

Independent review of ICRC price direction

Technical report

3604 67

Prepared for
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Glossary

Term	Definition
ABS	Australian Bureau of Statistics
ACTEW	Australian Capital Territory Electricity and Water Corporation
DEWS	Queensland Department of Energy and Water Supply
ECD	Enlarged Cotter Dam
GL/yr	Gigalitres per year
ICRC	Independent Competition and Regulatory Commission
kL	kilolitres
km	kilometres
L/p/d	litres/person/day
LMWQCC	Lower Molonglo Water Quality Control Centre
Ltd	Limited
M2G	Murrumbidgee to Googong Pipeline
MVIS	Molonglo Valley Interceptor Sewer
NPR	National Performance Report for Urban Water Utilities
NWC	National Water Commission
PWCM	Permanent water conservation measures
QWC	Queensland Water Commission (now defunct)
SEQ	South East Queensland
SPS	Sewage pump station
UMA	Utilities Management Agreement
UNFT	Utilities (network facilities) tax
WAC	Water abstraction charge
WTP	Water treatment plant

1 Introduction

1.1 Background

The Independent Competition and Regulatory Commission (ICRC) undertook a pricing review of the Australian Capital Territory Electricity and Water Corporation (ACTEW) in 2012 to determine prices for water and sewerage services for the period from 1 July 2013 to 30 June 2018. As part of this review, Cardno undertook an assessment of ACTEW's capital and operating expenditure (capex and opex) to determine prudent and efficient expenditure levels. This assessment was undertaken in late 2012. The ICRC released its Final Report and Price Direction for water and sewerage services in the Australian Capital Territory (ACT) on 26 June 2013.

On 26 September 2013, ACTEW submitted an application for review of the Price Direction by an Industry Panel under Part 4C of the Independent Competition and Regulatory Commission Act (the Act). An Industry Panel (Panel) was appointed in April 2014 and held a directions hearing on 25 July 2014. Cardno was subsequently engaged by the Panel to provide technical advice on specific matters of interest in accordance with the Terms of Reference reproduced in Appendix A.

1.2 Scope of works

The technical advice required of Cardno by the Industry Panel to assist in its review was set out in the scope of works received 21 August 2014 and is reproduced below:

- ▶ Task 1: ACTEW's operating and capital expenditure forecasts for 2013/14 to 2017/18
 - Advice on the key assumptions that are driving expenditure (e.g. asset replacements, demand forecasts, growth assumptions, environmental requirements, service standard requirements) and the impact of changes in these drivers on expenditure levels.
 - Review of ACTEW's forecast capital expenditure for sewerage over the period 2013/14 to 2017/18 and advice as to whether these forecasts are efficient and prudent. If the consultant concludes that these forecasts are not efficient and prudent, then the consultant should propose an alternative forecast that it considers is efficient and prudent.
 - Strategic review of ACTEW's governance processes around capital expenditure decision-making and advice as to whether ACTEW's current processes address the concerns identified in relation to this issue during the last price review. In particular the consultant should provide advice as to whether these processes are a) reasonable and b) sufficient to manage the risks in delivering its capital program (especially the sewerage program referred to above).
- ▶ Task 2: ACTEW's water sales forecasts for 2013/14 to 2017/18
 - A review of ACTEW's methodology for forecasting water sales and advice as to whether this methodology and the demand forecasts produced are reasonable for the purposes of setting prices.
 - Provision of alternative water sales forecasts broken down into Tier 1 and Tier 2 consumption levels, if the consultant concludes that ACTEW's forecasts are not reasonable. Tier 1 is defined as water demand between 0-548 litres per day (~200 kL per annum), while Tier 2 is defined as demand in excess of 548 litres per day (>200 kL per annum).
- ▶ Task 3: Regulatory treatment of the water security projects
 - a) Advice on the proportion of the \$570 million that ACTEW spent on the Enlarged Cotter Dam (\$420 million) and the Murrumbidgee to Googong Pipeline (M2G) (\$140 million) that can be attributed to existing customers (i.e. the proportion that delivers benefits to customers in the period to 30 June 2018 versus customers in the period 1 July 2018 to 30 June 2023 or post 30 June 2013) and advice on when ACTEW should start to recover the residual capital costs.

- > This would take the form of an estimate of the reasonable capacity expansion that was required to meet ACTEW's security of supply standard at the time and over the term of the next regulatory period, compared to the actual capacity installed.
- b) As an alternative to (a), advice on aligning the profile of the recovery of the capital costs associated with the water security projects with the profile of benefits that customers can expect to derive from the projects.
- > This would take the form of an estimate of the benefits that customers will derive from the water security assets over the economic life of those assets, and could utilise long-terms water demand forecasts and/or forecast population growth. To the extent possible, customer benefits in the initial stages of the assets' lives should reflect the value of water security and not just capacity.

1.3 2013 Price Direction – capital and operating expenditure review

1.3.1 Context

In June 2012, the ICRC assigned Cardno with the task of carrying out a detailed review of the capital and operating expenditure of ACTEW for water and sewerage services provided in the ACT. This review informed the ICRC's investigation to determine the price to apply for the ACT's water and sewerage services from 1 July 2013 to 30 June 2018. The purpose of this review was to inform the ICRC on the efficient levels of operating and capital expenditure of ACTEW.

1.3.2 Outcomes

The outcomes of our efficiency review conducted as part of the ICRC's Price Determination, that are relevant to the scope of works required by the Industry Panel, are summarised in the following sections. ACTEW did not dispute these particular findings and, as such, they are a relevant starting point for this technical report.

Capital and operating expenditure

The efficient levels of capex and opex developed through our 2012 review are summarised in Table 1-1 and Table 1-2.

Table 1-1 Proposed efficient operating expenditure (\$M)

Operating expenditure (\$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18	Total
ACTEW proposed operating expenditure	\$134.35	\$137.05	\$137.91	\$141.20	\$141.53	\$692.03
Recommended prudent and efficient operating expenditure	\$131.16	\$133.09	\$132.65	\$134.34	\$132.92	\$664.13
Percentage reduction	2.43%	2.97%	3.96%	5.11%	6.48%	4.20%

Table 1-2 Proposed efficient capital expenditure (\$M)

Capital expenditure (\$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18	Total
ACTEW proposed capital expenditure	80.0	137.4	112.6	96.1	82.4	508.6
Recommended prudent and efficient capital expenditure	63.7	109.9	105.6	90.0	79.4	448.6
Percentage reduction	-20.4%	-20.0%	-6.3%	-6.3%	-3.7%	-11.8%

Demand forecast

While ACTEW's endeavour to forecast demand utilised sophisticated statistical techniques, our review concluded that the predicted increase of total demand from 41.6 to 52.5 GL/yr over one or two years was unlikely. Our conclusion was based on the relative "permanency" of water conservation measures and

behaviours, even after the relaxation or elimination of water restrictions, and was supported by a preliminary analysis of post-drought residential demands in South East Queensland. We recommend that the demand forecast profile be steadily increased to 52.5 GL/yr over a longer period and that ACTEW review the appropriateness of a Modified End Use model approach for predicting demand in place of its existing approach.

Water security

The capital expenditure overspend (of 60% compared to budgeted expenditure) noted in our previous report was largely found to be the result of increased expenditure on ACTEW's water security projects. Most notably, the Enlarged Cotter Dam (ECD) was determined to be a major contributor to the total discrepancy between forecast and actual capital expenditure for water and sewerage services. We determined that the cost increases associated with the ECD appeared to be reasonable and acknowledged that, in the face of climate change, ACTEW's water security projects represented an extra precautionary approach to securing the ACT's water supply.

1.4 ACTEW's April 2013 submission

Following the release of the ICRC's Draft Report on Regulated Water and Sewerage Services in February 2013, ACTEW submitted a Response to the Draft Report (the Response) in April of the same year. The intent of the submission was to identify and address ACTEW's concerns with the Draft Report prior to the issuing of the final Price Direction. Included in the Response were discussion and propositions surrounding ACTEW's regulatory arrangements, demand, capex and opex forecasts, its regulated asset base and various other matters of importance to the Price Review. Those matters pertinent to this report and under our purview are summarised in the sections below.

Capital and operating expenditure

The methodology implemented by ACTEW to forecast opex in the April 2013 Response for the 2013/14 to 2017/18 period differed between that in the 2012 Main Submission to the ICRC, which contained an opex program developed prior to the separation of ACTEW Water. More specifically, ACTEW's revised 2013 forecast was based on a "base year" approach, as opposed to the "bottom-up" process evident in the 2012 estimation. Basic diagrammatic synopses of these methods, which are adapted from ACTEW, are depicted in Figure 1-1 and Figure 1-2. The opex forecasts for the 2013/14 to 2017/18 period as per the 2013 submission are enclosed in Table 1-3.

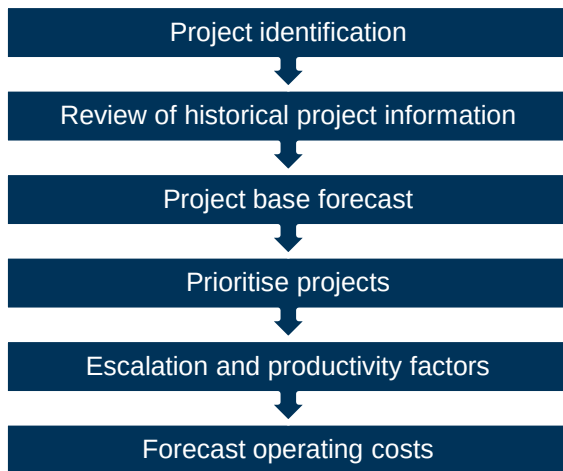


Figure 1-1 Bottom-up approach used by ACTEW in the 2012 submission

(Source: Adapted from ACTEW)

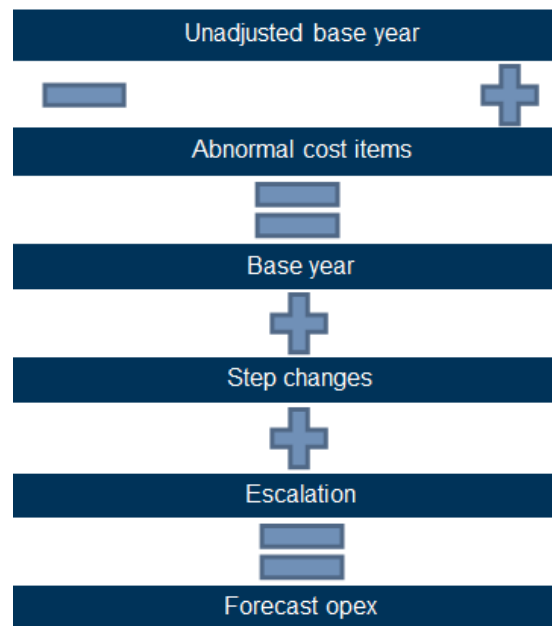


Figure 1-2 Base year approach used by ACTEW in the 2013 submission

(Source: Adapted from ACTEW)

Table 1-3 ACTEW's opex forecasts for 2013/14 to 2017/18¹ as per the April 2013 submission

\$M (real \$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18	Total
Maintenance (including major maintenance)	16.95	19.35	18.38	18.44	17.77	90.90
Operations	19.47	18.38	18.54	17.95	18.28	92.62
Planning and strategic management	5.55	5.59	5.81	5.69	5.75	28.39
Corporate services	19.25	19.64	19.41	19.47	20.36	98.14
Water abstraction charge (WAC) and utilities (network facilities) tax	27.72	27.54	27.37	27.01	26.69	136.32
Pass through	0.08	-	-	-	-	0.08
Total opex, water	89.02	90.50	89.50	88.57	88.85	446.45
Maintenance (including major maintenance)	20.68	20.64	20.38	20.92	20.64	103.25
Operations	17.17	16.60	16.71	16.86	17.04	84.39
Planning and strategic management	6.89	6.95	7.01	7.09	7.18	35.11
Corporate services	21.46	21.90	21.64	21.70	22.70	109.39
UNFT	3.31	3.37	3.44	3.51	3.58	17.21
Pass through	4.78	-	-	-	-	4.78
Total opex, sewerage	74.28	69.46	69.18	70.08	71.13	354.14
Total opex, water and sewerage	163.30	159.96	158.68	158.65	159.98	800.57

The capex program for the regulatory period of 2013/14 to 2017/18 was also adjusted by ACTEW in its 2013 Response in order to incorporate revisions to its organisational structure and capex planning and approval processes, the addition of carryover projects from the 2012/13 financial year and our suggested catch-up and continuing efficiency factors. The modified capex forecasts can be found in Table 1-4.

¹ Adapted from Table 1.23 of the Response

Table 1-4 ACTEW's capex forecasts for 2013/14 to 2017/18² as per the 2013 submission

\$M (real \$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18	Total
Asset renewal/replacement	16.94	13.95	19.66	22.54	19.70	92.78
Growth	5.75	15.82	8.26	3.82	5.54	39.19
Improvement	1.35	4.90	14.52	7.23	5.77	33.76
Other	1.74	3.50	-	-	-	5.24
Capital contributions	-2.03	-2.03	-2.03	-2.03	-2.03	-10.16
Total net capex, water	23.74	36.13	40.42	31.55	28.98	160.82
Asset renewal/replacement	17.09	27.58	21.70	18.98	16.09	101.45
Growth	9.21	17.68	52.37	46.68	23.68	149.63
Improvement	5.25	14.74	10.64	11.68	16.63	58.94
Other	2.30	4.87	-	-	-	7.16
Capital contributions	-2.66	-2.66	-2.66	-2.66	-2.66	-13.29
Total net capex, sewerage	31.19	62.21	82.06	74.69	53.75	303.89
Total net capex, water and sewerage	54.93	98.34	122.47	106.24	82.72	464.70

Demand

The demand forecasting approach utilised by ACTEW in the Response used the same model (the Breusch Ward model) as for the 2012 Main Submission to the ICRC, where forecast water volumes were segmented into five-year storage releases (for the purpose of estimating future opex) and annually-updated billed consumption forecasts (to enable price setting).

It was noted in ACTEW's 2012 response to our draft expenditure review report, and reiterated in the 2013 Response, that ACTEW "broadly... agree[d]"³ with our conclusion that demand be "ramped up"⁴ but were of the opinion that this adjustment did not stem from any statistical analysis or approach and was based on anecdotal evidence from the dissimilar climate of Queensland. ACTEW also stated in its 2012 response that it believed that the "ex-post adjustment for an autoregressive [AR] error process" component of the Breusch-Ward model "provide[d] a more statistically valid approach to forecasting the ramping up of demand"⁵ and that this adjustment would be included in its 2013 submission. As such, the ex-post AR error process adjustment was included in the volumes forecasts contained in ACTEW's 2013 submission and the results are shown in Table 1-5 and Table 1-6.

Table 1-5 ACTEW's storage releases forecasts for 2013/14 to 2017/18⁶ as per the 2013 submission

Financial year	Annual volume to be released from storage (ML)
2013/14	47,662
2014/15	48,316
2015/16	48,997
2016/17	49,263
2017/18	49,602

² Adapted from Table 1.15 of the Response

³ p. 29 of the Response

⁴ p. v, Review of ACTEW's Capital and Operating Expenditure, Cardno, November 2012

⁵ p. 29 of the Response

⁶ Adapted from Table 1.3 of the Response

Table 1-6 ACTEW's billed consumption forecast for 2013/14⁷ as per the 2013 submission

Tier	Annual consumption (ML)
1	21,200
2	19,665
Total	40,864

1.5 ACTEW Statement of Facts and Contentions

As per the process for an application for review of the ICRC's Price Direction, ACTEW submitted a publicly accessible Statement of Facts and Contentions (the Statement) on 31 July 2014 to the Panel. Of the issues raised in the Statement, those pertaining to the corporation's capex, opex and demand forecasts most relevant to this report are summarised below.

Capital and operating expenditure

The Statement presented a revised, lower set of opex forecasts for the 2013/14 to 2017/18 regulatory period as compared with ACTEW's proposals in its 2012 and 2013 publications and our 2012 recommendations. Updated capex forecasts were also produced, although these figures were, as a sum, greater than our initially advised values and expenditure over \$100M was projected to be delayed until 2015/16. An analysis of the variances between ACTEW's capex forecast in the Statement and earlier forecasts is provided in Section 4.2, and the final forecasts reached by ACTEW are replicated in Table 1-7 and Table 1-8.

Table 1-7 ACTEW's 2014 opex forecasts (adapted from Table 4.3 in the Statement)

\$M (real \$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18
Operating expenditure, water	61.2	63.0	62.1	61.6	62.2
WAC [^]	22.1	22.9	24.6	24.1	23.7
UNFT, water	4.0	4.3	4.4	4.5	4.5
Total, water	87.3	90.1	91.1	90.1	90.4
Operating expenditure, sewerage*	65.6	65.5	65.3	66.0	67.0
UNFT, sewerage	3.3	3.5	3.6	3.7	3.8
Total, sewerage	68.9	69.1	68.8	69.7	70.7
Total opex (net of WAC and UNFT)	126.8	128.5	127.3	127.6	129.2

* Exclusive of Uriarra package plant costs.

[^] 2013/14 figure is as per ICRC Price Direction. 2014/15 figure is as per model used by ICRC for setting 2014/15 prices, including pass-throughs for WAC and UNFT.

Table 1-8 ACTEW's 2014 capex forecasts (adapted from Table 4.4 in the Statement)

\$M (real \$12/13)	2013/14	2014/15	2015/16	2016/17	2017/18
Capex net of cap cons, water	23.8	36.1	40.1	31.2	28.5
Capex net of cap cons, sewerage	31.1	62.0	81.1	73.6	52.7
Total capex (net of cap cons)	54.9	98.1	121.2	104.8	81.2

Demand

⁷ Adapted from Table 1.1 of the Response

In this document, ACTEW contended an “absence of any determined principles or methods for setting demand forecasts” in the ICRC’s Price Direction (p. 19). The apparent lack of justification, in conjunction with the ICRC’s biennial recalibrations of the building block revenue model, was argued to produce “a highly uncertain basis on which to make critical operating, investment and financing decisions” (p. 17). In line with this contention, ACTEW stated that the ICRC’s approach demonstrated improper regard for Section 20(2) of the Act. They therefore proposed the implementation of a five-yearly review and reset of the building block model, to which demand forecasts will be required beyond the 2013/14 to 2014/15 period as originally delivered in the Price Direction, along with the annually updated application of the weather-based Breusch-Ward demand model.

2 Approach

2.1 Overview of approach

Our approach towards undertaking this scope of works has included the following activities:

- ▶ Review of background information including, but not limited to, ACTEW's respective April 2013 and July 2014 submissions to the ICRC and Panel
- ▶ Pre-meeting request for information from ACTEW
- ▶ Meeting with ACTEW staff on 4 September 2014 in Mitchell, Canberra, ACT
- ▶ Post-meeting request for information from ACTEW
- ▶ Analysis and investigation of ACTEW's capital and operating expenditure, water sales forecasts and regulatory treatment of water security projects
- ▶ Ongoing discussion with ACTEW and the Panel
- ▶ Preparation of the draft report
- ▶ Finalisation of this report.

A list of all documents received is detailed in Appendix B.

2.2 Regulatory definitions

The Panel's Terms of Reference makes reference to the regulatory tests of efficiency and prudence along with the "point in time for the provision of our service." These regulatory terms are defined in Table 2-1.

Table 2-1 Regulatory tests (as defined by the Panel)

Type of regulatory test	Definition
Efficient and prudent test	This test assesses whether the expenditure is such as would be incurred by a prudent service provider acting efficiently, in accordance with good industry practice, to achieve the lowest sustainable cost of delivering water and sewerage services.
Reasonable test	For water sales, the reasonableness test assesses whether the forecasts represent the best forecast or estimate possible in the circumstances. In considering the regulatory treatment of the water security projects, the reasonableness test assesses the capacity expansion that a prudent service provider would consider sufficient, appropriate, and not excessive in usual and ordinary circumstances.
Point in time for provision of the services	In providing the services, the consultant should consider the circumstances (including the information available) prevailing at the time of the ICRC's Final Decision (i.e., June 2013). However, if there has been any substantive change in circumstances that the consultant considers the Panel should be aware of, then the consultant should document these issues in its reports.

2.3 Price base and consumer price index assumption

All forecasts and historical values presented in this report, regardless of the source (author) or year of occurrence, have been escalated or deflated to \$2012/13 (unless noted otherwise) as required by the Industry Panel. Note that a majority of the past reports and other source documents, by us, ACTEW and the ICRC, are already presented in \$2012/13.

3 Profile of ACTEW

3.1 Corporate structure

ACTEW Corporation Limited (ACTEW), presently trading as ACTEW Water, was established as a Territory-owned Corporation (TOC) in 1995 under ACT corporations law, replacing the former Australian Capital Territory Electricity and Water Authority. ACTEW is owned by the ACT Government, and the company's voting shareholders are the Chief Minister and Deputy Chief Minister of the ACT. ACTEW owns and manages the water and wastewater businesses and assets in the ACT.

