties, single and multiple incidents are below the reference level;
- water conservation measures are being progressed although leakage has been above the economic level for some time;
- the number of sewer chokes is below the reference level although the 5-year rolling average is showing an increasing trend; and
- two to four of the 23 sewer systems have failed the dry weather overflow limits.

Core operating expenditure has increased by 3.7% above the determination mainly in the actual year 2019 and forecast for 2020; 1.1% was attributable to the impact of the drought (the determination assumed average weather conditions), about 1.1% to higher retail energy costs and 0.5% to external business costs. This leaves some 1% of total opex above the determination.

We noted that efficiencies have or are being implemented, mainly through the latter part of the period, of some 0.7% per annum. A further $12.4m of efficiencies are targeted for 2020 although not included within the submission.

We have noted some areas of the business where Sydney Water could be more efficient

- electricity costs: while cost increases are outside the direct control with increases in retail rates, Sydney Water did not meet the renewables forecast demand set in 2016;
- wastewater networks: the level of planned maintenance has been reducing over the last eight years resulting in a greater number of unplanned responses and costs. The deteriorating performance data suggests that Sydney Water was having difficulty responding to the increase in overflows. The low level of planned maintenance, including CCTV inspections and proactive root clearance could have contributed to the increasing numbers of overflows emerging as soil moisture content reduced and root intrusion increased. Had the level of planned maintenance continued at the 2012 period level of expenditure, some of the reactive maintenance and customer disruption might have been avoided. This suggests that the asset management process for these assets is not efficient;

- leakage: above the economic level of leakage for over two years; Sydney Water is not effective in repairing leaks quickly. An efficient water agency would respond quickly with repair teams to reduce the leak runs and restore to leakage to the economic level. By definition leakage greater than ELL for a significant period is not efficient. A broad estimate suggests that 10GL of water is lost per year with a value of $3m at WNSW rates or $25 to $30m for desalination water;
- Water conservation and leakage: the base water conservation program is focusing on customers to reduce leakage which is appropriate. However, the activity and expenditure to reduce leakage appears out of proportion to the total expenditure, some 10% of total expenditure on water conservation. We suggest that Sydney Water should be working to the long run ELL using the leakage value from the next resource development or could use SDP costs as a surrogate. This is an appropriate response for a water utility needing to meet significant growth in the future.
- IT Digital: It is unclear if benefits are overstated or not being effectively tracked. Schemes cited as delivering efficiencies do not appear to map back onto IT projects.
- Recycling – the Rosehill Camilla plant is not efficient due to the lack of customers or other use of the recycled water. Sydney Water continues to pay the scheme owner, Aquanet, and has failed to find alternative use for this valuable resource at a time of drought. The St Marys plant has been operating well below its design output while incurring full fixed costs. The plant is not efficient as is not delivering the full benefits expected of the scheme which is important during drought conditions;
- Water conservation: the balance of activities should be revisited. The business to business program benefits are overstated. We suggest the program is scaled back by $1m in 2020 to focus on pilot work. There should be greater expenditure on leakage reduction where the current level is significantly above the mean ELL and Sydney Water has greater control over the costs and benefits.

In summary, Sydney Water is efficient in many areas of its business although there are shortfalls set out above which need to be addressed.

Year 2020

Sydney Water has explained to us the reasons for increasing expenditure in 2020 above previous years and there is detailed information to support these additions. The forecast expenditure is $6m less than 2019 although when the one-off expenditure for drought is discounted, there is a $40m increase or about 1% of core operating expenditure. While these are reasonably based, we question whether a utility operating in the market would take further steps to limit these increases through absorbing some of the costs, for example not backfilling posts, and reduce the impact of these increases. In addition, the CxP estimated support costs are likely to be lower due to the successful implementation of the project. We note a stretched efficiency target of $12.1m has been proposed for 2020 which can be considered as a surrogate to market pressure.

We propose an efficient level of core operating expenditure for 2020 would be $963.1m.

Prudent Expenditure

We found that operating expenditure in the current determination period was prudent with two exceptions.

- We question whether elements of the City Planning expenditure, where related to stormwater drainage and likely to be included within a Stormwater Drainage Authority, should be funded by water and wastewater customers.
- Desalination costs: we noted that the SDP was severely storm-damaged on 16th December 2015 up to a period in late 2017 when the plant was not available. We asked Sydney Water why it continued to pay an availability charge when the plant was not effectively in a Water Security mode. We discuss Sydney Water's response in Section 5.3. We question whether customers should pay for the SDP water security costs during the period when the plant was not available for use and whether such costs should be covered from other sources such as insurance.

5.6. Operating Expenditure in the 2020 determination period

5.6.1. Overview

Sydney Water made two submissions for the Price Review. The first submission was dated July 2019. A subsequent Update[43] in November 2019 included additional base expenditure and cost pass-through expenditure in response to the current drought position. In this section we comment on the total base operating expenditure including proposed efficiencies. The cost pass-through elements of expenditure are discussed in Section 8.3 – Drought response measures.

Sydney Water has proposed operating expenditure for the period 2021 to 20254 by service as shown in Table 5-11 below. Expenditure in year 2020 is shown to enable trends to be observed. The allocation of corporate costs to operational service changes from the 2016 to the 2020 Determination period. This new methodology applies corporate expenditure to bulk water supply costs.

Table 5-11 2020 Determination Period Operating Expenditure by Service

SYDNEY WATER PROPOSED OPERATING EXPENDITURE: BY SERVICE						
($m 2019/20) year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
Water	281.53	393.20	409.37	410.53	410.12	1623.22
Water BOOT	96.86	101.04	101.74	101.79	102.41	406.99
Wastewater	557.23	482.09	483.19	476.37	474.07	1915.72
Stormwater	16.36	14.47	14.82	15.00	15.25	59.54
Recycled	26.56	32.96	32.86	32.09	32.26	130.17
TOTAL CORE OPERATING EXPENDITURE						
Total	978.5	1023.8	1042.0	1035.8	1034.1	4135.6
BULK SUPPLY COSTS						
WNSW Bulk supply	220.3	189.2	193.7	199.6	202.8	785.3
SDP	241.1	180.6	178.8	178.8	178.8	717.1
TOTAL REGULATED OPERATING EXPENDITURE						
Total	1439.9	1393.6	1414.5	1414.2	1415.7	5638.0

Source: November 2019 SIR and Atkins analysis

We have included year 2020 forecast expenditure for comparison. Water service expenditure excludes bulk water costs comprising bulk raw water, the BOOT operating costs and the SDP costs. Water service expenditure is summarised in Table 5-13 below.

Update submission

Sydney Water proposed some changes to its operating expenditure forecasts related to drought expenditure, increased reactive maintenance and other changes. The extent of these changes and related expenditures are proposed in Table 5.12 below. The submission also included additional cost pass-through expenditure which we review in Section 8.3

[43] Price Proposal 2020-24 Update to the July 2019 proposal, Sydney Water October 2019

Table 5-12 2020 Determination Period Operating Expenditure by Service

SYDNEY WATER UPDATE SUBMISSION OPERATING EXPENDITURE					
$m 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	**total 2021-24**
WATER SUPPLY RESILIENCE					
Prospect- Macarthur Pipeline	0.0	10.0	14.0	15.0	39.0
Cascade system	0.0	1.0	2.0	2.0	5.0
ENDURING WATER EFFICIENCY AND OPERATIONAL RESPONSES					
Water reactive	26.0	26.0	24.0	22.0	98.0
Wastewater reactive	9.0	9.0	7.0	6.0	31.0
Water efficiency communications	10.0	10.0	10.0	10.0	40.0
Water use data and analytics	4.0	4.0	4.0	4.0	16.0
Infrastructure resilience investigations	2.0	2.0	2.0	2.0	8.0
OTHER DRIVERS					
IT driven operating costs	0.0	-1.8	-9.2	-11.9	-22.9
IT operating expenditure	-3.0	2.0	0.0	-1.0	-2.0
BOOT Plant changes	3.1	3.0	2.9	2.9	11.9
TOTAL ADDITIONAL EXPENDITURE					
Total additional expenditure	51.1	65.2	56.7	51.0	224.0
EFFICIENCY ASSUMPTIONS					
Business-wide assumptions	-5.1	-15.7	-26.1	-42.0	-88.9
NET OPERATING EXPENDITURE					
Net expenditure	46.0	49.5	30.6	9.0	135.1

Source: Sydney Water Update November 2019

We discuss these variations to operating expenditure and the impact of the efficiency proposals in this section of the report

Expenditure by Service Area - Water

Water expenditure is reported in Table 5-13 below.

Table 5-13 Water service forecast operating expenditure 2020 to 2024

SYDNEY WATER OPERATING EXPENDITURE BY SERVICE - WATER						
$m 2019/20 Year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	**total 2021 to 2024**
TOTAL DIRECT COSTS						
Raw water abstraction	0.56	0.54	0.53	0.53	0.52	2.12
Water treatment BOOT	96.86	101.04	101.74	101.79	102.41	406.99
Water treatment Sydney Water	30.86	30.75	29.83	30.06	30.11	120.75
Water reticulation	109.41	107.91	107.07	106.29	105.67	426.95
Customer support	50.27	102.33	120.17	120.38	118.67	461.56
Pooled customer support	41.12	58.65	52.07	46.79	39.28	196.78
Total direct costs	**329.09**	**401.22**	**411.41**	**405.84**	**396.67**	**1615.14**
Sydney Water CORPORATE COST ALLOCATION						
Water corporate	49.31	90.48	91.75	93.16	94.38	
Total with corporate	**378.40**	**491.70**	**503.16**	**499.00**	**491.05**	**1984.91**
BULK WATER PURCHASES FROM WNSW						
Bulk water purchases	220.30	189.18	193.73	199.58	202.78	**785.27**
BULK WATER PURCHASES SDP						
Desal water treatment	241.06	180.62	178.81	178.81	178.81	**717.05**
TOTAL OPERATING EXPENDITURE WATER						
Total expenditure	839.75	861.50	875.70	877.39	872.64	**3487.23**

Source: SIR, RCM and Atkins analysis

Water corporate is shown separately as there is a change in cost allocation between 2020 and subsequent years. Form the 2020 Determination period, corporate costs are distributed across bulk water purchases when this was not done in earlier years. The impact is to increase water total expenditure with a corresponding reduction in wastewater total.

Water treatment by Sydney Water shows a level trend through the period; we discuss BOOT treatment works costs in Section 5.6.9 below. Water treatment at own works shows a level profile. Water reticulation shows a reducing trend over the period. Customer support shows a significant increase in expenditure which includes IT; also pooled customer support but to a lesser extent. We found that these variances are due to cost allocation as we would expect increases in water reticulation from additional water reactive work.

Sydney Water commented that

> *'Customer support' and pooled customer support' are indirect costs allocated through the RCM model from all businesses and corporate divisions. These indirect costs are other than those directly attributed costs such as water purchase, abstraction, treatment and distribution*.

Reported expenditure includes the additional efficiencies included in the Update submission.

Wastewater service expenditure is summarised in Table 5-14 below.

Table 5-14 Wastewater service forecast operating expenditure 2020 to 2024

SYDNEY WATER OPERATING EXPENDITURE BY SERVICE - WASTEWATER						
$ 2019/20 Year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	**total 2021-24**
TOTAL DIRECT COSTS						
Wastewater Transportation	137.69	140.16	140.76	140.42	139.88	698.90
Wastewater treatment	172.09	171.04	168.52	164.90	164.61	841.16
Sludge/ effluent disposal	13.34	12.60	12.06	12.09	12.09	62.20
Customer support	55.13	73.52	78.68	76.79	75.02	359.14
Pooled customer support	81.40	31.65	25.29	19.74	12.33	170.40
Total direct costs	**459.64**	**428.97**	**425.31**	**413.94**	**403.93**	**2131.79**
Sydney Water CORPORATE COST ALLOCATION						
Corporate	97.59	50.64	50.36	50.04	50.27	
Total expenditure	**557.23**	**479.61**	**475.67**	**463.98**	**454.20**	**2430.69**

Source: SIR, RCM and Atkins analysis

Wastewater transportation shows an even trend over the 2020 Determination period, while sewage treatment shows a reducing trend of 4.4%. Sludge disposal costs show an even trend. There is a significant increase in customer support costs which includes IT expenditure.

Process for preparing forecasts

Sydney Water has applied a structured approach to deriving a medium-term budget for the 2020 Determination period. This followed a similar process applied for the 2016 Determination period. The process started in July 2018 all the business units in compiling expenditure projections. There is evidence of internal challenge through the executive budget discussion where potential cost savings have been identified and evaluated. Sydney Water's Executive has been engaged in the process.

Assumptions

The key assumptions used in setting the budget comprise

- average weather conditions;
- the desalination plant operates for a minimum period of 14 months from January 2019. The impact is that no 'operational mode' charges from SDP are included;
- WNSW bulk water purchase costs based on IPART Determination;
- Long term projections for growth;
- Average raw water quality for BOOT treatment with no deterioration.

5.6.2. Bulk Water

There is a forecast increase in raw water demand from 575.9GL in 2021 to 598.1GL in 2024, equivalent to a growth of 0.8% per annum. Bulk water costs from WNSW are subject to a separate Determination by IPART. Sydney Water has assumed that costs will be lower than the 2020 base year although rising over the period. Sydney Water has no control over these costs.

Table 5-15 Bulk water volumes and costs

SYDNEY WATER OPERATING EXPENDITURE - 2020 DETERMINATION PERIOD					
$m 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
BULK WATER FROM WNSW					
Volume GL	575.9	582.8	589.6	598.1	
Cost	189.2	193.7	199.6	202.8	785.3
BULK WATER FROM SDP					
Volume GL	0.0	0.0	0.0	0.0	
Cost	180.6	178.8	178.8	178.8	717.1
TOTAL BULK SUPPLY					
Total	369.8	372.5	378.4	381.6	1502.3

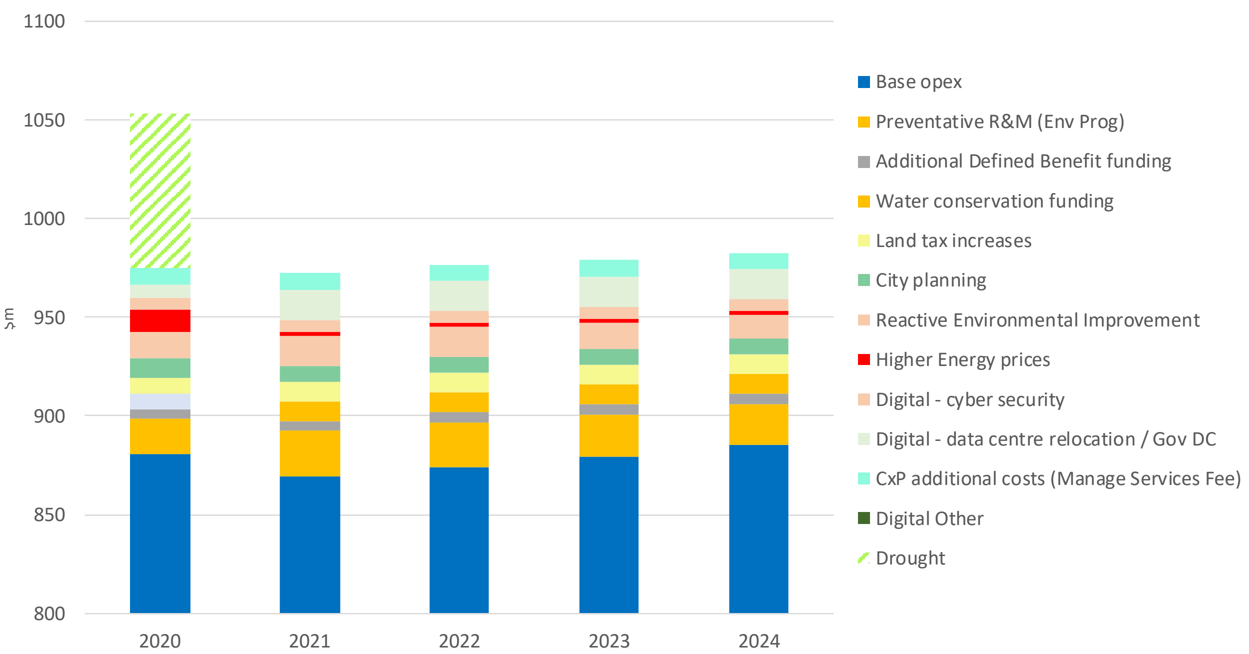
Source: Sydney Water SIR

Note: volume of bulk water from WNSW subject to change.

Sydney Water has assumed that the Desalination Plant will not operate during the 2020 Determination period and costs will be limited to an availability charge. While the plant is operating in 2019 and 2020, there is an assumption of ‘average costs’ for the 2020 Determination period which would limit costs to the availability charge. These charges are subject to a separate determination by IPART for a four-year period from July 2017; we assume these will be subject to a further determination in 2021.

5.6.3. Core operating expenditure

Expenditure in the 2020 Determination period is shown in Figure 5-14 which shows the variance in expenditure over the period. Year 2020 is shown for comparison.



Source: Sydney Water submission and document 281.2

Figure 5-14 Core operating expenditure drivers

The main reasons for expenditure increase over the 2020 Determination period from the 2020 base year are

- an average $4.5m/a for preventive maintenance as part of the environmental program (see section 5.6.7);
- an average $0.8m/a for reactive maintenance, also as part of the environmental program (5.5.6);
- increases in BOOT operating expenditure (5.6.9);
- a $8.9m/a reduction in energy costs (5.6.10);
- a reduction of $2m/a for city planning activities (5.6.11);
- an $8.5m/a increase in digital data centre relocation (5.6.12);
- a $2.1m/a increase in land tax from 2021 (5.6.5);
- a $2m/a to $10m/a from 2021 for water conservation activities including leakage reduction (5.6.14);

5.6.4. Efficiencies within the forecast

Sydney Water proposed efficiencies in the 2016 Determination period which we discussed in Section 5.4.4. These increased from the 2017 base to $24m/a by 2020, not including a further $12.4m stretched efficiency target for 2020 and not included in the submission.

In Table 5-16 below we summarise the further efficiencies proposed by Sydney Water over the 2020 Determination period using year 2020 as the base.

Table 5-16 Proposed efficiencies for the 2020 period

SYDNEY WATER OPERATING EXPENDITURE - 2020 PERIOD EFFICIENCIES						
$m 2019/20 Year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	Total efficiencies in period
SPECIFIC INITIATIVES						
Production Improvement Program (PIP)	15.20	2.30	3.50	7.70	7.70	21.20
Civil operating model (COM)	1.30	0.00	0.00	0.00	0.00	0.00
Network reorganisation	1.60	0.00	0.00	0.00	0.00	0.00
Supply chain	2.10	0.70	1.50	2.70	2.70	7.60
Multi-functional business centre (MFBC)	4.50	0.70	0.70	0.70	0.70	2.80
Total initiatives	24.70	3.70	5.70	11.10	11.10	31.60
EFFICIENCIES INCLUDED IN BASE EXPENDITURE						
Heat Mapping	12.1	10.4	11.2	13.2	13.2	48.00
BxP savings		2.60	-0.40	9.50	12.80	24.50
Total efficiency target	36.8	16.7	16.5	33.8	37.1	104.1
Percentage of 2020 base opex		1.63%	1.58%	3.26%	3.59%	
ADDITIONAL EFFICIENCIES IN UPDATE SUBMISSION						
Water	0.0	2.5	8.0	13.3	21.5	45.3
Wastewater	0.0	2.5	7.5	12.4	19.9	42.3
Stormwater	0.0	0.1	0.2	0.4	0.5	1.2
Total	0.0	5.1	15.7	26.1	41.9	88.8
Percentage of 2020 base opex		0.5%	1.5%	2.5%	4.1%	

Source Sydney Water SIR, Update submission, Atkins analysis

The efficiency initiatives started in the current period and are detailed in Section 5.6.4. Some were completed by 2020 so no further efficiencies are proposed in the 2020 period. Other efficiencies continue through the 2020 determination period. We have re-based the efficiencies from the 2020 base to clearly show those that have been achieved in the current period and further efficiencies planned in the 2020 period. The PIP is the main contributor of further efficiencies achieved through ongoing manpower reductions mainly from shift working. The supply chain initiative shows further savings from the implementation of the P4S program.

We have also included efficiencies from the heat mapping process which include indirect efficiencies from the IT Digital program and specific savings from the BxP program, both included in Table 5-20.

’The impact of these efficiencies is an average 2.5% per annum reduction on core expenditure. In the Update submission, Sydney Water is proposing a further efficiency target for the water, wastewater and stormwater services equivalent to 0.5%/a to 1.5%/a cumulative shown above. The basis of these efficiencies is not detailed and are applied outside the SIR submission data. We comment on these efficiencies against our assessment in Sections 5.7.2 and 5.7.3.

5.6.5. Operations and support expenditure

Expenditure by Operations and Maintenance, and Support expenditure is summarised in Table 5-17. We have termed operational activities to include Customer Delivery (previously Service Delivery and Customer Service) and Liveable City Solutions. This follows a similar analysis applied to the 2016 Efficiency Review and Determination.

Table 5-17 Operating and support expenditure

SYDNEY WATER OPERATING EXPENDITURE - BY DIVISION					
$m 2019/20 Year ending June	**2020**	**2021**	**2022**	**2023**	**2024**
TOTAL OPERATIONS AND MAINTENANCE EXPENDITURE					
Customer Delivery	868.92	844.36	848.76	841.80	838.32
Liveable city solutions	35.76	36.10	34.28	35.43	35.64
Bulk water purchases	220.30	189.18	193.73	199.58	202.78
Total direct expenditure	1124.97	1069.65	1076.77	1076.82	1076.74
TOTAL SUPPORT EXPENDITURE					
Corporate	150.21	146.23	147.25	148.28	149.80
Office of the MD	16.54	16.13	16.13	16.13	16.14
Corporation Level Adjustments	25.17	26.59	30.32	28.78	25.98
People & Corporate services	11.02	10.93	10.92	10.95	10.98
Finance Services	31.20	33.80	36.97	38.58	40.33
Customer Strategy & Regulation	15.66	16.14	15.63	15.36	15.82
Digital Business	65.14	74.14	80.59	79.31	79.96
Total support costs	314.93	323.96	337.80	337.40	339.01
TOTAL OPERATING EXPENDITURE					
Total	**1439.91**	**1393.61**	**1414.57**	**1414.22**	**1415.75**
Support as % of total	21.9%	23.2%	23.9%	23.9%	23.9%

Source: SIR and Sydney Water RCM analysis

There is an even trend in operations and maintenance expenditure over the 2020 Determination period and some 5% below the year 2020 forecast expenditure. Support costs forms an average 23.75% of total operating expenditure over the 2020 Determination period. This compared with 19% actual expenditure in the 2016 Determination period; a 6% of total operating expenditure (including bulk supply). The distribution of operations and support costs are shown in Figure 5-15 below.

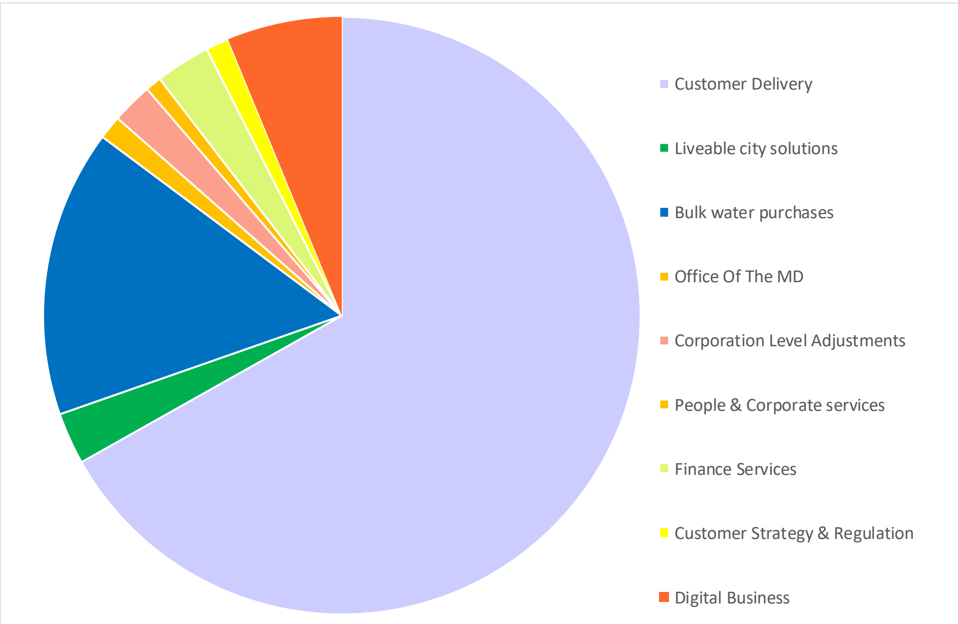


Figure 5-15 Distribution of Operating Expenditure by Activity

Total support costs have increased by $420m (+46%) above actual expenditure in the 2016 Determination period.

Corporate level adjustments
We noted that this expenditure has increased from a planned $77.6m in the 2016 Determination period to $112m in the 2020 period, an increase of $34.4m, more than a 50% increase. Sydney Water advised that this area of expenditure includes operating cost increases from capital projects and growth in demand although no detailed information has been provided.

People and corporate services
Expenditure in 2020 shows a significant reduction, confirmed from discussions with Sydney Water.

Finance Services
Expenditure has reduced significantly following a restructure partly offset by increases in land taxes. Actual land taxes were$16.8m for 2017 and $18.6m in 2018. The estimates for 2019 and 2020 are $20.8m and $21.1m respectively. Sydney Water assumes that this cost difference will increase to $10m/a over the 2020 Determination period; this is equivalent to an increase of $2.1m/a above the 2020 base year and reflects a general increase in tax and additional land acquired for the Western Sydney developments.

Customer Strategy and Regulation
Expenditure has reduced over the period.

Digital Business
Digital business shows a $36m increase above the 2016 Determination period. This is discussed in Section 5.6.12.

Office of the MD
This shows a significant increase of $63m above a small expenditure in the 2016 Determination period. It is likely that some additional activities are reported against this cost centre.

We found that the level of support expenditure showed a significant increase as a proportion of total costs; 23.7% compared with 16.3% in the 2016 Determination period. While the cost of some divisions shows significant reductions from restructuring, these are offset by large additional costs elsewhere to show a material increase in support costs when we would expect to see these held level or reduce.

5.6.6. Drought resilience projects
Additional operating expenditure is proposed for the Prospect to Macarthur pipeline and for the Cascade supply upgrade.

Prospect-Macarthur pipeline
Expenditure for the Prospect to Macarthur pipeline increases from $10m in 2022 to $15m in 2024 with a total $39m over the 2020 determination period. The project includes six new/upgraded pumping stations, two new reservoir sites, new pipelines, three new Re-chlorination plants and a pressure reduction valve. . The maintenance expenditure has been derived by applying a percentage to the capital expenditure for these assets. Sydney Water commented that

> *The maintenance percentages applied are based on Sydney Water's Modern Engineering Equivalent Replacement Asset (MEERA) database. The database is built based on Sydney Water's asset replacement costs and the actual operational and maintenance expenditure for each asset type has been calculated as a percentage of the capital asset cost replacement.*

While the methodology provides a basis to estimate indicative operating costs for option analysis, it does not relate to the likely operating expenditure on these assets across the business, taking into account the growth in demand over the current and future period, We have used actual and forecast expenditures in the

Regulatory Cost Model (RCM) which includes maintenance costs for all pumping stations, pipelines and reservoirs to derive a marginal increase of $2m/a for maintenance.

We would expect to see additional costs for the water pumping stations although not to the extent of the costs provided. The proposed power cost at $6.8m/a at full project operation is some 17% of the total Sydney Water power costs. Sydney Water provided additional information to show the basis of these costs. Some power cost estimates have been based on flow and head assessment and other pumping stations are derived from hydraulic modelling.

We comment in Section 8.3 that the western part of the project is prudent. The eastern part is a longer-term project mainly to meet growth in demand. The pumping costs assume full production from all the pumping stations from 2022 over three years of the determination period. As production is to meet a combination of drought and growth needs, we suggest it reasonable to assume 80% of full production over the three years. This results in power expenditure of $5.4m/a by 2024.

Total efficient operating expenditure would be phased, up to $7.4m/a by year 2024. Total efficient expenditure is $19.2m over the 2020 determination period.

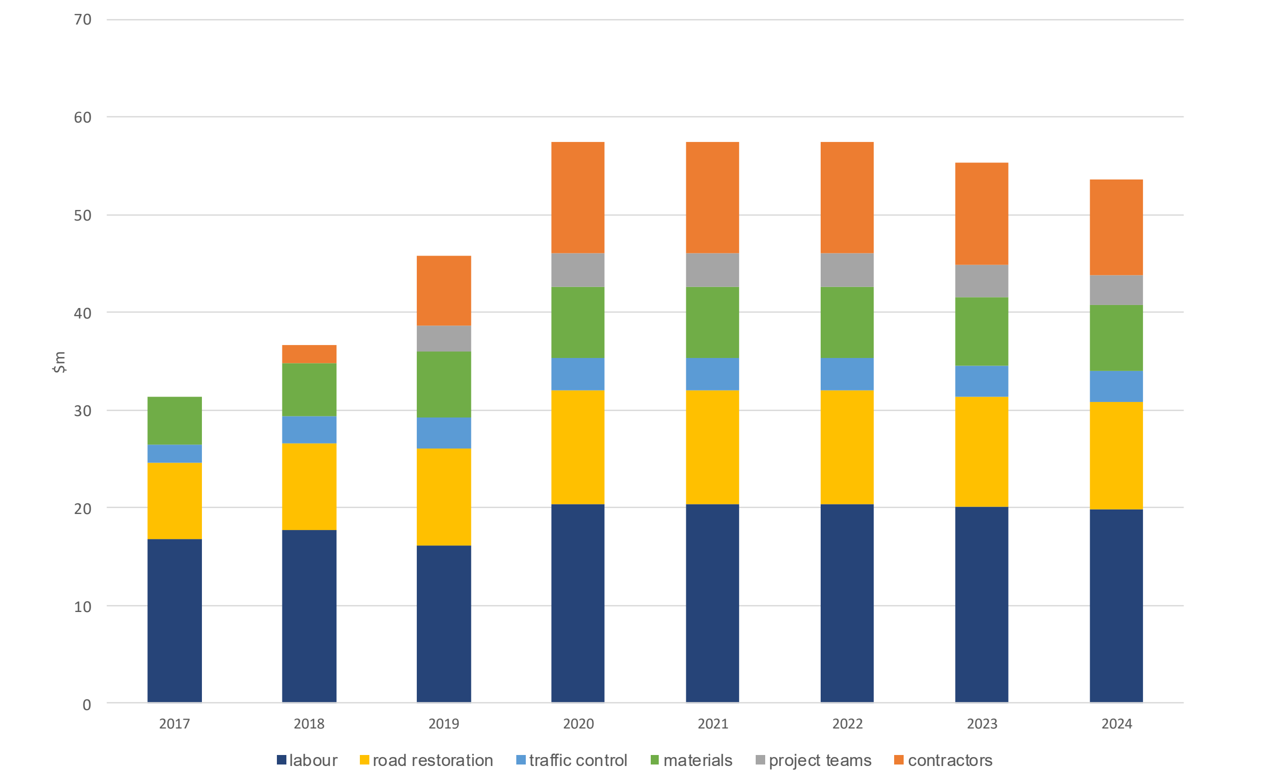
Cascade Supply Upgrades
Expenditure for the Cascade upgrade project is $1m/a in 2020 increasing to $2m in 2024 with a total $5m in the 2020 determination period. The additional costs relate to treatment works costs at the Cascade works, including chemicals and energy, network pumping costs and operation and maintenance. Sydney Water commented that there was an inconsistency in the business case document which excluded the total of both networks and treatment net expenditure '*as calculated in the supporting cost models*.

There is a lack of clarity in the way that operating costs have been estimated and offset against likely savings from the project which should be more explicit in business case documents. We have accepted the additional information provided by Sydney Water and have made no adjustments to proposed operating expenditure on the basis that this will be subject to efficiency adjustments.

5.6.7. Water networks and leakage management

Water networks and leakage management is part of the Customer Delivery Division, a new and the largest Division formed by the combining of the previous Service Delivery and Customer Service divisions accounting for some two thirds of core operating expenditure. The scope of operational activities includes water treatment and distribution, sewerage, sewage treatment, biosolids disposal. The customer services element builds in the implementation of the CxP project.

Reactive maintenance
Water reactive maintenance forms a significant level of expenditure when the Update submission proposals are included. Additional expenditure of up to $26m/a is proposed with a total $98m in the 2020 determination period. The profile of expenditure is shown in Figure 5-16 below shows how this expenditure is disaggregated over the period 2017 to 2024.



Source: Sydney Water doc 412.1

Figure 5-16 Water reactive expenditure 2017 to 2024

Sydney Water has derived the additional expenditure in the 2020 Determination by comparing total annual expenditure with the $31.4m in year 2017. The main reasons for the increase relate to additional gangs from the project team, contractors and direct labour plus associated road restoration, traffic control and material costs.

The driver for additional costs is the extra gangs required to repair leaks reported by customers and Sydney Water staff which in turn is due to the impact of drought conditions on the network. The quarterly values of leakage against the ELL and the number of leaks on water mains and service pipes are shown below.

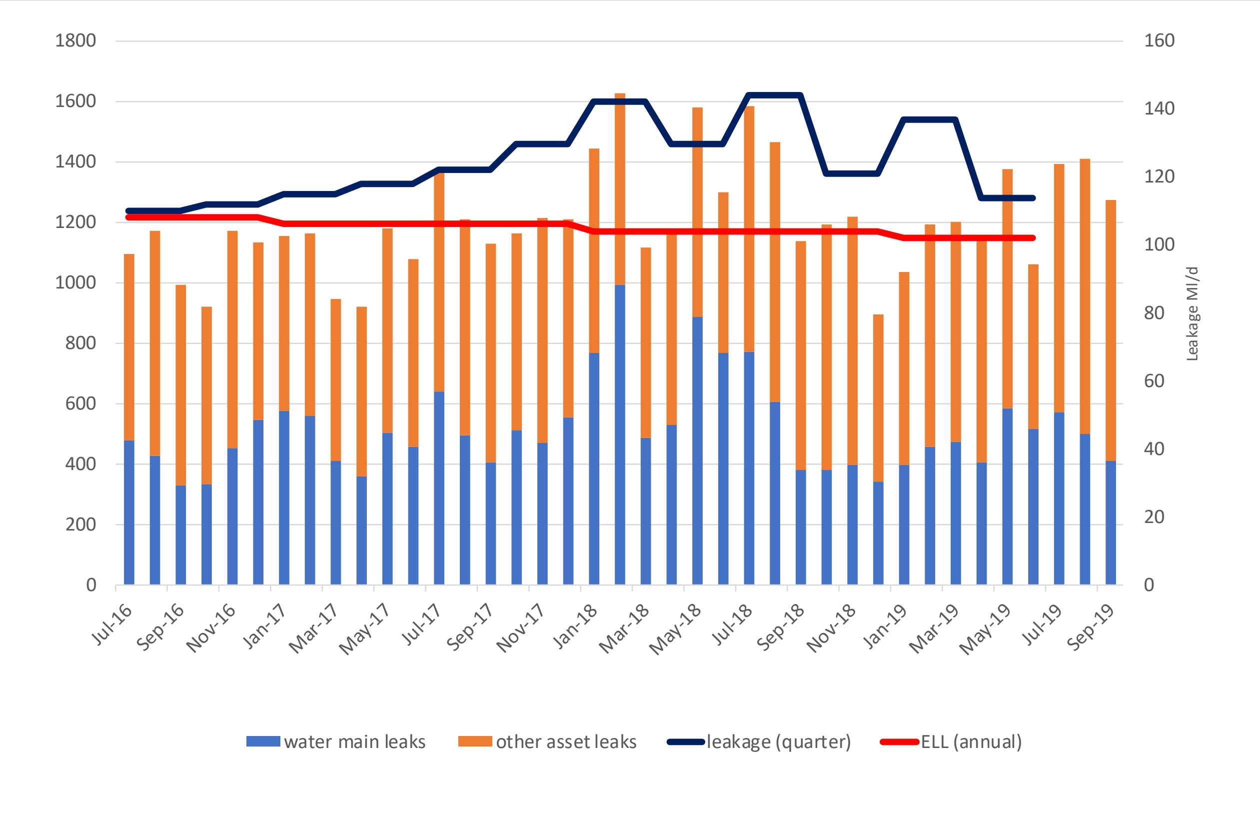


Figure 5-17: Quarterly Leakage compared with ELL and number of leak repairs

Sydney Water has responded to the increasing leakage through the increase in repair gangs although it remains significantly above the mean ELL. A reduction of leakage to the ELL is not forecast until 2022.

Sydney Water commented that the reactive response is due mainly to visible leaks; those detected on the surface. Active leakage detection is carried out, and we comment on this in Section 5.4.12, although real-time flow and pressure data is limited. Leakage repair times for the mainly visible leaks is shown in Figure 5-18. This showed that repair times increased from two days in March 2017 to 7 days in March 2018 reducing to two days in November 2018 followed by a smaller peak. From our experience with frontier leakage management utilities, we would expect visible leaks to be fixed within two days.

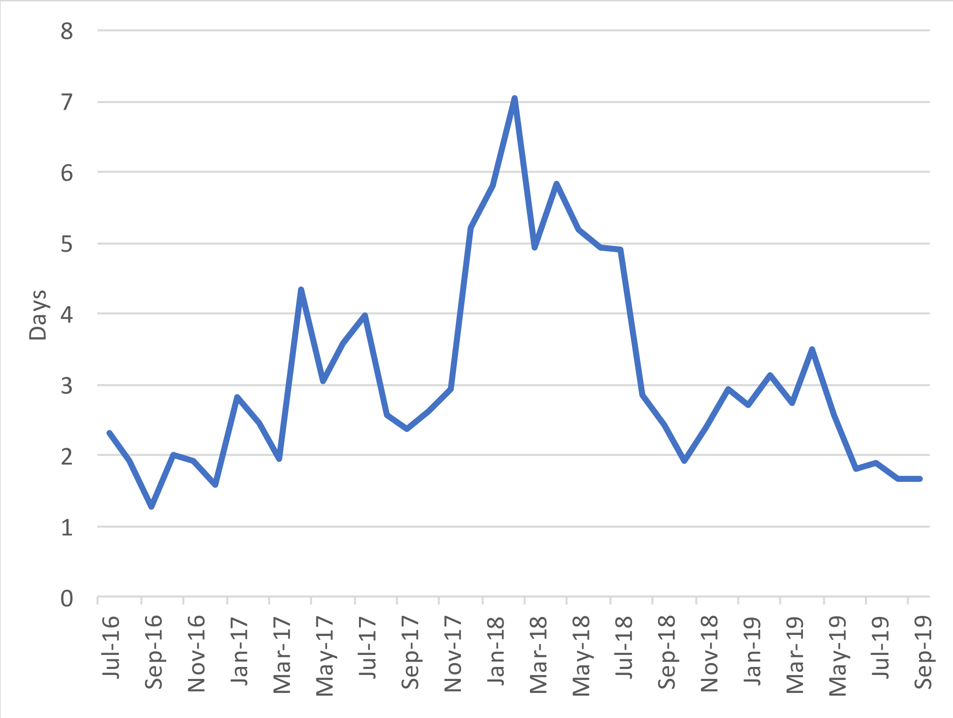


Figure 5-18: Leak run times for mainly visible leakage

We confirm that this reactive leakage activity is required to return leakage to its mean economic level as soon as practical. Leakage above the ELL is by definition is not efficient. In other regulatory domains, a frontier company would be required to return leakage to its ELL at no cost to customers. Sydney Water has assumed average weather conditions and has then needed to react to increasing leakage from the impact of drought conditions on the network. However, it has not been efficient in this response because:

- an effective continuous flow and pressure monitoring system is not available within the network to be able to respond to increasing leakage; a monitoring system would allow leaks to be detected early before they 'grow' and be visible at the surface;
- New technology such as acoustic loggers and other data loggers should be used extensively to drive more efficient and timely detection;
- the response time to repairing visible leakage has been slow; up to 7 days compared with an industry norm of two days. This increase in duration adds to total reported leakage;
- a reduction of leakage to ELL should be achieved in a shorter time than currently planned; this is really important when water use restrictions are in place;
- a reduction in planned maintenance over the 2016 Determination period discussed in Section 5.4.5

Experience from the impact of drought conditions confirms that the network has been stressed. Sydney Water needs to apply the latest technology for flow and pressure monitoring to improve the resilience of the network and operational resilience in any future drought conditions. We note that there is a proposed capital project[44]to address some of these issues with expenditure for pressure management and setting up district meter areas although expenditure has not been approved.

We conclude that the additional expenditure is required for mains and services repairs to return leakage to its mean economic level. However, there are operational shortfalls in the management of the leakage and repair program. This is mainly because of the time taken to detect and repair leaks .The impact has been an increase in leakage significantly above the mean economic level.

[44] Document 410 details of capex project for leakage management

If an effective and comprehensive leakage monitoring system, as is common practice for most frontier companies, had been in place then continuous monitoring could have focused leakage detection and repair at an early stage before being reported when visible above ground. Leaks can 'grow' so early detection reduces volume lost. Leakage run times could have been reduced and water saved. While there is limited information to derive a specific value of leakage reduction that could have been made, our experience suggests that leakage could have been more effectively controlled and near to the ELL.

Sydney Water explained that the purpose of the reactive expenditure is to repair broken and leaking pipes and fittings. We accept this view but note that had an effective leakage monitoring and detection system been in place then these leaks could have been found and repaired earlier than they have been. The impact has been that leakage is above the ELL for some time and by definition this is inefficient. Customers are asked to pay for water lost through leakage and the necessary repairs to resolve this.

We have estimated the cost of treated water lost through leakage based on a $2/kl[45]using the reported leakage against ELL[46]. We have assumed a 'deadband' margin of 5 Ml/d above ELL to reflect minor variations in leakage against ELL which we have excluded from the analysis.

- For the period from January 2017 to June 2019, we calculate that leakage above the deadband level to be 16GL at a cost of $32m (rounded).
- We understand from discussions with Sydney Water that it plans to reduce leakage to ELL by 2021/22. We estimate a further 4GL losses above the deadband, assuming a tapering reduction in leakage, giving a total $8m cost. This gives a total loss of water at a cost of $40m. We have distributed this adjustment evenly across the 2020 determination period.

We find that this cost is not efficient. The repair work is still required but customers should not be asked to pay for the value of water lost through inefficient leakage management.

Planned maintenance
Sydney Water plans to continue with a rebalanced work program with a greater focus on planned maintenance through the 2020 Determination period although with a reducing trend over the four years to 2024. This assumes average weather conditions.

If drought conditions continue, we would expect that leakage will increase because of drier ground conditions. This will require a quick response to repair leaks quickly and keep any increase in total to a minimum. Should further funding be required outside the 'average' year assumption, then Sydney Water needs to demonstrate that it is managing leakage in a timely and efficient manner.

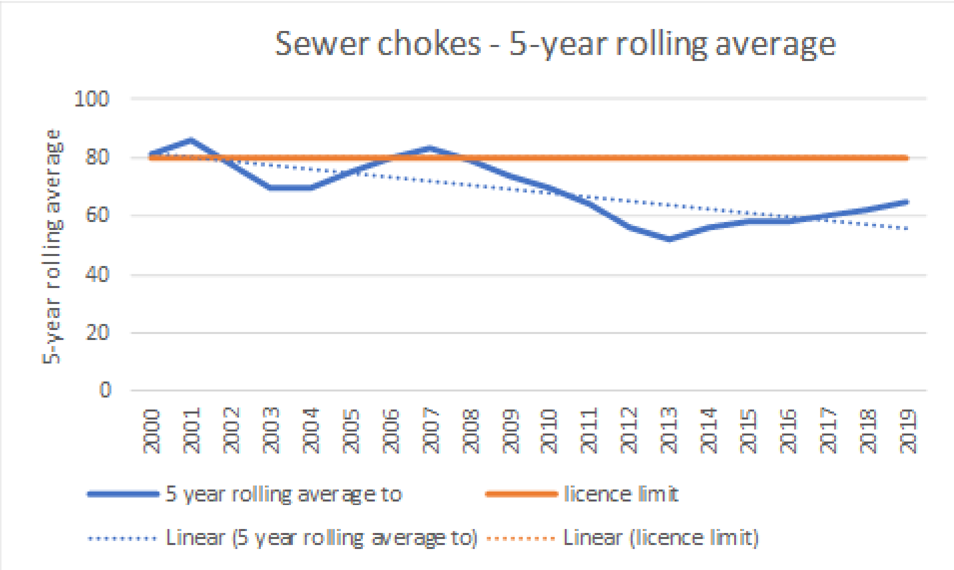
The interruptions performance measure is close to the licence limit and was exceeded in 2018 due to one exceptional and large event which was untypical of the nature of interruptions over recent years. The operational response is to undertake valve inspections and repairs and to install additional valves to minimise the number of customers impacted during any shutdown. The use of the Customer Hub should enable a more focused response with fewer properties impacted in any interruption.

The enhanced leakage detection activity is planned to continue through the 2020 Determination period. We consider a more comprehensive approach to leakage management is required; we discuss this in Section 5.5.12 and above.

[4545] Response to item 385, Sydney Water
[46] Document 371.2, Sydney Water

5.6.8. Wastewater environment program

The wastewater environment improvement program is a continuation of reactive and proactive work for dry weather overflows which has continued over many years. We commented in Section 5.3 that the reducing level of planned maintenance which includes CCTV inspections, proactive root clearance and repairing sewer pipes could have contributed to the increasing numbers of reported dry weather overflows emerging as soil moisture content reduced and root intrusion increased because of drought conditions. There is also an increasing trend in sewer blockages from fats, oil and grease which Sydney Water should manage through customer facing measures. Performance against the sewer choke measure is shown in Figure 5.19 below. This shows an increasing rolling average in the short run although the trend is reducing in the long run.



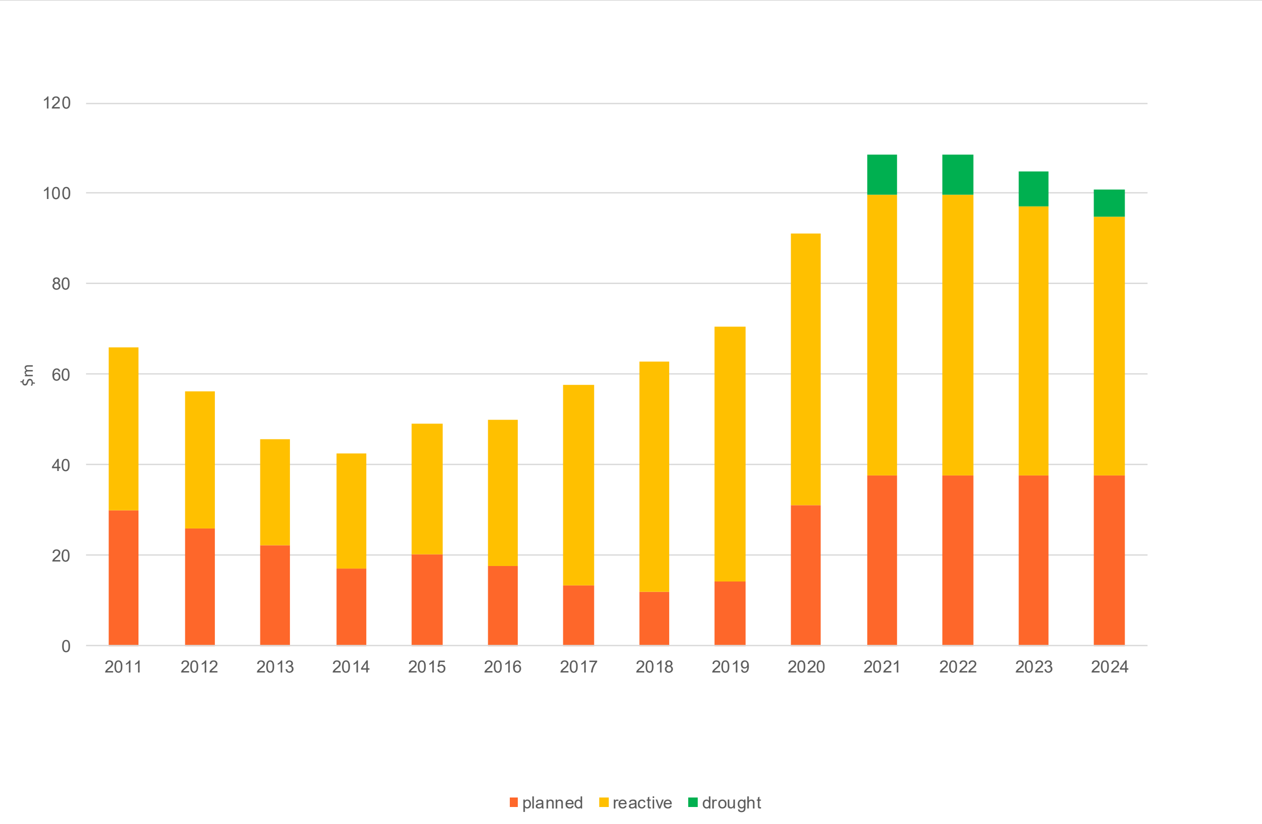
Source: Sydney Water

Figure 5-19 Licence Performance - sewer chokes

The increased work for this period is in response to the increase in the number of dry weather overflows to waterways. The licence performance measure is the number of dry weather overflows measured as a five-year rolling average which shows an increasing trend although lower than previous years. Figure 5-19 shows an increasing trend over the last five years although put into the context of a long-term performance from year 2000 then performance is lower than earlier years. It is reasonable to respond to the recent increasing trend although, assuming average conditions in the future, Sydney Water may be taking a risk averse approach in the level of increased resources being assumed.

We noted that at the end of the millennium drought that tree roots accounted for 70% to 80% of the total number of chokes. This proportion has reduced to about 50% with increases in the number due to soft chokes and fats oil and grease (FOG).

Sydney Water is proposing to increase expenditure in the 2020 determination period to an average $106m per annum from an equivalent $71m in the 2016 Determination period. This is a combination of planned maintenance (+$20m/a) and reactive (+15m/a). The profile of expenditure is shown below and includes an increase of up to $9m/a from the Update submission.



Source: Sydney Water doc 414.1

Figure 5-20 Planned and reactive maintenance expenditure

Preventative maintenance had reduced over the 2012 and 2016 Determination periods to a low of $12m in 2018. Sydney Water proposes an even $37.5m/a over the 2020 Determination period including additional manhole and CCTV inspections followed by root cutting and minor repairs. This compares with an average of $19m in the nine years up to 2019 although expenditure was low in 2014 to 2018. This is a near doubling of expenditure over the period. While there is a need for expenditure above the relatively low spend in the 2016 Determination period, we question whether this scale increase is efficient and justified.

Reactive maintenance expenditure proposals for the 2020 Determination period are an average $68.3m/a including additional 'drought' expenditure of $9m/a included in the November 2019 submission. This is an increase above the average $53m in the 2016 Determination period and $27m in the 2012 Determination period. Actual expenditure in 2019 was $56.4m in 2019 and $69m planned for 2020, This 'drought' expenditure is included for contractors to resolve sewer chokes and minor repairs. This main reactive work is to target those chokes having a significant environmental impact. Of an average 20,000 jobs, some 450 related to high environmental risk which are expensive to clean up.

We commented in Section 5.4.5 that the reducing level of planned maintenance which includes CCTV inspections, proactive root clearance and repairing sewer pipes could have contributed to the increasing numbers of reported dry weather overflows emerging as soil moisture content reduced and root intrusion increased because of drought conditions.

Had the level of planned maintenance, comprising CCTV inspections, root clearance and repairing sewer pipes continued through the 2016 Determination period at the rate of expenditure in the earlier 2012 period level of expenditure, then some of the reactive maintenance might have been avoided. The current position suggests that there has been a backlog on planned maintenance that Sydney Water is planning to address.

Our view is that this work needs to be done to meet expectations of both the public, the EPA and licence requirements. However, we question whether some of the reactive expenditure could have been avoided by more effective asset management and a greater activity in for example in proactive CCTV work during the 2016 Determination period. In addition, reports of effective responses to incidents and clear-up may well be matters of more effective working, monitoring and timely clean-up. With the Customer Hub now in place we would expect the process to be more effective.

There are uncertainties in the level of expenditure proposed to resolve sewer chokes. It is more effective to carry our preventive maintenance and we would expect the benefits to be reflected in lower reactive maintenance in future years with reduced clean-up operations. Our view of efficient expenditure takes into account

- the effect of low levels of proactive maintenance in the 2016 Determination period increasing subsequent reactive maintenance which is inefficient;
- the impact of increases in proactive maintenance on reactive work does not appear to be fully factored into the jobs forecast;
- there is insufficient information to demonstrate the forecast increase in jobs requiring repair and clean-up or where the cause of the blockage is other than tree roots;
- the need to be more efficient with clean-up costs;
- the use of the Customer Hub which should lead to more effective responses and it is not clear to what extent this is included within the expenditure proposals.

We support the increase in planned maintenance as this is essential to address the areas of high risk of blockages and high consequence of failure. However, the level of reactive expenditure is partly influenced by the reduction in planned maintenance in recent years which we discussed in Section 5.4.5. In addition, the reports on the shortcomings of clean-up operations suggests inefficiencies in working. Taking these two factors together we suggest that 12% of reactive expenditure is not demonstrated as being efficient for funding by customers. This is derived from the shortfall in planned maintenance in the current period, and the impact of this shortfall.

Sydney Water advised that for the 2020 determination period, $13m/ of large network repair costs will be capitalised. This is a change from the current assumptions. However, total costs were presented to us during our review to demonstrate the profile of expenditure over time shown in Figure 5.20 above. We have considered the total expenditure profile over the period but have taken into account that some costs are capitalised and would have capital efficiencies applied.

The level of efficient reactive expenditure reduces from $63.0m/a to $55.5m/a over the 2020 determination period. is results in an annual adjustment of $7.5m/a

5.6.9. BOOT Water Treatment

Sydney Water purchases potable water from four BOOT plants at Prospect, Macarthur, and the combined Woronora and Illawarra plants. The operating cost of supply is driven by volume and water quality; mainly colour and turbidity and included in operating expenditure. Other costs are covered in the RAB. Estimated volumes and expenditure are shown in Table 5-18. Sydney Water also operates other treatment plants so the total BOOT volumes are less than the total bulk supply.

Table 5-18 Future BOOT treated volumes and operating expenditure

[redacted]

Source: Sydney Water document 265.1

Estimated expenditure shows an increase from an average of $94.4m in the 2016 Determination period, when the SDP was operating in 2019 and 2020 to an average $101.7m in the 2020 Determination period. The assumed total volume treated in the future period is 544 GL/a compared with 513GL/a in the 2016 Determination period.

Sydney Water attributes this increase to increases in volume (1.6%) and deteriorating water quality. The 2020 expenditure is forecast as $93.7m when the SDP is in operation. Including the adjustment for finance lease costs this increases to $96.9m.

Impact of volume on expenditure

We have taken our demand forecasts presented in Section 4 to estimate the treatment volumes in a 'base case' with storage greater than 60%, with the existing SDP plant operating and with the extended SDP plant operating from 2023. We also assume that leakage is reduced to its mean economic level. The analysis assumes that one third of the operating expenditure is volume-related, confirmed by Sydney Water.

We have tested the Sydney Water forecast expenditure against our base volume forecast from Section 4 and the impact of the SDP and the SDP extension; we also test the assumptions underlying the water quality assumptions. We have used the weighted average of all BOOT plants ($61.08 per ML) For SDP scenarios, Sydney Water suggested that we should nly use Prospect variable rate as replacing that volume ($43.69 per ML) which is cheaper than weighted average of all plants. Given the above scenarios,

- the base demand case results in a saving of $1.11m over the period;

• if the SDP continues to operate through the 2020 determination period, there are BOOT treatment savings from $8.7m/a to a total $34.8m.

• If the SDP continues and the extension is commissioned by July 2022 then there are savings of $12.5m/a for 2023 and 2024.The analysis shows that

BOOTIn assessing efficient expenditure for the 2020 determination, we have assumed the base case scenario. The drought case scenario, where the SDP is in operation and the extension is brought into use, is considered against the cost pass through proposals. We discuss this in Section 8.5.7.

Impact of raw water quality on expenditure
Sydney Water comments that raw water quality shows a deteriorating trend in colour and turbidity although with this parameter values in the raw water treatment agreement. [redacted] Sydney Water advised us that it has asked WNSW to carry out further water quality monitoring to provide early warning of water quality changes to provide the ability to optimise the treatment process.

Sydney Water has an underlying assumption that future costs should reflect 'average' conditions and 'base' demands; those not impacted by drought restrictions. Sydney Water is assuming higher colour values in the future period and greater than the average for recent years. This is a risk averse approach and results in significant increases in treatment works costs which are likely to be overstated. We suggest that an efficient level of expenditure for the base case with average weather conditions and sharing the risk between customers and Sydney Water would be a $3.3m lower than that proposed.

Sydney Water commented that raw water quality, in particular higher colour, is likely to deteriorate due to drought conditions. It added that

> *We acknowledge that we would be adopting a low risk approach if we were to share the cost across the whole four-year period. Instead we therefore suggest that we bear the risk of an inflow event in the first two years of the determination and accept the Atkins reduction in these years but receive the full $3.3m /a in the last two years due to the impacts of growth and when rainfall events are more likely to occur.*

We accept this proposal as it shares the risk between Sydney Water and customers.

[redacted].

5.6.10. Electricity

Sydney Water has prepared energy demand based on forecast at 50 individual large sites contributing to 85% of total demand and aggregated sites for the remainder. The forecasts include for growth, the impact of capital projects such as the St Mary's and Quakers Hill upgrades. An allowance is made for energy efficiencies from the program business case. The objective is to limit energy requirements from the grid to the 1998 target of 365 GWh. Increased demand is met from existing and new renewable energy sources. The energy forecasts are shown in Table 5-19 below.

Table 5-19 Future Determination period Electricity Forecasts

SYDNEY WATER PROPOSED OPERATING EXPENDITURE - ELECTRICITY						
($k 2019/20) year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
ELECTRICITY DEMAND -GRID (GWh)						
Total Load Forecast	434.10	436.30	435.90	435.30	434.50	
Grid Purchase	358.30	358.40	351.30	348.50	348.70	1406.90
Renewables	75.80	75.80	75.80	75.80	75.80	
Additional Renewables	0.00	2.10	8.80	11.00	10.00	
Energy saving from 2020		1.00	5.40	9.60	13.00	
ELECTRICITY OPERATING EXPENDITURE						
Proposed expenditure (SIR)	47.60	40.90	39.50	39.10	38.90	158.40
Unit rate $/GWh	132.85	114.12	112.44	112.20	111.56	
Variance 2019/20		-14.1%	-15.4%	-15.5%	-16.0%	
ADJUSTMENTS						
Increase renewables (GWh)		0.00	7.20	7.20	7.20	21.60
Opex saving ($m)	0.00	0.00	0.52	1.86	1.86	4.24
Efficient expenditure	47.60	40.90	38.98	37.24	37.04	154.16

Source: Sydney Water and Atkins analysis

The rate forecast for grid supplies is derived from long term model built by consultants. The results have been reviewed internally and by an external independent market expert. The modelling takes into account retail rates, an assessment of network tariffs, market operator charges and large-scale generation certificates (LGCs), small-scale technology certificates (STCs) and Energy Savings certificates (ESCs). The electricity market is impacted by the closure of some coal powered power stations with greater reliance on gas-fired generation. The forecasts show a decline in rates, from a current high level through to 2024 with an increasing trend thereafter. The impact for the 2020 Determination period is a significant reduction of rates from the current rates. Sydney Water has identified cost risks related to market risks and network rates which could increase costs by some 10%.

Sydney Water has an energy efficiency program which is forecast to deliver 13 GWh additional savings over the 2020 Determination period, equivalent to 0.75% per year. In addition, energy from renewables is forecast to contribute to 20% of total demand.

These energy and expenditure forecasts do not include the additional power costs from the Prospect to Macarthur pipeline and Cascade supply upgrade. Our understanding is that these additional demands will increase power requirements by at least 40 GWh/a or 14% of grid supplies. We understand the overall objective is to maintain grid supplies no more than the 1998 level. These additional demands will place greater pressure on grip supplies unless more renewable energy can be procured.

While good progress has been made to manage grid energy within the 1998 level, further use of renewables should be explored. particularly give the increase in demand from the Prospect Macarthur pipeline. We consider that there is a need to develop further renewable energy sources to reduce the risk of increasing dependence on grid supplies and related costs. In this regard, a stretched renewable target of 2%/a (rounded) of grid supplies at year 2020through the 2020 Determination period has been applied from 2022[47] This is based on the target set in the 2016 Determination but not achieved. We note that the SDP, a high energy user, is 100% dependent on renewable energy[48].

[47] Note that opex savings in Table 5.19 were made on previous assumptions but the difference is not material
[48] https://www.sydneydesal.com.au/faqs/#energy

5.6.11. City Planning

We commented in Section 5.4.7 that Sydney Water has been requested by DPIE to provide strategic management and planning support, from year 2020, for the Western Parkway City including the South Creek and airport. The focus is on stormwater drainage with some input on key water infrastructure and land requirements to facilitate early planning. A shadow Storm Water Authority is being developed to take responsibility for this work. We had question whether elements of this expenditure, particularly related to stormwater drainage, should be funded by water and wastewater customers.

As this input is for a specific requirement which might morph into a separate planning authority, we question whether this expenditure would continue through the whole of the 2020 Determination period. We have assumed that the $8m/a proposed would continue through to the end of 2022.

Sydney Water commented that

> *We oppose this reduction. However, we recognise that there is a possibility that this work may transition to a separate planning authority and there may be no legislative requirement for us to conduct this role. We propose instead that funding is treated by IPART as a contingent expenditure, that is provided for similar to the triggering of the drought expenditure. That is, if legislative or planning requirement is placed on us by Government then the expenditure should be allowed.*

We note the comment which is a matter for IPART to address.

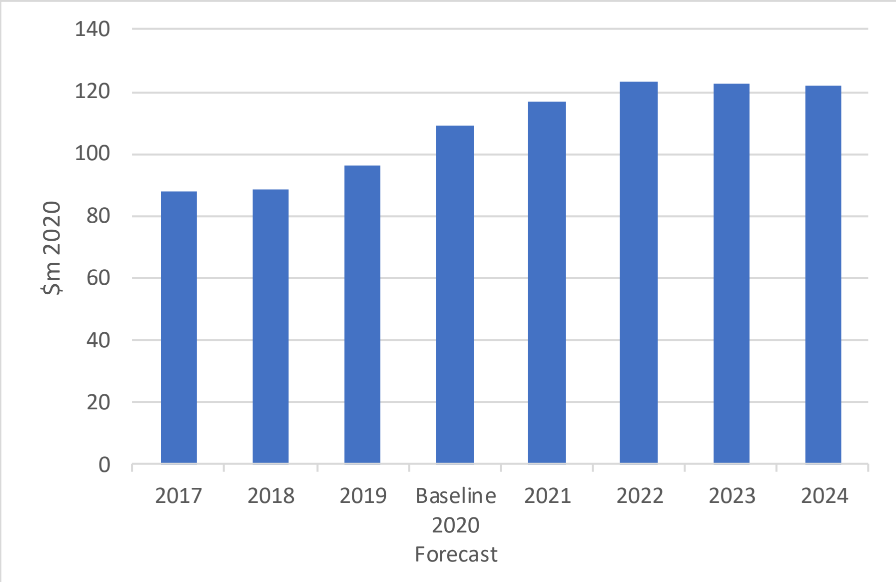
5.6.12. IT Digital

Table 5-20 shows the variance in proposed expenditure compared with the 2020 base year. Sydney Water provided an updated estimate after the July 2019 SIR which showed a downward adjustment of $1.5m in total operating expenditure in IT over the 2020 Determination period. This is due to the inclusion of efficiency savings from CxP of $13.6m against $12.1m of additional operating expenditure associated with BxP. Expenditure is $47.9m or 10.9% over the 2020 baseline year.

Table 5-20 IT expenditure summary by year 2021 to 2024

SYDNEY WATER PROPOSED OPERATING EXPENDITURE – IT DIGITAL					
($m 2020) year ending June	2021	**2022**	**2023**	**2024**	**Total 2021-24**
Baseline Forecast for 2020	109.4	109.4	109.4	109.4	**437.8**
SIR July submission	119.6	121.2	122.5	123.8	**487.2**
SIR November submission	117.0	123.4	122.3	122.0	**485.7**
Variance Forecast> 2020	7.6	14.0	12.9	12.6	**47.9**
Variance (%)	6.9%	12.7%	11.8%	12.3%	**10.9%**

Source: ***Sydney Water and Atkins analysis***



Source: Sydney Water and Atkins analysis

Figure 5-21 IT expenditure 2021 to 2024 compared with the 2020 baseline year forecast

The principal drivers for the increased expenditure are:

- Net operating cost of $8m per annum for the Data Centre relocation. The $32m increase is opex is partially offset by the $28m of future avoided capital costs. The need and efficient delivery model were discussed above in the 2016-20 commentary;
- ~$2m per annum for on-going support and maintenance of IoT infrastructure and devices and also for smart metering;
- $1m additional year on year expenditure from 2021/22 for digital connectivity from growth in number of digital devices.

Sydney Water is proposing total efficiencies from the digital program of $52.9m as shown below. This includes $22.9m for the impact of the BxP. A further $30m is proposed from other projects although it is difficult to relate these efficiency savings to specific IT projects.

Table 5-21 Digital operational efficiencies

SYDNEY WATER OPERATING EXPENDITURE - 2020 DIGITAL EFFICIENCIES					
$m 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	Total efficiencies in period
SPECIFIC INITIATIVES					
BxP	0.00	1.80	9.20	11.90	22.90
Other projects	5.00	5.00	10.00	10.00	30.00
TOTAL DIGITAL EFFICIENCIES					
Total digital efficiencies	5.00	6.80	19.20	21.90	52.90

Source: Sydney Water BxP Program and Operating Expenditure Presentations (September 2019)

5.6.13. Recycled water

Sydney Water provides recycled water facilities at Rosehill Camilla and St Mary's under S16a government direction. We comment in Section 5.4.10 on the plants and performance in the 2016 Determination period and why we consider both schemes not to be efficient over that time.

Expenditure proposals for the 2020 Period are shown in Table 5-22 below.

Table 5-22 Recycled water expenditure and outputs

[redacted]

Source: Sydney Water doc 239.1

For the 2020 Determination period, direct expenditure follows a flat profile similar to the previous determination period. For this period, corporate overheads have been applied to the recycling costs.

We compared unit operating costs, as $k/ Ml, and found that the Rosehill Camellia costs are three times greater than St Marys. The challenge for Sydney Water is to increase the output from St Marys to maximum output to provide full environmental benefits in terms of replacement flows.

We question whether the Rosehill Camellia costs should be included in operating expenditure funded by customers as it is clearly not efficient or delivering the benefits expected of the scheme, Sydney Water had not responded to the recommendation in the 2016 Determination Report[49]

> *We recommend that, in the light of the changes since the scheme was established, the ongoing economic case for the Rosehill (Camellia) recycled water scheme be reassessed.*

We understand that Sydney Water had not responded to this recommendation although commented to us that it had begun investigation options to improve the cost effectiveness of the scheme before the recommendation and provided supporting information to show that options had been reviewed. It commented that

[49] Review of prices for Sydney Water Corporation, IPART June 2016

> *We will continue to review options as new information becomes available, including the outcome of any government review of the infrastructure strategy of the Greater Parramatta and the Olympic Peninsula and any updates of the Government's Metropolitan Water Plan.*

There are clearly opportunities to be pursued in improving the water security in Sydney. The project continues to be inefficient and it is a matter for Sydney Water, IPART and government to resolve.

5.6.14. Water conservation and efficiency measures

We made detailed comments in Section 5.4.11 on the water conservation program in 2009 and 2010 which form the basis for the 2020 Determination period. The program includes leakage management and control.

Water efficiency communications

Sydney Water has proposed additional expenditure of $10m/a to cover water conservation advertising expenditure in a base year, whether or not water restrictions are in place. An additional $10m/a has also been included for water restrictions advertising as cost pass-through discussed in Section 8.3.

A disaggregation of these expenditures was provided which is shown in Table 5-23. Both base and cost pass-through expenditures include the same activities.

Table 5-23 Advertising expenditure

Category	Base operating expenditure ($m/a)	Combined Base and Cost pass-through expenditure ($m/a)
Agency spend	2.10	4.10
campaign production	1.65	2.70
Media	3.85	9.33
PR stunt and talent	0.40	0.65
Activations and events	0.50	0.77
Partnership/ engagement	0.39	0.50
Owned asset branding	0.23	0.37
Engaging with youth	0.50	0.68
Product and services	0.13	0.26
Research testing and tracking	0.10	0.25
Miscellaneous	0.15	0.39
	10.00	20.00

Source: Sydney Water doc 407.1

Sydney Water also provided details of its advertising budget for year 2020. This indicates actual expenditure in Q1 of about $6m and a full year budget of $20m. We accept this total level of expenditure is necessary during periods of water stress. However, we question whether the split between base and cost pass-through is appropriate. For example, if reservoir storage is greater than 70% is there a need for the $10m/a proposed. We suggest reprofiling with a $5m/a base expenditure plus a $15m/a during periods of water restrictions.

We suggest that there is monitoring of the success of these activities, using the measure of percentage reduction which Sydney Water uses. This could be reported quarterly on the Sydney Water website. We provide more detail on our recommended form of monitoring and reporting in Section 8.5.9.

Water use data and analytics

Sydney Water is proposing an additional $4m/a for water use data and analytics. This is to cover customer behaviour studies, use of smart meters and greater coverage of flow and pressure monitoring. We agree that these additional activities form an important support to collect and analyse customer and network data.

Infrastructure resilience investigations
Sydney Water has proposed as additional $2m/a for this work. We have not seen any information to support this level of expenditure. Our view is that this activity should be part of business as usual and not an addition to base expenditure.

Water conservation
Sydney Water is proposing a base program of $10m/a assuming no water restrictions. There are further contingent water conservation programmes related to the level of water use restrictions. We comment on the base program in this section and the contingent programs in Section 8.3.

We formed the view that the base water conservation plan includes appropriate activities to target losses on residential customers subject to meeting the efficiency methodology and the comments below. The activities, costs and savings to date provide a good basis for forecasts.

We found that there are uncertainties in the costs and benefits including

- the scaling up of these activities, which are dependent on customer response, may lead to reduced water saving benefits over time. This would increase the unit cost of savings;
- the assumptions for the level of business activity, costs and savings has yet to be justified. We agree that potential savings in this sector should be tested through pilot studies and a phased expenditure from $1m/a to $2m/a would be appropriate;
- greater certainty in water saving benefits are likely to be gained through further leakage reduction where the company has greater control of activities, costs and benefits.

The balance of water conservation should be reviewed. We propose to make any adjustments to the residential water conservation program although the balance of activities should be revisited. The business to business program benefits are overstated and we propose a lower level of expenditure. There should be greater expenditure on leakage reduction (see section below) where Sydney Water has greater control over the costs and benefits.

Leakage Management
We commented in Section 5.4.12 on the approach to leakage management. The economic level of leakage is derived from a methodology agreed between Sydney Water and IPART; this is part of the water conservation measures within the 2019 Operating Licence. The ELL calculation is sensitive to the value of water assumed. This is based on the current aggregate storage level in the impounding reservoirs. A short run approach is taken.

Our view, given the current water resources situation, is that a long run methodology should be applied which assumes a value of water based on the cost of the next resource development and takes into account the cost of drought measures. This is a common approach applied by many large water utilities who need to develop further resources for drought or to meet long term resource development. Applying this methodology is likely to reduce the ELL.

5.7. Prudent and Efficient Expenditure in the 2020 determination period

5.7.1. Scope for efficiency savings

We set out our approach to assessing the scope for efficiency savings in Section 1.4. We take account of performance against the Operating Licence requirements, the EPA licence criteria and customer service measures. The data presented shows that Sydney Water has performed well against some of these measures although there are adverse trends in performance on dry weather overflows and unplanned interruptions. The impact of current drought conditions has a deleterious impact on some measures such as bursts and leakage, unplanned interruptions and dry weather overflows.

We have looked at the balance of risk between customers and Sydney Water as this is important in defining work activities, assumptions and efficiency adjustments. We have identified some areas where risks are not shared equitably with customers. We have also identified where the assumption of average weather conditions has not been applied. In these areas, both operating and capital expenditure, we have made adjustments as a surrogate for the impact of incentives.

Our analysis of the information provided by Sydney Water at meetings and through subsequent questions and documentation has identified several areas where we believe there is scope for making efficiencies across the business. We discuss these areas below.

We also take note of the efficiencies achieved through the current determination period and continuing through to the 2020 Determination period. The following summarises the changes in scope we propose to adjust for imprudent or unjustified levels of expenditure. In its comments on the Draft Report in January 2020, of the ten adjustments we have proposed:

- Sydney Water has accepted three – water conservation advertising, infrastructure resilience; and City Planning (with a proviso);
- We have accepted the Sydney Water adjustments for three – Cascade system, BOOT plant volume and water quality;
- We have adjusted the scope reduction for three – Prospect -Macarthur pipeline, water reactive and wastewater reactive; and
- We have made no change to two scope reductions – Electricity

Drought resilience projects
We have reviewed the operating expenditure proposals for the Prospect to Macarthur pipeline project. We found these expenditures are overstated because the method used to estimate these components is not appropriate. We have based our level of efficient expenditure on the actual costs incurred by Sydney Water across its whole network to derive incremental costs.

Service Delivery – Water maintenance
Sydney Water proposes additional water maintenance expenditure to repair leaks and return leakage to the mean ELL. We confirm that this reactive leakage activity is required to return leakage to its mean economic level as soon as practical. Sydney Water was not able to respond to increasing leakage because it did not have the flow monitoring and leakage detection systems that most other frontier companies normally use. This results in delays in locating leakage at an early stage. Leaks were mainly reported when water had reached the surface. This has resulted in total leakage being well above the economic level. Customers are asked to pay for both water lost from the system and the cost of repairs. We conclude that the additional expenditure is required to return leakage to its mean economic level. However, the cost of water lost from the system above the ELL reflects inefficiency in operation which should not be included within the allowable expenditure.

Service Delivery - Wastewater maintenance
Sydney Water proposes increased expenditure to address sewer chokes arising in part by the impact of drought conditions. Our view is that this work needs to be done to meet expectations of customers, the EPA and licence requirements. However, we question whether some of the reactive expenditure could have been avoided by more effective asset management and a greater activity in for example in proactive CCTV work during the 2016 Determination period. In addition, reports of effective responses to incidents and clear-up may well be matters of more effective working, monitoring and timely clean-up. Customers should only be expected to fund efficient activities. With the Customer Hub now in place we would expect the process to be more effective.

BOOT Water treatment

BOOT treatment costs are driven by volume and water quality. In an average year assumption, with reservoir storage above 60% the desalination plant would not be operating and all bulk supplies would be derived from WaterNSW with the filtration plants with high throughput and water quality would be expected to be good. There are small changes to the assumed volumes which we have based on our demand forecast discussed in Section 4. This results in a small reduction in treatment costs.

With lower reservoir storage, below 60%, we assume that the SDP plant would be operating and the extension may operate later in the period. Treatment for the BOOT plants would be reduced. The lower loading rates on the filters would allow them to operate with deteriorating water quality, turbidity and colour, but within the water treatment agreement. This scenario has not been included in the base operating expenditure but is discussed with the cost pass-through proposals in Section 8.3.

[redacted]

We found this to be a risk averse approach and results in significant increases in treatment works costs in an average year scenario which are likely to be overstated. We have accepted Sydney Water's revised proposals to share any increasing cost risk between it and customers.

[redacted]

Electricity
Sydney Water has an energy efficiency program which is forecast to deliver 13 GWh additional savings over the 2020 Determination period, equivalent to 0.75% per year. In addition, energy from renewables is forecast to contribute to 20% of total demand. While good progress has been made to manage grid energy within the 1998 level, further use of renewables should be explored. We suggest a stretched renewables target of 2% of grid supplies by the end of the 2020 Determination period should be set. This should help to offset potential increases in grid supplied after 2024.

City Planning
Additional expenditure was included from 2020 to support the Department of Planning, Infrastructure and environment to provide strategic management and planning support for the Western Parkway City including the South Creek and airport. We had questioned whether elements of this expenditure, particularly related to stormwater drainage, should be funded by water and wastewater customers. As this input is for a specific requirement which might morph into a separate planning authority, we question whether this expenditure would continue through the whole of the 2020 Determination period. We have assumed that the $8m/a proposed would continue through to the end of 2022.

Water conservation - communications and advertising
Sydney Water is proposing $20m/a for communications and advertising. While the total expenditure is explained and activities are appropriate, we question the allocation between the base position, when there are no water restrictions and when these are introduced. We suggest that in the base case, with storage greater than 60%, communications and advertising costs should be $5m/a increasing to $20m/a when water restrictions are in place. The cost pass-through element would be $15m/a included in Section 8.5. Sydney Water has accepted this adjustment although suggested the trigger be 65% or 70%. We propose that this trigger be consistent with IPART's assumption on base and drought pricing scenarios.

Infrastructure resilience
There was no information provided to support the infrastructure resilience investigation proposals. We consider this activity to be business as usual and have adjusted the proposed expenditure. Sydney Water has accepted this adjustment.

Digital

Our review of the Digital projects in Section 6 identified significant operating expenditure efficiencies from the BxP and other projects. We have assumed that these efficiencies are included in Sydney Water's efficiency proposals although it is not entirely clear where these are.

5.7.2. Catchup efficiency

The first element of operating efficiency is the catch-up from an agency's current position to that of the frontier utility or benchmark utility. We compared the performance of Sydney Water using two independent approaches. The benchmarking is primarily to compare Sydney Water with its peer group in Australia and the UK and not used in a deterministic manner to derive expenditure recommendations.

Benchmarking with other Australian water companies

We used the NPR data for 2017/18, inflated to 2019/20 to compare Sydney Water with other large utilities and all utilities in Australia. The results are shown in Section 5.3.4. The analysis showed that Sydney Water's water and sewerage operating expenditure appears to be above average for the sector, with performance on the 82nd percentile on its 2020 data in relation to other large water utilities in Australia when compared in terms of operating expenditure per property.

Benchmarking with similar-sized water utilities in England and Wales

Ofwat is currently undertaking a price review (PR19) of the water companies in England and Wales. One element is a cost assessment using econometric models. The botex costs derived are a combination of operating and asset renewal expenditure. The methodology is set out in a report[50] which details the econometric models used for wholesale water and sewerage services. The analysis for the water service triangulates the results from five models combining water resources, treatment and distribution to derive a bottom-up and top-down base costs. A simple average of these costs is used. A similar analysis is carried out for the sewerage (wastewater) service triangulates from eight models covering sewage collection, treatment and bioresources.

We input the Sydney Water operating and replacement expenditure into the models to compare with an efficient expenditure derived from the modelling. While the analysis is sensitive to assumptions on exchange rates it provides an indicative comparison of Sydney Water against frontier companies. The results showed that Sydney Water's wastewater service is within 4% of the modelled costs although sensitive to the corporate cost allocation. The water service costs are significantly greater than the modelled costs. Sydney Water's resources costs are significantly greater than UK companies. The England and Wales companies tend to have different resource characteristics and size with low resources costs and invest in multi-barrier treatment processes rather than the single barrier treatment applied by Sydney Water.

From the results of our high-level benchmarking analysis with water utilities in England and Wales, the extent of catch-up efficiency is similar to the efficiency proposals included in the submission. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings but we have assumed that all is attributable to catch-up efficiency as much of this is productive efficiency.

5.7.3. Continuing efficiency

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 continuing efficiencies being gained across all major sectors through process innovation and new systems and technologies that all well performing businesses should achieve.

[50] Cost assessment for PR19: Our econometric models, Ofwat January 2019

A review conducted by the Organisation of Economic Cooperation and Development (OECD) in 2015[51] 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.

Analysis of the Productivity Commission Multi-Factor Productivity (MFP) data by IPART suggest that a sustained average annual MFP improvement[52] of between 0.6% and 0.8% is achievable in Australia. These results include performance from 1975-76 to 2017-18. They reflect economy-wide performance:[53] all industry sectors and all firms in each sector—not just frontier firms. In that sense, this range is conservative. Recognising this conservatism, we recommend the top end of that range: 0.8% per annum be adopted.

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[54] to undertake an assessment of 'Frontier Shift'; that is the scale of frontier shift that can be expected to achieve over the five-year determination period. The consultants use a Total Factor Productivity (TFP) approach including a technical change component, a scale component and an allocative efficiency component. A recommended frontier shift ranges is derived for botex, that is the combination of wholesale operating and asset replacement expenditure, of 0.6% to 1.4% per annum.

In its final determination in December 2019, Ofwat updated its assessment of Frontier Shift including the updated European Economics report and other reports to propose a level of Frontier Shift in its efficiency report forming part of its final determination[55]. In this document it comments on the responses it received from the UK water sector. It allocated a 1.1%/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, that a Frontier Efficiency of 0.8% per annum should be applied to proposed expenditure, applied to all base costs.

We compared the additional efficiencies proposed by Sydney Water in its Updated submission. Sydney Water proposed an increasing efficiency from 0.5% in 2021 to 1.5% in 2024 applied cumulatively. We found that there was little difference in the level of efficiency derived. Sydney Water proposed $87,0m (taking account our scope adjustments) in Frontier Shift over the 2020 determination period compared with $82.0m from our analysis. For consistency between operating and capital expenditure, and other efficiency reviews, we have applied our 0.8%/a continuing efficiency across all expenditure. There may be a combination of catch-up and Frontier Shift (continuing) efficiencies in these savings but we have assumed that all is attributable to continuing efficiency as much of this is dynamic efficiency.

5.7.4. Efficient level of operating expenditure

We present in Table 5-24 our proposals for an efficient level of operating expenditure for the 2020 Determination period from 2021 to 2024. The table includes the adjustments for the timing and scope of activities discussed in Section 5.6.1 above. A continuing efficiency is applied.

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[51] Frontier firms, technology diffusion and public policy: micro evidence from OECD countries, OECD Productivity Working Papers No. 02, November 2015.

[52] We consider that MFP is a more useful productivity indicator than labour productivity for a public water utility, which must make substantial capital investments efficiently.

[53] While productivity estimates are available for the combined energy and water utility sector, we prefer to examine productivity changes across the entire Australian economy. The productivity of the energy sector has been impacted by market restructuring, overinvestment in networks and policy uncertainty for the past twelve years.

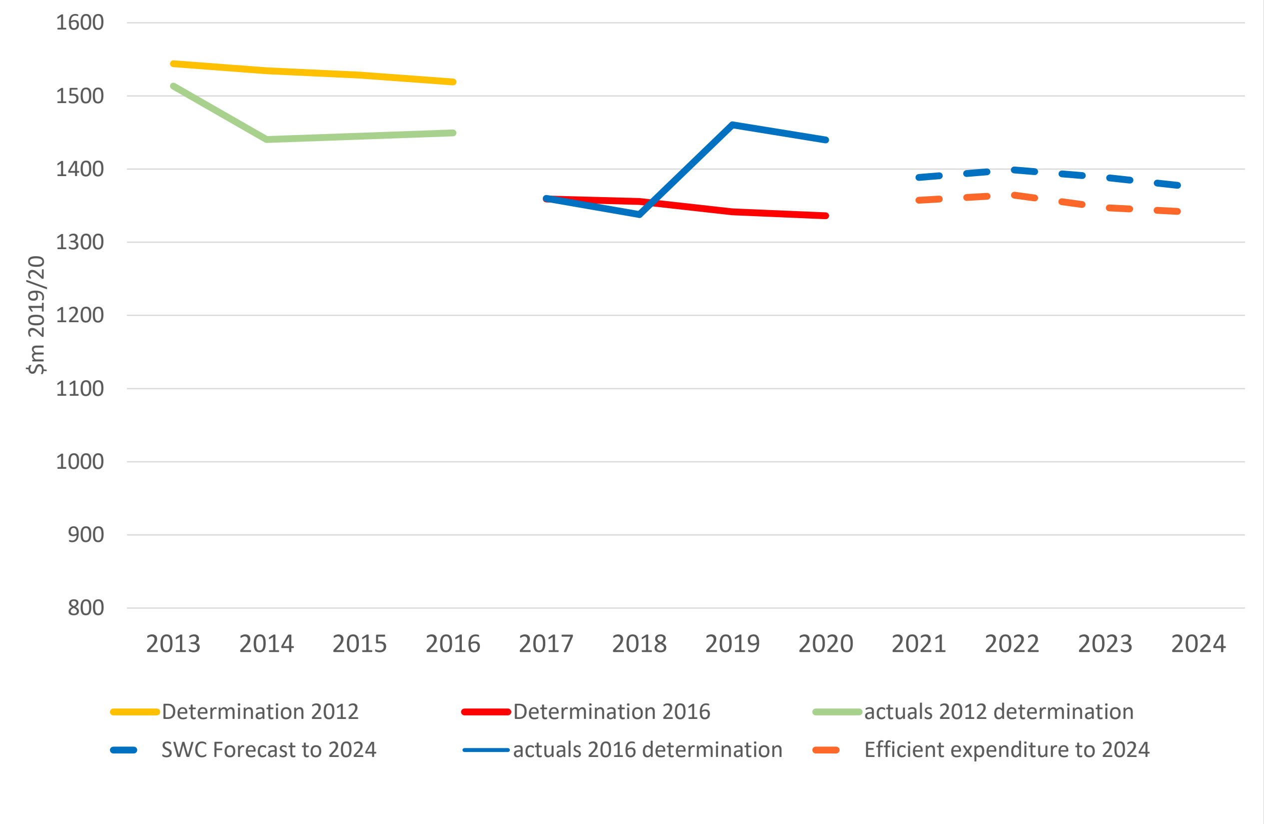
[54] Real Price Effects and Frontier Shift, Europe Economics January 2018

[55] PR19 Final Determination -Securing cost efficiency technical appendix, OFWAT December 2019

Table 5-24 Efficient operating expenditure in the 2020 Determination period

SYDNEY WATER TOTAL OPERATING EXPENDITURE					
($m 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**Total 2021 to 2024**
Water	393.2	409.4	410.5	410.1	1623.2
Water BOOT	101.0	101.7	101.8	102.4	407.0
Wastewater	482.1	483.2	476.4	474.1	1915.7
Stormwater	14.5	14.8	15.0	15.2	59.5
Recycled Water	33.0	32.9	32.1	32.3	130.2
TOTAL CORE OPERATING EXPENDITURE (including base efficiencies)					
Total including base efficiencies	1023.8	1042.0	1035.8	1034.1	4135.6
Base efficiencies by Sydney Water	20.0	18.2	31.5	34.8	104.5
Total excluding Sydney Water efficiencies	1043.8	1060.2	1067.3	1068.9	4240.1
ATKINS SCOPE ADJUSTMENTS					
Prospect Macarthur pipeline	0.00	-4.60	-7.60	-7.60	-19.80
Cascade supply upgrade	0.00	0.00	0.00	0.00	0.00
Water reactive - inefficient leakage expenditure	-10.00	-10.00	-10.00	-10.00	-40.00
Wastewater reactive/ environmental program	-7.50	-7.50	-7.50	-7.50	-30.00
BOOT water treatment - volume	-0.24	-0.27	-0.29	-0.31	-1.11
BOOT water treatment - treatment	-3.30	-3.30	0.00	0.00	-6.60
Electricity	0.00	-0.52	-1.86	-1.86	-4.24
City Planning	0.00	0.00	-8.00	-8.00	-16.00
Water conservation (to cost pass through)	-5.00	-5.00	-5.00	-5.00	-20.00
Infrastructure resilience (to bau)	-2.00	-2.00	-2.00	-2.00	-8.00
Total change in scope	-28.04	-33.19	-42.25	-42.27	-145.75
ATKINS EFFICIENCY ADJUSTMENTS					
Catchup efficiency	0.00	0.00	0.00	0.00	0.00
Continuing efficiency - Frontier Shift	-8.13	-16.43	-24.60	-32.85	-82.01
Total efficiency adjustments	-8.13	-16.43	-24.60	-32.85	-82.01
ATKINS TOTAL ADJUSTMENTS					
Total adjustments	-36.17	-49.62	-66.85	-75.12	-227.76
SYDNEY WATER PROPOSED EFFICIENCY CHALLENGE					
Business-wide efficiency gain	5.08	15.40	25.63	41.07	87.18
EFFICIENT BASE OPERATING EXPENDITURE					
Water	373.08	381.05	375.25	371.57	1500.95
Water BOOT	96.70	96.57	99.09	98.85	391.20
Wastewater	470.76	467.81	448.63	442.58	1829.78
Stormwater	14.35	14.59	14.64	14.76	58.35
Recycled Water	32.70	32.34	31.33	31.23	127.60
Total base opex	987.60	992.35	968.94	959.00	3907.88
BULK WATER					
WNSW Bulk supply	189.18	193.73	199.58	202.78	785.27
SDP	180.62	178.81	178.81	178.81	717.05
TOTAL RECOMMENDED EFFICIENT EXPENDITURE					
Total	1357.40	1364.89	1347.33	1340.59	5410.21

The impact of the adjustments for efficient expenditure is shown below.



Source: Atkins analysis

Figure 5-22 Efficient operating expenditure compared with forecast

6. Capital expenditure

6.1. Summary

During the current determination period, 2016-2020, Sydney Water has delivered a significantly larger capital expenditure program relative to the 2013-2016 Determination period. In the previous period from 2013-2016, Sydney Water spent an average of nearly $764m per annum (19/20 prices).

Sydney Water had a regulated capital expenditure allowance of $2.695 billion ($2019–20) for the 2016–20 Determination period. By 2020, according to its November 2019 submission, Sydney Water expected to have invested $3.250 billion, around $555 million (c.20%) more than the IPART determination. The overspend has been attributed to significant expenditure on additional growth that was not included within the 2015 submission, and in particular for wastewater services.

In November 2019, Sydney Water submitted an updated SIR which made a number of changes affecting the anticipated capex in the 2016-20 period including:

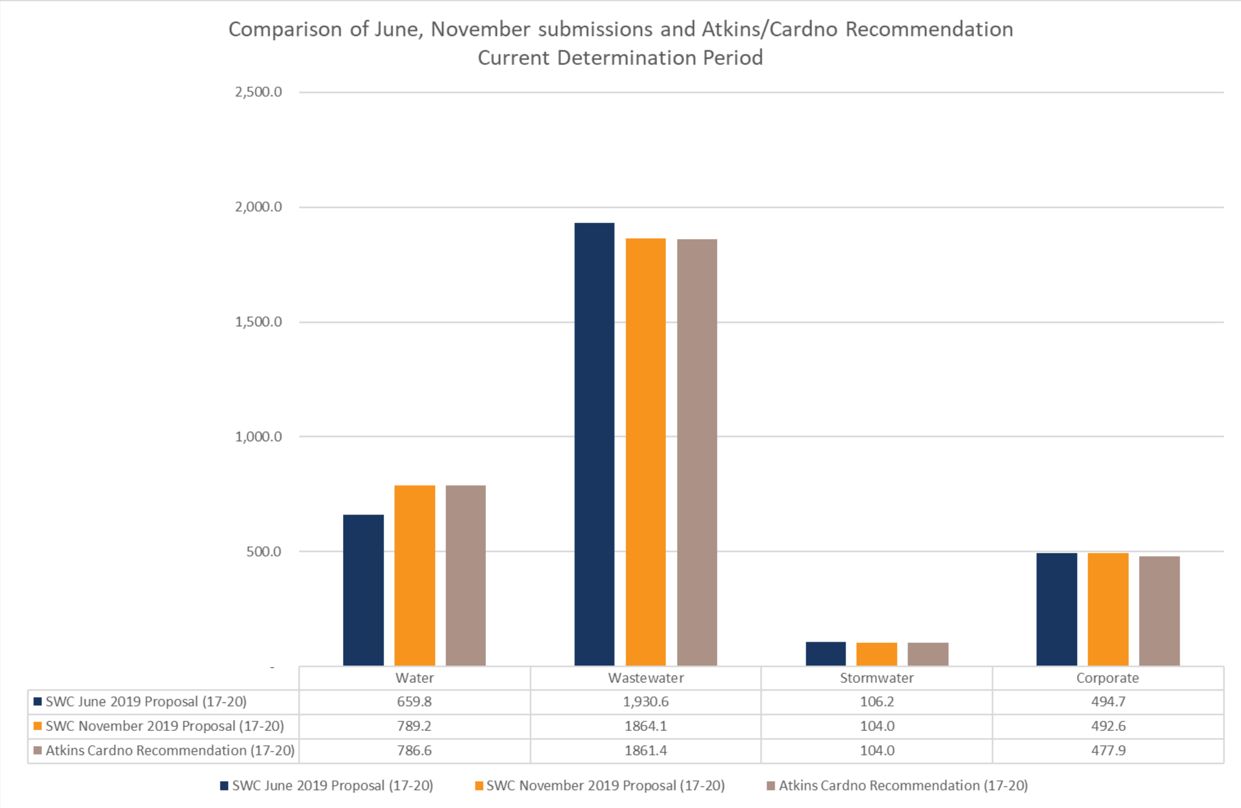
- Addition of a number of drought response schemes (discussed in Section 8):
  - Prospect to Macarthur Link ($76.7M in 2020)
  - Blue Mountains Cascade Supply ($4.7M in 2020)

- Changes and rephasing of Digital Portfolio capex program, resulting in $12.6M increase in anticipated expenditure in 2020.

- Correction of the coding of $63.0M for 'South West Priority Growth Area (SWPGA) - SW Front Servicing' which was previously wrongly classified as a wastewater rather than water project.

All other elements remain unchanged. The recommended prudent and efficient expenditure is based on the November 2019 submission. Other tables and figures below are based on the November 2019 submission unless otherwise indicated.

The capex in the June and November submissions are summarised against our recommendations below.



	Water	Wastewater	Stormwater	Corporate
SWC June 2019 Proposal (17-20)	659.8	1,930.6	106.2	494.7
SWC November 2019 Proposal (17-20)	789.2	1864.1	104.0	492.6
Atkins Cardno Recommendation (17-20)	786.6	1861.4	104.0	477.9

Source: Sydney Water SIR Capex 2 June and November 2019/ Atkins analysis

Figure 6-1 Comparison of June and November 2019 submissions and our recommendation

6.1.1. 2020 Determination Period

In the current determination period (2016-2020 inclusive) capital expenditure is $797m per annum. In its November 2019 submission, Sydney Water proposed to further increase this by 59% to $1,252m per annum for the 2020-2024 period.

Sydney Water's capital expenditure program for the forward period is generally based on bottom up evaluation of needs as documented in planning documents or analysis specific to the particular asset class and is documented in a series of 'Program Business Cases'. The total level of capital investment proposed through the bottom-up summation of Program Business Cases was $6,196 million as at June 2019 for the five year period from 2020 to 2025 (for infrastructure only, i.e. excluding information technology). Sydney Water then subjected this bottom-up program to top-down adjustments, efficiency challenges and rephasing.

In November 2019, Sydney Water submitted an updated SIR which made a number of changes affecting the anticipated capex in the 2020 Determination period including:

- Addition of a number of drought response schemes (discussed in Section 8):
  - Prospect to Macarthur Link ($484.2M in 2020-24)
  - Blue Mountains Cascade Supply ($41.1M in 2020-24)
- Rephasing of Critical Sewers, bringing expenditure forward but not affecting the overall proposed capex in 2020-24. The discussion of this expenditure below reflects these updated projections.
- Increase of $52.2M in proposed Wet Weather Overflow Abatement (WWOA) expenditure. The proposed increase in expenditure is discussed further below.
- Changes and rephasing of Digital Portfolio capex program resulting in a capex reduction of $26.9M in 2020-24. The discussion of this expenditure below reflects these updated projections.

All other elements remain unchanged. The recommended prudent and efficient expenditure is based on the November 2019 submission. Other tables and figures below are based on the June 2019 submission unless otherwise indicated.

We consider that Sydney Water's approach to program development in applying adjustments and efficiency challenges top-down demonstrates increased maturity and willingness to respond to its regulatory environment. However, we have noted significant variances between the approach Sydney Water has taken to apply efficiency challenges consistently across all major programs. While most programs are clustered around the average level of efficiency of 18% with little or no change between the initial and final levels of efficiency applied, two groups comprising four programs stand out which we interpret in terms of Sydney Water's appetite for taking on risk in realising efficiencies in the forward period as follows:

- Risk seeking – for the waterway health and wastewater treatment plants program, Sydney Water has applied both a high level of efficiencies (40% and 34% respectively) and increased these by 10-20% in its final review
- Risk averse – for the critical sewers and wet weather overflow programs, Sydney Water has reduced level of applied efficiency that were initially in line with the other programs (17% and 27% respectively) to zero.

On this basis we recommend two specific catch-up efficiency adjustments for critical sewers and wet weather overflow programs, to reach the average 18% level that Sydney Water have applied themselves for the remainder of their asset renewals programs.

For existing mandatory standards, we have also noted a number of instances where improved evidence between asset condition and performance levels would better help to justify or strengthen the proposed expenditure requirements, for example reservoir and WWTP renewals. We have recommended some specific prudency adjustments on this basis. We have also suggested increasing expenditure in some areas where we considered expenditure is required to maintain service levels most notably wastewater pumping station renewals.

For capital expenditure linked to growth we have noted that new property numbers are expected to be very similar to the current Determination period, as such we consider it reasonable that general water and wastewater growth expenditure should be at a similar average level for both services.

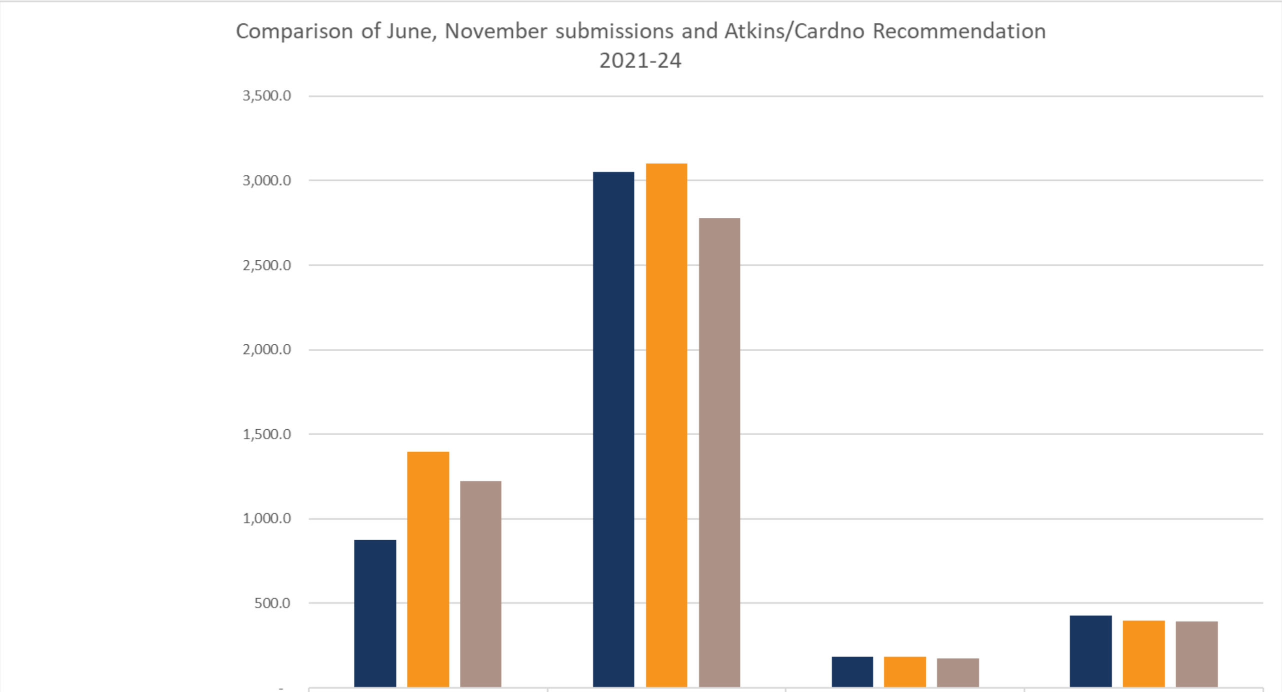
For corporate capex, we believe that there is good justification where Sydney Water is an outlier over the current and future determination periods for the IT component and that it does not suggest an underlying inefficiency. However, we do not have full confidence in the IT capex forecast for 2021-24 determination period and that there is a risk that this could lead to a significant increase in the outturn capital expenditure beyond the $348m forecast in the IPART submission.

We conclude that the level of efficient capital expenditure is as presented in Table 6-1 and Figure 6-2 below.

Table 6-1 Efficient level of capital expenditure future determination period

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - TOTAL PROGRAM							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Water	632.1	261.3	293.3	212.6	176.5	1399.3	1575.8
Wastewater	721.5	766.2	791.2	824.3	698.8	3103.1	3801.9
Stormwater	40.1	53.7	43.3	48.0	29.0	185.2	214.2
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1532.7	1200.9	1204.7	1148.9	959.5	5087.2	6046.7
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Water	426.2	420.4	207.6	190.2	163.7	1244.4	1408.1
Wastewater	727.3	709.5	716.1	684.1	805.2	2837.0	3642.2
Stormwater	41.7	49.6	40.3	44.2	40.8	175.9	216.6
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1334.1	1299.3	1040.9	982.6	1064.9	4656.9	5721.7
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-10.7	-20.8	-25.0	-31.4	-42.6	-87.9	-130.5
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Water	422.8	413.7	202.6	184.1	157.1	1223.2	1380.3
Wastewater	721.4	698.2	698.9	662.2	773.0	2780.7	3553.8
Stormwater	41.4	48.8	39.4	42.8	39.1	172.4	211.5
Corporate	137.8	117.9	75.0	62.0	53.0	392.7	445.7
Total Efficient Expenditure	1323.4	1278.5	1015.9	951.1	1022.3	4569.0	5591.3

Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis



	Water	Wastewater	Stormwater	Corporate
SWC June 2019 Proposal (21-24)	874.0	3,051.0	185.2	426.6
SWC November 2019 Proposal (21-24)	1399.3	3103.1	185.2	399.6
Atkins Cardno Recommendation (21-24)	1223.2	2780.7	172.4	392.7

Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-2 Comparison of June and November 2019 submissions and our recommendation

6.2. Methodology

This section presents the results of our review of the efficiency and prudency of Sydney Water's capital expenditure. We identify below the major investment drivers and explain the variances in the current determination period expenditure against the 2016 Determination period. We comment on the efficiency and prudency of capital expenditure in the current determination period and our view of future efficiency.

The methodology for the review of capital expenditure has focused on gaining an understanding of Sydney Water's external and internal environment as well as reviews of large projects and programs. Our views are guided by the evaluation of asset management and capital investment processes through interviews and Sydney Water presentations, which we discussed in Section 3 of this report. We have commented on the main asset management systems and processes used to budget, track, monitor and report capital expenditure.

We then make an assessment of an efficient level of expenditure for the determination period 2020 to 2024. We discuss the cost drivers and efficient cost level recommendations for each of the capital drivers (Existing Mandatory Standards, New Mandatory Standards, Growth, Government Programs and Business Efficiency) and the specific activities contained therein. For the avoidance of doubt our recommendations on efficient expenditure are based on a total envelope of expenditure we are not 'approving' any particular projects.

We have selected a representative sample of capital projects from the 2016 Determination period and proposed for 2020 to 2024 to gain an understanding of the efficiency and prudence of the investment.

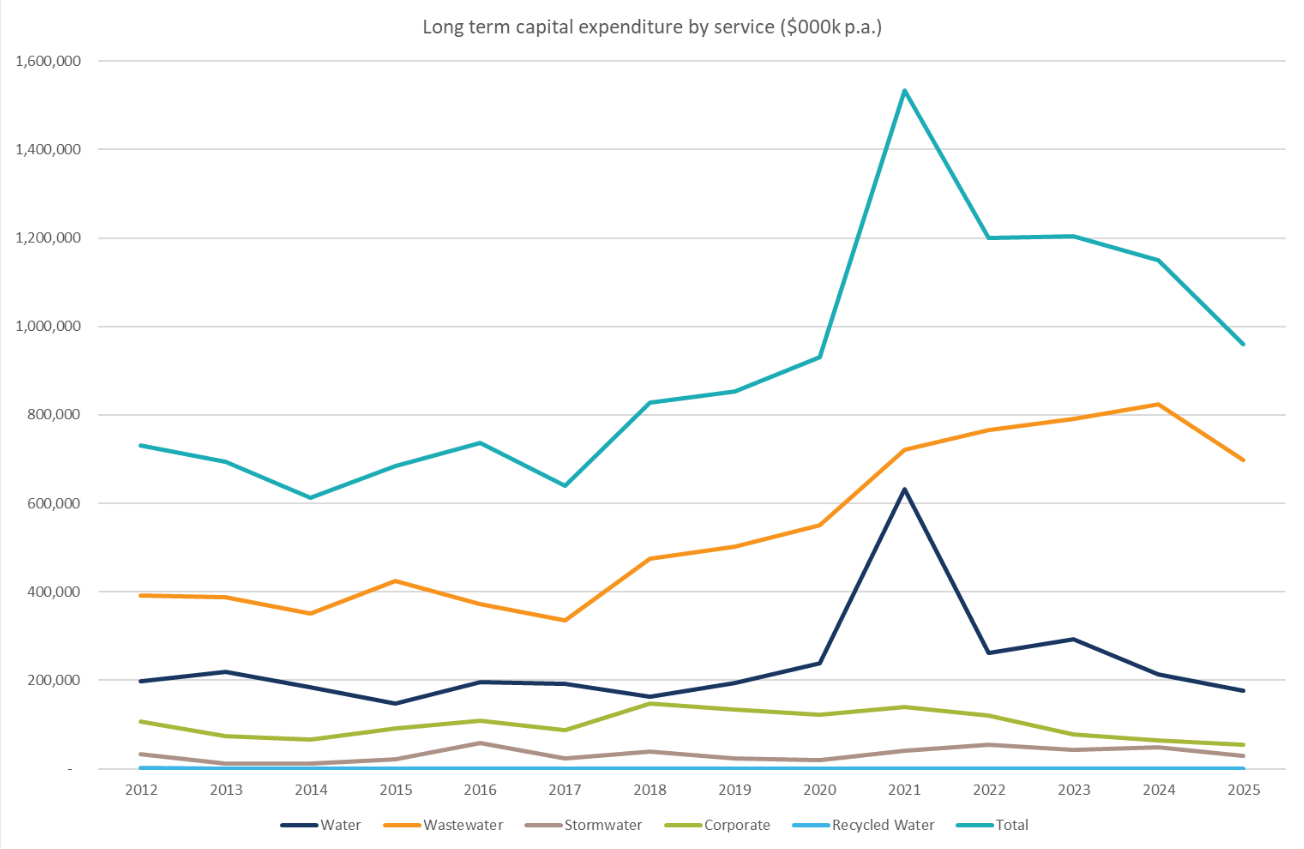
We present our analysis of the future expenditure proposals and comment on each driver on the potential for efficiencies through the robustness of cost estimates, the impact on operating expenditure, the need and timing of expenditure, approach to procurement and the impact of internal challenge and budget control.

Our views on future capital expenditure efficiencies are based on the hypothesis of a Frontier Company, the continuing efficiencies that a Frontier Company makes through innovation and technological development and the catch-up efficiency required of Sydney Water to achieve the performance of a Frontier Company over time. Our methodology is set out in Section 1.4.

6.3. Overview

During the current determination period, 2017-2020, Sydney Water has delivered a significantly larger capital expenditure program relative to the 2013-2016 Determination period. In the previous period from 2013-2016, Sydney Water spent an average of nearly $764m per annum (19/20 prices).

In the current determination period (2016-2020 inclusive) capital expenditure is $797m per annum. In its November 2019 submission, Sydney Water proposed to further increase this by 59% to $1,252m per annum for the 2020-2024 period



Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

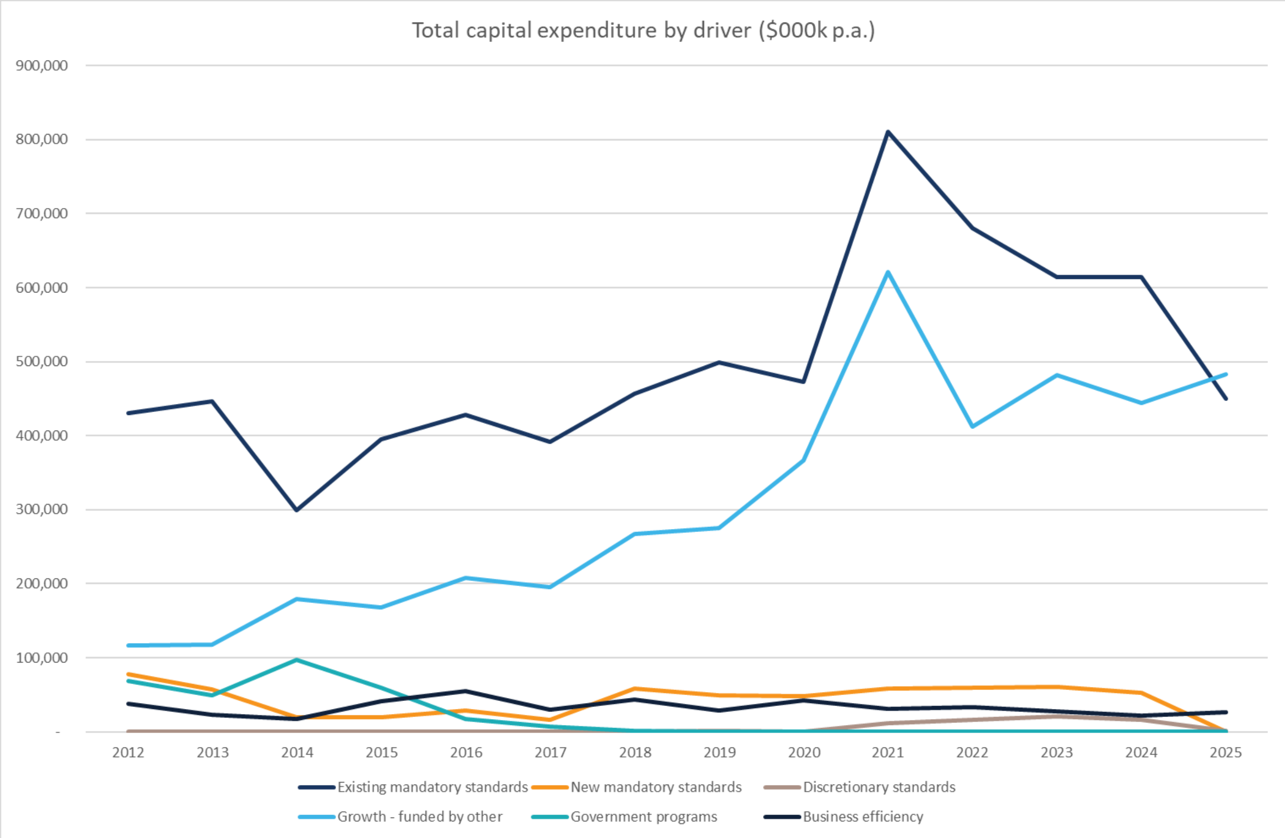
Figure 6-3 Sydney Water long term capex by service

Figure 6-3 shows that total capital expenditure is proposed to increase significantly in the future determination period with most of this being driven by expenditure in wastewater services. Water, Stormwater and Corporate capex maintain relatively constant expenditure levels from year to year.

We have noted that there are a greater number of significant (>$10m) projects over the future determination period that in the current determination period have been treated as separate line items, as opposed to being rolled up in wider programmes, when compared to Sydney Water's submissions to IPART in 2015 and 2011.

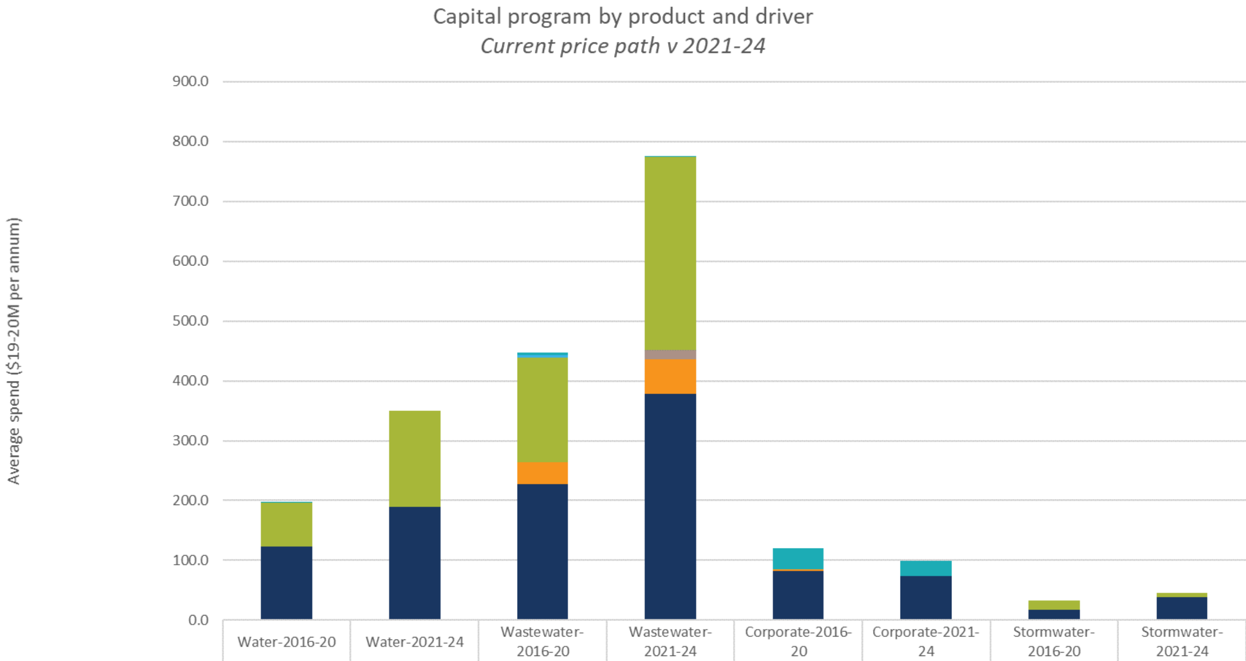
Figure 6-4 below sets out the trends in expenditure by driver, the most significant drivers of Sydney Water's proposed increased capital expenditure are Existing Mandatory Standards and Growth funded by other. Sydney Water are proposing relatively comparable expenditure for Business Efficiency; New Mandatory Standards and Government Programs with an increase in Discretionary Standards proposed being driven by one project in particular (the Vaucluse Diamond Bay outfall diversion).

Figure 6-5 below shows the breakdown of the capital program by driver and product and shows the key differences in expenditure between the current and the next determination periods.



Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-4 Sydney Water long term capex by driver



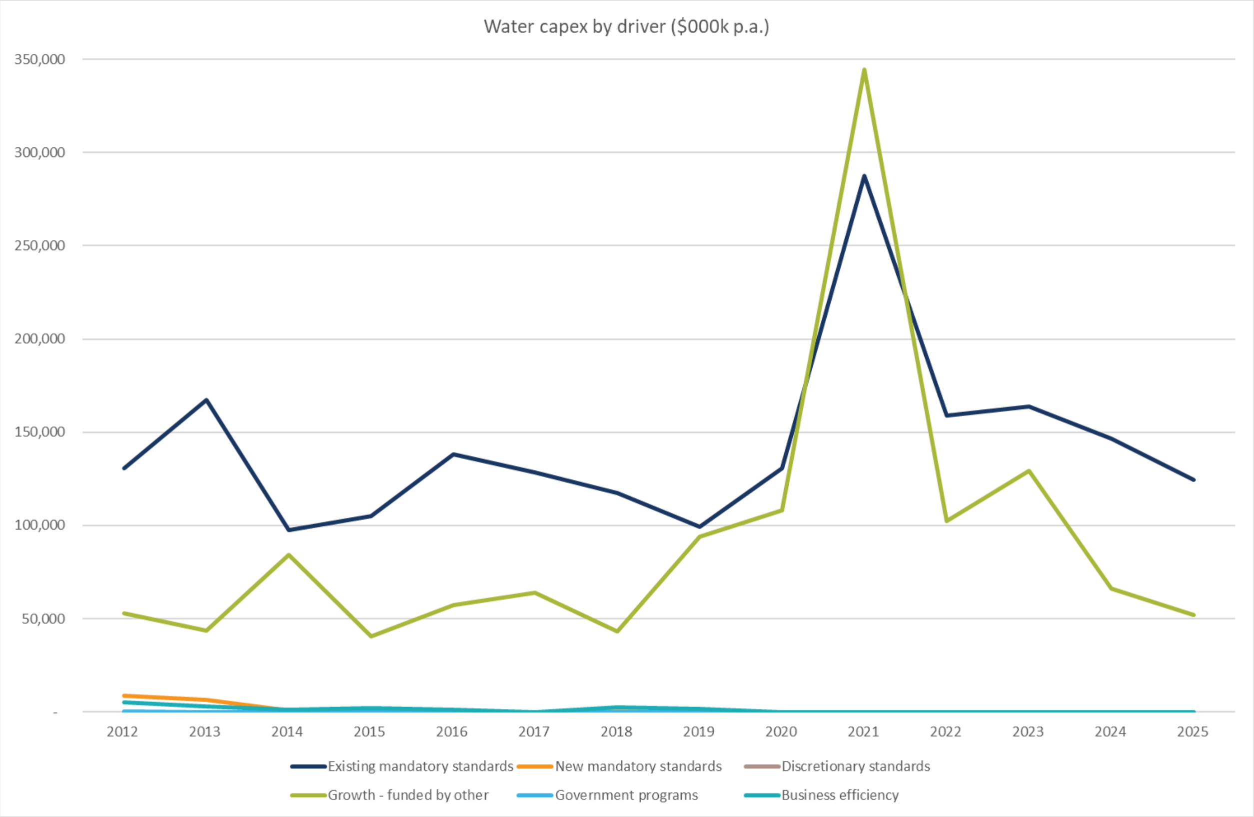
	Water-2016-20	Water-2021-24	Wastewater-2016-20	Wastewater-2021-24	Corporate-2016-20	Corporate-2021-24	Stormwater-2016-20	Stormwater-2021-24
Business efficiency	1.0	0.0	4.0	1.9	35.2	26.4	0.0	0.0
Government programs	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	73.2	160.7	174.4	321.7	0.0	0.0	14.9	7.7
Discretionary standards	0.0	0.0	0.3	15.9	0.0	0.0	0.0	0.0
New mandatory standards	0.0	0.0	37.3	57.9	2.7	0.0	0.0	0.0
Existing mandatory standards	122.8	189.2	227.1	378.4	82.4	73.5	17.4	38.6

Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-5 Breakdown of capital program by driver and service

6.4. Water service

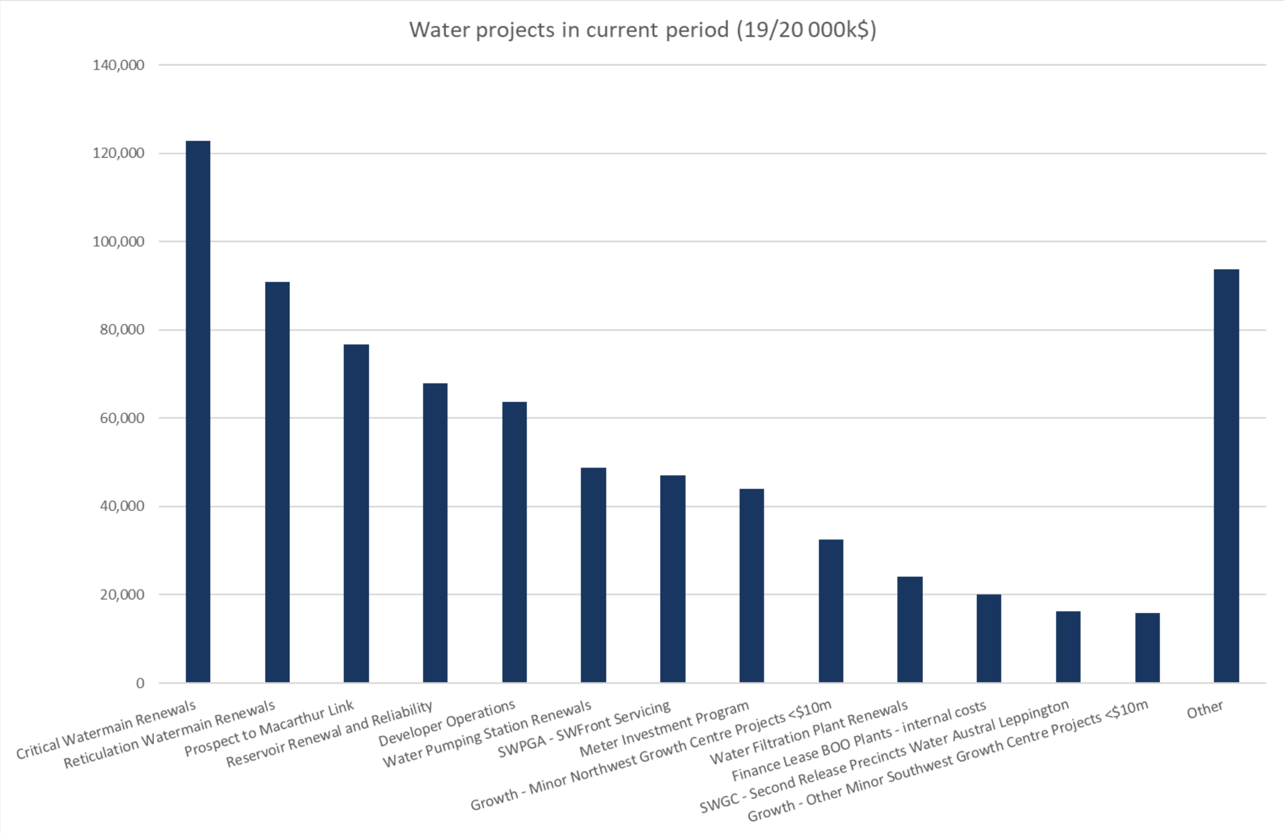
Water capital expenditure is projected to increase by 82% (+$152.5m average per annum) compared to the average spend in the current determination period. Expenditure trends are shown in Figure 6-6.



Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-6 Water service capex by driver

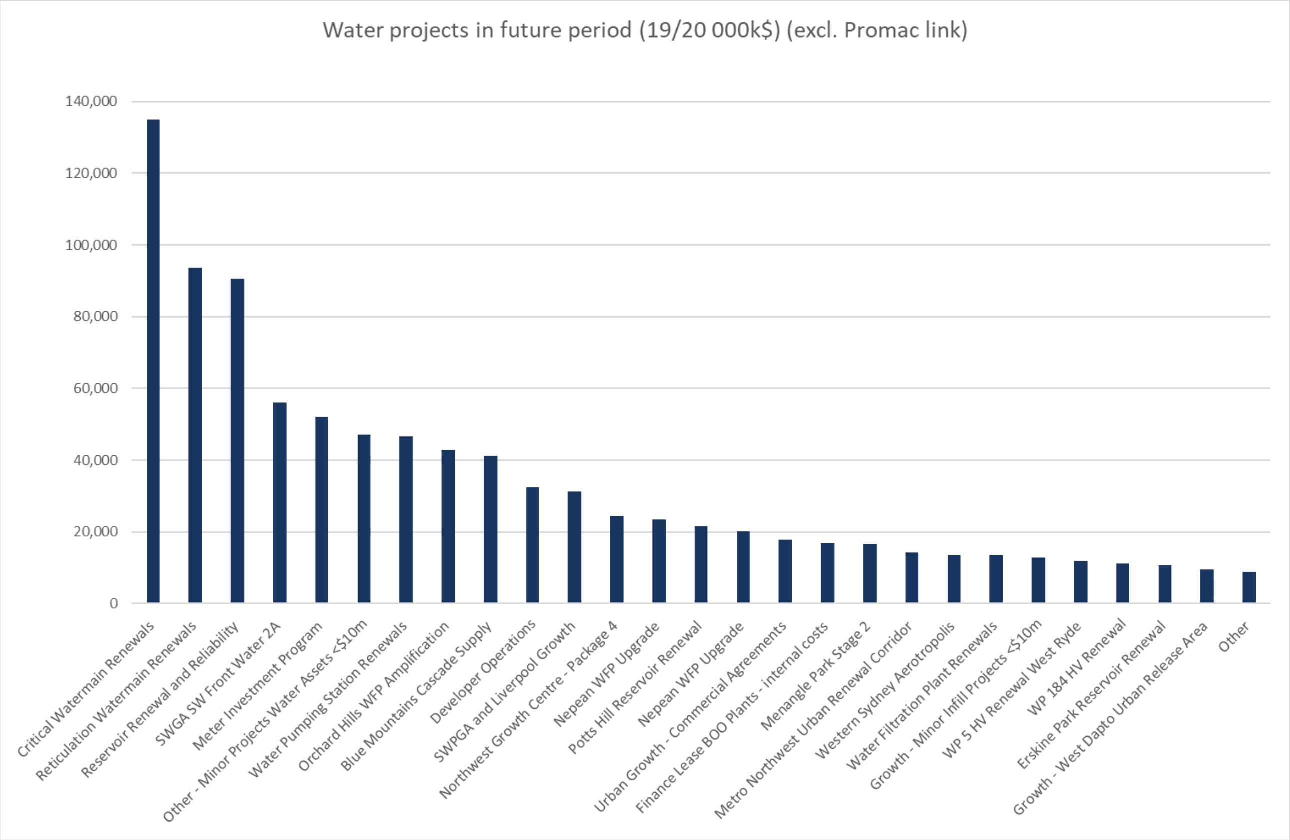
Capital expenditure in the current determination period is dominated by a number of large programmes, particularly water mains renewals, reservoir renewals, developer operations and water pumping stations renewals as well as early start expenditure on the Prospect to Macarthur link project as shown below.



Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-7 Water projects in current determination period

Expenditure proposed in the future period is dominated by the Prospect to Macarthur (Promac) link ($484m) which is orders of magnitude greater than any other program. Excluding the Promac link as shown in Figure 6-8, water main renewals remain the most significant expenditure proposed with increase expenditure on reservoir renewals. Sydney Water have stripped out a greater number of more significant projects in the future determination period as separate line items in the IPART submission compared to the current period. There also is significantly increased expenditure on separate growth projects proposed in the future period.



Source: Sydney Water SIR Capex 2 November 2019/ Atkins analysis

Figure 6-8 Water projects in future determination period

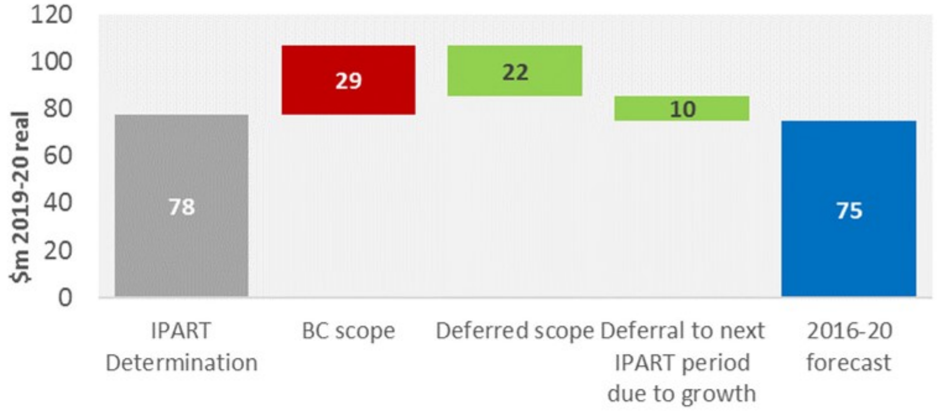
6.4.1. Existing mandatory standards

6.4.1.1. Current Determination Period (2016 - 2020)

Throughout the inception phase we identified a number of significant projects to review which represent 10% of the capital expenditure program. Below we discuss each of the specific program and projects in turn and summarise our key findings and any specific expenditure adjustments we recommend.

Reservoir Renewal and Reliability Program (WEM046)

Sydney Water has 256 service reservoirs within its area of operations. The Modern Engineering Equivalent Replacement Asset (MEERA) estimated replacement cost of the reservoirs assets was $2,470 million as of 30 June 2018. The 256 reservoirs are made up of 241 Networks reservoirs (11 of which are prescribed as dams under ANCOLD), nine recycled networks reservoirs and six treatment reservoirs. Most of the reservoirs were roofed in the late 1960s / early 1970s to ensure the maintenance of drinking water quality in the network. A number of these roofs are now reaching the end of their remaining life (taken as 50 years). A number of steel reservoirs also still have bitumen linings, which are in poor condition, while some mechanical / electrical equipment including re-chlorination facilities require renewal or replacement.



Source: Sydney Water SIR Capex 2 July 2019/ Atkins analysis, Sydney Water Corporation reservoir renewals presentation

Figure 6-9 Reservoir renewals Sydney Water current determination period expenditure

In its 2015 IPART submission, Sydney Water proposed expenditure of $102m. After the 2016 IPART determination Sydney Water proposed a revised expenditure of $78m. Total expenditure in the period is forecast to be slightly under the 2016 IPART determination at $75m. This was primarily down to deferring some scope into the next determination period. Sydney Water deferred expenditure of $10m due to contingent growth being recognised in the area fed by Liverpool reservoir. Rehabilitation was deferred to allow planning for growth which would otherwise would have been spent on two temporary reservoirs to mitigate the outage.

Level 1 condition assessments (using divers doing visual inspections) have been undertaken within the current period as part of a 5-year rolling programme to assess the total expected life of asset for each asset type within its class. Currently there are 28 reservoirs identified for renewal, with 21 of these classed as in poor or very poor condition.

Sydney Water identify reservoir renewals based on factors such as asset condition, business efficiency and poor performance. The assessment process includes an analysis of the current and future operating context, potential efficiency improvements. Projects are then prioritised based on a risk rating, decision framework analysis and remaining program funding constraints. Investment prioritisation for reservoirs does not follow the established CoF and CAC analysis and appears to be at a lower level of maturity overall than other asset classes we have reviewed.

Within the current period Sydney Water have been trialling development of their own proprietary technology for automatic re-chlorination dosing equipment in reservoirs as such a number of re-chlorination replacements that were scheduled for the current period have been deferred in to the next determination period.

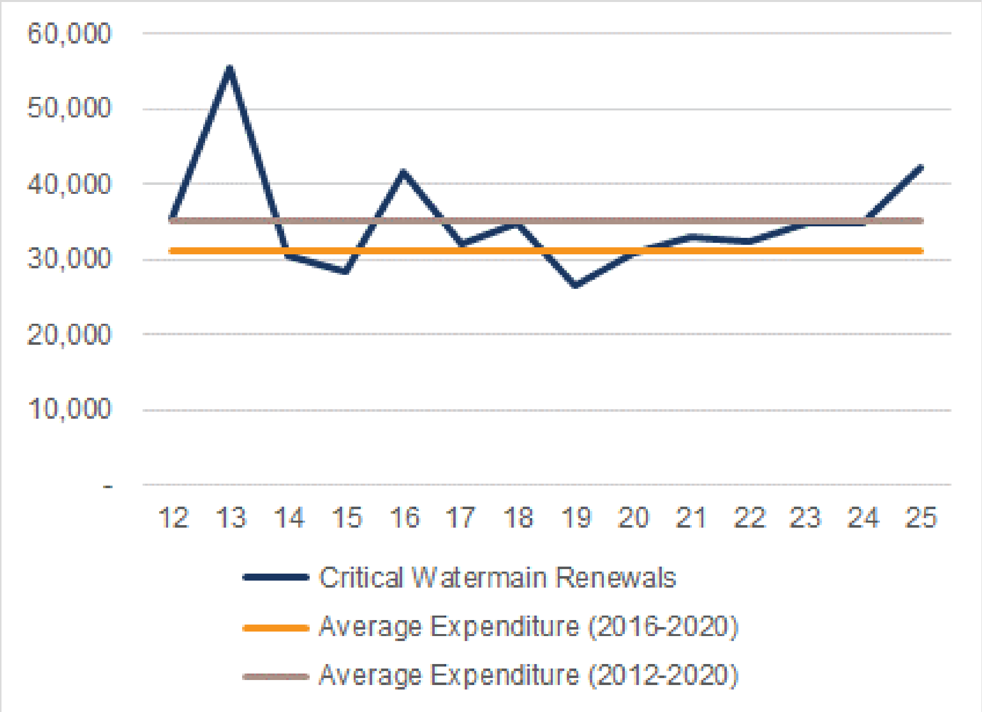
Sydney Water are expecting to renew 21 reservoirs by 2020.

Reticulation Water Main Renewals (WEM047)

In the current period, Sydney Water has underspent on renewal of water mains due to reprioritisation to other programs. The level of underspend is forecast to be $88.5 million (actual) v $128.7 million (forecast), around 70% of that anticipated (this figure is net of the change in accounting policy to capitalise reticulation water main breaks). Sydney Water does not consider that this underspend has contributed to the observed increase in water main bursts and leaks in recent years as it considers that dry weather and soils is the main factor. Sydney Water is not proposing any catch-up of this underspend in the forward period. This suggests that Sydney Water is comfortable with the current level of asset failure and performance risk for water mains despite the underspend.

Critical Water Mains (WEM040)

Since 2012, expenditure on critical water mains has generally been declining with average annual expenditure in the period 2012 – 2020 of $35.1 million but reducing to $31.1 million per annual in the current period 2016-2020. Notably, expenditure dipped in 2018/19 to $26.6 million. This was due to Sydney Water re-prioritising expenditure on asset renewal across all asset classes. This is shown in Figure 6-10. Expenditure in the current period has been lower than that forecast at the time of the last determination.



Source: Sydney Water SIR Capex 2 June July 2019/ Atkins analysis

Figure 6-10 Expenditure on critical water mains 2012 - 2025

As for reticulation water mains, renewal of critical water mains is required to maintain water continuity as required by the System Performance Standard in Sydney Water's Operating Licence. Sydney Water estimates that critical water mains contribute approximately 20% of the total of incidents against this standard but because of their large often large diameter also have the ability to materially impact performance through a small number of incidents.

Sydney Water has performed under the licence reference level for the number of properties experiencing an unplanned interruption more than five continuous hours (licence limit 40,000) in the period from 2012/13 to 2017/18; however, in this last year performance was 39,308 properties and just under the reference level. For year 2018-19, Sydney Water has breached the licence limit due to one large interruption which was considered an exceptional event. Sydney Water forecasts that it will meet its licence limits in 2019/20. This one significant occurred on a critical water main. Our analysis of mains breaks suggests that there is a long-term reducing trend; we suggest the measure is driven more by the ability to respond quickly to isolate mains and repair.

As Sydney Water has maintained performance in this area albeit with one exceptional event with reduced expenditure, we consider that expenditure on critical mains in the current period is prudent and efficient. The length of critical mains renewed also exceeded that forecast at the last determination at 31km v 30km.

Customer Metering (project WEM043)

The customer metering program is to maintain meter stock accuracy and compliance with the National Measurement Act which defines an accuracy of +/-4% required). There are a significant number of customer complaints from meter readings and adjustments. There are three workstreams:

- meter installation for new customers;
- reactive replacement of meters which have failed;
- proactive replacement of meters which are forecast to exceed the accuracy tolerance;

The total meter asset stock is some 1.3m of which 92% are 20mm size. The age profile shows a relatively small number of meters pre-1997 and an age profile of 60K/a from 1998 to 2001 increasing to an average 90k/a from 2002 to 2007 then dropping to an average 60k/a from 2008.

Replacement of damaged, faulty and broken meters is an essential activity in order for Sydney Water to correctly bill customers and maximise revenue.

The variance in expenditure and activity in the 2016 Determination period is summarised in Table 6-2.

Table 6-2 Variance in meter program costs and activities

SYDNEY WATER NEW AND REPLACEMENT METER ACTIVITY AND EXPENDITURE					
$M at 2019/20 price base	**2017**	**2018**	**2019**	**2020**	**Total**
2016 Determination	10.57	11.23	11.38	11.47	4
Actual/ forecast expenditure	11.94	10.48	11.79	12.90	47.11
Variance actual > determination	1.37	-0.75	0.41	1.44	2.47
UNIT COSTS					
unit cost $/meter	119.0	115.8	126.6	102.0	114.8
METER ACTIVITY					
2016 Determination forecast	104160	115148	121517	121858	462683
new meters	20,196	20,401	20,093	20,863	81,553
reactive replacement	13,887	12,500	16,910	12,689	55,986
proactive replacement	66,321	57,582	56,069	90,672	270,644
Test	0	0	0	2290	2290
Total actual meters	100,404	90,483	93,072	126,514	410,473
Variance actual > determination	-3,756	-24,665	-28,445	4,656	-52,210

Source: SIR June 2019 and Sydney Water document 222; Atkins Supplementary Report Table 4.4, July 2016

Year 2020 is a forecast. Sydney Water has commented that the increased activity in 2020 is a challenge. We agree that this 35% increase may not be achieved. Actual and forecast expenditure shows an increase of $1.8m (4%) when activity is 11% below the target.

Overall activity has been lower than planned. There has been an increase in reactive replacement as part of the preparation for CxP. New meters follow an increased trend over planned. The number of proactive meter replacement is significantly lower than planned mainly due to the contractor's resource constraints. There was difficulty attracting and retaining installation teams. We question the ability of the contractor in delivering the increased activity in 2020 which would in turn indicate a lower outturn expenditure.

The increase in meter unit costs is attributable to the difficulties in meter reactive replacement. New four-year contracts for the supply of meters were in place from 2018.

Water Pumping Station Renewals (WEM051)

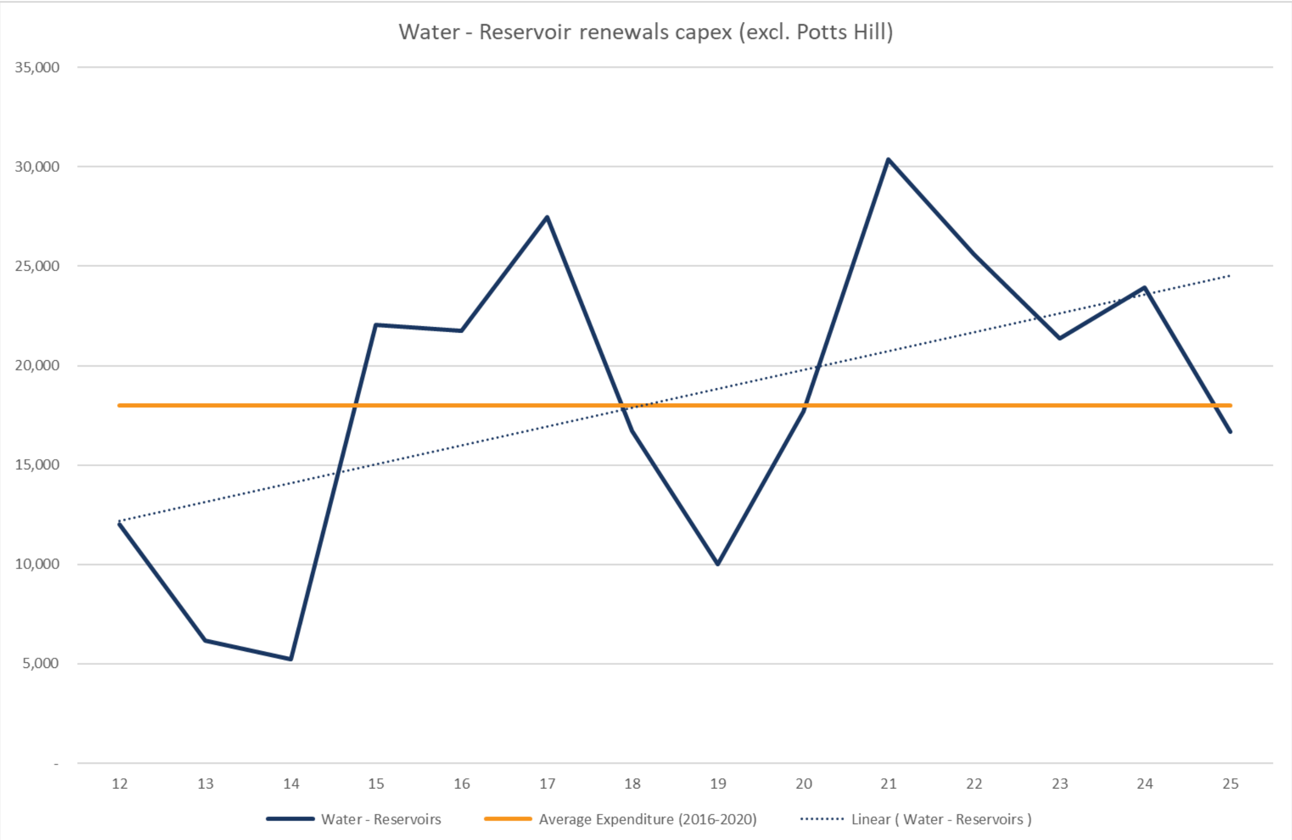
Differences between the outputs and costs of the current (2016 to 2020) and next (2020 to 2024) determination periods are identified in a waterfall graph provided in the Water Pumping Stations Renewals Program Business Case. The total expenditure for the 2016 to 2020 Determination period is currently forecasted to exceed the corresponding IPART Determination by $7.5 million (nominal), due to a net overspend on projects, recognition of work in progress and a revision of the accounting policy. However, these causes for variance are partially offset by the risk-based deferral of work to the 2020 to 2024 determination period.

We requested Sydney Water to provide a breakdown of this overrun to drivers. Sydney Water advised that the overruns were largely attributable to increased regulatory requirements and due to contractor constraints associated with the failure of one of its HV contractors. We accept that these factors are largely outside of Sydney Water's control and accept that the expenditure in the current period is justified.

6.4.1.2. Future Determination Period (2021 - 2025)

Reservoir Renewal and Reliability Program (WEM046)

The program is a continuation of the 2016-20 program which involves the renewal of reservoir roofs, relining of walls and renewal of some mechanical / electrical equipment including re-chlorination facilities, valves, mixers and instrumentation. Sydney Water is proposing a post efficiency expenditure of $90.6m for 2021-2024 (or $107.3m for 2021-2025) not including any major project works at Erskine or Potts Hill reservoirs. Excluding Potts Hill the proposed program of work represents a 41% increase in expenditure compared to the current period.



Source: Sydney Water Corporation November 2019 SIR submission and Atkins analysis

Figure 6-11 Reservoir renewals Sydney Water proposed future determination period expenditure

Sydney Water have identified 28 reservoirs for renewal (including Potts Hill and Erskine), with 21 of these classed as in poor or very poor condition. Sydney Water state the increase in expenditure is required to replace 14 sites which have bitumen lining which are all due for renewal in the 2020-2024 period, the remainder of program includes condition grade 4 and 5 assets due for repair to maintain their service life.

Within the current period Sydney Water have been trialling development of their own proprietary technology for automatic re-chlorination dosing equipment in reservoirs as such a number of re-chlorination replacements that were scheduled for the current period have been deferred in to the next determination period. Each unit is $1M cheaper than the like-for-like unit used for previous renewals. Sydney Water have plans to replace 9 units yielding a capex saving of $9M over the period when compared to a like-for-like replacement.

The auto-dosing replacement technology will also have an associated impact on opex within the “Water Other Programme” as less manpower will be required to physically attend to re-chlorinate.

Whilst there are inherent differences between reservoirs and linear asset classes the investment prioritisation process for reservoirs does not appear follow the established CoF and CAC analysis and appears to be at a lower level of maturity overall than other asset classes we have reviewed. Asset condition assessments have been undertaken for the reservoirs and we have accepted the need to increase expenditure beyond current levels due to the significant Potts Hill renewal project that is planned to be undertaken. We have taken a portfolio level assessment to our recommendations for expenditure on reservoir renewals which also includes the Erskine reservoir but excludes Potts Hill (discussed in more detail below). We are proposing that expenditure on reservoir renewals for the routine reservoir renewal program is maintained at current levels however have assumed the expenditure for 2021 has been largely agreed and committed so have maintained this as proposed with some expenditure deferred into year five of the period to enable prioritisation of works. The ongoing risk based approach to prioritisation of expenditure should be continued.

Table 6-3 Water - Reservoir Renewals Expenditure

RESERVOIR RENEWALS EXPENDITURE (including Erskine Park)							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021-2025**
SWC proposed expenditure	30,359	25,584	21,360	23,940	16,685	101,243	117,927
Atkins adjustment	-	(7,596)	(3,371)	(5,951)	1,304	(16,917)	(15,613)
Atkins recommended expenditure	30,359	17,989	17,989	17,989	17,989	84,325	102,314

Source: Sydney Water Corporation November 2019 SIR submission and Atkins analysis

Potts Hill Reservoir Renewal (WEM030)

Potts Hill Reservoir has a capacity of 500ML and serves 1.5m customers in the Sydney metropolitan area. The reservoir acts as a buffer to demand changes to optimise the operation of the Prospect WFP. Prospect Reservoir has a surface area of 175,000 m2 which is equivalent of 35 football fields and covered by a membrane liner and floating cover made of reinforced polypropylene (PRP) which has a 20 year design life. Testing in 2016 indicated a remaining life of 4 to 5 years. There are a number of unknowns which need investigation in the planning phase including continuity of supply, requirement for civil or electrical work.

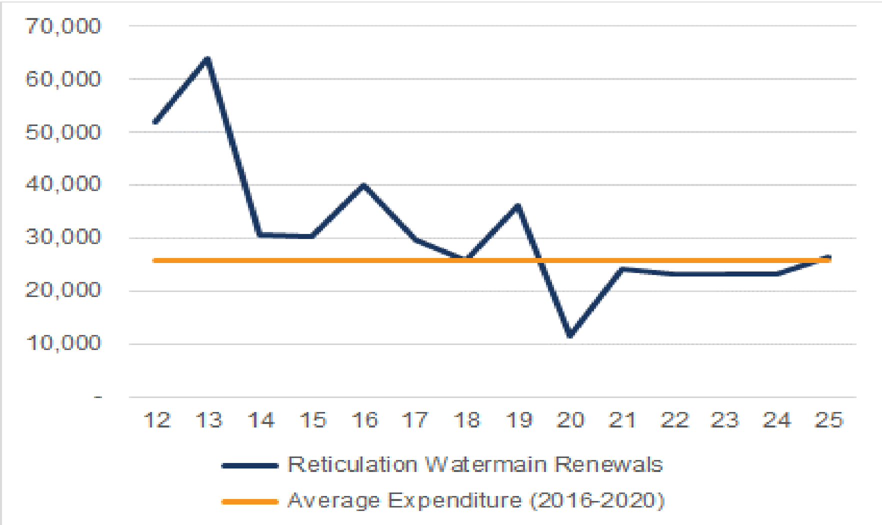
Sydney Water have included $21.4m in its submission for the future determination period. There is a requirement for further investigation and planning for this project to ensure the right solution is chosen. Since the November 2019 submission was issued we are informed that the urgency of the Potts Hill reservoir renewals scheme has increased for two reasons:

1) The asset was on an annual inspection cycle due to the deteriorating condition and the most recent November 2019 inspection has concluded that condition has worsened significantly. The inspection team could not traverse the covers for safety reasons. An inspection by divers concluded that the membrane covers are in such a poor condition that the original plan to buy time with patch repairs is no longer valid.

2) The likely expansion of the Sydney Desalination Plant will also impact Potts Hill so it is a further reason to address the reservoir issues in a timely way

Due to the specific nature, scale and criticality of Potts Hill we have kept this separate from our recommendations for the wider reservoir renewals program (discussed above) and make no adjustment for the project.

Reticulation Water Main Renewals (WEM047)
For the forward period, Sydney Water is proposing increased output to 30.4km per year with total expenditure lower than that in the current period due to a decreased assumed unit rate. This trend is shown in Figure 6-12. Sydney Water has also tightened up its identification process for renewals candidate by increasing the benefit-cost ratio required to quality and decreasing the pay-back period required. We do not propose any changes to Sydney Water's forward program for water mains renewals.



Source: Sydney Water Corporation June 2019 SIR submission and Atkins analysis

Figure 6-12 Reticulation water mains renewal expenditure 2012 - 2020

Critical Water Main Renewals (WEM040)
For the forward period, Sydney Water is proposing a step change in output of critical water mains renewed from 31km up to 42km (for the four year period 2020-2024). A number of additional outputs are also planned covering leak detection, pressure calming and refurbishing above ground pipelines. The proposed works are based on Sydney Water's understanding of the condition and risk of its assets. The program is based largely on actual condition and performance information for these assets.

The increase in scope for the forward program is offset to a large extent by two efficiency challenges – the first the top-down efficiency challenge based on improvements in areas such as procurement and cost estimating. This top-down challenge is 20% of the initially proposed program. An additional $4 million reduction has been applied specifically to this program to reflect expected gains due to new technology for relining or large water mains. After these efficiency challenges, average annual expenditure for the first four years of the forward period is $33.7 million which is above average annual expenditure in the current period ($31.1 million) but below the long term average since 2012 ($35.1 million). As Sydney Water is proposing considerably increased output for this level of investment and as there is little head room against the performance standard, we accept that the proposed expenditure for 2020-2024 is prudent and efficient. We note that Sydney Water forecasts a spike in expenditure in the fifth year of the forward program to $42.3 million. We recommend that prudent and efficient expenditure for this year is in line with the earlier years of the program, i.e. $33.7 million as there is no clear driver for this step increase in expenditure. This adjustment is shown in Table 6-4.

Table 6-4 Water – Critical Water Mains Renewals Expenditure

CRITICAL WATER MAINS RENEWAL EXPENDITURE							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total2021-2024**	**Total2021-25**
SWC proposed expenditure	33,089	32,301	34,758	34,758	42,270	134,906	177,176
Atkins recommended adjustment	-	-	-	-	(8,544)	-	(8,544)
Atkins recommended expenditure	33,089	32,301	34,758	34,758	33,727	134,906	168,633

Source: Sydney Water Corporation June 2019 SIR submission and Atkins analysis

Customer Metering (project WEM043)

Sydney Water proposes to continue the metering program of new, reactive and proactive replacement to meet the requirements of meter accuracy and reliability. The proposed expenditure and activities are shown in Table 6-5.

Table 6-5 Variance in meter program costs and activities

SYDNEY WATER NEW AND REPLACEMENT METER ACTIVITY AND EXPENDITURE					
$m at 2019/20 price base	**2021**	**2022**	**2023**	**2024**	**Total**
Forecast expenditure	13.15	12.75	12.60	13.48	51.98
METER ACTIVITY (number)					
new meters	21071	21282	21495	21710	85558
reactive replacement	12753	12817	12881	12945	51396
proactive replacement	92484	84761	84563	86426	348234
Test	1023	911	1013.0	1028	3975
Total meters	127,331	119,771	119,951	122,109	489,162
UNIT COSTS					
Average unit cost $/meter	103.3	106.4	105.1	110.4	106.3

Source: June 2019 SIR and SWC doc 222

New meter installations are in response to the growth in new connections where there is a modest increase above the 2016 Determination period. The reactive meter program shows a marginal reduction in activity. Proactive meter replacement is derived from the meter forecasting model which is based on the population of meter types and their failure rates, age and usage. The same model was used for the forecasting for the 2016 Determination period. For the future determination period, the criteria for the 20mm Elster replacement program has been extended from 4,100 to 4,300 Kl which is normally equivalent to 26 years. Even with this expended life, the proactive meter replacement program is a nearly 30% increase in activity compared with the 2016 Determination period. The assumed meter life is longer than most other water utilities.