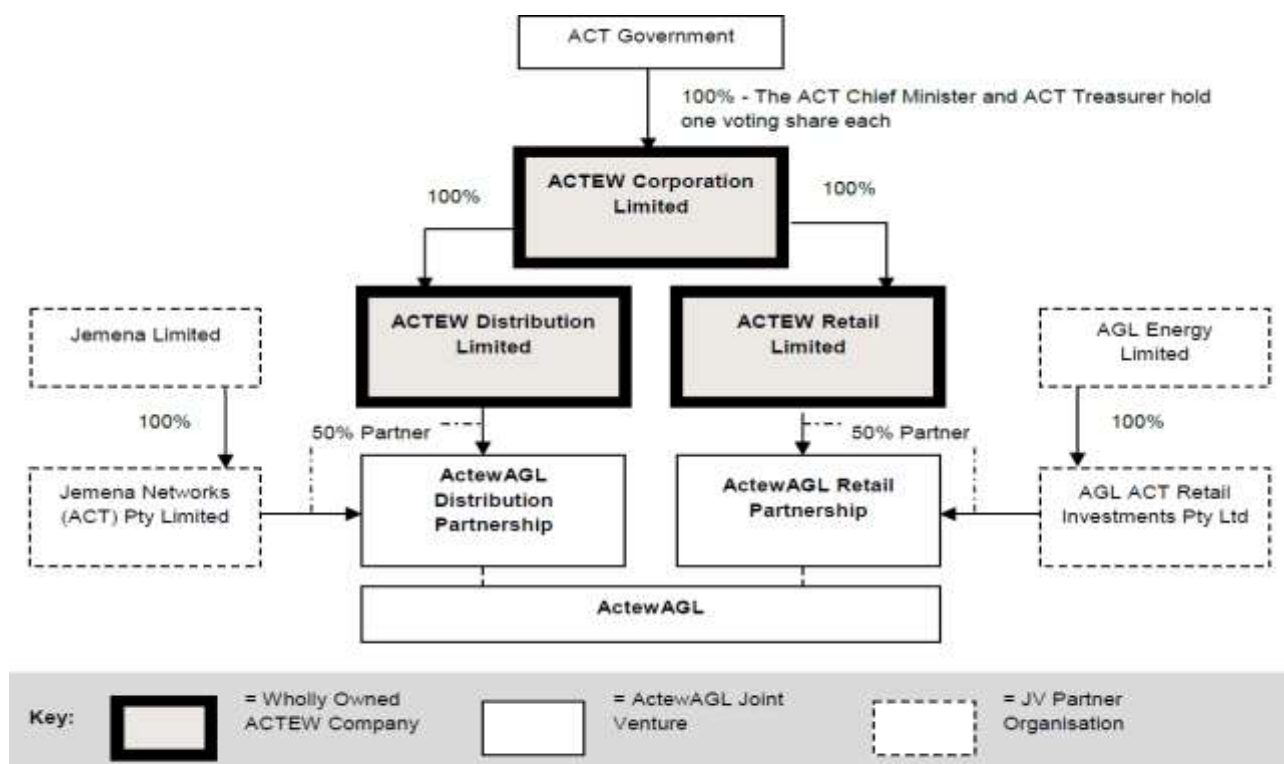
Under the TOC Act, ACTEW is required to:

- ▶ Operate as efficiently as any comparable business.
- ▶ Show a sense of social responsibility by having regard to the interests of the community.
- ▶ Operate in accordance with ecologically sustainable development.
- ▶ Maximise the sustainable return to the territory.

These requirements are of equal importance.

3.2 Organisational structure

At the time of our 2012 review, ACTEW had recently undergone an organisational transition whereby the water business components of both ACTEW and ActewAGL were re-integrated into a single ACTEW, ending the Utilities Management Agreement between the two corporations and eliminating the capex and opex margins paid to ActewAGL. ACTEW is now operating under the structure displayed in Figure 3-1.



Note (Jemena Limited Ownership): In January 2014 State Grid Corporation of China purchased a 60 per cent interest in Jemena Limited, with Singapore Power International retaining 40 per cent.

Figure 3-1 ACTEW and ActewAGL Joint Venture structure

Source: ACTEW Statement of Corporate Intent 2014-15 to 2017-18

ACTEW underwent an internal restructuring process in the period following our 2012 review. The current structure of the senior executive is shown in Figure 3-2. This structure provides a distinction between asset owner (asset management) and asset operator (project delivery, operations and maintenance) functions.



Figure 3-2 ACTEW's internal organisational structure

Source: ACTEW 2014

3.3 Asset base

As noted in our 2012 review, ACTEW's asset base includes:

Water Supply

- ▶ Four dams: Corin, Bendora, Googong and Cotter. The Cotter Dam was significantly enlarged in recent years
- ▶ Two water treatment plants (Mount Stromlo and Googong)
- ▶ 46 reservoirs
- ▶ 22 water pump stations
- ▶ Approximately 3,000 km of water trunk and reticulation mains.

By the end of 2012, the newly constructed Murrumbidgee to Googong Supply system (M2G), comprised of 13 km of trunk main and two pump stations, became operational.

Sewerage System

- ▶ Approximately 3000 km of sewers
- ▶ 27 sewage pump stations
- ▶ Lower Molonglo Water Quality Control Centre (LMWQCC) plus three smaller sewage treatment plants.

Recycled Water System

- ▶ Two treatment facilities
- ▶ One pump station
- ▶ One reservoir
- ▶ Approximately 15 km of distribution and reticulation mains.

ACTEW manages infrastructure with a current replacement cost of nearly \$5.3 billion with the average asset life consumed being in the order of 40%.

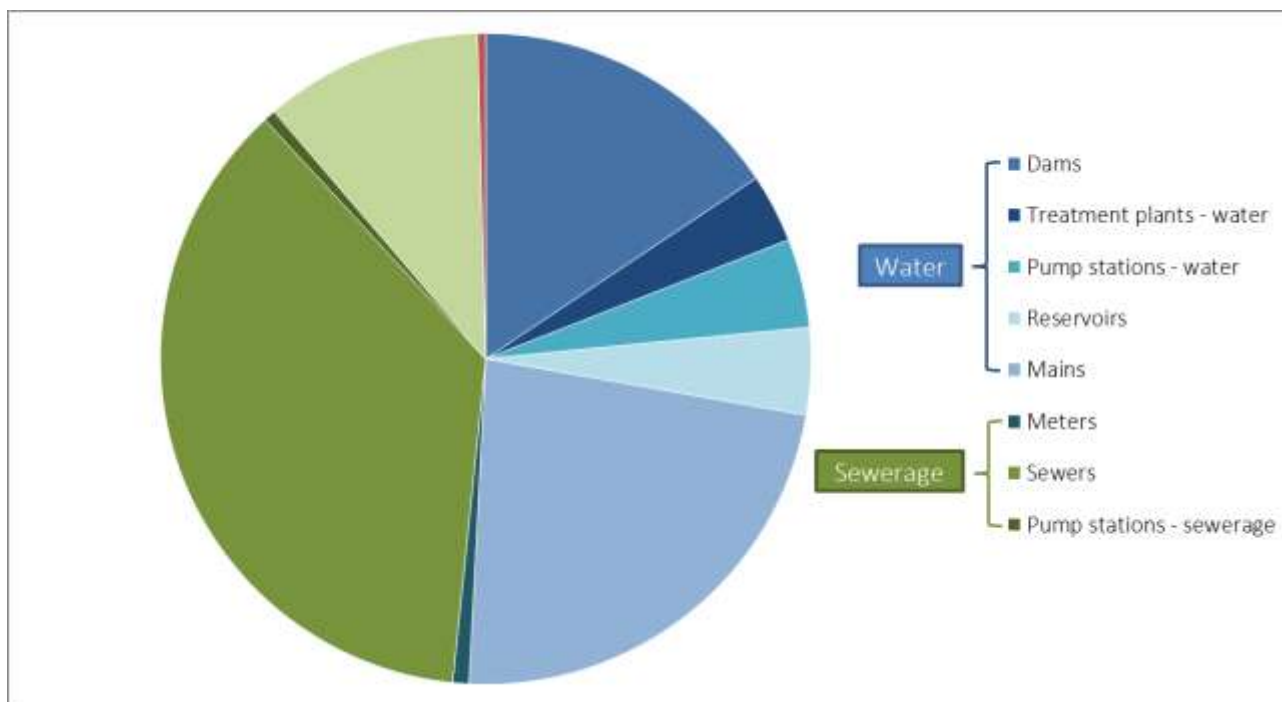


Figure 3-3 Replacement value breakdown of ACTEW's asset base by asset type as at November 2012

3.4 Service standards

We reviewed ACTEW's service standards as part of our 2012 review and relevant parts of this analysis are outlined below. The importance of service standards is that they define the quality of service that ACTEW is expected to provide to its customers.

Service standards for ACTEW's customers are described in the Water and Sewerage Services Connection and Supply Standard Customer Contract. The contract states that ACTEW will meet the customer service standards described in the Consumer Protection Code in dealings with its customers and in providing a water supply that "meets the requirements of the Water Supply and Sewerage Service Standards Code and the Drinking Water Quality Code of Practice". It also states that ACTEW will minimise "interruptions to (your) supply of water services and sewerage services".

The Consumer Protection Code, Water Supply and Sewerage Service Standards Code and the Drinking Water Quality Code of Practice 2007 largely provide a series of high level frameworks related to customer service standards. These codes include some levels of service but relate to more general customer service obligations, for example procedures and timeframes for complaints and the required notice to be given for any planned interruptions to supply. The majority of the service standards included in these codes are qualitative rather than quantitative.

In the main, and unlike the majority of other large water service providers in Australia, ACTEW does not provide the customer with specific quantitative levels of service it is required to provide. It also does not provide any guaranteed service levels similar to Victorian water service providers, where certain performance targets result in payments to customers if the targets are not achieved.

Under the previous Utilities Management Agreement (UMA) between ActewAGL and ACTEW, ActewAGL's performance was measured against a series of KPIs that were included in the agreement. These KPIs established a performance related incentive for ActewAGL. If ActewAGL met the performance targets it received a 3% margin, as approved by ICRC. If it failed to meet its performance targets, ActewAGL was liable for a fee adjustment or accrual of performance points that may have translated into a fee adjustment, depending on the criticality of the performance indicator and the magnitude of the performance shortfall. A number of these KPIs relate to internal obligations and requirements within the UMA between ActewAGL and ACTEW rather than being related specifically to the service provided to ACTEW's customers.

At the time of our 2012 review, ACTEW had maintained these KPIs as a means of assessing its performance. We understand that ACTEW is currently reviewing its service standards but had continued using these KPIs following the separation from ActewAGL. Therefore, the UMA KPIs are the only quantitative measures of the service provided by ACTEW to customers and therefore an important consideration of the outputs provided by ACTEW for its given level of operating and capital expenditure.

Specific performance indicators within the list of UMA KPIs that relate directly to customer service standards, together with the Water Division's 2010/11 performance, are presented in Table 3-1. This information is reproduced from our 2012 report.

Table 3-1 Key performance indicators included in the UMA related to customer service

KPI	Measure	Target	2010/11 Performance
DWQ Performance (E Coli)	Monthly	Zero E Coli	100%
DWQ Performance (Aesthetics)	Monthly	As per stated parameters ▶ Turbidity < 5 NTU ▶ True Colour < 15 PtCo units ▶ Fe < 0.3 mg/l ▶ Mn < 0.1 mg/l	100%
Sewerage Service Interruptions	Monthly	Main breaks/chokes per 1,000 properties < 35 Total breaks/chokes per 1,000 properties < 50	12.72 23.7
Sewer Overflow Events - Sewers >300 Dia	Monthly	All relevant Noticeable Events reported	Compliant
Sewer Overflow Events – Other overflows	Monthly	All relevant Noticeable Events reported	Compliant
Sewer Overflow Events – Annual Frequency	Monthly	Sewer overflow rate <100 per 100km in a financial year	43.7
Sewerage Overflows to Dwellings Response Time	Monthly	100% responded to within an hour	100%
Sewerage Service Restoration Time	Monthly	95% of restored within 5 hours	98.13%
Unplanned Water Supply Interruptions	Monthly	<150 in any 12 month period	120
Attendance at Burst or Leaking Water Pipes	Monthly	<105 minutes average in a month on a rolling 12 months	85.22
Attendance at Burst or Leaking Water Pipes Response metrics for Priority 1 events	Monthly	Maximum response time 240 minutes	Compliant
Attendance at Burst or Leaking Water Pipes Response metrics for Priority 2 events	Monthly	Percentage of Response Time within 24 hours 95% Maximum Response Time 48 hours for each event	98.67%
Water Service Unplanned Interruption Time	Monthly	Average Interruption Time < 2.5 hours average in a month on rolling 12 months	77.68 mins
Water Service Unplanned Interruption Time	Monthly	Interruption time less than 6 hours per event	100%
Planned interruptions to Utility Services: Notice Times	Quarterly	No occurrence	0 events
Planned interruptions to Utility Services: Restoration of Service	Monthly	No occurrence	Compliant
Responding to Written Customer Complaints & Queries – Accounts	Half Year	No occurrences	6 events
Responding to Written Customer Complaints & Queries – Other than	Half Year	No occurrences	1 events

KPI	Measure	Target	2010/11 Performance
Accounts			
Customer Contact Services – Answer rate	Annual	80% of calls answered within 30 secs in FY	82%
Customer Contact Services – Abandonment rate	Annual	5%	4%

We noted in our 202 report that although ActewAGL achieved the majority of its KPI targets under the UMA in 2010/11 (as well as in the proceeding five years back to 2005/06), the target levels that have been set would appear to be relaxed (i.e. not overly challenging) for a number of these service standards when compared to other metropolitan and urban water businesses. Comparison with the Victorian water businesses is reasonably straight forward as these businesses specify service standard targets that are approved by the ESC (the regulator in Victoria) and the following table benchmarks (where possible) ACTEW's performance targets against a small sample of Victorian water businesses. The Victorian water businesses' approved service targets and Guaranteed Service Levels are published in the ESC's Customer Service Code.

Table 3-2 Comparison of sample of key performance indicators targets

KPI	Service Provider	2012/13 Target
Customer Contact Services – Answer Rate	ACTEW	80% of calls answered within 30 secs in FY
	Yarra Valley Water	86% of calls answered within 30 secs in FY
	Barwon Water	95% of calls answered within 30 secs in FY
	North East	95% of calls answered within 30 secs in FY
Attendance at Burst or Leaking Water Pipes Response metrics for Priority 1 events	ACTEW	Maximum response time 240 minutes
	Yarra Valley Water	Average response of 26 minutes
	Barwon Water	Average response of 35 minutes
	North East	Average response of 50 minutes
Attendance at Burst or Leaking Water Pipes Response metrics for Priority 2 events	ACTEW	Percentage of Response Time within 24 hours 95% Maximum Response Time 48 hours for each event
	Yarra Valley Water	Average response of 38 minutes
	Barwon Water	Average response of 68 minutes
	North East	Average response of 120 minutes
Sewerage Overflows to Dwellings Response Time	ACTEW	100% responded to within an hour
	Yarra Valley Water	Guaranteed Service Level Payment of \$1,000 for not containing an internal sewer spill within an hour
	Barwon Water	Average response time for sewer spills of 80 minutes
	North East	Average response time for sewer spills of 30 minutes
Sewerage Service Interruptions	ACTEW	Main breaks/chokes per 1,000 properties < 35 Total breaks/chokes per 1,000 properties < 50
	Yarra Valley Water	6.3 per 1,000 properties (from an approved target of 45.3/100 km of main and based on 9,004km mains and 647,000 connected properties) *

KPI	Service Provider	2012/13 Target
	Barwon Water	8.1 per 1,000 properties (from an approved target of 43/100km of main and based on 2,338km mains and 124,000 connected properties) *
	North East	2.4 per 1,000 properties (from an approved target of 9/100km of main and based on 1,086km mains and 41,000 connections) *
Sewerage Service Restoration Time	ACTEW	95% of restored within 5 hours
	Yarra Valley Water	Average restoration time of 249 minutes
	Barwon Water	Average restoration time of 250 minutes
	North East	Average restoration time of 160 minutes

* Length of sewer mains and properties connected to the sewerage service taken from the National Water Commission's 2011 Report.

Although some of these comparator indicators do not match up entirely and although there are likely to be some definitional differences between the ACTEW KPIs and the Victorian KPIs, they do highlight that ACTEW's internal performance targets are, in some cases not as challenging as customer service targets approved by other water service providers.

These service standards are of particular importance in Victoria as proposed target levels form a cornerstone of each business's water plan, which sets out proposed prices for the next five years, and is submitted to the regulator. As such, customer service standards are a main driver of expenditure forecasts, with the performance targets used to target and justify future expenditure. These performance targets are also used in combination with customer willingness-to-pay surveys to assess whether customers are prepared to pay extra to increase performance.

There are two important findings from the above analysis:

1. As ACTEW does not have detailed approved service standards or guaranteed service levels, with its KPIs largely being an internal mechanism to measure the business's own performance, there is a disconnect between the service provided to the customer and the customer themselves. As such, service standards are not a true driver of expenditure in ACTEW's expenditure forecasts.
2. ACTEW's service standards appear less onerous than other water utilities in Australia, which suggests that its costs for providing its services could be relatively less than these other water utilities. However, Figure 3-13 and Figure 3-14 in the following sections demonstrate that ACTEW has the highest sewerage operating costs per property when compared with its peers and amongst the highest water operating costs per property. Taken together, these factors suggest that there is scope for efficiency gains in ACTEW's operating costs. We discuss the scope for operating cost efficiencies further in Section 4.2.

We found in 2012 that ACTEW's service standards were also not a direct driver of capital expenditure. ACTEW's capital expenditure planning processes (for example use of project description statements) do not require expenditure to be linked to a relevant service standard. There is limited investigation by ACTEW into linkages between capital expenditure and service standards, including for water and sewer mains renewals where the linkages are more direct than in other areas.

3.5 Benchmarking

To benchmark ACTEW against other water utilities, we have drawn on the comparative information published by the National Water Commission (NWC) in its National Performance Report 2012-13 for Urban Water Utilities. We included this analysis in our 2012 report and have used updated data for this report.

For this report, we present comparisons of ACTEW with water service providers in the 100,000+ customer (major utility) category in Australia and have taken account of the comparisons during our review. ACTEW is one of the smallest utilities by population in this category as illustrated in Figure 3-4.

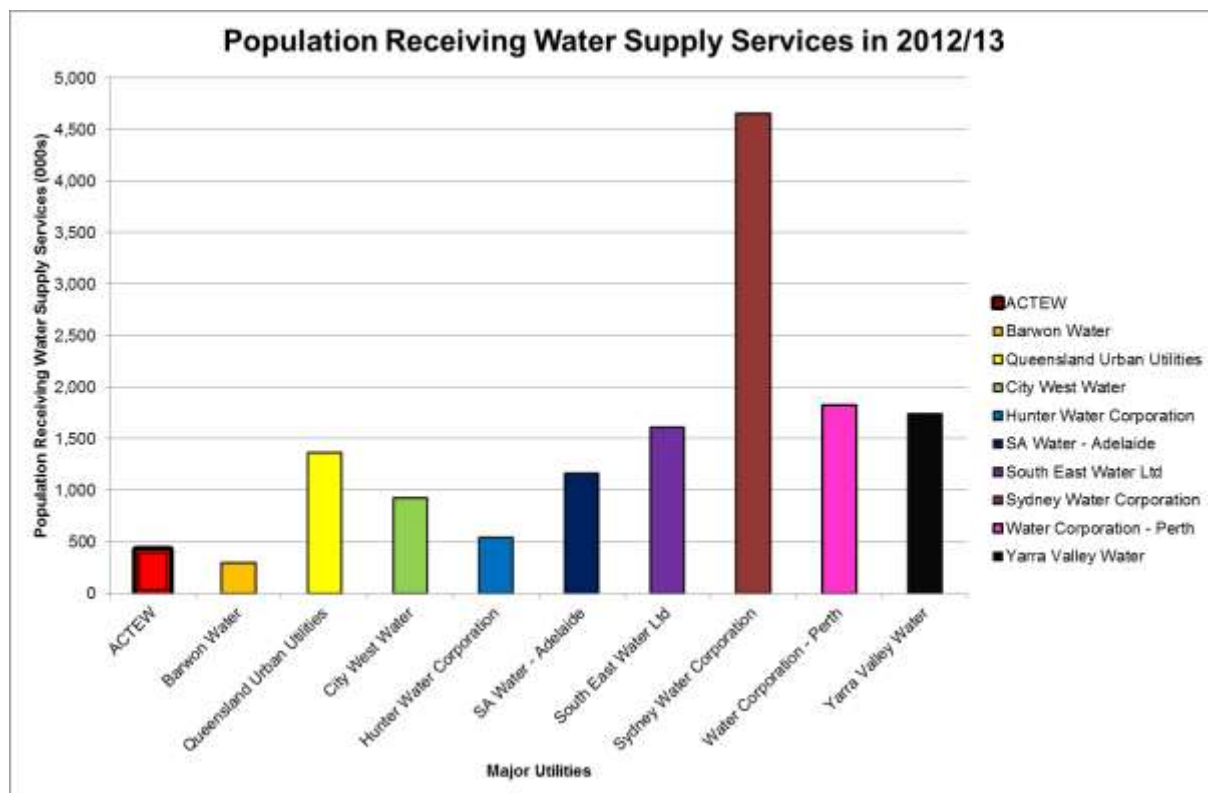


Figure 3-4 Population receiving water supply services in 2012/13 for ACTEW and similar utilities

Water and Sewage Flows

We reported in our previous review that the average residential water usage of ACTEW's customer base in the 2010/11 financial year was comparable to that of Hunter Water Corporation and SA Water – Adelaide. However, after a review of the latest data collated by the NWC, ACTEW's reported average water consumption has grown by 12%, and is now surpassed only by Water Corporation in Perth (Figure 3-5). ACTEW's average sewage flows (Figure 3-6), on the other hand, have decreased by 15% since 2010/11 but this is in line with the overall category-wide trend and hence maintains ACTEW's mid-category position.