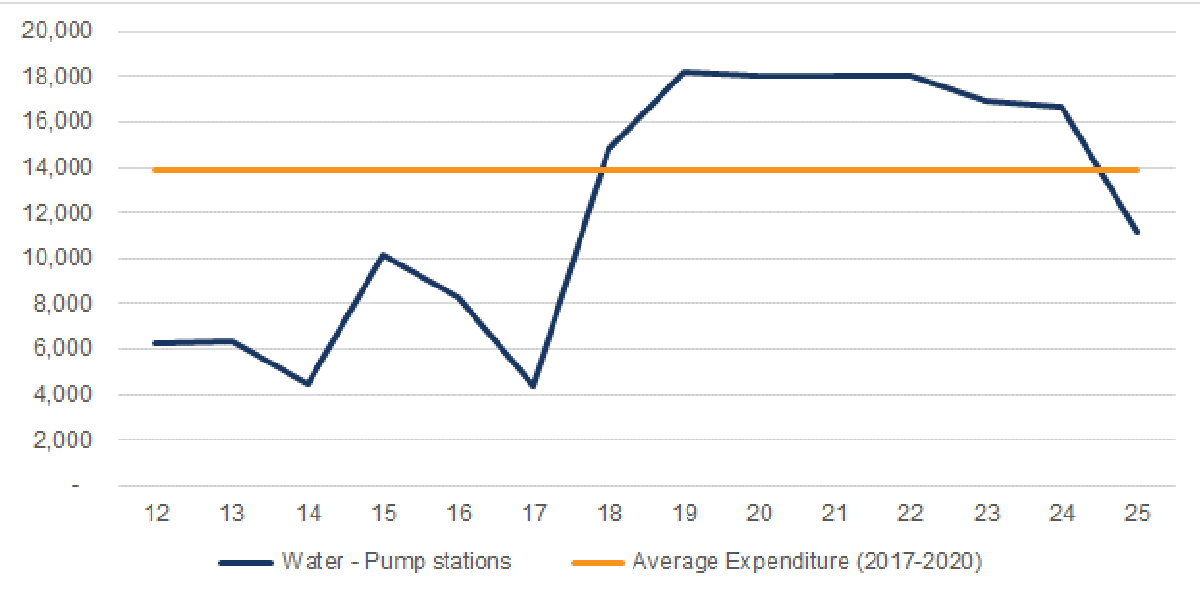
Average unit rates vary year-on-year due to the balance of replacement type and are lower than the 2016 Determination period. Sydney Water is introducing plastic meters at lower cost although the life may be potentially shorter. There is an open tender for the supply and separately for installation of meters.

We found that the new and replacement meter program is appropriate and conventional procurement has been used to seek market costs. We question the achievability of the increased proactive replacement program given the contractual difficulties in the 2016 Determination period and the near 30% increase in activity. A more realistic program would be to continue at the current rate plus 10%. This is a 50,000 reduction in activity and a corresponding $6.0m ($1.5m per annum) reduction in expenditure spread equally over the four years, based on the proactive replacement rates.

We consider that there is an opportunity to introduce ‘smart’ customer meters where meters can be read automatically either as drive-past, telemetry linked or other new technology. With constrained water resources this is important in identifying wastage on customer properties and enable the water conservation program to be more effectively targeted and at lower cost. The meter data can be collected more effectively and timely rather than the three-month meter reading cycle. While this will involve increased expenditure, the approach reflects similar approaches by frontier water utilities in water-stressed areas using the new technology that has been developed.

Water Pumping Station Renewals (WEM051, WEM052 and WEM032)

For the future period, Sydney Water has separated out two large water pumping station renewal projects from its overall program. There are for renewal of WPS84 ($11.1 million) and renewal of WPS5 ($11.9 million). The balance of the program is $46.6 million in the first four years of the forward period and $57.8 million over five years. While the last year of the forward program is below the preceding years, the overall trend is of a sustained increase above long term averages as shown in Figure 6-13.



Source: Sydney Water Corporation June 2019 SIR submission and Atkins analysis

Figure 6-13 Water pumping station renewals expenditure 2012 - 2020

Sydney Water has identified the following outputs for the forward period (4 year):
Proposed outputs over the four-year determination period:

- 3 major renewals (mechanical/electrical)
- 1 booster pumping stations renewals
- 5 high voltage (HV) electrical renewals
- 32 overhauls planned
- 64 overhauls reactive
- 92 like-4-like replacements
- 93 Pressure Reducing Valves (PRV) renewals
- 1 other program work

The available performance information and asset risk information does not provide justification for such a large increase in expenditure on water pumping station renewal from 2012 into the forward period. Therefore, we recommend that expenditure for water pumping station renewal (across the three items WEM051, WEM052 and WEM032) be reduced to be in line with average annual expenditure from 2016 – 2020 as shown in Table 6-6.

Table 6-6 Water pumping stations renewal recommended expenditure

WATER PUMPING STATIONS RENEWALS EXPENDITURE							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021 - 2025**
SWC proposed expenditure	17,998	18,062	16,911	16,658	11,194	69,629	80,823
Atkins adjustment	(4,120)	(4,184)	(3,034)	(2,781)	(2,684)	(14,119)	(11,435)
Atkins recommended expenditure	13,877	13,877	13,877	13,877	13,877	55,510	69,387

Source: Sydney Water Corporation June 2019 SIR submission and Atkins analysis

Northern Suburbs Ocean Outfall Sewer (NSOOS) (SEM089)

Works on the NSOOS in the forward period are across three packages - Package B, C and D. All expenditure in the forward period is within the SEM089 item within the SIR. However, Package B work is also partly in another item. To illustrate the works involved, the Package b scope comprises:

- Site 1 - (in Section 3) – desilt and rehabilitate 1.3km of tunnel that is 3.5m wide and 2.6m high
- Site 2 -(in Section 4) – desilt and rehabilitate 1.0km of tunnel that is 3.2m wide and 2.4m high
- Site 3 – (in Section 5) – desilt and rehabilitate 1.3km of tunnel that is 3.2m wide and 2.4m high
- Site 4 (in Section 4 and 5) – desilt only 3.2 km of tunnel that is 3.2m wide and 2.4m high

To develop the scope for each package, an initial inspection (traverses) is undertaken from which a specification is developed. Three contractors then tender on the schedule on a rates basis. The contract is awarded based on this initial scope. The consistent detailing of the scope and competition between three qualified contractors should lead to efficiency in costs.

The selected contractor pressure cleans and acid washes the surface. This provides a better view of the tunnel surface so that repairs can be specified. Where structural works are required, core sampling may be undertaken to establish the strength of the underlying material and confirm the design. The design (repair types) are determined by a consultant and Sydney Water, not the contractor. The contract is based on the rates initially tendered, only the scope changes at this stage.

We challenged Sydney Water as to how scope creep was avoided through this procurement approach. Sydney Water advised that it had found for Package A that the initial traverse inspections had consistently underestimated the scope of work required compared to the scope after the cleaning of the tunnel. Sydney Water has focused on improved certainty in costs for Package B. Indicators of how Sydney Water is seeking to improve certainty in its forward work requirements and costs include:

- Sydney Water has undertaken its own internal estimates for forward works packages as a benchmark for tendered costs
- Establishment and monitoring of performance KPIs for existing contractors
- Approach by Sydney Water to share innovations and improve collaboration between contractors

There are substantial challenges in undertaking these works. These include:

- Working in a live sewer which presents drowning and microbiological risks
- Fluctuations in the level of the sewer including due to wet weather. Pumping is used to draw down the sewer level. The working window is only 3am to 8am without pumping

- Gaining access to the damaged sections of the tunnel which are on the roof and sides of the tunnel
- Extraction and disposal of silt
- Noise and odour generated by the works and impacts of site compounds at the surface.

We are satisfied that Sydney Water's approach to rehabilitating this sewer is prudent and should lead to efficient outturn cost noting that there are substantial uncertainties but also opportunities for innovations to increase productivity.

6.4.2. Growth

6.4.2.1. Current Determination Period (2016 - 2020)

Water growth expenditure from 2016 to 2020 inclusive is expected to be $308.9M according to the November 2019 submission.

The largest single line item in the submission in the current period relates to "Developer Operations". Developer Operations relates to Developer-delivered infrastructure. Developer Operations relates to the developer-delivered work funded by Sydney Water under its Funding Infrastructure to Service Growth Policy. This work typically includes the construction of lead-in or upsized mains.

The second largest water growth project line in the period is actually a grouping of smaller investments in the Northwest Growth Centre. After this all projects are smaller than $20M.

Table 6-7 Largest water growth projects from 2016 to 2020

Rank	Title	Capex (16-20)
1	Developer Operations	82.0
2	Growth - Minor Northwest Growth Centre Projects <$10m	30.4
3	SWGC - Second Release Precincts Water Austral Leppington	17.7
4	South West Growth Centre - First Release Precincts Turner Road Water	16.3
5	Growth - West Dapto Urban Release Area	12.8
6	Growth - Other Minor Southwest Growth Centre Projects <$10m	12.2
7	Menangle Park	10.7
8	Growth - Minor Infill Projects <$10m	9.9
9	Emerald & Central Hills	8.0
10	Urban Growth - Commercial Agreements	7.0

Source: June 2019 SIR

During the interviews it emerged that one water growth project was wrongly reported in the June 2019 SIR as a sewerage project (SGO107 SWPGA – SW Front Servicing). This has been corrected in Sydney Water's November SIR update. We describe the project in this section.

SGO107 SWPGA – SW Front Servicing

This project was originally coded in the SIR as a wastewater project but actually relates to trunk water main construction for the South West Growth Area (SWGA). The SWGA is one of the largest greenfield growth areas, with estimates of approximately 200,000 dwellings in the long term. The south-western part of the SWGA is not currently served by a potable network.

Aggregate expenditure should be approximately equal to the sum of P50s rather than P80s. As well as transferring this expenditure from wastewater to water we have also therefore recommended an adjustment to reflect the FFC rather than P80 value. We have made the adjustment to match the current FFC estimate rather than the May 2018 P50 because of scope evolution and based on the level of expenditure to date. Strategic planning was undertaken by Sydney Water in 2012. In 2015 DPIE released the Lowes Creek/Marylands precinct for development; a further release, in the south west to Bringelly Road, followed in 2017. In parallel, the Roads and Maritime Services (RMS) started construction of the second phase of the Northern Road upgrade.

The project involves laying nearly 13km of trunk main along the Northern Road corridor in parallel with the road upgrade works being undertaken by RMS. Construction is advanced with operational completion expected by the end of 2019. The option of constructing the trunk mains, designed for ultimate demand, along the Northern Road was chosen following an options appraisal as it is the most direct and lowest cost alignment, with the lowest NPV. It did, however, require that the construction happen quickly to fit in with RMS's timetable for the road upgrade. Otherwise it would have been necessary to wait for the end of the road defects liability period.

Procurement for the scheme was unusual as there was no competitive procurement process. [redacted] This meant that the work could be carried out quickly, in parallel with the road upgrade, reducing indemnity risk, and taking advantage of some mobilisation efficiency.

Sydney Water identified three ways in which it believes it mitigated the risks of overpaying:

- It procured an independent cost estimate which it used to benchmark/review Lendlease's cost estimate
- It also carried out an internal review of Lendlease costs against the internal cost database. Lendlease's offer came in below the cost database estimate.
- It used the cost of the second preferred option as a ceiling which it could not exceed without changing approach.

The estimated fully inclusive Final Forecast Cost (FFC) is estimated to be $61.0M. [redacted]. We have recommended a reduction of $2.6M in expenditure in 2020 to match the FFC estimate.

6.4.2.2. Future Determination Period (2021 - 2025)

Sydney Water has proposed a significantly larger growth program of $642.7M between 2021-24 or $694.6M between 2021-25 in its November 2019 submission. The proposed 2021-24 expenditure would constitute a 108% increase in average water growth expenditure.

The largest proposed projects are summarised below.

[redacted]

Table 6-8 Largest water growth projects between 2021-25

Rank	Title	Capex (21-25)
1	SWGA SW Front Water 2A	56.0
2	SWPGA and Liverpool Growth	43.5
3	Orchard Hills WFP Amplification	42.7
4	Developer Operations	40.5
5	Western Sydney Aerotropolis	31.5
6	Northwest Growth Centre - Package 4	25.3
7	Nepean WFP Upgrade	23.6
8	Growth - Minor Infill Projects <$10m	18.9
9	Urban Growth - Commercial Agreements	17.8
10	Menangle Park Stage 2	16.7

Source: June 2019 SIR

Northwest Growth Centre - Package 4

This project is the fourth stage of extension of the trunk network in the NWGC, and aims to serve the Marsden Park, Marsden Park North, West Schofields, Vineyard and Riverstone East precincts. Development is already underway in Marsden Park and is expected to commence in the next few years in the other precincts.

It is part of an integrated package of work which also includes wastewater trunk assets. Packages 1 & 2 were delivered in 2011 and 2015 respectively whilst Package 3 is currently being delivered. Developers have already funded assets in Marsden Park. These costs are not included in this project line.

The project is at an early stage of development. An Options Assessment is currently being undertaken, with an Options Report expected in November 2019 and Concept Design by December 2020. The SIR includes $25.6M for water assets and $24.6M for wastewater assets between 2020 and 2025. During interview the source of the cost estimates was cited as the 2017/2018 GSIPs.

Upon review both of the wastewater network GSIPs quoted as the source of the cost estimates and the one water network GSIP which provided a breakdown of the cost estimate all incorporated 10% client contingency on top of 40% risk contingency on top of 75% scope contingency[58]. Cumulatively these make up very significant contingency allowances which more than double the cost estimates.

We have not recommended a specific adjustment to this project line, preferring instead to make a program level adjustment as detailed below.

[58] 117.56 - GSIP 2018 - Prospect North - Castle Hill, Rogans Hill, Parklea, Rouse Hill, Oakville Elevated Water Network, 117.73 - GSIP 2018 - Rouse Hill Wastewater Network and 117.72 - GSIP 2018 - Riverstone Wastewater Network

Western Sydney Aerotropolis

This project aims to improve the trunk capacity in the Western Sydney Aerotropolis Growth Area (WSAGA). Construction of the airport started in 2019 with the aim of making it operational by 2025/26.

The WGO056 line actually covers two discrete projects with discrete scopes and timeframes. Some of the related spend is also on WGO017 (''Growth - Other Minor Southwest Growth Centre Projects <$10m'). The two projects are:

- **Reticulation amplification**: this involves increasing the capacity of the existing reticulation network to provide sufficient network capacity for the planning horizon of 2024 in order to make the most of the existing capacity and defer much larger investment until it is really necessary.
- **WSAGA Trunk Drinking Water- Stage 1**: involves construction of a trunk network to the 2034 planning horizon.

The reticulation amplifications project commenced in November 2018 and construction is due to be complete at the end of 2019 at a Final Forecast Cost of $15.2M. The program is short largely to help to meet the water needs of airport construction which will peak during the earthworks phase. After this general development in the area is expected to have increased water demand significantly. The project is based on the solutions which could be put in place quickly and cheaply to increase network capacity, which has then defined the 2024 horizon rather than vice versa.

The reticulation amplifications were procured as a construction-only contract through direct negotiation with a panel constructor, in order to mobilise quickly and because they had good performance scores on the supplier panel. These scores do not include outturn cost. However, the Delivery Contractor's quoted price for this work was less than the cost estimation tool, which Sydney Water take as an indication that it represents value for money.

The "WSAGA Trunk Drinking Water- Stage 1" project is at an early stage of project development and no specific studies have yet been prepared. The costings are based on the GSIP and efficiency challenge in the Program Business Case. The SIR contains approximately $31.5M for this project (i.e. the spend from 2021 to 2025 against WGO056). The GSIP[59] does not provide details of how the costs have been derived.

Greater Parramatta to Olympic Peninsula (GPOP)

This project line (WGO039) is described in Section 6.5.3.2.

Approach taken to growth spend

Sydney Water has applied program level adjustments to a number of the project level cost estimates it has created. These have been applied in the Program Business Cases.

As part of the Network Growth Capital Program Business Case, Sydney Water states that:

- candidate project investment was based on the GSIP CAPEX data up to the 2021 time horizon only; and
- a 20% reduction was applied to the GSIP CAPEX data to allow for efficiency and optimisation benefits arising from optioneering and detailed planning

Sydney Water also applied a 'risk-sharing' approach in the Treatment Growth Capital Program Business Case. Sydney Water reports that the treatment growth program initially generated capex requirements of $1617.1m in the 2020-25 period. Management applied a challenge termed a risk sharing approach. This apparently reduced the 2020-25 investment requirement by $401.6m and the 2020-24 amount by $263.6m),

[59] 117.67 - GSIP 2018 - Prospect South - Cecil Park Water Network

resulting in the $1215.5m five-year total for this business case (and $919m over 2020-24). This is equivalent to a reduction in 2020-24 capex of 22% and 2020-25 capex of 25%.

However, the mechanisms used to apply these challenges and the urgency of timing, project scope and basis of cost estimate that the challenges have been applied to is not always clear.

We note from the interviews and the reviews undertaken that the GSIPs which are the source of some of these costs are considered to be first cuts and "not highly optimised". We also note that some of the cost estimates in the GSIPs incorporate 30% Sydney Water risk contingency on top of 30% risk contingency on top of 35% scope contingency[60] indicating a low level of confidence in scope and cost estimation. As seen for Northwest Growth Centre- Package 4 examined above, some of the GSIPs incorporate even higher levels of contingency.

Rates of new development in the 2016-20 period have been at unprecedented levels. Sydney Water sets out in Attachment 8 of its submission a number of reasons why development is expected to be lower than current levels. These reasons include declining dwelling approvals and housing-related lending.

Sydney Water is projecting a very similar average number of new connections in the next Determination period as during the current period. During the 2016-20 period Sydney Water expect average new water customer dwellings to be 35,213 p.a. and is projecting a very slightly higher average number of new connections (35,381) between 2020-25. Given this, we consider it reasonable that water and wastewater growth capex should be at a similar average level. We have not been given a compelling justification for the scale of increase requested.

We have therefore recommended an adjustment to proposed water growth expenditure to match the average expenditure in the 2016-20 period[61]. This adjustment has been applied pro-rata to Sydney Water's proposed expenditure for 2021-24. As there is less certainty in 2025, the adjustment for this year has simply been applied to match the average 2016-20 level.

We have identified and separated out all major (>$100M capex non-bucket code) projects from this adjustment as a number of them have been reviewed in their own right and found to be prudent or subject to specific adjustments. The basis of the adjustment is summarised below:

Table 6-9 Water growth expenditure adjustment

$m 2019/20	**Spend in 2016-20**	**Spend in 2021-24**
Major project growth expenditure	53.7	338.9
'General' growth expenditure	312.5	303.7

Sydney Water sets out in Attachment 8 of its submission a number of reasons why development is expected to be lower than current levels. These reasons include declining dwelling approvals and housing-related lending. During the 2016-20 period SWC expect average new water customer dwellings to be 35,213 p.a. and is projecting a very similar average number of new connections (35,381) between 2020-25.

Given that new property numbers are expected to be very similar to the current Determination period, we consider it reasonable that water growth expenditure should be at a similar average level. We have not been given a compelling justification for the scale of increase requested.

[60] See Table 3-1 in the Growth Servicing Investment Plan 2018
[61] After adjustment for miscoding of "SGO107 SWPGA – SW Front Servicing"

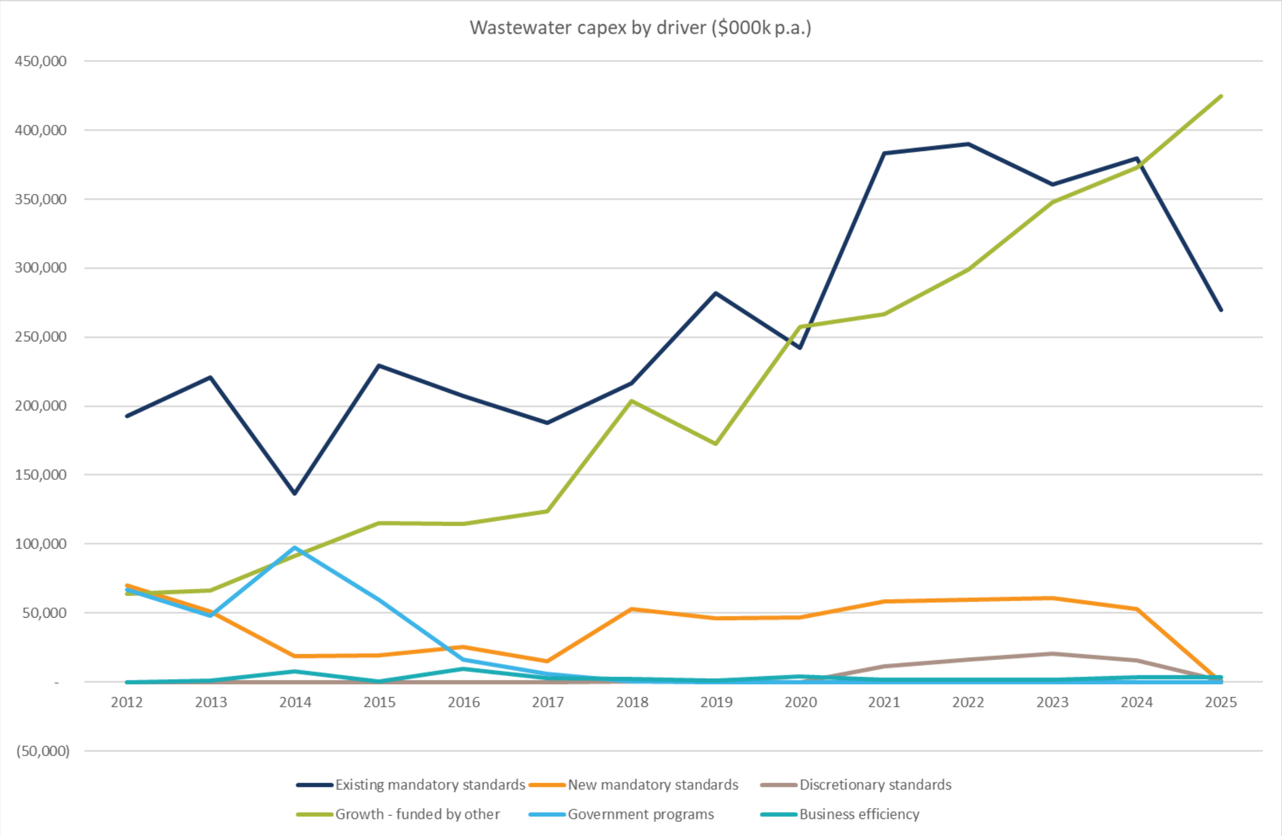
Adjustment for SGO107 SWPGA – SW Front Servicing cost estimation	-2.6	
Adjusted 'general' growth expenditure	309.9	303.7
Average adjusted annual general growth spend ($M p.a.)	62.0	75.9
Adjustment to maintain average capex ($M total applied pro-rata to SWC proposed expenditure)		55.9

Source: November 2019 SIR and Atkins/Cardno adjustment

Note: 2016-20 covers the period from 2016 to 2020 inclusive so covers five years; 2021-24 refers to a four year period.

6.5. Wastewater service

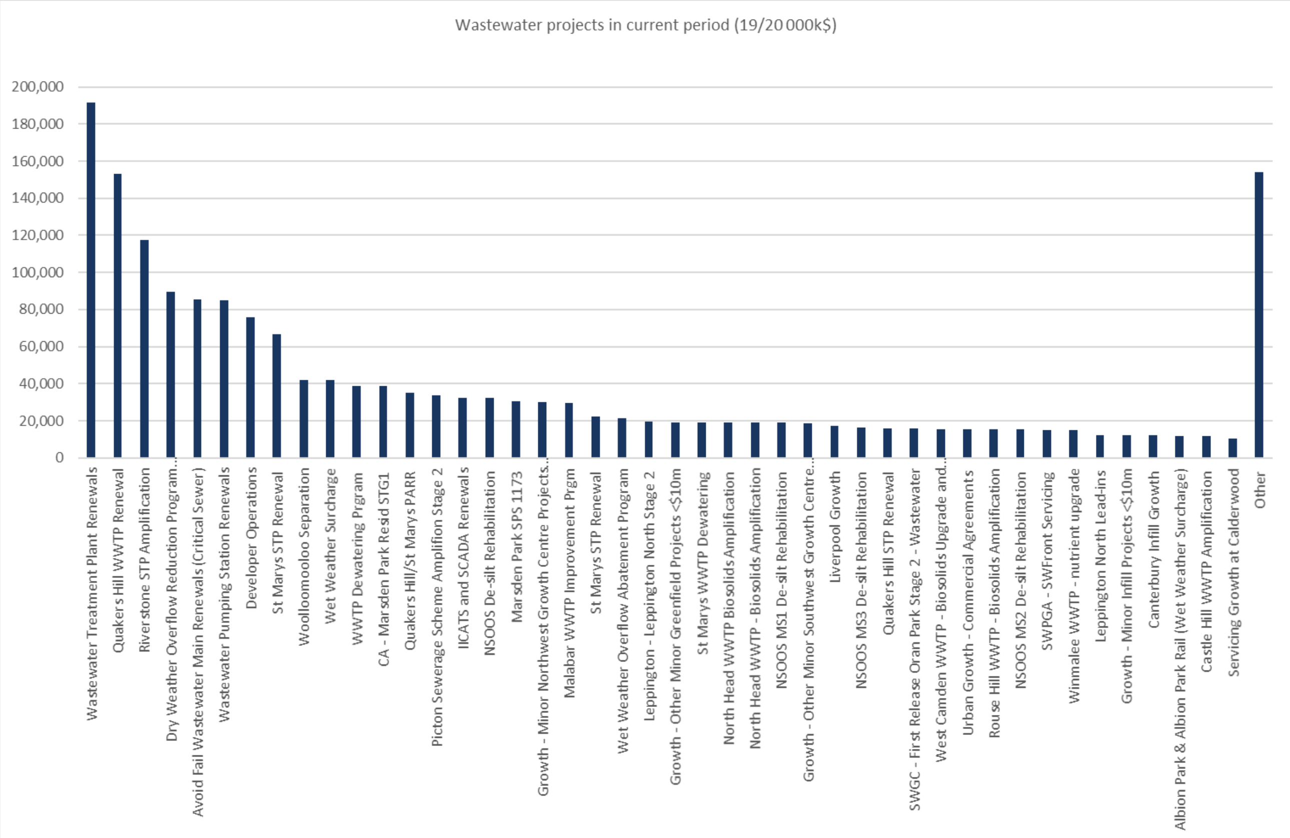
Wastewater capital expenditure is projected to increase by 73% (+$309.8m average per annum) compared to the average spend in the current determination period as shown in Figure 6-14 below.



Source: November 2019 SIR/Atkins analysis

Figure 6-14 Wastewater service capex by driver

Capital expenditure in the current determination period is spread across a significant number of projects / programs, of which three are particularly large: WWTP renewals programme, Quakers Hill WWTP Renewal and Riverstone STP Growth amplification. These are shown in Figure 6-15 below.

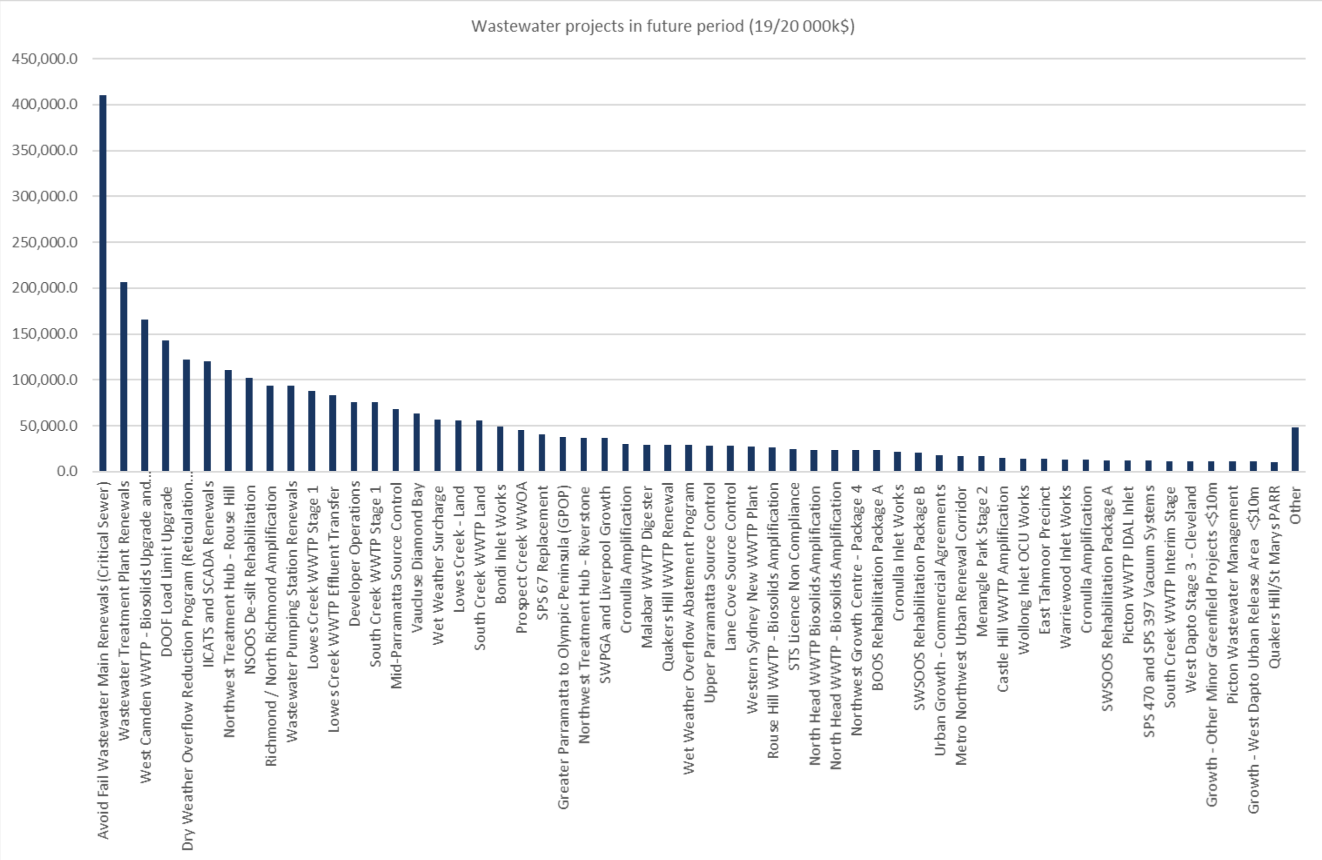


Source: November 2019 SIR/Atkins analysis

Figure 6-15 Wastewater service capital expenditure by project: current determination period

The increase in wastewater service capex is driven by an 63% increase in "existing mandatory standards" (+$146.8m per annum), 44% increase in "new mandatory standards" expenditure (+$17.7m per annum), 70% increase in "growth" (+$132.3m per annum), one significant "discretionary standards", Sydney Water's first discretionary project (the Vaucluse Diamond Bay outfall diversion) (+$15.5m per annum). These increases are mitigated slightly by a 26% decrease in "business efficiency" (- $0.7m per annum) and no expenditure in "government programs" (- $1.5m per annum).

The profile of projects in the next determination period continues to have a wide number of significant projects, of which many are associated with broader programmes of work rather than explicitly stand alone or special projects as shown in Figure 6-16 below.



Source: November 2019 SIR/Atkins analysis

Figure 6-16 Wastewater service capital expenditure by project: future determination period

6.5.1. Existing mandatory standards

6.5.1.1. Current Determination Period (2016 - 2020)

Wastewater Treatment Plant Renewals Program (SEM073)

Sydney Water owns 13 wastewater treatment plants (WWTP), 12 water recycling plants (WRP) and 3 storm flow plants with a current replacement cost (MEERA) of $4.45 billion (June 2018). The renewals program is designed to assist in meeting all Operating Licence requirements, maintaining performance against Environment Protection Licences, ensuring plant safety for workers and visitors, and creating positive impacts on community aesthetics by improving waterways and beaches.

Service performance measures include reducing non-compliant discharges, reduced odour complaints, lost time injuries performance trend improvement and maintaining satisfactory asset condition and reliability profiles.

In 2014-15, 36% of WWTP renewals total expenditure originated from planned works with the balance (64%) spent on unplanned projects. In November 2015 Sydney Water commenced Project See to improve the proportion of planned renewal work across Treatment plants by developing a consistent and forward-looking plan across Treatment operations, ensuring assets were identified, planned and addressed prior to significant performance issues or asset failure. Since then, process and system improvements have been rolled out across all treatment plants that includes:

- conducting monthly condition assessments, with a portion of the plant reviewed each month and the whole plant completed annually
- capturing both asset condition and consequence of failure that is translated into a risk score; and

- conducting quarterly prioritisation reviews of needs combined with capital program prioritisation reviews to agree on candidate projects to progress to the initiation business case stage gate.

Project See has enabled Sydney Water to become more proactive in the identification and management of treatment assets that has also resulted in a reduction of unplanned work. Sydney Water have reduced its expenditure on unplanned works to 23% in 2018/19.

Project See has also contributed to improving the prioritisation and allocation of expenditure on the capital program, with the output of these assessments providing input into the program prioritisation process. Sydney Water appear to have an improved understanding of the condition and criticality of each asset.

Overall performance at the WWTP has shown steady improvement over the last ten years. There has been a significant reduction in the number of Odour Complaints received shown below and the number of non-compliant discharges has reduced significantly in recent years shown in Figure 6-17 below. Figure 6-17 Wastewater Treatment Plants – Odour Complaints 2008-2019

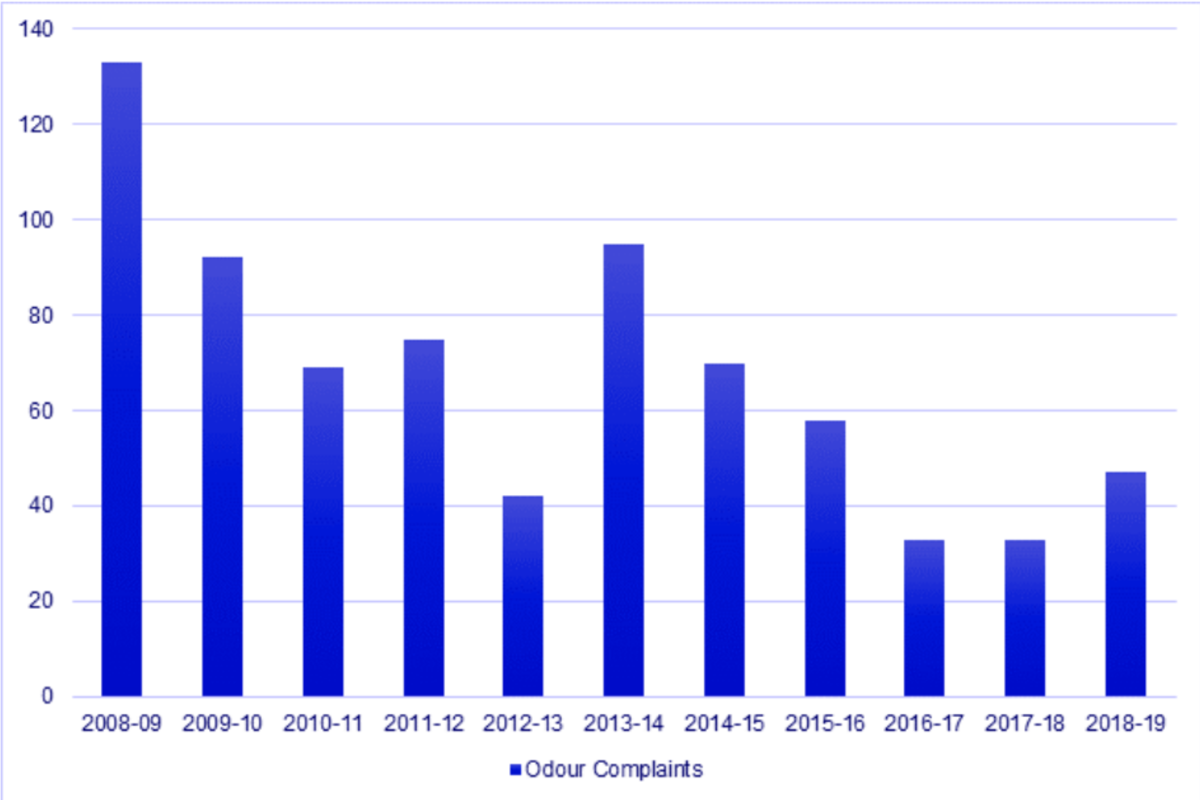


Figure 6-17 Wastewater Treatment Plants – Odour Complaints 2008-2019

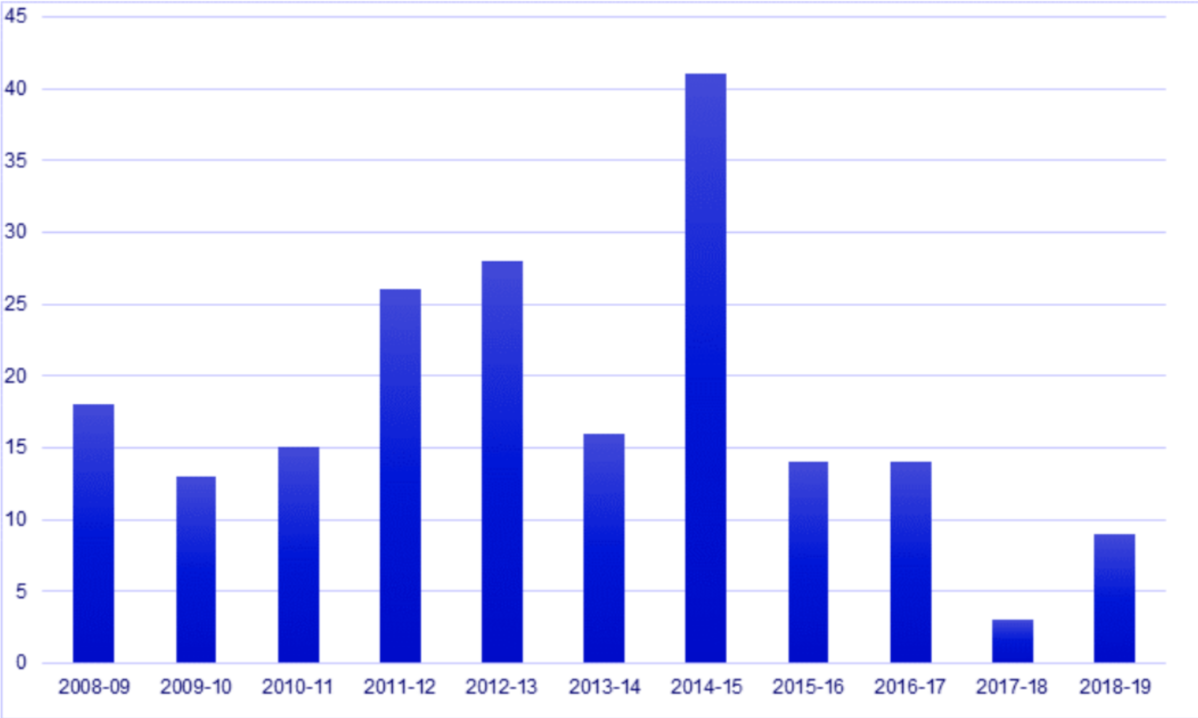


Figure 6-18 Wastewater Treatment Plants – Non-compliant bypasses 2008-2019

Quakers Hill and St Marys WWTP Amplification and Renewal

A combined Process and Reliability / Renewal (PARR) project is being undertaken to improve reliability and performance at Quakers Hill and St Marys and service growth.

At the time of the 2015 submission the total capex proposed was $176M for renewals works at Quakers Hill only the remainder of the expenditure was included within the WWTP renewals program. Subsequently to the submission and before the Delivery Approval Business Case (DABC) was developed the Quaker Hill project was separately identified as a regional project with the St Marys WWTP projects within the Lower South Creek. This program was identified as integrated driver project address both Existing Mandatory Standards and Growth. The PARR program was then identified as a Project of State Significance and it was approved by the Expenditure Review Committee (ERC) in April 2018.

The key objectives of the project are to:

- address the high risk of complete structural failure of the biological treatment units (IDAL Lagoons) at Quakers Hill
- provide reliable, cost effective treatment capacity for the current and future population (223,000 EP by 2030) in the Quakers Hill catchment while addressing the long term regulatory compliance and effluent management risks
- provide reliable and cost-effective treatment capacity for growth at the St Marys catchment (288,000 EP by 2026) together with the capacity needs for treating nutrient rich recycles from a consolidated biosolids treatment plant.
- provide the most economic, sustainable and efficient bio solids treatment solution that maximises renewable energy production and reduces biosolids truck movements and transportation costs and minimise the impact on our community and environment.

Sydney Water decided to opt for a Delivery Partner Model to undertake the project to leverage innovations throughout the supply chain. Detailed design work is nearing completion with several civil works and mechanical works packages have been committed. Works have commenced at Quakers Hill and St Marys with concrete works of major structures are in progress.

The total capex proposed within the DABC in September 2017 was $322M in $2019/20 (P80) however the expenditure proposed in the June 2019 SIR is $307M (P50). In June 2019 there was a significant variation sought of $32M (10%), over and above the updated expenditure forecast. As the expenditure proposed in the SIR is $307M (real $2019/20) there is firstly a shortfall of $15M (to get to the revised forecast expenditure) and on top of this the variation of $32M. There is therefore a shortfall between the total forecast expenditure and June 2019 submission of $47M (real $2019/20). This variation was not included within the June 2019 IPART submission.

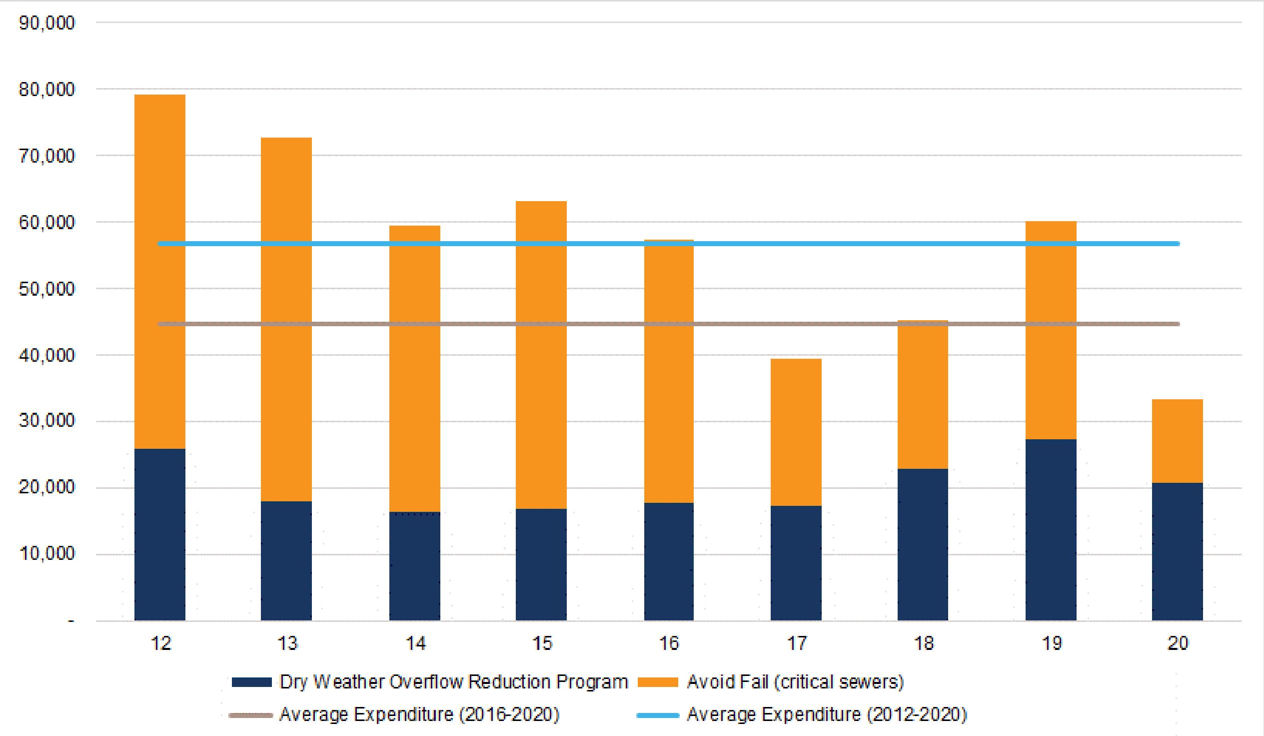
We have proposed a 30% proportional adjustment increase in expenditure to reflect the shortfall not included within the June 2019 SIR submission and efficiencies that may yet be realised within the overall program. The remaining expenditure in the current determination period should be looked at in more detail at the next efficiency review from a prudency perspective and adjusted accordingly.

As this project of works overlaps with our wider review on Wastewater Treatment Plant Renewals we have included this adjustment in our WWTP renewals program level review below to ensure we are not double counting any expenditure adjustment recommendations.

Sewer main renewals (SEM055 - Avoid Fail Wastewater Main Renewals (Critical Sewer), SEM042 - Dry Weather Overflow Reduction Program (Reticulation Sewer))

Sydney Water classifies its sewers as critical and non-critical depending on the potential consequences of failure of the segment of sewer. For sewers classed as critical Sydney Water adopts an “avoid-fail” strategy. Sydney Water has changed its classification of sewers that may overflow to waterways so that all sewers that may overflow to waterways are now classified as critical. Previously many were classified as non-critical. This make comparisons between the past and future difficult for the non-critical and critical sewer programs in isolation. Therefore, we have considered them jointly.

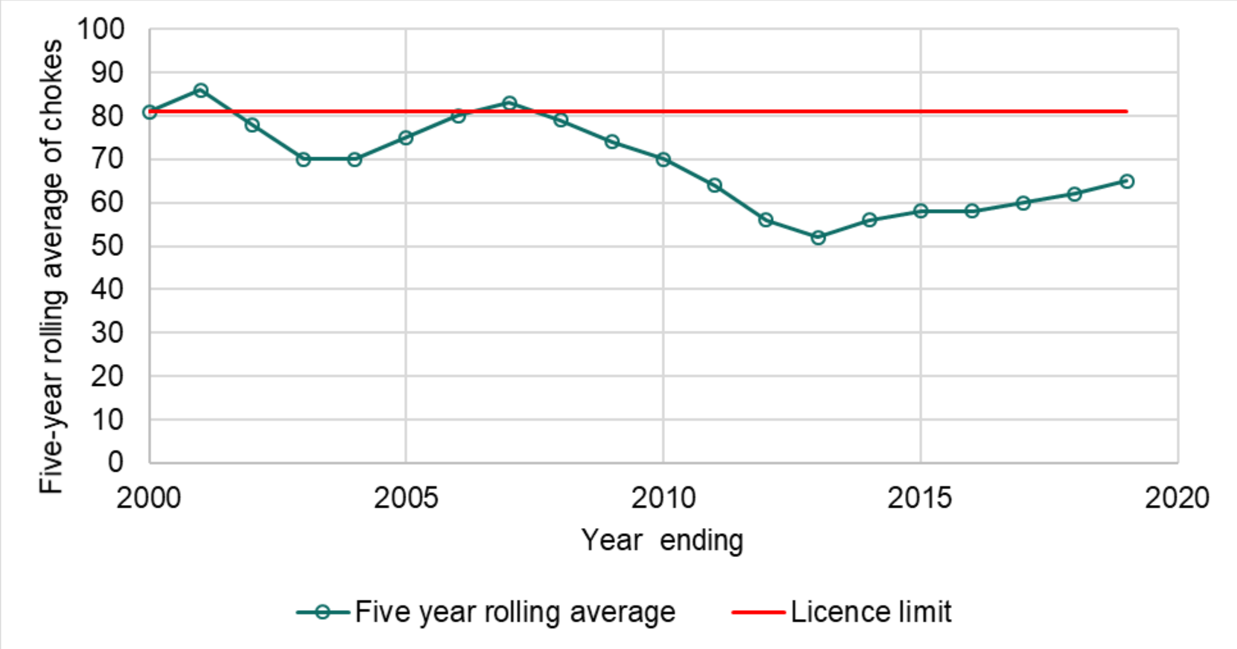
Expenditure on the two sewer main renewal programs has been declining since 2012 into the current period. Average annual expenditure between 2012 and 2020 was $56.7 million but has only been an average of $44.6 per annum for the period 2016 to 2020. Expenditure on avoid fail sewers has declined most materially while expenditure on reticulation sewers has increased in 2017/18 and 2018/19. The overall trend is shown in Figure 6-19.



Source: June 2019 SIR

Figure 6-19 Sewer main renewal expenditure 2012 – 2020

An important performance measure for sewer mains is the five year rolling average for sewer main chokes. This trends for the period 2000 to 2019 is shown below. While the long term trend is declining and below the target of 81 per annum, there has been an increase in recent years attributable to reduced soil moisture caused by the extended dry weather. This causes increased tree root intrusion into sewers.



Source: Atkins-Cardno analysis of Sydney Water data

Figure 6-20 Sewer choke trend 2000 – 2019

As Sydney Water has maintained performance below the target level through reduced expenditure in the current period, we consider that the expenditure on sewer main renewal in the current period is prudent and efficient. As discussed in the following section, Sydney Water is proposing a substantial increase in expenditure for these two programs in the forward period.

Northern Suburbs Ocean Outfall Sewer (NSOOS) (SEM089, SEM090, SEM091, SEM092, SEM093, SEM094)

Total expenditure on the NSOOS in the current period is forecast to be $101 million. This is lower than the $103 million ($96 million in $2014/15 rebased to 2019/20) forecast at the time of the last determination. However, Sydney Water has completed materially less rehabilitation than it forecast at the last determination. The increased unit rate for expenditure is due to actual productivity for desilting and rehabilitation being less than that forecast before work commenced (7 metres per day forecast compared with 3 metres per day achieved on average. A comparison of planned and actual expenditure in the current period is shown below.

Table 6-10 Planned and actual expenditure on NSOOS rehabilitation and desilting in current period

$m 19/20	2017	2018	2019	2020	Total (2017-2020)
Forecast	26	26	26	26	103
Actual	18.7	28.3	22.0	32.2	101
Variance	(7)	3	(4)	7	(2)

Sydney Water acknowledges that when it commenced works it did not appreciate the full financial impact of addressing the challenges of carrying out this work which include access, flow management, stakeholder management and the most cost effective repair techniques. Consequently, less work has been done than forecast and for a higher unit cost. These works are unique and it is reasonable that Sydney Water has underestimated the actual cost of the works given their unique nature.

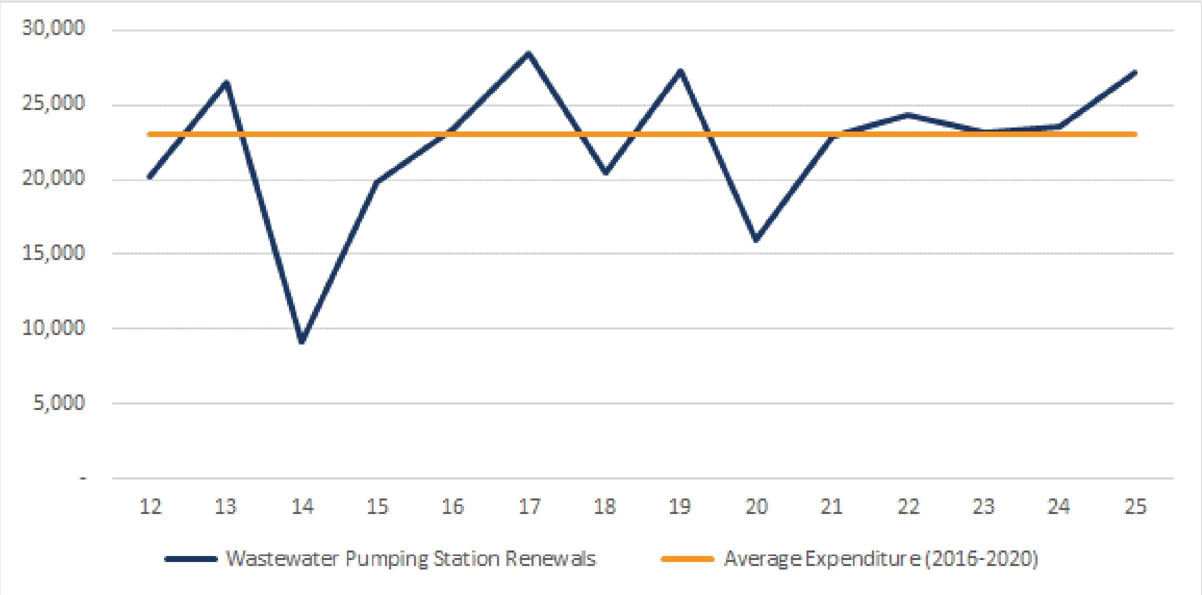
To try to address the challenges in the working environment, Sydney Water has engaged three contractors who have worked on the works in the current period. The contractors have been encouraged to innovate through trial of different working platforms and equipment which were demonstrated to us. The incentive for innovation is that the contractor would gain more share of the work through being more cost effective. Sydney Water retains the intellectual property of the innovations implemented. To drive efficiency, Sydney Water also monitors productivity of the contractors.

We accept that Sydney Water could not have known the true cost of the NSOOS desilting and rehabilitation works before it commenced the works due to their unique nature. Sydney Water has demonstrated that it is actively trying to decrease costs for the works. Therefore, we consider that the expenditure on the NSOOS in the current period is prudent and efficient despite the observed increase in costs compared with that forecast at the last determination.

Wastewater Pumping Station Renewals (SEM072)

Sydney Water has 690 wastewater pump stations within its wastewater network that require renewal of components as they reach the end of their useful life. This asset class also covers 13 vacuum sewage schemes and 19 low pressure sewage schemes.

The long term trend on renewal expenditure for water pump stations is shown in Figure 6-21. . In the current period, expenditure has averaged $23.0 million which is an increase of around $5 million per annum on the previous period. However, expenditure was variable with a notable dip in 2014.



Source: June 2019 SIR

Figure 6-21 Wastewater pumping station renewal expenditure 2012 – 2025 ($19/20)

WWPSs are currently inspected to Level 1 (visual) on a five year rolling program. The Level 1 inspection results trigger more detailed inspection based on the observations made. The performance of the Level 1 inspections has not provided an accurate picture of the condition of the wastewater pumping station assets. This is starkly illustrated by the failure of the Northmead WWPS and the ensuing mitigating actions. Following the collapse, risk assessment has led to identification of 86 pumping stations that will require a Level 2 inspection. This suggests that the existing Level 1 inspections were not sufficient for identifying risks or for informing management of the assets. These level 2 inspections are occurring in the current financial year and are not reflected in Sydney Water's submission.

We have not identified any expenditure that is not prudent or efficient in the current period. However, we anticipate that expenditure for 2019/20 will exceed that forecast in Sydney Water's SIR due to the need to undertake Level 2 inspections.

6.5.1.2. Future Determination Period (2021 - 2025)

North Head WWTP Biosolids Amplification (SEM088 and SGO029) (Integrated driver project)

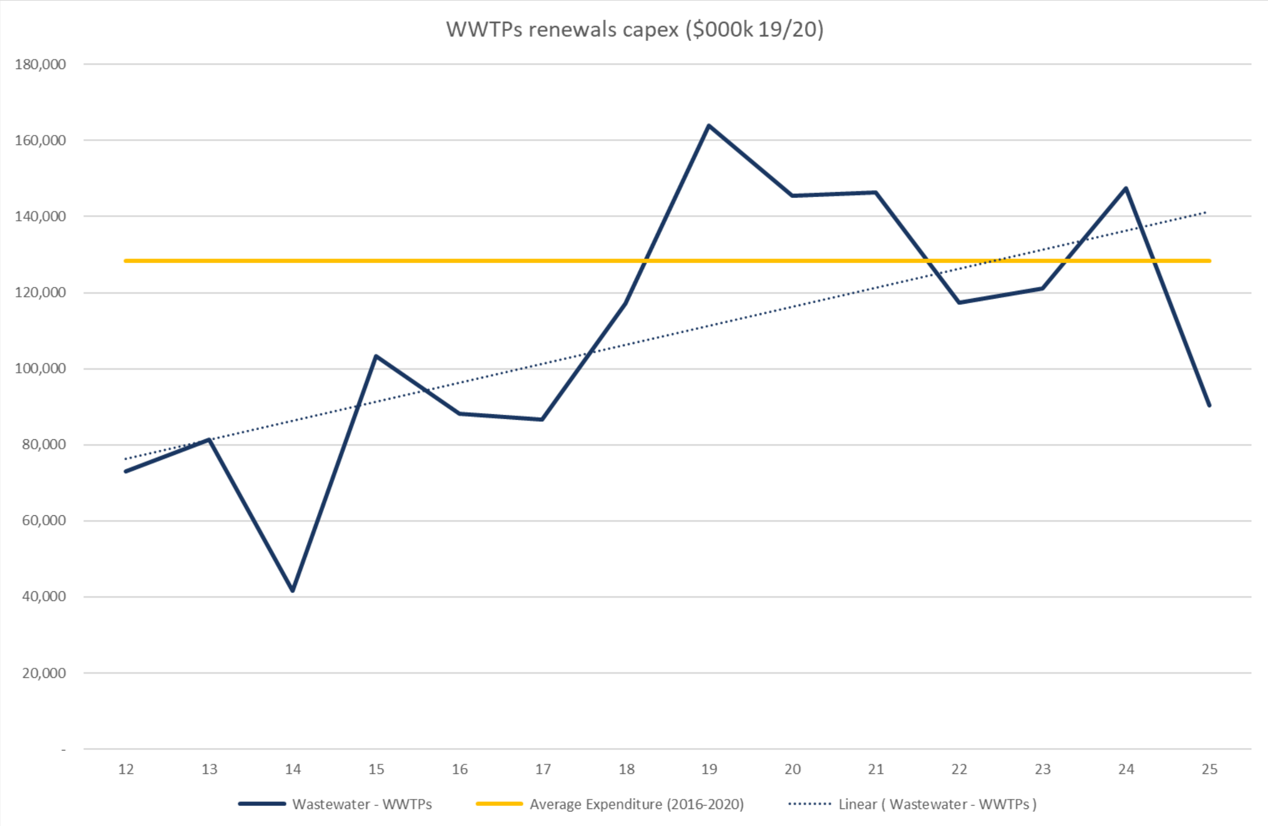
The North Head WWTP is Sydney Water's second biggest WWTP, serving an estimated 1.1million people in 2011 based on updated growth projects (in 2017) this is expected to rise to EP 2.1M by 2036. This project is to both increase biosolid digestor capacity in response to, and in anticipation of growth in the North Head catchment area as well as renewing and upgrading existing digesters and plant configuration with costs allocated to both 'growth' and 'existing mandatory standards' on a 50/50 basis. The key driver for this proposed expenditure is to meet EPL compliance targets for total suspended solids. The concentration of total suspended solids reaching the WWTPs increases during drought due to lower infiltration and dilution, Sydney Water have therefore been tracking closer to their licence limits in the last two years. Sydney Water have worked through the options of installing one or two digesters and their procurement and timing. It was found that the NPV break-even point for delaying was around 2030 for construction of two digesters separately.

We consider the proposed expenditure to be prudent, given that this was deferred from the current determination period.

From an efficiency perspective we consider there is significant room to learn lessons from the recently completed similar project at Malabar treatment works for which the same managing contractor was selected.

Wastewater Treatment Plant Renewals Program

This program includes the continued renewals of wastewater treatment plant assets. Within the comparable line item (SEM073) in the November 2019 SIR submission the proposed capital expenditure remains relatively constant from $211M in the 2016-2020 period to $206M in the 2020-2024 period. We have looked at all the Wastewater Treatment Plant Renewals (Existing Mandatory Standards) capital expenditure across all project line items as a whole to compare the like for like expenditure across both current and future determination periods. Combined expenditure in the current period is forecast to be $513M with a comparable proposed expenditure of $532M in the future period as shown in Figure 6-22 below.



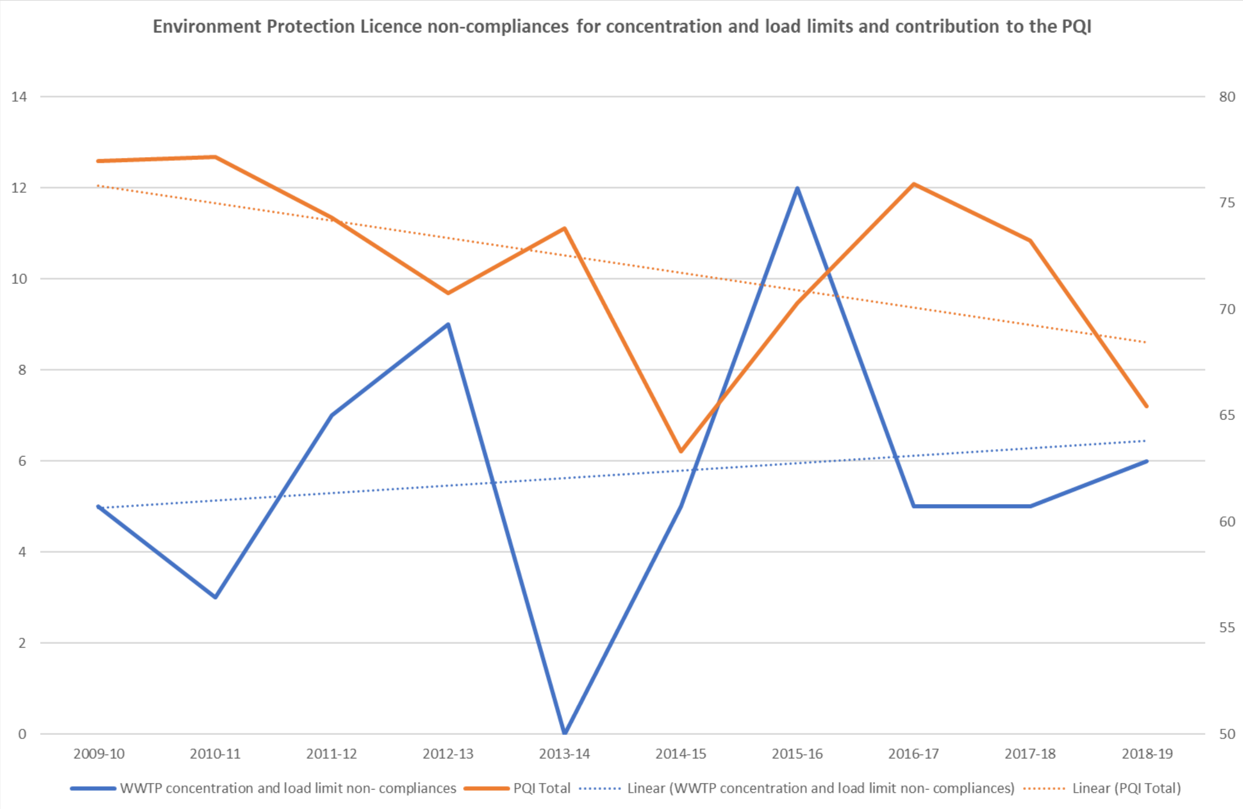
Source: November 2019 SIR/Atkins analysis

Figure 6-22 Wastewater treatment plant renewals capital expenditure

Sydney Water have proposed expenditure of $86M on four WWTP inlet works (major >$10M) projects. An Inlet Works Study was commissioned to assess 21 WWTP's with screening and grit assets as part of the preliminary treatment process. The screen and grit processes are essential to protect downstream processes from materials that cause blockages and wear on equipment and consume process capacity. Analysis undertaken during the study, indicate that 40% of all maintenance costs can be traced back to poor screening and grit capture at the front of the treatment plant. There is an expectation that this capital expenditure will have significant opex savings.

Current and forecast plant performance is not demonstrably linked to expenditure within the business case. However we acknowledge that there is complexity in showing direct causal links between renewals at a maintainable unit level through to ultimate impacts on service outcomes. We have been provided data for the last ten years for WWTP EPL exceedances of load limits as shown in Figure 6-23. Performance against WWTP EPL concentration and load limits compliance is relatively sensitive to a small number of incidents but long-term trends appear relatively stable.

Sydney Water have developed an internal metric called the Product Quality Index (PQI) to measure wastewater quality and the effectiveness of treatment processes compared to environment protection licence limits. It measures any interruptions to service to customers, and any reportable offences. The PQI provides the renewals program with a benefits measure to assess improvements to environmental performance, regulatory compliance, asset reliability and improved customer experience. Elements of the performance captured by the PQI are affected by prolonged dry weather. This is likely to be contributing to the reduction in the PQI from 2016-17 to 2018-19 and is likely to continue for several years based on the length of recent droughts (in the order of seven years in total). With a return to more stable weather conditions the PQI could be expected to increase back to levels in the mid '70s. The driver for the overall long term decrease in the PQI number in recent years appears to be the drought conditions which increases effluent solids concentrations into WWTPs.



Source: June 2019 SIR

Figure 6-23 Wastewater treatment plant EPL non compliances for concentration and load limits

The primary basis for the proposed program is the expected shift in the asset condition profile into the poor or very poor condition range which Sydney Water state is an 'unacceptable performance risk'. Within the business case Sydney Water have undertaken options analysis to test the base case by considering how a 10% reduction in capex would impact on the overall risk profile, exposure and potential consequences.

Sydney Water appear to have challenged the WWTP renewals programme from a top down efficiency perspective and hope to realise these via the P4S contracting model. This aligns with our overall analysis of Sydney Water's internal efficiency challenge in Section 3.4.5 above.

Furthermore, as the outcomes and benefits of Project See are being realised and there has been a shift away from reactive renewals towards planned works, this should help to reduce total capital expenditure on the program.

Renewals expenditure for this asset class has been significant over the last ten years and Sydney Water have demonstrated performance improvements across a range of measures we do not see a need to increase expenditure over and above levels in the current determination period.

The proposed increased expenditure in the future period does not appear to be delivering any greater performance benefits that cannot otherwise be attributed to changing exogenous factors. As such we recommend a programme level prudency adjustment to smooth the expenditure profile, and maintain expenditure in line with the current period as well as an increase of proposed expenditure for the final year in the period.

As we discuss in our review of Quaker's Hill and St Mary's WWTP above, and to ensure we have captured all WWTP renewals expenditure we have also included the proposed expenditure adjustment in our recommendations in Table 6-11 below.

Table 6-11 Wastewater treatment plant renewals expenditure

WWTP RENEWALS EXPENDITURE							
($k 2019/20) year ending June	2021	2022	2023	2024	2025	Total 2021-2024	Total 2021-2025
SWC proposed expenditure	146,314	117,266	120,997	147,527	90,313	532,104	622,417
Atkins WWTP program prudency adjustment	*(17,987)*	*11,060*	*7,330*	*(19,200)*	*38,014*	*(18,797)*	*19,217*
Atkins Quaker's Hill/St Mary's variation adjustment	*14,100*	-	-	-	-	*14,100*	*14,100*
Atkins total WWTP renewals adjustment	(3,887)	11,060	7,330	(19,200)	38,014	(4,697)	33,317
Atkins recommended expenditure	142,427	128,327	128,327	128,327	128,327	527,407	655,734

Source: November 2019 SIR

Wastewater Pumping Station Renewals (SEM072)

Sydney Water has 690 wastewater pump stations within its wastewater network that it considers require renewal. In the forward period (2021-2025), Sydney Water proposes expenditure for the entire wastewater pumping station program of $26.6 million per annum, a 15.6% increase on the $23.0m per annum expenditure in 2017-2020. However, for the four year period the average is $23.5 million with a sharp increase in year 5 of the forward program driving the average higher. The wastewater pumping station program in the forward period, included three vacuum sewerage schemes for renewal (SEM097) which is one driver for increased expenditure. The increase is after a 22% efficiency challenge applied top-down by Sydney Water. The following analysis concentrates on wastewater pumping station renewals not including the vacuum systems (i.e. SEM072).

Sydney Water's regulatory submission includes no expenditure for civil works (dry wells and wet wells) across its WWPS assets. This is very surprising given the likelihood that some of these assets would fail or be near failure during the forward period. When challenged, Sydney Water expressed its view that the better information it has gained since responding to the Northmead event suggests that expenditure on WWPS civil asset is highly likely in the forward period.

The emergent need for Level 2 condition inspections (and possibly Level 3) and the highly likely scope of civil works arising undermines Sydney Water's stated understanding of it risk across the WWPS asset class. Given better information on the condition of the civil assets, it is likely that a difference program would have been proposed. Comparing to the long term trend, it is highly likely that a step change in expenditure will be required. We propose an adjustment to Sydney Water's expenditure forecasts for the forward period of $5 million per annum to account for the works arising from the more detailed condition assessments. This is shown in Table 6-12.

Table 6-12 Wastewater pumping stations renewals expenditure

WASTEWATER PUMPING STATIONS RENEWALS EXPENDITURE							
($k 2019/20) year ending June	2021	2022	2023	2024	2025	Total 2021-2024	Tota l 2021-2025
SWC proposed expenditure	22,954	24,380	23,141	23,580	27,172	94,054	121,22 6
Atkins adjustment	5,000	5,000	5,000	5,000	5,000	20,000	25,000
Atkins recommended expenditure	27,954	29,380	28,141	28,580	32,172	114,054	146,22 6

Source: June 2019 SIR

Sewer main renewals (SEM055 - Avoid Fail Wastewater Main Renewals (Critical Sewer), SEM042 - Dry Weather Overflow Reduction Program (Reticulation Sewer))

As discussed above, Sydney Water classifies its sewers as critical and non-critical depending on the potential consequences of failure of the segment of sewer. For sewers classed as critical Sydney Water adopts an “avoid-fail” strategy. Sydney Water has changed its classification of sewers that may overflow to waterways so that all sewers that may overflow to waterways are now classified as critical. Previously many were classified as non-critical. This make comparisons between the past and future difficult for the non-critical and critical sewer programs in isolation. Therefore, we have considered expenditure jointly for the future period.

In response to the draft report, Sydney Water outlined that the sewers that may overflows to waterways and affected by the change in classification are less than 10% of the total length of all sewers. The change in classification reflects that Sydney Water will now manage these assets proactively to identify and address sections of sewer main in poor condition that may cause overflows ideally before an overflow occurs. We acknowledge that this cohort of sewers is now subject to a different management approach and we agree that this is appropriate. We have considered expenditure across all programs together because there are performance measures, such as the overall choke rate, which will be influenced by all investment. Also, general provisions within the Protection of the Environment Operations Act 1997 for pollution to land will also be influenced by expenditure as a whole. We recognise the different asset management strategies for the sewer main asset class and have sought to reflect this throughout this analysis where appropriate,

The following performance standards relate to sewer mains:

i. Operating Licence – Wastewater overflow standard

ii. Environmental Protection Licence

  (a) Total chokes for all systems

  (b) Dry weather overflows to waterways (system specific)

Operating Licence - Wastewater Overflow Standard

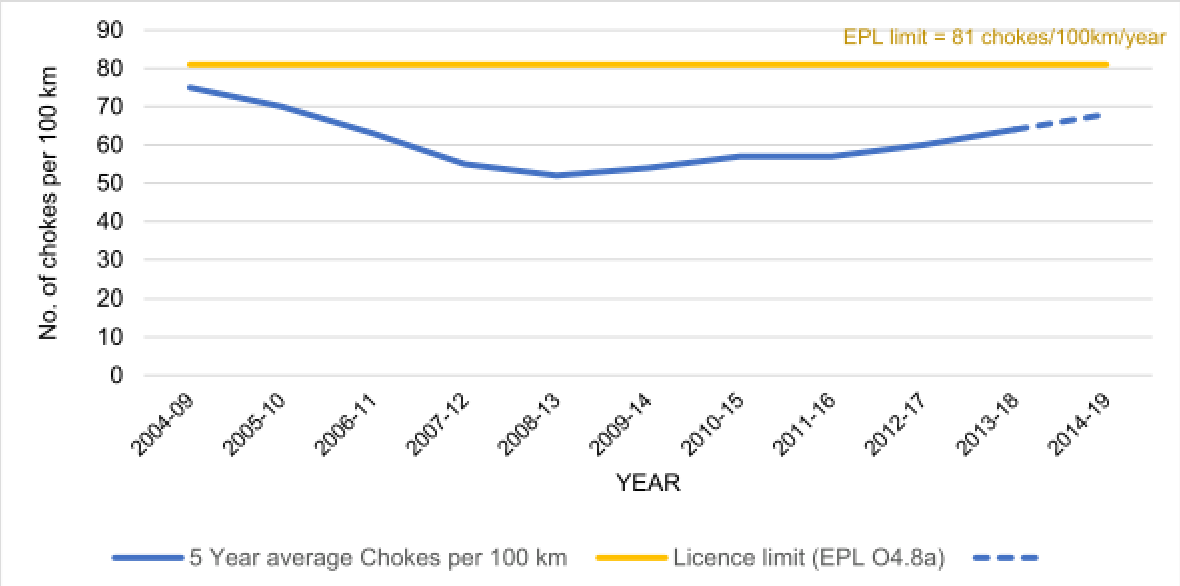
The Wastewater Overflow Standard in Sydney Water’s Operating Licence requires that:

- No more than 14,000 properties (other than public properties) experience an uncontrolled dry weather overflow per year
- No more than 175 properties (other than public properties) experience three or more uncontrolled dry weather overflows per year.

Sydney Water is performing well within these standards.

Environmental Protection Licence – Total chokes

Sydney Water's Environmental Protection Licence requires that on a rolling five-year average, there are less than 81 chokes per 100 kilometres of sewer. Sydney Water’s five year rolling average choke rate for the wastewater reticulation system is shown in Figure 6-24.



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Source: Sydney Water Corporation submission Attachment 2 – Figure 3-1

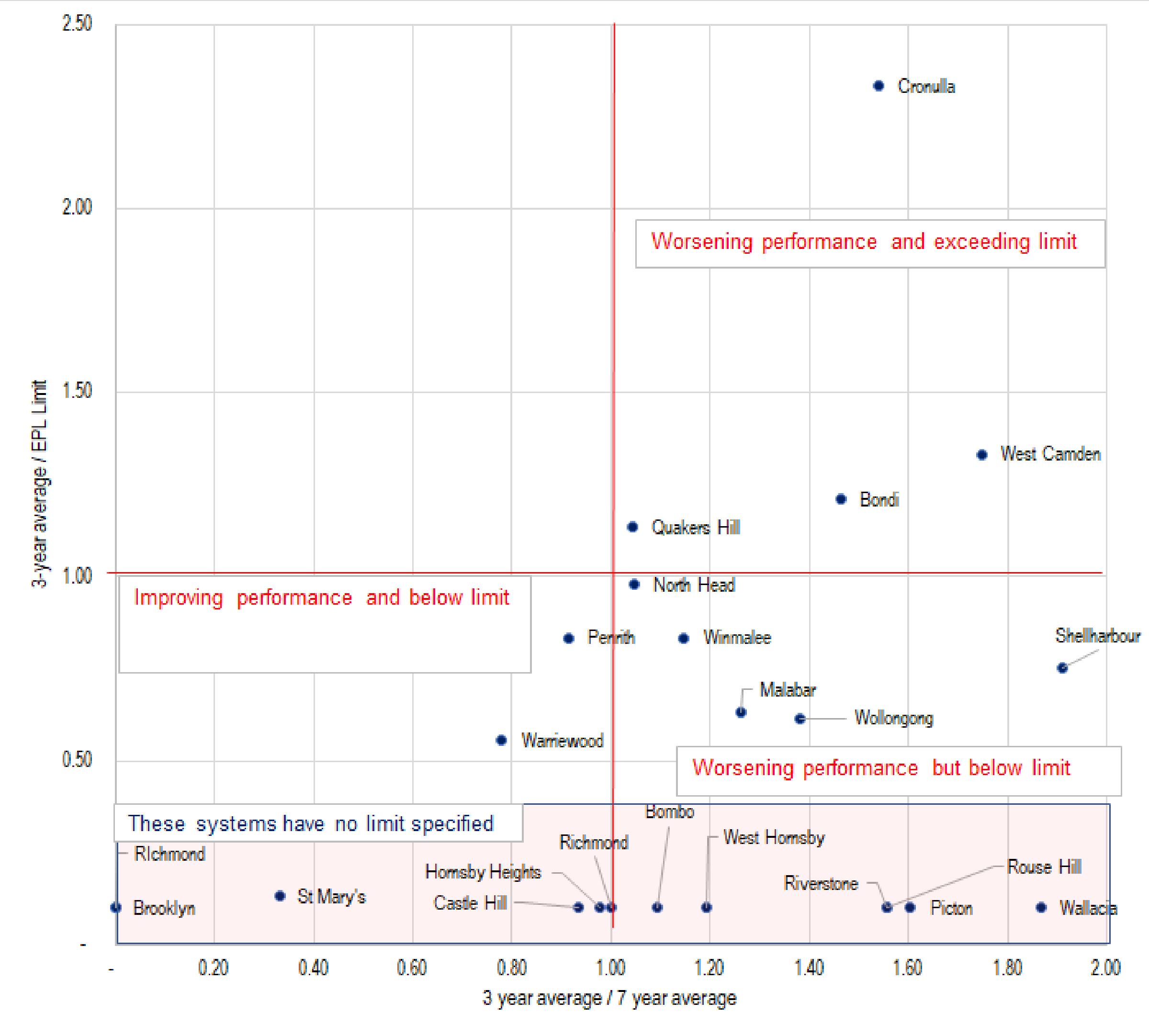
Figure 6-24 Sewer choke trend 2004 - 2019

Recent years have seen a decline in Sydney Water's performance on this measure which Sydney Water attributes largely to the very dry conditions leading to increased root intrusions into the pipe network. However, in the November 2019 update to its regulatory submission, Sydney Water notes that the proportion of chokes attributable to root intrusion has been decreasing in recent years with debris in particular increasing proportionally. Sydney Water considers that without a proactive intervention program, it will breach the five-year rolling average in 2021. However, wetter weather (i.e. a return to average weather) would also likely improve performance in this timeframe all else being equal, albeit at a slower rate than under a more proactive approach. The longer term trend for sewer chokes from 2000 shows that Sydney Water has made clear improvement in driving down the overall choke rate as measured by the five year rolling average. Sydney Water notes that the improvement observed from 2005/06 onward was due to an intensive five year choke reduction program.

Environmental Protection Licence – Dry weather overflows to waterways

Sydney Water's Environmental Protection Licence requires that the number of dry weather overflows to waterways meets the specified limit for each system where an EPL is in place. As noted in Section 3.2.2, where an EPL is not in place, Sydney Water needs to comply with the requirement in the Protection of Environment Operations Act where pollution of land or water is an offence.

We requested Sydney Water to provide the actual number of dry weather overflows to waterways from each system in each of the past seven years. We then compared the average number of overflows in the last three-years to the seven-year average as a measure of whether performance was declining or improving. We also compared the three year average to the limit specified in the EPL. Note that many systems do not have a limit specified. The results of this analysis are shown in Figure 6-25.



Source: Atkins-Cardno analysis of Sydney Water information (354.1)

Figure 6-25 Dry weather overflow to waterway performance

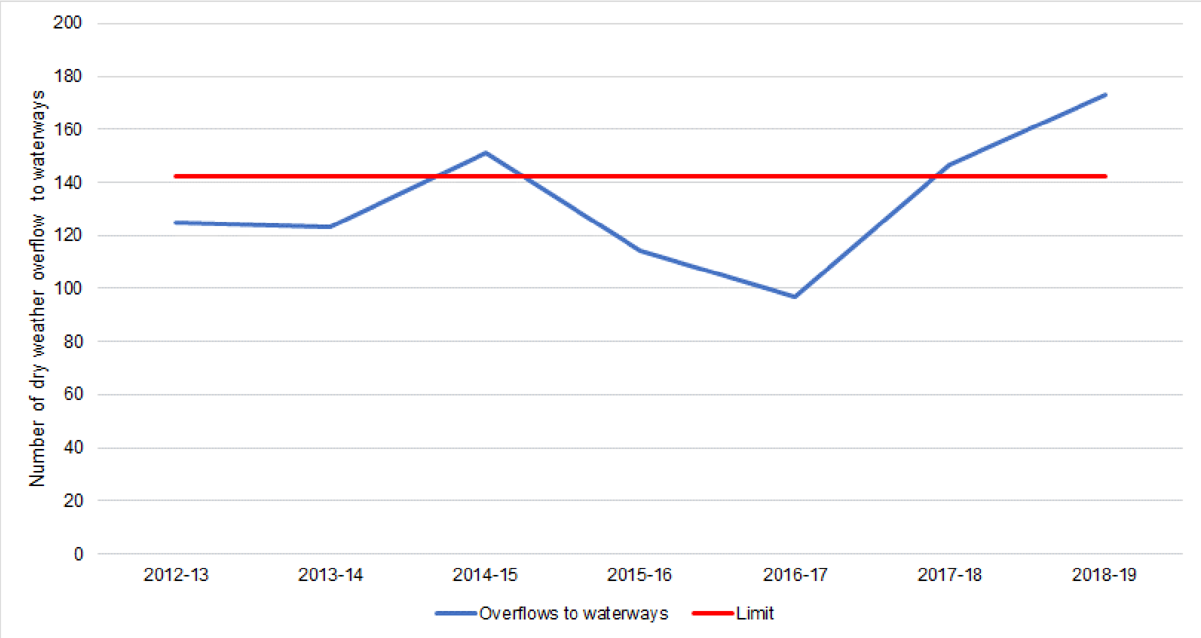
This analysis shows that:

1. Eight of 23 systems show improving performance (this includes Richmond which has registered zero overflows to waterways in all years). All of these systems are also below the license limit where specified
2. 11 of 23 systems show worsening performance but performance is still below the license limit where specified
3. Four of 23 systems show worsening performance and average performance in the last three years exceeds the license limit. These four systems and their corresponding limits are:
   - Cronulla (18)
   - Quakers Hill (5)
   - Bondi (19)
   - West Camden (3)

Cronulla is a stand out in terms of deteriorating performance with the three year average 2.33 times the seven year average. All of these systems are much smaller than the large systems of North Head and Malabar. Malabar has shown some decline in performance in recent years but it is still well below the licence limit.

In response to the draft report, Sydney Water detailed that it was concerned that this analysis does not reflect actual performance as it masks non-compliance given that any exceedance of the limit represents a non-compliance, there is no allowance for averaging of performance. We understand that compliance is measured annually (and have discussed this in Section 3.2.2). The purpose of this analysis is to illustrate trends in performance over time and the level of performance (or non-compliance). We are also interested in Sydney Water's understanding of the drivers of performance and how performance varies over time given that climate (which is out of Sydney Water's control) is one factor affecting overflows. This analysis also shows that despite Sydney Water being consistently non-compliant in four systems over the three year average and very close to non-compliant for one further system (North Head), it has faced no regulatory action for these non-compliances until now. Regulatory action in the form of a mandated Pollution Reduction Program for the North Head and Cronulla systems has now been formalised (in November 2019).

Performance of the North Head system specifically (Figure 6-26) has been variable over the period with improving performance in 2015/16 and 2016/17 preceding deterioration in the last two years.



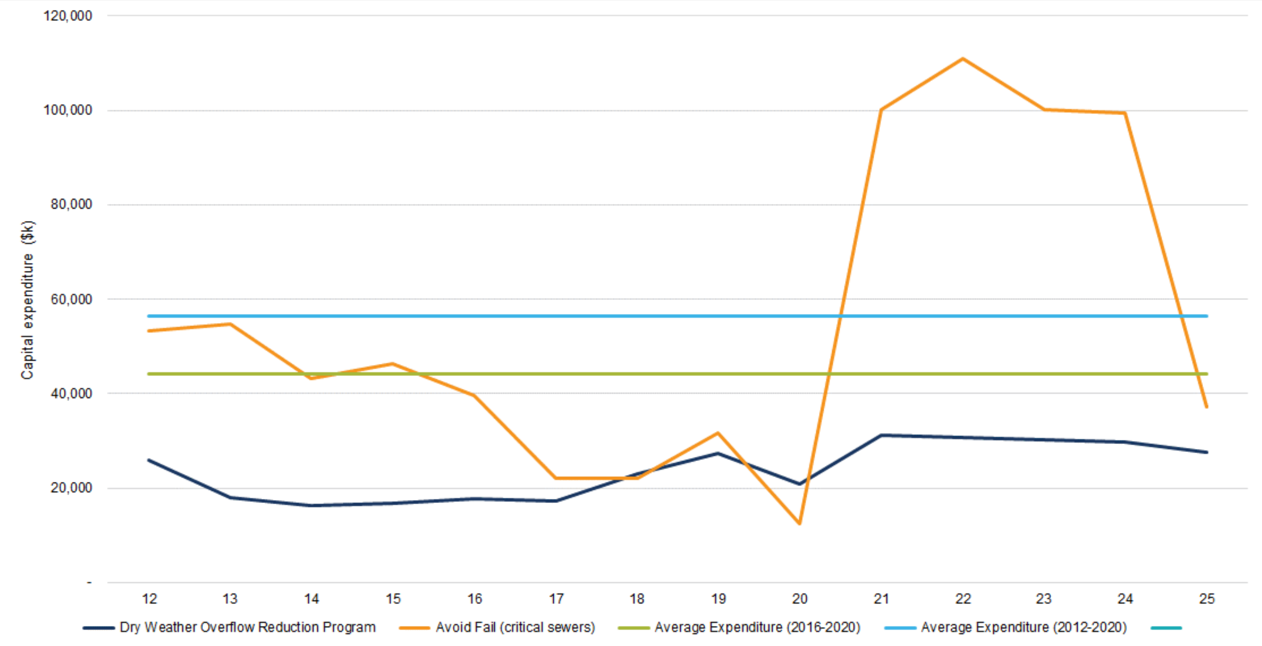
Source: Atkins-Cardno analysis of Sydney Water information (354.1)

Figure 6-26 Dry weather overflows to waterways performance - North Head

As part of its November 2019 updates to its regulatory submission, Sydney Water advised that the EPA has now formalised a requirement that the North Head and Cronulla Networks need to be brought into compliance with the system level standards for dry weather overflows to waterways. The EPA requires that compliance needs to be achieved by 30 June 2021. While Sydney Water was in discussions with the EPA regarding this Pollution Reduction Program at the time of preparing its submission, the direction has come after Sydney Water’s regulatory proposal was submitted and following our initial review work. The timing of the direction makes it difficult for Sydney Water to take a measured approach to achieving compliance for these systems.

While the above performance measures relate to the occurrence of overflows, Sydney Water also has regulatory obligations to limit the impact of overflows on the environment. This relates to the response and clean-up of overflows. In this area, Sydney Water has faced increased regulatory oversight and enforcement action in recent years. From January 2018 to April 2019, 15 of 27 EPA actions imposed on Sydney Water related to incidents in environmentally sensitive bushland. In these isolated locations, overflow detection can be late, which allows more time for released effluent to reach natural waterways. Clean-up activities for these locations are also often costly.

Sydney Water is proposing an extraordinary increase in capital expenditure on the renewal of sewer mains in the forward period. This is shown below for all expenditure from 2012 to 2025 (actual, forecast and proposed).



Source: November 2019 SIR

Figure 6-27 Expenditure on sewer main renewal 2012 - 2025

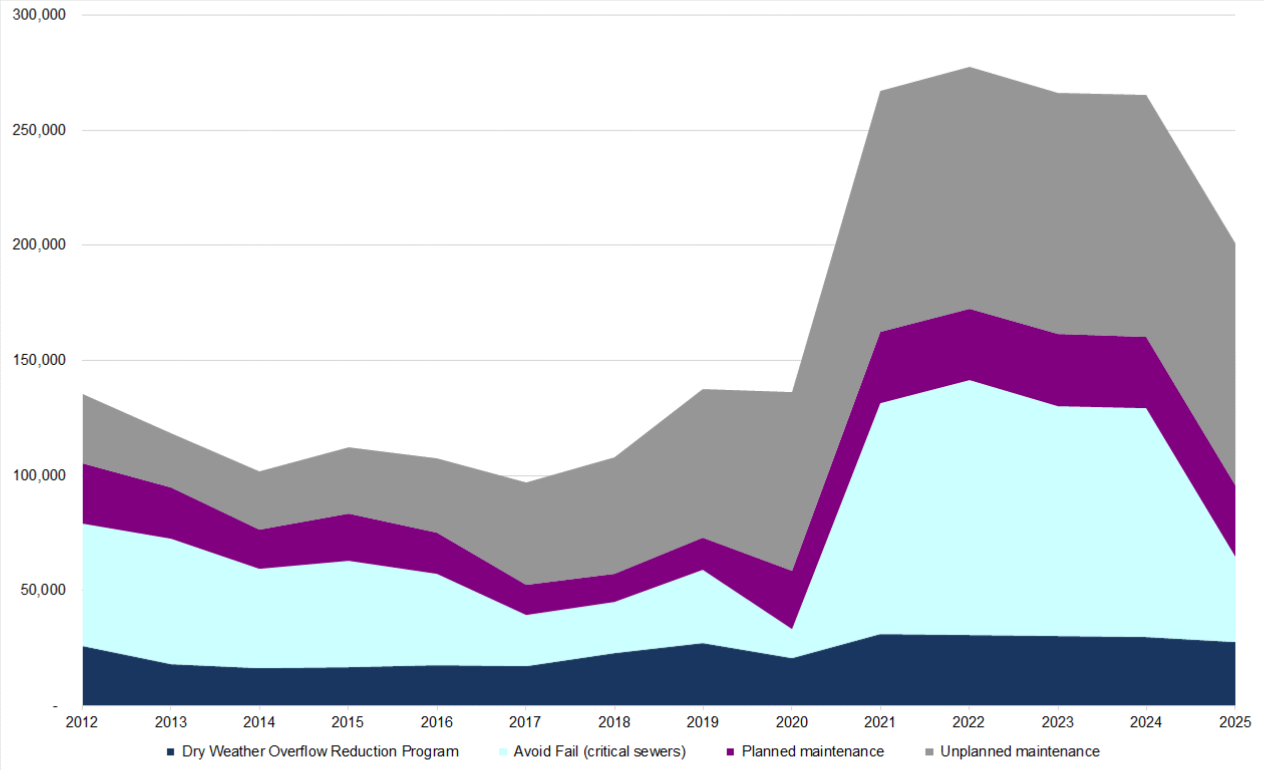
The critical sewer renewal program is proposed to increase from $22.1 million per annum by a factor of four to $90 million per annum (2021-2025). This is largely attributable to the program targeting dry weather overflows to waterways. The program for reticulation sewers also shows considerable increase, by 41% so that average annual expenditure in the forward period is proposed at $30.0 million per annum compared with $21.2 million per annum in the current period. This increase in expenditure for non-critical sewers is for a reduced cohort following the reclassification of sewers impacting waterways out of this program. This has reduced the non-critical sewers cohort by about 10%.

There is a trade-off between capital and operating expenditure for the management of sewers across their lifecycle when managing to performance. Opex activities such as CCTV, root cutting and cleaning and may reduce the need for capital works that renew the mains. Similarly, renewal of the assets should reduce the need for ongoing operating expenditure. Therefore, it is somewhat surprising that while Sydney Water proposes extraordinary increases in capital expenditure for sewer mains it also proposes extraordinary increases in unplanned maintenance as shown in Figure 6-28.

In response to the draft report, Sydney Water made the following observations regarding this analysis:

- Unplanned maintenance expenditure does not permanently reduce chokes as 67% recur with three to four years
- The critical sewers program (waterways) does not address chokes and overflows in the balance of the network – this expenditure is sourced from the dry weather overflow reduction program.

Consequently, Sydney Water concludes that the reactive opex and targeted waterways program are justified to address the different needs for maintaining performance of the sewerage network and that the proactive waterways program will not quickly reduce the need for increased opex.



Source: Sydney Water November 2019 SIR

Figure 6-28 Sewer main totex 2012 - 2025

The movement in each program for the preceding, current and future periods is quantified in Table 6-13.. While the critical sewers program is the largest absolute and proportionate increase between the current period and the future period, all program increase by at least 29% and the increase in totex is 121%.

Table 6-13 Sewer main totex by program 2012 - – 2025

All figures $19/20, $'000	Avg. 2012-2015 ($'000 p.a.)	Avg. 2016-2020 ($'000 p.a.)	Avg. 2021-2025 ($'000 p.a.)	Variance ($'000 p.a.)	Variance (%)
Dry Weather Overflow Reduction Program (capex)	19,281	23,169	29,961	6,792	29%
Avoid Fail (critical sewers) (capex)	49,324	22,108	89,577	67,469	305%
Planned maintenance (opex)	21,425	16,440	31,000	14,560	89%
Unplanned maintenance (opex)	26,925	53,940	104,900	50,960	94%
Totex	116,955	115,657	255,438	139,781	121%

Source: November 2019 SIR

There is a clear need for Sydney Water to act to meet its Operating Licence and EPL limits relating to overflows from the wastewater network. While performance against the Operating Licence and the EPL limit for total chokes are within limits, performance against the EPL limits for dry weather overflows has failed for seven systems in the last three years and 15 of 23 systems show deteriorating performance. Sydney Water has very recently received a formal direction from EPA to bring the North Head and Cronulla systems into compliance and this needs to be done quickly – by 30 June 2021. The systems are not uniform – the North Head and Malabar systems have licence limits an order of magnitude higher than the other systems. We accept that there is a strong need for Sydney Water to increase its activity to address deteriorating performance evidence by the increase in dry weather overflows to waterways.

While recognising the materiality of the challenge Sydney Water faces in achieving compliance for these systems, we are concerned that Sydney Water's response to the observed deterioration in performance is disproportionate to the rate of deterioration and its level of performance with respect to its licence limits. Both capex and opex are proposed to increase substantially – by 118% between the current and forward periods. Sydney Water has noted that sewer chokes due to roots are declining as a proportion of total chokes meaning that efforts may be better focused on activities other than relining. There is also the potential that a return to average climate conditions may improve performance (albeit with a backlog of partial or potential blockages due to tree roots that will require cleaning). The most immediate performance challenge is meeting the dry weather overflows to waterways standard for the North Head and Cronulla catchments by 30 June 2021. However, there are five more catchments that have been non-compliant or been close to non-compliance in recent years.

We see no justification for the increase in the reticulation sewer program above historic averages given that a proportion of sewers with the potential to overflow to waterways have been reclassified from non-critical to critical and the substantial expenditure on this cohort. This would lead to a reduction in scope of the reticulation program with all else being equal. Also, the performance measures that apply to both critical and non-critical sewers – the overall choke rate and internal overflows – should see benefit from the substantial investment in the sewers that overflow to waterways. We recommend an adjustment to this program to match the 2016-2020 annual average, a total reduction of $37.1 million (Approximately 30% of the scope).

We also recommend that the scope of the overflows to waterways program be reduced by one tenth. This is to:

- better match the magnitude of expenditure with the challenge faced by Sydney Water. While not underestimating the seriousness of the compliance challenge, totex on sewer mains is proposed to increase by 118% in the future period with this program a large driver of expenditure
- account for potential overlap with the benefits of the concurrent ramp up in unplanned maintenance. While Sydney Water notes that reactive opex (cleaning, root cutting and sometimes CCTV survey) will not prevent future chokes from occurring, there will be some deferral or moderation of chokes and through reactive opex, information will be gained on failure modes and underlying causes that will allow improved management of the network.
- Moderate the timing of expenditure to a small extent. In our opinion, a more considered approach that evolves to better information and continually improves will provide better value for money to customers. However, the recent formalisation of the Pollution Reduction Plan for the North Head and Cronulla systems which requires compliance by 30 June 2021 makes it difficult for Sydney Water to be measured in the timing of its response in these locations which has in part led to us making a smaller scope adjustment than what we may have proposed in other circumstances.

The impact of this scope adjustment to the critical sewers (overflows to waterways program) is a $18.4 million reduction in the level of prudent and efficient expenditure.

We also see no reason for no efficiency challenge having been applied to the critical sewers program. Firstly, this is inconsistent with Sydney Water's approach and there is no obvious reason to exclude this program. Secondly, this program is only in its infancy; greater efficiencies are likely to be realised in less mature programs such as this. We propose that this program have a 18% efficiency challenge applied. This efficiency adjustment has only been applied to the critical sewers and is applied after the scope adjustment set out above. The impact of the efficiency adjustment is to reduce recommended prudent and efficient expenditure by $84 million. This should not lead to any reduction in scope.

In response to the draft report, Sydney Water raised concern over the application of an 18% efficiency challenge due to the challenges its face in environmental performance and compliance risk. We consider that it is important to separate out compliance risk and risk to achieving efficient delivery. We accept the compliance risk and we accept that expenditure needs to be adjusted to reflect this risk and apparent deteriorating performance. However, we do not agree that this "risk" extends to achieving efficient delivery. Sydney Water has spent considerable time moving towards a new procurement model that it has designed to deliver the forward program efficiently. At our interviews , Sydney Water also outlined that it considers that there is adequate market capacity to deliver the increased program. This work is also non-complex technically, repeatable and an area in which new innovations are emerging. There is no reason that we can see that Sydney Water would not be able to, or should not aim to, achieve the same level of efficiencies it expects to achieve in other areas of its program. We therefore maintain that the 18% efficiency adjustment to the critical sewer is appropriate. This efficiency challenge has only been applied to the critical sewers component of sewer mains expenditure net of the scope adjustments outlined previously.

Our proposed adjustments are summarised in Table 6-14.

Table 6-14 Sewer main renewal program adjustments

Sewer main renewal program							
($k 2019/20) year ending June	2021	2022	2023	2024	2025	Total 2021-2024	Total 2021-2025
SWC proposed expenditure	131,394	141,614	130,401	129,366	64,919	532,775	597,694
Atkins adjustment	(33,433)	(34,879)	(32,477)	(31,916)	(6,704)	(132,706)	(139,409)
Atkins recommended expenditure	97,961	106,735	97,924	97,450	58,215	400,069	458,284

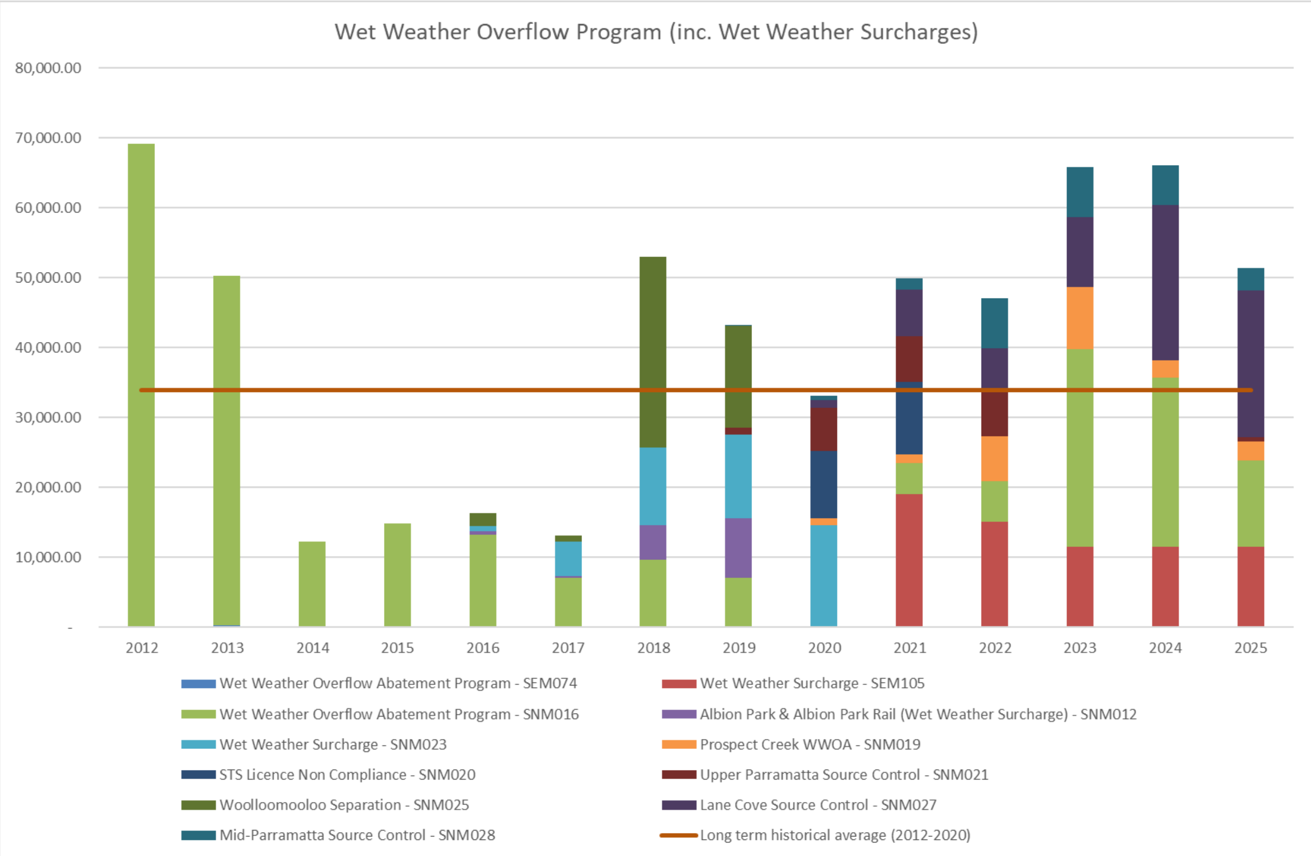
Source: November 2019 SIR

6.5.2. New mandatory standards

6.5.2.1. Current Determination Period (2016 - 2020)

Wet Weather Overflow Abatement Program (SNM016)

Throughout the 2012 and 2016 Determination periods Sydney Water reported and managed expenditure for Wet Weather Overflow and Wet Weather Internal Surcharge mitigation projects as a combined program. As shown in Figure 6-29 below combined expenditure across the overall program has varied significantly between each determination period. Historically Sydney Water invested significantly in large volume storage and treatment solutions with significant capex requirements. Throughout the current determination period there has been a shift towards source control solutions as well as mitigation internal surcharges through increasing hydraulic capacity. Moving forward the Wet Weather Overflow abatement programme is being treated as a separate program to Wet Weather Internal Surcharges. We discuss this in more detail in Section 6.5.2.2 below.



Source: Sydney Water June 2019 SIR submission and Atkins/Cardno analysis

Figure 6-29 Wet Weather Overflow and Wet Weather Surcharge SWC expenditure

6.5.2.2. Future Determination Period (2021 - 2025)

Wet Weather Overflow Abatement Program (SNM016)

Sydney Water has been negotiating with the EPA to agree an alternative to the frequency targets for Wet Weather Overflow Abatement in its four largest coastal wastewater systems (North Head, Malabar, Bondi and Cronulla) since 2013. In 2015 Sydney Water engaged an economic consultancy to complete non market valuations on the benefits of wet weather overflow abatement (public health protection, environmental improvement and improving waterway aesthetics and amenity).

The valuations were then used to assess the regulatory framework that was agreed in principle with the EPA in 2015. After failing to agree a regulatory framework with the EPA in 2015 negotiations commenced again in 2017. In 2018 a new risk assessment methodology to prioritise ~1,000 overflows across the four systems was agreed with the EPA. The EPA proposed a regulatory measure requiring Sydney Water to reduce the level of risk from Category 1 overflows (highest risk) to Category 3 (moderate risk). To meet this requirement, Sydney Water would need to reduce the volume of many high risk overflows by up to 99%. The cost to store this volume of wastewater was deemed to be excessive.

Sydney Water engaged an economic consultancy to re-run the 2015 CBA based on the new proposed regulatory requirement. This analysis showed that the regulatory requirement was unachievable in most instances and a small number of sites had a positive cost benefit for this level of abatement. Sydney Water engaged directly with the EPA to explain this analysis and the underlying assumptions in the CBA. The EPA economist validated that the approach was robust and appropriate. Subsequent to these discussions, Sydney Water and the EPA negotiated an alternative regulatory measure, which allows Sydney Water to achieve its regulatory requirements using source control solutions. (on both Sydney Water and privately owned assets) Source control solutions combined a range of approaches to divert water from the network and are considered much more cost effective solution than storage or treatment. The regulatory measure was not agreed with the EPA in time to inform Sydney Water's program business case or June 2019 pricing submission. These were based on the draft 2018 regulatory measure.

Sydney Water and the EPA are in agreement that source control presents good value for money to the community and can drive significant environmental improvement over large geographic areas. This will be the focus of the 2020-24 period across three priority catchments. After Sydney Water had submitted its submission to IPART, the EPA has outlined their intent to impose a more stringent improvement level which would require additional funding and source control work to occur across five catchments (instead of three).

Sydney Water proposed total expenditure of $172M within its July 2019 submission to IPART which was based on an internally approved business case finalised in June 2019. At the time of the June submission three priority catchments were identified with source control projects chosen as the primary focus of abatement. These projects corresponded to 40 EPA credit points for investment which manages environmental impact (this is an offset regime). These projects involve $141M expenditure out of the total $172M ($31M is for other wet weather overflow abatement activities). Subsequent to the IPART submission and following further discussions with the EPA, it was mandated that Sydney Water are required to achieve 60 credit points within the 20220-24 regulatory period.

In its November update to its pricing proposal, Sydney Water detailed that an additional $52M of capital expenditure would be required to achieve the additional 20 credit points. The cost and benefit (credit points) of the 40 point and 60 point programs are summarised below.

Table 6-15 Revised wet weather overflow abatement program

	Capital expenditure ($M)	Points	$M per point
Original 40 point program	141	40	3.5
Additional 20 points	52	20	2.6
Revised 60 point program	193	60	3.2

We challenged Sydney Water regarding the decreasing marginal cost of addressing the wet weather overflows – the additional 20 points are only three-quarters of the cost of the first 40 points ($2.6M per point compared with $3.5M per point). The implication is that the initially proposed (40 point) program is less value for money than the revised program (60 point). Sydney Water responded that the 40 point program was focused on larger catchments which were prioritised because of their size. Initial work has since provided better estimates of the costs of abatement works which has led to the estimates of the revised program.

Notwithstanding the above evaluation of the marginal incremental costs of achieving additional credit points we consider that the original program of work based on 40 points was not challenged from an efficiency perspective by Sydney Water. The building block component projects of the program were not finalised at the time of our initial review.

As this target is now an environmental obligation and mandated by the EPA, from a prudency perspective, we have no further opinion. Sydney Water appear to be on the back foot in terms of planning and procurement for the projects so we consider there to be program efficiencies to be made once a more detailed procurement strategy has been developed and the market tested. The reduced marginal cost of the additional works (a 25% reduction on the original program) supports that there are likely efficiencies to be gained by further development of the delivery of this program. We have therefore made a program level efficiency adjustment of 18% to bring the efficiency challenge in line with other programs we have seen that Sydney Water have internally challenged themselves on as shown in Table 6-16.

For the avoidance of doubt we are not promoting any changes in scope, outputs or increase in performance risk sharing by Sydney Water.

Table 6-16 Wet Weather Overflow Program – recommended expenditure adjustment

WET WEATHER OVERFLOW PROGRAM							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021-2025**
SWC proposed expenditure	51,004	59,712	60,715	52,669	-	224,100	224,100
Atkins recommended adjustment	(9,181)	(10,748)	(10,929)	(9,480)	-	(40,338)	(40,338)
Atkins recommended expenditure	41,823	48,964	49,786	43,188	-	183,762	183,762

Source: November 2019 SIR

6.5.3. Growth

6.5.3.1. Current Determination Period (2016 - 2020)

Wastewater growth expenditure from 2016 to 2020 inclusive is expected to be $757.6M according to the November 2019 submission, much larger than water growth capex.

As with the water service, the largest single line item in the submission in the current period relates to “Developer Operations”. The second largest wastewater growth project line relates to Riverstone STP Amplification. This is followed by “SWPGA – SW Front Servicing” which was miscoded as a sewerage project in the June 2019 submission and is actually a water service project as discussed above. After this all projects are smaller than $50M.

Table 6-17 Largest wastewater growth projects from 2016 to 2020

Rank	Title	Capex (16-20)
1	Developer Operations	127.0
2	Riverstone STP Amplification	124.9
3	SWPGA – SW Front Servicing	63.0
4	CA - Marsden Park Resid STG1	45.1
5	Picton Sewerage Scheme Amplifion Stage 2	40.8
6	WWTP Dewatering Program	38.6
7	Growth - Minor Northwest Growth Centre Projects <$10m	36.3
8	Quakers Hill/St Marys PARR	35.0
9	Growth - Other Minor Greenfield Projects <$10m	32.9
10	Marsden Park SPS 1173	31.4

Source: June 2019 SIR

6.5.3.2. Future Determination Period (2021 - 2025)

Sydney Water has proposed a much larger program of $1,286.8M between 2021-24 or $1,711.7M between 2021-25. The proposed 2021-24 expenditure would constitute a 70% increase in average water growth expenditure.

It includes a number of very large projects as can be seen below.

Table 6-18 Largest wastewater growth projects between 2021-25

Rank	Title	Capex $m (2020-2025)
1	West Camden WWTP - Biosolids Upgrade and Amplification	165.9
2	Northwest Treatment Hub - Rouse Hill	162.3
3	Lowes Creek WWTP Effluent Transfer	154.9
4	Lowes Creek WWTP Stage 1	144.0
5	South Creek WWTP Stage 1	132.0
6	Developer Operations	94.5
7	Richmond / North Richmond Amplification	94.1
8	Northwest Treatment Hub - Riverstone	82.3
9	SPS 67 Replacement	75.6
10	Lowes Creek - Land	61.5

Source: June 2019 SIR

Upper South Creek

This investment relates to increase wastewater treatment capacity to service the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA).

At the time of preparing its pricing submission, the plans were at an early stage and Sydney Water expected it would need to develop two WWTPs spread across SIR lines as follows:

- Lowes Creek WWTP (SG0084, 85, 86)
- South Creek Treatment Plant (SGO101, 102, 103)

In January 2019, Sydney Water approved funding (at NABC stage) to complete the planning phase and determine whether one or two WRPs would be preferred. Since the submission, Sydney Water has developed the Upper South Creek and West Camden Wastewater Servicing Plan (August 2019), which concluded that a single Upper South Creek Resource Recovery Facility (RRF) will best meet the servicing objectives for the region at lowest cost.

The options appraisal undertaken to justify moving to a single treatment plant appears reasonable. However, the scheme is at a fairly early level of definition and refinement, with two potential sites under consideration and concept design not yet complete.

Sydney Water does not build new wastewater treatment works often. The cost estimates for the treatment elements are based on a mix of an international consultant's cost estimation database and recent Sydney Water experience at Quakers Hill and Riverstone, which involved a lot of new construction, albeit a more conventional treatment process.

Because it is a large project, it will pass through Infrastructure NSW's approval processes. This will start once concept design is complete. The approval process may have program impacts. It may also lead to a recommendation affecting procurement such as the use of a BOOT contract. This would clearly have a significant impact on capex/opex. However, the impact of the decision on overall revenue requirements may be limited so we have assumed that it will be treated as ordinary capex.

Sydney Water's capex estimate is summarised as follows:

	Investment (2019/20) ($m)	Investment (2020/21) ($m)	Investment (2021/22) ($m)	Investment (2022/23) ($m)	Investment (2023/24) ($m)	Investment (2024/25) ($m)	Investment 2025-29 ($m)
[redacted]		-	-	-	-	-	-
Airport interim: 1 ML/d tertiary treatment plant (assumed SWC to service)	1.0	20.0	20.0	-	-	-	-
Effluent transfer to Nepean River	-	-	-	-	49.9	49.9	-
Stage 1: 42 ML/d tertiary treatment plant	2.2	5.0	20.5	162.9	162.9	162.9	-
RO treatment and brine transfer	-	-	-	-	-	139.4	175.9
Totals	79.1	25.0	39.5	162.9	212.8	352.2	175.9

Source: 293.12 session 34 Lowes Creek WWTP and South Creek WRP

Figure 6-30 Sydney Water's cost estimate for the Upper South Creek scheme ($18-19M)

The overall capex of the Upper South Creek project is similar to the previous two treatment plant solution ($1,074M in $19/20 rather than $1,082M). However, Sydney Water is now proposing to bring the expenditure forward significantly increasing the proposed spend in the next Determination period (by $143.1M from 2020-2024) as summarised below.

We find that at this stage, and subject to ongoing monitoring of outturn development in the areas to be serviced, the proposal to construct a new treatment facility appears prudent. However, the early stage of definition of the project and the need to pass through Infrastructure NSW's gateways means that we are not convinced that expenditure will be undertaken on the timescales set out in the presentation made to us. We have made a number of adjustments to reflect this view, for example we assume:

- Land purchase happens in 2021 rather than 2020.
- Some of the construction of the 42Mld tertiary treatment takes place in 2026 rather than completing in 2025.
- A third of the RO treatment and brine transfer takes place in 2025 rather than 44%.
- Effluent transfer capex takes place a year later than forecast by Sydney Water in 2025 & 2026.

Table 6-19 Difference between submission and revised Sydney Water proposal

$m 2019-20 year ending	2020	2021	2022	2023	2024	2025	After 2025	Total capex	Spend in 2020-24	Spend in 2020-25
Lowes Creek and South Creek total spend	6.0	10.7	22.1	138.2	199.2	195.0	511.0	1,082.2	376.2	571.2
SWC proposed Upper South Creek treatment plant	81.6	25.6	41.5	167.0	218.1	361.0	180.3	1,075.1	533.8	894.8
Atkins Cardno View										
Adjusted expenditure	3.3	103.9	41.5	150.3	150.3	309.2	316.6	1,075.1	449.3	758.5
Adjustment to SIR	-2.7	93.2	19.4	12.1	-48.9	114.2	n/a	n/a	73.2	187.3
Adjustment relative to Upper South Creek proposal	-78.3	78.3	-	-16.7	-67.8	-51.8	136.3	0.0	-84.5	-136.3

Source: June 2019 SIR and presentation "293.12 session 34 Lowes Creek WWTP and South Creek WRP"

Richmond / North Richmond Amplification

This project relates to increasing the wastewater treatment capacity in Richmond and North Richmond in the North West of Sydney to deal with growth in the catchment and to improve the quality of the treated effluent.

An options appraisal was completed in 2015 but is currently being revisited in the light of the Hawkesbury Nepean Nutrient Framework (HNNF) which means that treated effluent will need to achieve lower nutrient levels.

Influent load at both plants is increasing significantly year on year. The capacity of North Richmond WWTP is expected to be exceeded need year. It is non-compliant with the wet weather overflow limit and as a result part of one oxidation ditch has been sacrificed to provide storm storage. Significant growth is expected in the catchment exacerbated by the rezoning of Redback to provide 1,400 dwellings, with more than 450 constructed to date.

The proposed project consists of two stages:

- Stage 1 – capacity upgrade, which involves decommissioning the existing North Richmond WWTP, a transfer from North Richmond WWTP to Richmond WRP and amplification of Richmond WRP. The GSIP envisages completion in 2022.
- Stage 2 – which is to upgrade the quality of the treated effluent to meet load limits by upgrading the tertiary denitrification process. It is envisaged this will be complete in 2023.

The total proposed capex in the SIR is $96.6M. However, the project is at a reasonably early stage of definition. A technology comparison has not yet been done for the plant. Sydney Water is preparing an OABC for submission in October 19.

During interviews, we were told that the costing in the 2017 NABC is based on the 2012 cost estimation tool, with escalation applied and scope added for Stage 2. It is not clear why the proposed capex is significantly greater than the capex in the NABC ($92.5M). We have proposed an adjustment to the expenditure to match the NABC estimate.

Sydney Water consider that delivery is now on the critical path for compliance with the HNNF which strongly incentivises investment to be in place by 2024 otherwise the 5 year rolling compliance period will be judged from 2020 onwards, whereas if investment is in place compliance will be judged from 2024.

Although it is presented as two separate stages, it may be procured under a single delivery contract. A procurement strategy has not yet been prepared.

Northwest Treatment Hub - Rouse Hill

The purpose of this proposed project is to increase wastewater treatment capacity to serve the North West Growth Area (NWGA). It is closely linked to a number of other wastewater investments in the NWGA and is Phase 2 of a three phase program.

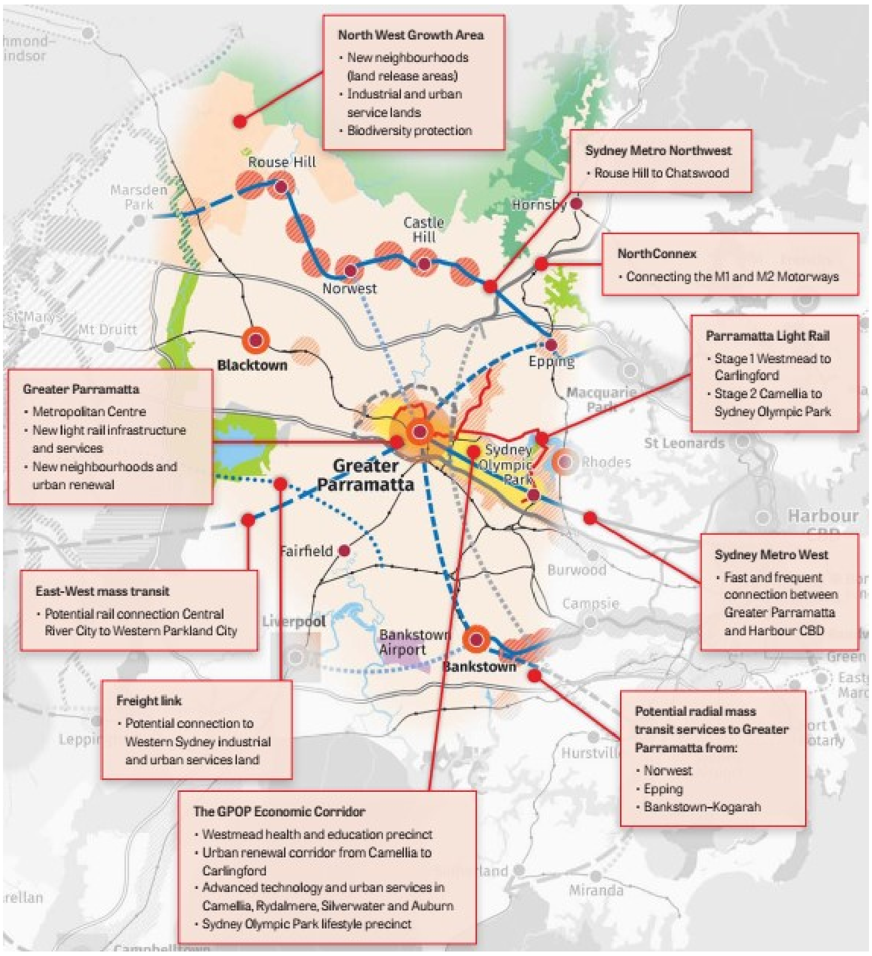
Despite its name, Phase 1 (SGO038 "'Rouse Hill WWTP - Biosolids Amplification"), did not relate to biosolids amplification, but instead it involved an interplant transfer and some WWTW capacity increases. This project is designed to deal with growth but also the anticipated tightening of load limits as part of the HNNF.

The scope of the project incorporated in the submission is based on the initial Castle Hill and Rouse Hill Growth Amplification Options Assessment Report completed in 2017. The project incorporates conversion of Rouse Hill to settled sewage plant with sludge transfers (primary and waste activated sludge) to Riverstone WWTP.

A new options appraisal "The North West Treatment Hub Phase 2- Options Assessment Report" is currently being prepared and will reflect the HNNF. This may change the details of the scheme.

A cost estimate of $214M has been prepared for the scheme, although a detailed breakdown of this estimate was not available. The submission incorporates a lower figure of $165M and assumes it will be complete by 2025. The difference between these figures is the challenge applied to the scheme costs in the Wastewater Treatment Program Business Case.

Greater Parramatta to Olympic Peninsula (GPOP)



GPOP has been identified as the Central City's economic growth corridor. Significant government investment is being put into the area to catalyse growth including Parramatta Light Rail Stage 1 and Stage 1 of the Westmead Hospital Redevelopment.

There is also a lot of development investment being made with high rise construction in Paramatta, construction in Olympic Park for example.

The aim of GPOP Stage 1 is to provide the wastewater, water and stormwater assets to deal with 10 years of growth. The figures quoted below relate to all three services (water, wastewater and stormwater) i.e. project lines WGO039, SGO076 and DGO012.

The SIR includes capex of $81.9M for these three lines up to 2025 of which $4.6M is in the current Determination period. The latest OABC (dated January 2019) includes expenditure of $177M of which $45M is to rebuild Northmead SPS103.

Northmead SPS103 is a separate project within Sydney Water but included in the same line in the SIR. Amplification of the SPS had been identified as necessary due to growth. However, a catastrophic asset failure took place, with the collapse of a dividing wall which flooded the power infrastructure and caused a spill to the Parramatta River. A temporary SPS has been constructed, which Sydney Water assume will be in place for three years based on how long Sydney Water expects it will take to put a replacement SPS in place. The temporary SPS has been created by installing two prefabricated pumping stations together. It is in land not owned by Sydney Water and doesn't meet Sydney Water standards. For example, storage volumes are small, so there are lots of pump start/stops.

The aim is to complete rebuilding of SP0103 by July 22 because it is considered a realistic achievable data rather than based on a commitment to EPA or others. Optioneering is currently underway so the solution and cost may change.

The estimated cost of other works has also increased since the price submission. Partly this is due to scope escalation such as further investigation suggesting that a new SPS for SPS314 is needed rather than a simple upgrade. One of the source documents cited during interview for the cost estimates is the GPOP Sub-Regional Plan. We note that this plan incorporates 35% risk contingency and 75% scope contingency.

It was apparent during interview that Sydney Water does not have a fixed view on the phasing of investments within Stage 1 and when, in the next 10 years, the investment will be required. The triggers for investment have not been identified yet except for SPS101. We have therefore not been provided a robust basis with which to make a positive adjustment to Sydney Water's proposed capex for this project line.

Northwest Growth Centre - Package 4

This project relates to water and wastewater and is described in Section 6.4.2.2.

Approach taken to growth spend

The approach taken to growth spend is similar to that outlined for the water service in Section 6.4.2.2.

Rates of new development in the 2016-20 period have been at unprecedented levels.

Sydney Water sets out in Attachment 8 of its submission a number of reasons why development is expected to be lower than current levels. These reasons include declining dwelling approvals and housing-related lending. During the 2016-20 period Sydney Water expect average new wastewater customer dwellings to be 35,256 p.a. and is projecting a slightly lower average number of new connections (34,236) between 2020-25.

Given that new property numbers are expected to be very similar to the current Determination period, we consider it reasonable that general wastewater growth expenditure should be at a similar average level. We have not been given a compelling justification for the scale of increase requested.

We have therefore recommended an adjustment to proposed 'general' wastewater growth expenditure to match the average expenditure in the 2016-20 period[62]. This adjustment has been applied pro-rata to Sydney Water's proposed expenditure for 2021-24. As there is less certainty in 2025, the adjustment for this year has simply been applied to match the average 2016-20 level.

We have identified and separated out all major (>$100M capex non-bucket code) projects from this adjustment as a number of them have been reviewed in their own right and found to be prudent or subject to specific adjustments. The basis of the adjustment is summarised below:

Table 6-20 Wastewater growth expenditure adjustment

$m 2019/20	**Spend in 2016-20**	**Spend in 2021-24**
Major project growth expenditure	147.8	523.1
'General' growth expenditure	724.3	763.7
Average annual general growth spend ($M p.a.)	144.9	190.9
Adjustment to maintain average capex ($M total applied pro-rata to SWC proposed expenditure)		184.3

Source: November 2019 SIR and Atkins/Cardno adjustment

Note: 2016-20 covers the period from 2016 to 2020 inclusive so covers five years; 2021-24 refers to a four year period.

6.6. Stormwater service

Stormwater capital expenditure is projected to increase by 54% (+$19.7m average per annum) compared to the average spend in the current determination period as shown in Figure 6-31 below.

[62] After adjustment for miscoding of "SGO107 SWPGA – SW Front Servicing"

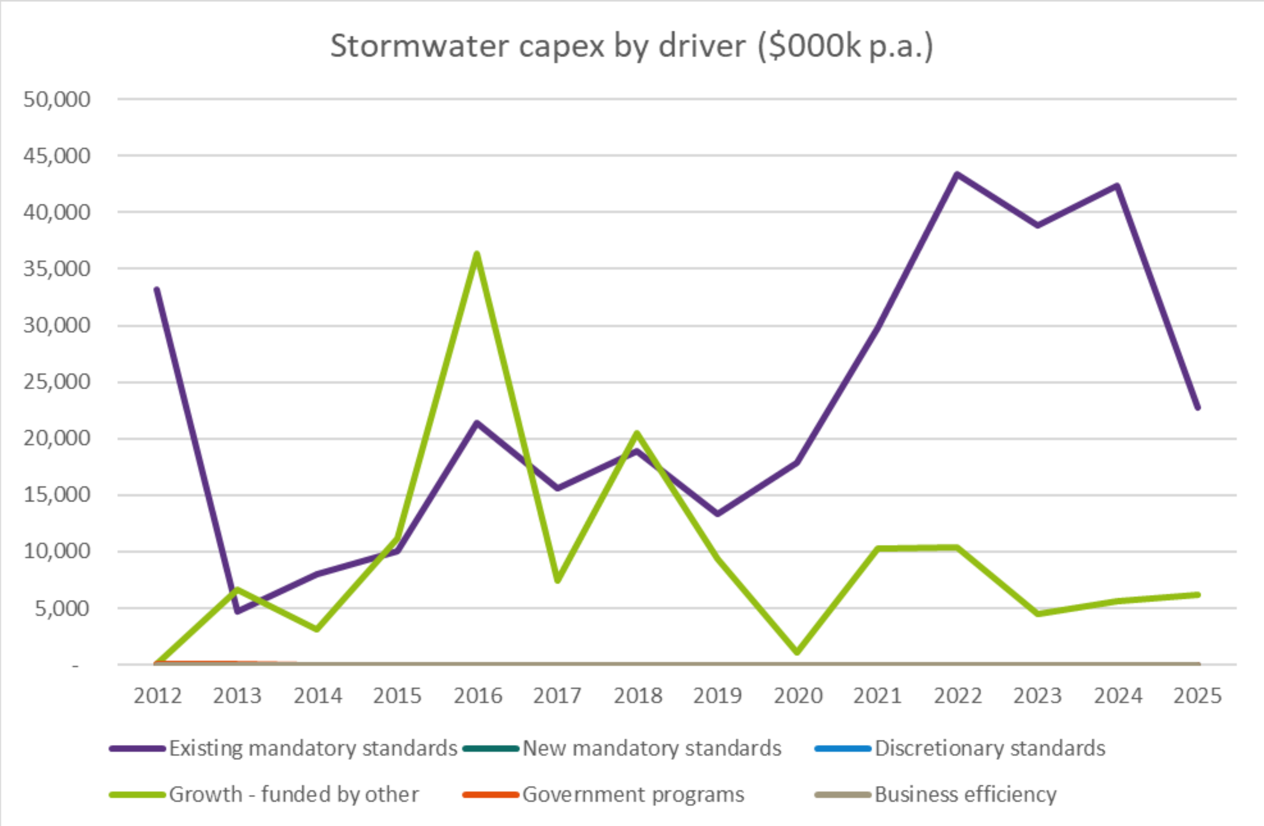


Figure 6-31 Stormwater service capex by driver

Overall expenditure in Stormwater projects was $106M in the current period. Sydney Water underspent by $42M less than the IPART determination in 2016.

6.6.1. Existing mandatory standards

6.6.1.1. 2016 and 2020 Determination Periods

Stormwater renewals

Total stormwater expenditure on existing mandatory standards was $68M in the current determination period. Sydney Water are proposing an expenditure of $154M in the future period marking a 127% increase on current levels. Sydney Water have also underspent on existing mandatory standards in the current period by some $31M attributed to delays reaching agreement with councils and works reprioritisation.

Overall Sydney Water state that in the current determination period they have “maintained the service and managed risk, avoiding collapses and slightly reducing the proportion of assets in the lowest condition categories.” In Figure 6-32 below we present the comparative expenditure across the current and future determination periods across the 14 individual project line items in the SIR that represent Stormwater Existing Mandatory Standards.

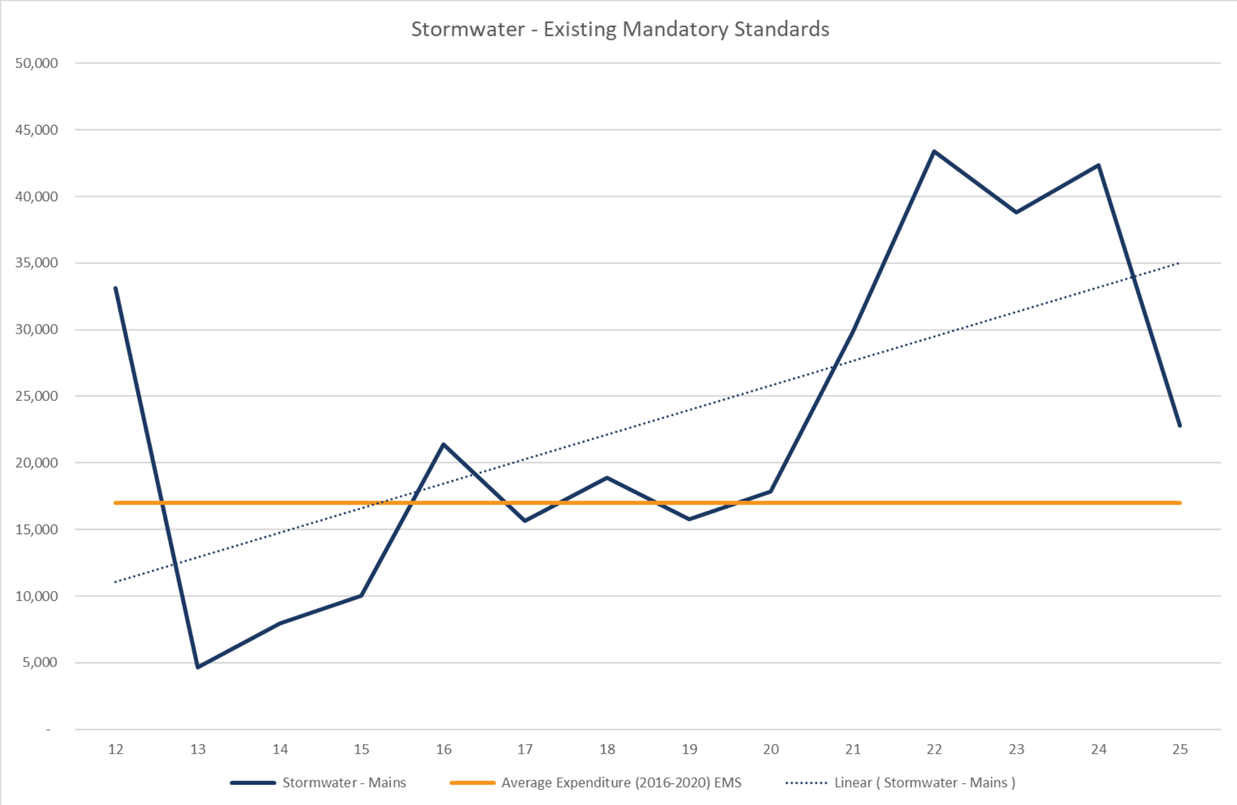
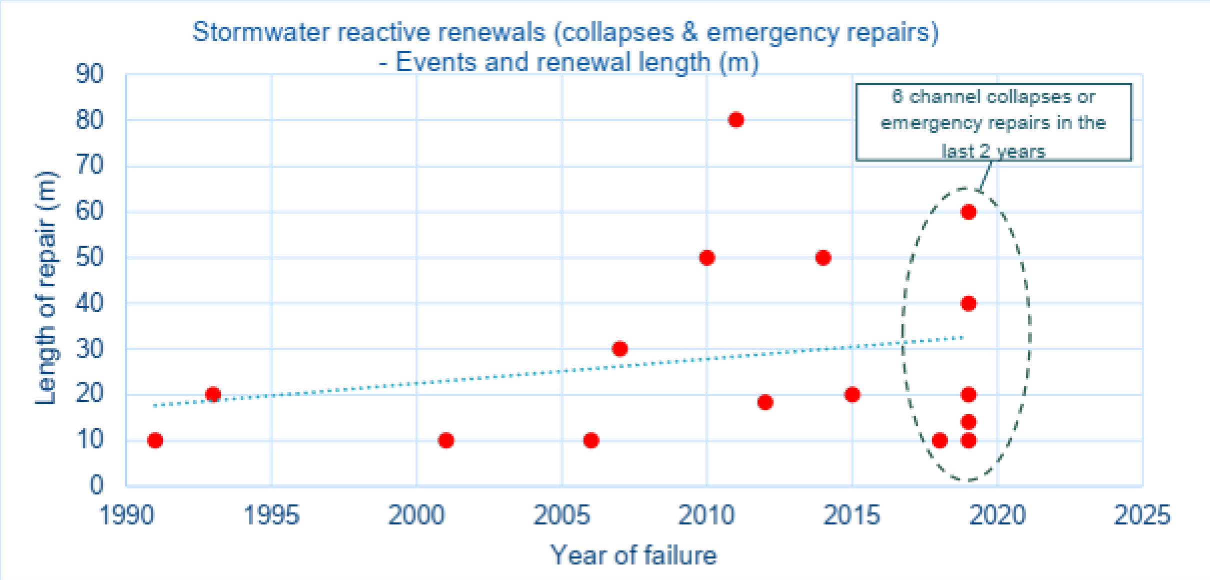


Figure 6-32 Stormwater Existing Mandatory Standards SWC proposed expenditure

Source: Sydney Water Corporation June 2019 SIR submission and Atkins analysis

The main drivers for the increased expenditure proposed in the future period include maintaining services and network health and to reduce the asset risk profile from very high to high. In the current period Sydney Water undertook a risk based program of reprioritisation of projects which was effective at maintaining relatively stable asset performance. As a result a significant number of projects that have been planned for some time are now in the active phase, equating to around 70% of the proposed expenditure in their November-19 business plan submission. Sydney Water name 6 significant renewal projects in the future period with the remainder of expenditure for minor works or as yet unidentified or candidate projects.

Sydney Water have provided evidence that reactive renewals for stormwater assets have increased sharply over the last two years with associated reactive repair costs incurring higher costs overall that planned renewals.



Source: SWC response to Atkin's Draft Report – Sydney Water Corporation Expenditure and Demand Forecast Review

We have taken a portfolio level approach to reviewing the Stormwater existing mandatory standards, including all renewals and the Erskineville flood risk project, however we have excluded expenditure on waterways health due to the specific nature of this project and that it has a separate business case. We have based our view on recommended expenditure in the round and consider that overall average like for like expenditure levels as in the current period should be increased to a certain extent, particularly for those named projects. Prioritisation of expenditure appears to have worked effectively in the current period and maintaining a focus on project prioritisation should be continued into the future period and risk reprioritisation undertaken periodically to efficiently deploy resources.

We are therefore supportive of increasing expenditure relative to the current period to reduce the asset risk profile and recommend including committed expenditure for projects in the active phase as well as some expenditure for minor renewals projects and planning. We have some reservations over the prudency of all of the proposed investment particularly in the later years of the program where projects are less well defined or scoped so we recommend a deferring some expenditure and commensurate outputs into 2025. We consider that Sydney Water should maintain focus on prioritisation of expenditure in the later years of the period as they have demonstrated this has been effective in recent years. We have assumed expenditure for 2021 is now largely agreed so have left this as proposed by Sydney Water. We also recommend increased expenditure in 2025 beyond that proposed by Sydney Water. Overall this equates to 90% of capital expenditure proposed by Sydney Water between 2021 and 2024 as outlined in Table 6-21 below. We recommend smoothing the expenditure profile into the final year of the determination period.

Table 6-21 Stormwater Existing Mandatory Standards Expenditure (excluding waterways health)

STORMWATER EXISTING MANDATORY STANDARDS EXPENDITURE (excluding Waterways Health)							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021-2025**
SWC proposed expenditure	23,255	38,819	37,702	38,474	14,816	138,249	153,065
Atkins adjustment	-	(5,750)	(4,633)	(5,405)	18,253	(15,788)	2,466
Atkins recommended expenditure	23,255	33,069	33,069	33,069	33,069	122,461	155,530

Source: November 2019 SIR and Atkins/Cardno adjustment

Stormwater – Waterway health program

The primary driver for the Waterway Health Program is to improve the health of waterways managed by Sydney Water. Sydney Water's Operating Licence requires that it provides, operates, manages and maintains a Stormwater Drainage System as described in Section 14(1)(b) of the Act. However, the 2019 - 2023 Operating Licence now makes specific reference to Sydney Water having authority (but not being required) to manage the impacts of stormwater on waterway health. Sydney Water's customers have also indicated a willingness to pay for improved waterway health.

This program is focussed on waterways in Sydney Water's declared catchments within the broader Cooks, Georges and Parramatta River catchments. The program is being delivered through two stages of work across the current and future period. There are three packages of work in Stage 1. Package A comprised construction of litter booms and was completed in 2017. Package B comprises five projects that are planned and three of which will be delivered from September 2019. Sydney Water forecasts that it will only deliver half of the 2016 determination capital expenditure total of $19 million. Sydney Water identifies the following reasons for this underspend:

- Deferral of work due to Sydney Water capping expenditure under this program ($5 million impact)
- Schedule delays due to greater time for negotiation, planning and reporting and working with local Councils. Local governments are key stakeholders as many works are delivered jointly ($4million impact).

In the forward period, Sydney Water proposes $16.1 million of works on litter booms, gross pollutant traps, wetlands, bioretention systems a sediment basin and stormwater pump stations.

Sydney Water has undertaken a willingness to pay study (*Willingness to Pay for the Outcomes of Improved Stormwater Management* , Gillespie Economics, 2018) specific to the activities and outcomes of the waterway health program. This report attributes specific willingness to pay values to components of the potential program such as length of waterways in good health and mass of rubbish removed from waterways. This information informed options analysis across Sydney Water's entire investment program through the *Bringing it all together: Customer-informed IPART submission* willingness to pay study. The study found 67% customer support for the waterway health program proposed.

However, while this wider willingness pay to study was undertaken, it did not inform the final level of investment in the waterway health program. Instead, the program was subject to a 40% reduction as part of the overall top-down "efficiency" challenge. This 40% reduction comprises a 21% challenge to program costs and the balance for "prolongation of the program past 2024". Sydney Water stated that the wider results of this study were not used to set the total level investment because:

- The results were not available in sufficient time to inform the program
- Trade-offs in between benefits and costs between the waterway health program and other programs could not be undertaken with sufficient rigour.

Notwithstanding that time constraint, it is surprising that Sydney Water has selected a lower of investment than apparently supported by its customers. It appears that Sydney Water will miss an opportunity to deliver value to its customers. This also appears incongruous with the 'options analysis' in the program business case which tested the the impact of a reduction in the proposed scope of the program by 10%. This analysis by Sydney Water concluded that this adjustment would result in increased risks to the environment and reputation and an overall move in the risk profile from "medium" in the base case (program as proposed) to "high" under the option of a 10% reduced scope.

The nature of this "efficiency" challenge is also different to what has been applied to other programs. The efficiency challenge here includes a scope reduction through deferral. The efficiency challenge for other projects and programs are intended that the same scope be delivered net of the efficiency challenge to the estimated expenditure. Given the customer support for this program and Sydney Water's greater confidence in the costs and benefits of delivery gained in the current period, we consider that the deferral of expenditure is not justified. We recommend that the $6.5 million of expenditure deferred be considered prudent in the 2021-2024 period.

Within the overall program budget, specific projects were initially identified through sub-regional and precinct planning activities, as well as in response to customer complaints. Individual projects were then subject to cost-benefit analysis based on the benefits identified in the earlier study. Projects were prioritised based on benefit-cost ratio.

The program put forward for the 2021-2024 period is then:

- Carry over of projects deferred from the current period
- The highest priority (highest benefit-cost) projects determined from the long list and through cost benefits analysis.

The bottom up program was subject to internal challenges to recognise synergies in delivery.

Our recommended level of prudent and efficient expenditure for the forward period is detailed in Table 6-22.

Table 6-22 Stormwater - Waterway Health Program Expenditure

STORMWATER – WATERWAY HEALTH PROGRAM							
($k 2019/20) year ending June	2021	2022	2023	2024	2025	Total 2021-2024	Total 2021-2025
SWC proposed expenditure	6,550	4,551	1,122	3,905	7,986.3	16,129	24,115
Atkins adjustment	1,625	1,625	1,625	1,625	(6,500)	6,500	-
Atkins recommended expenditure	8,175	6,176	2,747	5,530	1,486	22,629	24,115

6.6.2. Growth

6.6.2.1. Current Determination Period (2016 - 2020)

Stormwater growth expenditure from 2016 to 2020 inclusive is expected to be $74.5M, much smaller than water and wastewater growth capex.

The largest single line item in the submission in the current period relates to “Green Square Trunk Drainage (HAF), which is reviewed below. The second and third largest stormwater growth project lines relates to Strangers Creek. After this all projects are smaller than $5M.

Table 6-23 Stormwater growth projects from 2016 to 2020

Rank	Title	Capex $m (2016-2020)
1	Stormwater - Green Square Trunk Drainage (HAF)	55.6
2	Strangers Creek Trunk Drainage	12.9
3	Strangers Creek - Land	7.8
4	Elizabeth Macarthur Creek - Land	3.8
5	Greater Parramatta to Olympic Peninsula (GPOP)	1.2

6	Elizabeth Macarthur Creek Trunk Drainage	1.1

Source: June 2019 SIR

Stormwater – Green Square Trunk Drainage (HAF) (GD0030)

Green Square is 280 hectares of former industrial land located 4km South of the Sydney CBD and 3.5km north of Sydney airport. It has been identified as a strategic growth centre with one of the highest projected population densities (19,500/km2) in Australia.

The land has been subjected to a series of recent flooding events, having previously been the site of Waterloo Dam and carries a high risk profile due to the high population density.

This is a joint project with a cost sharing agreement in place between Sydney Water (46%) and City of Sydney Council (54%). Total capital expenditure proposed in the 2015 IPART submission for Sydney Water's project costs was $52M in real $ terms, with the June 2019 submission indicating a 30% increase in Sydney Water's project expenditure of $68M. The 2015 IPART submission included "Variation-1" to the project.

The project was procured using an alliance agreement in February 2015, "The Green Square Trunk Stormwater Project Alliance " with a pain/gain share contracting model applied. There have been three significant expenditure variations to the project for a number of reasons including pain-share costs, easements, scope changes and program completion date movements as shown in **Table 6-24**. We highlight the increase in expenditure throughout the project lifecycle.

Table 6-24 Green Square Trunk Drainage project variations

Project Stage	Date	Sydney Water (nominal $)	Total project costs (nominal $)
Project Initiation Business Case	Jan-14	$36.8M	$80M
SWC board approved funds (Delivery Business Case)	Apr-14	$45.8M (p80)	$99M
Variation-1	Dec-14	$52.7M (+$6.8M)	$114.1M
Variation-2	Jan-17	$61M (+$7.9M)	$131M
Variation-3	Oct-17	$74M (+$13.5M)	$162M
June 2019 Forecast	Jun-19	$66M	$143M

Source: Atkins-Cardno analysis of information provided by Sydney Water (274.1)

The funding and delivery arrangements for this project are more complex than for other projects. There is a cost sharing mechanism in place with City of Sydney and a small proportion of Sydney Water's funding has come from the NSW Government's Housing Acceleration Fund (HAF). Sydney Water received one payment of $10 million for Green Square in 2014-15 and this amount was included in the SIR2 Capex 2 for that year. As part of IPART's process for calculating the Regulatory Asset Base deducts cash contributions from relevant capital expenditure items (where such values are submitted with external contribution included) for the 2016 Determination, IPART *deducted* $7 million (net of tax) for this HAF cash contribution from the Green Square capex amount in SIR Capex 2 for 2014-15. Sydney Water received the HAF funding in 2014-15 but this *was not* (and has never been) included in the RAB therefore we have not proposed any adjustments for this project.

6.6.2.2. Future Determination Period (2021 - 2025)

Sydney Water has proposed a program of $37.0M which is a little lower ($1.9M p.a.) than the rate of spend in the current Determination period. The largest project relates to GPOP. The second largest relates to Elizabeth Macarthur Creek Trunk Drainage.

We have not carried out any reviews of these future proposed projects. Expenditure is less than in the current Determination period and we have not recommended any specific adjustments to Sydney Water's proposed expenditure.

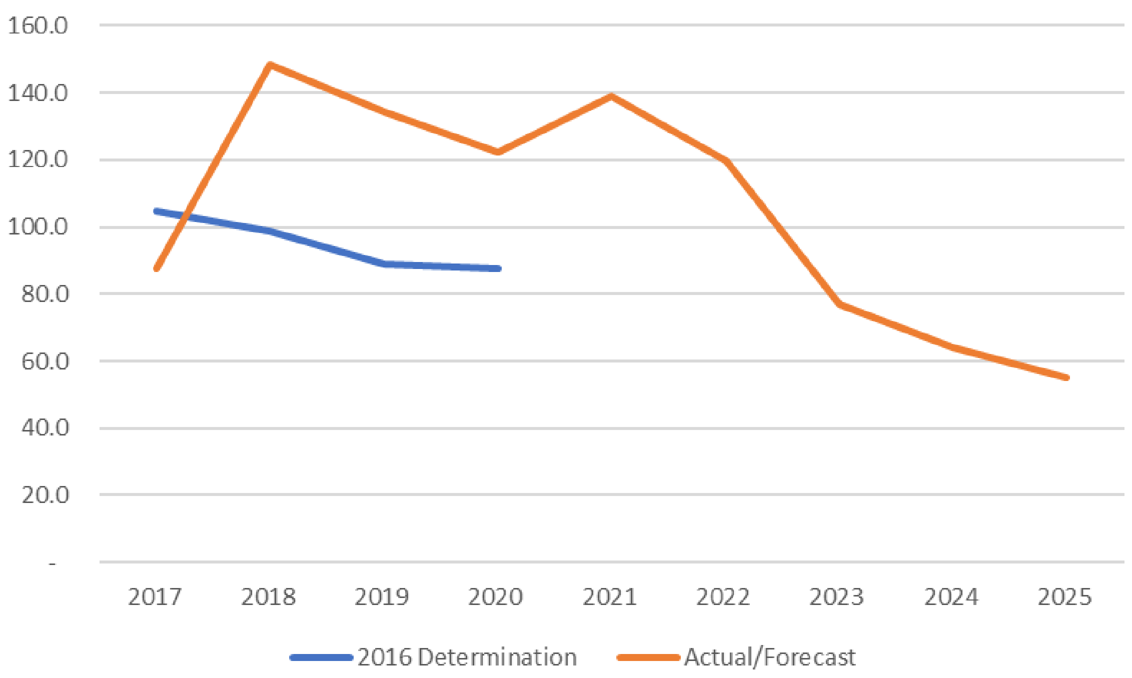
Table 6-25 Stormwater growth projects between 2021-25

Rank	Title	Capex $m 2019 (2021-2025)
1	Greater Parramatta to Olympic Peninsula (GPOP)	20.9
2	Elizabeth Macarthur Creek Trunk Drainage	15.5
3	Stormwater - Green Square Trunk Drainage (HAF)	0.6

Source: June 2019 SIR

6.7. Corporate expenditure

The other significant area of capital expenditure is corporation-wide projects, classified in the SIR under Corporate. Figure 6-33 shows total corporate expenditure through the current and future determination period.



Source: November 2019 SIR

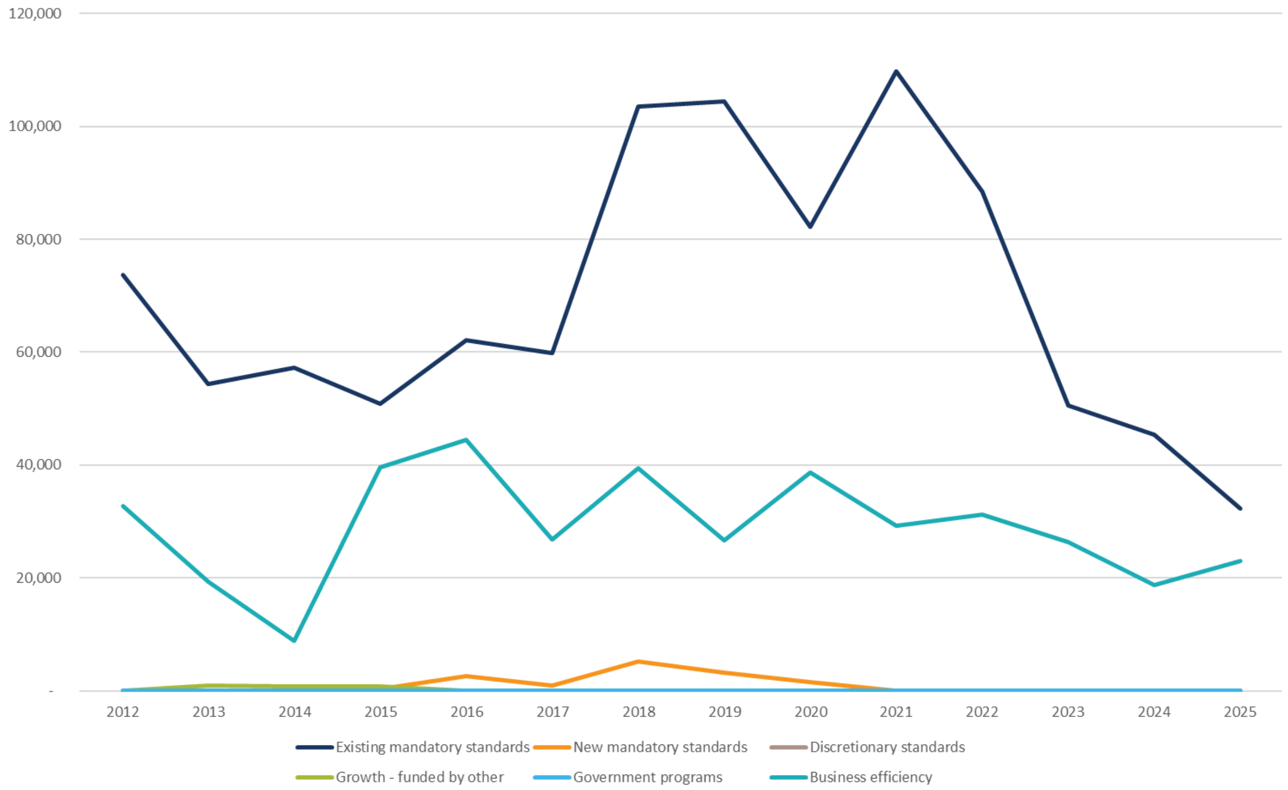
Figure 6-33 Corporate capital expenditure 2016-2025

Between 2016 and 2020, capital expenditure on corporate projects is forecast to significantly exceed the amount in the 2016 Determination period. Actual expenditure, according to the November 2019 submission, is expected to be $492.6m compared with $380m in the IPART 2016 Determination, an increase of 30%, and also considerably more than the $417m originally requested in the 2016 submission[63].

By way of contrast with other recent determination periods, this compares with $223m actual versus $213m in the 2012 Determination (2015/16 prices) for the 2012-16 determination period but it is still considerably less than the $560m (2011/12 prices) expended in the 2008-12 determination period.

While capital expenditure is forecast to begin a downward trend from 2022 driven by reductions in IT expenditure, there is still considerable uncertainty around the costs of some projects, e.g. Enterprise Asset Management, so we do not have full confidence in the forecasts.

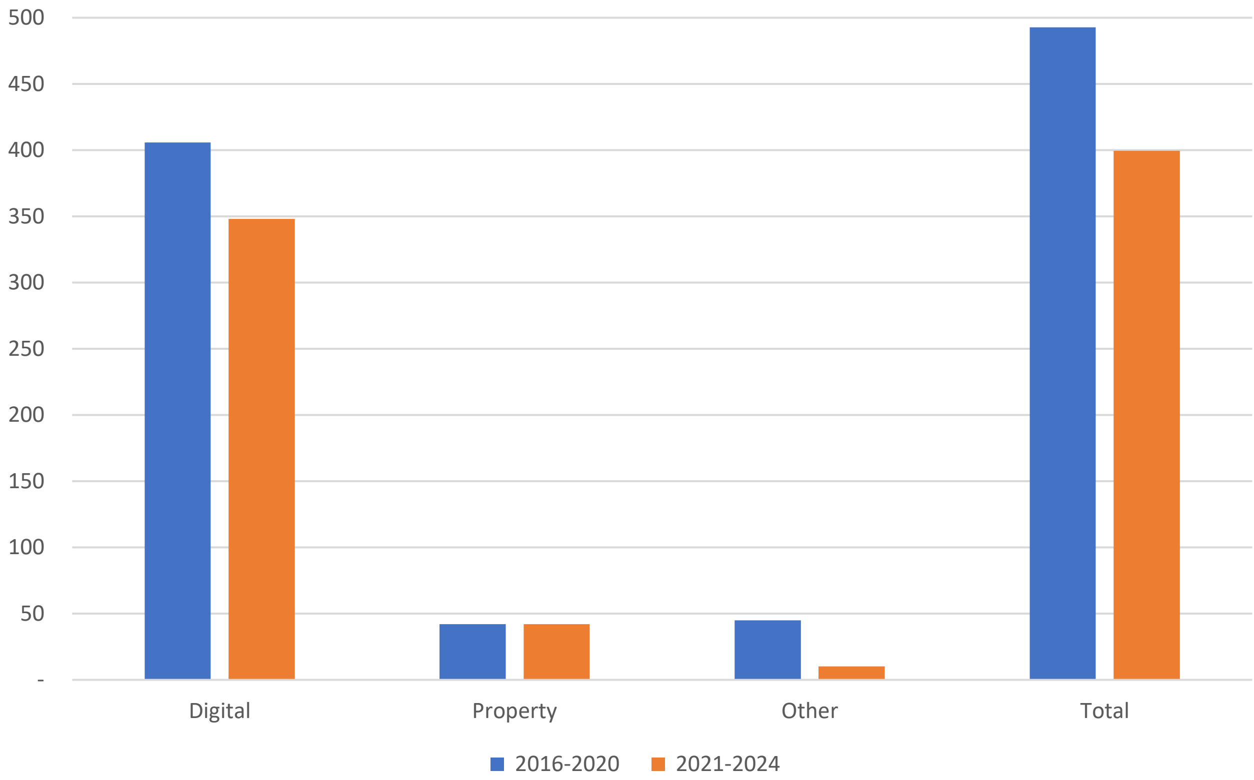
We have focused our analysis on the two most material areas of corporate expenditure in the current and future price plans: IT Services and Property. Expenditure almost exclusively sits under either Existing Mandatory Standards or Business Efficiency drivers. The analysis of corporate expenditure by driver and by projects in the current and future determination periods are shown below.