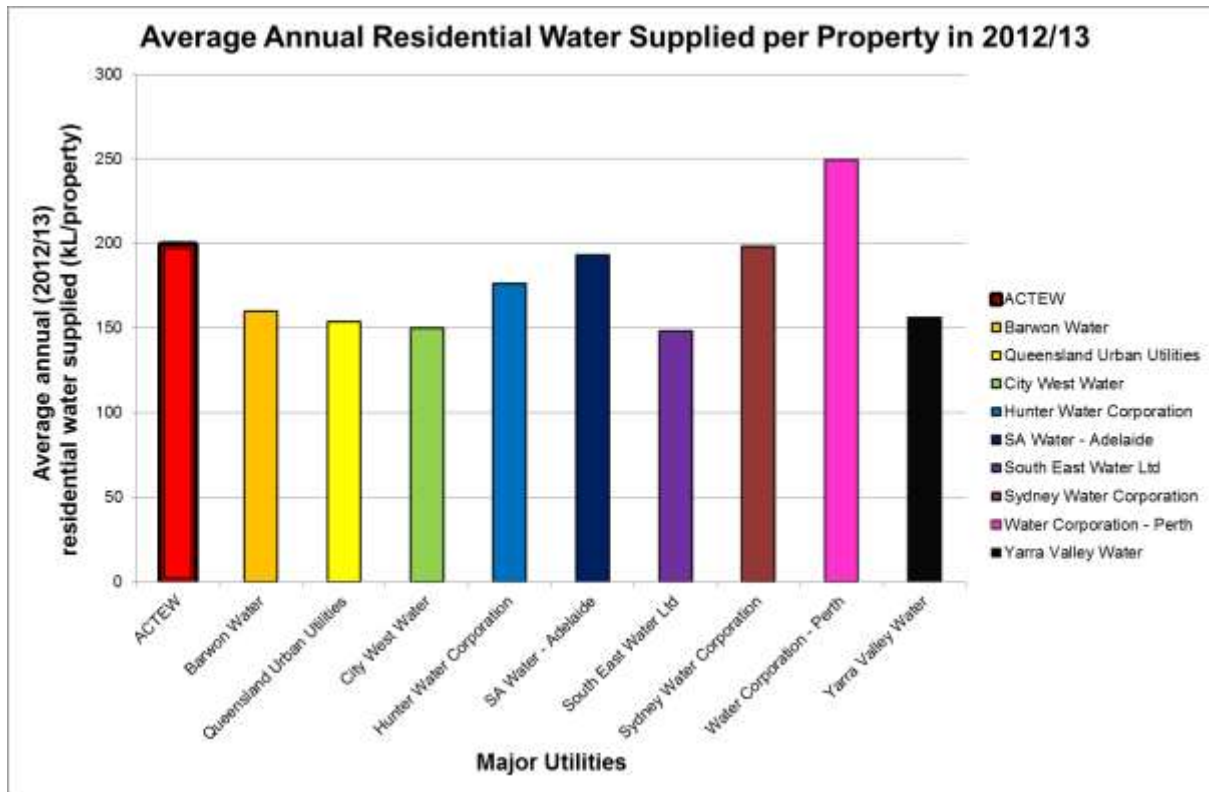


Figure 3-5 Average annual residential water supplied per property in 2012/13 for ACTEW and similar utilities

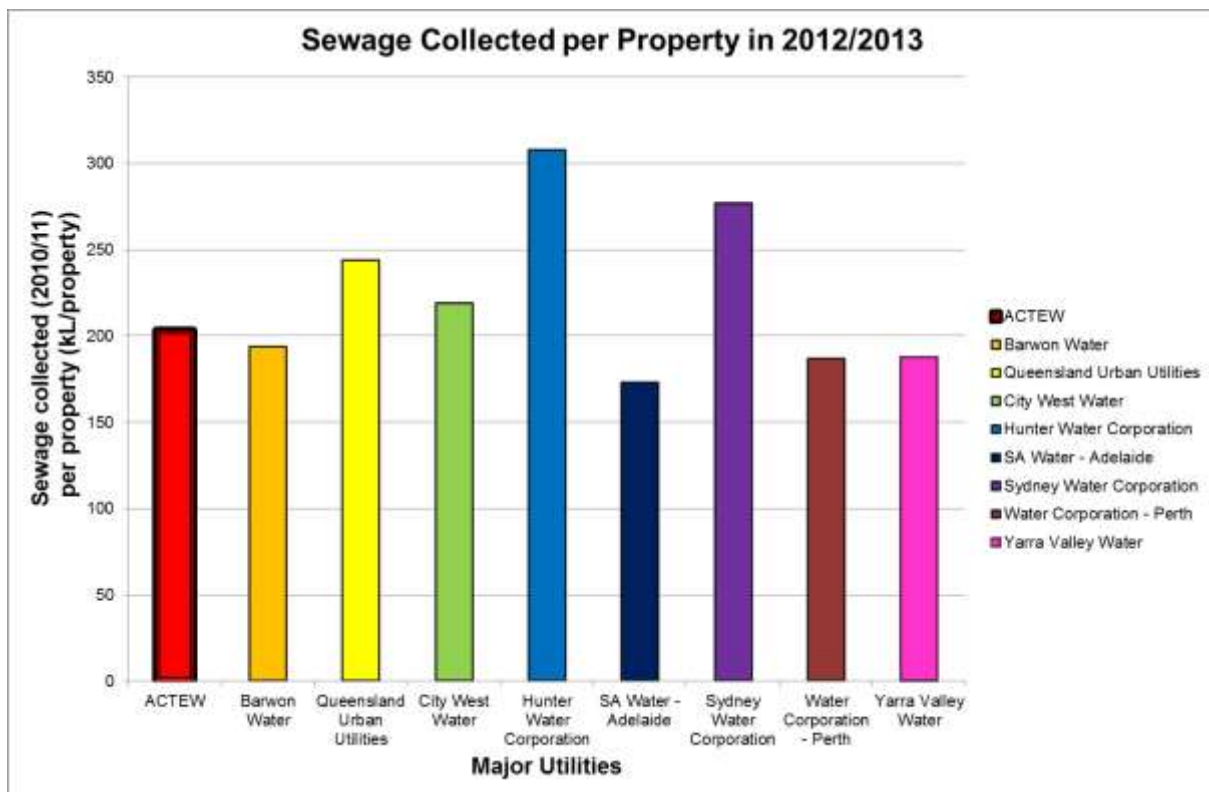


Figure 3-6 Sewage collected per property in 2012/13 for ACTEW and similar utilities

Asset Performance Measures

ACTEW is approximately mid-range with respect to the rate of water main breaks relative to the other service providers in the major utility category adopted by the NWC (Figure 3-7). This is comparable to its 2010/11 position, although lower in absolute terms, and equates to more than a 50% reduction from its 2006/07 rate (when water main breaks in ACTEW's network were first collated in the NPR).

With regards to unplanned interruptions across all asset classes in Australia's major utility water supply networks, ACTEW has the second least number of unplanned interruptions per 100 properties (Figure 3-8), which is an improvement on both its relative ranking (of equal third) and absolute performance in 2010/11. Its performance in terms of water losses has also improved, considerably in this instance, resulting in ACTEW now being the category leader in this measure (Figure 3-10). Conversely, the average duration of unplanned interruptions in the ACT reticulated water network has generally increased since the inception of these records in 2005/06 (Figure 3-9) and, in the period since our last review, ACTEW's relative position has worsened from fourth to seventh.

ACTEW's performance as defined by the rate of main breaks and chokes in its sewerage network has, in the past, been vastly different to that described by the reliability of its water mains. In 2008/09, ACTEW's rate of sewerage main breaks and chokes peaked and were more than double that of the next highest rate for a major utility (Hunter Water Corporation). In recent times, however, ACTEW's reported performance in this area has improved to now be equal seventh in the category, ahead of Sydney Water Corporation and SA Water – Adelaide.

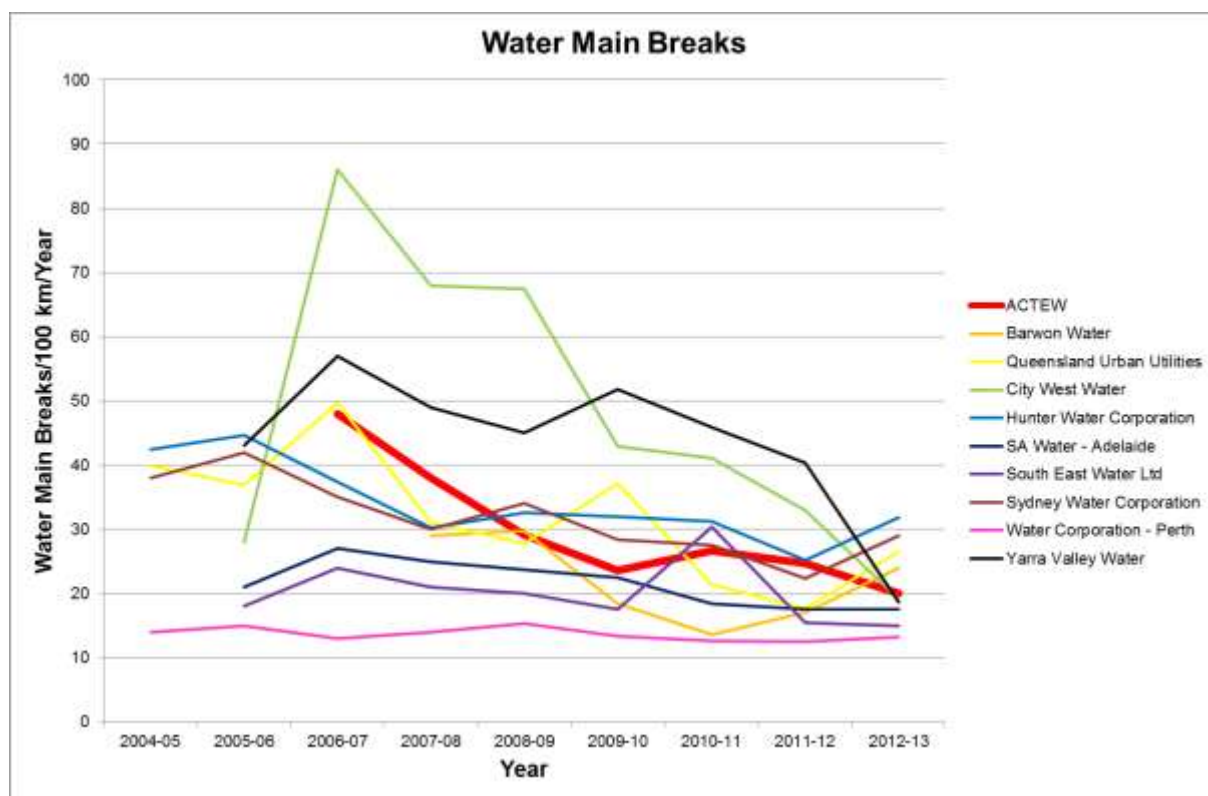


Figure 3-7 Water main breaks per 100 km of water mains for ACTEW and similar utilities (2004/05 to 2012/13)

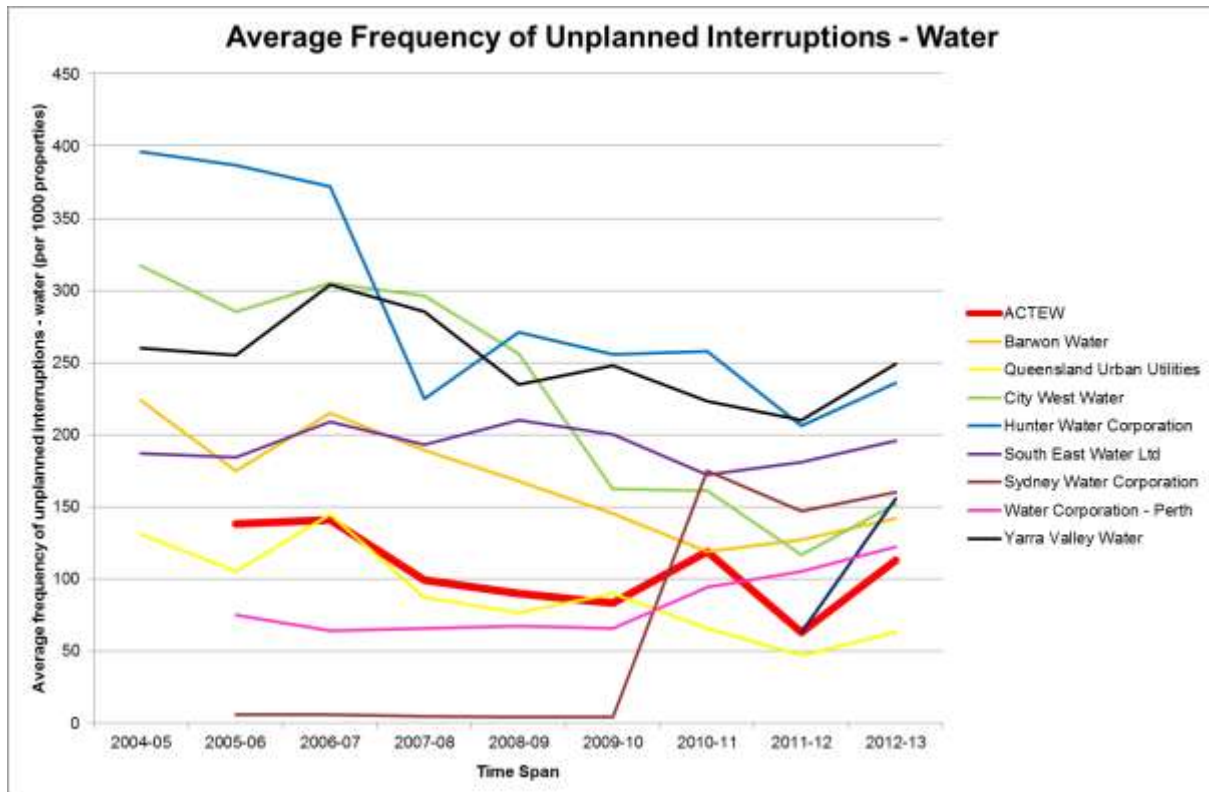


Figure 3-8 Frequency of unplanned interruptions to the supply of water for ACTEW and similar utilities (2004/05 to 2012/13)

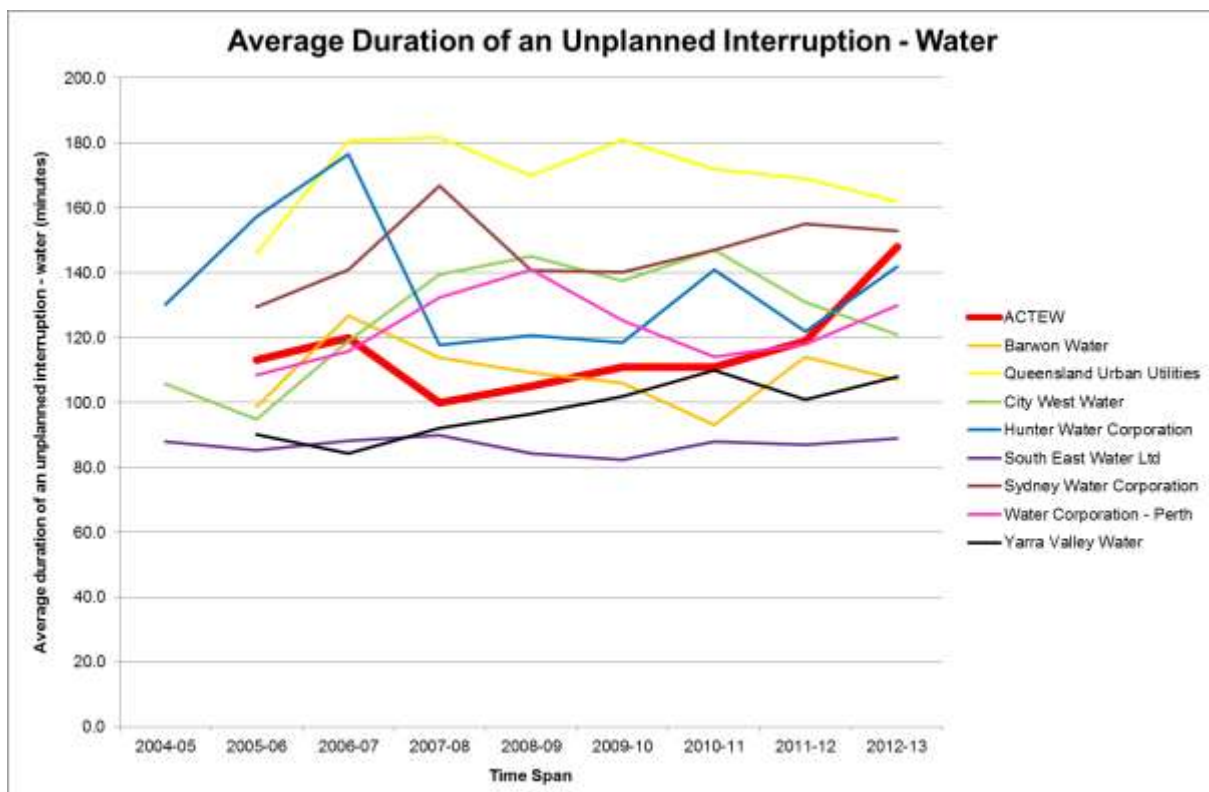


Figure 3-9 Average duration of unplanned interruptions to the supply of water for ACTEW and similar utilities (2004/05 to 2012/13)

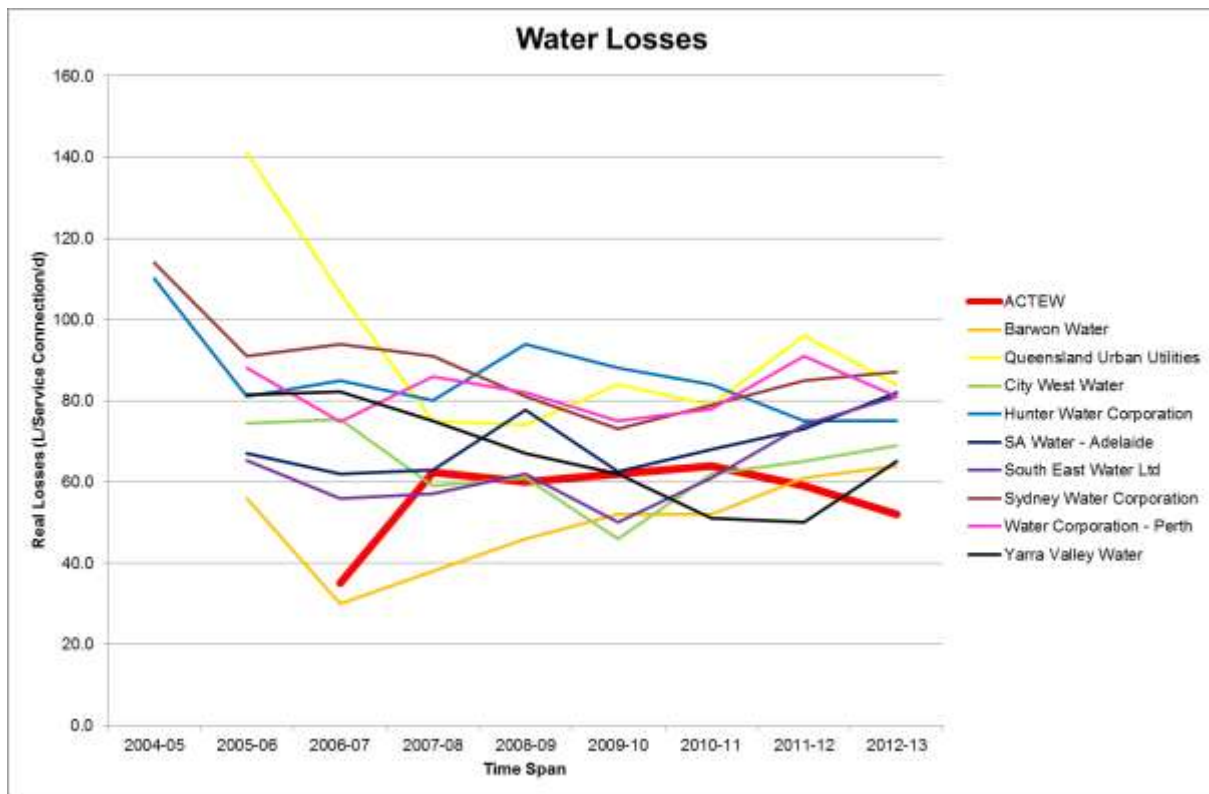


Figure 3-10 Daily water losses per service connection for ACTEW and similar utilities (2004/05 to 2012/13)