Source: November 2019 SIR

Figure 6-34 Corporate capital expenditure by driver 2016-2024

[63] Source: September 2015 SIR where Corporate expenditure was forecast to be $382.566m in 2016-20 determination period in $2016 prices, converted to $416.947m in 2019/20 prices.



Source: November 2019 SIR

Figure 6-35 Corporate capital expenditure by programme 2016-2024

6.7.1. Information Technology

We discuss in Section 2.9 the strides that Sydney Water has made in the digital sphere. There is much to commend, although we have identified some areas from a prudency and efficiency perspective that are relevant to this review. These issues are highlighted below where appropriate.

Sydney Water has broken down its digital services into four distinct portfolios:

- Foundation Systems (FS) which are common to many organisations and provide the foundational infrastructure technologies (e.g. end user devices, servers, networks) and enterprise services for security, integration, connectivity and collaboration such as the Data Centres, Cyber Security and Cloud Services
- Systems of Record (SoR) which are the front, middle and back office systems containing primary data sources and the associated services supporting common business capabilities like finance, procurement and customer management. This includes the SAP infrastructure (CxP, BxP), Enterprise Asset Management and modelling capabilities
- Systems of Differentiation (SoD), or sometimes referred to as Systems of Engagement (SoE), that underpin Sydney Water's Lifestream strategy which are designed to create customer value for example by better serving customers through accurate and timely information or improving investment decisions. The portfolio is made up of Field Management Services, the Customer and Spatial Hubs and Analytics & Information Management
- Systems of Monitoring and Control (SoM&C)[64], also referred to as Operational Technology Services (OTS) when it relates to operational expenditure, and which are made up of data from devices and applications like the Internet of Things (IoT), integrated hydraulic and telemetry/SCADA operations as well as new areas of capability such as artificial intelligence (AI) and machine learning (ML)

[64] For continuity across determination periods, the SoM&C capital submission has not been included by Sydney Water in the IT submission.

6.7.1.1. Expenditure

On 30th August 2019, Sydney Water informed us that there were more recent forecasts made at the end of July 2019 compared with its IPART submission and corresponding SIR price proposal, which were based on its February 2019 forecast. Updates were made to both the 2016-20 and 2020-24 operating and capital expenditure forecasts. We were sent comprehensive supporting documentation setting out these changes and thus our analysis is based on this latest position, summarised in Table 6-26 below. Key highlights to note when compared with the original submission are significant reductions in capital expenditure in both determination periods and some minor adjustments to the operational expenditure.

Table 6-26 Revised IT expenditure. Source: Sydney Water July 2019 and November 2019 SIRs

($2019-20 million)	2016-20				2020-24		
IT expenditure	Determination	Jul-19	Nov-19	Change	Jul-19	Nov-19	Change
Operational expenditure (including OTS)	382.00	419.09	422.19	3.10	487.20	485.70	-1.50
Operational expenditure (excluding OTS)	348.40	364.89	367.99	3.10	425.20	423.70	-1.50
Capital expenditure	324.00	411.40	405.80	-5.60	375.00	348.00	-27.00
Total IT Expenditure	**672.40**	**776.29**	**773.79**	**-2.50**	**800.20**	**771.70**	**-28.50**

IT expenditure does not easily lend itself to focusing only on capital investment. In the current determination period, the split is 52% capex to 48% opex and in the next determination period this is forecast to move to 45% capex and 55% opex. The levels of expenditure are therefore very similar and hence why we also reference IT opex spend in this section when we are reviewing projects. Opex may relate to costs related to the implementation of capital projects or to recurrent opex associated with licences and support for new projects.

The largest item of expenditure by far has been CxP in 2016-20 ($183m versus Determination of $126m) hence Systems of Record dominated the expenditure by portfolio. This amount significantly reduces in 2021-24 however we have flagged up the risk that capital expenditure may be significantly understated in 2021-24 depending on the outcome of decisions on EAM combined with some gaps and uncertainty around CxP and BxP expenditure.

Foundation Systems also increased significantly from the IPART Determination ($75m versus $34m) because of the unforeseen Data Centre and Cyber Security requirements, a trend which carries over into the next determination period relating to further investment in these areas.

Systems of Differentiation expenditure is forecast to increase by 63%. This relates to Customer planned investment ($35m), Analytics and information management ($20m), Modelling ($17m), Developer ($13m), Apps compliance and enhancement ($13m) and Mobility ($10m) and in our view has been less well justified.

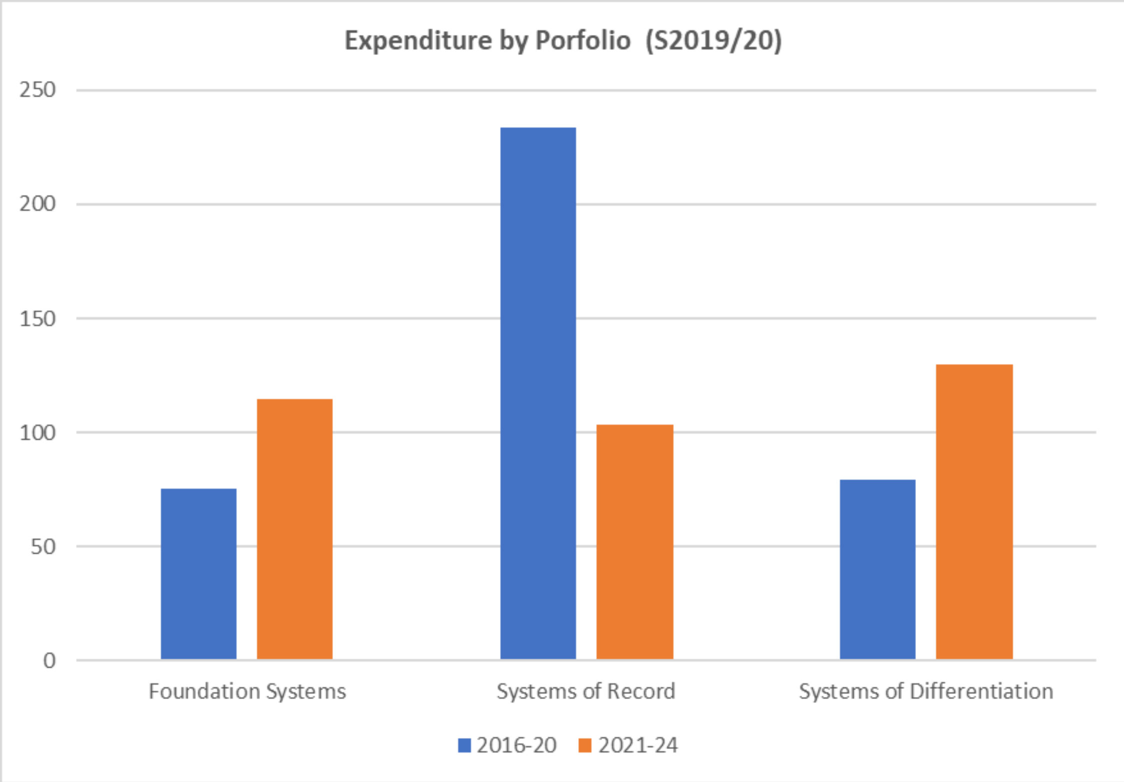


Figure 6-36 Expenditure by Portfolio. Source: Sydney Water Capital Submission Presentation

6.7.1.2. Benefits and efficiencies

One of the drivers of digital expenditure is to deliver benefits including business efficiencies, which are particularly pertinent to this review where they translate into capex or opex savings or avoided expenditure.

Table 6-27 IT Business efficiency expenditure. Source: Sydney Water SIR July 2019

($m 2019-20 million)	Total 2016-20	Total 2021-24
IT Business Efficiency	59	114
Total IT expenditure	405	348
% Business Efficiency	15	33

The proportion of business efficiency expenditure in 2016-20 is relatively small at 15%. This is largely because digital capital expenditure was dominated by CxP, which was not a business efficiency project.

Of the $59m in IT business efficiency, $12m relates to BxP and the benefits will not be realised until it implemented in the future determination period. The majority of the investment, $38m, related to Systems of Differentiation such as Field Services Management, Multi-Function Business Centre and the Customer Hub which we understand has contributed to efficiencies in initiatives such as the Production Improvement Program, Network Reorganisation and the Supply Chain initiative. The total efficiencies in the current determination period from these initiatives are stated to be $47m however it is not clear what proportion were delivered by digital initiatives and what by other initiatives.

In the future determination period, the proportion of business efficiency expenditure is more than double at $114m. This is broken down under three headings, $8m for EAM, $15m for Systems of Record, which is principally BxP and $91m relating to Systems of Differentiation such as analytics and information management and customer initiatives. There are $31.6m in opex efficiencies identified in 2021-24 , however it is difficult to see the extent to which these efficiencies relate directly or indirectly to the IT investments. For the Systems of Differentiation investment in particular, as discussed above, we believe there is a balance to strike between being overly ambitious and an early adopter of new technologies or being a laggard that is operating inefficiently. The right place to be is ready to swiftly adopt proven technology not to be taking risks at customers' expense where either the potential benefits are not clear or not justified.

In our opinion, it is not easy to track the benefits and there could be a clearer line of sight to demonstrate whether digital investments successfully achieve what is set out in business cases. Part of the issue is that benefits may not be realised until the next determination period (so efficiencies in 2016-20 may actually be realised from IT investments made in the 2012-16 determination period). Another challenge is that it is generally not the Digital team's responsibility to track those benefits, although from our perspective they should form part of the submission made to justify the IT investments. Clearly if the efficiencies set out in a business case are not realised, or only partially delivered, this may lead one to conclude that some or all of the expenditure was not prudent hence why this is critical in our opinion to have visibility on the outcomes of the investments.

We recognise that benefits are not only financial. There is scope to improve how business cases identify operational outcomes that will be delivered and then track those, such as improving operational performance or customer metrics as measured by Sydney Water's Operating Licence. CxP is a good example where one would expect customer metrics to be on an upward glidepath as a result of the new systems and processes that have been put in place.

6.7.1.3. Projects

SAP projects

SAP has a strong presence in Australian utilities with some or all of its processes adopted in 32 utilities across the country, including in three other water utilities (Water Corporation, SA Water and Seqwater). Sydney Water's decision to implement an SAP utility solution has and will continue to dominate its digital strategy and investment across at least three determination periods, from 2012 to 2024.

In the 2015 review, we had challenged the governance and approval process for the SAP implementation because approval had been sought at a component and not at a programme level. We argued that the selection of providers for the billing system (CxP) and the ERP (BxP) were inextricably linked[65] and also the approach being taken did not provide visibility of the total potential costs or around the implications for retiring some relatively recently implemented or upgraded systems. While it is useful to understand this historic context, it is not possible to know if the decision-making and approvals would have been different if the latter approach had been followed. Also, while the expenditure related to implementing SAP is considerable, there

[65] Extract from Atkins Cardon 2015 report: "…Crucially, we believe that T2020 and ERP should be jointly approved, which is not currently envisaged. Sydney Water is proposing that the decision for T2020 goes to its Board for approval in principle to be followed by submission of the T2020 Business Case to NSW Treasury for a Gateway Review and NSW Government approval. This is because the SAP IS-U and SAP CRM solution is both dependent on and consistent with the ERP implementation. Sydney Water's Business Cases highlights that:

…the T2020 Program will consider the ERP Program in its planning and similarly, the ERP Program will need to keep abreast of the progress of the T2020 Program and consider the status as part of ongoing program planning" and that "*the SAP ERP Stage 1 is targeting having SAP environment enablers and SAP Core deployed by July 2017…This ensures that by June 2018 there is a stable and settled SAP ERP base in place for T2020 to leverage" and "an integrated schedule will be developed highlighting dependencies*".

Thus, if approval is not granted for the ERP implementation, we believe the whole basis for selecting an SAP billing and customer management solution would need to be re-assessed. Without the synergies and benefits of having an integrated ERP, the business case for T2020 is significantly weakened. There are very few examples of corporations selecting an SAP billing and customer management solution which is not part of a wider SAP ERP solution. In our opinion, it is not compelling as a standalone solution and we believe that there would be other lower cost and viable options which could be considered. The crossover and synergies are such that we do not understand why the approval process is not being treated as a package".

would have been significant costs in replacing or upgrading Sydney Water's previous digital landscape so we are not suggesting that significant investment could have been avoided.

We asked Sydney Water to capture the total costs relating to capital expenditure, operational expenditure associated with the implementation and also on-going opex costs, for SAP which is summarised in Table 6-28.

Table 6-28 SAP Costs Final. Source: Sydney Water

		19/20$ Million			
SAP component	**Source**	**Pre 16**	**2016-20**	**2020-24**	**Total**
CxP Project Capital	EOM July 19 latest CxP forecast	23	183	0	**205**
CxP Project Opex	CxP actuals and forecast	1	26	0	**27**
CxP Ongoing Opex	CxP actuals and forecast	0	10	34	**44**
BxP Project Capital	EOM July 19 latest BxP forecast	7	42	38	**87**
BxP Project Opex	BxP BCV	0	0	1	**1**
BxP Ongoing Opex	BxP BCV	0	0	12	**12**
EAM Project Capital	EOM July 19 latest EAM forecast	0	0	38	**38**
EAM Project Opex	EAM 20-24 Submission	0	0	0	**0**
EAM Ongoing Opex	EAM 20-24 Submission	0	0	0	**0**
	Total	**31**	**260**	**123**	**414**

While the latest forecast of the full SAP implementation is stated as ~$414 million, we believe there are still some areas of significant uncertainty and/or elements that have not been costed, so this total will increase. However, it is not clear if this increase will be in 2020-24 or relates to expenditure in the subsequent determination period. Our assessment is based on:

- EAM costs of $38m are a rough estimate at this stage based on an upgrade [redacted] so there is considerable uncertainty still about this cost;
- Track record on robustness of cost estimates. There has been significant variation from early cost estimates and/or initial business cases for CxP, BxP and other IT projects;
- $87m is not the final BxP cost. Some areas have been de-scoped in this phase or in other cases were always anticipated to be delivered later so a further implementation phase is required (referred to as 'Wave X' by Sydney Water) but there is no cost yet associated with this project; and
- During our interviews, we identified that there is ~$3m capital expenditure required for minor enhancements to CxP but which has not been budgeted for. We assume that there will be some re-prioritisation of other IT expenditure so as not to exceed the amount requested

CxP SAP project – Previous, Current and Future Determination periods

CxP went live in June 2019. Overall, there is a full and detailed audit trail dating back 14 years to support the replacement of the 32 year old ACCESS billing system. There is no doubt that the Corporation secured maximum value for customers by sweating the original asset as long as it did and the need for a replacement was compelling. This was therefore essentially a renewals project and while some business efficiencies are being delivered by CxP, they are relatively modest.

The scope of the original project changed from replacement and decommissioning of ACCESS to include replacing the Customer Management System (CMS) too. The new solution is underpinned by SAP IS-U and SAP CRM.

Costs

Total capital expenditure for the previous and current determination periods stands at $205m (2012-16: $23m and 2016-20: $183m rounded) and $27m in project operational expenditure. The final outturn capital cost has increased by 19% compared with the original estimate however the costs are very similar to the two Business Cases.

CxP	IPART submission 2015/16	Business Case 2015/16	Revised Business Case 2017/18	Final outturn costs 2019/20
Capital costs	172.20	200.75	212.23	205.00

Also, we understand there is ~$40m in other Corporate opex associated with additional manpower needs during the preparedness and implementation phases (often referred to as the "Storm and Surge") although this does not appear in the Business Cases; while we understand that this cost may not be directly IT-related, we believe the total project cost should have been captured and been through the approval process so that there was full visibility on all the direct and indirect costs.

The increase in capital cost relates to a number of changes compared with the original scope and approach which related to de-risking the implementation and future proofing the project and which overall, we would judge as prudent and efficient:

1. Appointment of the Wipro, Cap Gemini and EY consortium to act as the Implementation Services as opposed to Sydney Water acting as program integrator to engage partners to deliver work packages
2. Pausing BxP implementation and thus CxP running on an SAP finance layer interfacing with existing Finance systems rather than SAP ERP core systems as originally envisaged
3. Integrate CxP on a common SAP S/4HANA platform which has new functionality, as opposed to ECC6 which is an older version of the SAP enterprise core, and thus also aligning the platform for BxP implementation which avoids further upgrades
4. Infrastructure being hosted at the NSW Government Data Centres rather than at the Homebush Data Centre, which will be decommissioned in the next determination period, and could not have been anticipated before

It is the on-going opex costs which have increased significantly and this is one of the main items leading to the overall increase in IT opex costs over the next determination period. They were originally estimated at $22m over the 10 years after implementation for licensing and support. In the revised business case this increased to $59m: this has converted to $10m of opex the current determination period and $34m in 2020-24. The original business case included the SAP licencing costs [redacted] but failed to factor in the Application Vendor support costs ($22m)[redacted]. The cost has been market tested via an open tender and is based on a signed contract; Sydney Water also argue that the costs for support for an alternative application would be of similar magnitude so these costs cannot be avoided.

During our interviews, a further ~$3m capital expenditure was also identified as required for minor enhancements to CxP in the next determination period but which has not been budgeted for. We assume that there will be some re-prioritisation of other IT expenditure so as not to exceed the amount confirmed in the IPART Determination.

Benefits and efficiencies

As highlighted above, the key driver for this project was not business efficiency. Sydney Water's argument, as set out in its 2016 Business Case, was that the Corporation was already performing at the frontier of the industry so there was relatively little scope to drive significant further efficiencies. This is supported by some independent research from a benchmarking study by the Water Services Association of Australia, the International Water Association and Third Horizon of Customer Cost to Service published in December 2011 and which it is assumed is still reflective of the current environment. The report highlighted that Sydney Water's cost to service per connected property was the lower amongst the 15 participating organisations, 41.7% below the mean for the participating organisations and 31.5% below the mean for the five large organisations with more than 500,000 connections. Based on this evidence, the conclusion that "...replacing the billing, customer interaction and associated satellite systems with a modern COTS[66] billing and customer interaction system is not expected to achieve great operating facilities..." appears reasonable. Thus while $13.6m in quantifiable opex savings are identified between 2020-24, which is associated with reduced labour and savings from managed services, monthly licence charge and software charges associated with retired systems, this still leads to a net overall increase in opex of $20.4m once the recurrent opex costs of $34m are factored in.

Replacement of existing assets

From a prudence and efficiency perspective, we also considered if there was any remaining asset life in the systems that CxP has replaced. In our 2015 review, we identified CMS as a stranded asset and made an adjustment at the time[67]. In total, there are 19 other systems or applications either decommissioned or replaced by SAP IS-U and SAP CRM; 13 of these are Microsoft Access databases which never registered an asset value and the remainder have been in service for over 10 years. We are therefore satisfied with Sydney Water's response that there is no residual value as reflected in the Fixed Asset Register.

Implementation

In terms of Go-Live, the early indications are that CxP has been deployed successfully. It is currently in its "Early Lifecyle Support" phase and it is expected that the stabilisation period will last one year; while headcount had been topped up from 60 FTEs on duty at any one time to 90 staff with the intention that this level of additional resource would be required until May 2020, it is already clear that this magnitude of extra support is not necessary and is gradually being reduced. Our assessment of the current state was not only based on a desktop review but also included a visit to the Contact Centre in Liverpool to witness first-hand the difference and impact between the old (ACCESS and CMS) and new (SAP-ISU and SAP CRM) landscapes. Key takeaways were:

- a data reconciliation rate of only 340 failures from 101.3 million records, i.e. almost negligible;
- positive scores on all internal operational metrics (average call handling time, accuracy of invoicing and exception handling);
- from a customer perspective a seamless transition to the new system which is evidenced by no increase in customer complaints and no increase in customer waiting time for answering calls;
- training and familiarisation programme successfully delivered and on-going support available to all Customer Service Representatives;
- Read-only access to old systems so that transactions and data are still available for the foreseeable future but avoiding the additional costs associated with transferring all data across to CxP; and
- more efficient and effective business processes compared with previous systems and processes, with for example some processes that could take any time between a day or up to a week now happening virtually instantly and positive feedback from staff on the ground about the new ways of working.

BxP SAP project - Current and Future Determination periods

We supported back at the 2015 review the principle of the SAP ERP implementation, which has more recently been renamed BxP. There is broad consensus in the world's leading corporations that an ERP is a vital organisational tool because of the way it integrates varied organisational systems, incorporates best practice by reflecting the vendor's interpretation of the most effective way to perform each business process and facilitates error-free transactions and production. Ultimately this promotes efficiency, reliability and provides

[66] COTS stands for 'Commercial Off the Shelf' system.
[67] We stated back in 2015 that "…There may be other assets which fall into this category and this will need to be considered at the time of the review for the subsequent price path" (Source: Atkins Cardno 2015 report).

additional management insight compared with best of breed solutions to support better decision-making and drive business efficiencies.

BxP was paused for a period in this determination period as a risk measure to ensure the success of the CxP implementation. Also fundamental to the de-risking of the project is that Sydney Water is looking to avoid customisation; the focus is on configuration while looking for the business to change its processes rather than the software to change to fit Sydney Water's historic ways of working.

Costs

Total capital expenditure is forecast at $87m and $12m in recurrent operational expenditure over the next determination period for Stage 1. The $87m is an estimate which will be validated at the completion of the commercial negotiations with the delivery partner, anticipated to be complete by February 2020. We also scrutinised the recurrent opex costs as these had increased significantly for CxP from the original estimate, however Sydney Water explained for BxP that they are able to leverage on the CxP support already in place with the supplier and the licence costs are confirmed, so these costs will not be subject to significant variance.

However, this is not the final BxP cost. Some areas have been de-scoped in this phase or in other cases were always anticipated to be delivered later so a further implementation phase is required (referred to as 'Wave X' by Sydney Water). There is no cost yet associated with this project but it is unlikely to be costed until the Stage 1 implementation is completed by July 2021. As a very rough estimate, and based on the difference between the original full scope cost and the 2016 Stage 1 business case, it may be reasonable to assume a capital cost of at least $46m for Wave X.

BxP $2019/20$ (millions)	Previous Business Case full scope - 2016 (Stage 1 and Wave X)	Previous Business Case - 2016 (Stage 1 only)	Revised Business Case - August 2019 (Stage 1 only)	Wave X as of 2019
Total project cost	103.85	57.45	86.59	Not costed
Total recurrent opex costs (8 years)	29.68	10.08	28.84	
Total cost	**133.53**	**67.53**	**115.43**	

The Stage 1 increase in cost of $29m (a 51% increase) relates to:

- Implementation timing extended from 12 to 16 months
- 7-month Foundation phase included to mitigate risk of delays once the Implementation phase commences
- Scope changed to include delivery of Cost Model capability and building blocks of the EAM functionality
- Organisational change management activities increased and in line with learnings from CxP delivery
- Technology shift to SAP/4HANA Platform, Government Data Centre and SAP Cloud
- Uplift of recurrent costs to reflect learnings from CxP with regards to on-going SAP support costs

Sydney Water has declared $14.64m as written off in the 2016-20 Determination period as a result of changes to program and scope as this expenditure did not add to the productive capital base. This is essentially aborted effort and thus would be considered imprudent expenditure so we concur with the Corporation's decision to treat the expenditure in this way. Our challenge to Sydney Water was how it could demonstrate to us that $14.64m is the appropriate amount to write off and that it should not be higher? The Corporation explained that the financial statements have been through the annual audit process by the Auditor-General for New South Wales and have been signed off as giving a true and fair view of the financial position and financial performance for 2017, 2018 and 2019. The corresponding documentary evidence was also supplied. While this may be the case, the Independent Auditor's Report is a high level document and we did not expect and nor does it reference a level of detail relating to individual items of expenditure such as this write-off. We also note that the Auditor-General specifically caveats that it does not provide assurance that the Corporation has carried out its activities effectively, efficiently and economically. While we are therefore unable to validate the amount that has been declared, we believe that Sydney Water has acted in good faith by recognising some expenditure has been imprudent and in its own words is making "a self-imposed prudency adjustment".

Program

The pause in BxP implementation led to the Corporation delivering a more basic version to act as an enabler for CxP but not threaten its delivery. Thus, the following has been delivered in 2016-20 Determination period:

- SAP Ariba Source to Contract
- Simple fiancé protype and conductivity layer for CxP
- Finance Cost model
- Digital high-level architecture

The program has changed substantially and with implementation of the Stage 1 now taking place in the next determination period. The scope includes the financial system, some of the 'governance, risk and compliance' (GRC) but not the full capability in this phase and the Enterprise Portfolio and Program Management (EPPM). A second phase, referred to as Wave X, will see the remaining GRC capability (governance, risk and compliance) implemented alongside health and safety, payroll and HR. It is possible to deliver in two stages because the current systems which would be replaced in Wave X are serviceable, with the exception of H&S system which is considered to be a more urgent priority and for which the decision is directly linked to EAM decision on asset management.

The Stage 1 Foundation phase commenced in August 2019 and subject to approval of the business case, the Implementation phase will commence in March 2020 with a Go Live date of July 2021. Between onshore and offshore contributors, the project team is set to number ~300 people at its peak.

It is unclear when Wave X will be implemented: Sydney Water's submission states: "At this point in time, a decision has not been taken as to whether the investment will occur in the 2020-24 period". In our view, it would be surprising that the Corporation would wait until the 2024-28 period rather than implement sooner after the Stage 1 implementation is complete, because Sydney Water will not be realising the full capability and benefits of having an Enterprise Resource Planning solution.

We also noted in the previous review that the timeframes for SAP implementation appear long when compared with other SAP implementations. We have seen timetables of half the time for water utilities in the UK and longer timetables tend to be associated with companies operating in multiple markets (e.g. a pharmaceutical giant implemented SAP in 35 markets in four years, a food and beverage conglomerate implemented SAP in 120 markets in 7 years). Thus, we believe our original observation still stands that there is a risk that a longer implementation timetable incurs additional costs and that phasing requires interim interfaces which again which have the effect of driving up costs. This may result in some expenditure which is not prudent or efficient; it is very difficult to assess at this point in time and this will need to be considered post-implementation at the next review.

Procurement

The original approach was for Sydney Water to act as the program integrator and engage partners to deliver clearly defined work packages. The Corporation explained that "…. further analysis revealed challenges in attracting and retaining the right skills, our maturity in managing IT delivery contracts of this nature including integrating the work, the high legal and administrative overhead. It was identified that combining CxP and BxP into a single Implementation Services Contract delivered by a single consortium would reduce program risk…". This revised procurement approach was approved [redacted] in May 2016 [redacted] approved the down-selection a consortium led by Wipro and including Cap Gemini and EY to work towards formation of an agreed contract for implementation services for CxP and BxP.

The Corporation also benefits from pre-negotiated NSW State Government contracts at favourable rates and permits existing licences to be leveraged with SAP which is a material reduction in overall program risk and promotes best value.

Replacement of and integration with existing assets

A key consideration from a prudence and efficiency perspective is the remaining asset life in the systems that BxP will be replacing in the next determination period. This will need to be considered at the time of the next review, similar to the exercise we have carried out for CxP which is summarised above.

We have also highlighted good practice that all digital Business Cases should consider as a standing item the implications of how the proposed investment aligns with BxP implementation (even if it is just to confirm that there is no crossover). Otherwise there is a risk that other IT investments may not align, could become obsolete, lead to significant integration costs and/or another option may be more appropriate to integrate with SAP. [redacted].

Benefits and efficiencies

With the revised programme for implementation, the benefits are now realised much later than CxP, when it was originally envisaged that they would be delivered before. Also, the benefits and efficiencies case has changed from four years ago: while the estimated costs to deliver have increased, the benefits have increased and at a reasonably comparable rate.

BxP benefits $2019/20 (millions)	2021	2022	2023	2024	Total
Capex total (avoided costs)	0.00	2.00	11.70	14.40	28.10
Opex total	0.00	1.80	9.20	11.90	22.90
Total benefits	**0.00**	**3.80**	**20.90**	**26.30**	**51.00**

We queried the opex savings in 2022 and whether this would be realised so swiftly on the back of implementation in July 2021. The Corporation responded that it was confident that efficiencies would be delivered almost immediately as a result of removing a large number of manual workarounds. We also discussed the scale of recurrent opex savings and Sydney Water confirmed that the ~$12m forecast in 2024 is a fair representation of the on-going opex savings going forward.

We would expect there to be strong evidence of the opex benefits being realised and which would inform the historic assessment of the prudence of the expenditure at the next review.

Enterprise Asset Management - Current and Future Determination periods

Enterprise Asset Management is the third of the three transformation programs planned by Sydney Water after CxP and BxP. This program focuses on Sydney Water's asset management capability and it is predicted that this will take 18 to 24 months to deliver and be completed by the end of the next determination period.

The current capability is delivered through Maximo, which covers plants and electrical assets, as well as Hydra, Tibco Business Process Management and Business Intelligence products utilised for linear and other assets. As part of the BxP scope, sourcing/procurement and inventory management functions will be removed from Maximo thus reducing future business transformation required under the EAM program.

We are satisfied that the EAM investment ($5.8m) in the current determination period, linked to maintaining and enhancing Maximo and asset related work requests for the other systems, has been prudent and efficient.

The investment in the next determination period is of a different magnitude but it is not predicted that this will be clearer until the first half of 2021/22. The timing both in terms of building up a business case and ultimately the decision on what the capability will look like in the future is driven by two key factors:

- The need to deliver BxP as a precursor for any future integration which, as identified above, will not be completed until July 2021.
- IBM's Maximo extended support for the current version terminates in April 2021 and so there is the risk of having unsupported software beyond this date.

Sydney Water has set out that it will consider the following three options:

1. Upgrade the current EAM solution to the latest version of Maximo - All future versions of Maximo have a new user interface that will require additional business organisation change management (OCM) and user retraining as part of the program.
2. Implement EAM as an SAP on premise (GovDC) solution - Consistent with Sydney Water's current SAP approach to its enterprise architecture. Integrating back into Sydney Water systems and delivering the business OCM and user training as part of the program.
3. Implement EAM as an SAP "Software as a Service" (SaaS) solution from a service provider – Again integrating back into Sydney Water systems and delivering the business OCM and user training as part of the program.

We were informed that the $38.14m capital expenditure represents a provision based on Sydney Water's prior Maximo upgrade and the CxP and BxP process development and integration. In other words, this is the best central estimate for option 1, although we were not provided with an audit trail for how this cost was derived. While we understand this option must be considered, we think it very unlikely as this will involve complex integration between BxP and Maximo (there are somewhere between 10 to 12 interfaces), and most crucially the Corporation would not be realising the full benefits of its SAP implementation by going down this road[68].

[redacted] The uncertainty in the costs related to these other options could be up to 100% difference compared with the current "provision".

In terms of operational expenditure, we queried that there is no operational expenditure in the budget and we were informed that this is correct and would be at Sydney Water's risk. Any recurrent operational costs for licencing and support will not materialise until the 2024-28 determination period and the current view is that this will be opex neutral compared with the existing costs for these items.

We also considered whether the investment could be pushed back until the 2024-28 determination period but the Corporation is of the view that the risk is too big in terms of having an unsupported application. In addition, it would be reasonable to assume this delay would impact negatively on the efficiency and effectiveness of Sydney Water's asset management capability. Thus, the decision rests as set out above with either an upgrade or the porting data to one of the two solution set out above.

Data Centre Relocation - Current and Future Determination periods

Sydney Water is in the middle of a major relocation of the facilities for its computer systems and associated components, such as telecommunications and storage systems. The option being pursued of moving to the Government Data Centres (GovDCs)[69] was the only logical one, supporting the NSW Government's Data

[68] In the 2015 review, we made similar observations: "Furthermore, we have been informed that a decision on one of the potential components, Enterprise Asset Management, will not be taken until 2019/20 and thus the $29m cited does not form part of the total cost of implementation at this point in time. While the Business Case states that Enterprise Asset Management is out of scope of the ERP Program, we are not satisfied that that the implications of this statement are clear. This relates to a decision on the future of Maximo: one of the options that will be considered is implementing an SAP asset management solution which could therefore form part of the ERP implementation. However, there is no visibility on this in this Business Case although it was costed in a previous iteration of a financial breakdown shared with us for the ERP. If an SAP asset management solution is not the preferred option, there are then implications for additional systems integration costs to consider and some of the benefits of using an SAP ERP integrated solution will not be realised if a non SAP asset management solution is employed".

[69] See https://www.digital.nsw.gov.au/policy/buying-ict/government-data-centres and https://www.digital.nsw.gov.au/policy/buying-ict/government-data-centres for more information

Centre Reform Strategy and, also of key importance to note, it is not a like for like replacement as this will provide a significant uplift in resilience. The existing facilities are what are referred to as Tier 1 while GovDC offers Tier 3 facilities[70]. Also, anecdotally this is also in line with the approach being taken by Water NSW.

Sydney Water set out clearly the justification in its submission[71] which we support:

"NSW Government policy requires all NSW Government agencies (except State Owned Corporations) to relocate remaining data centre and computer room infrastructure into GovDC and decommission specialist infrastructure by mid-2019. While not directly applicable to us as a State-Owned Corporation, we acknowledged the merits of the reform and committed to hosting our strategic CxP SAP platform at GovDC, as four of the five data centre migration triggers listed in the Data Centre Reform Circular were applicable to our existing arrangements:

- *the lease on an existing building or data centre lease is ending*
- *there is a major equipment/infrastructure refresh due*
- *there is a major software refresh due*
- *the current data centre is too unreliable or inefficient for future needs.*

Most notably, the Greater Sydney Commission has requested we surrender the lease of our Homebush Data Centre site, as part of their development of the Central River City. The move from our own Tier 1 data centres to GovDC's data centre is also central to enhancing IT security at Sydney Water."

Due to its significant purchasing power, the Government is able to secure preferential rates and evidence of its competitiveness is that the Gov DC is winning market share from private providers on open tender. The recent award to host CxP at GovDC was won on an open tender.

In the short-term, this change leads to a significant uplift in in both capital and operational costs across the current and future determination periods as the Corporation shifts from its existing Homesbush and Parramatta sites to the Government Data Centres. This is offset by avoided capital expenditure which would have been required for either re-locating Homebush to an alternative site, and also the disaster recovery site in Parramatta will close which will create savings.

The total allocated is $56.2m for the data centre migration and Sydney Water is assuming there will be no capex expenditure requirement in Homesbush in the next determination period, however if any is required, they are committed to working within this budget. The program envisages a three-year glide path with closure of Homesbush by 2023. Capital costs relate to floor space and energy requirements for the hardware rather than being linked directly to storage requirements. The opex is higher in GovDC compared with the past as a result of moving from Tier 1 to Tier 3 capability and meeting higher cyber security standards, with $35.5m budgeted in the IPART submission for 2021-24. While Sydney Water explained it was difficult to identify the comparable opex costs for the current determination period, they indicated that it is approximately a net $5m increase in totex per year between the two determination periods.

At the next review, there will need to be an exercise to identify if there is any residual life left in assets and thus any value to be written off for stranded assets. However, Sydney Water aims to ensure this is not the case by minimising any future investment, recycling assets in GovDCs where appropriate and selling off unwanted hardware to recoup costs where possible.

In terms of the current application landscape, it is envisaged that a third are disappearing (not least because of CxP and BxP), a third will move to flexible infrastructure in the Cloud and a third will move to GovDCs.

[70] For background information on tier certification and classification systems, see https://uptimeinstitute.com/tiers
[71] Sydney Water Price Proposal, Attachment 9: Capital expenditure p111-112.

We also raised the issue of "dark data" with Sydney Water. In the Water Services Association of Australia's report on the digital economy[72], it identified that:

New data is being produced at an extraordinary rate: 50% of the data existing worldwide was generated in the last 10 months. Most data remains under-analysed, presenting a real business risk and cost. The Veritas Databerg Report estimates that by 2020, worldwide $4.6 AUD trillion will be wasted due to gathering and storing too much data that is not being used….only 10% of current data collected in Australia is tagged as 'business critical' while 62% of it remains 'dark' (of unidentified value) and 28% are ROT (redundant, obsolete or trivial).

We asked Sydney Water how it could demonstrate that its storage requirements are optimal and how it minimises dark data. The Corporation explained that it has two primary forms of dark data, plant SCADA/telemetry archives and system log files. Plant SCADA/Telemetry data accounts for 8 Terra Bytes (TB) of its overall data storage of 1,445 TB or 0.6%. This is optimised by rolling up the data and only storing data points required to demonstrate Operating License Compliance. For file shares, application files, ESB data and general log files, it uses low cost low speed storage where old data is purged regularly. Data other than file shares account for approximately 350 TB or 24% of overall data storage.

The table below summarises the various types of data storage in use by Sydney Water and its relationship across the two determination periods. The capacity estimates for the Data Centre business case are included in the cost estimates. The estimates translate to approximately:

- 400 TB SAN / NAS (which are the first two rows below)
- 150 TB Exadata (which is the third row below)

Table 6-29 Terra Byte storage across the determination periods. Source: Sydney Water

Data Type	Storage in TB			Comments
	2016	2020	2024	
Data storage presented to servers for business applications	260	340	250	Target level is optimised through application consolidation
File Shares, Application Files, ESB data and Log Files	350	550	165	Target level is optimised through use of Office 365 (Cloud Storage)
Oracle Data Bases for Business Applications	61	89	130	Business data is predicted to grow
Total	**671**	**979**	**545**	

Overall, we were satisfied that Sydney Water understands and is managing in an efficient way its storage needs. Moreover, the Corporation's view is that relatively storage is cheap, it is the back-up and recovery requirements which are the most significant areas of expenditure.

Analytics and Information Program (AIM) and Internet of Things (IoT) - Current and Future Determination periods

The AIM and IoT programs are designed to extract value from the existing and future "data lakes", often also referred to as "big data", as well as exploring ways to share the dataset externally. IoT technology supports both improved near real-time asset monitoring and better predictive analytics leading to more pro-active asset management. It could also potentially enable new approaches to demand management and pricing. The aim ultimately is to improve customer and environmental outcomes while at the same time promoting business efficiency. This is all part of Sydney Water's strategy to make itself a "hyper-connected utility" rather than what it has referred to as "an analogue business with a digital veneer".

[72] WSAA (2018) Harnessing The Digital Economy, a discussion paper for the Australian and New Zealand water industry

Sydney Water has identified 90+ use cases for IoT technology, such as:

- Avoid sewer surcharge and customer impact, rebates and clean-up costs
- Avoid environmental overflow and customer impact, EPA fines, clean-up costs, compliance issues and loss in reputation
- A better understanding of the asset performance can inform renewal planning and lead to a deferral of asset investment or influence the design of new assets
- Potential for general water consumption reduction of residential and commercial properties through digital metering (consumption transparency, leak alerts)
- Reduced meter reading cost
- Predictive maintenance to reduce overall cost of maintenance and reduce plant down-time.
- Personnel Safety (wearables), vehicle and asset
- Near real-time reporting to our key stakeholders (EPA, Health etc.)
- Atmospheric monitoring for a range of parameters including odour, H2S, compliance etc.
- Soil monitoring to feed into predictive models for pipe burst etc.
- River/Stream monitoring – proactive monitoring for compliance, quality etc.
- Use of drones to reduce WHS challenges during inspections and incidents

In terms of the concept of sharing data externally, the ambition is for Sydney Water's data lake to connect to the NSW Government data lake and then potentially connecting into the broader ecosystem of information. The aim is to drive unique insights that Sydney Water – and others – have not had before. The challenge from an efficiency review perspective is that "[Sydney Water] doesn't know what we don't know, so we're going on a journey with a lot of partners to try and uncover this…" and thus it is more difficult to measure the benefits and justify the expenditure. The Customer Hub is probably the best example of the reverse application, with the Corporation drawing on data from other sources including weather data and data from the emergency services to identify earlier and better understand operational issues on the network.

Overall, we were satisfied with that the stated approach for developing and managing projects is an appropriate one[73]. In particular, the small-scale proof on concepts before any potential wider rollout that we saw first-hand appeared to work effectively. However, we were concerned about the risks of Sydney Water pioneering new and unproven technology, which appeared to be the case based on the information initially presented to us, as this could lead to inefficient or potentially imprudent expenditure; we would hope that a focus on utility collaboration and partnering, which was subsequently presented to us, should minimise this risk.

The investment in AIM is $3.3m and IoT ~$5.5m in the current determination period. While we did not identify any issues with the efficiency or prudency of the expenditure, more needs to be understood about benefits realisation, including the contribution to business efficiency where this is a driver. This also applies to future investment in the next determination period for which Sydney Water is proposing $34m in its analytics capability and enabling innovation and mobility.

[73] Five key steps or activities underpin the approach: 1. Technology Evaluation, 2. Utility Collaboration, 3. Partnering, 4. Agile Development and 5. Innovation Kickstart

Table 6-30 Forecast expenditure on digital utility measures for 2020–24

($2019-20 million)	2020–21	2021–22	2022–23	2023–24	Total
Analytics and Information Management (Foundation)	4.6	4.6	3.6	4.6	**17.3**
Analytics and Information Management (Consumption)	1.5	0.8	1.1	1.1	**4.6**
Digital Innovation	0.5	0.5	0.5	0.5	**2.1**
Mobility	1.2	3	2.8	3.4	**10.4**
Total	**7.8**	**8.8**	**8**	**9.7**	**34.3**

In its response to our challenge about quantifying the benefits, Sydney Water provided a range of examples of efficiencies which were either historic (ICCATS investments) or anticipated in the future (IoT).

Table 6-31 Demonstration of Potential IoT Benefits (Source: Sydney Water response no.304)

Historic		Future	
Sewer Pumping Station performance optimisation through auto flushing,	$3m-$6m	IoT sewer blockage detection	$4m/year avoided costs
Introduction of Low Power Remote Terminal Units	>$7m	Digital metering	>$5m/year
Water Network Operation electricity savings	~$1m/year		
IICATS online H2S monitoring system	> $550k/year in one system		

The ambition shown by Sydney Water's Digital Services in its hyper-connected strategy is commendable but:

1. This does not always align with what other members of the Atkins/Cardno review team were presented for the Water, Wastewater and Recycled Water programmes – in particular the impact of the IoT devices on reducing the number of incidents and the move from a reactive or preventative approach to service resilience and asset maintenance to a predictive and responsive model was not reflected in these plans.
2. The benefits captured in Business Cases and subsequent responses to the Atkins/Cardno team do not translate into opex business efficiencies being presented to us.

The challenge is summed up by Sydney Water in its submission: "As we proceed with these investments, we need to evaluate and quantify the benefits of adopting IoT technologies"[74]. In other words, there is still considerable uncertainty in the benefits. This feeds into our overall observations about the strength of the justification for this expenditure and how it translates into business efficiencies in Sections 6.7.1.2 and 6.7.1.5.

6.7.1.4. Benchmarking

We have considered benchmarking as useful to inform the appropriateness of Sydney Water's level of IT investment.

In the 2015 review, Atkins/Cardno observed that: "While we may expect that Sydney Water is an outlier in one determination period where there is a necessary and justified peak in expenditure, we would not expect to see Sydney Water consistently higher than average as this would suggest an underlying inefficiency. The benchmarking with other Australian utilities suggest opex is under the average and that capex is higher than the average, which we also observed in 2011". This trend was also picked up in the Third Horizon report commissioned by NSW Department of Finance and Services in 2013, who carried out a strategic review of Sydney Water's IT expenditure. They had reported that IT spend as a percentage of revenue in 2013 decreased but was still 0.7% higher than the Gartner Utilities industry benchmark; IT capital expenditure as a percentage of total IT spend was consistently higher than the Gartner Utilities industry benchmark for the past five years; and IT FTE as a percentage of total FTE compared well to the Gartner industry benchmark.

[74] Sydney Water Price Proposal, Attachment 9: Capital expenditure p119

We asked Sydney Water to confirm the total capital and operating IT expenditure as a percentage of total expenditure for each year of current and future determination periods to inform benchmarking analysis captured below.

Table 6-32 Analysis of IT expenditure compared with total expenditure

($2019-20 million)	2016-17	2017-18	2018-19	2019-20	Total 2016-20	2020-21	2021-22	2022-23	2023-24	Total 2020-24
IT Capex	74.4	117.2	107.5	106.5	**405.6**	119.7	89.8	79.0	59.2	**347.8**
IT Opex (excluding OTS)	74.9	83.1	98.0	111.9	**368.0**	101.2	107.5	106.8	107.0	**422.5**
Total IT Expenditure	**149.3**	**200.3**	**205.5**	**218.4**	**773.6**	**220.9**	**197.3**	**185.8**	**166.2**	**770.3**
IT Expenditure % of Total Expenditure	**7.5%**	**9.3%**	**8.9%**	**9.6%**	**8.9%**	**9.4%**	**8.3%**	**7.1%**	**6.3%**	**7.7%**
Capex % of IT Totexpenditure	50%	59%	52%	49%	**52%**	54%	46%	43%	36%	**45%**
Opex % of IT Total Expenditure	50%	41%	48%	51%	**48%**	46%	54%	57%	64%	**55%**
% IT Capex of total capex	11.6%	14.2%	12.1%	12.7%	**12.7%**	11.9%	8.8%	6.3%	4.7%	**7.7%**
% IT Opex of total opex	5.5%	6.2%	6.9%	7.8%	**6.6%**	7.5%	8.0%	7.9%	7.8%	**7.8%**

Source: November 2019 SIR and Atkins/Cardno analysis

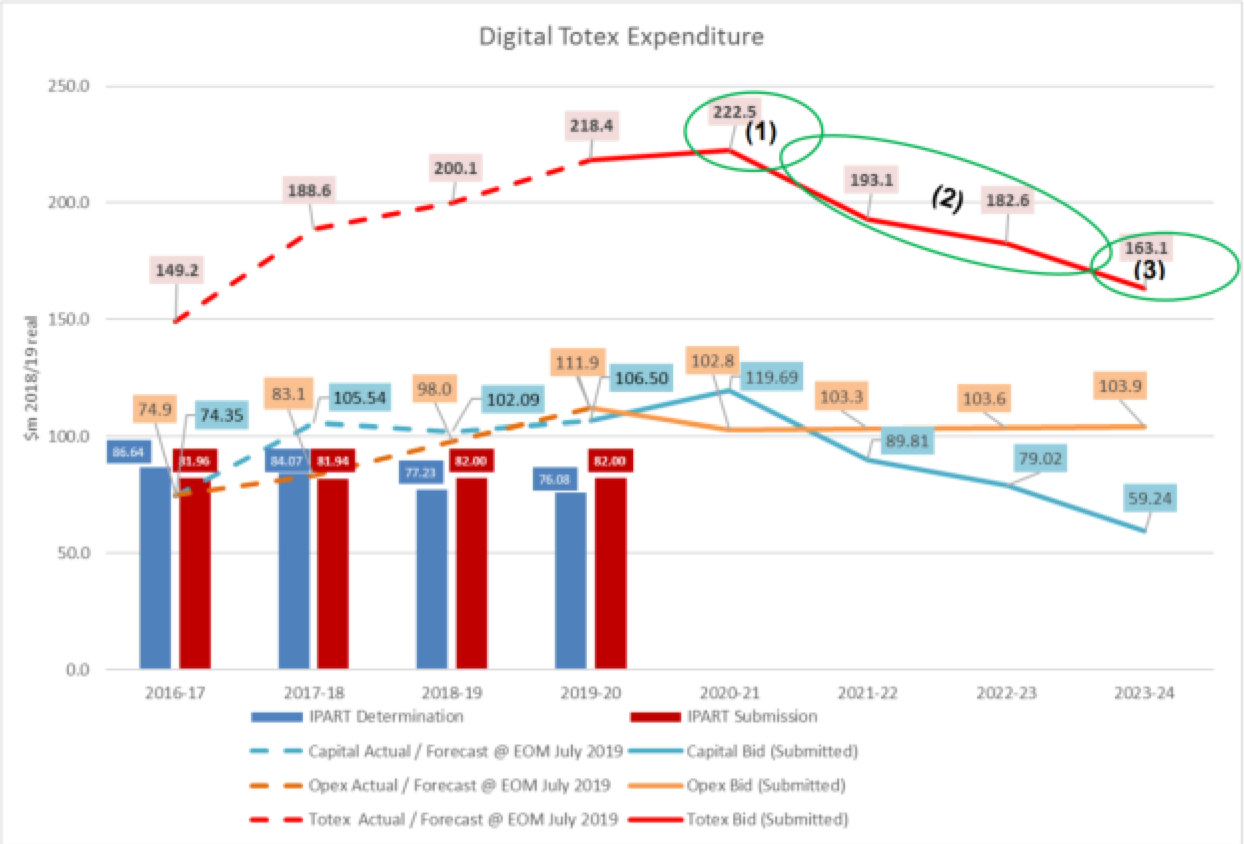
Sydney Water's IT expenditure as a percentage of its total expenditure averages at 8.9% across the 2016-2020 Determination period and is forecast to reduce to 7.7% over the next determination period. The split between capex and opex is almost identical in 2016-2020 but as capital expenditure reduces in the next determination period, opex accounts for a much larger proportion even if the actual amount forecast is very stable over 2020-2024.

There are some factors that need to be taken into consideration:

- A major limitation of benchmarking a business's expenditure within relatively short timeframe is that businesses may be at different points in their investment cycles. In Sydney Water's case it is going through a significant transformation over two determination periods with multi-year capital projects and as such, it is to be expected that Sydney Water expenditure will trend upwards in comparison to the benchmark during this period.
- It is not generally possible to drill down into the detail of benchmarking data to confirm there is a like for like comparison. For example, it varies between utilities whether telemetry and SCADA are included under Corporate expenditure or within the Water/Wastewater/Recycled expenditure[75] [76].
- There is a new trend when compared with the last two determination periods whereby we are witnessing a transition in the digital sphere to Software as a Service operating expenditure solutions where in the past capital infrastructure solutions would have been the norm. Sydney Water's view is that there are adjustment costs associated with the transition with some upward pressures on both capital and operating expenditure in the short time but that "…over time…the move to an opex-based system should lead to lower combined operating and capital expenditure profile. [Sydney Water is] …currently managing such as a transition and looking to do so in a way that minimises the impact on our totex".

Sydney Water had provided a generic illustration to highlight the trend in overall expenditure in the future and we requested that this was updated with actual figures to identify the totex highpoint and when the Corporation forecasts expenditure will reduce. This is captured in Figure 6-37 below.

[75] Sydney Water had historically captured telemetry and SCADA (referred to by the Corporation as "Operational Technology Services") expenditure under Wastewater but this department has now been merged with the other digital teams and thus sits together now under IT Corporate expenditure.
[76] For the purposes of benchmarking, we believe it is more appropriate to exclude telemetry and SCADA.



Key: (1) Totex highpoint: 2021/22 (2) Totex reduction: Across 2021/22 to 2023/25 (3) Total Business as Usual (BAU) post 2024/25. Note: OTS opex costs and OT hyper-connectivity opex costs excluded from above consistent with capex figures that exclude Systems of Monitoring & Control.

Figure 6-37 Adjustment period associated with IT systems transition (Source: Sydney Water Response to Item 286)

For utilities in Australia, we have compared Sydney Water's IT capital and operating expenditure as a percentage of total capital and operating expenditure from data based on forecast expenditure to 2020.

Capex benchmarking	2013	2014	2015	2016	2017	2018	2019	2020	Average
Sydney Water	4.9%	7.1%	6.3%	11.6%	11.6%	12.8%	11.5%	12.7%	9.8%
Mean*	4.6%	5.1%	6.2%	5.9%	6.4%	7.0%	6.4%	6.0%	6.0%
No. Australian Utilities	22	16	21	21	19	17	17	12	18

Opex benchmarking	2013	2014	2015	2016	2017	2018	2019	2020	Average
Sydney Water	4.7%	4.3%	4.5%	4.9%	5.5%	6.2%	6.9%	7.8%	5.6%
Mean*	6.6%	7.0%	7.4%	6.4%	6.6%	6.7%	6.7%	6.3%	6.7%
No. Australian Utilities	19	14	11	6	6	6	6	5	9

* Benchmark calculated as IT capital and operating expenditure as a percentage of total capital and operating expenditure. The mean line represents the weighted average across all included participants, the mean is calculated when there is data available for twelve or more utilities for the year. Source: Commercial in confidence IT expenditure benchmarking survey from a global management consultant.

At face value, Sydney Water is an outlier on capex but as discussed earlier this is to be expected. On opex, Sydney Water is around the average for 2016-20 and again there is a reasonable explanation to justify the overall increase in the next determination period.

	Capex			Opex		
Company	**Average over 8 years**	**SWC 2016-20**	**SWC 2021-24**	**Average over 8 years**	**SWC 2016-20**	**SWC 2021-24**
Sydney Water	9.8%	12.2%	7.7%	5.6%	6.6%	7.8%
Mean*	6.0%	-	-	6.7%	-	-

We have also looked at stripping out one-off costs associated with CxP, BxP, EAM, Cyber Security and Data Centre relocation and at the same time we have also factored back into calculation the avoided expenditure which would have resulted if these capital projects had not been undertaken. We can see below what impact this has on the comparison over the two determination periods: Capex would be below the mean for 2016-20 and about ~1% above the mean in 2021-24, which is not a major variance given the amount of transformation that is planned. The effect on opex in 2016-20 would actually place Sydney Water ~1% under the average both in 2016-20 and also over the last 8 years; we could only identify minimal one-off opex costs in the next determination period so this percentage is unchanged.

	Capex			Opex		
Company	**Average over 8 years**	**SWC 2016-20**	**SWC 2021-24**	**Average over 8 years**	**SWC 2016-20**	**SWC 2021-24**
Sydney Water	9.8%	5.3%	6.9%	5.6%	5.8%	7.8%
Mean*	6.0%	-	-	6.7%	-	-

6.7.1.5. Conclusions

Overall, we believe that there is good justification where Sydney Water is an outlier over the current and future determination periods and that it does not suggest an underlying inefficiency.

Sydney Water is applying new technology as we would expect that of a company either at or pushing to be at the frontier. This is following a similar direction to water companies in England and Wales where projects and activities like the Customer Hub, Spatial Hub and pipe tracing have been employed for a number of years. In our view, the Corporation is still catching up rather than having achieved sufficient to be considered a ‘frontier’ company in the area, e.g. particularly until firstly BxP is implemented and delivering benefits and also, we can see the impact of digital initiatives on moving from more reactive to predictive asset management.

We have however caveated that we do not have full confidence in the capex forecast for 2021-24 determination period and that there is a risk that this could lead to a significant increase in the outturn capital expenditure beyond the $348m in the IPART submission. Thus, while the overall capital expenditure envelope for IT in the next determination period appears to reflect an efficient level of expenditure at a global level, there are significant increases in Foundation Systems and Systems of Differentiation expenditure in 2021-24 which are less well justified either by the need and/or benefits. Therefore, if there are any further increases in expenditure linked to CxP, BxP and EAM, these should be managed within the $348m total envelope, with corresponding reductions in expenditure in these two other portfolios. In our view, this is what a company operating in the open market would do to ensure it remained within the constraints of a fixed budget by taking further steps to limit any increases through deferral, further prioritisation or by funding through efficiencies delivered elsewhere.

6.7.2. Property

The Property program focuses on operational and non-operational land and building assets with the aims of:

1. Improving workplace amenity
2. Correcting or maintaining land and building compliance
3. Meeting heritage conservation obligations
4. Supporting land-related asset and real estate transactions

There were no material issues identified with the Property program. It appears to be effectively and efficiently managed and prioritised in order to keep within the IPART Determination. Thus, in the current determination period, the actual expenditure aligned with the IPART Determination ($42m) and the requirement for the next determination period is the same, even if the build-up at component level looks quite different.

There are no major changes in the assumptions around the FTE core staff and number of contractors between the two determination periods. In terms of the size of the estate, they are very similar too with the biggest change being the closure of the Homebush Data Centre.

In 2016-20, the focus has been on improving workplace accommodation of key operational and corporate assets and depot consolidation ($30m), heritage related improvements ($6m), demolition and remediation of land where contamination exists, acquisition of easements and property as well as disposal of unwanted assets ($6m).

For the next determination period, the workplace accommodation and depot consolidation shows a reduction from $30m to $24m focusing on Bondi, Quakers Hill and Liverpool Treatment Plants and other sites to be determined ($16m) as well as master planning for the Deport and Laboratory at West Ryde ($8m). Heritage related work required to meet the standards in the Heritage Act 1979 is driven by the priorities set out in the Strategic Heritage Asset Management Program and shows a 50% estimated reduction ($4m). Much more expenditure is expected on land and easements ($13m), driven by the long lead-time required for purchase of land in advance of delivery of new works as well as land rehabilitation, for which the cost is based on the North Bondi embankment stabilisation project.

It is also worth noting that the lease for Sydney Water's Parramatta headquarters ends in 2024 so at some point in the next determination period, the Property team will explore the available options and prepare a Business Case setting out the most efficient and effective option or options. These are likely to include renewing the lease, leasing another site or building their own premises.

6.7.3. Other corporate expenditure

The $45m of 'Other' Corporate expenditure in 2016-20 is made up predominantly of Operating Model expenditure ($19m, of which $7.2m relates to the Customer Hub and $6.4m Multi-Functional Business Centre non digital implementation costs), Minor Corporate Projects ($9m), Minor Plant and Equipment ($7m) and Field and Laboratory Equipment ($4m).

In 2021-24 the expenditure, the Minor Plant and Equipment and Field and Laboratory Equipment Field have been merged into one SIR entry ($10m), with a slight reduction between the determination periods ($0.9). The bigger reduction is because the new Operating Model is now complete and there is no other expenditure identified for Minor Corporate Projects.

6.8. Prudent and Efficient Expenditure in the current determination period

The IPART brief requires us to comment on the efficiency and prudence of capital expenditure in the current determination period. The prudence test relates to how decisions are made on the basis of information available at that time and how the investment was executed. We have considered the efficiency and prudence of capital investments during the 2016-20 Determination period. We have discussed specific business processes in our strategic review in Section 3.

We have not noted any specific items of imprudent expenditure in the current determination period and have made one specific adjustment for a project that was miscoded.

Efficient expenditure in the current determination period

We summarise below our view on efficient expenditure in the current determination period. Note that this is based on the November 2019 update submission and excludes recycled water.

Table 6-33 Water Service: Summary of prudent and efficient capital expenditure current determination period ($19/20M)

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - WATER SERVICE				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	128.6	117.3	99.4	130.8
New mandatory standards	0.0	0.2	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	63.8	43.0	93.9	108.2
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.1	2.3	1.6	0.0
Total	192.5	162.9	194.9	239.0
Atkins/Cardno recommended adjustments for specific programs or projects				
SGO107 SWPGA				-2.6
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS				
Existing mandatory standards	128.6	117.3	99.4	130.8
New mandatory standards	0.0	0.2	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	63.8	43.0	93.9	105.6
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.1	2.3	1.6	0.0
Total	192.5	162.9	194.9	236.4
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	128.6	117.3	99.4	130.8
New mandatory standards	0.0	0.2	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	63.8	43.0	93.9	105.6
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.1	2.3	1.6	0.0
Total Efficient Expenditure	192.5	162.9	194.9	236.4

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-34 Wastewater Service: Summary of prudent and efficient capital expenditure current determination period ($19/20M)

SYDNEY PROPOSAL - CAPEX - WASTEWATER SERVICE				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	187.6	216.5	281.7	242.5
New mandatory standards	15.2	53.0	46.0	46.5
Discretionary standards	0.0	0.4	0.9	0.0
Growth - funded by other	123.8	203.7	172.4	257.8
Government programs	5.6	0.2	0.1	0.0
Business efficiency	3.1	1.9	1.0	4.2
Total	335.4	475.8	502.0	550.9
Atkins/Cardno recommended adjustments for specific programs or projects				
Upper South Creek Expenditure				-2.7
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS				
Existing mandatory standards	187.6	216.5	281.7	242.5
New mandatory standards	15.2	53.0	46.0	46.5
Discretionary standards	0.0	0.4	0.9	0.0
Growth - funded by other	123.8	203.7	172.4	255.1
Government programs	5.6	0.2	0.1	0.0
Business efficiency	3.1	1.9	1.0	4.2
Total	335.4	475.8	502.0	548.2
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	187.6	216.5	281.7	242.5
New mandatory standards	15.2	53.0	46.0	46.5
Discretionary standards	0.0	0.4	0.9	0.0
Growth - funded by other	123.8	203.7	172.4	255.1
Government programs	5.6	0.2	0.1	0.0
Business efficiency	3.1	1.9	1.0	4.2
Total Efficient Expenditure	335.4	475.8	502.0	548.2

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-35 Stormwater Service: Summary of prudent and efficient capital expenditure current determination period ($19/20M)

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - STORMWATER				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	15.6	18.9	13.3	17.8
New mandatory standards	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	7.4	20.5	9.4	1.1
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0
Total	23.1	39.4	22.7	18.9
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS				
Existing mandatory standards	15.6	18.9	13.3	17.8
New mandatory standards	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	7.4	20.5	9.4	1.1
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0
Total	23.1	39.4	22.7	18.9
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE				
($M 2019/20) year ending June	2017	2018	2019	2020
Existing mandatory standards	15.6	18.9	13.3	17.8
New mandatory standards	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0
Growth - funded by other	7.4	20.5	9.4	1.1
Government programs	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0
Total Efficient Expenditure	23.1	39.4	22.7	18.9

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-36 Corporate expenditure: Summary of prudent and efficient capital expenditure current determination period ($19/20M)

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - CORPORATE				
($M 2019/20) year ending June	2017	2018	2019	2020
Total	87.7	148.3	134.2	122.4
Atkins/Cardno recommended adjustments for specific programs or projects				
BxP Imprudency Adjustment	-5.2	-5.2	-4.3	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE				
($M 2019/20) year ending June	2017	2018	2019	2020
Total Efficient Expenditure	82.5	143.1	129.9	122.4

Source: November 2019 SIR and Atkins/Cardno analysis

6.9. Prudent and Efficient Expenditure in the future determination period

6.9.1. Continuing efficiency

In line with our recommendations on operational expenditure continuing efficiency, we further recommend that Sydney Water be set a continuing efficiency target of 0.8% per annum for capital expenditure. Further detail on this can be found in Section 5.7.3 above.

6.9.2. Catch-up efficiency

We have applied our judgement to determine the level of catch-up efficiency that could be achieved by Sydney Water based on our assessments of the capital processes and the review and analysis of sample programs and specific projects which are representative of the program as a whole. Sydney Water have demonstrated significant improvements and internal top down efficiency challenges and rephasing at a capex program level for the future determination period. These efficiencies are expected to be gained through improved cost intelligence, delivery and procurement improvements, program and portfolio management improvements and improvements for optimised solutions.

We noted that efficiencies at a program level vary between program business cases with the level of efficiency applied dependent on the expectation for being able to gain efficiency and the evaluation of the risk to delivering program outcomes with less expenditure. We detail the internal programme level efficiency challenges that Sydney Water have made in Section 3.4.5. When we compared with the total level of top-down efficiencies applied to each program and the change in the applied level of efficiencies between the initial five year program and the four year program we noted an average level of efficiency challenge of 18%. There were however two programs which represented significant outliers where no internal efficiency challenge appears to have been applied:

i. Critical Sewers; and
ii. Wet Weather Overflows

On this basis we recommend only two specific catch-up efficiency adjustments on these two specific programs to reach the average 18% level that Sydney Water have applied themselves. We have decided not to recommend any further catch-up efficiency adjustments at a whole of program level as we have done in previous reviews as we consider that Sydney Water's approach to program development in applying adjustments and efficiency challenges top-down demonstrates increased maturity and willingness to respond to its regulatory environment.

Our assessment of the level of continuing and catch-up efficiencies achievable in the future determination period is shown in below Table 6-37.

Table 6-37 Cumulative efficiency capex challenge

Cumulative efficiency challenge (%)					
	2021	**2022**	**2023**	**2024**	**2025**
Continuing efficiency at the Frontier	***0.80%***	***1.60%***	***2.40%***	***3.20%***	***4.00%***
Catch-up efficiency	-	-	-	-	-
Total efficiency	**0.80%**	**1.60%**	**2.40%**	**3.20%**	**4.00%**

6.9.3. Efficient level of expenditure

We have derived an efficient level of capital expenditure for each service by making adjustments to the November 2019 SIR updated submission. We have made specific challenges to capital programs and projects where we consider that Sydney Water is not proposing efficient expenditure. We then apply a continuing efficiency to reflect the ongoing innovations and efficiency savings that a Frontier company would realise.

We have not been able to break down corporate expenditure into the different drivers at this stage due to the way it has been presented to us at our reviews with Sydney Water. We have made high level adjustments for total corporate expenditure.

Water Service

We summarise our proposals for prudent and efficient capital expenditure in Table 6-38. Note that the Prospect to Macarthur adjustment in the table is discussed in Section 8 below.

Wastewater Service

We summarise our proposals for prudent and efficient capital expenditure in Table 6-39 below.

Stormwater Service

We summarise our proposals for prudent and efficient capital expenditure in Table 6-40 below.

Corporate Service

We summarise our proposals for prudent and efficient capital expenditure in Table 6-41 below.

Table 6-38 Water Service: Summary of Efficient Capital Expenditure

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - WATER SERVICE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Existing mandatory standards	287.4	158.7	163.9	146.6	124.6	756.6	881.2
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	344.8	102.5	129.4	66.0	51.9	642.7	694.6
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	632.1	261.3	293.3	212.6	176.5	1399.3	1575.8
Atkins/Cardno recommended adjustments for specific programs or projects							
Reservoir Renewals and Reliability	0.0	-7.6	-3.4	-6.0	1.3	-16.9	-15.6
Water PS renewals scope	-4.1	-4.2	-3.0	-2.8	-14.1	-14.1	-28.2
Critical water mains renewal	0.0	0.0	0.0	0.0	-8.5	0.0	-8.5
General growth adjustment	-12.0	-15.9	-15.8	-12.1	10.0	-55.9	-45.8
Metering adjustment	-1.5	-1.5	-1.5	-1.5	-1.5	-6.0	-7.5
Prospect to Macarthur adjustment	-188.4	188.4	-62.0			-62.0	-62.0
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Existing mandatory standards	225.2	202.0	137.4	136.4	101.7	701.0	802.7
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	200.9	218.5	70.2	53.9	62.0	543.4	605.4
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	426.2	420.4	207.6	190.2	163.7	1244.4	1408.1
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-3.4	-6.7	-5.0	-6.1	-6.5	-21.2	-27.8
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Existing mandatory standards	223.4	198.7	134.1	132.0	97.6	688.3	785.9
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	199.3	215.0	68.5	52.1	59.5	534.9	594.4
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Efficient Expenditure	422.8	413.7	202.6	184.1	157.1	1223.2	1380.3

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-39 Wastewater Service: Summary of Efficient Capital Expenditure

SYDNEY PROPOSAL - CAPEX - WASTEWATER SERVICE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Existing mandatory standards	383.5	389.9	360.7	379.5	269.8	1513.5	1783.3
New mandatory standards	58.5	59.7	60.7	52.7	0.0	231.6	231.6
Discretionary standards	11.6	16.0	20.4	15.6	0.7	63.5	64.2
Growth - funded by other	266.6	299.1	348.0	373.1	424.9	1286.8	1711.7
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	1.4	1.4	1.4	3.4	3.4	7.7	11.1
Total	721.5	766.2	791.2	824.3	698.8	3103.1	3801.9
Atkins/Cardno recommended adjustments for specific programs or projects							
"Wet Weather Overflow Abatement" program efficiency	-9.2	-10.7	-10.9	-9.5	0.0	-40.3	-40.3
Critical and Non-Critical Mains Renewals scope and efficieny	-33.4	-34.9	-32.5	-31.9	-6.7	-132.7	-139.4
Quakers Hill and St Marys WWTP variation	14.1	0.0	0.0	0.0	0.0	14.1	14.1
WWTP renewals prudency	-18.0	11.1	7.3	-19.2	38.0	-18.8	19.2
Richmond/North Richmond Amplification		-4.1				-4.1	-4.1
Upper South Creek Expenditure	93.2	19.4	12.1	-48.9	114.2	75.9	190.0
General growth adjustment	-46.0	-42.4	-56.1	-35.7	-44.0	-180.2	-224.2
Wastewater PS civil works	5.0	5.0	5.0	5.0	5.0	20.0	25.0
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Existing mandatory standards	344.1	371.1	340.5	333.4	306.1	1389.1	1695.1
New mandatory standards	49.3	49.0	49.8	43.2	0.0	191.3	191.3
Discretionary standards	11.6	16.0	20.4	15.6	0.7	63.5	64.2
Growth - funded by other	320.8	272.1	304.0	288.6	495.0	1185.5	1680.5
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	1.4	1.4	1.4	3.4	3.4	7.7	11.1
Total	727.3	709.5	716.1	684.1	805.2	2837.0	3642.2
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-5.8	-11.4	-17.2	-21.9	-32.2	-56.2	-88.5
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**2021-24 Total**	**2021-25 Total**
Existing mandatory standards	341.3	365.2	332.3	322.7	293.8	1361.5	1655.4
New mandatory standards	48.9	48.2	48.6	41.8	0.0	187.5	187.5
Discretionary standards	11.5	15.7	19.9	15.1	0.7	62.2	62.9
Growth - funded by other	318.3	267.7	296.7	279.3	475.2	1162.0	1637.2
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	1.4	1.4	1.4	3.3	3.3	7.5	10.8
Total Efficient Expenditure	721.4	698.2	698.9	662.2	773.0	2780.7	3553.8

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-40 Stormwater Service: Summary of Efficient Capital Expenditure

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - STORMWATER							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Existing mandatory standards	29.8	43.4	38.8	42.4	22.8	154.4	177.2
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	10.3	10.3	4.5	5.6	6.2	30.8	37.0
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	40.1	53.7	43.3	48.0	29.0	185.2	214.2
Atkins/Cardno recommended adjustments for specific programs or projects							
Stormwater Renewals	0.0	-5.8	-4.6	-5.4	18.3	-15.8	2.5
Waterway health	1.6	1.6	1.6	1.6	-6.5	6.5	0.0
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Existing mandatory standards	31.4	39.2	35.8	38.6	34.6	145.1	179.6
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	10.3	10.3	4.5	5.6	6.2	30.8	37.0
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	41.7	49.6	40.3	44.2	40.8	175.9	216.6
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-0.3	-0.8	-1.0	-1.4	-1.6	-3.5	-5.1
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Existing mandatory standards	31.2	38.6	35.0	37.4	33.2	142.1	175.3
New mandatory standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary standards	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Growth - funded by other	10.2	10.2	4.4	5.4	6.0	30.2	36.2
Government programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business efficiency	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Efficient Expenditure	41.4	48.8	39.4	42.8	39.1	172.4	211.5

Source: November 2019 SIR and Atkins/Cardno analysis

Table 6-41 Corporate Expenditure: Summary of Efficient Capital Expenditure

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - CORPORATE							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Total	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-1.1	-1.9	-1.8	-2.0	-2.2	-6.9	-9.1
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Total Efficient Expenditure	137.8	117.9	75.0	62.0	53.0	392.7	445.7

Source: November 2019 SIR and Atkins/Cardno analysis

6.10. Conclusions

In Table 6-42 we provide the total level of recommended capital expenditure for the period 2021-2024 and 2021-25. We believe Sydney Water has the capability and resources to realise these capital efficiencies.

Table 6-42 Efficient Level of Capital Expenditure

SYDNEY WATER CORPORATION PROPOSAL - CAPEX - TOTAL PROGRAM							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Water	632.1	261.3	293.3	212.6	176.5	1399.3	1575.8
Wastewater	721.5	766.2	791.2	824.3	698.8	3103.1	3801.9
Stormwater	40.1	53.7	43.3	48.0	29.0	185.2	214.2
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1532.7	1200.9	1204.7	1148.9	959.5	5087.2	6046.7
Atkins/Cardno recommended adjustments for specific programs or projects							
Reservoir Renewals and Reliability	0.0	-7.6	-3.4	-6.0	1.3	-16.9	-15.6
Water PS renewals scope	-4.1	-4.2	-3.0	-2.8	-14.1	-14.1	-28.2
Critical water mains renewal	0.0	0.0	0.0	0.0	-8.5	0.0	-8.5
General growth adjustment	-12.0	-15.9	-15.8	-12.1	10.0	-55.9	-45.8
Metering adjustment	-1.5	-1.5	-1.5	-1.5	-1.5	-6.0	-7.5
Prospect to Macarthur adjustment	-188.4	188.4	-62.0	0.0	0.0	-62.0	-62.0
"Wet Weather Overflow Abatement" program efficiency	-9.2	-10.7	-10.9	-9.5	0.0	-40.3	-40.3
Critical and Non-Critical Mains Renewals scope and efficieny	-33.4	-34.9	-32.5	-31.9	-6.7	-132.7	-139.4
Quakers Hill and St Marys WWTP variation	14.1	0.0	0.0	0.0	0.0	14.1	14.1
WWTP renewals prudency	-18.0	11.1	7.3	-19.2	38.0	-18.8	19.2
Richmond/North Richmond Amplification	0.0	-4.1	0.0	0.0	0.0	-4.1	-4.1
Upper South Creek Expenditure	93.2	19.4	12.1	-48.9	114.2	75.9	190.0
General growth adjustment	-46.0	-42.4	-56.1	-35.7	-44.0	-180.2	-224.2
Wastewater PS civil works	5.0	5.0	5.0	5.0	5.0	20.0	25.0
Stormwater Renewals	0.0	-5.8	-4.6	-5.4	18.3	-15.8	2.5
Waterway health	1.6	1.6	1.6	1.6	-6.5	6.5	0.0
ADJUSTED EXPENDITURE BEFORE APPLICATION OF EFFICIENCY TARGETS							
Water	426.2	420.4	207.6	190.2	163.7	1244.4	1408.1
Wastewater	727.3	709.5	716.1	684.1	805.2	2837.0	3642.2
Stormwater	41.7	49.6	40.3	44.2	40.8	175.9	216.6
Corporate	139.0	119.8	76.9	64.0	55.2	399.6	454.8
Total	1334.1	1299.3	1040.9	982.6	1064.9	4656.9	5721.7
Atkins/Cardno recommended additional capital efficiency targets (beyond those applied by the company)							
Continuing efficiency (%)	0.80%	1.60%	2.40%	3.20%	4.00%		
Continuing efficiency ($M)	-10.7	-20.8	-25.0	-31.4	-42.6	-87.9	-130.5
Catch-up efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%		
Catch-up efficiency ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATKINS/CARDNO ASSESSMENT OF EFFICIENT EXPENDITURE							
($M 2019/20) year ending June	2021	2022	2023	2024	2025	2021-24 Total	2021-25 Total
Water	422.8	413.7	202.6	184.1	157.1	1223.2	1380.3
Wastewater	721.4	698.2	698.9	662.2	773.0	2780.7	3553.8
Stormwater	41.4	48.8	39.4	42.8	39.1	172.4	211.5
Corporate	137.8	117.9	75.0	62.0	53.0	392.7	445.7
Total Efficient Expenditure	1323.4	1278.5	1015.9	951.1	1022.3	4569.0	5591.3

Source: November 2019 SIR and Atkins/Cardno analysis

7. Asset Lives

IPART requested us to

> *Audit and assess the accuracy with which Sydney Water has classified its existing assets and planned capital expenditure into the following asset classification classes: Civil, Electrical, Mechanical, Electronic and Non-depreciating assets (or 'CEMELND') and make recommendations regarding*
>
> - *the efficient capital expenditure on new assets in each classification class by business area;*
> - *the average remaining life of existing assets by classification and in each business area; and*
> - *the expected life of new assets by classification class and business area*

Our approach to this task focused on a discussion and analysis of the Corporation's methodology and assumptions. We discussed the changes in asset life assumptions from 2016 and inspected documents in support of asset life assumptions and analysis by service area to identify and assess in the various classification classes:

- the value of all existing assets
- the efficient expenditure on new assets
- the average remaining life of existing assets
- the expected life of new assets

Confirmation that the values entered against each asset are accurate is outside of the scope of this audit. It is our understanding that this exercise is carried out internally and subject to audit by the financial auditors.