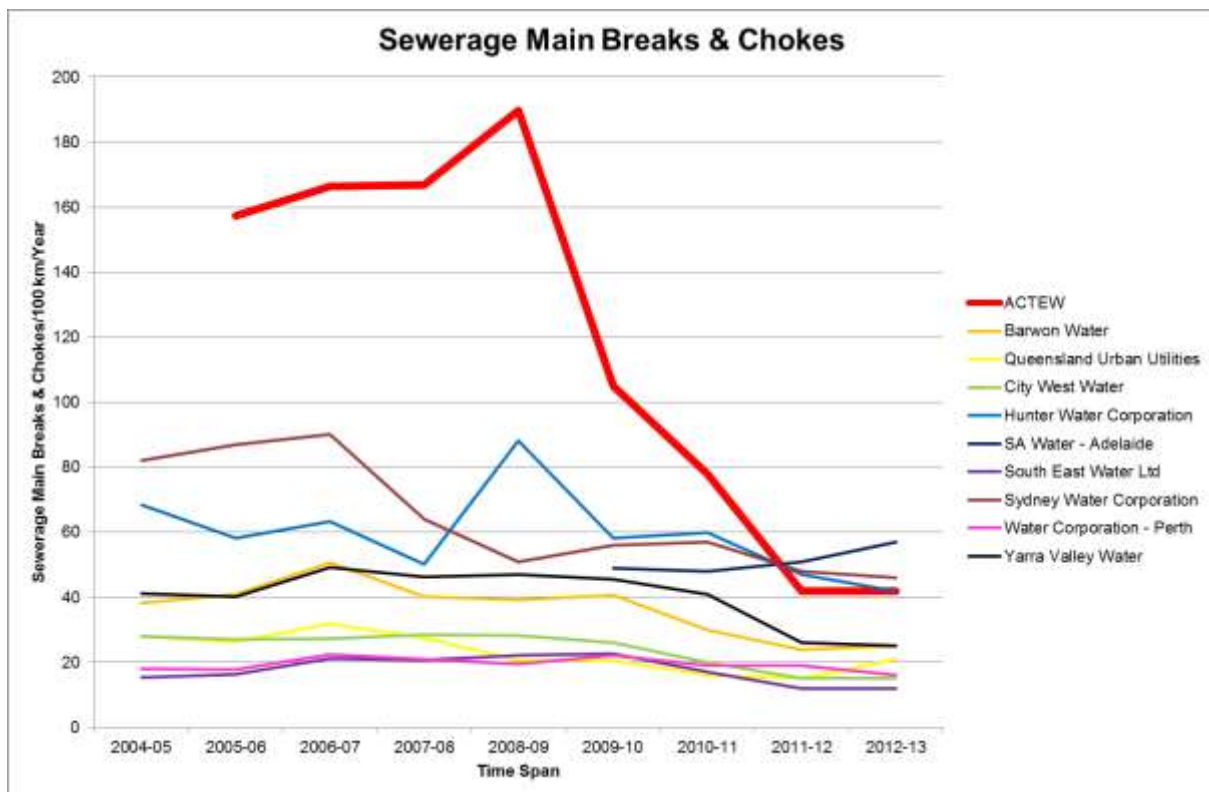


Figure 3-11 Sewerage main breaks and chokes per 100 km of sewerage mains for ACTEW and similar utilities (2004/05 to 2012/13)

Complaints

ACTEW's relative level of water quality complaints has remained steady since 2009/10, in fourth position. Despite possessing close to a mid-range ranking, the number of water quality complaints received by ACTEW is 55% below the 2012/13 average and reflects its investments in water treatment post-2005/06.

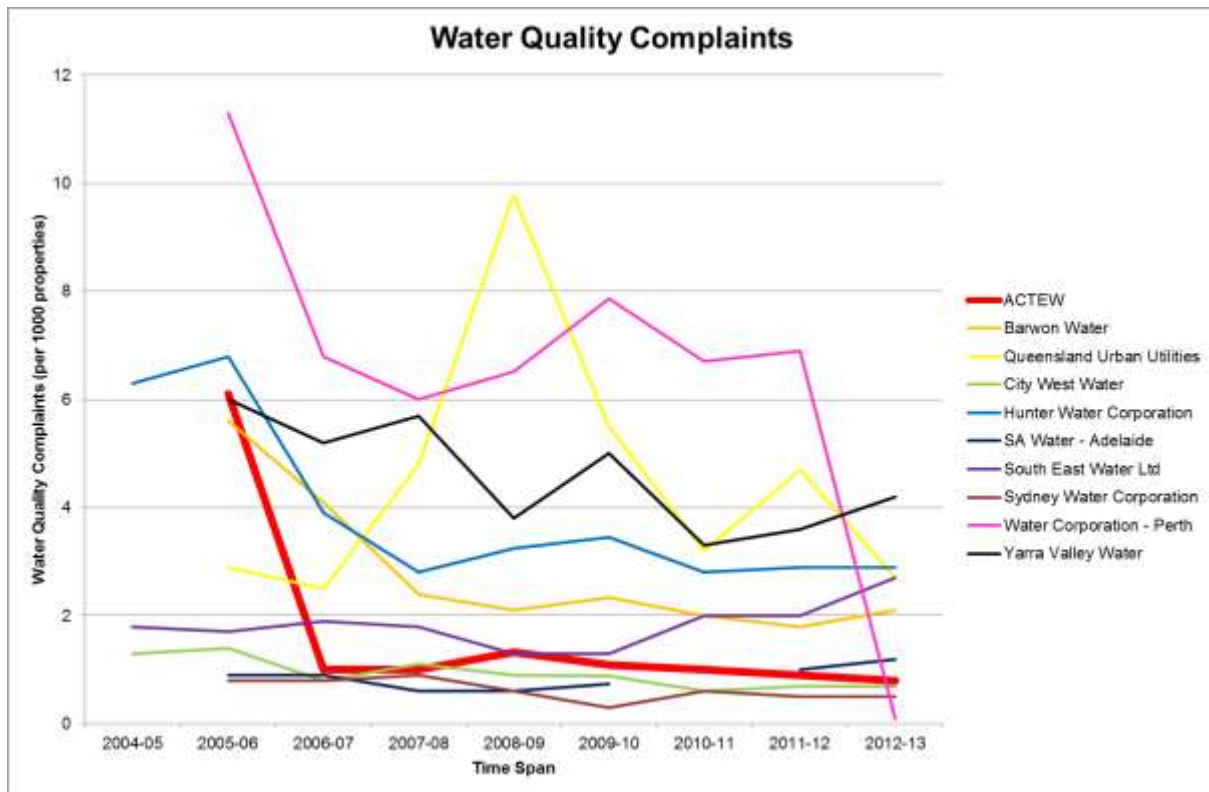


Figure 3-12 Water quality complaints per 1000 properties for ACTEW and similar utilities (2004/05 to 2012/13)

Capital and operating expenditure

Since our 2012 review, ACTEW's operating costs per property have increased and its relative position amongst its peers has worsened, i.e. it has relatively higher costs per property.

ACTEW's sewerage operating costs have remained as the highest amongst the comparison group. The trends in water and sewerage capex are quite variable. Despite the decreasing trend in water capex per property following the completion of the water security projects, ACTEW is still the second highest in this sample. For sewerage capex per property, ACTEW is amongst the lower ranked utilities.

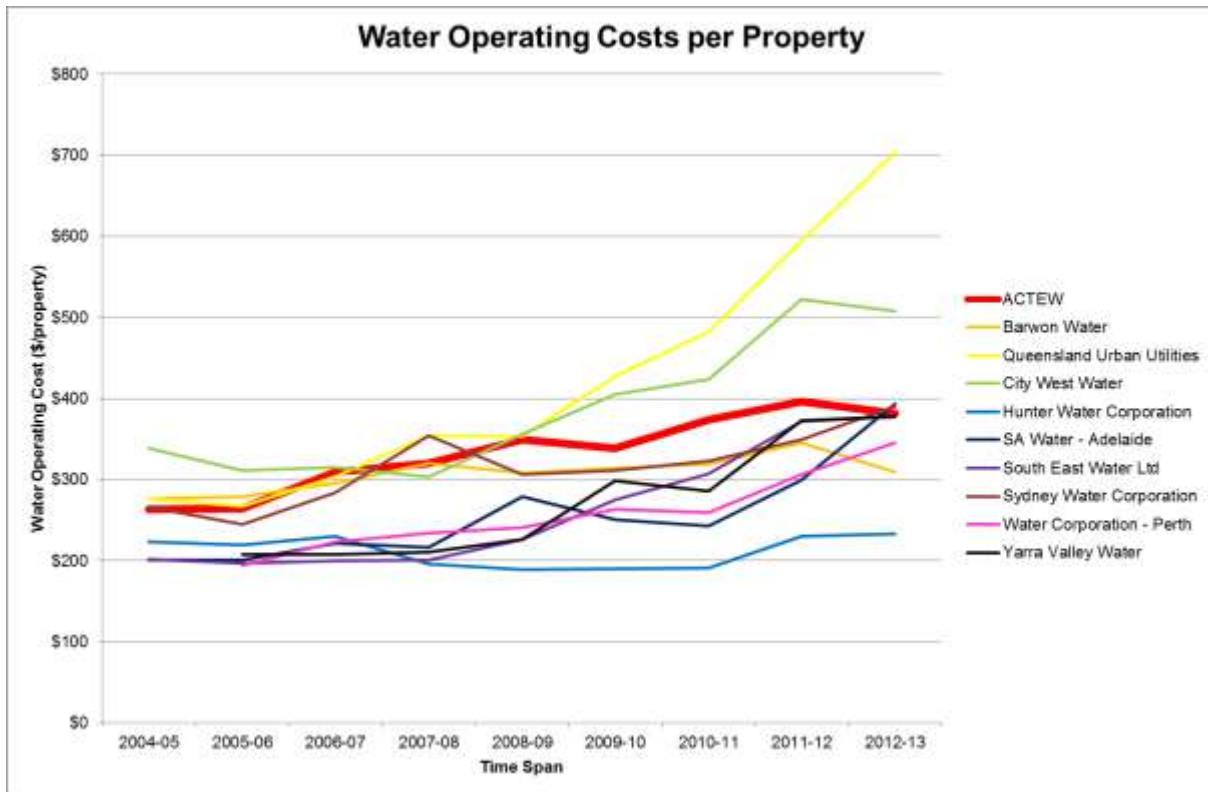


Figure 3-13 Water supply operating costs per property for ACTEW and similar utilities (2004/05 to 2012/13)

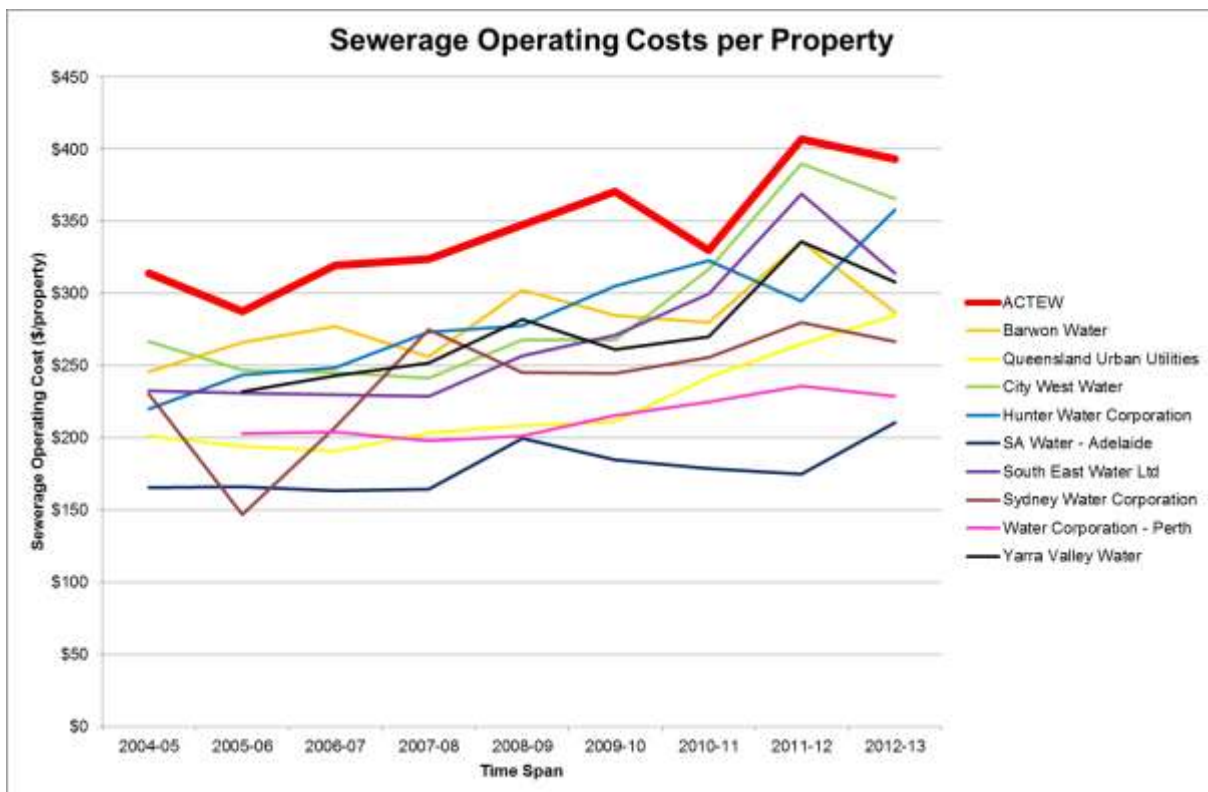


Figure 3-14 Sewerage operating costs per property for ACTEW and similar utilities (2004/05 to 2012/13)

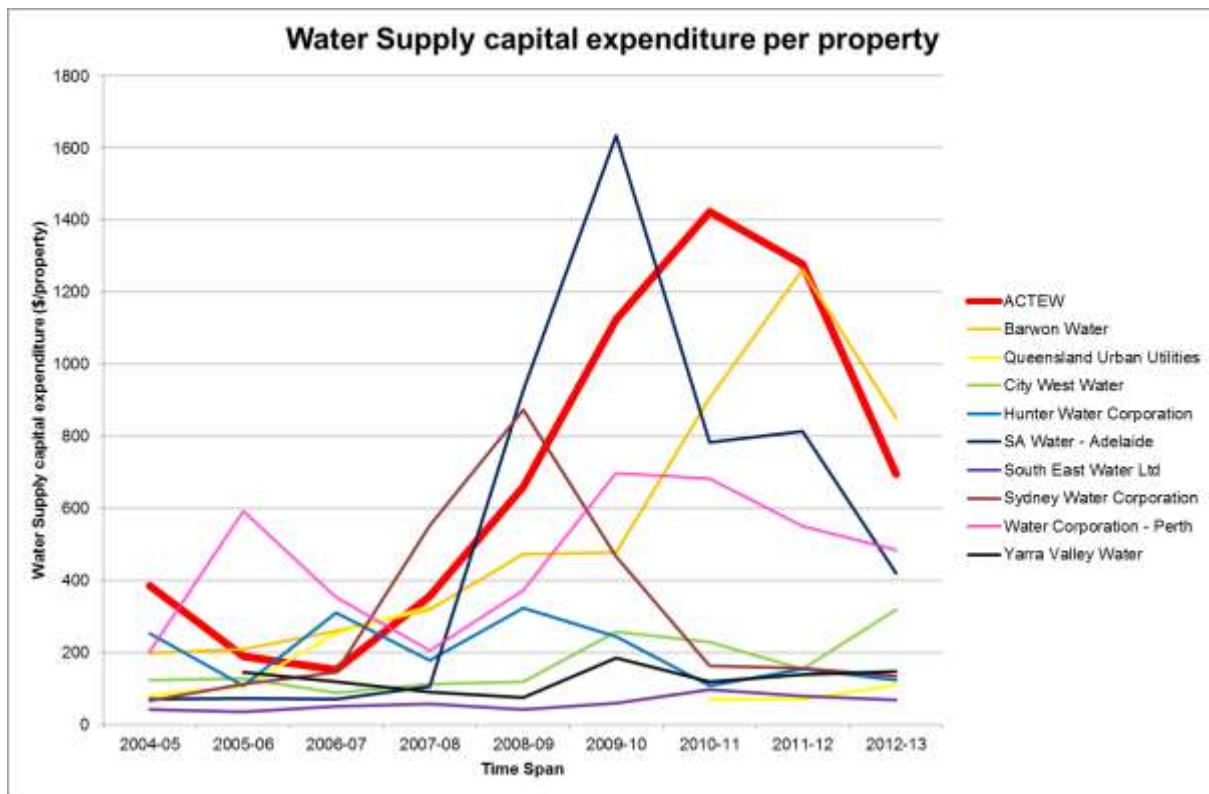


Figure 3-15 Water supply capital expenditure per property for ACTEW and similar utilities (2004/05 to 2012/13)

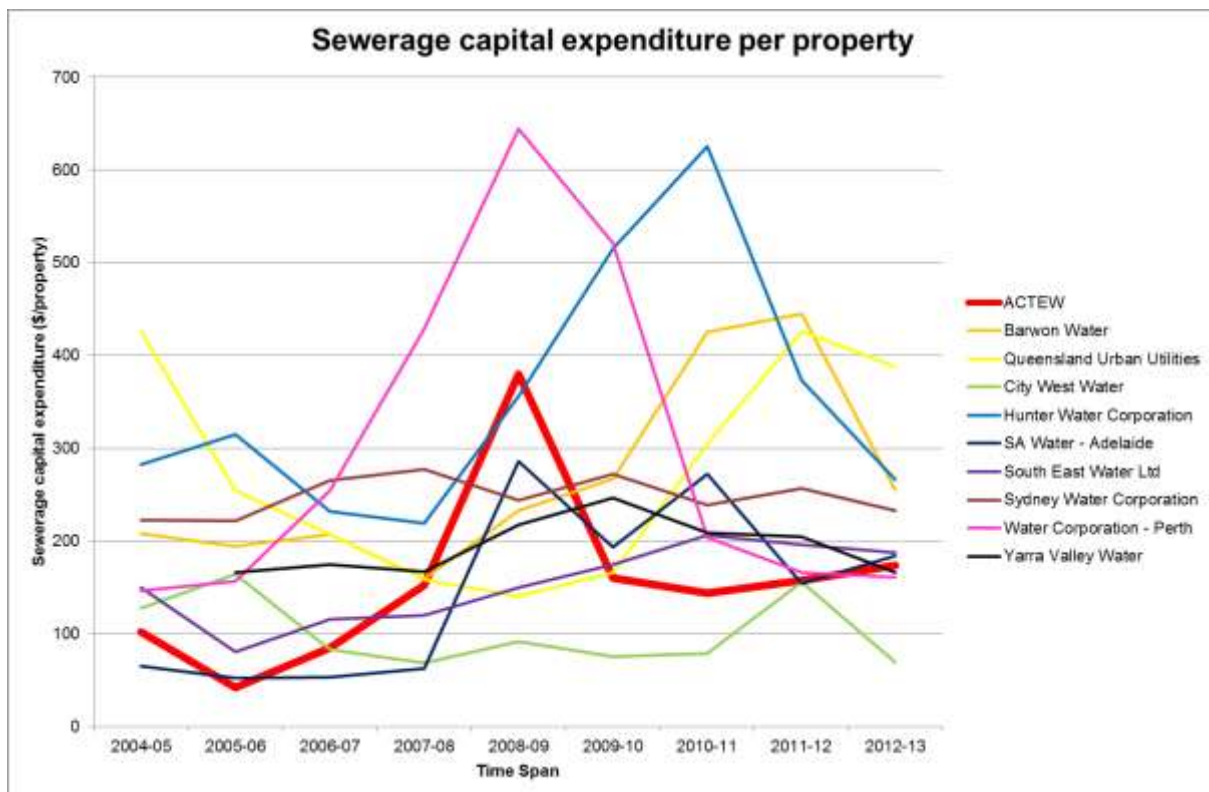


Figure 3-16 Sewerage capital expenditure per property for ACTEW and similar utilities (2004/05 to 2012/13)

4 Task 1: ACTEW's operating and capital expenditure forecasts for 2013/14 to 2017/18

4.1 Scope of works

As specified in the Panel's Terms of Reference, Task 1 consists of three requirements:

- Advice on the key assumptions that are driving expenditure (e.g. asset replacements, demand forecasts, growth assumptions, environmental requirements, service standard requirements) and the impact of changes in these drivers on expenditure levels.
- Review of ACTEW's forecast capital expenditure for sewerage over the period 2013/14 to 2017/18 and advice as to whether these forecasts are efficient and prudent. If the consultant concludes that these forecasts are not efficient and prudent, then the consultant should propose an alternative forecast that it considers is efficient and prudent.
- Strategic review of ACTEW's governance processes around capital expenditure decision-making and advice as to whether ACTEW's current processes address the concerns identified in relation to this issue during the last price review. In particular the consultant should provide advice as to whether these processes are a) reasonable and b) sufficient to manage the risks in delivering its capital program (especially the sewerage program referred to above).

4.2 Comparison of operating and capital expenditure forecasts

To provide context to this report, the development and assessment of forecasts of prudent and efficient operating and capital expenditure is charted in Table 4-1 and Table 4-2. These tables detail:

- ▶ the original forecasts proposed by ACTEW in its submission to the 2012 price review
- ▶ the recommended efficient forecasts from our 2012 review
- ▶ the revised forecasts submitted by ACTEW in its 2013 response to ICRC's draft report
- ▶ the forecasts used by ICRC in its final determination
- ▶ the forecasts included in ACTEW's Statement of Facts and Contentions submitted in 2014 for this independent review
- ▶ for capital expenditure only, an updated capital program provided by ACTEW on 24 September 2014 that includes the most recent forecasts for each of its capital projects. This forecast was in nominal terms, therefore we deflated⁸ the forecast to arrive at costs in \$12/13.

Table 4-1 Comparison of ACTEW and Cardno opex forecasts and ICRC determination for 2013/14 to 2017/18⁹

Source		Proposed efficient total (water and sewerage) opex (2012/13 \$M)					
Author	Document title	2013/14	2014/15	2015/16	2016/17	2017/18	Total
ACTEW	ACTEW Main Submission to the ICRC: Regulated Water and Sewerage Services from 1 July 2013 (2012)	134.4	137.1	137.9	141.2	141.5	692.0

⁸ The nominal costs were deflated to a real \$12/13 basis using an assumption of 2.5% per annum for price escalation. It has not been possible due to time constraints to check with ACTEW the assumptions used to arrive at its nominal forecasts.

⁹ For reference, the sources of these figures are as follows:

- Table 9.17 in ACTEW's Submission (2012)
- Table 7-32 in Cardno's Final Report (2012)
- Table 1.21 in ACTEW's Response to Draft Report (2013)
- Table 8.8 in ICRC's Final Report (2013)
- Table 4.3 in ACTEW's Statement of Facts and Contentions (2014)

Source		Proposed efficient total (water and sewerage) opex (2012/13 \$M)					
Cardno	Review of ACTEW's Capital and Operating Expenditure (2012)	131.2	133.1	132.7	134.3	132.9	664.1
ACTEW	Response to the Draft Report: Regulated Water and Sewerage Services (2013)	127.4	129.1	127.9	128.1	129.7	642.2
ICRC	Final Report: Regulated Water and Sewerage Services – Report 5 of 2013 (2013)	127.3	128.9	-	-	-	-
ACTEW	Statement of Facts and Contentions (2014)	126.8	128.5	127.3	127.6	129.2	639.4

Table 4-2 Comparison of ACTEW and Cardno capex forecasts and ICRC determination for 2013/14 to 2017/18¹⁰

Source		Proposed efficient /forecast total (capex (2012/13 \$M)					
Author	Document title	2013/14	2014/15	2015/16	2016/17	2017/18	Total
ACTEW	ACTEW Main Submission to the ICRC: Regulated Water and Sewerage Services from 1 July 2013 (2012)	80.1	137.4	112.7	96.1	82.4	508.6
Cardno	Review of ACTEW's Capital and Operating Expenditure (2012)	63.7	109.9	105.6	90.0	79.4	448.6
ACTEW	Response to the Draft Report: Regulated Water and Sewerage Services (2013)	54.9	98.3	122.5	106.2	82.7	464.7
ICRC	Final Report: Regulated Water and Sewerage Services – Report 5 of 2013 (2013)	54.8	98.0	-	-	-	-
ACTEW	Statement of Facts and Contentions (2014)	54.9	98.1	121.2	104.8	81.2	460.2
ACTEW	Forecast capex program supplied on 24 September 2014	43.0	62.1	83.5	134.7	108.1	431.3

Table 4-1 shows that the opex forecast most recently submitted by ACTEW in April 2013 and in its 2014 Statement of Facts and Contentions for the 2013/14 to 2017/18 period is consistently below that of our proposed efficient forecast and previous forecasts submitted by the water utility.

In contrast to its opex forecasts, ACTEW's annual capex forecasts in its 2014 Statement of Facts and Contentions are higher than that proposed in our 2012 Review Report. Total capex over the review period is \$11.6M (2.6%) above the amount we considered prudent and efficient at the time of our review. ACTEW has also proposed a more peaked expenditure profile due to a relatively low level of forecast expenditure in 2012/13. However, its most recent update, provided on 24 September 2014, shows that ACTEW forecasts it will underspend the total amount of capital expenditure recommended as efficient by us in 2012 by some \$17M in real terms.

The revised capital expenditure program submitted by ACTEW includes \$41M in expenditure over the period for projects that were not identified in its original 2012 submission to the ICRC. These projects reflect

¹⁰ For reference, the sources of these figures are as follows:

- Table 8.13 in ACTEW's Submission (2012)
- Table 8-15 in Cardno's Final Report (2012)
- Table 1.15 in ACTEW's Response to Draft Report (2013)
- Table 9.6 in ICRC's Final Report (2013)
- Table 4.4 in ACTEW's Statement of Facts and Contentions (2014)

ACTEW's response to emerging needs, partially a result of a better understanding of asset condition. The largest single item is \$17M for relining of large sewer mains. These projects account for 9.6% of the total proposed capital expenditure program as it currently stands. We consider that inclusion of these not previously identified projects reflects prudent practice by ACTEW as it is in the best position to understand its business risks and respond to them. We note that inclusion of these new projects has not led to an increase in the overall program compared to that previously submitted, and therefore ACTEW has deferred expenditure that was included in the original submission. We also note that these additional projects will generally be subject to the ACTEW's revised governance processes which we discuss further in Section 4.4.

4.3 Analysis of proposed operating expenditure

ACTEW's proposed operating expenditure as submitted in its Statement of Facts and Contentions for the period from 2013/14 to 2017/18 is as per its April 2013 submission to the ICRC, with the exception that the operating costs of the Uriarra sewage treatment plant have been decreased to reflect the efficient and prudent costs of a package plant. The exclusion of these costs is in the order of \$0.56 M per annum¹¹ (\$2012/13). ACTEW notes that these costs have been excluded to reflect an approach where the costs are treated as a Community Service Obligation. It is not within our scope to comment on whether this expenditure should be treated as a Community Service Obligation and we have therefore used ACTEW's April 2013 operating cost forecasts as our starting point for this analysis.

As noted in Section 1.4, ACTEW's April 2013 estimates were developed through a base year and variance (step change) approach. A summary of these step changes for each financial year in the forecast period has been adapted from ACTEW's 2013 Response and is presented in Table 4-3.

Table 4-3 Step changes and derivation of forecast operating expenditure for 2013/14 to 2017/18¹²

\$M (real \$2012/13)	2013/14	2014/15	2015/16	2016/17	2017/18
"Opening" operating expenditure	122.45	127.42	129.06	127.87	128.13
Real escalation	1.53	1.10	1.09	1.37	1.64
ECD maintenance	0.20	-	-	-	-
Environmental management, ECD/M2G	0.49	-1.08	-0.38	-1.01	-0.12
Major maintenance, water	-0.89	2.24	-1.12	-0.13	-0.90
Major maintenance, sewerage	-0.68	-0.23	-0.45	0.31	-0.57
Water treatment costs due different sources	1.40	-0.28	0.34	0.20	0.18
Southwell Park Closure	0.60	-0.60	-	-	-
Tantangara Transfer	0.71	-	0.17	-0.17	-0.04
Other	1.62	0.49	-0.83	-0.81	-0.43
ICRC review costs	-	-	-	0.5	1.8
Total operating expenditure (excluding WAC and UNFT)	127.42	129.06	127.87	128.13	129.72

In submitting its review operating cost forecasts, ACTEW noted that¹³:

"(we have) taken into account Cardno's recommendations since the integration of ACTEW and ActewAGL Water Division. Since then ACTEW has undertaken a substantial review of its business and operation with the business undertaking a transformation process. Actual operating expenditure outcomes under the new organisation are now available and have highlighted greater opportunities for savings than previously envisaged. As a result, ACTEW is submitting a substantially lower operating expenditure program in this proposal."

¹¹ p. 12, "Operating expenditure" PowerPoint presentation from ACTEW to Cardno, 4 September 2014

¹² Adapted from Table 1.21 of the Response

¹³ Response to the Draft Report Regulated Water and Sewerage Services, ACTEW, April 2013, p57

ACTEW backed up this statement by proposing in its April 2013 submission forecasts that were an average of \$4.4M per annum (3.3%) lower than that recommended by us, resulting in a cumulative reduction in operating expenditure of \$21.9M compared with our recommendations. When compared with its original submission to the pricing review, the reduction in operating costs is greater: \$10.0M per annum (7.5%) lower and a total saving of \$49.8M as noted in Section 4.2.

In regards to ACTEW's currently proposed opex for the 2013/14 to 2017/18 period as set out in its April 2013 Response, we note that the savings identified in ACTEW's forecast (appearing as negative variances in particular years) are the result of assumptions regarding the water sources it will use and year to year fluctuations in its maintenance requirements. These variances are typical of those faced and managed by water utilities across Australia.

We note that there is no explicit allowance for productivity improvements in ACTEW's forecasts. We expect that an organisation of the size and capability of ACTEW to be proactively identifying opportunities to reduce the costs of its services to its customers (where service levels and outputs do not change). We challenged ACTEW on this topic and received a response that the organisation is seeking efficiency improvements in its operations, even if these are not accurately reflected in the revised 'base year' methodology discussed in its April 2013 Response.

ACTEW advised that while no explicit productivity gains have been included in its operating expenditure forecasts, there are inherent productivity gains in the forecasts due to there being no allowance for population growth. Population growth in the ACT in 2012/13 was 1.7% and 1.4% in 2013/14¹⁴. Assuming a 1.4% annual population growth rate for the remaining three years of the regulatory period, the total population growth over the period will be 7-8%. While economies of scale should lead to the impact on ACTEW's operating costs being less than this total, we consider that the impact will be material and can be considered a proxy productivity gain.

During our meetings with ACTEW, we asked for explanations regarding each of the step changes detailed in Table 4-3. We were satisfied that the reasons given were justified.

As noted in Section 3.4, ACTEW is at a starting point of being a higher cost water and sewerage service provider than its peers but appears to generally have less onerous service standards than its peers. However, ACTEW has proposed substantial reductions in its operating expenditure forecasts compared with that recommended by us in 2012. Considering that ACTEW has acted positively in lowering its operating expenditure already, the justifications provided for the step changes in operating expenditure and the inherent efficiency gains due to population growth, we consider that ACTEW's operating expenditure forecasts from its April 2013 Response should be adopted as prudent and efficient.

However, we recommend that ACTEW consider for future whether its forecasting and internal budgeting approach adequately accounts for:

- ▶ Opex arising from new capital investments
- ▶ Opex arising from population growth, e.g. increased treatment plant throughput
- ▶ Efficiency gains through improved work practices, lower input costs, adoption of new technology and other sources.

4.4 Capital expenditure governance

The Terms of Reference require us to comment on whether ACTEW's processes for governance of capital expenditure are reasonable and adequate to manage the risks to delivery of its program. The Terms of Reference note that we identified concerns in this area in our 2012 review. The specific concerns identified by us at this time included¹⁵:

¹⁴ This growth figure is to the end of the March quarter. Source: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0>

¹⁵ Table 6-9, p81, Review of ACTEW's Capital and Operating Expenditure, Cardno, November 2012

- ▶ Focus on “solutions” rather than needs
- ▶ Limited consideration of “do nothing” option
- ▶ Customer consultation in rare cases only
- ▶ Financial evaluation undertaken as a secondary consideration to technical evaluation
- ▶ Business cases focus on implementation rather than justification
- ▶ Limited review points for development of current program
- ▶ (Previously) capital review committee composition potentially biased towards capital delivery. Limited demarcation between asset owner and asset delivery.

ACTEW has undertaken considerable work to improve its capital governance processes since our last review. This work has culminated in the launch of its infrastructure Planning and Delivery Framework ‘iPaD’. This is a gateway process for project delivery that has three main types of documents required to support the development and delivery of projects:

- ▶ Concept Development Statement
- ▶ Technical Report
- ▶ Business Case (one for design, one for construction).

The framework is flexible and the documentation required depends on the size and complexity of the scope of works. Some elements of the framework, including the overall flowchart for project delivery (titled the ‘Process Map to Delivery Phase’), are in the process of being developed and, as such, are yet to be released. However, many elements of ACTEW’s capital delivery framework are already in place. Of these, there has been a particular focus on the project initiation phase to ensure that the appropriate risks and opportunities are identified at the earliest stage in the project lifecycle. The decision tree for project initiation under the iPaD framework is detailed in Figure 4-1.

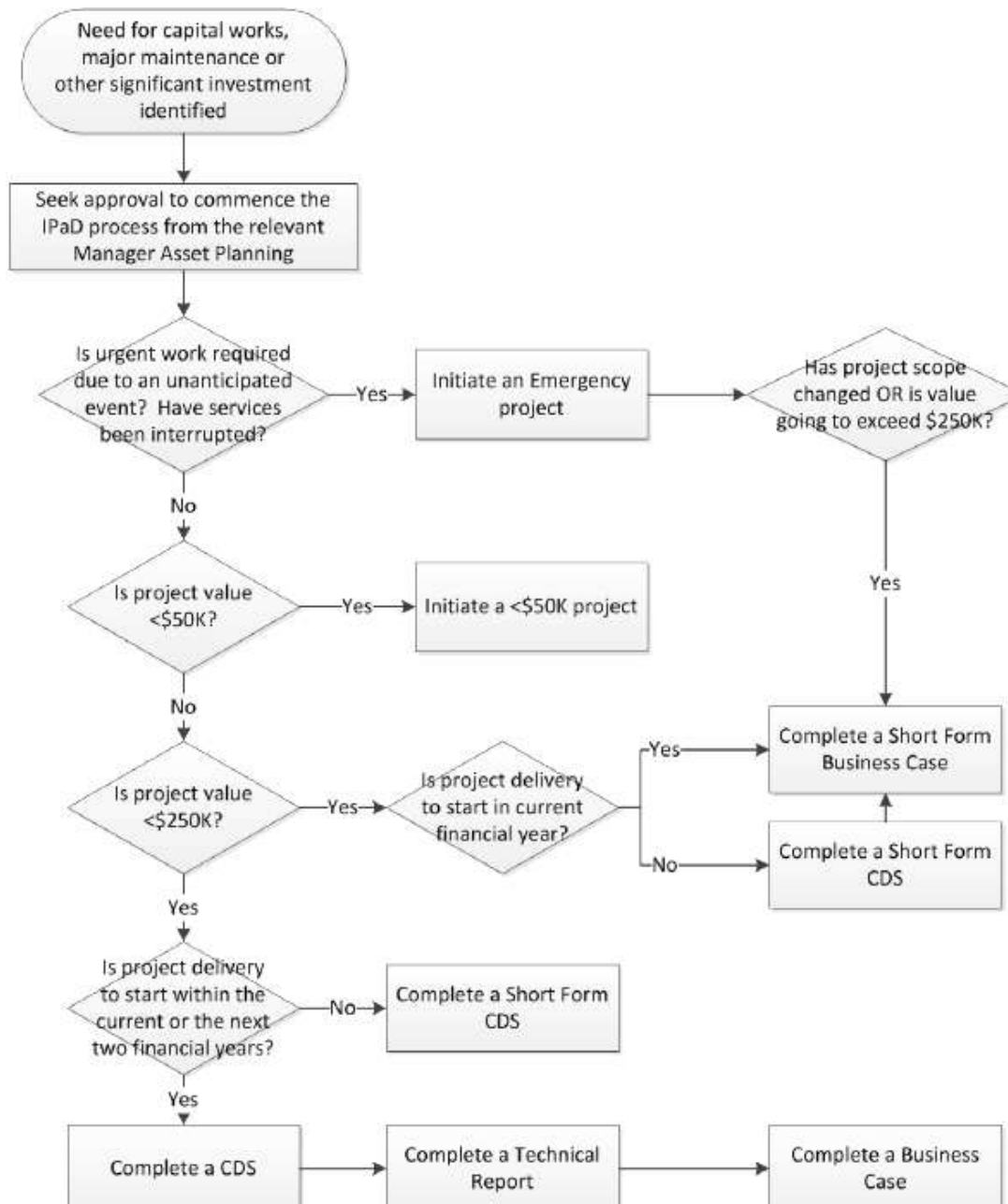


Figure 4-1 iPaD initiation decision tree

We note that this decision tree is only for investment initiation; finalising and implementing the gateway process across the whole capital delivery cycle is imperative for ACTEW to demonstrate that it has appropriate governance in place for its capital expenditure. We challenged ACTEW to demonstrate that the move to the new delivery framework was improving its investment decisions. ACTEW responded that its gateway reviews are rigorous and that at each gate, the documentation is reviewed by the Investment Review Committee and cannot progress without unanimous support from the Committee. ACTEW notes that since implementation of the framework, two business case documents and two technical reports have been rejected by the Investment Review Committee from progressing. Table 4-4 summarises the documents rejected by the Investment Review Committee and the reasons for the rejection. ACTEW notes that the documentation for each project has since been approved. We consider that this evidence of scrutiny helping to provide some assurance that ACTEW's governance processes are adequate to manage its investment program.

Table 4-4 Documents rejected by Investment Review Committee

	Project	13/14 Actuals	Forecast 14/15	Forecast 15/16	Forecast 16/17	Forecast 17/18	Total
<i>Technical reports rejected</i>							
CX10 066	Belconnen Trunk Sewer Augmentation Stage 1	-	260,662	7,640,159	10,563,317	3,652,894	22,117,032
<i>Reasons for rejection:</i>							
Further technical analysis of a) an overflow tank and b) requirement of a new sewer north of the creek.							
CX10 380	MVIS North Odour Control System	-	-	968,607	4,847,879	9,542,271	15,358,757
<i>Reasons for rejection:</i>							
- Determine if there is another way to reduce odours at the new Molonglo development site at an additional cost that doesn't have the visual impact issues - Update stack heights in the technical report from 26 to 36, as 36 is the contingency - Advise whether the developer will provide funding - Determine whether assets will be located on unleased or leased land - Options are currently reviewed in isolation, review possibility of hybrid option.							
<i>Business Cases rejected</i>							
CX10 098	Charnwood WPS Pumps & Controls Replacement	34,494	457,914	-	-	-	492,408
<i>Reasons for rejection:</i>							
- The risks identified were generic and require updating to be specific to the project - The project driver/benefit was not clear. It was difficult to determine what exactly is the reasoning for this project i.e. is it safety? Is it financial? - There was no information in the business case in relation to the length of time the upgrade would defer the pump station from requiring replacement.							
CX10 889	MVIS and Fred Reardon Bypass Relining	-	539,624	4,933,393	11,594,568	-	17,067,585
<i>Reasons for rejection:</i>							
- The Committee recognises that the work contained in this project is urgent however the business case requires further work including review of different options considered and their pricing - Project was previously major maintenance and as such written advice as to whether works can be capitalized is needed - Review currency of condition assessment - Consequence of failure is enormous and this needs to be better represented.							