Assumed Life of New Assets

Sydney Water has not formally documented the processes it has in place to derive its asset classification, however, overall the Corporation was able to demonstrate the processes in place and that the classification is applied as described.

The Corporation assigns the CEMELND classification to current and planned expenditure in the capital program for each asset class to a point when a new asset is completed, applying standardised percentages depending on the asset based on technical sheets provided by asset management. Assets with a very high value of investment are reviewed on a case by case basis and their percentage split against CEMELND is customised rather than applying the standard percentage splits. When assets are commissioned, they are added to the financial asset register where a more detailed analysis of asset lives is carried out.

Sydney Water provided a schedule of asset lives for each fixed asset category: civil, electronic, mechanical and electrical for the water, wastewater, stormwater and corporate services. These are the 2020 Determination period assumptions. The method of preparation is unchanged from the 2016 Determination period. and prepared though there have been no significant changes in asset life assumptions. Sydney Water applies a detailed and structured approach to asset classification for each new asset added to the register.

There is a significant increase in IT Digital capital expenditure which is allocated to a Corporate electronic life of ten years.

Residual Life of Existing Assets

Sydney Water has demonstrated how the asset values for water, wastewater, stormwater and corporate are rolled forward through the current determination period from 2016 to 2020 taking opening asset values, adding new capital expenditure and subtracting depreciation. The analysis allows for asset disposals although these are shown only for non-depreciable assets. An adjustment is made for a change in price base each year.

Asset disposals are shown as non-depreciable assets with a 42% benefit sharing ratio. There is one capital contribution for civil assets in 2017.

The weighted remaining life of existing assets show marginal changes between the opening and closing years of the determination period as new assets are added during the current determination period. For example, water civil assets show an increase from 93.2 to 94.2 years as a result of asset additions. The water electrical assets life is relatively unchanged at 20.5 years and mechanical assets from 29.9 to 30.1 years. The largest movement in asset life is for electronic where remaining life reduces from 8.6 to 6.4 years, a nearly 25% reduction.

The wastewater residual asset life for electrical and mechanical assets are relatively unchanged from 2016 to 2020. Civil assets show a small reduction whereas electronic asset life increases from 9.3 to 10.3 years.

The residual life for Corporate electronic assets is relatively unchanged at 6.3 years.

Efficient expenditure

We report in the tables below our findings on efficient capital expenditure by service and asset type. These have been derived by adjusting expenditure for those projects which are known to be only Civils assets and then pro-rating the remaining expenditure of Sydney Water's "Capex by RAB" in the November 2019 SIR.

Table 7-1 Efficient water expenditure by asset category

	2020	2021	2022	2023	2024	2025	Total 2020-24
Civil	186.1	350.2	342.7	155.6	145.9	133.6	994.5
Electrical	10.1	14.4	14.9	11.2	8.4	3.6	49.0
Mechanical	35.4	50.3	47.4	29.1	25.0	18.2	151.8
Electronic	4.7	7.8	8.7	6.6	4.8	1.8	27.9
Non-Depreciable Asset	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient expenditure	236.4	422.8	413.7	202.6	184.1	157.1	1223.2

Source: November 2019 SIR and Atkins/Cardno analysis

Table 7-2 Efficient wastewater expenditure by asset category

	2020	2021	2022	2023	2024	2025	Total 2020-24
Civil	298.2	398.4	385.1	424.2	409.3	441.5	1617.0
Electrical	67.6	89.3	81.6	68.7	78.8	104.2	318.5
Mechanical	81.2	109.9	101.2	84.9	92.4	122.8	388.3
Electronic	32.2	69.5	85.3	59.7	54.8	57.9	269.4
Non-Depreciable Asset	69.0	54.2	45.0	61.4	26.9	46.6	187.6
Efficient expenditure	548.2	721.4	698.2	698.9	662.2	773.0	2780.7

Source: November 2019 SIR and Atkins/Cardno analysis

Table 7-3 Efficient stormwater expenditure by asset category

	2020	2021	2022	2023	2024	2025	Total 2020-24
Civil	18.9	41.4	48.8	39.4	42.8	39.1	172.4
Electrical	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mechanical	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electronic	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-Depreciable Asset	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient expenditure	18.9	41.4	48.8	39.4	42.8	39.1	172.4

Source: November 2019 SIR and Atkins/Cardno analysis

Table 7-4 Efficient corporate expenditure by asset category

	2020	2021	2022	2023	2024	2025	Total 2020-24
Civil	13.0	7.6	10.7	4.1	4.0	5.0	26.3
Electrical	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mechanical	2.9	2.6	2.6	2.1	1.9	2.5	9.2
Electronic	104.7	126.2	103.1	64.1	52.6	41.1	345.9
Non-Depreciable Asset	1.9	1.5	1.5	4.7	3.5	4.4	11.3
Efficient expenditure	122.4	137.8	117.9	75.0	62.0	53.0	392.7

Source: November 2019 SIR and Atkins/Cardno analysis

8. Special review items

8.1. Growth expenditure

We have commented on Sydney Water's SCIP in Section 3.3 and the growth assumptions underlying it in Section 4.1.

The key investments included in Sydney Water's SCIP in the 2020-2025 period are:

Table 8-1 Key investments in 2020-25 in the SCIP "resilient city" scenario

Date	Investment	Comment
2022	$367M for Cooks River WWOA	Not a growth project. WWOA is reviewed in Section 6.5.2.2
2024	$600M for Lowes/South Creek S1. Note that the timing of this investment is common to all three SCIP scenarios, although the investment is smaller ($450M) in the Traditional scenario.	As discussed in Section 6.5.3.2, the scope and name of this project has subsequently changed to "Upper South Creek". The cost estimate is also significantly higher than in the SCIP and it is likely to be completed after 2024.
2025	$90M for Nepean ADWG (water)	The SCIP does not provide details of the project. The SIR includes $23.6M for Nepean WFP Upgrade to be complete in 2024 (line WGO047).
2025	$130M for Macarthur to Nepean Pipeline (water)	The SCIP does not provide details of the project and it is not clear which project it might relate to in the price submission.

With the exception of the cost of Lowes/South Creek, all of these investments are common to all three SCIP scenarios.

In general, we conclude that the link between the SCIP and the price submission is relatively weak and they appear to have been prepared as standalone submissions with limited integration.

8.2. SDP Network Upgrade

We are required to

(i) Assess the efficiency of any expenditure on drought response and water conservation measures proposed by Sydney Water;

Sydney Water's November 2019 update to its pricing submission identifies expenditure that will be required to augment its network if the Government decides to proceed with an expansion of the Sydney Desalination Plant. These costs were not included in its original submission.

The existing Sydney Desalination Plant currently provides supply into the Potts Hill system. Any expansion of the existing Desalination Plant will require augmentation of Sydney Water's network so that supply from this source can be more widely distributed. These works will allow water to be transferred from the Potts Hill system into the Prospect system. The scope of works currently proposed comprises:

- 50 ML reservoir at Potts Hill to provide additional operational storage
- Pump station at Potts Hill to transfer water from Potts Hill to the Prospect system. The pump station is to be sized for 300Mld
- Construction of 7.6km of 1800mm to transfer water from the pump station at Potts Hill into the Prospect System.

The identified location to deliver water into the Prospect System is at Pipehead (Guildford). The optioneering undertaken within the Options and Preliminary Design Report considered the appropriate locations of the storage tank and transfer point to optimise system hydraulics and whether the existing WMN01 between Potts

Hill and Pipehead could be reused. The hydraulic analysis recommended that the existing site of the Potts Hill reservoirs as the most appropriate site for the storage tank due to constraints at Prospect and Pipehead. Based on the information provided we consider this is sound however we note that only desktop investigations have been undertaken to date and there is a risk that further constraints are identified as the design is progressed.

The existing WMN01 main is one of three above ground mains between Potts Hill and Pipehead. The main was commissioned in 1888 making it 131 years old. The pipeline has been offline for five years but Sydney Water had planned rehabilitate the main in future to provide additional contingency for taking WWN04 “the tunnel” offline. The options analysis has relied upon a 2007 condition assessment confirmed extensive leaks to almost 50% of the joints along the pipeline as well as spalling of the cement lining and corrosion of the cast iron supports, and loss of internal coating within the pipe. A financial analysis was undertaken comparing the cost of repairing the leaks with constructing a new main. We consider that the analysis could have been extended to include the latest cost estimates, sensitivity and scenario testing and greater quantification of repair cost options. Sydney Water advised that a more detailed condition assessment is currently in progress. Initial results suggest that the main is in poorer condition than recorded in 2007.

While we consider that options assessment appropriate for the circumstances, more time more time to assess risks and investigate options may lead to a better solution being identified

A total project cost estimate of $436m has been prepared by Jacobs as part of the concept design. Sydney Water has subject this estimate to its own review and challenge. Sydney Water notes in its Pricing Proposal Update that it considers that this is a “low case estimate”. Forecast expenditure for the four year, future determination period is $368m capex and $1.5m opex as indicated in the expenditure profile in Table 8-2 below.

Table 8-2 Sydney Desalination Plant expansion network upgrade – capital and operating expenditure

($m 2019/20) year ending June	2020	2021	2022	2023	2024	Total 2021-2024
SDP expansion Network Upgrade capital expenditure	220.8	147.2	0.0	0.0	-	**368.0**
SDP expansion Network Upgrade capital expenditure		0.5	0.5	0.5		**1.5**

Source: Sydney Water update to our 2020-24 price proposal

In our review, we sought assurance from Sydney Water that it is aware of and it will manage the risks to outturn cost that it can control such as procurement strategy and the supply of steel pipe. Sydney Water provided assurance that it is aware of and seeking to manage these risks. On this basis, we consider that the estimate provided by Sydney Water is the best available estimate at this time notwithstanding that procuring these works in an active market will present a risk to the outturn cost that Sydney Water has reduced ability to control.

8.3. Prospect to Macarthur Link

We are required to

1. *Assess the efficiency of any expenditure on drought response and water conservation measures proposed by Sydney Water;*

Sydney Water’s November 2019 update to its pricing submission identifies expenditure to construct a link between Prospect and Macarthur. Most of these costs were not included in its original submission.

The immediate purpose of the link is to allow water to be transferred from Prospect to Macarthur to mitigate the risk of shortfall due to declining storage levels in the southern dams. In the longer term the solution is designed to allow growth to be serviced. Approximately $142.5m of the scheme was already included in Sydney Water’s submission as a growth servicing solution. Sydney Water has included an additional $560.9m in its November 2019 updated submission as a drought response.

This scheme forms ones of the first tranche of recommendations of the drought options study commissioned by Sydney Water and WaterNSW. It is classified as a ‘no regrets’ solution as it involves bringing forward future growth capex and adapting existing assets. The options study included only the western element with a much lower cost estimate than included in the Supplementary Submission.

The drought options study does not incorporate sophisticated economic optimisation or set out a clear process of options identification and evaluation. However, our view is that the first tranche of interventions is nonetheless reasonably sensible and robust.

The scheme as proposed by Sydney Water in its November 2019 submission involves two 'fronts' to be delivered in two stages. The western link is scheduled for completion in 2021 at a cost of $646.0m and the eastern link is planned for late 2023 at a cost of $62.0m. By contrast, the drought options study only included the western front.

We consider that the western front is prudent. It helps to address the most urgent drought shortfall risk in the southern dams' system by bringing forward investment which would nearly all be required in order to service growth in the future. However, we do not consider that Sydney Water has made a strong case that the eastern front is prudent. The eastern front is primarily driven by future growth expectations. It is uncertain how the drought and responses to it will evolve. The eastern front is designed to deliver benefits a number of years into the future when deeper demand restrictions may well be in place and the balance of resources between north and southern systems may be different.

Given the current state of development of the project, we consider that the time needed for project preparation and approvals, procurement, mobilisation and construction makes it unlikely that construction will be substantially complete by June 2021 and that much of the construction will still be taking place in 2022. We have therefore recommended an adjustment to the proposed capex to remove the eastern front expenditure and reprofile the western front expenditure as summarised below.

Table 8-3 Prospect to Macarthur Link – recommended expenditure adjustment

PROSPECT TO MACARTHUR LINK								
($k 2019/20) year ending June	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021-2025**
SWC proposed expenditure	76,690	399,460	22,750	62,000	-	-	484,210	484,210
Atkins recommended adjustment		(188,355)	188,355	(62,000)			(62,000)	(62,000)
Atkins recommended expenditure	76,690	211,105	211,105	-	-	-	422,210	422,210

In its Supplementary Submission, Sydney Water has proposed additional opex of $10m in 22, $14m in 23 and $15M in 24 and thereafter. Many of the costs appear to have been prepared using basic 'percentage of capex' figures with little substantiation (e.g. 1.7% p.a. O&M for pipelines). We note for comparison that a lower figure of 0.6% is quoted for the Cascade scheme[77].

We consider that this is an over estimate of the net opex impact of the scheme. For example, it seems unlikely that Sydney Water will incur an additional $2.5m p.a. of costs (equivalent to many new employees) for O&M of the pipeline assets alone. We have recommended an adjustment to the opex impact as detailed in Section 5.

8.4. Blue Mountains Cascade Supply

We are required to

2. *Assess the efficiency of any expenditure on drought response and water conservation measures proposed by Sydney Water;*

[77] See page 301 of "365.3 Cascades Drought OABC v10 with attachments"

Sydney Water's November 2019 update to its pricing submission identifies expenditure to upgrade Cascade WFP to enable it to use an alternative supply and to upgrade the emergency supply from the Orchard Hills System to secure supply in the context of the decline in Oberon dam levels.

Oberon Dam storage has reduced significantly, and some modelling scenarios suggests that it could run out of water by the end of 2021-22. This scheme aims to treat water from an alternative, lower quality, source (Duckmaloi weir) at Cascade WFP. It also aims to increase the capacity of the emergency supply from the Orchard Hills System, slowing the drawdown of Oberon Dam.

The Options Appraisal conducted by Sydney Water identified the least cost solution, ruling out more expensive solutions, and appears reasonable robust. We consider that the proposed scheme is prudent and efficient and have not recommended any adjustments to capex.

8.5. Drought response measures and water conservation projects

We are required to

3. *Assess the efficiency of any expenditure on drought response and water conservation measures proposed by Sydney Water;*
4. *Identify drought response measures proposed for the 2020 Determination period that overlap with the long-term growth investment plans – drought response measures that represent bringing forward investment needed to service growth.*

8.5.1. Update Submission – cost pass-through

Sydney Water's proposals for water conservation were revised in the Update Submission dated November 2019. All expenditure, other than the base water conservation activities discussed in Section 5, are proposed as 'Cost Pass Through' operating expenditure. Total proposed expenditure to be triggered by the implementation of water use restrictions is shown in Table 8-3 below.

Table 8-4 Drought Response Cost Pass through expenditure

SYDNEY WATER UPDATE SUBMISSION COST PASS THROUGH OPERATING EXPENDITURE					
$m 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	**total 2021-24**
WATER SUPPLY RESILIENCE					
Network upgrades for extended SDP	0.0	0.5	0.5	0.5	1.5
NON-INFRASTRUCTURE DROUGHT RELATED					
Water conservation	51.0	63.0	63.0	63.0	240.0
Water restrictions advertising	10.0	10.0	10.0	10.0	40.0
Water restrictions implementation	15.0	15.0	15.0	15.0	60.0
Drought management	1.6	1.6	1.6	1.6	6.3
Total drought related	77.6	89.6	89.6	89.6	346.3
TOTAL COST PASS THROUGH					
Total	77.6	90.1	90.1	90.1	347.8

Source SWC Update Table 2-5; amounts are rounded

8.5.2. Network upgrade

This is expenditure related to the network upgrade works discussed in Section 8.2 above.

8.5.3. Water conservation

Sydney Water is proposing expenditure of $51m in 2021 increasing to $63/a in the subsequent three years. This is in addition to the $10m/a included in base expenditure. This is to increase water conservation activities in response to the level of water restrictions in place which in turn are reflective of the reservoir storage levels. The activities and costs related to each level of water restrictions is shown in Table 8-5. The base level of water conservation is shown for comparison.

Table 8-5 Water conservation activities and costs related to the level of water restriction

SYDNEY WATER - WATER CONSERVATION COST PASS THROUGH								
	Baseline		**Level 1 < 50%**		**Level 2 <40%**		**Level 3 < 30%**	
$m 2019/20 Year ending June	Water savings (Ml/a)	Cost	Water savings (Ml/a)	Cost	Water savings (Ml/a)	Cost	Water savings (Ml/a)	Cost
WATER SAVING ACTIVITIES (WATERFIX) WITH RESIDENTIAL CUSTOMERS								
Showers	No data		390	5.062	496	8.463	562	10.762
Toilets			260	3.376	331	5.655	374	7.175
Taps			130	1.668	165	2.828	187	3.587
Other			130	1.688	165	2.828	187	3.587
Washing machines			195	2.531	248	4.241	281	5.381
Outdoor			195	2.531	248	4.241	281	5.381
Total residential	420	2.13	1300	16.856	1653	28.256	1872	35.873
WATERFIX STRATA								
Waterfix strata	230	1.28	680	7.23	805	12.33	911	15.73
BUSINESS ACTIVITIES								
Business to business	130	4.00	420	2.00	536	5.60	607	8.00
Waterfix commercial	120	1.20	300	2.80	358	5.20	405	6.80
Total Business activities	250	5.20	720	4.80	894.00	10.80	1012.00	14.80
TOTAL CUSTOMER SAVINGS AND COSTS								
Total savings and costs	900	8.61	2700	28.88	3352	51.38	3795	66.40
WATER SAVING WITHIN SWC								
Leakage reduction	100	1.00	300	4.00	447	7.00	506	9.00
Administrative costs		0.40		7.10		11.60		14.6
TOTAL SAVINGS AND COSTS								
Total		10.01	3000	39.98	3799	69.98	4301	90.00
Adjusted expenditure	**1000**	**10.01**	**3000**	**33.00**	**3799**	**52.00**	**4301**	**63.47**

Source: SWC Update submission appendix table 8.

We comment on:

- Costs and the benchmark analysis
- Leakage comparisons
- Water conservation activities
- Key findings
- Efficient level of water conservation

Costs and the benchmark analysis

Sydney Water notes that there is a lack of cost information for the proposed water conservation programs, particularly for the level of activities proposed in Table 8-4. It carried out a benchmark analysis comparing water conservation costs for water utilities in England and Wales (E&W) using data derived from a review of the companies draft business plans. The adjusted expenditure above is derived from this benchmark analysis.

The analysis is used to derive a relationship between total cost per property and total benefit per property for water conservation measures. The regression analysis shows an R2 of 0.597. which is indicative of the variance in costs and benefits. Sydney Water then applies its costs and benefits from Table 8-4 above. It derives proposed expenditures taking the mid-point between the Economic Level of Water Conservation (ELWC) derived expenditures and the regression line for the total benefits shown. This results in a reduction of 18% to 31% of the original water conservation proposals.

The analysis compares Sydney Water's water conservation costs, including leakage reduction, with those of England and Wales companies. These companies' primary focus for the 2020 to 2025 period is on leakage reduction by at least 15% and greater for some companies. In addition, some companies are showing further savings through the installation of 'smart meters' or similar compared with dumb meters. Water conservation activities generally include a modest level of retrofit activities and targeted promotional activities. The leakage reduction targets are driven by customer preference and willingness to pay as well as Ofwat and the Environment Agency's lack of confidence in companies' assessment of economic levels of leakage. In addition, the Outcome Delivery Incentive (ODI) for leakage gives financial incentives for out-performing targets.

The analysis in Figure 8.3 of the Update submission appendix shows that the cost curve for Sydney Water's mainly retrofit programs is significantly steeper than the benchmark curve. This implies that the cost of these retrofit activities is greater than leakage reduction. The costs at a higher level of activity of retrofit penetration are at the limit of the likely range of costs. The uncertainty of this analysis questions whether increasing activities shown as Level 3 in Table 8.4 are efficient. We propose an efficient level of expenditure of $52m/a through the period of water restrictions which is just above the upper quartile of the range of costs.

Leakage comparisons

We comment on Sydney Water's approach to leakage management in Section 5.4.12. While Sydney Water has an ILI of 1.63 and is classified as band A in the World Bank classification of water utilities[78], its performance is comparable with well performing E&W companies. However, it currently does not have the flow and pressure monitoring infrastructure and the extent of new technology which many E&W companies have in place. This currently makes timely active leakage detection more difficult and less efficient. We note that there is a capital project to address this current leakage management shortfall.

A first step in efficient water conservation is to return leakage to its mean ELL using base expenditure. To put the leakage reduction in context, returning leakage to mean ELL is some 24 Ml/d when annual water conservation measures are forecast to deliver less than half this figure.

The economic level of leakage is derived from a methodology agreed between Sydney Water and IPART; this is part of the water conservation measures within the 2019 Operating Licence. The ELL calculation is sensitive to the value of water assumed. This is based on the current aggregate storage level in the impounding reservoirs. A short run approach is taken. The ELL for 2020 is estimated to be 102 Ml/d using the short run methodology and reservoir storage of 40 to 45%. Using the mean ELL level, current performance is significantly above this level, some 30 Ml/d.

The economic level of leakage is derived from a methodology agreed between Sydney Water and IPART; this is part of the water conservation measures within the 2019 Operating Licence. The ELL calculation is sensitive to the value of water assumed. This is based on the current aggregate storage level in the impounding reservoirs. A short run approach is taken. The ELL for 2020 is estimated to be 102 Ml/d using the short run

[78] Water Conservation Report 2018-19, Sydney Water, 2019

methodology and reservoir storage of 40 to 45%. Using the mean ELL level, current performance is significantly above this level, at 30 Ml/d.

Water conservation activities
The water conservation activities are defined in Section 5.4.11. Sydney Water explained that the unit cost of each water conservation activity increased with each level of restriction; for example, the doubling of funding results in a third increase in savings. The increase in retrofit costs appears to be mainly due to promotion, location of customers willing to partake and the resources needed to carry out this increased workload. The program has the benefit of enhanced advertising under a separate expenditure line.

The activities proposed are consistent with good water conservation practice. These retrofit activities could be extended to institutional customers including hospitals, schools and government buildings. Sydney Water has been successful in attracting residential customers to this scheme and reasonable savings have been reported in 2018 and 2019. However, scaling up of these activities three- or four-fold presents a significant challenge and questions the achievability of the increased levels of activity and delivery of savings.

Water savings from common activities such as showers, toilets and tap re-washering are documented although savings from business to business activities are less certain. There is an uncertainty in the targeting of these retrofit activities and the rate of take-up which then drives cost uncertainty.

Companies in England and Wales promote similar water conservation activities with now a focus on targeting particular groups of customers and wider promotional activities. There is also focus on repairing customer’s service pipes generally at no cost to customers. This activity does not appear to be included in the water conservation measures.

A challenge is to identify customers with high levels of leakage which from our experience could be around 1 in every 100 customers or more. While Sydney Water comments that it has algorithms to identify such customers, these are dependent on meter readings taken every quarter. In the medium term, the use of smart meters or similar and dataloggers attached to existing meters (if they are suitably enabled) provides an opportunity for real time monitoring to identify high customer water use for investigation.

Key findings
We formed the view that

- there is some evidence to show that the scaling up of water conservation activity up to level 2 can be achieved and maintained. The efficiency of further scaling up to the level 3 activities has not been robustly demonstrated as the costs and benefits are less certain than level 2. Further data on costs and benefits of the level 2 program is needed to confirm the efficiency of the next level;
- the costs and benefits of the business and commercial water savings has not been tested as the program is only just starting. This is shown as a significant expenditure yet the benefits have a low confidence;
- the balance between water conservation and leakage management activities is skewed to the former when, from our experience in the UK, far greater benefits are derived from leakage management than water conservation measures;
- there is insufficient focus given to leakage control with only 10% of the proposed expenditure to reduce leakage and the level of savings are likely to be understated. This is an activity within the direct control of Sydney Water and, from our experience of leakage control in the UK, there are opportunities for greater benefits form a leakage control program managed directly by Sydney Water.
- An efficient level of expenditure of $52m/a (as the level 2 proposal) is proposed being around the upper quartile of the cost and benefit analysis.

Sydney Water should review the balance of its program in response to water restriction levels in the short and long term with greater focus on leakage reduction. In the short term, significantly greater focus should be given to leakage control. To put this in context, the current leakage level is significantly above the mean ELL and is over twice the level 3 total water conservation program. A leakage strategy should be developed to focus on short term leakage reductions, including pressure control, to reduce water losses.

In the medium term, Sydney Water should develop and implement a water conservation within the whole-of-business so it is ready to manage in average and drought condition to include

- the use of smart meters for every customer so that consumption can be monitored and excess use readily identified and fixed. Assuming 1 in 100 customers has excess leakage then this helps to focus on those properties where clear benefits can be made;
- the implementation of current best practice flow and pressure monitoring within discreet (district meter) areas as well as flow-modulated pressure management;
- the application of current best practice leakage detection and repair so leakage can be located and fixed quickly and much shorter than current repair times.

8.5.4. Water restriction advertising

We comment in Section 5.6.13 on the proposal for additional water restriction advertising.

Sydney Water provided details of its advertising budget for year 2020. This indicates actual expenditure in Q1 of about $6m and a full year budget of $20m. We accept this total level of expenditure is necessary during periods of water scarcity. However, we question whether the split between base and cost pass-through is appropriate. For example, if reservoir storage is greater than 70% is there a need for the $10m/a proposed. We propose a $5m/a base expenditure plus a $15m/a during periods of water restrictions.

We suggest that there is an outcome measure to monitor the success of these activities, using the measure of daily water distribution input and the percentage reduction from a defined base which Sydney Water currently uses. This could be reported quarterly and published on the Sydney Water website.

8.5.5. Water restrictions implementation

Sydney Water is proposing $15m/a on the implementation and regulation of published waster use restrictions. The main areas of expenditure are for up to 50 community water officers including out of hours working, increasing staff in the customer contact centre and closer liaison with businesses to reduce water use. This level of activity was similar to the Millennium drought. We accept that this level of activity is needed.

8.5.6. Drought management

Sydney Water is proposing $1.5m/a for management of the drought activities and providing governance and cost controls. We agree that this is essential for the effective and efficient management of the drought activities and to control expenditure.

8.5.7. Variance in BOOT costs

The introduction of water use restrictions as reservoir storage reduces has an impact on BOOT expenditure. Section 5.6.8 presents three options for throughput of the filtration plants based on reduced demand and the operation of the existing SDP and extension. The increase in costs from the SDP1 plant and subsequently the SDP expansion plant should be offset by annual savings of $8.7m (SDP1 operation) and $12.5m (SDP and expansion operation) from BOOT treatment costs. These costs should be taken into account when deriving the total cost impact of the water restrictions.

8.5.8. Efficient cost pass-through expenditure

We propose a level of efficient expenditure for cost-pass through activities related to the implementation of drought restrictions is shown in Table 8-6.

Table 8-6 Efficient cost pass-through expenditure

SYDNEY WATER UPDATE SUBMISSION COST PASS THROUGH OPERATING EXPENDITURE					
$m 2019/20 Year ending June	**2021**	**2022**	**2023**	**2024**	**total 2021-24**
WATER SUPPLY RESILIENCE					
Network upgrades for extended SDP	0.0	0.5	0.5	0.5	1.5
NON INFRASTRUCTURE DROUGHT RELATED					
Water conservation	51.0	63.0	63.0	63.0	240.0
Water restrictions advertising	10.0	10.0	10.0	10.0	40.0
Water restrictions implementation	15.0	15.0	15.0	15.0	60.0
Drought management	1.6	1.6	1.6	1.6	6.3
Total drought related	77.6	89.6	89.6	89.6	346.3
ATKINS RECOMMENDED SCOPE AND EFFICIENCY ADJUSTMENTS					
Water conservation measures	0.0	-12.0	-12	-12	-36.0
Water restrictions advertising	5.0	5.0	5	5.0	20.0
Savings from BOOT plant operation	-10.30	-10.43	-15.92	-16.01	-52.66
Efficiency adjustment	0.0	0.0	-1.7	-2.5	-4.1
ATKINS RECOMMENDED TOTAL COST PASS THROUGH					
Total	72.3	72.6	65.5	64.6	275.0

8.5.9. Drought performance monitoring recommendations

We recommend quarterly reporting to provide visibility of short term performance against targets. We propose that Sydney Water monitor the success of water conservation activities, using the measures of:

- Average monthly water distribution input sourced from both WaterNSW and the desalination plant(s) and in total;
- the percentage reduction in demand from a defined base which Sydney Water currently uses, compared with target reduction;
- the rolling annual average leakage in Ml/d at the end of the quarter compared with the ELL;
- the quarterly average leakage value in Ml/d compared with target – also shown in graphical form for the last five years
- the volume of recycled water produced (Ml/d) against capacity from S16a plants at Rosehill-Camilla and the St Mary's plant

This data should be reported quarterly, within 28 days of the of the quarter, and published clearly on the Sydney Water website. Explanations for variances against targets are required.

8.6. Environmental licensing requirements

With respect to Sydney Water's environmental licensing requirements, we are required to:

- *review Sydney Water's performance against EPL requirements over the 2016 Determination period*
- *recommend the efficient costs associated with delivering the required EPL outcomes over the 2020 determination period*
- *consider the implications of the EPA's 2024 (and beyond) regulatory framework on Sydney Water's 2020 expenditure.*

We describe and provide comment on Sydney Water performance against EPL requirements in Section 3.2.2.

We have reviewed specific projects and programs relating to EPL requirements as part of our review of future capital expenditure. Most notably is the expenditure relating to the dry weather overflows to waterways program, the wet weather overflows abatement program and wastewater treatment in Section 6.

There has been considerable focus from EPA and Sydney Water in the current EPL review for which the major change is the move to a risk based approach for management of wet weather overflows and a point scheme for their abatement. The most material likely future changes to Sydney Water's EPL at the next review will be the introduction of bubble licencing to the Hawkesbury-Nepean river to manage nitrogen loads and improve the health of the waterway. Bubble licencing will enable polluters including Sydney Water to pursue a range of measure to contain nutrient loads such as increased treatment, recycling, trading and offsets. Sydney Water has commenced planning for the introduction of this licensing approach. Bubble licensing will enable trading of credits for pollution abatement so that lowest marginal cost abatements can be promoted. Work in quantifying the cost implications are preliminary only at this stage.

8.7. Finance leases

Sydney Water is upgrading its Prospect and Macarthur Water Filtration Plants (WFPs), which are subject to finance leases. This is to improve the reliability of the plants in meeting requirements under the 2011 Australian Drinking Water Guidelines (2011 ADWG). We are required to

- *recommend the efficient level of capital expenditure for the upgrade works and the basis for the cost estimates underpinning the expenditures,*
- *examine the procurement and contract delivery model process Sydney Water has carried; and*
- *recommend the efficient operating expenditure of the WTPs,*
- *consider the use of benchmarking to establish the efficiency of the upgrades works recurring operating expenditure.*

At the 2016 Determination, IPART included in Sydney Water's Regulatory Asset Base (RAB) [redacted] for the Prospect WFP upgrade and [redacted] for the Macarthur WFP upgrade.

Macarthur Filtration Plant

This treatment plant is the single source of supply to 290,000 people in South West Sydney. The lease with Macarthur Water was extended in 2011 to 2030. The plant capacity is 60 to 235 Ml/d depending on raw water quality. The revised Macarthur Water Filtration agreement included an upgrade to meet the 2011 ADWG requirements including an asset condition guarantee to ensure assets are operated and maintained to be handed over at the end of the term. The 2011 ADWG includes for turbidity measured at individual filters and improving disinfection contact time.

The scope of works comprised upgrading the on-line monitoring and pre-chlorination system, installation of an advanced coagulation control system and upgrading of the chlorine and ammonia dosing system. The filter control valves are to be upgraded to allow individual operation with associated washwater and sludge handling improvements. [redacted]. The 2016 RAB included a $10.9m (2020 price base) allowance in the RAB. [redacted].

Sydney Water explained that the 2016 Determination estimate included initial cost estimates based on early concept design during the planning stage. There has been an increased scope of work from design development, a more clearly defined concept design and commercial terms and an increase in Sydney Water's costs for project management.

Capital cost estimates

Sydney Water obtained an independent review of the technical proposals, the cost estimates and financing. Consultants reported that the technical solutions were appropriate. The cost estimates were in line with industry [redacted]. Financing provides value-for-money based on public sector comparator. The contract was finalised in August 2018 with completion planned for September 2020.

Procurement and contract delivery

The approach to procurement of these works is complex because of the incumbent BOOT plant owner. In an open market, Sydney Water would follow its P4S procurement route to identify the most beneficial procurement route and then obtain competitive tenders for the work. The current approach appears to request the BOOT owner for the capital costs for the designs previously agreed with them. There is no apparent testing of these costs in the market although an independent review has been carried out. There also appears to be no incentives to outperform the costs in any target cost and profit-sharing arrangement. Contingencies are included but it is unclear who gains from any efficiencies delivered. We are not able to confirm that the current procurement process and costings are efficient given the constraints of an existing BOOT contract.

As this project is at an advanced stage we have not applied an efficiency but note that there is little opportunity to set target costs and share profits and losses in an equitable way.*Operating expenditure*

[redacted].

Efficient expenditure

The level of efficient expenditure is shown in Table 8-7below. We have made some adjustments to asset lives consistent with our view set out in the 2016 Efficiency Report.

Table 8-7 Efficient finance lease expenditure - Macarthur

[redacted]

Prospect Filtration Works

This treatment plant is the single source of supply to 4m people in Sydney with a maximum capacity of 3000 Ml/d but this reduces to 1500 Ml/d depending on raw water quality. It is owned and operated by The Prospect Water Partnership. The lease has been extended for a further 15 years to 2035. The objective of the upgrade is to ensure compliance with the 2011 ADWG guidelines under adverse water quality conditions, to improve reliability and increase the capacity of the works to 1800 Ml/d during adverse water quality conditions.

The 2016 Determination allowed [redacted] for the upgrading works to meet the ADWG requirements. Further research and development work in 2017 confirmed that the capacity of the plant could be increased to 2000 Ml/d during adverse raw water quality conditions with minor capital and operating changes. The project scope was amended.

The scope of work comprises the installation of filter to waste and backwash recovery systems to enable individual filters to be operated independently to meet the new ADWG requirements. Upgrades are required to the electrical and control systems, chemical storage and dosing systems and site services. The scope also includes measures to reduce the risk of flooding of the plant.

The concept design was completed for the reliability upgrade to meet the ADWG requirements and the capacity increase in 2018. An independent technical review of the designs was carried out by consultants. Commercial negotiations for the terms of the upgrade have commenced. Final proposals from the Prospect Water Partnership are expected to be submitted in 2020 with the upgrade completed in 2025.

Capital cost estimates

[redacted] Sydney Water attributed the cost variance to increases from the concept design, additional costs for the capacity upgrade and increased Sydney Water costs. The cost estimate prepared to date is based on the concept design completed in 2018; detailed cost estimate to be submitted by Prospect Water Partnership in 2020.These costs are subject to independent review by consultants. We expect the costs to be subject to challenge with resulting efficiencies to be made.

Procurement

The approach to procurement of these works is complex because of the incumbent BOOT plant owner. In an open market, Sydney Water would follow its P4S procurement route to identify the most beneficial procurement route and then obtain competitive tenders for the work. The current approach appears to request to BOOT owner for the capital costs for the designs previously agreed with them. There is no apparent testing of these costs in the market. There also appears to be no incentives to outperform the costs in any target cost and profit-sharing arrangement. Contingencies are included but it is unclear who gains from any efficiencies delivered. We are not able to confirm that the current procurement process and costings are efficient. Sydney Water should revisit the procurement process in the light of the new P4S process and demonstrate that there is an outperformance process so that gains can be shared equitably between the contractor, Sydney Water and customers. Sydney Water commented that

> *The BOOT agreement was entered into in 1993, and they were entered into under a private public partnership (PPP). The private sector owns, operates and maintains the water filtration plant as set out in the agreement between it and Sydney Water. They also have the right to upgrade the water filtration plant (subject to agreement with Sydney Water). Sydney Water does not have the recourse to nominate or select the procurement or delivery approach, nor for it to deliver the upgrade.*
>
> *The P4S procurement method only applies to Sydney Water owned and operated assets; and is not applicable to the BOOT agreement. The intent of P4S was to apply to routine capital works; not for the procurement and delivery of large standalone projects.*
>
> *Under the BOOT agreement, the private sector takes all risk to fund, design and deliver the upgrade. This is as they own and operate the water filtration plant and are hence best placed to manage the risks. Sydney Water has no control over the water filtration plant or upgrade. This arrangement is in line with standard PPP contractual arrangements. With the private sector under the BOOT taking on all risks with regard to cost overruns or delays under a lump sum contract with Sydney Water.*
>
> *For Sydney Water to take this risk, or to profit-share, it would require a modification and renegotiation of the terms of the BOOT agreement and result in Sydney Water taking on more risk, and hence ownership and control of the water filtration plant and this would outweigh any benefits.*
>
> *Sydney Water has implemented the following approach to ensure efficiency in the capital costs, which are to be independently reviewed:*
>
> *- full open book transparency with Prospect Water Partnership to ascertain the cost build-up and assumptions adopted*

- *competitive quotations to be sought (at least three) to ensure market coverage for defined works (civil, mechanical, electrical), plant, equipment and materials*
- *detailed review of risk costs and contingency allowance*
- *benchmark review of cost estimates*

[redacted] This increase does not give us confidence that the scope of works and their costs are well controlled. We consider that there is scope to deliver efficiencies through greater challenge of the scope, effective design, procurement and project management and reductions in risk contingencies. For example, why should Sydney Water be paying for additional flood risk measures to the plant when this should be an issue for the BOOT contractor to resolve.

The Sydney Water [redacted] costs represent [redacted] of the capital cost and appear excessive in that this is a BOOT contract where design and contract supervision are the responsibility of the owner. Sydney Water explained that this [redacted] included the costs of the Project Water Partnership preparing outline designs. We suggest an efficient cost for outline designs and Sydney Water costs should not be more than [redacted] of the capital costs. We assume efficient Sydney Water costs are included within the [redacted] efficiency saving applied to the total costs in the paragraph above.

Operating expenditure

[redacted] We suggest that this is reviewed in relation with the existing operating costs as there should be some synergy of costs. Further analysis is required to demonstrate that this is an estimate of efficient additional costs. The latest program suggests that completion of the upgrade is not planned until 2025. Operating costs falling into the 2020 Determination period are not likely to be material. This is an issue to be revisited at the 2024 Determination.

Efficient expenditure

The project is subject to scrutiny from several independent experts. We assume that they will focus on the efficiency of design, the basis of cost estimates and procurement. We consider the Sydney Water costs are higher than we would expect from similar design and construct projects. [redacted]. Sydney Water should be pressing the BOOT contractor to deliver these reasonable efficiencies.

The level of efficient expenditure is shown in Table 8-7 below. We have re-profiled the proposed expenditure to reflect what we consider to be a most likely program. We have then applied the efficiencies outlined above to expenditure from 2021. We have also made some adjustments to asset lives consistent with our view set out in the 2016 Efficiency Report.

Table 8-8 Efficient finance lease expenditure - Prospect

[redacted]

[redacted]

8.8. Discretionary expenditure

Vaucluse Diamond Bay

In its submission to IPART, Sydney Water are seeking a discretionary expenditure of $63.5M in the next determination period for the Vaucluse Diamond Bay project with total project costs of $64M.

Sydney Water's wastewater system on the South Head Peninsula does not presently undergo wastewater treatment processes before discharging into the environment. Instead, the wastewater collected from the Vaucluse and Diamond Bay catchments is discharged untreated into the Tasman Sea via three cliff-base ocean outfalls approximately 3.5km north of Bondi Beach that were built between 1916 and 1936.

In 2016 the EPA directed Sydney Water to carry out a pollution study as part of the Bondi Licence. Sydney Water completed the study by carrying out a risk assessment of the outfalls in 2017 (PRP 305). The current EPA licence allows for a discharge of effluent at the location, however the outcomes of the study found that the outfalls:

- have degraded the nearby ocean floor habitat
- create a visible pollution plume on top of the water about 75% of the time
- had potential human health impacts to around 2,000 people a year who access the water (e.g. spearfishing, swim events).

To address the issues identified within the PRP305 Sydney Water initiated the Vaucluse Diamond Bay strategy in January 2017 to decide on the preferred options for the scheme. Sydney Water proposed additional pumping stations and pipes to transport wastewater from the Vaucluse-Diamond Bay area (where the outfalls are) to the Bondi wastewater treatment plant to stop untreated wastewater outfalls during dry weather.

We consider that Sydney Water has demonstrated that it has obtained a certain degree of buy in from the EPA for the project outcomes, despite it not being a formal EPA undertaking or direction. Sydney Water have also demonstrated a significant degree of stakeholder engagement and customer support for the environmental and social outcomes of scheme with a willingness to pay study indicating that customers would be prepared to pay an additional $2.30 per year to cease the untreated outfalls. This project has also obtained a significant degree of media coverage and political support from the NSW premier. We would therefore consider it to be a prudent project to undertake in the next period.

8.9. Land sales

We are asked to

- *identify all surplus (non-operational) land and recommend the value of surplus land to be removed from the RAB, where required;*
- *identify all parcels of land (both operational and non-operational) retired for Biobanking and assess Sydney Water's participation in Biobanking.*

Land Sales

Sydney Water manages and extensive portfolio classified as either operational or non-operational assets. We comment on non-operational land disposals and exclude disposal of operational land. Non-operational assets which are surplus to requirements are made available for sale or alternative use. Where such an asset is sold or disposed, the value is deducted from the RAB. A property optimisation process is applied to identify property which is potentially in excess of requirements. The asset disposal policy dated February 2018 has been applied. A summary of asset disposals and RAB adjustments are shown in Table 8-6 below.

Table 8-9 Land sales 2016 Determination Period

SYDNEY WATER LAND SALES					
$m at 2019/20 price base	**2016**	**2017**	**2018**	**2019**	**2020**
OPERATIONAL					
Net Value	34.74	19.58	26.47	3.37	4.58
RAB adjustment	14.58	8.22	13.17	1.72	0.75
Method	42%	42%	CAM	CAM	CAM
Transactions (no)	8	17	20	16	8
Transactions >$1m(no)	4	9	4	1	1
Value of sales > $1m (%)	90	88	83	38	32
POST LINE IN SAND ASSETS					
Net Value	1.042	0.04	0.07	0.00	0.00
RAB adjustment	0.596	0.002	0.005	0	0
Method	Historical	Historical	CAM	CAM	CAM
Transactions (no)	3	3.00	0.00	0.00	0.00
NON-OPERATIONAL					
Net Value	8.51	2.32	0.72	4.02	0.90
RAB adjustment	0	0	0	0	0
Transactions (no)	3	3	2	15	2
Transactions >$1m(no)	2	9	4	1	1

Sources: Sydney Water submission and document 235.1

In 2016, the last year of the 2012 Determination period, there were significant land sales of both operational and non-operational land. There is no adjustment for non-operational land sales in the RAB[79].

For the 2016 Determination period asset sales continued at a significant level; in 2017 and 2018 with several high value land sales. The number of total and high value sales is reduced in 2019 and 2020. Non-operational asset sales varied through the period at an average $2.0m/a; there were no adjustments to the RAB.

[79] Sydney Water Submission July 2019 Section 3.5.2

For the 2020 Determination period, the land disposal follows the methodology agreed with IPART. The net value of operational asset disposals is assumed to be $4.6m/a with a 42% adjustment to give an annual are assumed as $1.9m RAB adjustment. Sydney Water commented that it was not forecasting any significant land sales through the period. The forecast is similar to the 2019 and 2020 land sales.

Sydney Water is not forecasting any non-operational land sales in the 2020 Determination period. We have not carried out a detailed review of all non-operational assets to test this assumption although it would be unusual to have no sales in the period. It would be reasonable to assume that sales would continue at the same rate, some $2m/a.

Bio Banking

Sydney Water is also considering bio-banking as an alternative to land sales. This is essentially a biodiversity offset scheme to improve land management by promoting stewardship of flora and fauna while simultaneously creating financial value. The scheme is managed by the NSW Office of Environment and Heritage and has been active for 10 years. There are two key elements to the scheme:

1. Developers and landholders who undertake development or clearing, generate a credit obligation which must be retired to offset their activity.
2. Landholders – like Sydney Water – establish a biodiversity stewardship site on their land, generating credits to sell to developers or landholders who require those credits, to securely offset activities at other sites.

Sydney Water's Board decided in October 2018 that it should participate in the scheme. Key to the decision-making process is that a site will still be sold off if this is assessed to be the most economically advantageous outcome. However, where the value of the credits is higher, the land will be put under stewardship management.

The process to identify sites considers their suitability (e.g. minimum size of 5 hectares for viability and state of vegetation) and availability (e.g. the Corporation's current and future strategic needs) as part of the options assessment. While some costs are funded by Sydney Water directly (program and audit costs), other costs related to land management are funded by the Biodiversity Conservation Trust with whom the Biodiversity Stewardship Agreement is signed.

In total credit values of $55m have been identified against land management costs of nearly $17m. Picton WWTP & Farm is the first trail site which is likely to go live in 2019/20, with Glenfield WWTP identified as the potential next site. Sydney Water has also identified the following parcels of land (all operational sites) as other potential locations to utilise for biobanking:

1. Prospect Reservoir South
2. North Boiler Paddock
3. South Boiler Paddock
4. Minchinbury Reservoir
5. Glenfield WWTP
6. Macarthur BOOT Plant
7. Wallacia WWTP x 4 separate areas
8. Liverpool WWTP
9. Rouse Hill Trunk Drainage Land (TDL)
10. St Mary's WWTP
11. Fairfield Storm Plant

We support the Corporation's decision to participate in the scheme. Customers are not paying for the operation of the scheme as it is funded through other mechanisms but customers will benefit by sharing in a percentage of any profits as a result of the way it has been set up and agreed in principle with IPART. In other words, it appears there are multiple winners: the environment wins through protection and stewardship of the land, customers will benefit from lower bills and Sydney Water's shareholders will also benefit.

8.10. Information technology

We have discussed this under the relevant sections for IT expenditure.

8.11. Avoided costs

We are required to

> *review the expected change in the present value of the temporary or permanent deferral expenditure on potable water, wastewater and stormwater services, as a result of a proposed recycled water, sewer mining or stormwater harvesting scheme.*

Sydney Water has not proposed any further recycling schemes for the 2020 Determination period.

8.12. Projects subject to government directions

Under section 16(A) of the *Independent Pricing and Regulatory Tribunal Act 1992* (the IPART Act), the Premier may direct IPART to include the efficient costs of complying with certain specified requirements when setting prices.

We are required to:

- review the efficient costs associated with delivering the required services and outcomes over the 2016 Determination period
- recommend the efficient level of operating and capital expenditure for each year over the 2020 determination period, where relevant.

Rosehill-Camellia recycled water scheme and St Mary's Replacement Flows project

We comment on the performance of the recycling plants at Rosehill-Camilla and St Mary's in 5.4.10 and 5.6.13. The Rosehill-Camellia scheme incurs only operating expenditure. The St Mary's plant is predominantly operating costs with some membrane replacement capex. For the 2020 Determination period, both scheme operating expenditure receives an allocation of corporate expenditure which increase operating expenditure.

Our main comment is that the full benefit of these schemes is not realised as, in the case of Rosehill-Camilla there is no use for all the production and at St Mary's the plant is operating at a significantly lower output than planned.

There does not appear to be sufficient incentive for Sydney Water to operate these plants to deliver full benefits, especially at a time of drought. In Section 8.5.9 we have recommended enhanced monitoring and reporting of these volumes to highlight this issue.

Green Square

Refer to Green Square in Section 6.6.2

9. Output measures

IPART requested us to:

a) *Review the utility's performance against its output measures over the 2016 Determination period. Where output measures have not been achieved, provide comment on the reasons for this.*

b) *Recommend a set of new output measures for the utility's proposed operating and capital expenditure program, for the 2020 determination period.*

This task should be informed by the review of capital and operating expenditure.

9.1. Past performance in the current determination

In its submission to the 2016 Determination, Sydney Water proposed 31 output measures and targets, IPART included a rationalised list of 20 output measures in its Determination.

Sydney Water advised that it has adjusted the level of output or target for measures included in the Determination based on its understanding of the "reprofiling and scope reductions handed down in the 2016-17 to 2019-20 Final Determination". These adjustments do not appear to have been previously communicated nor agreed with IPART.

The output measures proposed at the 2016 Determination and the adjustments made by Sydney Water are detailed below. This table includes Sydney Water's reasoning for the reduction, its revised target and the level of adjustment (all are reductions). The average level of reduction in the output measures is 22%.

We have not examined the logic and calculation of each of the revised output measures in detail. It is reasonable where a scope reduction was proposed at the 2016 Determination that this should result in a reduced output measure.

Sydney Water's forecast of its performance against the revised outputs measures for the current period is shown in Table 9-1 below. Sydney Water's performance can be summarised as follows:

- Under achievement of output measure by <10%: six measures;
- Within <10% to >10% variance against the output measure: three measures;
- Over achievement of outputs measure by >10%: ten measures.

We consider that the reprioritisation of effort by Sydney Water away from some areas and into others generally suggests a sound approach to managing its infrastructure as it responds to emerging needs and performance trends. However, it also highlights the difficulty in forecasting future performance and the expenditure requirements to deliver the desired performance. The reality is that the output measures and targets selected at the time of the last Determination have not formed a robust, customer-focused, basis for prioritising infrastructure investment in the current period.

A cause for concern in the current period output measures is that Sydney Water has delivered substantially (-23%) less rehabilitation of sewers subject to dry weather overflows than proposed at the time of the last Determination. It is now proposing a significant ramp up of expenditure in this area for the future period due to declining performance. There is clearly a need to improve forecasting in this area.

Table 9-1 Summary of Sydney Water's adjustments and performance against output measures

Output classification	Description	Measure	2016-20 'Original' submission output Target	2016-20 'Revised' Output Target	Reduction in target	Rationale for revised target	Output Forecast 2016–20	Variance 2016–20	Sydney Water comment on performance
Renewal of critical water mains	Renewals of critical water mains nearing the end of their service lives. Program aims to ensure assets operate with acceptable performance and failure risks (including to the community and environment) are managed.	km	47	30.4	35%	Decreased in line with Atkins-Cardno reduction to Program. A further 20% reduction in outputs has been applied to the re-baselined outputs as the 5 year program outputs were incorrectly attributed to the 4 year price path.	31.3	0.8	31.3 km of renewals are forecast over 2016-20. This is on track to achieve the four–year target. Around 2.4km of planned renewals will be deferred to 2020-24 following a risk review and prioritisation of higher risk work.
Renewal of large valves	Renewals of large valves that are nearing the end of their service life. Program aims to ensure assets continue to operate at an acceptable performance level in delivering water to customers and minimising the impact on the community and the environment through failures.	No.	120	112.2	7%	Decreased in line with Atkins-Cardno scope reduction to Program	76.0	-36.2	76 large valves are forecast to be renewed over 2016-20, which is 36 less than the four–year target. The variance is mainly due to the reallocation of resources to higher priority programs of work and issues with access to the network.
Renewal/ reliability of distribution mains	Renewals and reliability upgrades of reticulation pipelines that are nearing the end of their service life. Program aims to ensure assets continue to operate at an acceptable performance level in delivering water to customers and minimising the impact on the community and the	km	180	152.7	15%	Decreased in line with Atkins-Cardno reduction to Program	96.1	-56.6	A total of 96 km is forecast to be renewed over 2016-20, which is significantly less than the four–year target. The variance is mainly due to refinements in candidate selection criteria resulting in less candidates being selected for renewal.

Output classification	Description	Measure	2016-20 'Original' submission output Target	2016-20 'Revised' Output Target	Reduction in target	Rationale for revised target	Output Forecast 2016–20	Variance 2016–20	Sydney Water comment on performance
	environment through failures.								
Reservoir reliability program	Program to renew reservoirs that are at the end of their useful life to ensure reliability of compliance to current licensed service levels.	No.	33	20.6	38%	Decrease the output target to reflect re-prioritised reservoir renewal program following scope reduction by Atkins-Cardno	20.0	-0.6	20 reservoirs are forecast to be renewed over 2016-20, in line with the four–year target.
Water pumping station renewals	Program to renew water pumping stations identified as fair, poor or very poor condition. Final target is subject to outcome of future site condition assessments..	No.	15	11.9	21%	Decreased in line with Atkins-Cardno reduction to Program	8.0	-3.9	Forecast to deliver four water pumping station renewals less that target. Water pumping stations have been condition assessed and assets are renewed based on condition and risk consequence.
	HV upgrades	No.	16	12.7	21%	Decreased in line with Atkins-Cardno reduction to Program	11.0	-1.7	Forecast to deliver 2 fewer WPS HV upgrades less that target. HV equipment at WPS sites have been condition assessed and assets will be renewed based on condition and risk consequence.
Renew Large Diameter Wastewater Mains	Program to renew 'Avoid Fail' category sewers that are nearing the end of their service life, including rising mains.	Km	34	31.8	6%	Decreased by slightly less than the Atkins-Cardno scope reduction to Program (this is offset by a larger cut to manholes)	17.7	-14.1	Forecast to deliver significantly fewer main renewals than target due to Northern Suburbs Ocean Outfall project taking longer to rehabilitate due to project complexity and significant access, structural and safety issues. In addition to this there have been delays in the South Western Suburbs

Output classification	Description	Measure	2016-20 'Original' submission output Target	2016-20 'Revised' Output Target	Reduction in target	Rationale for revised target	Output Forecast 2016–20	Variance 2016–20	Sydney Water comment on performance
									Ocean Outfall rehabilitation project.
	Number of manholes / vent stacks	No.	80	60	25%	1 package of manhole rehabilitation was deferred	57.0	-3.0	Program largely on track to deliver manhole renewals target.
	km of pressure mains	km	4.0	4.0	0%	Output unchanged as the reduction to the critical sewer program was applied to the above 2 metrics	0.1	-3.9	Planning completed but pressure main renewal to be delivered in next price path.
Rehabilitate Sewers subject to Dry Weather Overflows	Program to abate dry weather overflows that reach waterways and repeat overflows affecting customers.	km	112	98.6	12%	Decreased in line with Atkins-Cardno reduction to Program	76.1	-22.5	It is planned to complete 76km of sewer rehabilitation over 2016-20. This is less than the target due to risk-based reprioritisation of work.
Sewage treatment plant (WWTP) renewals	Program to ensure WWTPs meet its licence performance requirements through to 2023	No. renewal projects	163	106	35%	Original submission target was based on a 5 year period with outputs reduced by 20% to align with the 4 year period. The 4 year revised output target was decreased by 19% in line with Atkins-Cardno scope reduction to the Program.	168.0	62.0	Forecast variance over 2016-20 due to more high priority asset renewals being identified than initially forecast and increased deterioration in asset condition.
	Number of Chemical Dosing Systems	No.	41	27	34%	Original submission target was based on a 5 year period with outputs reduced by 20% to align with the 4 year period. The 4 year revised output target was decreased by 19% in line with Atkins-Cardno scope	22.0	-5.0	

Output classification	Description	Measure	2016-20 'Original' submission output Target	2016-20 'Revised' Output Target	Reduction in target	Rationale for revised target	Output Forecast 2016–20	Variance 2016–20	Sydney Water comment on performance
						reduction to the Program.			
	Number of odour control renewals	No.	11	7	36%	Original submission target was based on a 5 year period with outputs reduced by 20% to align with the 4 year period. The 4 year revised output target was decreased by 19% in line with Atkins-Cardno scope reduction to the Program.	10.0	3.0	
	Number of solids treatment renewals	No.	82	53	35%	Original submission target was based on a 5 year period with outputs reduced to align with the 4 year period. The 4 year revised output target was decreased further in line with Atkins-Cardno scope reduction to the Program.	80.0	27.0	
Wastewater pumping station renewals	Program to renew wastewater pumping stations that have reached the end of their service life.	No.	19	16.7	12%	Decreased in line with Atkins-Cardno reduction to Program	23.0	6.3	Forecast to deliver six additional wastewater pumping station renewals than target due to an increased number of candidates requiring major renewal than initially forecast.
	Number of Pump Renewals	No.	37	32.6	12%	Decreased in line with Atkins-Cardno reduction to Program	19.0	-13.6	
Stormwater - pipe and	Renewal and rehabilitation of stormwater conduits	km	7	5.2	26%	Decreased in line with Atkins-Cardno scope reductions. A	2.1	-3.1	Forecast to deliver 3.1kms less than target due to deferral of City Area 30

Output classification	Description	Measure	2016-20 'Original' submission output Target	2016-20 'Revised' Output Target	Reduction in target	Rationale for revised target	Output Forecast 2016–20	Variance 2016–20	Sydney Water comment on performance
channel renewal	(pipes, box culverts) at the end of their service life.					further 20% reduction in outputs has been applied to the re-baselined outputs as the 5 year program outputs were incorrectly attributed to the 4 year price path			project in line with reprioritisation of infrastructure capital renewal programs
	Renewal and rehabilitation of open channels that have reached the end of their service life.	km	3	2.2	27%	Decreased in line with Atkins-Cardno scope reductions. A further 20% reduction in outputs has been applied to the re-baselined outputs as the 5 year program outputs were incorrectly attributed to the 4 year price path	2.8	0.6	Staging of Johnstons Creek renewal forecast to contributing additional outputs in the current period.
	Stormwater condition assessment	km	160	119	26%	Decreased in line with Atkins-Cardno scope reductions. A further 20% reduction in outputs has been applied to the re-baselined outputs as the 5 year program outputs were incorrectly attributed to the 4 year price path	151.2	32.2	Based on current condition assessment planning we are forecasting to exceed the condition assessment target by 32 km.

9.2. Future Determination period output measures

Our opinion is that while output measures provide some assurance that Sydney Water is investing in its infrastructure, the current framework places too much emphasis on the physical infrastructure (the 'outputs') and not the service provided to customers ('outcomes'). A good example of this, is that it would be better for Sydney Water to focus on identifying the most cost-effective means to reduce or maintain interruptions to customer supply, whether that be operational response effectiveness, back-up generation for pumping stations, or targeted mains renewals, than to focus on delivering a certain length of water mains renewal.

This is consistent with IPART's view expressed in the review of Sydney Water's current Operating Licence that "Our preferred approach to licensing is to specify the outcomes or performance standards that the licensee must achieve, and only specify the means of achieving them where necessary. The licence does not, and is not intended to, prescribe how Sydney Water provides its services". There is also the observed significant variance between the measures targeted in the current period and their achievement which calls into question the usefulness and validity of the forward 'output measure' forecasts.

A simple model for the relationship between infrastructure investment and the service experienced by customers is shown in Figure 9-1. This model could also be extended to other desired service outcomes such as environmental protection.

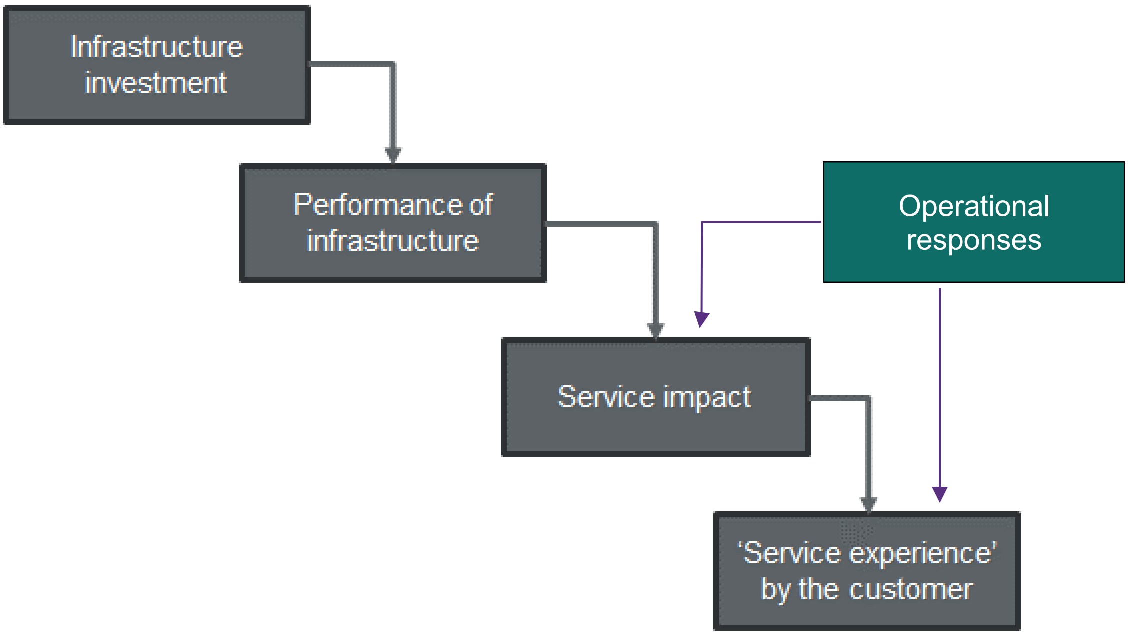


Figure 9-1 Simple model for relationship between infrastructure investment and customer service

Currently, there are measures in place for monitoring elements of infrastructure performance and service impact through the Operating Licence System Performance Standards and measures within Environmental Protection Licences. These help provide balance to the current output measures.

In consideration of the existing measures in place within the Operating Licence System Performance Standard (which focus on the service impact) and the Customer Contract (which provides protections around the service experience) we consider that there is scope for improvements in measures at the infrastructure investment and performance of infrastructure levels. We make the following observations and recommendations for IPART's consideration:

Infrastructure investment

- The breadth of the current suite of output measures results in diminished focus on important areas of investment. For example, in the future period, Sydney Water has proposed significant investment in the sewer network to reduce overflows and there should be greater scrutiny in this area in coming years.

- We recommend that, if retained, output measures should be restricted to investments for which the best measure of success is not short- or medium-term performance or service measures. Examples may include:
    i. major projects which significantly affect the size of the capital program but for which the best measure of success is not short- or medium-term performance or service measures.

       We consider that delivery of the Prospect to Macarthur link and SDP expansion network upgrade would be examples of this as they are major projects specifically designed to improve supply in a drought, rather than business as usual, situation.

       However, we would suggest that the output should be framed in such a way as to allow flexibility to identify alternative, more effective, ways to deliver the same outcomes, e.g. rather than the output being to deliver the Prospect to Macarthur link we recommend that it should be framed as “Significantly enhance the ability to transfer water between the metro dams and southern dams areas”. The title of the SDP expansion network upgrade is already sufficiently non-specific to allow this flexibility. We promote these as a specific outputs below.

       We also consider that 'achievement of the wet weather overflow abatement program to the satisfaction of the EPA’ is another suitable example as it is a major program with specific objectives to deliver an improvement in system performance. We promote this as a specific output below.
    ii. potentially, a small number of asset classes which are key to delivering sustainable long-term service / resilience for more extreme events, but which do not have an impact on short or medium term service levels. At this stage, we do not consider there are any asset classes with significant expenditure impacts which meet this definition.
- However, the Overall Deliver Measure in use by WaterNSW provides an alternative measure of infrastructure investment that captures a whole of program view. We consider that there is merit in this, or a similar measure appropriate to Sydney Water’s delivery approach, being included as a future output measure in future reviews.

Performance of infrastructure

- Currently infrastructure performance standards include the sewer chokes standard within the Environmental Protection Licenses. There is no similar measure in use for water mains. We recommend:
    - In the case of water mains and water pumping stations, we consider that it would be preferable to specify performance in terms of the stability of customer minutes lost to interruptions to maintain focus on customer outcomes. However, we note that customer measures of water supply interruptions were considered in the review that led to the current Operating Licence. Any future changes in this area are likely best considered as part of the end of term review of the current Operating Licence.
    - In the case of sewers and sewage pumping stations, we consider that it would be preferable to specify performance in terms of maintaining or reducing the number of wet and dry weather overflows affecting customers and the environment. Recognising the inherent variability in these events, the measure could be defined as an acceptable range.

      Where Sydney Water has proposed a program of improving performance (e.g. the Wet Weather Overflow Abatement program) this should be measured against the metric being used to justify the improvement (satisfying the EPA obligation, or number of points). Otherwise we recommend that the measure should be to achieve good or stable performance.
- For facility assets such as treatment plants and pumping stations, there is typically redundancy that makes reporting on asset failures less meaningful as a customer focused measure than for assets where failure likely causes a service interruption.
- Additional measure of infrastructure performance that we consider may provide value to Sydney Water and its customers include:
    - Asset condition - % of assets by replacement cost in certain condition grade(s)
    - Asset risk - % of asset by replacement cost in certain risk categories
    - Energy efficiency – kWh energy consumed per ML water sold or similar measure

- Treated water performance - % of treated flows > a threshold turbidity.

We recommend that the baseline data to establish these measures should be gathered by Sydney Water to inform the next price review. As the measures are not yet established, we have recommended retaining a limited number of asset renewal output measures as set out below.

9.2.1. Specific measures

In its July 2019 submission Sydney Water proposed a series of specific output measures. We consider that tracking all of those outputs for those with number measures is not particularly meaningful or effective given the subjective nature of the outputs. For example, many assets of the same type vary in size and maintainable units can be split to varying degrees and are not standard measures. There would need to be much clearer and more explicit definitions of these output measures as well a detailed assessment of the baseline numbers in order to ensure consistency and meaningful output measure data. This would need to be followed up with a detailed audit of the processes and data to validate any measures.

We have provided recommendations on specific output measures in the interim as we recognise the proposed move to outcomes-focused measures may take some time to implement. We reference and comment on Sydney Water's submission in Table 9-1 and provide additional measures below. We have proposed an additional sub-set of output measures within this table relating to sewer mains to reflect the importance of and level of investment in this asset class in the 2020-21 to 2023-24 period.

Table 9-2 Summary of proposed measures for the future Determination period

Type	Description	Unit	Sydney Water Proposed Target 2021 to 2024	Atkins Comment	Atkins recommended Target 2021 to 2024
Water					
Critical water mains	Renewals of critical water mains	km	42	Include	42
	Renewal of large valves	Each	80	Do not include	N/A
Reticulation water mains	Renewals and reliability upgrades of reticulation mains	km	121.6	Include	121.6
Reservoirs	Roof renewal or extensive repair of reservoirs	Each	28	Do not include	N/A
	Renewal or extensive repair of rechlorination plants	Each	24	Do not include	N/A
Water pumping stations	Renewal of water pumping stations	Each	4	Do not include	N/A
	High–voltage electrical upgrades	Each	5	Do not include	N/A
Drought	Significantly enhance the ability to transfer water between the metro dams and southern dams areas		n/a	New measure	Project completion
Drought	Upgrade the network to enable the expansion of SDP		n/a	New measure	Project completion
Leakage (ELL)	Economic level of leakage (ELL)	Ml/d	n/a	New measure	Performance against annual ELL target defined by dam storage level
Leakage (Quarterly)	Quarterly spot leakage against target Quarterly spot leakage against target Quarterly spot leakage against target	Ml/d	n/a	New measure- suggest reported quarterly on the SWC website	Quarterly spot leakage against target

Type	Description	Unit	Sydney Water Proposed Target 2021 to 2024	Atkins Comment	Atkins recommended Target 2021 to 2024
Water Conservation	Meet water conservation targets	Ml/d or % reduction in total demand	n/a	New measure - suggest reported quarterly on the SWC website	Whilst in drought: meet the demand reduction and water conservation targets as agreed with NSW state government Whilst not in drought: meet the ELWC targets agreed with IPART
Wastewater					
Large wastewater mains	Renewal of large gravity mains	km	26.4	Include	26.4
	Renewal of pressure mains	km	18.7	Include	18.7
	Rehabilitation of the NSOOS/SWSOOS & BOOS	km	12.5	Include	12.5
Wastewater pumping stations	Renewal of wastewater pumping stations	Number	16	Do not include	N/A
	High-voltage electrical upgrades (reliability upgrade)	Number of packages	4	Do not include	N/A
Wastewater reticulation mains	Renewal of wastewater reticulation mains	km	100	Include.	70
	Renewal of critical wastewater mains that may overflow to waterways (Lining, dig and repair)	km	172.2[1]	New output measure proposed	155
	Renewal of critical access chambers that may overflow to waterways (Lining, dig and repair)	No.	12,589[1]	New output measure proposed	11,330
Wet Weather Overflow Performance	Wet Weather Overflow Abatement program		n/a	New measure	Completion of improvements to the satisfaction of, and timetable agreed with, the EPA
Dry weather overflow performance	Stable or improved dry weather overflow performance across the whole sewerage network where		n/a	New measure	Stable performance taken as the 10 year average of dry weather flows +/- one standard deviation
Stormwater					
Stormwater channels, culverts and pipes	Renewal of open channels, culverts and pipes	km	8.7	Include – risk based prioritisation of outputs and defer remainder to 2025	7.7
	Relining of stormwater pipes	km	2.2		1.9
	Renewing fences	km	6.1		5.4
Treatment*	Wastewater treatment	# Unit Type	188	Do not include	N/A
	Chemical system renewal	# Unit Type	9	Do not include	N/A

Type	Description	Unit	Sydney Water Proposed Target 2021 to 2024	Atkins Comment	Atkins recommended Target 2021 to 2024
	Odour control	# Unit Type	8	Do not include	N/A
	Power supply	# Unit Type	46	Do not include	N/A
	Solids treatment	# Unit Type	61	Do not include	N/A
	Recycled water treatment	# Unit Type	1	Do not include	N/A
	Water filtration	# Unit Type	18	Do not include	N/A

Note:

1. These standards were not proposed by Sydney Water but are included in this table as a logical complement to the proposed output measure for wastewater reticulation mains. The starting figure for critical sewers is sourced from Sydney Water's business case. The starting point for sewers that may overflow to waterways is sourced from the waterway choke strategy.

Significantly enhance the ability to transfer water between the metro dams and southern dams areas – project completion We have also made a number of recommendations for enhanced drought performance monitoring and reporting which we discuss and propose in Section 8.5.9.

Appendices

Appendix A. Project Summaries

A.1. Water Pumping Station Renewals

PROJECT DETAILS

Project Name	Water Pumping Station Renewals	
Project Number	WEM051 - Water Pumping Station Renewals WEM052 - WP 184 HV Renewal WEM032 - WP 5 HV Renewal West Ryde	Both 2016 and 2020 determination period
Work Program	Water Pumping Station Renewals	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Output Measure	Sydney Water proposed 15 WPS renewals for the 2016-2020 Determination period and has adjusted this to 11.9 based on the Determination "scope adjustments"	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	28.4	20.4	27.3	16.0	**92.0**	24.6	27.8	26.5	27.0	**106.0**	**198.0**

NEED FOR SCHEME

The purpose of this program is for end of service life renewal of water pumping station (WPS) assets. Sydney Water owns and managed 141 WPS which are classed as either conventional or booster stations.

WPS renewal supports achievement of the System Performance Standards in Sydney Water's Operating Licence relating to water continuity and water pressure.

SCOPE OF WORKS

The scope of works covers three separate items from the SIR:

- WEM051 is the ongoing WPS renewal program ($92.1 million from 2016 to 2020 and $105.9 million from 2021 to 2024)
- WEM052 is for renewal of HV assets at pump station 184 ($11.44 million)
- WEM032 is for renewal of HV assets at pump station 5 (West Ryde) ($12.08 million)

Differences between the outputs and costs of the current (2016 to 2020) and next (2020 to 2024) determination periods are identified in a waterfall graph provided in the Water Pumping Stations

Renewals Program Business Case. The total expenditure for the 2016 to 2020 Determination period is currently forecasted to exceed the corresponding IPART Determination by $7.5 million (nominal), due to a net overspend on projects, recognition of work in progress and a revision of the accounting policy. However, these causes for variance are partially offset by the risk-based deferral of work to the 2020 to 2024 determination period.

We requested Sydney Water to provide a breakdown of this overrun to drivers. Sydney Water advised that the overrun was attributable to:

1. Increased requirements by Ausgrid – 44%
2. Contractor resource constraints – 41%
3. Changes to Sydney Water HV work requirements – 11%
4. Changes to Australian Standards – 4%

While we have not investigated this breakdown in detail, we accept that the cost overruns are due to largely factors outside of Sydney Water's control.

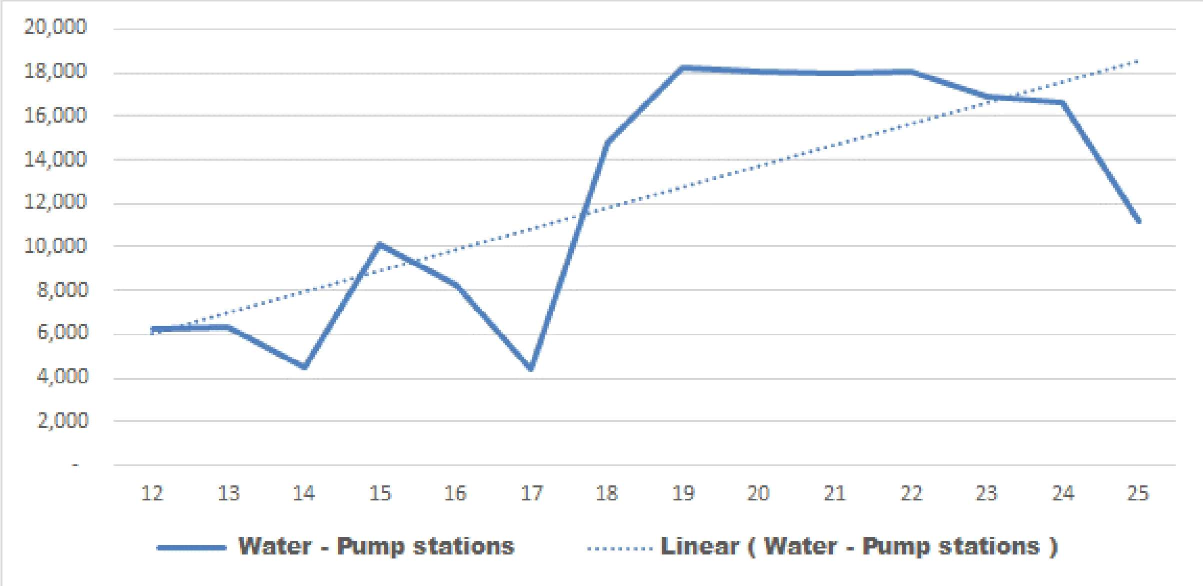
As a result of the risk-based deferral of work, in addition to the inclusion of additional scope items such as pressure reducing valves and overhauls, Sydney Water has proposed a larger expenditure program for the 2020 to 2024 determination period.

The forward program under WEM051 includes for renewal of WPS, associated high voltage equipment and renewal of pressure reducing valves.

Sydney Water has identified the following outputs for the forward period (4 year):
Proposed outputs over the four-year determination period:

- 3 major renewals (mechanical/electrical)
- 1 booster pumping stations renewals
- 5 high voltage (HV) electrical renewals
- 32 overhauls planned
- 64 overhauls reactive
- 92 like-4-like replacements
- 93 Pressure Reducing Valves (PRV) renewals
- 1 other program work

The long-term trend on renewal expenditure for water pump stations is shown below. This shows a sustained increase from $6 million pa in 2012 to $18 million in the forward period.



IMPACT ON OPERATING COSTS

We reviewed the business case for the upgrade of the high voltage equipment WP5 (Ryde). The scope for this project includes for replacement of the existing starters with variables speed drives. Variable speed drivers will typically lead to material reductions in energy use. The business case states that there will be no change in operating and maintenance costs. In our experience, this will not be correct and Sydney Water should achieve material reductions in energy use from the HV upgrades.