ACTEW provided details of all the projects that had been passed through each of its three broad stages (Concept Development Statement (CDS), Technical Report and Business Case). We matched the project numbers for each project passing through the relevant gate with the most up-to-date capital program provided by ACTEW to determine the associated amount of expenditure that had been approved¹⁶. This is summarised in

¹⁶ ACTEW provided to us two separate documents detailing the approval of projects through each stage. The first was a word document that listed all project numbers, the second was a spreadsheet that listed the dates of approval and the total project value. We used the word document as our starting point and matched this to the most recent version of the capital program as the basis of this analysis. We used the most recent version of the capital program as it includes year to year forecasts. There has not been time available to reconcile the two different source documents. The spreadsheet of approval dates includes a total of \$73M in expenditure (basis not stated) where there is either an approved Design of Construction Business Case that was approved after July 2013. This is less than the \$109M of expenditure with approved Business Cases derived by starting at the word document. We first requested ACTEW's capital program monitoring tool on 4 September 2014. The word document summarising the status of project approvals was provided on 10 September 2014. We clarified this information request on 11 September 2014 setting out that we had expected a spreadsheet with all capital projects individually identified. ACTEW provided a spreadsheet with the requested data in this format on 22 September 2014. The information in this spreadsheet was relied upon for the following analysis. In a letter to the Industry Panel dated 21 November 2014, ACTEW advised that "...the spreadsheet that was provided...was only able to be partially completed due to the time constraints given in the data request". We note that no advice was

Table 4-5, along with the proportion of the total capital program represented by the total expenditure at each gate. We have used the term “gate” to refer to each of the main documentation requirements but note that this may not exactly relate to ACTEW’s gateway process. We cannot confirm this however as the overall gateway process documentation is not available. Also, we understand that there are broadly two types of business case reports – design and construction. We have not been provided with a breakdown to these sub-categories. We do not consider that these issues materially impact on the analysis presented.

Table 4-5 Summary of projects passing each stage by value

	13/14 Actuals	Forecast 14/15	Forecast 15/16	Forecast 16/17	Forecast 17/18	Total
Concept Development Statement	557,244	1,076,889	2,756,971	2,891,095	3,533,812	10,816,011
<i>Proportion of program</i>	1%	2%	3%	2%	3%	3%
		27,612,58				109,546,28
Business Case	6,496,498	6	27,005,757	27,643,187	20,788,259	7
<i>Proportion of program</i>	15%	45%	32%	21%	19%	25%
Technical report	20,487	968,491	8,011,523	23,200,963	19,403,926	51,605,390
<i>Proportion of program</i>	0%	2%	10%	17%	18%	12%

The following observations can be made regarding the data summarised in

Table 4-5:

- ▶ As to be expected because the new processes have only recently been introduced, very little of the actual 13/14 expenditure was approved through this delivery framework.
- ▶ Very little of the capital program has approved concept development statements in place. This is somewhat surprising as concept development statements are the means by which it is confirmed that there is a genuine need that requires investment to address and the percentages are lower than for business cases and technical reports which in the process should follow approval of a concept development statement. We acknowledge that ACTEW will likely use other justification documents to confirm the need for investment for the early part of its program that predate the new approval process.
- ▶ Very little of the capital program currently has an approved technical report in place. This is also somewhat surprising as ACTEW’s “Initiation and Approval Manual” states that technical reports are required for all projects with value (design and construction) greater than \$250k. Only 2% of the 2014/15 expenditure has an approved technical report and we consider it unlikely that much of the expenditure in this year will be under an approved technical report. Therefore, ACTEW needs to satisfy itself that it has adopted the most appropriate option with the lowest lifecycle cost through means outside of this approval framework.
- ▶ A reasonable proportion of the program (25%) currently has an approved business case in place. We consider that this will increase to cover the great majority of the program for the final three years of the regulatory period. However, we note that only 45% of the program for the current financial year has a business case in place. We understand that the business cases are where ACTEW commits to pursuing a preferred option and therefore is critical in the approval framework. Therefore, ACTEW needs to satisfy itself that the investment that is not covered by an approved business case is prudent and efficient.
- ▶ We note that for the last three years of the capital program, 87% (\$65M) of the total amount of capital expenditure that has an approved business case in place (\$75M) is covered by only four individual projects. Inspection of the most recent capital program indicates that there are 137 individual capital projects with expenditure >\$250,000 in the last three years of the capital program. Therefore, ACTEW has a large amount of work in front of it if it is to subject all of its capital program to its approval processes and we consider it unlikely that all expenditure can be approved through these processes in the time available.

given by ACTEW regarding the completeness of the spreadsheet when it was provide on 22 September 2014. The following analysis has not been able to be revisited.

This analysis shows that ACTEW has begun implementing its new approval processes and that it is likely to increase in coverage to capture the great majority of the capital expenditure program in the last three years of the regulatory period. We consider however that much of the expenditure in the transition period of 2014/15 will be unlikely to have an approved technical report in place under these new processes and therefore ACTEW needs to be satisfied that this expenditure is prudent and efficient through other documentation. We also note that ACTEW has already acted prudently by deferring its capital expenditure in the early years of the program. Its forecast capital expenditure for 2013/14 and 2014/15 is \$105M, only two thirds of the \$153M recommended by us as prudent and efficient. ACTEW stated that it has deferred some expenditure to ensure that it is approved through the new processes.

ACTEW stated further that it is seeking to improve its culture around capital delivery by promoting accountability, increasing reviews of project delivery and identifying where internal capability needs to be improved. Specific measures to support these objectives include:

- ▶ Project managers being required to present the documentation supporting capital investment to the Investment Review Committee and therefore demonstrate personal accountability.
- ▶ Monthly project health checks on a sample of projects. The health check tests both process compliance and achievement of outcomes.
- ▶ Investigating the root causes for departures from time, cost and quality and putting in place corrective actions to address these root causes.
- ▶ A Program Dashboard including performance metrics and a summary of program delivery status is reviewed monthly by the Investment Review Committee. We were provided with the July 2014 Dashboard. We note that this document states that *"The Program has seen significant revision since the Capital Works Program was submitted in May 2014. In conjunction with analysis being undertaken on the performance of our assets and the broader asset management improvement program, the Capital Works Program has been re-baselined for 2014-15. As a result, 20 projects were identified as not being critical to be complete this financial year and therefore can be deferred without increasing the risk profile of the business"*.

To complement our review of ACTEW's capital delivery processes, we also reviewed a small sample of business cases and technical reports and found them to be adequate to support the proposed expenditure. We also reviewed a sample of minutes from investment Review Committee meetings.

Based on our review of:

- ▶ ACTEW's recently implemented capital delivery framework
- ▶ The progress of investment being approved through this framework
- ▶ A sample of approval documentation.

We are satisfied that ACTEW has in place a reasonable governance framework for delving its capital expenditure. We also consider that the processes are generally sufficient to manage the risks in delivering its capital program as there is increased rigour in the development and approval of business cases and technical reports. However, we note that ACTEW faces a significant challenge to deliver its proposed level of expenditure for 2016/16 and 2017/8. We discuss this further in Section 4.8.

We note however that the current capital governance processes will not cover very much of the expenditure in the first two years of the regulatory period, particularly for technical reports. Further, we note that only a small number of business cases applying to the last three years of the review period (i.e. 2015/16, 2016/17 and 2017/18) have been approved. (The number approved is 17 according to the Word document of approved project codes and 19 if the approvals spreadsheet is used as the reference point although assumptions around timing of expenditure need to be made when referencing this source). Given that ACTEW's capital program includes 137 separate projects with expenditure >\$250k in 2015/16, 2016/17 and 2017/18, it has a significant amount of work to undertake if it wishes its capital program to be subject to the new governance framework. For this reason, we consider that there is material risk that ACTEW will not achieve its proposed capital expenditure program for the regulatory period.

4.5 Drivers of capital expenditure and analysis of capital expenditure program

We are required by the Panel to identify the major drivers of ACTEW's capital expenditure in the 2013/14 to 2017/18 regulatory period. For its initial submission to the 2012 Price Review, ACTEW adopted the following cost drivers:

- ▶ Renewal
- ▶ Growth
- ▶ Improvement (Regulation and efficiency)
- ▶ Non-system assets.

We noted in our 2012 review that ACTEW did not allocate components of capex projects amongst drivers and instead assigned the entirety of each project to a single driver. We concluded that analysis of the program by driver should be considered as a guideline only.

In its April 2013 submission, ACTEW provided an updated capital program, using the following revised drivers:

- ▶ Renewal
- ▶ Growth
- ▶ Regulation
- ▶ Efficiency.

In this revised submission, ACTEW still allocates expenditure to the major driver only. This is material, for example for the LMWQCC effluent filter construction and renewal project which comprises around 13% of the total capital program and has been allocated to growth but involves a significant amount of renewals expenditure.

For the purposes of identifying the drivers for the capital program, we have used the capital program provided by ACTEW on 24 September 2014 as this provides the most current picture. Table 4-6 provides a summary of ACTEW's capital program by driver. Table 4-7 provides a summary of ACTEW's capital program broken down by both service and driver. We have made some minor assumptions where the service or driver was not nominated in the capital program. For projects allocated as "both" water and sewer, we have allocated the expenditure 50/50 to each service. Figure 4-2 shows the profile of the capital expenditure program by driver.

Table 4-6 Total forecast capex in the 2013/14 to 2017/18 period by driver¹⁷

Driver	Capex in financial year (nominal)					Total	Proportion of total
	2013/14	2014/15	2015/16	2016/17	2017/18		
Efficiency	7.28	7.62	0.85	5.12	7.06	27.93	6.5%
Growth	16.09	10.27	20.15	61.37	34.37	142.25	33.0%
Regulation	0.81	1.09	5.76	18.23	29.68	55.57	12.9%
Renewal	18.80	43.07	56.78	49.94	36.98	205.56	47.7%
Total	43.0	62.1	83.5	134.7	108.1	431.3	

Table 4-7 Total forecast capex in the 2013/14 to 2017/18 period by service line and driver

Service and driver	Total capex (\$12/13 M)	Proportion of total (%)	Variance from 2013
Water			
Efficiency	16.85	3.9%	1.52
Growth	27.78	6.4%	-1.26
Regulation	14.05	3.3%	-2.77
Renewal	72.40	16.8%	-20.87

¹⁷ Data collated from ACTEW's supplied forecast capex program supplied on 24 September 2014

Service and driver	Total capex (\$12/13 M)	Proportion of total (%)	Variance from 2013
Allocation from "both" category	1.07	0.2%	
Allocation from unspecified categories	1.17	0.3%	
Subtotal - water	133.32	30.9%	
Sewerage			
Efficiency	8.03	1.9%	1.69
Growth	113.03	26.2%	-23.31
Regulation	41.52	9.6%	-9.14
Renewal	115.75	26.8%	13.71
Allocation from "both" category	1.07	0.2%	
Allocation from unspecified categories	1.17	0.3%	
Subtotal - sewerage	280.57	65.0%	
Total – water and sewerage	413.89	96.0%	
Corporate			
Efficiency	0.97	0.2%	
Growth	0.00	0.0%	
Regulation	0.00	0.0%	
Renewal	16.46	3.8%	
Total – corporate	17.43	4.0%	
Total – all categories	431.32	100.0%	

* Excludes projects in the "both" and "corporate" categories

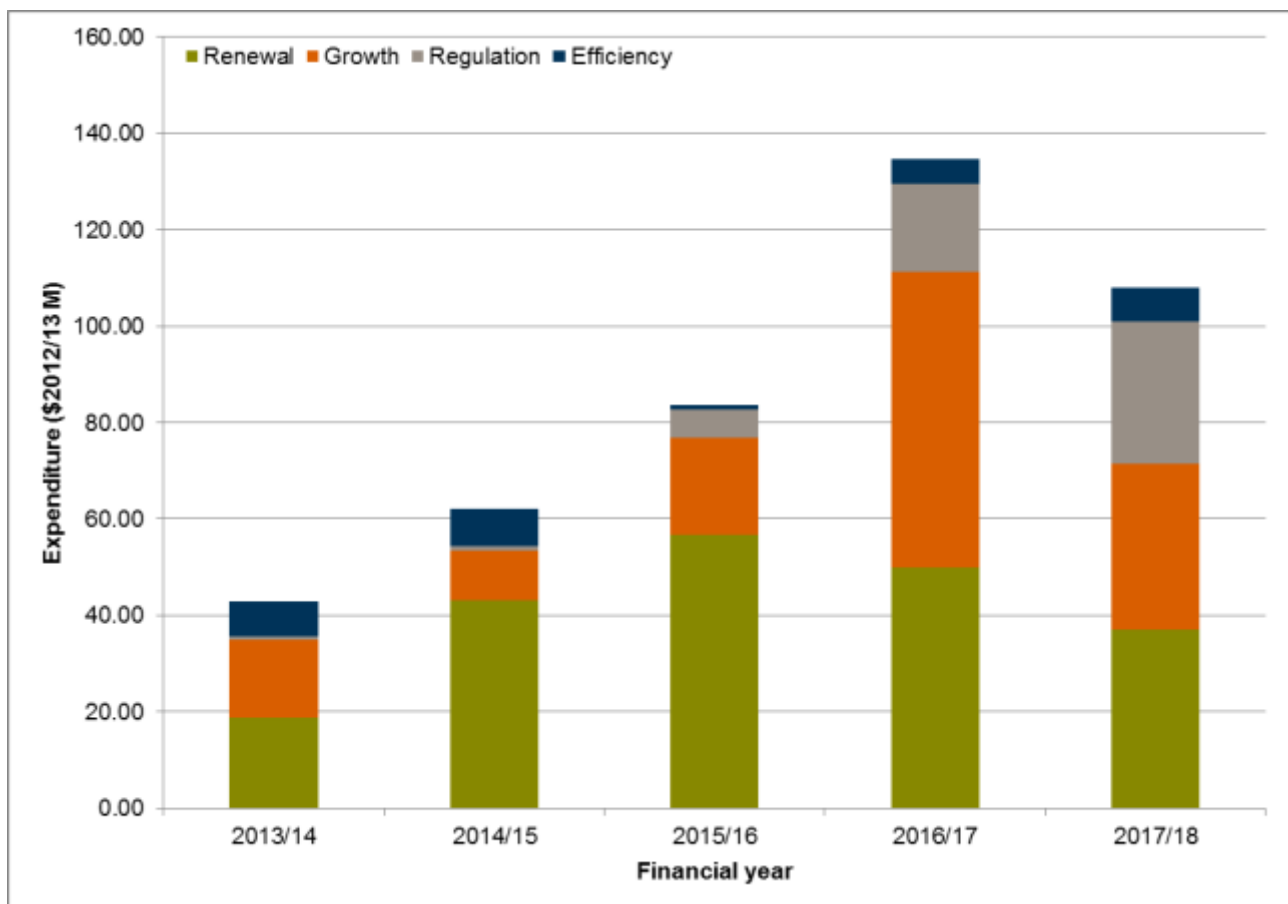


Figure 4-2 Total forecast capex in the 2013/14 to 2017/18 period by driver

Table 4-7 shows that expenditure on the water service is around half of that for the sewerage service in the regulatory period. Across both services, the major driver for capital expenditure is renewals, accounting for 48% of the total. Growth is the second largest driver, accounting for 33%. For the water service, renewals is the largest driver, totalling \$72M or 17% of the overall program. For the sewerage service, renewals (\$116M, 27%) is the largest expenditure category, slightly ahead of growth (\$113M, 26%). As noted, however, we caution these allocations are not rigorous and in particular, we believe that the allocation to the growth driver is overstated due to the inclusion of the LMWQCC filter renewal project entirely in the growth category.

ACTEW's capital program, as for most utilities, is lumpy, with the top ten projects by value accounting for over half of the total forecast expenditure in the regulatory period. These top ten projects, and the driver for each is detailed in Table 4-8.

Table 4-8 Top ten projects by total forecast capex in the 2013/14 to 2017/18 period

Rank	2012 rank	Project no.	Project description	Service line	Driver	Total forecast expenditure (\$2012/13)	Cumulative percentage of total forecast expenditure (%)
1	1	CX10534	LMWQCC - Additional Effluent Filters (2)	Sewerage	Growth	57,487,696	13
2	2 [†]	CX10011	Sewer Mains Rehabilitation 2014-15	Sewerage	Renewal	34,556,253	21
3	4	CX10066	Belconnen Trunk Sewer Augmentation Stage 1	Sewerage	Growth	22,117,032	26
4	3	CX10755	LMWQCC Aeration System Renewal	Sewerage	Renewal	20,981,030	31
5	6	CX10846	Fyshwick SPS Augmentation	Sewerage	Regulation	17,653,237	35
6	N/A [‡]	CX10889	MVIS and Fred Reardon Bypass Relining	.*	Renewal	17,067,585	39
7	5	CX10380	MVIS North Odour Control System	Sewerage	Growth	15,358,757	43
8	8	CX10844	Lake Tuggeranong Precinct SPS Augmentation	Sewerage	Regulation	15,334,188	46
9	7	CX10082	Corin Dam - Outlet Valves and Mains Relocation Stage 1	Water	Regulation	13,404,741	50
10	11	CX10847	Constitution Ave Trunk Sewer Augmentation	Sewerage	Growth	12,189,156	52
Cumulative total of top ten projects						226,149,675	52

To illustrate the lumpiness of the capital program further, Figure 4-3 shows a histogram of all projects in the capital program organised from highest total expenditure to lowest. The quartiles and cumulative percentage of total expenditure is also shown.

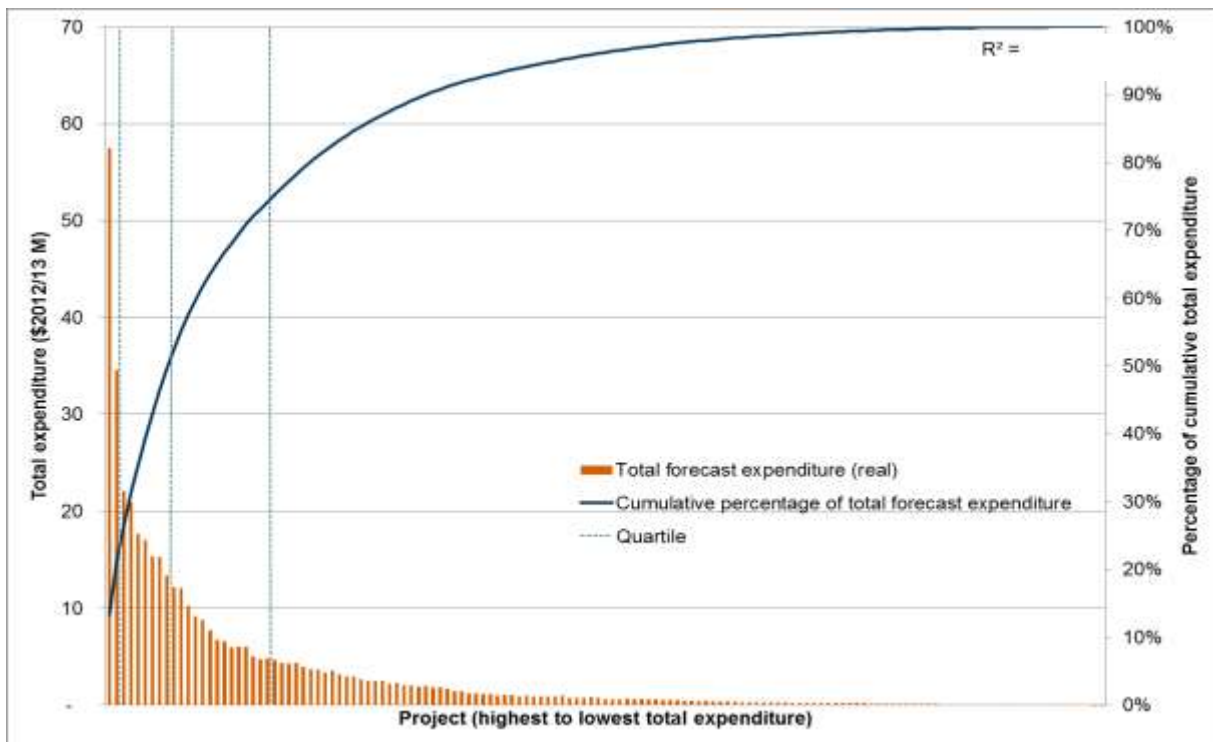


Figure 4-3 Distribution of total capex program in the 2013/14 to 2017/18 period

ACTEW has provided to us its most up-to-date capital expenditure program for the regulatory period. The profile of this latest expenditure program is compared with the recommended level of efficient capital expenditure made by us in our 2012 report and with that submitted by ACTEW in its 2014 Statement of Fact and Contentions in Figure 4-4.

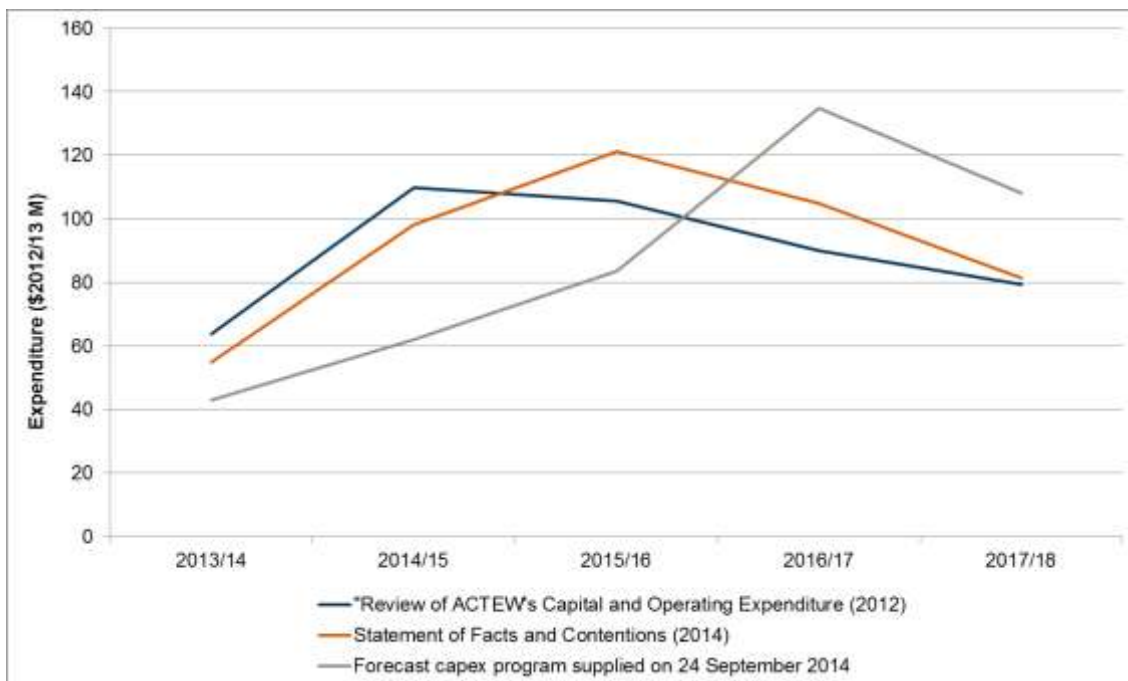


Figure 4-4 Comparison of proposed and forecast capital expenditure forecasts

The following observations can be made from Figure 4-4:

- ▶ Actual capex incurred in 2013/14 of \$43.0M is relatively well below the \$63.7M proposed by Cardno in our 2012 report and the \$54.9M forecast by ACTEW in its April 2013 response to the ICRC's Draft Report.

- ▶ This underspend is forecast to continue in 2014/15 and 2015/16. ACTEW expects that it will incur around \$90M less in capital expenditure in the first three years of the regulatory period compared to that proposed by us in 2012.
- ▶ However, there is a large peak of expenditure forecast for 2016/17. This peak is \$134.7M, more than 50% higher than the forecast expenditure for the prior year. This peak is the result of the underspend forecast for the earlier years of the program being pushed back to the later years of the program.
- ▶ As noted previously, the total amount of capital expenditure forecast by ACTEW across the regulatory period is around \$17M less than that recommended by in our 2012 report.

Figure 4-5 illustrates the changes to ACTEW's current capital expenditure program compared to its April 2013 Response.

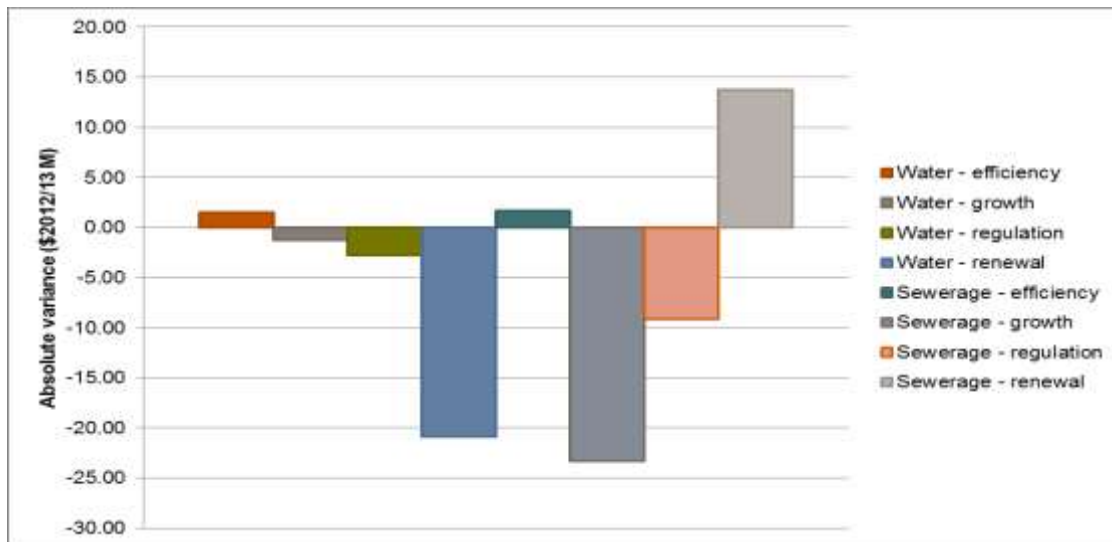


Figure 4-5 Variance in total forecast capex from the April 2013 submission (by service line and driver)

4.6 Real escalation factors for capital expenditure

As noted in Sections 1.4 and 1.5, ACTEW's capex forecast included in its Statement of Facts and Contentions was amended from its original July 2012 submission on the basis of accepting our efficiency factors and adjustments to the timing of its capex program. However, in its April 2013 submission (that remained as the basis for their July 2014 Statement), ACTEW contended that our proposed constant real escalation factor for capital expenditure of 1.02% per annum was not appropriate. ACTEW consequently commissioned an update from KPMG of its forecast for real capital cost inflation.

Table 4-9 summarises the proposed profile of real capital cost escalation proposed by ACTEW for its initial submission in 2012, proposed by us in our 2012 Review Report and proposed by ACTEW in April 2013. These forecasts are also charted in Figure 4-6. This figure also includes the most up to date ABS indices for road and bridge construction in New South Wales and non-residential building construction in the Australian Capital Territory.

Table 4-9 Comparison between Cardno's recommended and ACTEW's adopted real escalation factors for capital expenditure¹⁸

Source	Real escalation factor (%) in financial year							Cum.
	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	Average	
ACTEW's capital expenditure forecast as of July 2012	6.65	0.8	0.98	1.32	1.71	2.66	2.35	1.148
Cardno's recommendation in the November 2012 report	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.063

¹⁸ Adapted from Table 1.13 of the Response

ACTEW's capital expenditure forecast as of 30 April 2013	1.47	0.68	1.46	0.68	0.68	0.78	0.96	1.059
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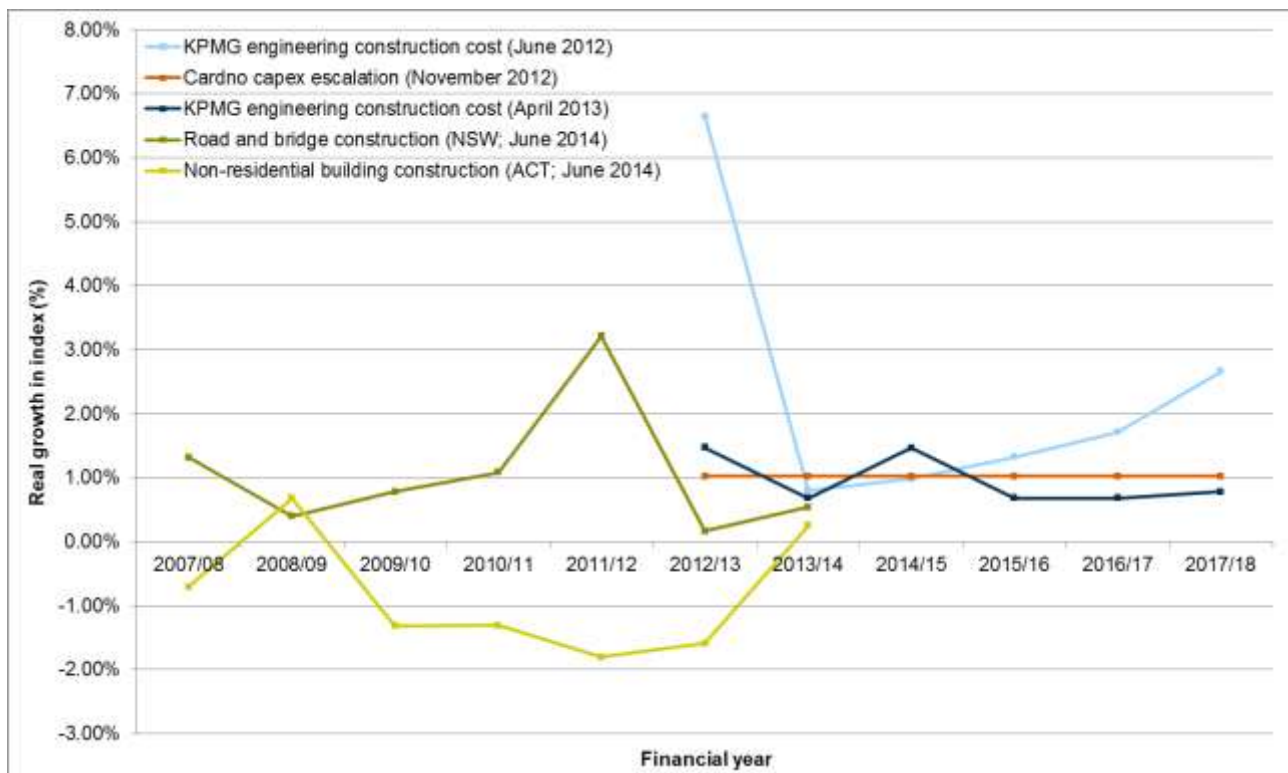


Figure 4-6 Comparison of capex escalation and construction indices from 2007/08 to 2017/18

It can be concluded from Table 4-9 and the general trends observed in Figure 4-6 that ACTEW's currently adopted real escalation factors are much less than those originally proposed and are closer to the constant real escalation factor of 1.02% recommended in our 2012 report. On average, the set of real escalation factors applied by ACTEW over the 2012/13 to 2017/18 period are 0.06% less (in absolute terms) than our previously suggested escalation factor. Furthermore, the peak encountered in ACTEW's initially submitted escalation factor for the 2012/13 financial year was reduced considerably to generate a more stable profile.

Comparing ACTEW's revised real escalation forecast to the actual values of the Roads and Bridges and Non-residential Construction indices, it can be seen that the ACTEW forecast is above both actually recorded indices in 2012/13 and 2013/14 (the indices forecast by us in 2012 are also above these actual values). However, the trends have converged in 2013/14, particularly for the Roads and Bridge Construction Cost Index. We consider this index to be the most relevant historic index for ACTEW's capital costs.

Based on this analysis, we consider that ACTEW's revised forecast for real capital cost escalation as submitted in April 2013 and subsequently in its 2014 Statement of Facts and Contentions is not unreasonable.

It should be noted that real capital cost escalation factors are only directly relevant when considering ACTEW's capital program as submitted in April 2013 and the slightly revised version submitted with its 2014 Statement of Facts and Contentions. The most recent version of its capital expenditure program provided on 24 September 2014 included expenditure in nominal terms.

4.7 Sewerage capital expenditure specific projects

It is clear from Table 4-7 in Section 4.5 that the sewerage projects proposed to be undertaken in the period from 2013/14 to 2017/18 compose the majority (specifically, 65%) of ACTEW's future capex program and are hence the primary portion of expenditure. Given that ACTEW's annual capex forecast peaks above historical averages in 2015/16 and 2016/17, and that the ICRC's Final Decision and acceptance of ACTEW's forecast is limited to the financial years of 2013/14 and 2014/15, the Panel has requested us to advise them on the prudence and efficiency of ACTEW's sewerage capex forecast. We have therefore included in this section a review of specific projects at the LMWQCC, which constitute \$82M (19%) of the total capital program over the 2013/14 to 2017/18 period. Table 4-10 summarises the initial budget and forecast outturn for each of these three projects.

Table 4-10 Initial budget, outturn and variance for specific LMWQCC capex projects¹⁹

Project no.	Project name	Expenditure	Capex							
			Prior to 2013/14	2013/14	2014/15	2015/16	2016/17	2017/18	After 2017/18	Total
CX10534	LMWQCC Tertiary System Upgrade	Initial budget (\$2012/13 M)	*1.97	1.69	7.83	32.59	21.55	11.79	0	77.42
		Actual* and forecast outturn (\$2012/13 M)	*1.97	*2.26	2.18	4.82	35.90	12.32	10.62	70.08
		Absolute variance (\$2012/13 M)	0.00	0.57	- 5.65	- 27.77	14.35	0.53	10.62	- 7.34
		Percentage variance (%)	0	34.0	- 72.2	- 85.2	66.6	4.5	N/A	- 9.5
CX10677	LMWQCC Solids Handling Upgrade	Initial budget (\$2012/13 M)	*1.83	0	0	0	0	5.14	0	6.97
		Actual* and forecast outturn (\$2012/13 M)	*1.83	*3.08	0.91	0	0	0	0	5.82
		Absolute variance (\$2012/13 M)	0	3.08	0.91	0	0	- 5.14	0	- 1.15
		Percentage variance (%)	0	N/A	N/A	N/A	N/A	- 100	N/A	- 16.5
CX10755	LMWQCC Aeration System Renewal	Initial budget (\$2012/13 M)	0	1.41	13.06	9.46	0.13	0	0	24.06
		Actual* and forecast outturn (\$2012/13 M)	0	0	4.09	16.89	0	0	0	20.98
		Absolute variance (\$2012/13 M)	0	- 1.41	- 8.97	7.43	- 0.13	0	0	- 3.08
		Percentage variance (%)	N/A	- 100	- 68.7	78.5	- 100	N/A	N/A	- 12.8

Table 4-11 summarises information presented to us by ACTEW on the delivery of each of these three projects, including progress against forecast delivery milestones and reasons for variance from these milestones.

¹⁹ Adapted from a presentation to Cardno by ACTEW (4 September 2014)

Table 4-11 Project delivery status and comments regarding specific LMWQCC projects²⁰

Project no.	Project name	Key performance indicator (KPI)/milestone	Initial completion date	Forecast completion date	ACTEW's comments on project delivery
CX10534	LMWQCC Tertiary System Upgrade	Completion of preliminary design phase	August 2014	June 2015	Behind schedule but below budget due to: ▸ increased prudency ▸ identification of additional work (power supply and dam stabilisation) ▸ resourcing issues between ACTEW and the consultant.
		Completion of detailed design phase	December 2015	July 2016	
		Complete construction of new filters (2)	September 2016	June 2017	
		Complete refurbishment of existing filters (4)	April 2018	October 2018	
CX10677	LMWQCC Solids Handling Upgrade	Completion of preliminary design phase	July 2015	June 2015	▸ Excessive exceedances of the air emissions licence have led to the ICRC-determined budget being brought forward from 2017/18 to enable completion of the preliminary design. ▸ An element of the preliminary design scope is to identify immediate process improvements to deliver a reduction in exceedances.
		Completion of detailed design phase	August 2016	October 2016	▸ An extended detailed design phase is proposed but there will be a reduction in the project's overall capex program due to a reduction in the overriding scope.
		Complete construction works	April 2021	July 2019	N/A
		Miscellaneous comments:			▸ Resourcing reductions within ACTEW have resulted in a "slippage" to the project's capex program in certain areas. ▸ The use of Computational Fluid Dynamic (CFD) Modelling is currently optimising the project's scope and associated capex.
CX10755	LMWQCC Aeration System Renewal	Submit construction business case	May 2014	February 2015	▸ Issues with power supply to the LMWQCC led to additional works in relation to blower selection and design.
		Practical completion of blowers installation	February 2016	May 2016	▸ A lengthy blower selection analysis was undertaken to ensure the selected blower type would deliver value to ACTEW.

Key for Table 4 11	
	On target/ahead of schedule
	Behind schedule
	Target deadline missed

²⁰ Adapted from a presentation to Cardno by ACTEW (4 September 2014)

Figure 4-7, Figure 4-8 and Figure 4-9 show the initial budget profile for each of these projects compared to the most current forecast. Note that each vertical axis is to a different scale.

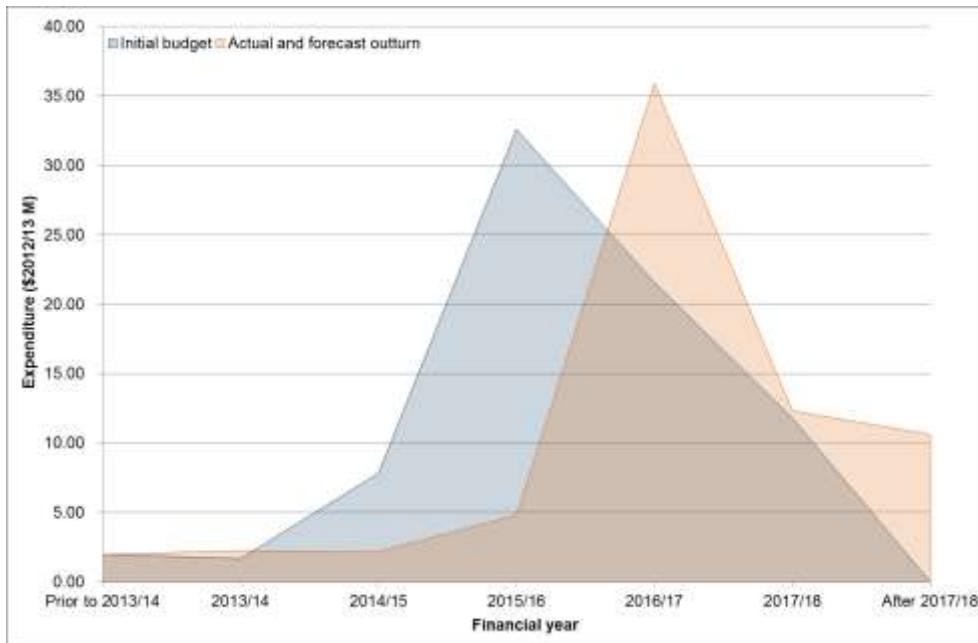


Figure 4-7 Capex profile for CX10534

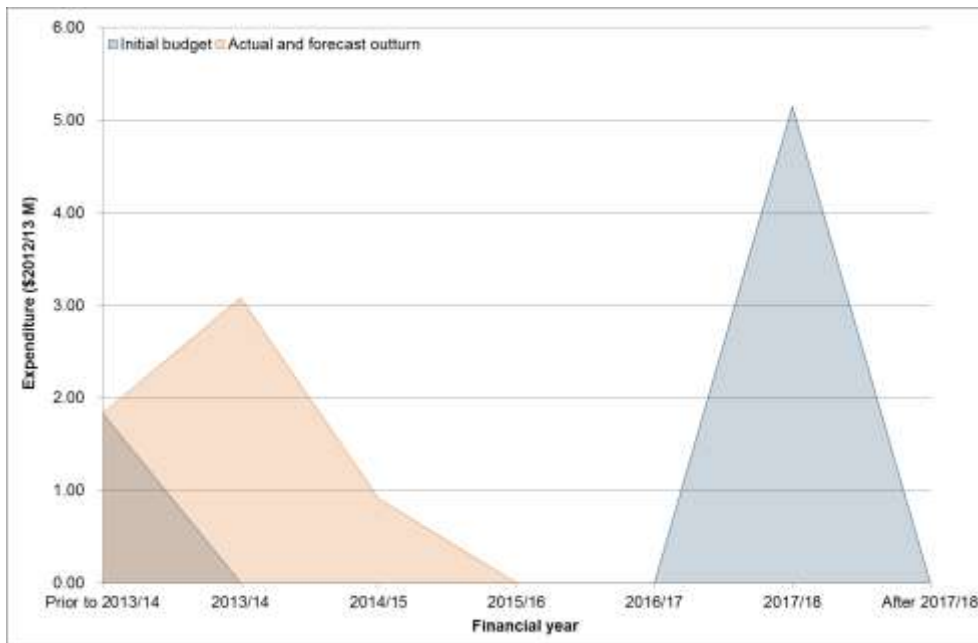


Figure 4-8 Capex profile for CX10677

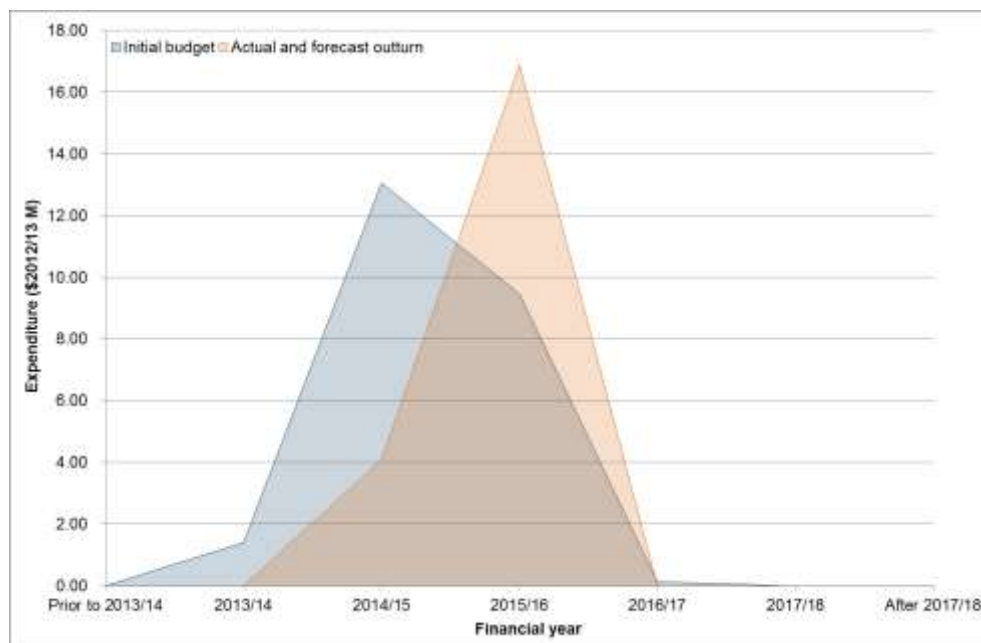


Figure 4-9 Capex profile for CX10755

The following observations can be made in considering the above information on delivery of these three projects:

- ▶ Expenditure on CX10534 and CX10755 is generally forecast to slip by one year. Expenditure for CX10677 was brought forward a number of years but this amount is small compared to the total of the other two projects.
- ▶ The forecast outturn for each project is around or just under the initial budget total.
- ▶ Delays are attributed by ACTEW to increased time spent in justifying the investments and ensuring that adequate investigation is undertaken to select the most appropriate option.