OPTIONS APPRAISAL

The expenditure forecast for the 2020 to 2024 determination period was developed through condition assessment, risk assessment, knowledge of spare part availability, failure histories and suppliers' recommendations. The following specific logic was adopted for each stream of this program:

- Water pumping stations: An asset at a water pumping station is investigated for either renewal or operational actions when the asset degrades to poor or worse condition
- High-voltage equipment: A condition assessment performed by Downer in 2014 recommended the replacement of most high-voltage equipment by 2025 due to being in poor or worse condition and a lack of available spare parts. Many items of high-voltage equipment had also exceeded their design life, being over 40 years old, no longer met current regulations, and were difficult to support and maintain.
- Booster pumping stations: Some booster pumping stations are based on obsolete hydropneumatics technology. This program has allowed for the replacement of these pumping stations with modern variable speed stations.
- Pressure reducing valves: More than 200 pressure reducing valves were installed between 2006 and 2013, with limited overhaul or renewal undertaken since. Over the 2020 to 2024 determination period, 117 pressure reducing valves have been selected for renewal based on the

manufacturer's recommended maintenance schedule. The renewal of these valves is supported by a significant increase in the total annual reactive maintenance cost over the last two years (from approximately $300,000 to approximately $430,000 per year), along with an increase in breaks and leaks in pressure-reduced areas.

The options analysis for this program was undertaken by evaluating the effect of reducing the scope of works on the condition profile of water pumping stations. High-voltage equipment, hydropneumatic booster pumping stations and pressure reducing valves were excluded from this testing due to being the key priorities of the renewals program.

The options analysis found that reducing the scope of works by 20% would result in an additional 3% of the asset replacement value deteriorating to poor or worse condition by 2025.

COST ESTIMATING METHOD

The business case has been developed through analysis of historic costs and cost estimates for the large projects and for like for like renewal items.

The WPS renewals program has been subject to a 14% top-down efficiency challenge by Sydney Water.

PROCUREMENT METHOD

In the current period, Sydney Water has faced challenged in delivering high voltage works due to a shortage of qualified contractors and demand from other infrastructure projects in Sydney. Also, one of its contractors qualified for high voltage work, RCRC Tomlinson, went into receivership in the current period. Sydney Water attributes some of the overruns in the current period to difficulties in finding contractors for the work to be undertaken.

DELIVERY

Currently, the Water Pumping Stations Renewal Program is overseen by the Customer Delivery - Networks team will be responsible for selecting candidate projects, packaging candidate projects and performing pre-net present value calculations. Design, procurement and other processes within the project planning and construction phases will be delivered by the Customer Delivery - Civil Projects, Customer Delivery - Civil Contracts and Liveable City Solutions - Delivery Management teams. Sydney water identifies that the key risks to the successful on-time delivery of the program are the availability of internal and external personnel for high voltage work, the timeliness of approvals issued by the applicable electrical supply authority for high voltage work, and seasonal restrictions on when work can be undertaken (i.e., planned work should be undertaken during the low-demand seasons of winter and autumn).

The forward program for WPS renewals will be delivered by Regional Delivery Consortia under the P4S model.

POST PROJECT REVIEW

Not applicable

KEY DOCUMENTS REVIEWED

- 66.1 WPS Capital Program Business Case 2020-21 to 2024-25 V0.2_draft.pdf
- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- Response to Item 102 – reasons for capital expenditure variance

- 195.1 Report WP0184 Rev 0
- 197.1 HV Asset Condition Assessment Report – final
- 198.1_20034357 - WP0003 Renew Valves – DABC
- 199.1_20032491 - CBC 6043 - PI&S - WP5 Renew two starters&motor#8
- 199.2_20032491 - CBC 6043 -Need - WP5 Renew two starters&motor#8

A.2. Wastewater Pumping Station Renewals

PROJECT DETAILS

Project Name	Wastewater Pumping Station (WWPS) Renewals	
Project Number	SEM072 – Wastewater pumping station renewals	Both 2016 and 2020 determination period
Work Program	Wastewater Pumping Station Renewals	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Output Measure	Sydney Water proposed 19 WWPS renewals for the 2016-2020 Determination period and has adjusted this to 16.7 based on the Determination "scope adjustments"	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	28.4	20.4	27.3	16.0	**92.0**	24.6	27.8	26.5	27.0	**106.0**	**198.0**

NEED FOR SCHEME

The primary driver for the Wastewater Pumping Stations Renewals Program is renewal to meet existing mandatory standards. Renewal of its wastewater pumping stations, vacuum sewer systems and low pressure sewer systems, along with associated reliability and resilience improvements and condition assessments, is expected to assist Sydney Water in meeting its current Environmental Protection Licence obligations, while reducing risks to compliance, environment, and health and safety to an acceptable level.

Sydney Water's Environmental Protection Licence requires that there are no dry weather overflows from wastewater pumping stations. While there appears to be no discernable trend in the number of dry weather overflows from wastewater pumping stations since 2004/05, an average of three dry weather overflows have occurred per year over the past five years.

Sydney Water's Environmental Protection Licence further stipulates a limit on the number of dry weather overflows reaching waterways. In five of the past six years, the number of non-conformances resulting from dry weather overflows reaching waterways has exceeded the applicable license limit.

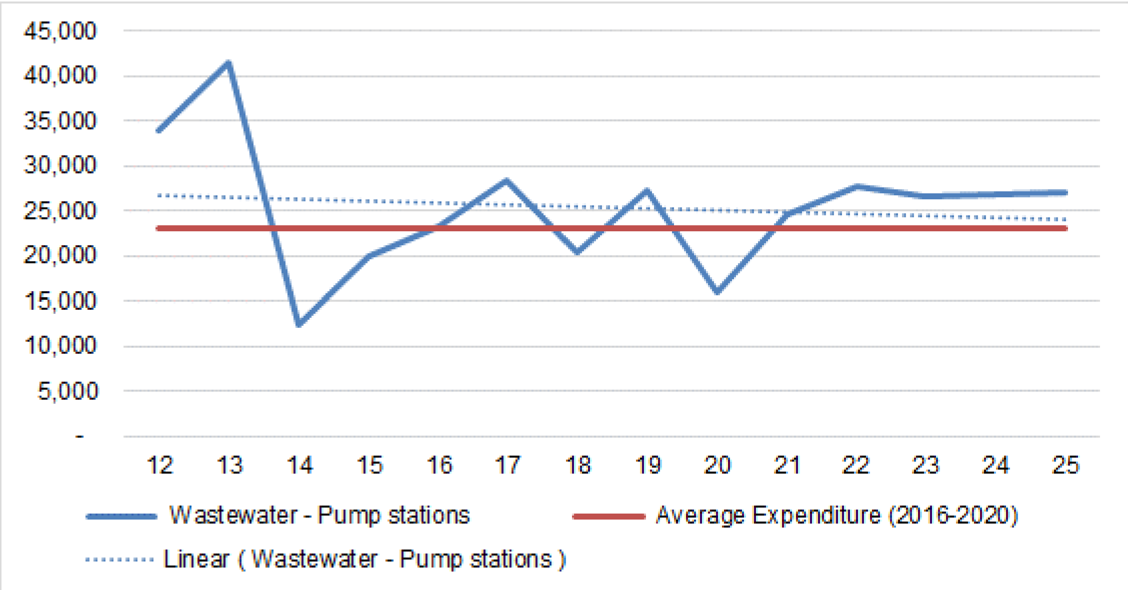
SCOPE OF WORKS

Sydney Water managed 680 WWPS. Sydney Water proposes the following outputs within the four year period 2016-2020 for WWPS renewals:

- 16 major renewal projects
- 13 reliability improvement packages
- Four like-for-like Sewage Pumping Station (SPS) pumps, motors and valves

- packages
- Eight contingency projects
- Four pumps, motors and valves overhaul packages
- Three LPS (electrical/pumps/control/pot lid) projects
- Three flood and climate change projects
- Seven electrical renewal projects
- Four SPS reactive overhaul of pumps and valves packages
- Three Low Pressure Sewerage (LPS) system upgrade projects
- Three vacuum system renewal projects
- One package emergency work
- One wet well rehabilitation project
- Four bushfire protection projects.

The long term trend on renewal expenditure for water pump stations is shown below. The forward period (2021-2025) proposes expenditure of $26.6 million per annum, a 15.6% increase on the $23.0m per annum expenditure in 2017-2020.



IMPACT ON OPERATING COSTS

There is no expected material impact on operating costs as most renewals are on a like for like basis.

OPTIONS APPRAISAL

WWPSs are inspected on a five year rolling program. This is a Level 1 (visual) condition assessment undertaken by the Asset Inspection Services team. Maintenance Services Technicians also undertake condition assessment when undertaking maintenance work. Sydney Water provided to us the Planned Maintenance task descriptions for these condition assessments. The Level 1 inspection results trigger more detailed inspection based on the observations made.

Level 1 Condition assessment is undertaken in accordance with Sydney Water's *Asset Life Cycle Grading for Condition Based Asset Valuation* (161.1) guideline. This guideline applies across asset classes. We make the following observations regarding this guideline:

- The guideline is based on the 2001 version of the International Infrastructure Management Manual. The latest revision of this document was released in 2015
- The condition grading table at section 2.4 assigns conditions grades on a 1 (very good) to 5 (very poor) scale. While a scale of this type is in line with industry practice, the descriptions for each level are generic and do not give good guidance for specific asset classes
- Further, each rating is aligned with an assessed remaining useful life. For example:
    - 4 (Poor) = Two years remaining useful life (for all civil and mechanical/electrical assets except for pipelines for which remaining useful life is 5 years)
    - 5 (very poor) = Zero years remaining useful life (as failed or failure is imminent)

  Contemporary practice is that remaining useful life is expressed as a proportion of the expected useful life to be more meaningful. Under Sydney Water's current approach, a communication asset with expected useful life of seven years is treated the same as a civil asset with expected useful life of 80 years.
- Good industry practice will consider multiple dimensions of asset condition including performance, functionality, integrity and compliance. This is a more mature approach that takes time to evolve.

Based on the above assessment, we consider that there is an opportunity for Sydney Water to substantially overhaul its approach to asset condition assessment, across all asset classes.

The performance of the Level 1 inspections has not provided an accurate picture of the condition of the wastewater pumping station assets. This is starkly illustrated by the failure of the Northmead WWPS and the ensuing mitigating actions. While the cause of the failure of the station is not known, it was around 80 years of age, a typical expected useful life for civil assets. Sydney Water's Level 1 inspections had not triggered a Level 2 inspection before the collapse but following the collapse, risk assessment has led to identification of 86 pumping stations that will require a Level 2 inspection. This suggests that the existing Level 1 inspections were providing false negatives and were not performing satisfactorily for the purpose of asset management. Sydney Water has programmed the first 20 of this group for inspection and these are underway. Sydney Water anticipates that the cost of level 2 inspections of its 680 WWPS will be $10 million.

In reviewing the scope of the Level 2 inspections, we are concerned that these may not provide the best value for money for Sydney Water as the scope appears reactive, the structural inspections and outputs are not clearly defined and confined space entry equipment and support is costed for two sites but wet wells are not to be entered (as the mobilisation costs are high, the greatest advantage needs to be taken of confined space entry). On a risk basis, there may be benefit in Sydney Water undertaking Level 3 inspections (including wet well entry, core sampling and strength testing) for a sample of pump stations and using these results to infer condition and remaining useful life across cohorts more accurately and

more cost effectively. In our experience, many WWPS asset managers will routinely undertake Level 3 condition assessments on wells that are nearing the end of their useful life given the risk associated with these assets and the cost to replace them if they fail. Sydney Water's regulatory submission includes no expenditure for civil works (dry wells and wet wells) across its WWPS assets. This is very surprising given the likelihood that some of these assets would fail or be near failure during the forward period. When challenged, Sydney Water expressed its view that the better information it has gained since responding to the Northmead event suggests that expenditure on WWPS civil asset is highly likely in the forward period. The emergent need for Level 2 condition inspections (and possibly Level 3) and the highly likely scope of civil works arising undermines Sydney Water's stated understanding of it risk across the WWPS asset class. Given better information on the condition of the civil assets, it is likely that a difference program would have been proposed. Comparing to the long term trend, it is highly likely that a step change in expenditure will be required.

COST ESTIMATING METHOD

The business case has been developed through analysis of historic costs from similar projects. The WWPS renewals program has been subject to a 22% top-down efficiency challenge by Sydney Water.

PROCUREMENT METHOD

The forward program for WWPS renewals will be delivered by Regional Delivery Consortia under the P4S model.

DELIVERY

The program has been divided into a number of major projects and packages. There are four packages of work proposed for WWPS reliability improvements.

POST PROJECT REVIEW

Not applicable

KEY DOCUMENTS REVIEWED

- 69.1 WWPS Draft Capital Program Business Case 2020-21 to 2024-25 v0.2_draft.pdf
- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- 207.1 response to item 207 Explanatory note
- 207.2 Asset Condition rating Mechanical
- 207.3 Elec PM for all type of pumps
- 207.4 Mech PM for all type of pumps
- 207.5 Wetwell Inspection 5 yearly
- 207.6 Asset Condition rating Electrical
- 161.1 CBAV AMQ0005

A.3. Reticulation Water Main Renewals

PROJECT DETAILS

Project Name	Reticulation Water Main Renewals	
Project Number	WEM039 – Capitalisation of water main breaks WEM047 – Reticulation water main renewals	Both 2016 and 2020 determination period
Work Program	Reticulation Water Main Renewals	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Output Measure	None	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	29.5	25.9	36.2	11.6	**103.0**	24.0	23.2	23.2	23.2	**94.0**	**197.0**
Planned From review documents											

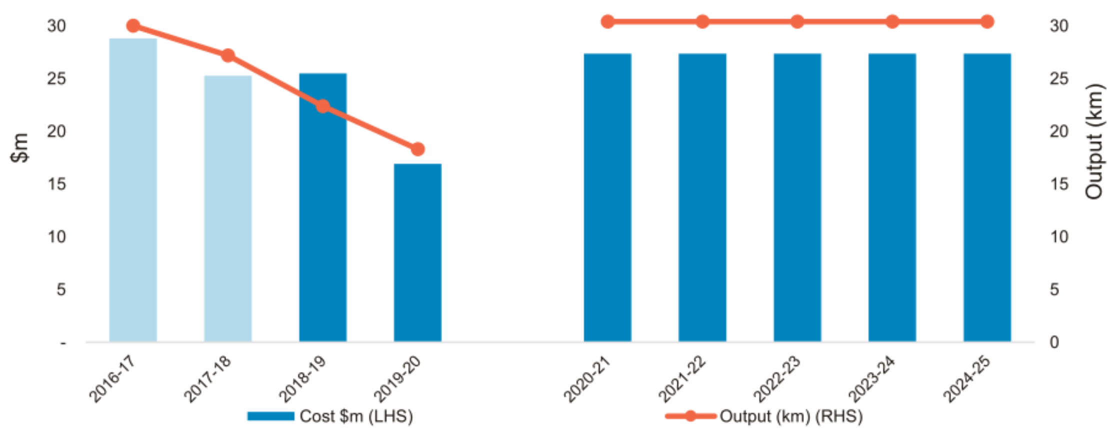
NEED FOR SCHEME

Reticulation water mains, which are water mains of less than 300 millimeters (mm) in diameter with a low impact of failure, form just over 80% of Sydney Water's water main network. Renewal of reticulation water mains is required to maintain water continuity as required by the System Performance Standard in Sydney Water's Operating Licence. Sydney Water has performed under the licence reference level for the number of properties experiencing an unplanned interruption more than five continuous hours (licence limit 40,000) in the period from 2012/13 to 2017/18; however, in this last year performance was 39,308 properties and just under the reference level. For year 2018-19, Sydney Water has breached the licence limit due to one large interruption which was considered an exceptional event. Sydney Water forecasts that it will meet its licence limits in 2019/20.

Sydney Water attributes the decline in performance in 2017/18 to increased water main breaks and an increase in the number of significant events requiring complex shutdowns. Our analysis of mains breaks suggests that there is a long-term reducing trend; we suggest the measure is driven more by the ability to respond quickly to isolate mains and repair.

SCOPE OF WORKS

In 2016 – 2020, Sydney Water decreased its water main renewal activity with output declining from around 30km in 2016/17 to around 17 km in 2019/20 as shown below. This was due to Sydney Water re-prioritising renewal expenditure across asset classes. Total expenditure in the 2016 – 2020 Determination period of $88.5 million is well below the forecast included in the 2016 Determination of $128.7 million (these figures in $18/19).



Source: 67.1 Reticulated Water Mains Capital Program Business Case 2020-21 to 2024-25

In the 2021 – 2025, Sydney Water is proposing to renew 30.4 km of water mains in each year and complete 1.6km of watermain resilience projects in each year. It proposes expenditure for this increased output which is lower than that forecast to be incurred in the current period, $94 million for the forward period compared with $103 million in the current period. These figures excluded capitalised water main breaks.

IMPACT ON OPERATING COSTS

There is no expected material impact on operating costs as most renewals are on a like for like basis.

OPTIONS APPRAISAL

The Reticulation Water Main Renewal Decision Framework (2019) provides the basis for identifying and evaluating candidates for reticulation water main renewal. Within this framework, sections of reticulation water mains that experience three breaks in a two-year period, or two breaks in a two-year period for reticulation water mains of more than 250 mm in diameter, are financially evaluated by comparing the net present value of renewal with the net present value of projected maintenance. Once evaluated to be financially viable, these reticulation water main sections proceed to detailed investigation and are grouped into work packages for detailed scoping and cost estimation, prior to procurement and construction.

Under this program, the average annual length of reticulation water main to be renewed is assumed to increase by 9% between the 2016 to 2020 Determination period and the 2020 to 2024 determination period. This assumption is based on the addition of overheads to projected maintenance costs, which creates more positive benefit-cost ratios for renewal, along with the inclusion of mains that have high service interruption impacts and an allowance for the increasing age of the infrastructure.

In addition to reticulation water main renewals, a stream for reticulation network resilience is also included in the forward program. The budget estimate for this stream was based on actual costs for past projects of equivalent scopes. Further scope clarification and decision frameworks are required to be developed for this stream of capital work.

The options analysis for this program was undertaken by evaluating the effect of reducing the scope of works on the risk profile of the end benefits.

The options analysis found that reducing the scope of works by 20% would result in an increased annual rectification cost for reticulation water main failures (an approximate additional $300,000 per year), an additional 1,000 properties affected by an unplanned water interruption of five hours or more in duration, an increased risk of non-compliances against the Operating Licence and an increased risk of customer dissatisfaction. Overall, the risk assessment determined that the risk score would increase from "medium" in the base case (program as proposed) to "high" or "very high" under this option.

COST ESTIMATING METHOD

The business case has been developed through analysis of historic costs from similar projects. Sydney Water is proposing a reduced unit cost for watermain renewals in the forward period of $900,000 per kilometre of mains renewed. Costs for resilience projects have been assumed at $1.25 million per km as Sydney Water has no reference projects to draw upon. The reticulation water mains renewals program has been subject to a 20% top-down efficiency challenge by Sydney Water.

PROCUREMENT METHOD

Currently, water main renewals are delivered by four largely regional based contractors. The forward program for WPS renewals will be delivered by Regional Delivery Consortia under the P4S model.

DELIVERY

Currently, Sydney Water identifies candidate water mains for renewals every two weeks which are then bundled and procured in packages. Sydney Water plans to continue this fortnightly identification and works bundling in the future.

POST PROJECT REVIEW

Not applicable

KEY DOCUMENTS REVIEWED

- 67.1 Reticulated Water Mains Capital Program Business Case 2020-21 to 2024-25 v0.2_draft.pdf
- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- 28.1 Decision framework for reticulation water mains renewals

A.4. Critical Water Main Renewals

PROJECT DETAILS

Project Name	Critical Water Main Renewals	
Project Number	WEM040 – Critical water main renewals	Both 2016 and 2020 determination period
Work Program	Critical Water Main Renewals	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Output Measure	Sydney Water proposed 47 km of critical water main renewals for the 2016-2020 period and has adjusted this to 30.4 km based on the Determination “scope adjustments”	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	32.0	34.8	26.6	31.0	**124.4**	33.1	32.3	34.8	34.8	**134.9**	**259.3**
Planned From review documents											

NEED FOR SCHEME

Critical water mains are water mains of greater than 300 millimeters (mm) in diameter or those with a relatively high impact of failure. Critical water mains comprise around 20% of Sydney Water's water main network.

As for reticulation water mains, renewal of critical water mains is required to maintain water continuity as required by the System Performance Standard in Sydney Water’s Operating Licence. Sydney Water has performed under the licence reference level for the number of properties experiencing an unplanned interruption more than five continuous hours (licence limit 40,000) in the period from 2012/13 to 2017/18; however, in this last year performance was 39,308 properties and just under the reference level. For year 2018-19, Sydney Water has breached the licence limit due to one large interruption which was considered an exceptional event. Sydney Water forecasts that it will meet its licence limits in 2019/20.

Sydney Water attributes the decline in performance in 2017/18 to increased water main breaks and an increase in the number of significant events requiring complex shutdowns. Our analysis of mains breaks suggests that there is a long-term reducing trend; we suggest the measure is driven more by the ability to respond quickly to isolate mains and repair.

Because of their size and sometimes crucial role in the supply network, critical water mains can have a much large impact on water supply continuity than reticulation water mains.

SCOPE OF WORKS

In the 2016 – 2020 Determination period, Sydney Water expects to deliver:

- 30km of renewal of critical water mains
- 300km condition assessment of critical water mains
- 20,000 valve inspections
- 112 valve renewals
- Preparation of 1,270 system operating manuals.

The scope of works proposed by Sydney Water for the 2021-2025 period comprises:

- 42 km renewed
- 4 km above ground pipelines refurbished
- 400 above ground pipeline joints refurbished
- 200 km condition assessments (level 1)
- 140 condition assessments (level 2)
- 260 km leak detection works
- 23 pressure calming issues resolved
- 80 valve renewals
- 3,200 valve inspections

Sydney Water notes that while it proposes an increase in the length of critical water mains renewed the forward period represents 0.5% of the critical water main stock by value and 0.2% by length.

IMPACT ON OPERATING COSTS

There is no expected material impact on operating costs as most renewals are on a like for like basis.

OPTIONS APPRAISAL

Sydney Water's strategy for critical water mains is to identify critical water mains with unacceptable risks of failure and prioritise these water mains for either renewal or rehabilitation in order to prevent or minimise the impacts of critical water main failure. The renewal program for critical water mains is developed through two approaches:

- Bottom-up approach: Specific renewals are identified through a bottom-up approach, where a risk profile of all critical water mains by length is generated. This risk profile is updated annually with recent failure histories and condition assessment information. Water mains assessed to be in the "Very High" or "High A" risk categories are deemed to have an unacceptable risk of failure. Initial risk ratings developed from this risk assessment are confirmed through condition assessment, and risk mitigation actions (such as renewal, rehabilitation or non-asset/capital solutions) are developed based on the results of the condition assessments. If the resulting identified water main meets the requirements of the decision framework and its renewal is economically justified (i.e., the renewal cost to mitigate the risk posed by main failure is outweighed by the total ongoing cost and risk of failure), it is selected for renewal. Renewal and rehabilitation are targeted at the worst-performing sections of each critical water main in order to maximise the benefits of the capital works and are also considered for lower risk assets where a positive net present value will be generated.

- Top-down approach: For the purpose of developing the Critical Water Main Renewals Program Business Case, a statistical analysis was conducted based on the age profile of the asset base in order to estimate the average annual length of critical water mains to be renewed.

For the remaining items within the scope of works, the following methods were employed to estimate the annual quantity of work to be performed:

- Renewal/rehabilitation of above-ground critical water mains and joints: Annual quantity of work derived from previously performed Level 1 condition assessments. Joints to be rehabilitated through the installation of external leak clamps.
- Condition assessments of critical water mains: Annual quantity of work derived from the annually updated risk profile of critical water mains. Assets within the "High A" and "High B" risk categories are to be condition assessed within five years of being identified through the risk assessment.
- Leak detection: Annual quantity of work based on the length of critical water mains in the "High" risk categories, as identified in the annually updated risk profile of critical water mains
- Rectification of pressure transients: Annual quantity of work based on historical data from Sydney Water's integrated instrumentation, control, automation and telemetry system (IICATS)
- Valve inspections: Annual quantity of work based on the number of valves in the "High" risk categories
- Valve renewal: Annual quantity of work based on past failures and trend analyses. Specific valves to be renewed are identified based on the results of the inspection program and shutdown activities.

We queried Sydney Water as to the basis of the condition gradings of critical water mains used within the economic evaluation model which decides whether mains should be renewed or not. Sydney Water responded that mains are assessed using the following approaches:

1. theoretical prediction (70%)
2. theoretical prediction + adjusting factor of failure history (25%)
3. predicted probability of failure based on physical condition assessment (5%).

Sydney Water advised that the theoretical prediction considers age, material, size and soil condition and that critical water mains are prioritised for condition assessment based on their risk profiles. When the actual condition assessment is carried out and the probability of failure is predicted based on the assessment, then the predicted probability of failure is used as the first choice. The theoretical prediction is used as the last choice when there is no failure history, or no condition assessment available.

Sydney Water notes that for the forward period, there are no asset renewals proposed based purely on category 1 (theoretical prediction only). The majority of renewals are based on failure history coupled with condition assessment. This provides assurance that Sydney Water is obtaining sufficient evidence on which to base its decision making.

COST ESTIMATING METHOD

The business case has been developed through analysis of historic costs from similar renewal projects and assumed costs for other activities.

To develop unit rates for renewals, three sources were considered:

- Review of 41 projects in various stages of completion and between 100 m and 1.1 km in length: Average of $2,630/m
- Review of 27 completed projects: Average of $2,775/m
- Delivery partner analysis of cost curves on completed projects: Average of $2,937/m

The average unit rate adopted for the Business Case: $2,781/m. Sydney Water considers that this is a challenging rate. We note that the rate will vary with diameter and that there may be an incentive for Sydney Water to renew lower unit rate mains to maintain overall output and costs within the forward period.

Sydney Water has also applied a program specific efficiency of $4 million to the critical water mains program to reflect emerging technology for renewal through spray lining of larger pipes. This technology is assumed to be able to be applied to 1km per year of mains and incur unit rates of $1,000 per m.

The critical water mains program has been subject to a 20% top-down efficiency challenge.

PROCUREMENT METHOD

Critical water main renewals are delivered by Sydney Water's Networks and Civil Project teams. While the Regional Delivery Consortia may take on some critical water mains works, the Network and Civil Project teams will continue to deliver some works.
Other activities such as condition assessment are delivered by a mix of internal and external resources.

DELIVERY

Critical Water Main packages are expected to be scoped quarterly with further investigation then carried out to confirm the individual sites within the package meet decision frameworks requirements prior to progression into implementation. Works packages will be released three times per year.

POST PROJECT REVIEW

Not applicable

KEY DOCUMENTS REVIEWED

- 65.1 Critical Water Mains Capital Program Business Case 2020-21 to 2024-25_draft.pdf
- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- 219.1 Response to item 219 - Condition grading CWM
- 51.1 Water mains AMP - AMQ0049

A.5. Sewer Main Renewals

PROJECT DETAILS

Project Name	Dry Weather Overflow Reduction Program (Reticulation Sewer) Wastewater mains - Existing mandatory standards (refer to SIR IDs and project names below)	
Project Number	SEM055 - Avoid Fail Wastewater Main Renewals (Critical Sewer) SEM042 - Dry Weather Overflow Reduction Program (Reticulation Sewer)	Both 2016 and 2020 determination period
Work Program	Sewer Main Renewals	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Output Measure	A number of outputs • Renewal of large diameter sewer mains – 34 km which Sydney Water adjusted to 31.8 km based on 'scope reduction' from the last determination • Renewal of large manholes/vent stacks – 80 No. which Sydney Water adjusted to 60 No. based on 'scope reduction' from the last determination • Renewal of reticulation sewers – 112 km which Sydney Water adjusted to 98.6 km based on 'scope reduction' from the last determination	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR) (Nov-19)	39.4	45.2	59.1	33.5	**177.1**	131.4	141.6	130.4	129.4	**532.8**	**709.8**
Planned From review documents											

NEED FOR SCHEME

Sydney Water's wastewater network comprises over 25,000km of sewer mains with an estimated replacement cost of $33 billion. The wastewater network collects sewage and transports it to treatment plants. Renewal of sewer mains is required to maintain this function and to prevent environmental harm and risk to public health which can occur when sewage overflows from the network. Overflows from the network can occur during dry weather when there is a blockage (choke) in a pipe, e.g. caused by the presence of tree roots. Overflows from the network can occur during wet weather where the flows in the sewer exceed the hydraulic capacity of the sewer. This is typically due to the ingress of stormwater in the sewer.

Sydney Water classifies its sewers as critical and non-critical depending on the potential consequences of failure of the segment of sewer. For sewers classed as critical Sydney Water adopts an "avoid-fail" strategy. Sydney Water has changed its classification of sewers that may overflow to waterways so that all sewers that may overflow to waterways are now classified as critical. Previously many were classified as non-critical. This make comparisons between the past and future difficult for the non-critical and critical sewer programs in isolation. Therefore, we have considered expenditure jointly for the future period.

In response to the draft report, Sydney Water outlined that the sewers that may overflows to waterways and affected by the change in classification are less than 10% of the total length of all sewers. The change in classification reflects that Sydney Water will now manage these assets proactively to identify and address sections of sewer main in poor condition that may cause overflows ideally before an overflow occurs. We acknowledge that this cohort of sewers is now subject to a different management approach and we agree that this is appropriate. We have considered expenditure across all programs together because there are performance measures, such as the overall choke rate, which will be influenced by all investment. Also, general provisions within the Protection of the Environment Operations Act 1997 for pollution to land will also be influenced by expenditure as a whole. We recognise the different asset management strategies for the sewer main asset class and have sought to reflect this throughout this analysis where appropriate,

The following performance standards relate to sewer mains:

1. Operating Licence – Wastewater overflow standard
2. Environmental Protection Licence
    a. Total chokes for all systems
    b. Dry weather overflows to waterways (system specific)

We discuss each of these following

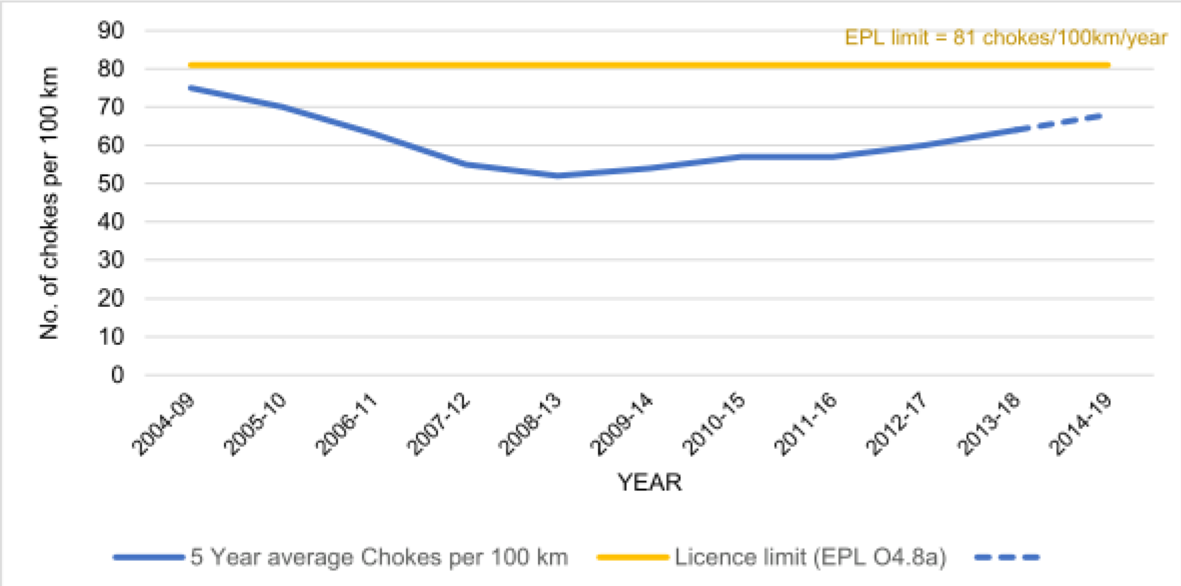
Operating Licence - Wastewater Overflow Standard
The Wastewater Overflow Standard in Sydney Water's Operating Licence requires that:

- No more than 14,000 properties (other than public properties) experience an uncontrolled dry weather overflow per year
- No more than 175 properties (other than public properties) experience three or more uncontrolled dry weather overflows per year.

Sydney Water is performing well within these standards.

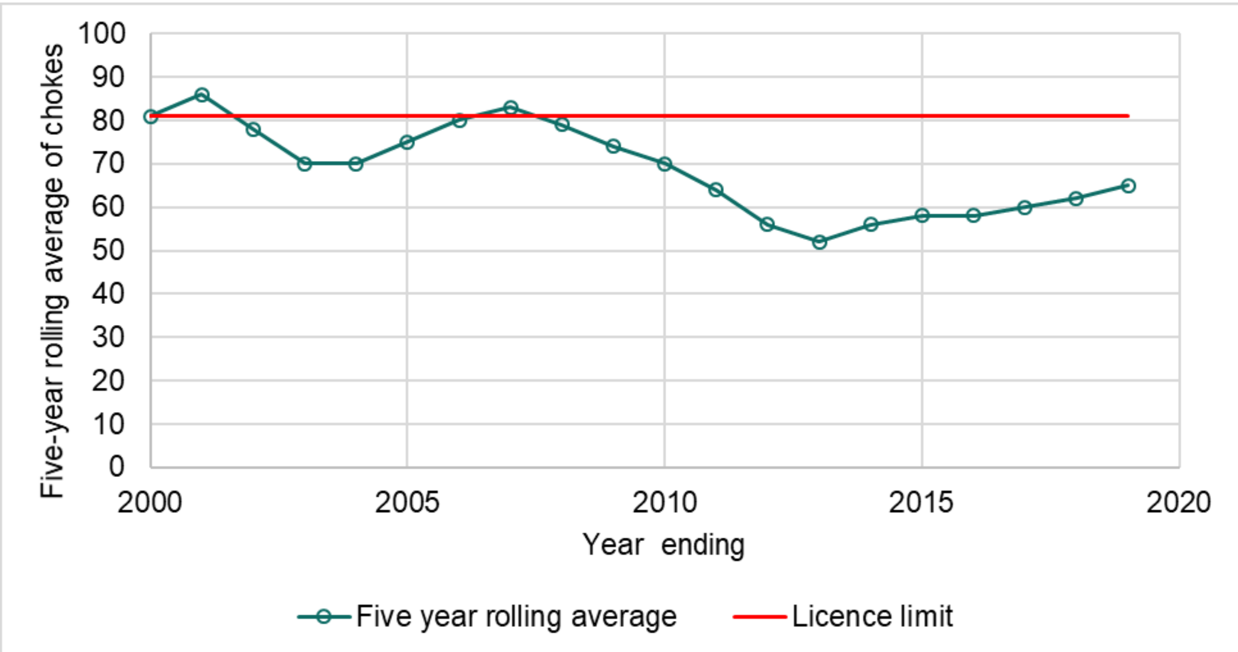
Environmental Protection Licence – Total chokes
Sydney Water's Environmental Protection Licence requires that on a rolling five-year average, there are less than 81 chokes per 100 kilometres of sewer. This is a partial measure for licence condition O4.7 which requires Sydney Water to deliver ongoing improvement in the environmental performance of the wastewater reticulation system.

Sydney Water's five year rolling average choke rate for the wastewater reticulation system is shown following.



Source: Sydney Water Corporation submission Attachment 2 – Figure 3-1

Recent years have seen a decline in Sydney Water's performance on this measure which Sydney Water attributes largely to the very dry conditions leading to increased root intrusions into the pipe network. However, in the November 2019 update to its regulatory submission, Sydney Water notes that the proportion of chokes attributable to root intrusion has been decreasing in recent years with debris in particular increasing proportionally. Also, while tree root intrusion accounts for around 80% of blockages in Sydney Water's sewerage network and there is evidence to demonstrate that root intrusion increases with the reduced soil moisture levels which occur during drought conditions, we note that the worsening performance has also occurred from 2015 which is before the onset of the current drought. This suggest that drought is one of multiple factors driving the deteriorating performance. Sydney Water considers that without a proactive intervention program, it will breach the five-year rolling average in 2021. However, wetter weather (i.e. a return to average weather) would also likely improve performance in this timeframe all else being equal, albeit at a slower rate than under a more proactive approach. The longer term trend for sewer chokes from 2000 below shows that Sydney Water has made clear improvement in driving down the overall choke rate as measured by the five year rolling average. Sydney Water notes that the improvement observed from 2005/06 onward was due to an intensive five year choke reduction program.



Source: Atkins-Cardno analysis of Sydney Water data

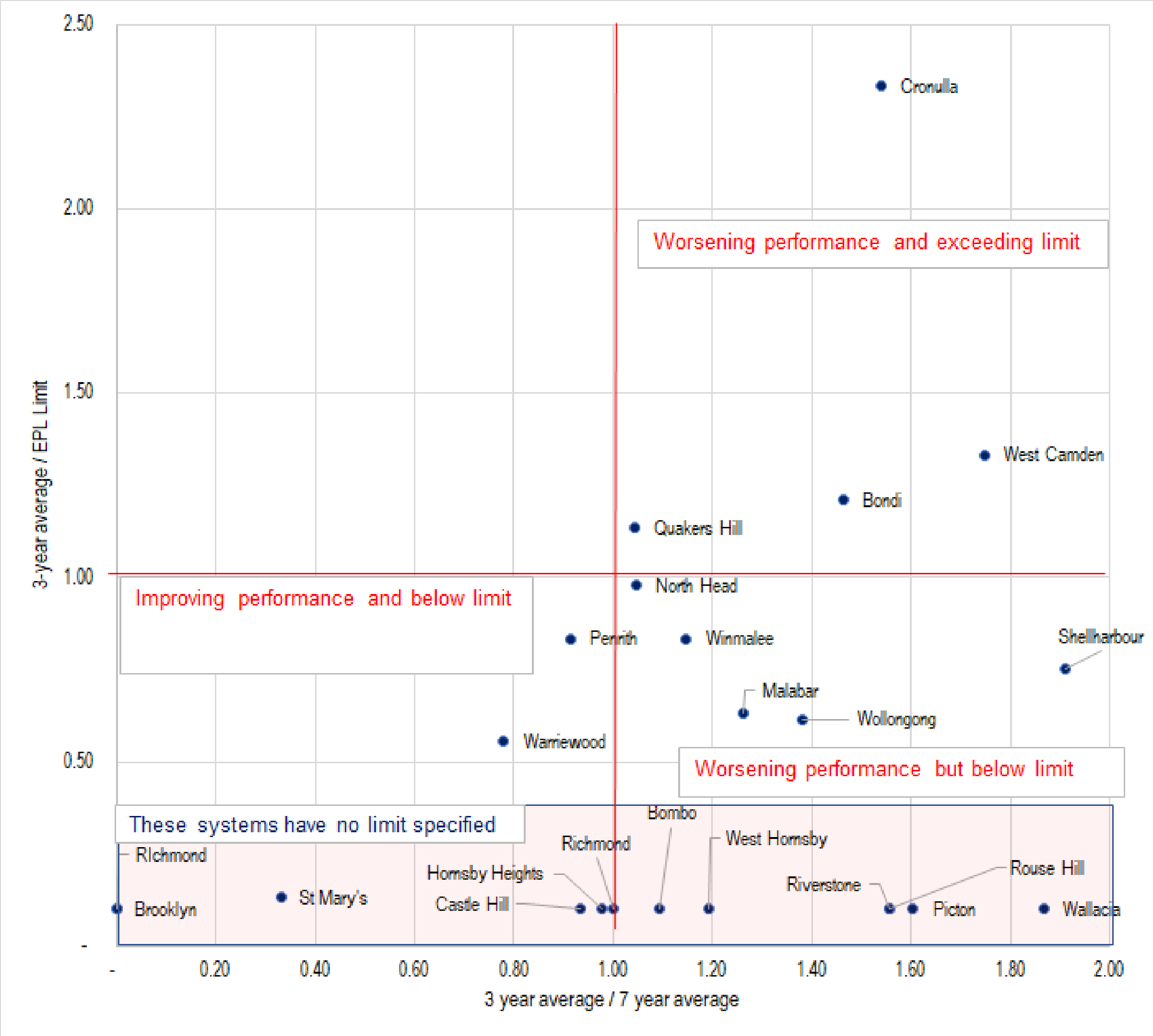
Environmental Protection Licence – Dry weather overflows to waterways
Sydney Water's Environmental Protection Licence requires that the number of dry weather overflows to waterways meets the specified limit for each system where an EPL is in place. Where an EPL is not in place, Sydney Water needs to comply with the requirement in the Protection of Environment Operations Act where pollution of land or water is an offence.

The limit for the number of dry weather overflows to waterways for each system, along with the compliance status for each financial year between 2012 and 2019, is shown in the table below.

EPL	Limit	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
North Head	142	Compliant	Compliant	Non-compliant	Compliant	Compliant	Non-compliant	Non-compliant
Malabar	122	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Wollongong	26	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Non-compliant
Bondi	19	Compliant	Compliant	Compliant	Compliant	Non-compliant	Compliant	Non-compliant
Cronulla	18	Compliant	Non-compliant	Compliant	Compliant	Non-compliant	Non-compliant	Non-compliant
Winmalee	12	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Warriewood	9	Compliant	Non-compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Penrith	8	Compliant	Non-compliant	Non-compliant	Compliant	Compliant	Non-compliant	Compliant
Quakers Hill	5	Non-compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Non-compliant
St Mary's	5	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Shellharbour	4	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
West Camden	3	Compliant	Compliant	Compliant	Compliant	Non-compliant	Non-compliant	Compliant
Total non-compliant		**1**	**3**	**2**	**0**	**3**	**4**	**5**

Source: Atkins-Cardno analysis of Sydney Water information (155.1)

We requested Sydney Water to provide the actual number of dry weather overflows to waterways from each system in each of the past seven years. We then compared the average number of overflows in the last three-years to the seven-year average as a measure of whether performance was declining or improving. We also compared the three-year average to the limit specified in the EPL. Note that many systems do not have a limit specified. The results of this analysis are shown following.



Source: Atkins-Cardno analysis of Sydney Water information (354.1)

This analysis shows that:

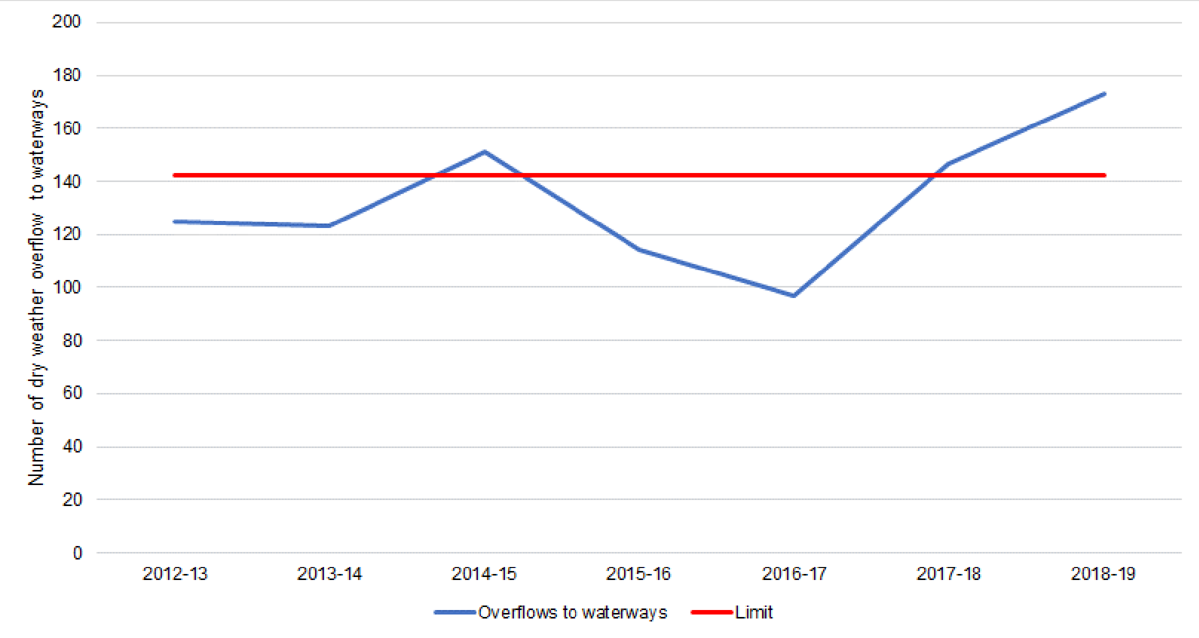
1. Eight of 23 systems show improving performance (this includes Richmond which has registered zero overflows to waterways in all years). All of these systems are also below the license limit where specified
2. 11 of 23 systems show worsening performance but performance is still below the license limit where specified
3. Four of 23 systems show worsening performance and average performance in the last three years exceeds the license limit. These four systems and their corresponding limits are:
    a. Cronulla (18)
    b. Quakers Hill (5)
    c. Bondi (19)
    d. West Camden (3)

Cronulla is a stand out in terms of deteriorating performance with the three-year average 2.33 times the seven-year average.

All of these systems are much smaller than the large systems of North Head and Malabar. Malabar has shown some decline in performance in recent years, but it is still well below the license limit.

In response to the draft report, Sydney Water detailed that it was concerned that this analysis does not reflect actual performance as it masks non-compliance given that any exceedance of the limit represents a non-compliance, there is no allowance for averaging of performance. We understand that compliance is measured annually (and have discussed this in Section 3.2.2). The purpose of this analysis is to illustrate trends in performance over time and the level of performance (or non-compliance). We are also interested in Sydney Water's understanding of the drivers of performance and how performance varies over time given that climate (which is out of Sydney Water's control) is one factor affecting overflows. This analysis also shows that despite Sydney Water being consistently non-compliant in four systems over the three year average and very close to non-compliant for one further system (North Head), it has faced no regulatory action for these non-compliances until now. Regulatory action in the form of a mandated Pollution Reduction Program for the North Head and Cronulla systems has now been formalised (in November 2019).

Looking at the North Head system specifically, performance has been variable over the period with improving performance in 2015/16 and 2016/17 preceding deterioration in the last two years as shown below.

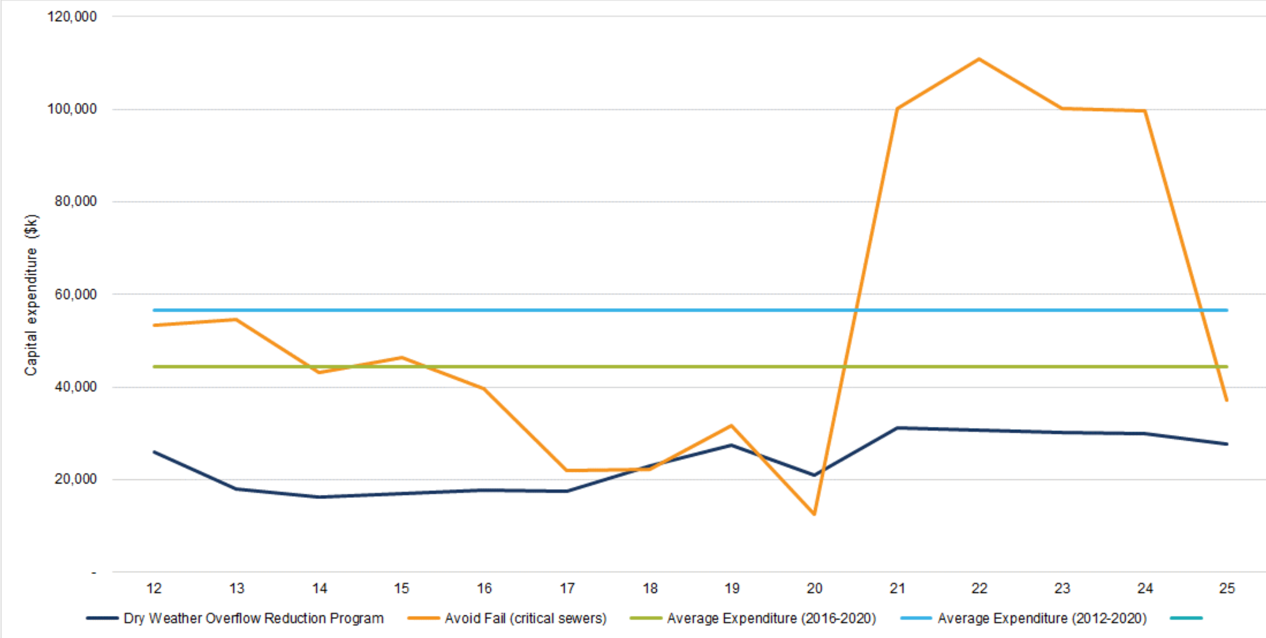


Source: Atkins-Cardno analysis of Sydney Water information (354.1)

As part of its November 2019 updates to its regulatory submission, Sydney Water advised that the EPA has now formalised a requirement that the North Head and Cronulla Networks need to be brought into compliance with the system level standards for dry weather overflows to waterways. The EPA requires that compliance needs to be achieved by 30 June 2021. While Sydney Water was in discussions with the EPA regarding this Pollution Reduction Program at the time of preparing its submission, the direction has come after Sydney Water's regulatory proposal was submitted and following our initial review work. The timing of the direction makes it difficult for Sydney Water to take a measured approach to achieving compliance for these systems. While the above performance measures relate to the occurrence of overflows, Sydney Water also has regulatory obligations to limit the impact of overflows on the environment. This relates to the response and clean-up of overflows. In this area, Sydney Water has faced increased regulatory oversight and enforcement action in recent years. From January 2018 to April 2019, 15 of 27 EPA actions imposed on Sydney Water related to incidents in environmentally sensitive bushland. In these isolated locations, overflow detection can be late, which allows more time for released effluent to reach natural waterways. Clean-up activities for these locations are also often costly.

SCOPE OF WORKS

Sydney Water is proposing an extraordinary increase in expedniture on the renewal of sewer mains in the forward period. This is shown in the figure below for all expendtiure from 2012 to 2025 (actual, forecast and proposed).



The table following details the average annual expenditure for each program and in total for the three period 2012-2015, 2016-2020 and 2021-2025. The critical sewer renewal program is proposed to increase from $22.1 million per annum by a factor of to $90 million per annum (2021-2025). This is largely attributable to the program targeting dry weather overflows to waterways. The program for reticulation sewers also shows considerable increase, by 29% so that average annual expenditure in the forward period is proposed at $30.0 million per annum compared with $23.2 million per annum in the current period. This increase in expenditure for non-critical sewers is for a reduced cohort following the reclassification of sewers impacting waterways out of this program. This reclassification has reduced the non-critical sewers cohort by about 10%.

All figures $19/20, $'000	Avg. 2012-2015 ($'000 p.a.)	Avg. 2016-2020 ($'000 p.a.)	Avg. 2021-2025 ($'000 p.a.)	Variance ($'000 p.a.)	Variance (%)
Dry Weather Overflow Reduction Program	19,281	23,169	29,961	6,792	29%
Avoid Fail (critical sewers)	49,324	22,108	89,577	67,469	305%
Total	68,605	45,277	119,539	74,26	164%

The scope of works proposed includes undertaking CCTV condition assessments, relining reticulation sewers, rehabilitating discrete sections of reticulation sewers and refurbishing vent shafts on reticulation sewers. These programs aim to reduce the frequency of sewer chokes and dry weather overflows and, as a consequence, reduce Sydney Water's risks to compliance, environment, and health and safety to an acceptable level.

Proposed outputs over the forward five-year period include:

- CCTV and inspections
  - 300 km of CCTV inspection of reticulation sewers
  - 1,000 km of CCTV inspection of critical sewers
  - 325 km traverse inspection of critical sewers
- Level 1 inspections
  - 1860km of Level 1 inspections of manholes of critical sewers
- Relining

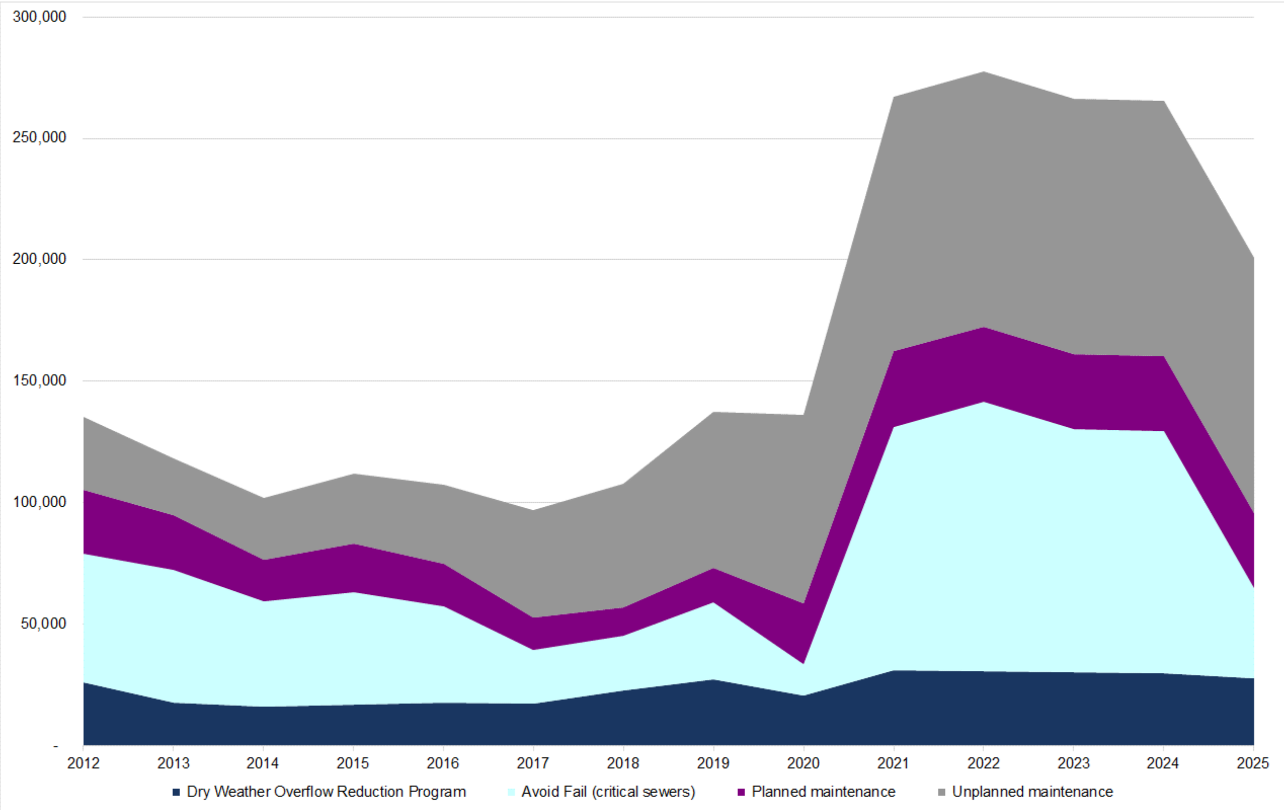
- 125 km of lining of reticulation sewers
- 128km of lining of critical sewers

- Discrete rehabilitation
  - 150 m of discrete rehabilitation of reticulation sewers
  - 28.1km of discrete rehabilitation of critical sewers

- Maintenance hole rehabilitation
  - 150 deep maintenance holes assessed
  - 100 deep maintenance holes rehabilitated

IMPACT ON OPERATING COSTS

There is a trade-off between capex and opex for the management of sewers across their lifecycle when managing to performance. Opex activities such as CCTV, root cutting and cleaning and may reduce the need for capital works that renew the mains. Similarly, renewal of the assets should reduce the need for ongoing operating expenditure. Therefore, it is somewhat surprising that while Sydney Water proposes extraordinary increases in capital expenditure for sewer mains it also proposes extraordinary increases in planned and unplanned maintenance as shown below.



In response to the draft report, Sydney Water made the following observations regarding this analysis:

- Unplanned maintenance expenditure does not permanently reduce chokes as 67% recur with three to four years
- The critical sewers program (waterways) does not address chokes and overflows in the balance of the network – this expenditure is sourced from the dry weather overflow reduction program.

Consequently, Sydney Water concludes that the reactive opex and targeted waterways program are justified to address the different needs for maintaining performance of the sewerage network and that the proactive waterways program will not quickly reduce the need for increased opex

The movement in each program for the preceding, current and future periods is quantified in the table below. While the critical sewers program is the largest absolute and proportionate increase between the current period and the future period, all program increase by at least 29% and the increase in totex is 121%.

All figures $19/20, $'000	Avg. 2012-2015 ($'000 p.a.)	Avg. 2016-2020 ($'000 p.a.)	Avg. 2021-2025 ($'000 p.a.)	Variance ($'000 p.a.)	Variance (%)
Dry Weather Overflow Reduction Program (capex)	19,281	23,169	29,961	6,792	29%
Avoid Fail (critical sewers) (capex)	49,324	22,108	89,577	67,469	305%
Planned maintenance (opex)	21,425	16,440	31,000	14,560	89%
Unplanned maintenance (opex)	26,925	53,940	104,900	50,960	94%
Totex	116,955	115,657	255,438	139,781	121%

OPTIONS APPRAISAL

Development of scope of works – reticulation and critical sewers (excluding dry weather overflows to waterways)

The Dry Weather Overflow Management Decision Framework provides the basis for selecting, evaluating and approving the maintenance and renewal of sewer mains that experience chokes and cause dry weather overflows. Within this framework, the following decision rules are applied in order to identify candidates for CCTV condition assessment and inspection, sewer relining, and vent shaft refurbishment:

- *Condition assessments:* Reticulation sewers are scheduled for CCTV condition assessment on the basis of the following three main drivers:
    - Repeat failures of the sewer (three or more chokes in a five-year period)
    - Sewer is likely to cause an overflow to a waterway or other sensitive site
    - Reactive reasons.

  All critical sewers are inspected on a cyclical basis, with sewers inspected more frequently as they near the end of their service life. Pressure sewers are inspected on a much less frequent (40-year) cycle. For both reticulation and critical sewers, work is identified and scheduled from the results of the condition assessments.
- *Reactive inspections:* Reactive inspections are typically identified from many situations, such as:
    - Overflows inside homes
    - Overflows affecting multiple properties and/or requiring high cost rebates
    - Overflows causing an incident and/or customer complaint
    - Safety or operational concerns (e.g., seepage, subsidence or odour).

- *Sewer renewal:* Based on current and historical trends and no expectations of material changes to the condition of the sewer network, 25 km of reticulation sewer relining per year is projected to be required over the 2020 to 2024 determination period. For critical sewers, approximately 5 km of relining per year is projected to be required over the 2020 to 2024 determination period.

  A temporary protective coating is also proposed to be applied to 5.5 km of critical sewers per year, along with an allowance for the renewal of 18.7 km of pressure mains over the 2020 to 2024 determination period due to the failure of significant lengths of pressure mains.

Development of scope of works – dry weather overflows to waterways

The Dry Weather Overflow to Waterways Management Process (2019) outlines the procedure for identifying and prioritising networks and SCAMPs, and the reticulation sewers and structures within these, in respect to dry weather overflows to waterways. Under this process, the performance of each network and SCAMP is calculated as the ratio of the annual number of dry weather overflows to waterways and the license limit applicable to the network or SCAMP. Networks, and SCAMPs within these networks, are sorted in descending order of performance, with five-year average annual performance used to distinguish between equivalent performance ratios. SCAMPs with a network performance ratio of 80% or higher and a SCAMP performance ratio of more than 100% are ranked first, followed by SCAMPs with a network and SCAMP performance ratio of 80% or higher. Within these networks and SCAMPs, the assets targeted for inclusion in the forward three-year inspection program are reticulation sewers that are hydraulically modelled, and structures connected to these. Targeted assets are subject to a three-step process, comprising rapid Level 1 maintenance hole inspections, Level 2 inspections (if required) and remediation or renewal work (such as root cutting, patch lining or relining, if required). For the purpose of developing an expenditure forecast for the 2016 to 2020 Determination period, the number of remediation and renewal activities is estimated based on sewer and structure quantities and historical program data, and unit rates are based on historical unit rates with a suitable overhead addition.

The Dry Weather Overflow to Waterways Management Process is supplemented by the Dry Weather Overflows to Waterways: Review and Program Costing report produced by Infrastream (2019), which discusses, in further detail, historical performance and causes of dry weather overflows to waterways and proposes additional expenditure for incorporation into the forward expenditure program.

This report details that 80% of sewer chokes are caused by tree roots, with 94.1% of chokes occurring in clay pipes and 98.6% of chokes occurring in pipes of less than or equal to 225 mm in diameter. For reference, 71% of Sydney Water's sewer network comprises clay pipes, while 87.3% of the network is less than or equal to 225 mm in diameter. In addition, the report details a high correlation between soil moisture and the annual number of chokes, along with a prevalence of chokes occurring in or around bushland. The report also identifies that 72% of dry weather overflows to waterways occur in modelled reticulation sewers. Lastly, the report evaluated the effectiveness of various remediation and renewal treatments (one-off root cutting, cyclic root cutting, junction jetting, patch lining and reticulation sewer lining) and found that reticulation sewer lining was the most effective treatment (88%). Root cutting was found to be less than 40% effective, with more than half of chokes at these locations returning within three years.

Over the next three years, this report proposes 44.6% of additional expenditure due to the inclusion of access difficulty factors (five grades of access difficulty) and a 10% contingency, and a recommendation that all Grade 4 and Grade 5 access difficulty-rated sewers within the program cohort are lined. Infrastream's recommendation to line all Grade 4 and Grade 5 access difficulty-rated sewers within the program cohort is based on assumptions around the effectiveness of various remediation and renewal techniques and a calculated payback period for lining of approximately eight years.

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COST ESTIMATING METHOD

The business case has been developed through analysis of historic costs sourced from the business. We have undertaken some benchmarking against other cost sources. However, it is difficult to achieve a robust comparison due to the difficulty in estimating the impact of factors such as access for working near waterways, traffic control, stakeholder/community engagement, reinstatement, site set-up and potential restrictions on working hours.

PROCUREMENT METHOD

The forward program for sewer main renewals will be delivered by Regional Delivery Consortia under the P4S model.

DELIVERY

As shown in the figures above, there are significant peaks in expenditure for sewer main renewals in 2023 and 2024 which are 172% and 164% over the average annual expenditure proposed for 2021 to 2025. The average annual expenditure proposed for 2021-2025 is in turn 165% above the current period. This profile will be extremely challenging for Sydney Water to deliver in any circumstance.

POST PROJECT REVIEW

Not applicable

CONCLUSIONS ON PRUDENCE AND EFFICIENCY

There is a clear need for Sydney Water to act to meet its Operating License and EPL limits relating to overflows from the wastewater network. While performance against the Operating License and the EPL limit for total chokes are within limits, performance against the EPL limits for dry weather overflows has failed for seven systems in the last three years and 15 of 23 systems show deteriorating performance. Sydney Water has very recently received a formal direction from EPA to bring the North Head and Cronulla systems into compliance and this needs to be done quickly – by 30 June 2021. The systems are not uniform – the North Head and Malabar systems have license limits an order of magnitude higher than the other systems. We accept that there is a strong need for Sydney Water to increase its activity to address deteriorating performance evidence by the increase in dry weather overflows to waterways.

While recognising the materiality of the challenge Sydney Water faces in achieving compliance for these systems, we are concerned that Sydney Water's response to the observed deterioration in performance is disproportionate to the rate of deterioration and its level of performance with respect to its licence limits. Both capex and opex are proposed to increase substantially – by 118% between the current and forward periods. Sydney Water has noted that sewer chokes due to roots are declining as a proportion of total chokes meaning that efforts may be better focused on activities other than relining. There is also the potential that a return to average climate conditions may improve performance (albeit with a backlog of partial or potential blockages due to tree roots that will require cleaning). The most immediate performance challenge is meeting the dry weather overflows to waterways standard for the North Head and Cronulla catchments by 30 June 2021. However, there are five more catchments that have been non-compliant or been close to non-compliance in recent years.

We see no justification for the increase in the reticulation sewer program above historic averages given that a proportion of sewers with the potential to overflow to waterways have been reclassified from non-critical to critical and the substantial expenditure on this cohort. This would lead to a reduction in scope of the reticulation program with all else being equal. Also, the performance measures that apply to both critical and non-critical sewers – the overall choke rate and internal overflows – should see benefit from the substantial investment in the sewers that overflow to waterways. We recommend an adjustment to this program to match the 2016-2020 annual average, a total reduction of $37.1 million (Approximately 30% of the scope).

We also recommend that the scope of the overflows to waterways program be reduced by one tenth. This is to:

- better match the magnitude of expenditure with the challenge faced by Sydney Water. While not underestimating the seriousness of the compliance challenge, totex on sewer mains is proposed to increase by 118% in the future period with this program a large driver of expenditure
- account for potential overlap with the benefits of the concurrent ramp up in unplanned maintenance. While Sydney Water notes that reactive opex (cleaning, root cutting and sometimes CCTV survey) will not prevent future chokes from occurring, there will be some deferral or moderation of chokes and through reactive opex, information will be gained on failure modes and underlying causes that will allow improved management of the network.
- Moderate the timing of expenditure to a small extent. In our opinion, a more considered approach that evolves to better information and continually improves will provide better value for money to customers. However, the recent formalisation of the Pollution Reduction Plan for the North Head and Cronulla systems which requires compliance by 30 June 2021 makes it difficult for Sydney Water to be measured in the timing of its response in these locations which has in part led to us making a smaller scope adjustment than what we may have proposed in other circumstances.

The impact of this scope adjustment to the critical sewers (overflows to waterways program) is a $18.4 million reduction in the level of prudent and efficient expenditure.

We also see no reason for no efficiency challenge having been applied to the critical sewers program. Firstly, this is inconsistent with Sydney Water's approach and there is no obvious reason to exclude this program. Secondly, this program is only in its infancy; greater efficiencies are likely to be realised in less mature programs such as this. We propose that this program have a 18% efficiency challenge applied. This efficiency adjustment has only been applied to the critical sewers and is applied after the scope adjustment set out above. The impact of the efficiency adjustment is to reduce recommended prudent and efficient expenditure by $84 million. This should not lead to any reduction in scope.

In response to the draft report, Sydney Water raised concern over the application of an 18% efficiency challenge due to the challenges its face in environmental performance and compliance risk. We consider that it is important to separate out compliance risk and risk to achieving efficient delivery. We accept the compliance risk and we accept that expenditure needs to be adjusted to reflect this risk and apparent deteriorating performance. However, we do not agree that this "risk" extends to achieving efficient delivery. SWC has spent considerable time moving towards a new procurement model that it has designed to deliver the forward program efficiently. At our interviews , Sydney Water also outlined that it considers that there is adequate market capacity to deliver the increased program. This work is also non-complex technically, repeatable and an area in which new innovations are emerging. There is no reason that we can see that Sydney Water would not be able to, or should not aim to, achieve the same level of efficiencies it expects to achieve in other areas of its program. We therefore maintain that the 18% efficiency adjustment to the critical sewer is appropriate. This efficiency challenge has only been applied to the critical sewers component of sewer mains expenditure net of the scope adjustments outlined previously.

Our proposed adjustments are summarised following.

SEWER MAIN RENEWALS PROGRAM							
($k 2019/20) year ending June	**2021**	**2022**	**2023**	**2024**	**2025**	**Total 2021-2024**	**Total 2021-2025**
SWC proposed expenditure	131,394	141,614	130,401	129,366	64,919	532,775	597,694
Atkins adjustment	(33,433)	(34,879)	(32,477)	(31,916)	(6,704)	(132,706)	(139,409)
Atkins recommended expenditure	97,961	106,735	97,924	97,450	58,215	400,069	458,284

KEY DOCUMENTS REVIEWED

- 70.1 Reticulation Sewer Draft Capital Program Business Case 2020-21 to 2024-25 v0.2_draft.pdf
- 56.1 Sewer mains AMP - AMQ0032.pdf
- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- 7. Sydney Water 2020-24 price proposal plus attachments-CONFIDENTIAL.pdf
- 155.1 Table for dry weather overflows to waterways trends for 7 years

- 155.2 Chart for dry weather overflows to waterways trends for 7 years
- 163.1 Waterway choke strategy D0001272 (Titled the Dry Weather Overflows to Waterways Management Process)
- 163.2 Waterway choke strategy D0001272_1
- 163.3 Waterway choke strategy D0001272_2
- 163.4 Waterway choke strategy D0001272_3
- 164.1 Infrastream DWOW Review and Program Costing Report ver1.0.pdf
- 354.1 Response to item 354 - Dry weather overflows 2012-13 to 2018-19

A.6. NSOOS

PROJECT DETAILS

Project Name	Northern Suburbs Ocean Outfall Sewer	
Project Number	<table><tr><th>Name</th><th>Number</th><th>Period</th></tr><tr><td>NSOOS De-silt Rehabilitation</td><td>SEM089</td><td>2020-2025</td></tr><tr><td>NSOOS MS1 De-silt Rehabilitation</td><td>SEM090</td><td>2016-2019</td></tr><tr><td>NSOOS MS2 De-silt Rehabilitation</td><td>SEM091</td><td>2016-2019</td></tr><tr><td>NSOOS MS3 De-silt Rehabilitation</td><td>SEM092</td><td>2016-2019</td></tr><tr><td>NSOOS scrubber replacement</td><td>SEM093</td><td>2016-2019</td></tr><tr><td>NSOOS Stage 2 Manhole Rehabilitation</td><td>SEM094</td><td>2016-2019</td></tr></table>	Current and future determination periods
Work Program	Manage Critical Sewers	
Key Investment Driver(s)	Asset renewal	
Stage	Ongoing	
Similar Projects	Rehabilitation is also planned for the Bondi Ocean Outfall Sewer (BOOS) and South West Sydney Ocean Outfall Sewer (SWSOOS) in the future period	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	18.7	28.3	22.0	32.2	**101**	32.2	38.2	36.9	14.9	**122.3**	
Planned From review documents											

NEED FOR SCHEME

The Northern Suburbs Ocean Outfall Sewer (NSOOS) collects sewage in the North Head catchment. The sewer flows from west to east and transports sewage to North Head where it is treated to a primary level and discharged through a deep ocean outfall.

The sewer was constructed as lined rock tunnel from 1916 - 1933. Failure of the lining is leading to silt build-up in the tunnel and reduced structural integrity. Silt build-up reduces hydraulic capacity of the sewer. Therefore, desilting and rehabilitation is required to maintain the functionality of the tunnel in the medium and long term.

The condition and serviceability of the tunnel has been confirmed through traverse inspections. We were provided with and reviewed an example report and consider that this provides sound evidence of the need for the proposed works. Based on the inspections undertaken, there are many sections of the tunnel with no assessed remaining service life and many sections with structural grading of 4 or 5 (5 being the worst). Given the criticality of this asset to sewage collection and transfer, this risk is deemed unacceptable by Sydney Water. We challenged Sydney Water as to whether this level of risk was overstated given that it is currently providing service despite the risk. Sydney Water responded that failure of the lining is reducing hydraulic capacity and increasing the likelihood of a partial collapse of the tunnel. Therefore, the potential for the inherent risk to be realised would result in substantial costs to repair any failures or improve capacity. Sydney Water also provided data on the level of flows within the tunnel that demonstrate that the capacity of the sewer is reduced.

SCOPE OF WORKS

Works on the NSOOS have been underway for a number of years and focus on Sections 1 – 7 comprising 28.6km between North Head and Dundas. An initial package of work, Package A, comprising three milestones (MS) has been carried out in the three years from 2016/17 to 2018/19. The milestones within Package A are for work in Sections 3 and 5 of the tunnel and include:

- MS1 (in Section 3) – desilt and rehabilitate 1.3km of tunnel that is 3.5m wide and 2.6m high
- MS2 -(in Section 3) – desilt and rehabilitate 0.9km of tunnel that is 3.5m wide and 2.6m high
- MS3 (in Section 5) – desilt and rehabilitate 1.2km of tunnel that is 3.2m wide and 2.4m high

Package B is has commenced and is planned to continue until 2021/22. Works are proposed at four project sites as follows

- Site 1 - (in Section 3) – desilt and rehabilitate 1.3km of tunnel that is 3.5m wide and 2.6m high
- Site 2 -(in Section 4) – desilt and rehabilitate 1.0km of tunnel that is 3.2m wide and 2.4m high
- Site 3 – (in Section 5) – desilt and rehabilitate 1.3km of tunnel that is 3.2m wide and 2.4m high
- Site 4 (in Section 4 and 5) – desilt only 3.2 km of tunnel that is 3.2m wide and 2.4m high

Package B has been included by Sydney Water across two SIR codes – SEM055 and SEM089. The breakdown of expenditure in the current period to the package elements is provided in the following table.

			$NOMINAL				
Project Number	SIR Capex 2 Final Mapping	Sir Capex 2 Mapping Code	2016-17 Actual	2017-18 Actual	2018-19 Forecast Jan	2019-20 Planning_Esc	Total Act/Fct 2016-20 Forecast
20032288 NSOOS Investigation Stage 2	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	756,422	801	1,068	-	758,29
20033211 NSOOS Rehab Pkge A Sec3&5	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	1,533,518	158,336	-	-	1,691,85
20033535 NSOOS MS2 Desilt Rehab Brightm	NSOOS MS2 De-silt Rehabilitation	SEM091	3,320,439	6,321,138	6,638,544	-	16,280,12
20033536 NSOOS MS3 Desilt Rehab LaneCov	NSOOS MS3 De-silt Rehabilitation	SEM092	3,474,928	7,043,026	5,613,346	-	16,131,30
20033537 NSOOS MS1 Desilt Rehab TheSpit	NSOOS MS1 De-silt Rehabilitation	SEM090	1,289,999	8,909,144	8,519,143	-	18,718,28
20033884 NSOOS Rehab Pkge B Sec3&5	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	4,125	292,428	584,362	-	880,91
20034122 F_NSOOS Desilt Rehabilitation	NSOOS De-silt Rehabilitation	SEM089	-	-	-	32,200,000	32,200,00
20036000 NSOOS RehabPkgB MS4 QuakersHat	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	-	-	2,885,518	-	2,885,51
20036001 NSOOS RehabPkgB MS5 Anzac Park	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	-	-	2,940,610	-	2,940,61
20036002 NSOOS RehabPkgB MS6WoodfordBay	Avoid Fail Wastewater Main Renewals (Critical Sewer)	SEM055	-	-	2,823,342	-	2,823,34
		TOTAL	10,379,432	22,724,873	30,005,934	32,200,000	95,310,23

Source: 271.1 Response to item 271 - NSOOS mapping to SIR

Two further Packages – Package C and D are planned to be undertaken in the forward period. All expenditure in the forward period is within the SEM089 item within the SIR and is for Package B (part), C and D.

Total expenditure on the NSOOS in the current period is forecast to be $101 million. This is lower than the $103 million ($96 million in $2014/15 rebased to 2019/20) forecast at the time of the last determination. However, Sydney Water has completed materially less rehabilitation than it forecast at the last determination. The increased unit rate for expenditure is due to actual productivity for desilting and rehabilitation being less than that forecast before work commenced (7 metres per day forecast compared with 3 metres per day achieved on average). A further $122 million is planned for the first four year of the future period and $142 million for the five year period. In total, Sydney Water is planning to spend $522 million to rehabilitate the NSOOS over a 15 year period.

A comparison of planned and actual expenditure in the current period is shown below.

$19/20	17	18	19	20	Total
Forecast	26	26	26	26	103
Actual	18.7	28.3	22.0	32.2	101
Variance	(7)	3	(4)	7	(2)

IMPACT ON OPERATING COSTS

The NSOOS is a gravity system. During construction pumping using wet weather pumps is being undertaken to draw down the level of the sewer to aid working. These costs are capitalised so there should be no material impact on operating costs now or in the future.

OPTIONS APPRAISAL

There are substantial challenges in undertaking these works. These include:

- Working in a live sewer which presents drowning and microbiological risks
- Fluctuations in the level of the sewer including due to wet weather. Pumping is used to draw down the sewer level. The working window is only 3am to 8am without pumping
- Gaining access to the damaged sections of the tunnel which are on the roof and sides of the tunnel
- Extraction and disposal of silt
- Noise and odour generated by the works and impacts of site compounds at the surface.

The rehabilitation methods have been specified based on the input of structural engineering experts. In Package A, four different rehabilitation techniques were specified and this has increased to seven in Package B demonstrating the evolution of the project. The repair requirements are not fully specified until the sewer section has been desilted and the tunnel surface subject to pressure cleaning and acid wash. This increases the difficulty in forecasting costs.

Sydney Water acknowledges that when it commenced works it did not appreciate the full financial impact of addressing the challenges during the Package A works or have full knowledge of the works required to rehabilitate the sewers. Consequently, less work has been done than forecast and for a higher cost. These works are unique and it is reasonable that Sydney Water has underestimated the actual cost of the works given their unique nature.

To try to address the challenges in the working environment, Sydney Water has engaged three contractors who have worked on Package A. The contractors have been encouraged to innovate through trial of different working platforms and equipment which were demonstrated to us. The incentive for innovation is that the contractor would gain more share of the work through being more cost effective. Sydney Water retains the intellectual property of the innovations implemented. To drive efficiency, Sydney Water also monitors productivity of the contractors.

We accept that Sydney Water could not have known the true cost of the NSOOS desilting and rehabilitation works before it commenced the works due to their unique nature. Sydney Water has demonstrated that it is actively trying to decrease costs for the works. Therefore, we consider that the expenditure on the

NSOOS in the current period is prudent and efficient despite the observed increase in costs compared with that forecast at the last determination.

COST ESTIMATING METHOD

Costs are tendered by contractors against a schedule of rates for the various desilting and rehabilitation activities involved in the scope. Sydney Water has obtained tendered from three contractors that have built up competence and understanding of the requirements of the works. These rates have been used to forecast the costs for Package B. Based on the competitive procurement, we are satisfied that the costs are likely to be efficient.

PROCUREMENT METHOD

The initial inspection (traverses) and works specification are undertaken by external consultants. An initial specification is drawn up based on this inspection. Three contractors then tender on the schedule on a rates basis. The contract is awarded based on this initial scope. The consistent detailing of the scope and competition between three qualified contractors should lead to efficiency in costs.

The selected contractor pressure cleans and acid washes the surface. This provides a better view of the tunnel surface so that repairs can be specified. Where structural works are required, core sampling may be undertaken to establish the strength of the underlying material and confirm the design. The design (repair types) are determined by a consultant and Sydney Water, not the contractor. The contract is based on the rates initially tendered, only the scope changes at this stage.

We challenged Sydney Water as to how scope creep was avoided through this procurement approach. Sydney Water advised that it had found for Package A that the initial traverse inspections had consistently underestimated the scope of work required compared to the scope after the cleaning of the tunnel. Sydney Water has focused on improved certainty in costs for Package B. Indicators of how Sydney Water is seeking to improve certainty in its forward work requirements and costs include:

- Sydney Water has undertaken its own internal estimates for forward works packages as a benchmark for tendered costs
- Establishment and monitoring of performance KPIs for existing contractors
- Approach by Sydney Water to share innovations and improve collaboration between contractors.

DELIVERY

As noted, Sydney Water has worked with three contractors to date to build capability and understanding of the working environment. Sydney Water has not decided whether this work will move into the P4S procurement arrangement or not as it does not know if the existing NSOOS contractors will be accepted onto this arrangement or not. It is therefore continuing with the existing arrangement for now.

Three packages of works are proposed for the future period (costs in $18/19):

- Package B – in progress to 2021/22 - $45.1 million
- Package C – 2021/22 to 2022/23 - $42.8 million
- Package D – 2022/23 to 2024/25 - $19.5 million

A staged approach to delivery in packages of work is appropriate for a rolling program of this nature.

POST PROJECT REVIEW

This is a rolling program of work that has been underway for three years and Sydney Water expects a total program duration of 15 years. To date, Sydney Water has demonstrated a review and improvement culture through:

- Changed specification for repairs with increased treatment types
- Increased validation of the scope requirements after the initial traverse
- Increased use of internal estimates
- Encouraging innovations and sharing these with contractors.

KEY DOCUMENTS REVIEWED

- 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm
- 68.1 Critical Sewer Capital Program Business Case 2020-21 to 2024-25 v0.2_draft.pdf
- 75.1 - NSOOS package A_delivery approval business case.pdf
- 75.2 - NSOOS package B_delivery approval business case.pdf
- 268.1 - NSOOS Section 1 - Eustace St - North Head WWTP 2016.pdf
- 269.2 NSOOS Package B Rehabilitation Tech Spec.pdf
- 270.1 Response to item 270 - NSOOS.pdf
- 271.1 Response to item 271 - NSOOS mapping to SIR.pdf

A.7. Wet Weather Overflow Abatement Program

PROJECT DETAILS

Project Name	Wet Weather Overflow Abatement Program	
Project Number	SNM016	Both 2016 and 2020 periods
Work Program	Wet Weather Overflow Abatement Program	
Key Investment Driver(s)	New Mandatory Standards	
Stage	Planning	
Similar Projects	There are many projects that have been aligned to the wet weather overflow abatement program that we have used as for historical comparators Wet Weather Overflow Abatement Program - SEM074 Wet Weather Surcharge - SEM105 Wet Weather Overflow Abatement Program - SNM016 Albion Park & Albion Park Rail (Wet Weather Surcharge) - SNM012 Wet Weather Surcharge - SNM023 Prospect Creek WWOA - SNM019 STS Licence Non Compliance - SNM020 Upper Parramatta Source Control - SNM021 Woolloomooloo Separation - SNM025 Lane Cove Source Control - SNM027 Mid-Parramatta Source Control - SNM028	

FINANCIALS AND PROGRAM (costs to 2019/20)

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR) (Nov-19)	7.9	36.9	24.2	18.5	**87.5**	51.0	59.7	60.7	52.7	7.9	**224.1**

NEED FOR SCHEME

The Wet Weather Overflow Abatement program addresses wastewater overflows which occur in wet weather when rain inundates sewers.
Historically Sydney Water invested significantly in large volume storage and treatment solutions with significant capex requirements. Throughout the current determination period there has been a shift away from capital intensive downstream storage solutions towards source control projects.
Sydney Water has been negotiating with the EPA to agree an alternative to the frequency targets for Wet Weather Overflow Abatement in its four largest coastal wastewater systems (North Head, Malabar, Bondi and Cronulla) since 2013. The EPA confirmed in correspondence to Sydney Water dated 8 August 2019 that it needed to achieve 60 credit points.

SCOPE OF WORKS

At the time of our review the overall WWOA program comprises of source control projects developed across 6 catchments:

i. Lane Cove
ii. Mid Parramatta
iii. Upper Parramatta
iv. Prospect Creek
v. Middle Harbour Mosman
vi. Wolli Creek

As well as a significant Licence Non Compliance Monitoring Program.

OPTIONS APPRAISAL

Sydney Water proposed total expenditure of $172M within its July 2019 submission to IPART which was based on an internally approved business case finalised in June 2019. At the time of the June submission three priority catchments were identified with source control projects chosen as the primary focus of abatement. These projects corresponded to 40 EPA credit points for investment which manages environmental impact (this is an offset regime). These projects involve $141M expenditure out of the total $172M ($31M is for other wet weather overflow abatement activities). Subsequent to the IPART submission and following further discussions with the EPA, it was mandated that Sydney Water are required to achieve 60 credit points within the 20220-24 regulatory period.

In its November update to its pricing proposal, Sydney Water detailed that an additional $52M of capital expenditure would be required to achieve the additional 20 credit points. The cost and benefit (credit points) of the 40 point and 60 point programs are summarised in the following table.

	Capital expenditure ($M)	Points	$M per point
Original 40 point program	141	40	3.5
Additional 20 points	52	20	2.6
Revised 60 point program	193	60	3.2

We challenged Sydney Water regarding the decreasing marginal cost of addressing the wet weather overflows – the additional 20 points are only three-quarters of the cost of the first 40 points ($2.6M per point compared with $3.5M per point). The implication is that the initially proposed (40 point) program is less value for money than the revised program (60 point). Sydney Water responded that the 40 point program was focused on larger catchments which were prioritised because of their size. Initial work has since provided better estimates of the costs of abatement works which has led to the estimates of the revised program.

COST ESTIMATING METHOD

Cost estimates have been built bottom up on a project by project basis. As this is the first significant program of source control abatement works undertaken by Sydney Water there is not a significant data set of historical costs to be used as a comparator. One previously delivered project - Wolli Creek ERS rehabilitation (2016-2020 period) has been used to develop unit costs and planning level estimates for the projects within the program

The program does not appear to have been challenged top down from an efficiency perspective.

PROCUREMENT METHOD

Detailed design and construction will be procured under P4S

DELIVERY

Sydney Water appear to be on the back foot in terms of planning and procurement for the projects so we consider there to be program efficiencies to be made once a more detailed procurement strategy has been developed and the market tested. The reduced marginal cost of the additional works (a 25% reduction on the original program) supports that there are likely efficiencies to be gained by further development of the delivery of this program. We have therefore made a program level efficiency adjustment of 18% to bring the efficiency challenge in line with other programs we have seen that Sydney Water have internally challenged themselves.

We do not propose any adjustment to outputs or scope as we recognise that this is a mandatory EPA obligation.

POST PROJECT REVIEW

N/A

KEY DOCUMENTS REVIEWED

93.1 Letter to Sydney Water confirming implementation of 60 points WWO abatement framework
93.2 DOC19 233583 Wet Weather Overflow Abatement regulatory measure – EPA refined version March 2019
93.3 DOC19-233583 Ltr to SW - WWOA - EPA refined regulatory measure and improvement level 2020-24
93.4 Issues with WWOA Regulatory Measure 7 November 2018
93.5 Metropolitan Infrastructure – Sydney Water – Wet Weather Overflow Abatement – EPA response to Sydney Water letter of 29 March
93.6 Metropolitan Infrastructure SW EPLs 372 378 1688 1728 WWOA EPA proposed regulatory ~ 24 price path
93.7 Metropolitan Infrastructure – Sydney Water – Wet Weather Overflow Abatement – Sydney ~ February 2019
93.8 Response to revised WWOA Regulatory Measure 7 December 2018
93.9 Signed Response to Issues 6 & 8 - WWOA Regulatory Measure & Improvement Level 18 June 2018
93.10 Storage Volumes & Costs High Risk Sites - January 2019
93.11 Sydney Water Response to WWOA Regulatory Measure Background Paper 29 March 2018
93.12 WWOA Capital Program 2020-24 - 20 June 2019
93.13 WWOA Credit Point Analysis Final 14 May 2019
93.14 WWOA Regulatory Measure Issues Discussion 26 September 2018
96.1 2018-19 EPA Compliance Activity Tracker w explanations
96.2 EPA Regulatory Action Tracker
96.3 Clarification to request EPA activity 2018-19
78.1 WWO Capital Program Business Case 2020-21 to 2024-25 v0.2
293.8 Session 32 Upper Parramatta Source Control Project
293.9 Session 32 Wet Weather Overflow
158.1 Response to Item 158 - Explanation of documents provided
158.2 15-06-05 Economic values of overflow impacts
158.3 15-10-14 Final WWOA CBA results
158.4 18-11-30 Workshop on environmental valuation
158.5 18-10-15 Results presentation WWOA CBA modelling update

A.8. Wastewater Treatment Plant Renewals

PROJECT DETAILS

Project Name	Wastewater Treatment Plant Renewals (existing mandatory standards) including:	
	Cronulla STP Odour Control	SEM040
	Malabar Odour Management	SEM044
	West Camden WWTP - Biosolids Upgrade and Amplification	SEM053
	Malabar WWTP Improvement Prgm	SEM062
	North Head STP - (PARR)	SEM064
	Quakers Hill WWTP Renewal	SEM068
	SP1146 to replace SP0008	SEM069
	Wastewater Treatment Plant Renewals	SEM073
	Bondi Inlet Works	SEM080
	Bondi Ventilation Upgrade Stage2	SEM081
	Cronulla Amplification	SEM085
	Cronulla Inlet Works	SEM086
	DOOF Load Limit Upgrade	SEM087
	North Head WWTP Biosolids Amplification	SEM088
	St Marys STP Renewal	SEM098
	St Marys WWTP Dewatering	SEM099
	Warriewood Inlet Works	SEM104
	Wollong Inlet OCU Works	SEM106
Project Number	All	Both 2016 and 2020 periods
Work Program	Wastewater Treatment Plant Renewals	
Key Investment Driver(s)	Asset Renewal	
Stage	Ongoing	
Similar Projects	Dewatering	
Output Measure	Number of sewage treatment plant renewal 2016-20 ‘Original’ submission target – 163 2016-20 ‘Revised’ Output target - 106	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	2025	Sub Total 21-24
Planned (SIR)	**86.6**	**117.2**	**163.9**	**145.6**	**513.3**	**146.3**	**117.3**	**121.0**	**147.5**	**90.3**	**532.1**

NEED FOR SCHEME

The purpose of this program is for end of service life renewal of ‘maintainable units’ within Wastewater Treatment Plants (WWTP) assets. Sydney Water owns and managed 28 WTTPs which are either sewage treatment plants or recycled water plants. This is an ongoing program of works.

SCOPE OF WORKS

- Renewal: to renew assets that are no longer able to contribute the required service level. The renewed asset will be one of similar functionality.
- Reliability: to ensure process reliability and compliance to current licensed service levels and expected performance levels
- Critical spares: to ensure the availability and reliability of plant assets. Spares will generally be held where maximum allowable downtime is less than the time required to procure the item.
- Capital expenditure over $5k per Sydney Waters accounting policy (SDIMS0055).

The output of the program 2020-24:

AREA	SUMMARY DESCRIPTION	2020-2024 Outputs	Output Type
Wastewater Treatment Renewals	Includes all renewal assets relating to Wastewater effluent treatment (incl. Preliminary, Primary, Secondary and Tertiary Treatment processes).	188	Number of Unit Types
Chemical System Renewal	Includes all renewal assets for our chemical dosing systems.	9	Number of Unit Types
Odour Control	Includes all asset renewals within the odour controls systems within the treatment plants.	8	Number of Unit Types
Solids Treatment	Relates to assets responsible for the solids process stream within the treatment plant.	61	Number of Unit Types
Power Supply	Includes renewal of High and Low voltage supply systems at the treatment plant.	46	Number of Unit Types
Recycled Water Treatment	Renewal of assets associated with the reclaiming of effluent water for industrial and other uses (Bondi)	1	Number of Unit Types
	TOTAL MAINTAINABLE UNITS	**313**	

IMPACT ON OPERATING COSTS

Sydney Water have proposed further expenditure of $86M on four WWTP inlet works (major >$10M) projects. An Inlet Works Study was commissioned to assess 21 WWTP's with screening and grit assets as part of the preliminary treatment process. The screen and grit processes are essential to protect downstream processes from materials that cause blockages and wear on equipment and consume process capacity. Analysis undertaken during the study, indicate that 40% of all maintenance costs can be traced back to poor screening and grit capture at the front of the treatment plant. There is an expectation that this capital expenditure will yield some opex savings

OPTIONS APPRAISAL

The expenditure forecast for the 2020 to 2024 determination period was developed through condition assessment, risk assessment, knowledge of spare part availability, failure histories and suppliers' recommendations.

Within the business case Sydney Water have undertaken options analysis to test the base case by considering how a 10% reduction in capex would impact on the overall risk profile, exposure and potential consequences. According to the BC a 10% reduction in investment capital will impact the delivery timing of candidate projects currently risk-rated as Medium (forecasted to be High within 5 years), deferring them into the next determination period. The consequences from a risk perspective of this would likely result in:

- Increased risk of penalties in relation to our operational and environmental licence (High 3 – Critical/Unlikely)
- Increased risk to our reputation due to customer complaints due to odour (Medium 4,Moderate/Possible)
- Increased safety risk due to failure to maintain our assets (Medium 4 Critical/Very unlikely)
- Increased risk of increased operational costs due to continued asset failure caused by degradation of asset condition of wastewater treatment assets (Medium 4 Critical/Very unlikely)

Due to a number of measures indicating performance improvements across plants there does not appear to be a need to increase expenditure above current levels.

COST ESTIMATING METHOD

Sydney Water use three sources of data to develop the costs estimates. Total replacement costs, In-flight Project costs and Historic Benchmarks. These are then brought together within the "Asset Renewal Tool (Candidate Extract) 20-25.to develop a program level estimate. This was undertaken for a five-year determination period.

PROCUREMENT METHOD

The forward program for WWTP renewals will be delivered by Regional Delivery Consortia under the P4S model.

DELIVERY

The program has been divided into a number of major projects and packages.

POST PROJECT REVIEW

N/A

KEY DOCUMENTS REVIEWED

72.1 WWTP Capital Program Business Case 2020-21 to 2024-25 v0.2_draft
351.1 Att 1 References
351.2 Att 2 Scope of Work Synopsis
351.3 Att 3 Project Dossier - Active Projects 2020-25
351.4 Att 4 Project Dossier - Candidates 2020-25 IPART
351.5 Att 5 Age and Replacement Value of Wastewater Treatment Assets
351.6 Att 6 Baseline Outputs 2020-25
351.7 Att 7 Benefit Profiles
351.8 Att 8 Risk Register
351.9 Att 9 Civil Remediation - Prioritised Delivery packages
351.10 Att 10 Deliverability Review P6 Schedule
351.11 Att 11 Inlet Works Prioritisation
351.12 Att 12 Decision Frameworks
351.13 Att 13 Candidate Prioritisation process
351.14 Att 14 Project Dossier - Candidates 2020-25 Option C
351.15 Att 15 - Partnering for Success (P4S) Overview
359.1 WWTP Performance
359.2 STSIMP 2017_18 Vol 1
359.3 STSIMP 2017_18 Vol 2
293.3 Session 26 Wastewater Treatment Plant Renewals & Dewatering
160.1 Guideline WWTP CoF Assessment-D0000827
58.1 Wastewater treatment_n_recycling plant AMP - AMQ0113

A.9. Reservoir Renewals Program

PROJECT DETAILS

Project Name	Reservoir Renewals Program (including Potts Hill and Erskine reservoir renewal)	
Project Number	WEM046	Ongoing program across both periods
Work Program	Reservoir Renewals Program	
Key Investment Driver(s)	Asset Renewals	
Stage	Implementation/Planning	
Similar Projects	Erskine Park Reservoir Renewal – WEM028 Potts Hill Reservoir Renewal – WEM030	
Link to asset plans	Water Reservoirs AMP	
Output Measure	Reservoir renewals - renew 33 reservoirs by 2020 – on track	

FINANCIALS AND PROGRAM (costs to 2019/20)

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	2025	Sub Total 21-24
Planned (SIR)	27.5	16.7	10.0	17.7	71.9	30.4	25.6	21.4	23.9	16.7	101.2

NEED FOR SCHEME

The 256 reservoirs are made up of 241 Networks reservoirs (11 of which are prescribed as dams under ANCOLD), nine recycled networks reservoirs and six treatment reservoirs. Most of the reservoirs were roofed in the late 1960s / early 1970s to ensure the maintenance of drinking water quality in the network. A number of these roofs are now reaching the end of their remaining life (taken as 50 years). A number of steel reservoirs also still have bitumen linings, which are in poor condition, while some mechanical / electrical equipment including re-chlorination facilities require renewal or replacement.

SCOPE OF WORKS

The forward program is a continuation of the 2016-20 program which involves the renewal of reservoir roofs, relining of walls and renewal of some mechanical / electrical equipment including re-chlorination facilities, valves, mixers and instrumentation.

Sydney Water have identified 28 reservoirs for renewal (including Potts Hill and Erskine), with 21 of these classed as in poor or very poor condition. Sydney Water state the increase in expenditure is required to replace 14 sites which have bitumen lining which are all due for renewal in the 2020-2024 period, the remainder of program includes condition grade 4 and 5 assets due for repair to maintain their service life

IMPACT ON OPERATING COSTS

Within the current period Sydney Water have been trialling development of their own proprietary technology for automatic re-chlorination dosing equipment in reservoirs as such a number of re-chlorination replacements that were scheduled for the current period have been deferred in to the next determination period. Each unit is $1M cheaper than the like-for-like unit used for previous renewals. Sydney Water have plans to replace 9 units yielding a capex saving of $9M over the period when compared to a like-for-like replacement.

OPTIONS APPRAISAL

There was minimal demonstrable evidence of options appraisal undertaken. Options were not well linked to expenditure levels within business case.

COST ESTIMATING METHOD

Unit rates have been derived using trending analysis of the 2016-20 program of works. The estimates have been derived based on actual cost of projects completed with similar or same scope.

PROCUREMENT METHOD

This will be a blend of P4S contracts and smaller contracts depending on the complexity of the work

DELIVERY

We are proposing that expenditure on reservoir renewals for the routine reservoir renewal program is maintained at current levels however have assumed the expenditure for 2021 has been largely agreed and committed so have maintained this as proposed with some expenditure deferred into year five of the period to enable prioritisation of works. The ongoing risk based approach to prioritisation of expenditure should be continued.

POST PROJECT REVIEW

N/A

KEY DOCUMENTS REVIEWED

54.1 Water reservoirs AMP - AMQ0120 293.11 Session 33B Reservoir Renewal 325.1 Response to Item 325 - Clarification Response 325.2 - Attachment 1 - RES Operating Facilities 325.3 - Attachment 1.1 - RES Operating Facilities 325.4 - Attachment 2 - Planned Level 1 Condition Assessment 325.5 - Attachment 3 - Planned Water Quality Analysers renewals 325.6 - Attachment 4 - Partnering for Success 325.7 - Attachment 5 -DM Delivery Estimate 325.8 - 1.0 Water Network PCG Minutes 19th Sep 2018 v1.0 325.9 - PCG Sept 18 – RBO 325.10 - 20035313 Wiley Park Reservoir OABC 325.11 - Erskine Park Reservoir_NABC Estimation_Rev1_IPART 325.12 - Cost Estimate - OABC 20033208 WS0347 Dapto Reservoir - Rev 1.2

A.10. Stormwater Renewals Program

PROJECT DETAILS

Project Name	Stormwater Renewals		
Project Number	Stormwater - Flood Risk Program	DEM002	Ongoing program across both 2016 and 2020 periods
	Stormwater - Astrolabe Park Renewal	DEM003	
	Stormwater - Johnstons Creek Renewal	DEM004	
	Stormwater - Powells Creek Naturalisation	DEM005	
	Rouse Hill Trunk Drainage Land Acquisitions	DEM009	
	Cooks River Bank Renewal	DEM010	
	Stormwater Minor Renewals	DEM011	
	Alexandra Canal Renewal	DEM012	
	Carrs Park Stormwater Renewal	DEM013	
	City Area 30	DEM014	
	Tidal Open Channel Renewals	DEM015	
	Erskineville Flood Safe	DEM016	
Work Program	Stormwater Renewals		
Key Investment Driver(s)	Asset Renewals		
Stage	Ongoing		
Similar Projects	Stormwater - Waterway Health	DEM008	
Link to asset plans	Stormwater AMP - AMQ0064		
Output Measure	Pipe and Channel Renewal and Rehabilitation		

FINANCIALS AND PROGRAM (costs to 2019/20)

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)	14.99	17.57	14.93	11.23	**59**	23.25	38.82	37.70	38.47	**138**	

NEED FOR SCHEME

The objectives of the program in the current period were to:

- maintain services & network health (relative to current state)
- reduce the number of asset collapses
- reduce public safety risks

Sydney Water indicate that the main drivers for the increased expenditure proposed in the future period include maintaining services and network health and to reduce the asset risk profile from very high to high

SCOPE OF WORKS

The scope of the work has been derived through a condition assessment program which defined a long list of projects which was then prioritised down to 6 major projects and numerous minor renewals. The program proposes to: • renew 6,579 metres of open channel • renew 4,278 metres of conduits (pipes, culverts etc) • perform 160,000 metres of condition assessment • renew 6,106 metres of open channel fencing; and • renew 4 gross pollutant traps

IMPACT ON OPERATING COSTS

Not explicit

OPTIONS APPRAISAL

As well as the proposed investment program Sydney Water undertook an options analysis has been for the following investment scenarios: 1. reduce scope by ten percent (10%); 2. increase scope to renew all stormwater assets with a risk ranking of High 2 3. increase scope to renew all stormwater assets with a risk ranking of High This options appraisal appears to have been undertaken retrospectively rather than prior to informing the expenditure levels. Sydney Water have provided evidence that reactive renewals for stormwater assets have increased sharply over the last two years with associated reactive repair costs incurring higher costs overall that planned renewals. We are therefore supportive of increasing expenditure relative to the current period to reduce the asset risk profile and recommend including committed expenditure for projects in the active phase as well as some expenditure for minor renewals projects and planning. We have some reservations over the prudency of all of the proposed investment particularly in the later years of the program where projects are less well defined or scoped so we recommend a deferring some expenditure and commensurate outputs into 2025 We proposed to adjust outputs proportionally with expenditure levels.

COST ESTIMATING METHOD

Sydney Water have used historical unit costs per m2 for renewals of canals, open channels and pipe and box culverts to develop the forward program.

PROCUREMENT METHOD

Detailed design and construction will be procured under the P4S initiative

DELIVERY

In the current period Sydney Water are on track to meet their output measure target. They have maintained the service and managed risk, avoiding collapses and slightly reducing the proportion of assets in the lowest condition categories

POST PROJECT REVIEW

N/A

KEY DOCUMENTS REVIEWED

63.1 Stormwater AMP - AMQ0064 162.3 Stormwater CA D0001386 273.1 Stormwater Renewals Capital Investment Program Business Case 2021-21 to 2024-25 V3.1_draft 275.1 Session 24 Asset Renewal - Stormwater

A.11. Green Square Trunk Drainage

PROJECT DETAILS

Project Name	'Stormwater - Green Square Trunk Drainage (HAF)	
Project Number	DG0030	2016
Work Program	N/A	
Key Investment Driver(s)	Growth	
Stage	Completed	
Similar Projects	Stormwater renewals	

FINANCIALS AND PROGRAM (costs to 2019/20)

Year ending (price base $m 19/20)	2017	2018	2019	2020	17-20 Total
Planned (SIR)	32.52	12.21	10.85	0.05	55.62

NEED FOR SCHEME

The land in the Green Square area has been subjected to a series of recent flooding events, having previously been the site of Waterloo Dam and carries a high risk profile due to the high population density.

SCOPE OF WORKS

This is a joint project with a cost sharing agreement in place between Sydney Water (46%) and City of Sydney Council (54%). Total capital expenditure proposed in the 2015 IPART submission for Sydney Water's project costs was $52M in real $ terms, with the June 2019 submission indicating a 30% increase in Sydney Water's project expenditure of $68M. The 2015 IPART submission included "Variation-1" to the project.

The projects driver to reduce the risk of flooding in the area has called for an enhancement of the service capacity of the existing trunk drainage network with the construction of a new stormwater main from Link Road, Zetland to the head of Alexandra Canal, located downstream of Huntley Street Alexandra, together with stormwater quality improvement infrastructure. The proposed trunk drainage works for the project is planned to replace and upgrade the carrying capacity of the existing trunk drainage asset upstream of Joynton Avenue, and will provide additional trunk drainage capacity downstream of Joynton Avenue.

IMPACT ON OPERATING COSTS

N/A

OPTIONS APPRAISAL

5 options were considered in terms of the alternative alignment of the drainage. We were not provided significant detail on the general concept options for the drainage scheme.

COST ESTIMATING METHOD

Cost estimates were developed by external consultants and were built bottom up.

PROCUREMENT METHOD

The project was procured using an alliance agreement in February 2015, "The Green Square Trunk Stormwater Project Alliance " with a pain/gain share contracting model applied.

DELIVERY

There have been three significant expenditure variations to the project for a number of reasons including pain-share costs, easements, scope changes and program completion date movements as shown in . We highlight the increase in expenditure throughout the project lifecycle

Project Stage	Date	Sydney Water (nominal $)	Total project costs (nominal $)
Project Initiation Business Case	Jan-14	$36.8M	$80M
SWC board approved funds (Delivery Business Case)	Apr-14	$45.8M (p80)	$99M
Variation-1	Dec-14	$52.7M (+$6.8M)	$114.1M
Variation-2	Jan-17	$61M (+$7.9M)	$131M
Variation-3	Oct-17	$74M (+$13.5M)	$162M
June 2019 Forecast	Jun-19	$66M	$143M

POST PROJECT REVIEW

The funding and delivery arrangements for this project are more complex than for other projects. There is a cost sharing mechanism in place with City of Sydney and a small proportion of Sydney Water's funding has come from the NSW Government's Housing Acceleration Fund (HAF). Sydney Water received one payment of $10 million for Green Square in 2014-15 and this amount was included in the SIR2 Capex 2 for that year. As part of IPART's process for calculating the Regulatory Asset Base deducts cash contributions from relevant capital expenditure items (where such values are submitted with external contribution included) for the 2016 Determination, IPART deducted $7 million (net of tax) for this HAF cash contribution from the Green Square capex amount in SIR Capex 2 for 2014-15. Sydney Water received the HAF funding in 2014-15 but this was not (and has never been) included in the RAB therefore we have not proposed any adjustments for this project.

KEY DOCUMENTS REVIEWED

76.1 Stormwater - Green Square Trunk Drainage Final Report 76.2 - Green Square & West Kensington FRM Plan _Jul 2013 76.3 - Green Square & West Kensington FRM Study _May 2013 76.4 - Green Square Alliance - RFP Document v6 20140428 FINAL 76.5 - Green Square Initiation and Delivery BCs 76.6 - Green Square Stormwater Drain REF (April 2014) 76.7 - GSSD_0001-0016_C 76.8 - VBC1_Green Square Trunk Stormwater Drainage 76.9 - VBC2_Green Square Trunk Stormwater Drainage 76.10 - VBC3_Green Square Trunk Stormwater Drainage 76.11 - WRL TR 2014-28 Green Square FINAL DRAFT 20140826 274.1 Session 24 Stormwater-Green Square Trunk Drainage

A.12. Stormwater – Waterway health

PROJECT DETAILS

<table>
<tr><td>Project Name</td><td colspan="2">Stormwater - Waterway Health</td></tr>
<tr><td>Project Number</td><td>DEM008</td><td>Ongoing program across both 2016 and 2020 periods</td></tr>
<tr><td>Work Program</td><td colspan="2">Stormwater - Waterway Health</td></tr>
<tr><td>Key Investment Driver(s)</td><td colspan="2">Existing mandatory standards (in SIR)
Improved service</td></tr>
<tr><td>Stage</td><td colspan="2">Ongoing</td></tr>
<tr><td>Similar Projects</td><td colspan="2">
<table>
<tr><td>Stormwater renewals</td><td>DEM001</td></tr>
<tr><td>Stormwater - Flood Risk Program</td><td>DEM002</td></tr>
<tr><td>Stormwater - Astrolabe Park Renewal</td><td>DEM003</td></tr>
<tr><td>Stormwater - Johnstons Creek Renewal</td><td>DEM004</td></tr>
<tr><td>Stormwater - Powells Creek Naturalisation</td><td>DEM005</td></tr>
<tr><td>Rouse Hill Trunk Drainage Land Acquisitions</td><td>DEM009</td></tr>
<tr><td>Cooks River Bank Renewal</td><td>DEM010</td></tr>
<tr><td>Stormwater Minor Renewals</td><td>DEM011</td></tr>
<tr><td>Alexandra Canal Renewal</td><td>DEM012</td></tr>
<tr><td>Carrs Park Stormwater Renewal</td><td>DEM013</td></tr>
<tr><td>City Area 30</td><td>DEM014</td></tr>
<tr><td>Tidal Open Channel Renewals</td><td>DEM015</td></tr>
<tr><td>Erskineville Flood Safe</td><td>DEM016</td></tr>
</table>
</td></tr>
<tr><td>Link to asset plans</td><td colspan="2">Stormwater AMP - AMQ0064</td></tr>
<tr><td>Output Measure</td><td colspan="2">None</td></tr>
</table>

FINANCIALS AND PROGRAM (costs to 2019/20)

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)				6.60	9.05	6.55	4.55	1.12	3.91	16.13	25.18
Actual	0.65	1.30	0.50								

NEED FOR SCHEME

The primary driver for the Waterway Health Program is to improve the health of waterways managed by Sydney Water. By constructing new stormwater quality improvement devices, this program aims to reduce quantities of pollutants discharged to waterways, reduce runoff, increase native vegetation, increase populations of key fauna, improve customer satisfaction, and improve amenity and use of waterways.

Sydney Water's Operating Licence requires that it provides, operates, manages and maintains a Stormwater Drainage System as described in Section 14(1)(b) of the Act. However, the 2019 - 2023

Operating Licence now makes specific reference to Sydney Water having authority (but not being required) to manage the impacts of stormwater on waterway health.

Sydney Water considers that "it will need to play a changing role… to transition Sydney's waterways toward a state that aligns with [its] vision… to be the lifestream of Sydney for generations to come". As such, Sydney Water has proposed this Waterway Health Program of capital works.

Sydney Water's customers have also indicated a willingness to pay for improved waterway health through the following studies:

- Deliberative democracy forum conducted by Sydney Water with its customers in 2015: Customers expressed a "strong desire" for Sydney Water to deliver the outcomes of a Water Sensitive City, even if higher customer prices were required
- *Willingness to Pay for the Outcomes of Improved Stormwater Management Report* (Gillespie Economics 2018): Customers indicated a "positive" willingness to pay for the outcomes of the proposed Waterway Health Program
- *Bringing it all together: Customer-informed IPART submission (CIPA) Phase 3* (Woolcott 2018): 67% level of support for improving waterway health through increased customer charges.

SCOPE OF WORKS

This program is focussed on waterways in Sydney Water's declared catchments within the broader Cooks, Georges and Parramatta River catchments. The program is being delivered through two stages of work across the current and future period:

- Stage 1 – planned for current and next period
- Stage 2 – planning and design starting in the next period

There are three packages of work in Stage 1. Package A comprised construction of litter booms and was completed in 2017. Package B comprises five projects that are planned and three of which will be delivered from September 2019. Sydney Water forecasts that it will only deliver half of the 2016 determination capital expenditure total of $19 million. Sydney Water identifies the following reasons for this underspend:

- Deferral of work due to Sydney Water capping expenditure under this program ($5 million impact)
- Schedule delays due to greater time for negotiation, planning and reporting and working with local Councils. Local governments are key stakeholders as many works are delivered jointly ($4million impact).

In the forward period, Sydney Water proposes $16.1 million to deliver:

- two litter booms
- five gross pollutant traps
- four wetlands
- three bioretention systems
- one sediment basin; and
- two stormwater pump stations.

IMPACT ON OPERATING COSTS

Not explicit

OPTIONS APPRAISAL

Sydney Water has undertaken a willingness to pay study (*Willingness to Pay for the Outcomes of Improved Stormwater Management* , Gillespie Economics, 2018) specific to the activities and outcomes of the waterway health program. This report attributes the following willingness to pay values to components of the potential program:

- $0.93 per annum for 10 years for every extra kilometre of waterway in good health in 30 years' time;
- $0.18 per annum for 10 years for every additional hectare of native vegetation plantings, including wetlands, in 30 years' time;
- $0.10 per annum for 10 years for every additional set of recreation facilities built in local open spaces used for stormwater management, in 30 years' time; and
- $0.18 per annum for 10 years for every additional garbage truck load of rubbish and litter removed from the waterways each year.

This information informed options analysis across Sydney Water's entire investment program through the *Bringing it all together: Customer-informed IPART submission* willingness to pay study. Figure 1 is an extract from this study which shows the waterway health improvement program tested. The study found 67% customer support for this program.

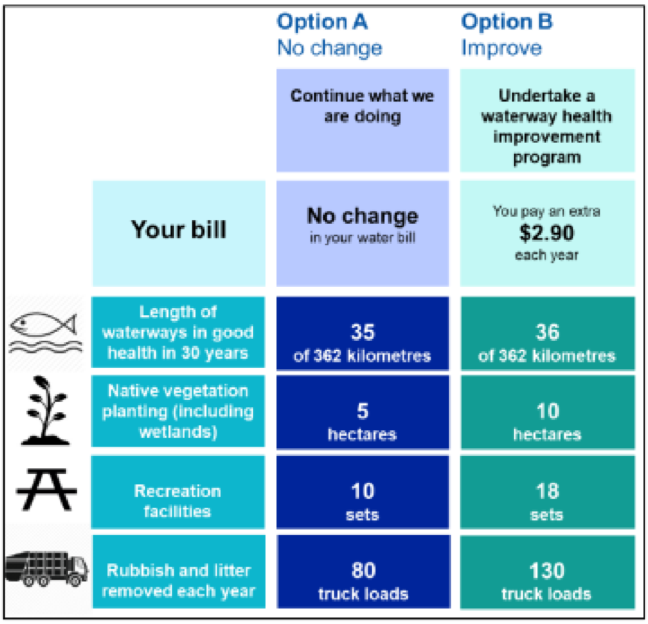

Figure 1 – Options tested for the "Bringing it all together: Customer-informed IPART submission" study

However, while this wider willingness pay to study was undertaken, it did not inform the final level of investment in the waterway health program. Instead, the program was subject to a 40% reduction as part of the overall top-down "efficiency" challenge. This 40% reduction comprises a 21% challenge to program costs and the balance for "prolongation of the program past 2024". Sydney Water stated that the wider results of this study were not used to set the total level investment because:

- The results were not available in sufficient time to inform the program
- Trade-offs in between benefits and costs between the waterway health program and other programs could not be undertaken with sufficient rigour.

We understand that the last constraint is because few other programs have been justified with an estimate of economic benefits (i.e. through the willingness to pay study). Notwithstanding that time constraint, it is surprising that Sydney Water has selected a lower of investment than apparently supported by its customers. It appears that Sydney Water will miss an opportunity to deliver value to its customers. This also appears incongruous with the 'options analysis' in the program business case which tested the the impact of a reduction in the proposed scope of the program by 10%. This analysis by Sydney Water concluded that this adjustment would result in increased risks to the environment and reputation and an overall move in the risk profile from "medium" in the base case (program as proposed) to "high" under the option of a 10% reduced scope.
The nature of this "efficiency" challenge is also different to what has been applied to other programs. The efficiency challenge here includes a scope reduction through deferral. The efficiency challenge for other

projects and programs are intended that the same scope be delivered net of the efficiency challenge to the estimated expenditure. Given the customer support for this program and Sydney Water's greater confidence in the costs and benefits of delivery gained in the current period, we consider that the deferral of expenditure is not justified. We recommend that the $6.5 million of expenditure deferred be considered prudent in the 2021-2024 period.

Within the overall program budget, specific projects were initially identified through sub-regional and precinct planning activities, as well as in response to customer complaints. In particular, the construction of litter booms and gross pollutant traps were initially identified by Customer Delivery in response to operational feedback and customer complaints, while "natural" stormwater systems were identified through planning work conducted in the 2016 to 2020 determination period and Greater Parramatta to Olympic Peninsula Stage 1. Candidate projects for this program were subsequently selected and prioritised using a decision framework.

Individual projects were then subject to cost-benefit analysis based on the benefits identified in the Gillespie study. Projects were prioritised based on benefit-cost ratio.

The program put forward for the 2021-2024 period is then:

- Carry over of projects deferred from the current period
- The highest priority (highest benefit-cost) projects determined from the long list and through cost benefits analysis.

The bottom up program was subject to internal challenges to recognise synergies in delivery.

COST ESTIMATING METHOD

Costs for the forward program are based on the following:

- Litter boom costs and based on actual costs in 2016-20 program
- GPT costs are based on actual costs from a specific project from 2015/16
- Cost for natural stormwater treatment systems: cost based on detailed cost estimates for concept designs

Sydney Water applied an efficiency gain of 2% to capital costs estimated to account for expected savings through bundling projects into packages for planning, design and delivery (note – this was at the program level and before the top-down efficiency adjustments).

PROCUREMENT METHOD

Detailed design and construction will be procured under the P4S initiative

DELIVERY

The Waterway Health Program will be led by Sydney Water but delivered in partnership with local councils. For example, for some works, Sydney Water will require ownership of or access to land owned by local governments on which to construct the works.
Sydney Water has identified that the key risks to the successful on-time delivery of the program are the long lead times arising from the extensive engagement, planning and approvals processes required, and the competition for wetland/bioretention system footprint with other Council-managed uses in parks and the public domain. However, Sydney Water considers that through the lessons learned in the current period regarding working with Councils and undertaking negotiations and getting approvals it will not face the same delays to schedule in the forward period.

POST PROJECT REVIEW

N/A

KEY DOCUMENTS REVIEWED

63.1 Stormwater AMP - AMQ0064 216.1 Waterway Health Capital Inv Program Business Case 2021-21 to 2024-25_Draft_V3.0.pdf 10. SWC AIR SIR 2019 - UNPROTECTED for IPART 010719.xlsm 217.1 Waterway health improv. program Dec Fwork - D0001391.pdf 251.8 Session 12 Asset Renewal - Waterway Health

A.13. SDP expansion network upgrade

PROJECT DETAILS

Project Name	SDP Expansion Network Upgrade	
Project Number	N/a	Current and future determination periods
Work Program		
Key Investment Driver(s)	Growth / Resilience	
Stage	Planning	
Similar Projects	Construction of the Prospect to Macarthur link will also provide increased resilience in the water supply network	

FINANCIALS AND PROGRAM (costs to 2019/20)

Budget in 2019 Needs Assessment BC	$436 M	**Initial Delivery Date**	June 2022
Outturn cost / Forecast outturn cost in Submission	N/a	**Actual / Forecast Delivery Date**	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)				68	**68**	220.8	147.2			**368**	**436**

NEED FOR SCHEME

The existing Sydney Desalination Plant currently provides supply into the Potts Hill system. Any expansion of the existing Desalination Plant will require augmentation of Sydney Water's network so that supply from this source can be more widely distributed. This requirement will be exacerbated in times of restriction when the existing extent of distribution of water from the desalination plant places less demand on the desalination plant. These works will allow water to be transferred from the Potts Hill system into the Prospect system.

SCOPE OF WORKS

The scope of works currently proposed comprises:

- 50 ML reservoir at Potts Hill to provide additional operational storage
- Pump station at Potts Hill to transfer water from Potts Hill to the Prospect system. The pump station is to be sized for 300Mld
- Construction of 7.6km of 1800mm to transfer water from the pump station at Potts Hill into the Prospect System.

The identified location to deliver water into the Prospect System is at Pipehead (Guildford).

IMPACT ON OPERATING COSTS

Operating costs are estimated in the Pricing Proposal Update at $0.5M per annum. The basis of this estimate is not clear. It appears to relate to inspection and maintenance only. Ongoing operating costs will vary materially based on the volume of water transferred into the prospect system. The documentation provided has sized the pumping requirements, but this has not been used to inform the development of an estimated pumping (electricity) cost.

OPTIONS APPRAISAL

The optioneering undertaken within the Options and Preliminary Design Report considered the appropriate locations of the storage tank and transfer point to optimise system hydraulics and whether the existing WMN01 between Potts Hill and Pipehead could be reused. Sizing of infrastructure has been based on an assumed need to transfer 300ML/d from the Potts Hill system into the Prospect system.

The hydraulic analysis recommended that the existing site of the Potts Hill reservoirs as the most appropriate site for the storage tank due to constraints at Prospect and Pipehead. Based on the information provided we consider this is sound however we note that only desktop investigations have been undertaken to date and there is a risk that further constraints are identified as the design is progressed.

The existing WMN01 main is one of three above ground mains between Potts Hill and Pipehead. The main was commissioned in 1888 making it 131 years old. The pipeline has been offline for five years but Sydney Water had planned rehabilitate the main in future to provide additional contingency for taking WWN04 “the tunnel” offline. The options analysis has relied upon a 2007 condition assessment confirmed extensive leaks to almost 50% of the joints along the pipeline as well as spalling of the cement lining and corrosion of the cast iron supports, and loss of internal coating within the pipe. A financial analysis was undertaken comparing the cost of repairing the leaks with constructing a new main. This analysis concluded that the net present cost of repairing the main is $90M compared with $106M for replacing the main. The repair option is then discounted due to the residual risk associated with repairing the main. We consider that the financial analysis is barely sufficient for decision making but we do not disagree with the conclusion. The analysis could have been extended to include the latest cost estimates, sensitivity and scenario testing and greater quantification of repair cost options.

Sydney Water advised that a more detailed condition assessment is currently in progress. Initial results suggest that the main is in poorer condition than recorded in 2007.

While we consider that options assessment appropriate for the circumstances, more time to assess risks and investigate options may lead to a better solution being identified.

COST ESTIMATING METHOD

A cost estimate has been prepared by Jacobs as part of the concept design. Sydney Water has subject this estimate to its own review and challenge. Sydney Water notes in its Pricing Proposal Update that

> *"The capital expenditure forecast of $436 million for the Sydney Desalination Plant expansion network upgrade is considered a low case estimate. It is subject to further work to assess the impacts of introducing larger volumes of water into our network, especially as it was not originally designed for this direction of water flow.*

We consider that the costs for this scheme if progressed will be at risk of increase due to undertaking procurement in an active market where other drought response infrastructure is being procured. Sydney Water stated that it is aware of this risk.

PROCUREMENT METHOD

A 50% design is currently in progress to input into a Detailed Business Case which is expected for completion in February 2020. The Detailed Business Case will be subject to review and approval by Infrastructure NSW's gateway process. A procurement strategy has not yet been formalised. Sydney Water has identified suppliers of steel water pipe but has not yet considered approaches to deliver procurement efficiency.

DELIVERY

N/a

POST PROJECT REVIEW

N/a

KEY DOCUMENTS REVIEWED

- 2. Sydney Water update to our 2020-24 price proposal
- 367.1 Response to item 367 - Capex SDP Expansion.pdf
- 367.2 (CONFIDENTIAL) Desal Stage 2 Networks NABC_with signatures_10 May 2019
- 367.4 (CONFIDENTIAL) IA217100 Drought Response Sydney Desal Stage 2 - Option Report Rev1 Final.pdf

A.14. Prospect to Macarthur Link

PROJECT DETAILS

Project Name	Prospect to Macarthur Link	
Project Number	WEM033 WGO058	Mainly future price period
Work Program		
Key Investment Driver(s)	Drought response/growth	
Stage	Planning / Concept Design underway	
Similar Projects	SDP expansion network upgrade	

FINANCIALS AND PROGRAM (costs to 2019/20)

Budget in 2019 Options Appraisal BC	$708.0 m (P50)	**Initial Delivery Date**	September 2021 (western element) 2023 (eastern element)
Cost in Submission	$560.9m against these SIR lines plus $142.5M against WGO053, 054, 056 and SGO108	**Actual / Forecast Delivery Date**	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)				76.7	**76.7**	39.5	22.8	62.0		**484.2**	**560.9**
Planned From review documents											

NEED FOR SCHEME

The immediate purpose of this link is to allow water to be transferred from Prospect to Macarthur to mitigate the risk of shortfall due to declining storage levels in the southern dams.

Some of the scheme was already included in SWC's submission as a growth servicing solution. In the longer term the solution is designed to allow growth to be serviced.

SCOPE OF WORKS

The investment provides a two-way connection between the Prospect South and Macarthur systems with capacity to transfer up to 120 Ml/d. It involves two 'fronts' to be delivered in two stages. The western link is scheduled for completion in 2021 and the eastern link is planned for late 2023.

The Western front is designed to allow 100Mld transfer and the Eastern front infrastructure is to service the demand growth expected from 2023 until 2026 and to allow 120Mld transfer.

The transfer is sized to meet the projected 2026 'restricted' average day demand of 120 Mld, assuming 13.7% savings from restrictions, compared to 89Mld in 2021. Some infrastructure in the link was already envisaged in longer term growth servicing plans.

IMPACT ON OPERATING COSTS

In its Supplementary Submission, SWC has proposed additional opex of $10M in 22, $14M in 23 and $15M in 24 and thereafter. Many of the costs appear to have been prepared using basic % of capex with little substantiation (e.g. 1.7% p.a. O&M for pipelines). We note for comparison that a lower figure of 0.6% is quoted for the Cascade scheme[80]. We consider that this is an over estimate of the net opex impact of the scheme. For example, it seems unlikely that SWC will incur an additional $2.5M p.a. of costs (equivalent to many new employees) for O&M of the pipeline assets alone. We have recommended an adjustment to the opex impact as detailed in Section 5.6.6.

OPTIONS APPRAISAL

This scheme forms ones of the first tranche of recommendations of the drought options study commissioned by SWC and WaterNSW. It is classified as a 'no regrets' solution as it involves bringing forward future growth capex and adapting existing assets. The options study included only the western element with a much lower cost estimate than included in the Supplementary Submission. The study does not incorporate sophisticated economic optimisation or set out a clear process of options identification and evaluation. However, our view is that the first tranche of interventions is nonetheless reasonably sensible and robust. The Options Appraisal conducted by SWC carried out 'fatal flaw' shortlisting but only for a small number of alternative solutions to address different sections of the link. The fatal flaw shortlisting resulted in one or two options for all sections of the link. Multicriteria analysis was then used to score these options and select a preferred solution. The options appraisal did not examine alternative strategic solutions.

COST ESTIMATING METHOD

The costs presented for the scheme include: • $364.4M in NABC • $708.0M P50 in OABC • $703.4M in SIR (including all lines)- SWC explains that less than $708M because of an error in escalation SWC estimates that $62.0M of the scheme relates to the eastern front, and $646.0M to the western front. The costs in the OABC have been prepared by an external consultant. The cost estimates include construction risk contingency of 18% of Contractor costs and margin and SWC risk contingency of 10% of SWC own-costs. These do not appear unreasonable.

PROCUREMENT METHOD

At the time of interview this had not been determined

DELIVERY

[80] See page 301 of "365.3 Cascades Drought OABC v10 with attachments"

N/a

POST PROJECT REVIEW

N/a

KEY DOCUMENTS REVIEWED

363.1 - Clarification response to Prospect MacArthur Pipeline 363.2 - ProMac Approved NABC 363.3 - ProMac Approved OABC 363.4 - PN20036379 Options Report Rev2 final signed 376.1 Response to item 376 - Opex Pro-Mac transfer 386.2 Session 2a Prospect Macarthur 388.1 Response to Item 388 Capex - ProMac Pipeline 389.1 Response to Item 389 western - eastern breakdown 390.1 Response to Item 390 ProMac Pipeline 391.1 Response to Item 391 Capex - ProMac Pipeline 391.4 - Email 20190620 392.1 Reponse to Item 392 Capex - ProMac Pipeline

A.15. Blue Mountains Cascade Supply

PROJECT DETAILS

Project Name	Blue Mountains Cascade Supply	
Project Number	WEM034	Mainly future price period
Work Program		
Key Investment Driver(s)	Drought response	
Stage	Planning	

FINANCIALS AND PROGRAM (costs to 2019/20)

Budget in 2019 Options Appraisal BC	$46.2 m (P50)	**Initial Delivery Date**	2021
Cost in Submission	$45.8M	**Actual / Forecast Delivery Date**	

Year ending (price base $m 19/20)	2017	2018	2019	2020	Sub Total	2021	2022	2023	2024	Sub Total	Total
Planned (SIR)				4.7	**4.7**	29.1	12.0			**41.1**	**45.8**
Planned From review documents											

NEED FOR SCHEME

Oberon Dam storage has reduced significantly, and some modelling scenarios suggests that it could run out of water by the end of 2021-22. This scheme aims to treat water from an alternative, lower quality, source (Duckmaloi weir) at Cascade WFP. It also aims to increase the capacity of the emergency supply from the Orchard Hills System, slowing the drawdown of Oberon Dam.

SCOPE OF WORKS

The scheme aims to upgrade the Cascade Water Filtration Plant so that it can treat water from a new raw water source, making an additional water source available for local supply. It also involves upgrading the emergency supply systems from Orchard Hills System.

IMPACT ON OPERATING COSTS

In its Supplementary Submission, SWC has proposed additional opex of $1M in 22, $2M in 23 and 24. This is significantly higher than the net opex in its OABC of $1.0M p.a. The basis of the estimate is not clear and we have recommended an adjustment to the opex impact as detailed in Section 5.6.6.

OPTIONS APPRAISAL

This scheme forms ones of the first tranche of recommendations of the drought options study commissioned by SWC and WaterNSW. The study does not incorporate sophisticated economic optimisation or set out a clear process of options identification and evaluation. However, our view is that the first tranche of interventions is nonetheless reasonably sensible and robust. The Options Appraisal conducted by SWC identified the least cost solution, ruling out more expensive solutions, and appears reasonable robust.

COST ESTIMATING METHOD

The costs presented for the scheme include: • $27.2M in NABC • $46.2M P50 in OABC The P50 cost estimates include scope growth contingency of 35%, construction risk contingency of 20% of Contractor costs and margin and SWC risk contingency of 10% of SWC own-costs. These do not appear unreasonable given the stage of development and uncertainties of the scheme.

PROCUREMENT METHOD

It is likely to be procured through the integrated alliance

DELIVERY

N/a

POST PROJECT REVIEW

N/a

KEY DOCUMENTS REVIEWED

365.1 Response to item 365 - Cascades Water Supply 365.2 NABC - Cascades Drought _v3 approved 365.3 Cascades Drought OABC v10 with attachments 386.4 Session 3a Cascades Water Supply 394.1 Response to Item 394 - Capex -Cascades Water supply

Appendix B. Terms of Reference

SCOPE OF WORK

PROJECT NAME: Sydney Water and WaterNSW Expenditure and Demand Forecasts Reviews

BACKGROUND

IPART seeks the services of suitably qualified consultants to undertake separate **expenditure and demand reviews** for the following:

A. Sydney Water Corporation's water, sewerage, stormwater and other services

B. WaterNSW's bulk water services in the Greater Sydney area, including to its main customer Sydney Water.

More information about these previous reviews is available on our website https://www.ipart.nsw.gov.au/Home/Industries/Water.

We note that the **expenditure reviews** for projects A and B include review items that may require specialist expertise (see appendices). We also require a suitably qualified consultants to undertake the **demand reviews**, particularly for project A. The consultant must clearly identify in a single proposal the projects it is bidding for (see Section 9 – Pricing).

IPART is also requesting quotes, as a separate piece of work, to undertake a similar expenditure and demand forecast review for Hunter Water. The consultant may also bid for this piece of work in its itemised proposal.

EXPENDITURE REVIEW - OBJECTIVES

IPART's role is to set prices which reflect the efficient costs of delivering a utility's monopoly services. Our price reviews seek to protect customers from paying for inefficient or unnecessary expenditure, while ensuring each utility raises adequate revenue to cover the efficient costs required to deliver its monopoly services.

The objective of this consultancy is to review each utility's operating and capital expenditure from two perspectives – actual expenditure incurred since the 2016 price determination and forecast expenditure for the 2020 determination period.

The time period definitions for the purposes of this consultancy are:

2016 determination period = the period from 1 July 2015 to 30 June 2020.[81]

2020 determination period = determination period from 1 July 2020 up to 30 June 2025.

The consultant's recommendations on efficient levels of expenditure will be used to determine maximum prices to apply from 1 July 2020 for each public water utility. Box 1 provides an explanation of the efficiency test that the consultant is required to undertake.

[81] The consultant will also need to assess the efficiency of actual expenditure incurred in 2015-16, the last year of the 2012 determination period. We also note that 2019-20, the last year of the 2016 determination period, is forecast expenditure.

Box 1: Efficiency test

The efficiency test examines whether a utility's capital and operating expenditure represents the best and most cost-effective way of delivering monopoly services to customers.

Broadly, the efficiency test considers both *how the investment decision is made*, and *how the investment is executed*, having regard to, amongst other matters, the following:

- customer needs, subject to the utility's regulatory requirements
- customer preferences for service levels, including customers' willingness to pay
- trade-offs between operating and capital expenditure, where relevant
- the utility's capacity to deliver planned expenditure
- the utility's expenditure planning and decision-making processes.

The efficiency test is applied to:

- historical capital expenditure, and
- forecast capital and operating expenditure

that is included in the utility's revenue requirement, for the purposes of setting regulated prices.

The efficiency test is based on the information available to the utility at the relevant point in time. That is:

- for forecast operating and capital expenditure, we assess whether the proposed expenditure is efficient given currently available information
- for historical capital expenditure, we assess whether the actual expenditure was efficient based on the information available to the utility at the time it incurred the expenditure (i.e., whether the utility acted prudently in the circumstances prevailing at the time it incurred the expenditure).

EXPENDITURE REVIEW - DESCRIPTION OF SERVICES

For the expenditure review, IPART requires the consultant to provide the following three tasks:

- **TASK 1** - a strategic review of the utility's long-term investment plans (10 to 20 years) and asset management systems and practices.
- **TASK 2** - a detailed review of the utility's historical and forecast operating and capital expenditures for efficiency.
- **TASK 3** - a review of the utility's performance against past output measures and to propose new output measures for the next determination period if appropriate.

Task 1: Review of long-term investment planning and asset management practices and processes

For each utility, the consultant must undertake a strategic review of the utility's long-term investment planning and its asset management systems and practices as specified below. In undertaking this task, the consultant must provide advice on:

a) Whether the longer-term capital investment strategy is the most efficient, and whether processes supporting this including options analysis, procurement processes, customer engagement practices, whole of life cycle planning and assessment of capital and operating expenditure trade-offs are best-practice and therefore likely to result in efficient investment decisions.

b) The key assumptions that are driving expenditure (e.g., asset replacements, demand forecasts and growth assessments (**please see links with the demand review below**), environmental regulatory requirements, licensing standards, customer service standards and preferences), including comments on whether these assumptions are reasonable and how they have been considered and tested by the utility.

c) The robustness of systems for linking asset management decisions with current and future levels of service and performance requirements, including customer preferences, service standards and environmental outcomes.

d) The way in which the utility manages the risks associated with asset failure or underperformance.

e) Any particular concerns or issues relating to the utility's strategic processes for determining and prioritising future infrastructure expenditure and asset management decisions.

Task 2: Detailed review of operating and capital expenditure

For each utility, the consultant must undertake a detailed review of its operating and capital expenditure for efficiency. The consultant must use findings from Task 1 to inform this task.

T2.1 Detailed review of operating expenditure

T2.1.1 Actual operating expenditure

The consultant must review actual operating expenditure incurred over the 2016 determination period. In undertaking this task, the consultant must:

Report and comment on the variations in operating expenditure from what was allowed in the 2016 determination, including the extent to which these variations are justified or not.

Identify and comment on the nature and size of operational savings realised (e.g., whether they are permanent or temporary in nature).

T2.1.2 Efficiency of forecast operating expenditure

The consultant must review the efficiency of forecast operating expenditure for the 2020 determination period. In undertaking this task, the consultant must:

c) Provide recommendations as to the efficiency of the utility's forecast level of operating expenditure and provide annual estimates of the level of operating expenditure that is required to efficiently supply the regulated monopoly services.

d) Identify the potential for and recommend efficiency savings to be achieved within the operating expenditure budget, and provide evidence and reasoning to support the recommended savings.

e) Advise on the appropriateness of and recommend how shared operating costs (including overheads) are allocated to monopoly services, and the rationale for this allocation.

f) Identify any consequential impacts on capital expenditure (i.e. increased or reduced costs) based on the assessment of operating expenditure.

g) Where appropriate, have regard to productivity benchmarking analysis when identifying potential efficiency savings.

T2.2 Detailed review of capital expenditure

T2.2.1 Capital program

The consultant must review the utility's capital program to inform recommendations as to the efficiency of the utility's level of capital expenditure. In undertaking this task, the consultant must:

h) Assess the reasonableness of the utility's capital expenditure program as a whole, within the context of its long-term plans and the assumptions underlying them, including the scale, scope and planning of the entire capital expenditure program. That is, the consistency of the utility's proposed 5-year capital expenditure program with its longer term program of capital expenditure, and the implications of and risks associated with the 5-year program for the longer term program.

i) Undertake a detailed investigation into the outcomes and project planning for a sample of the utility's capital projects above an agreed materiality threshold (to be agreed with IPART, but generally at least 10% of capital projects above a $10 million materiality threshold).

j) Advise on the appropriateness of the cost allocation method used to allocate operating costs to capital projects.

k) Review the appropriateness of the asset lives used to calculate regulatory depreciation (or 'return of capital') in the utility's pricing proposal, and recommend adjustments where appropriate.

l) Review the allocation of any common capital costs between monopoly services and other parts of the business and assess whether there has been any inappropriate allocation of common capital costs.

m) Advise on the robustness and effectiveness of the utility's ring fencing of capital costs where relevant[82] from its other operations, and identify opportunities for improvement (IPART will advise the consultant upon appointment where ring-fencing applies).

T2.2.2 Efficiency of actual and forecast capital expenditure

The consultant must review the efficiency of actual and forecast capital expenditure for the 2016 and 2020 determination periods. In undertaking this task, the consultant must:

n) Report and comment on actual and forecast capital expenditure for each year, including the variations in actual capital expenditure from what was allowed in the 2016 determination.

o) Provide recommendations as to the efficiency of the utility's level of capital expenditure and provide annual estimates of the level of capital expenditure that is required to efficiently supply the regulated monopoly services.

p) Identify any consequential impacts on operating expenditure (i.e., increased or reduced costs) based on the assessment of capital expenditure.

q) Identify the potential for and recommend efficiency savings to be achieved within the capital expenditure budget, and provide evidence and reasoning to support the recommended savings.

[82] For example, ring-fencing applies to a recycled water scheme where it represents a higher-cost means of servicing customers than a 'traditional' network based servicing strategy.

a) Where appropriate, have regard to productivity benchmarking analysis when identifying potential efficiency savings.

b) Audit and assess the accuracy with which the utility has classified its historical and planned capital expenditure into asset classification classes [for example, Sydney Water's assets are categorised as Civil, Electrical, Mechanical, Electronic and Non-depreciating (or 'CEMELND'), each with different asset lives] and make recommendations regarding:

the efficient capital expenditure on new assets in each classification class by business area

the average remaining life of existing assets by classification class and business area

the expected life of new assets by classification class and business area.

T2.3 Special review items

Attachments A and B provide further details on potential key issues related to each expenditure review. These attachments are included to give an indication of important expenditure items the consultant may need to focus on. IPART may revise areas of focus once each utility has provided its pricing proposal to IPART. The weight given to each the special review items will be finalised prior to the expenditure interviews (see timetable below).

Task 3: Review of output measures and propose new output measures

The consultant should use any findings from Task 2 to inform this task. In undertaking this task, the consultant must:

r) Review the utility's performance against its output measures over the 2016 determination period. Where output measures have not been achieved, provide comment on the reasons for this.

s) Recommend a set of new output measures for the utility's proposed operating and capital expenditure program, for the 2020 determination period.

DEMAND REVIEW - OBJECTIVES

The objective of this consultancy is to review the utility's forecast sales and customer connections used to support its proposed expenditure and prices.

Once IPART has determined the revenue requirement for the 2020 determination period, the next step is to decide on the utility's forecasts for sales and customer connections. These forecasts are used in calculating the price levels to recover the required revenue.

It is important that the demand forecasts are as accurate as possible. If they differ markedly from actual sales volumes and connections over the determination period, prices will result in significant over-recovery or under-recovery of the required revenue.

It is also important that short-term and long-term forecast sales and connections align with and support the utility's expenditure proposals. In particular, the utility's long-term growth projections that underpin strategic capital investment plans must be robust and based on reasonable assumptions and best available information.

DEMAND REVIEW - DESCRIPTION OF SERVICES

For the demand review, IPART requires the consultant to provide the following two tasks:

- **TASK 1** - a review of the reasonableness of the utility's long-term growth projections
- **TASK 2** - a review of the reasonableness of the utility's demand and customer connection forecasts over the 2020 determination period

The consultant should note that, in preparing its bid, the size and complexity of these tasks differ markedly for Sydney Water and WaterNSW.

- **For Sydney Water -** both tasks are relatively large pieces of work.
- **For WaterNSW –** only Task 2 applies. Further, about 99% of WaterNSW's total water sales will be determined through the Sydney Water demand review. This is because WaterNSW relies on water sales estimates supplied by Sydney Water to set its prices.

Task 1: Review of long-term growth projections (Sydney Water only)

The consultant must review the reasonableness of Sydney Water's long-term growth projections that underpin its strategic capital investment plan. In undertaking this task, the consultant must:

t) Report and comment on the growth projections, including the forecasting method, inputs and data used, and *ex-post* adjustments used.

u) Advise on the profile of growth projections.

v) Advise on the sensitivity and certainty of growth projections.

w) Review the consistency of assumptions against other publicly available data, having regard to Government forecasts of population, household and dwelling growth, development approvals and development completions.

x) Identify any consequential impacts on operating and capital expenditure proposed over the 2020 determination period and beyond, with particular focus on how changes in growth projections affect the timing and nature of capital investment decisions/pathways and the ensuing NPV of different growth servicing options (i.e., **links with expenditure review**).

Task 2: Review sales and customer connection forecasts

T2.1 Sydney Water

The consultant must review the approach and reasonableness of forecast sales and connections for the 2020 determination period by:

Service - water, wastewater, and stormwater, and

Customer type – residential and non-residential.

When assessing the reasonableness of forecasts, the consultant must give consideration to population growth, weather conditions, implied average use per property/connection, and assumed changes in use per property/connection due to conservation measures and/or price changes.

The consultant should not duplicate reviews that have already been undertaken. In particular, we note that Sydney Water's econometric model to forecast water demand has been subject to external peer review in the past. The consultant's review should, therefore, focus on the inputs into models and any outstanding items from previous reviews that have not been incorporated.

In undertaking this task, the consultant must:

y) Report and comment on the variations in actual sales and customer connections from what was allowed in the 2016 determination.

z) Report and comment on the reasonableness of forecast sales and customer connections for the 2020 determination period.

aa) Recommend annual estimates for forecast sales and customer connections for each year of the 2020 determination period.

bb) Advise on forecasting models/methods employed (benchmark against other relevant regulated businesses).

cc) Advise on input assumptions used to form forecasts (e.g., consistency of assumptions against other publicly available data).

dd) Advise on statistical significance and sensitivity of forecasts.

ee) Advise on price elasticity of demand assumptions and other *ex-post* adjustments used to estimate residential and non-residential water sales.

ff) Advise on non-revenue water, which includes real system losses (i.e., leakage), unauthorised consumption, and unbilled unmetered consumption (e.g., for firefighting).

gg) Identify any consequential impacts on incremental operating and capital expenditure of adjustments made to sales and connection forecasts (i.e., **link with expenditure review**).

T2.1 WaterNSW

WaterNSW's customer numbers are stable and Sydney Water accounts for about 99% of WaterNSW's total water sales, so the effect of customer numbers is not as important in setting prices as forecast bulk water sales.

Further, as noted above, WaterNSW relies on water sales estimates supplied by Sydney Water to set its prices. The scope of this task is therefore much smaller in size, limited to bulk water sales to WaterNSW's remaining customers.

In undertaking this task, the consultant must:

hh) Report and comment on the variations in actual sales and customer connections from what was allowed in the 2016 determination.

ii) Report and comment on the reasonableness of forecast sales and customer connections for the 2020 determination period.

jj) Recommend annual estimates for forecast sales and customer numbers for each year of the 2020 determination period.

kk) Advise on forecasting models/methods employed.

ll) Advise on input assumptions used to form forecasts.

mm) Advise on statistical significance and sensitivity of forecasts.

REQUIRED OUTPUT

The primary output items from expenditure and demand forecast reviews are set out below.

6.1 Reports (all in MS Word format)

6.1.1 Inception Report

The consultant is required to produce an Inception Report (no more than 5 pages), to be provided shortly after the inception meeting (exact date to be agreed to by IPART and the consultant at the inception meeting) that outlines agreed:

- review protocols, including communication contacts and channels
- methodologies and terminology, including any common approaches across concurrent expenditure reviews
- identification of any interdependencies in the expenditure reviews for the utilities
- key issues and/or areas of focus
- protocols for interaction with utilities and stakeholders
- details of proposed resourcing by task.

6.1.2 Draft and Final Reports

The consultant will be required to produce a Draft and Final Report for the expenditure and demand reviews. The reports must include:

- a clear explanation of the consultant's reasons or rationale for each of its findings/outcomes, including its information sources, approach and any key assumptions used
- report actual values in $nominal and forecast values in $2019-20, applying CPI indexes to be provided by IPART.

Furthermore:

- all tables and calculations in the reports must also be provided in Excel format to facilitate the transfer of the consultant's outputs to IPART's pricing models (to avoid rounding errors introduced through text-only formats), and
- the consultant must conduct a thorough Quality Assurance check of all outputs to eliminate errors and inconsistencies.

The Appendix of the Draft and Final Report for the expenditure reviews should contain a one-page summary for each capital project examined in detail (as per section 2.2.1 (b)). The one-page summaries should include the following:

- the planned project budget, program and outputs
- the actual or forecast project costs, program and outputs (appropriate to the stage in the project)
- reasons for variations between actual and forecast expenditures
- additional information that identifies any proactive planning by the utility for change of project scope or process development as a result of the project
- assessment of the project procurement approach, outcomes and contribution to the utility's capital program drivers, and
- an assessment of the project's efficiency.

The Draft and Final Reports should be clearly and logically set out and written in plain English, avoiding the unnecessary use of technical terms. The reports should incorporate appendices for supporting information and evidence where necessary.

The Draft and Final Reports must also be provided in PDF format suitable for web publication (i.e., on IPART's website for stakeholder comment).

Versions of the Draft Report

The Draft Report is required to be a complete document that addresses all tasks, as outlined in this scope of works, with supporting justification. Its purpose is to provide IPART and each utility with the opportunity to comment on the consultant's recommendations. Therefore, it should not be a 'working draft' document.

The consultant will produce two versions of the Draft Report

The first version will be based on financial data in the utility's pricing proposal (received on 1 July 2019) and due mid-September. A second version will be updated to incorporate end year actual financial data for 2018-19 when it becomes available (received in mid-September). This Draft Report will be due end-October, and released to the utility for comment.

Versions of the Final Report

Each utility and IPART will provide comments on the Draft Report directly to the consultant. The consultant must consider and respond to these comments in the Final Report.

The consultant should note that the Final Report will be released as a public document on IPART's website (i.e., alongside IPART's Draft report early March 2020).

The utility may identify expenditure projects or other detail that is commercial-in-confidence. The consultant must provide a version of the Final Report suitable for publication without commercial-in-confidence information, subject to IPART's instructions as to whether it agrees that the identified information is commercial-in-confidence. Therefore, the consultant must provide two versions of the Final Report:

- one confidential version
- one public version suitable for publication without confidential information.

6.1.3 Supplementary Report

The consultant will be asked to prepare a Supplementary Report that responds to the utility's submission to IPART's Draft Report released in March 2020. This Supplementary Report will be due end-April 2020.

The consultant should note that the Supplementary Report will also be released as a public document on IPART's website. Therefore, the consultant must provide two versions of the Supplementary Report:

- one confidential version
- one public version suitable for publication without confidential information.

6.2 Additional outputs

Additional required outputs of the consultancy include:

- Regular discussions and meetings with the utility and any issues arising so that there are 'no surprises'.

- Written fortnightly work in progress report to IPART covering key issues, actionable items, communication with utilities, resourcing, and time and expenses – email format.
- Written summary of key issues in utility's pricing proposal which will be incorporated in a Tribunal briefing and IPART's Issues Paper– MS word format and no more than 15 pages.
- Information requests to the utility setting out the information required (in addition to currently available information) to be provided to the consultant to perform the required services, as set out in this scope of works. This is to be provided at least one week in advance of interviews with utility staff – either MS Word or Excel format
- Written response to stakeholder submissions to IPART's Issues Paper and Draft Report which will be incorporated in Tribunal briefings - MS word format and no more than 15 pages.
- Presentations to IPART, which outline the major issues and findings of the Draft Report and the Final Report –presenting to the Tribunal

SOURCES OF INFORMATION

For each review, IPART has provided (in each Attachment below) a list of documents as a guide only, it should not be considered exhaustive.

In addition to its own analysis of available information provided, the consultant is required to source and report analysis of other inputs through:

- interviews with utility staff
- comparisons with relevant organisations, and
- the consultant's experience in the water and sewerage industry and in other comparable sectors, and in undertaking other similar tasks.

In the event that the consultant identifies gaps in the information, it is the responsibility of the consultant to take the necessary steps to acquire the required information and to liaise promptly with IPART to ensure that the consultancy outputs are delivered on time. Should the reliability of the information be in doubt, the consultant is expected to source 'second best information', apply sound judgement and provide detail and justification for assumptions made.

SELECTION CRITERIA

IPART will evaluate each quote based on the following criteria:

- the proposed methodology to perform the required Services (this includes demonstrating an understanding of the Services required)
- demonstrated capability to perform the required Services (including the proposed team, the team's experience and the allocated hours to complete the required Services) [The consultant should note that this is a mandatory requirement]
- total cost to IPART of the delivery of the required Services
- experience in providing Services of a similar nature including any prior work undertaken for IPART
- proposed quality assurance procedures and risk management procedures

PRICING

With regard to **projects A and B**, consultants can either: submit a bid for a single project; submit a bid for both projects; or submit a bid with another specialist consultant as a subcontractor for either or both projects. IPART will only enter into a contractual arrangement with a single consultant; if a bid is submitted with a subcontractor. The consultants must clearly identify which of the parties would enter into this arrangement with IPART.

The consultant should clearly identify in its proposal the projects it is bidding for and provide:

- a total price for its proposal
- individual pricing breakdowns of the expenditure and demand forecast reviews for each project (i.e., Sydney Water and WaterNSW) it is bidding for.

That is, please itemise bids if your proposal is for both projects so that your proposal can be considered on a joint and standalone basis

The consultant must include in its proposal any estimated associated expenses, e.g. travel, accommodation.

The consultant must clearly identify if their proposed pricing is in line with the NSW Government's Standard Commercial Framework capped resource rates for Financial Services. All proposals that do not comply with these rates must be clearly identified.

LIAISON/CONSULTATION

The consultant may be required to attend and participate in meetings, have involvement in consultation, and attend and present at workshops or Tribunal meetings as circumstances dictate.

TIMETABLE

While the dates are indicative, the consultant must meet the work schedule outlined below for each utility. Dates in bold represent key review milestones.

Indicative date	Activity
1 July 2019	**Utility pricing proposal due**
8 July 2019	Inception meeting with IPART
12 July 2019	Inception Report
15 July 2019	Key issues meeting with IPART
22 July 2019	Key issues paper to IPART (key issues from utility's pricing submission)
29 July 2019	Progress/feedback meeting with IPART
5 August 2019	Commence interviews with utility staff (first round)
10 September 2019	**IPART release Issues Paper (commenting on utility pricing proposal)**
16 September 2019	**Updated AIR/SIR from utilities due (actuals for final quarter of 2018-19)**
16 September 2019	Provide initial Draft Report to IPART
27 September 2019	IPART comments on the initial Draft Report due to consultant
14 October 2019	**Stakeholder submissions due on IPART Issues Paper**
18 October 2019	Submissions paper to IPART (views on stakeholder submissions to IPART's Issues Paper)
21 October 2019	Continue interviews with utility staff (second round)
28 October 2019	Provide finalised Draft Report to IPART
6 November 2019	Present findings of Draft Report to IPART (Tribunal)
8 November 2019	Provide finalised Draft Report to utilities
22 November 2019	Utilities' comments on Draft Report due to consultant
26 November 2019	**Public hearing - Sydney Water and WaterNSW**
9 December 2019	Provide Final Report to IPART

10 March 2020	**IPART releases Draft Report**
6 April 2020	**Stakeholder submissions due on IPART Draft Report**
End-April 2020	Provide Supplementary Report in response to submissions to IPART's Draft Report – revising expenditure and demand recommendations
16 June 2020	**IPART release Final Report**

RESOURCING

The consultant is expected to commit to and maintain a single project manager for the duration of this review. The consultant will ensure that the persons assisting the consultant in providing the services includes persons with appropriate expertise including in the water industry (and/or a comparable industry, such as energy), engineering and/or regulatory economics, and in the special review items outlined in Appendices A and B.

In drafting its proposal, the consultant should attach the resume for each of the personnel nominated for this expenditure review. In addition, the consultant should provide a breakdown of the proposed hours and hourly rates for each of the above tasks, by personnel.

CONFIDENTIALITY AND CONFLICT OF INTEREST

The quote should explicitly address any conflicts of interest (actual or perceived), and the consultant's capacity to comprehensively and effectively manage it. Please contact us once you identify any potential conflict of interest, before lodging your response.

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