We consider that ACTEW is acting prudently in delaying the delivery of these projects. ACTEW stated that it intends to prepare a procurement strategy for the capital works at the LMWQCC to help realise efficiencies and ensure that the significant works can be carried out in parallel.

4.8 Further consideration of expenditure in 2016/17 and 2017/18

The preceding analysis has highlighted that:

- ▶ For the first two years of the regulatory period, ACTEW forecasts significant underspend of its capital program against its original forecasts. The underspend in the first two years is forecast at around \$50M.
- ▶ ACTEW's most current capital expenditure program has significant peaks of expenditure in 2016/17 and 2017/18 as some of this underspend is 'caught up'. However, the current program is in total less than that proposed by ACTEW in April 2013 and recommended by us in our 2012 report.
- ▶ There has been slippage in the projected delivery of the program as a whole and in the large value projects at the LMWQCC.
- ▶ ACTEW has implemented a new capital delivery framework. Most of the expenditure proposed for 2016/17 and 2017/18 has not been approved through this framework.

These factors suggest that there is significant risk to the successful delivery of the capital program towards the end of the review period. We have analysed expenditure in more detail in these two years and have determined:

- ▶ The total forecast capital expenditure is \$242M across 51 projects.

- ▶ The average expenditure across the two years of \$121M per annum is around 50% higher than in the next highest year, 2015/16.
- ▶ The largest ten projects in these two years constitute \$169M or 70% of the total expenditure.

We consider that the observed trends in ACTEW's capital expenditure program, i.e. underspend at the beginning of the program followed by a peak of expenditure at the end of the program substantially above preceding years, reflects the combination of a number of factors:

- ▶ Prudent action by ACTEW to delay some expenditure in the first two years of the program while it improved its capital governance processes.
- ▶ Prudent action by ACTEW to extend the coverage of the new governance processes to as much as the program as possible rather than relying on previous project justifications and options assessment.
- ▶ Organisational change following the separation of ACTEW Water which has only in the last 6-12 months led to the current structure for capital delivery.

A key question arising out of the observed changes in the level and profile of ACTEW's capital program and the proposed reasons for these changes is: to what extent does the observed deferral of expenditure present an unacceptable increase in risk to ACTEW's service delivery? The alternative is that the deferral of expenditure reflects a greater understanding by ACTEW of its risk profile and that the deferred projects are unlikely to be progressed within the review period.

While we acknowledge that ACTEW faces greater risk to its service delivery through the observed deferral of projects, we also consider that some of the items of expenditure that constitute the peaks in 2016/17 and 2017/18 are unlikely to be required by ACTEW in the review period because of its improved understanding of the risks it faces as a business. That is, some of the expenditure is unlikely to be considered prudent for delivery in the proposed timeframe. A further consideration is that the peaks of expenditure in these two years, which is on average 50% higher than the preceding year, will create challenges for ACTEW's planning, design and procurement teams to be resourced appropriately to meet the significant increases in workload. Even though the expenditure in these years is lumpy with a small number of projects contributing the bulk of the program, the observed increase for 2016/17 and 2017/18 is a step change rather than a smooth increase.

Based on the above considerations, we believe that the prudent and efficient level of capital expenditure in 2016/17 and 2017/18 for ACTEW is lower than that proposed in its most recent capital program. We understand that in drawing this conclusion we face considerable information asymmetry and that the scope of our work has not allowed a thorough review of the revised capital program. Therefore, we have taken a cautious approach to identify the quantum of expenditure that is unlikely to be prudent and efficient for ACTEW to deliver in the proposed timeframe.

Our approach has been to employ the information provided to us by ACTEW to identify projects 'at risk' of not being prudent and efficient to be delivered in 2016/17 and 2017/18. To do this, we have used a number of indicators that we consider are flags for 'at risk' projects:

- ▶ Whether a business case (either design or construction) has been approved. For this analysis, we have used both sources of approvals information provided by ACTEW to ensure completeness. We found that 11 of the 51 projects in these two years currently have an approved business case. The approved business cases are for the largest projects however and therefore cover \$100M of expenditure in these years. This means that there is \$143M or 59% of the expenditure that does not yet have an approved business case. At this point in time, there is 21 months until the beginning of 2015/16. Time is also required for procurement and contractor mobilisation before construction can commence.
- ▶ Whether the amount of expenditure in 2016/17 and 2017/18 is greater than \$5M. A larger value of expenditure will generally indicate a more challenging or complex project to construct. There are 15 projects with value greater than \$5M and these account for \$198M or 82% of all expenditure in these two years.
- ▶ Whether more than 80% of the project expenditure occurs in 2016/17 and 2017/18. Design and other preliminary costs typically account for around 20% of capital costs. Therefore, this metric identifies projects where limited planning and design occurs before 2016/17. There are 34 projects where there is

more than 80% of the expenditure in these last two years and these projects total \$132M or 55% of the total.

As noted, this analysis has been limited by the time available to review ACTEW's most up to date capital program. We also acknowledge that the chosen metrics for assessing 'at risk' projects are coarse and do not account for the specific scope of works or circumstances related to each project. However, we are comfortable that at an aggregate level, they provide a useful insight into ACTEW's capital program.

To further refine the analysis, we identified the projects that are flagged by all three measures. There are nine projects that meet all three criteria with total expenditure of \$87M in 2016/17 and 2017/18. We consider that this is a reasonable estimate of the total amount of expenditure that is most 'at risk' of not being prudent and efficient for delivery in 2016/17 and 2017/18.

We have stated in Section 4.4 that we consider that ACTEW has in place a reasonable governance framework for delving its capital expenditure and that we believe that these processes are generally sufficient to manage the risks in delivering its capital program. We also found in our meetings with ACTEW that it has made changes to its organisational structure to better support the delivery of capital expenditure prudently and efficiently. However, we consider that, on balance, reductions to ACTEW's planned capital expenditure for 2016/17 and 2017/18 are justified.

We suggest that \$20M, or around a quarter of the amount of expenditure that was flagged under all three measures, is at most significant risk of not being prudent and efficient. We therefore suggest that the prudent and efficient level of capital expenditure is as per ACTEW's most up to date capital program (as provided on 24 September 2014) but less \$10M in 2016/17 and \$10M in 2017/18.

We note that this assessment does not in any way preclude ACTEW from delivering the capital projects it considers to be prudent and efficient to deliver service to its customers.

The analysis of the capital program for 2016/17 and 2017/17 is summarised in Table 4-12.

Table 4-12 Analysis of capital expenditure in 2016/17 and 2017/18

Ref	Project	Driver	Service	Total (\$12/13)	Total in 16/17 and 17/18 (\$12/13)	% of total in 16/17 and 17/18	No business case		Value >\$5M		>80% spend in 16/17 and 17/18		All three risk indicators	
							No.	\$12/13	No.	\$12/13	No.	\$12/13	No.	\$12/13
CX10011	Sewer Mains Rehabilitation 2014-15	Renewal	Sewerage	34,556,253	16,904,765	48.9%			X	16,904,765				
CX10029	Minor Sewer Mains Augmentation (CX10027-CX10031) 2013/18	Growth	Sewerage	2,519,074	2,519,074	100.0%	X	2,519,074			X	2,519,074		
CX10066	Belconnen Trunk Sewer Augmentation Stage 1	Growth	Sewerage	22,117,032	14,216,211	64.3%	X	14,216,211	X	14,216,211				
CX10082	Corin Dam - Outlet Valves and Mains Relocation Stage 1	Regulation	Water	13,404,741	12,920,438	96.4%	X	12,920,438	X	12,920,438	X	12,920,438	X	12,920,438
CX10114	Mains Replacement Programme	Renewal	Water	6,560,864	3,640,273	55.5%	X	3,640,273						
CX10149	Meter Replacement Programme 2013/18 (meter replacement only)	Renewal	Water	9,160,304	5,541,962	60.5%			X	5,541,962				
CX10380	MVIS North Odour Control System	Growth	Sewerage	15,358,757	14,390,151	93.7%			X	14,390,151	X	14,390,151		
CX10382	Odour Scrubbers - Western Broadacre Stage 1	Regulation	Sewerage	2,668,823	131,392	4.9%								
CX10398	Sewer Network Ventilation Improvements	Efficiency	Sewerage	933,530	933,530	100.0%	X	933,530			X	933,530		
CX10534	LMWQCC - Additional Effluent Filters (2)	Growth	Sewerage	57,487,696	48,225,917	83.9%			X	48,225,917				
CX10636	Fyshwick STP Upgrade	Renewal	Sewerage	10,248,967	9,547,193	93.2%	X	9,547,193	X	9,547,193	X	9,547,193	X	9,547,193
CX10727	Service Reservoirs Roof Repairs	Renewal	Water	7,694,242	6,725,636	87.4%	X	6,725,636	X	6,725,636	X	6,725,636	X	6,725,636
CX10737	Water General Defects Rectification for Capex Projects	Efficiency	Water	18,403	8,944	48.6%								
CX10738	Sewer General Defects Rectification for Capex Projects	Efficiency	Sewerage	140,793	35,775	25.4%								
CX10780	Water Pump Station Renewals Programme 2013-18	Renewal	Water	3,395,506	3,223,195	94.9%	X	3,223,195			X	3,223,195		
CX10781	Sewer Pump Station Renewals Programme 2013-18	Renewal	Sewerage	2,943,905	2,442,638	83.0%	X	2,442,638			X	2,442,638		
CX10782	Renolyds Reservoir	Growth	Water	882,945	882,945	100.0%	X	882,945			X	882,945		
CX10789	Water Treatment Plants EIM&C Assets Renewal Program	Renewal	Water	6,742,618	6,045,776	89.7%	X	6,045,776	X	6,045,776	X	6,045,776	X	6,045,776
CX10793	Stromlo WTP backwash system Renewal	Renewal	Water	792,311	541,678	68.4%	X	541,678						
CX10795	Stromlo WTP chlorine dosing system renewal	Renewal	Water	4,345,733	1,974,011	45.4%	X	1,974,011						
CX10796	Googong WTP Sludge Disposal Sysyem Assets Renewal Program 2013/18	Renewal	Water	894,551	894,551	100.0%	X	894,551			X	894,551		
CX10798	Googong WTP Clarifier System Assets Renewal Program	Renewal	Water	632,246	632,246	100.0%	X	632,246			X	632,246		
CX10799	Googong WTP chlorine dosing system renewal	Renewal	Water	5,945,045	5,188,504	87.3%	X	5,188,504	X	5,188,504	X	5,188,504	X	5,188,504
CX10801	Googong WTP Stage 1 Filter Media and Diffusers Renewal -one bed only in 17/18	Renewal	Water	1,892,098	1,892,098	100.0%	X	1,892,098			X	1,892,098		
CX10803	Observatory pump renewal	Renewal	Water	631,038	631,038	100.0%	X	631,038			X	631,038		
CX10804	Stromlo WTP pathogen upgrade	Regulation	Water	271,346	271,346	100.0%	X	271,346			X	271,346		
CX10809	Stromlo WTP organics management upgrade - design	Growth	Water	631,038	631,038	100.0%	X	631,038			X	631,038		
CX10810	Stromlo WTP services corridor	Efficiency	Water	5,082,103	5,082,103	100.0%	X	5,082,103	X	5,082,103	X	5,082,103	X	5,082,103
CX10812	Stromlo WTP site drainage	Efficiency	Water	1,139,071	1,038,818	91.2%	X	1,038,818			X	1,038,818		
CX10815	Googong WTP pathogen upgrade	Regulation	Water	271,346	271,346	100.0%	X	271,346			X	271,346		
CX10817	Googong WTP potable and local area supply	Growth	Water	3,742,802	1,256,998	33.6%	X	1,256,998						
CX10819	Googong WTP algal metabolite management - design	Growth	Water	504,424	504,424	100.0%	X	504,424			X	504,424		
CX10820	Googong pH adjustment upgrade - design	Growth	Water	1,020,613	1,020,613	100.0%	X	1,020,613			X	1,020,613		
CX10821	LMWQCC Service Air Renewal Programme	Renewal	Sewerage	927,734	625,044	67.4%	X	625,044						
CX10824	LMWQCC Chlorination & De-Chlorination Assets Renewal Programme	Renewal	Sewerage	894,500	894,500	100.0%	X	894,500			X	894,500		
CX10825	LMWQCC Chemical Dosing System Assets Renewal Programme	Renewal	Sewerage	2,201,519	1,950,886	88.6%	X	1,950,886			X	1,950,886		
CX10827	LMWQCC EIM&C Renewal Programme	Renewal	Sewerage	4,665,045	2,393,908	51.3%	X	2,393,908						
CX10844	Lake Tuggeranong Precinct SPS Augmentation	Regulation	Sewerage	15,334,188	13,396,975	87.4%	X	13,396,975	X	13,396,975	X	13,396,975	X	13,396,975
CX10845	Lake Burley Griffin & Cotter Precinct SPS Augmentation	Regulation	Sewerage	4,262,236	3,770,994	88.5%	X	3,770,994			X	3,770,994		
CX10846	Fyshwick SPS Augmentation	Regulation	Sewerage	17,653,237	17,151,970	97.2%	X	17,151,970	X	17,151,970	X	17,151,970	X	17,151,970
CX10847	Constitution Ave Trunk Sewer Augmentation	Growth	Sewerage	12,189,156	11,186,622	91.8%	X	11,186,622	X	11,186,622	X	11,186,622	X	11,186,622
CX10850	Cotter SPS Flood Protection	Efficiency	Sewerage	236,944	236,944	100.0%	X	236,944			X	236,944		
CX10851	Renolyds Reservoir - Mains Connection	Growth	Water	126,208	126,208	100.0%	X	126,208			X	126,208		
CX10854	North Molonglo Mains Connections	Growth	Water	781,776	781,776	100.0%	X	781,776			X	781,776		
CX10855	Water Mains Relocations	Efficiency	Water	4,755,412	4,258,504	89.6%	X	4,258,504			X	4,258,504		
CX10857	Stromlo Bulk Water supply main valve renewal	Renewal	Water	415,223	415,223	100.0%	X	415,223			X	415,223		
CX10865	Stromlo WTP Base Station Radios-Relocation	Efficiency	Water	592,361	592,361	100.0%	X	592,361			X	592,361		
CX10876	Unplanned Minor Water Capital Works Programme 2013/18	Renewal	Water	1,797,724	806,104	44.8%								
CX10881	Unplanned Minor Sewer Capital Works Programme 2013/18	Renewal	Sewerage	1,651,041	806,104	48.8%								

Ref	Project	Driver	Service	Total (\$12/13)	Total in 16/17 and 17/18 (\$12/13)	% of total in 16/17 and 17/18	No business case		Value >\$5M		>80% spend in 16/17 and 17/18		All three risk indicators	
							No.	\$12/13	No.	\$12/13	No.	\$12/13	No.	\$12/13
CX10888	Minor Assets Acquisition Program	Renewal	Corporate	4,364,539	1,609,882	36.9%								
CX10889	MVIS and Fred Reardon Bypass Relining	Renewal	Sewerage	17,067,585	11,594,568	67.9%			X	11,594,568				
Total				-	242,765,196			142,709,632		198,118,790		132,451,661		87,245,216

4.9 Recommended operating and capital expenditure

We are required to provide advice on ACTEW's capital and operating expenditure forecasts and in doing so, consider the circumstances (including the information available) prevailing at the time of the ICRC's Final Decision, i.e. June 2013.

We have noted in Section 4.3 that we consider that the operating expenditure forecast submitted by ACTEW in its April 2013 Response is prudent and efficient based on the analysis able to be completed. This recommended level of expenditure is set out in Table 4-13.

Table 4-13 Recommended prudent and efficient operating expenditure

	2013/14	2014/15	2015/16	2016/17	2017/18	Total
Recommended efficient operating expenditure (\$12/13)	127.4	129.1	127.9	128.1	129.7	642.2

Considering the information available in June 2013, we conclude that ACTEW's prudent and efficient level of capital expenditure for the period 2013/14 and 2017/18 is as recommended in our 2012 Review Report. This is because ACTEW did not submit any information in its April 2013 Response that alter our conclusions. This expenditure profile is set out in Table 4-14.

Table 4-14 Recommended prudent and efficient capital expenditure

	2013/14	2014/15	2015/16	2016/17	2017/18	Total
Recommended prudent and efficient capital expenditure (\$12/13)	63.7	109.9	105.6	90.0	79.4	448.6

The scope of works also requires that if there is any substantive change in circumstances then this should be documented. ACTEW has submitted its most recent capital expenditure program which shows that it forecasts that its expenditure for the period to 2017/18 will be \$431M, some \$17M less than that recommended by us in 2012, with a profile that has considerably changed, having large peaks of expenditure in 2016/17 and 2017/18. We consider this to constitute a substantive change in circumstances from those prevailing in June 2013.

As set out in Section 4.8, we consider that a prudent and efficient level of capital expenditure based on the information presently available is as per ACTEW's current capital program, less \$10M in both 2016/17 and 2017/18. This recommended capital expenditure profile is set out in Table 4-15.

Table 4-15 Recommended prudent and efficient capital expenditure based on current information

	2013/14 (Actual)	2014/15	2015/16	2016/17	2017/18	Total
ACTEW's current capital expenditure forecasts (\$12/13)	43.0	62.1	83.5	134.7	108.1	431.3
Less adjustment for expenditure at risk of delivery (\$12/13)				-10.0	-10.0	-20.0
Recommended prudent and efficient capital expenditure (\$12/13)	43.0	62.1	83.5	124.7	98.1	411.3

5 Task 2: ACTEW's water sales forecasts for 2013/14 to 2017/18

5.1 Scope of works

As specified in the Panel's Terms of Reference, Task 2 consists of two activities:

- a. A review of ACTEW's methodology for forecasting water sales and advice as to whether this methodology and the demand forecasts produced are reasonable for the purposes of setting prices.
- b. Provision of alternative water sales forecasts broken down into Tier 1 and Tier 2 consumption levels, if the consultant concludes that ACTEW's forecasts are not reasonable. Tier 1 is defined as water demand between 0-548 litres per day per connection (~200 kL per annum), while Tier 2 is defined as demand in excess of 548 litres per day per connection (>200 kL per annum).²¹

In assessing ACTEW's water sales forecasts the consultant is required to conduct a review of ACTEW's water sales forecast model and provide advice on the:

- ▶ suitability and adequacy of the model or approach to developing the water sales forecasts
- ▶ suitability and adequacy of the data and information used
- ▶ suitability of the assumptions, particularly for water savings from water restrictions (if applicable), and demand management and water conservation programs
- ▶ application of the methodology
- ▶ the balance between the use of historical trends and key drivers in generating the forecasts.

If the consultant considers that ACTEW's water sales forecasts are not sufficiently robust for the Panel's purposes, the consultant should prepare revised, independent, annual financial year forecasts for ACTEW's water sales (Tier 1 and Tier 2) over the period 1 July 2013 to 30 June 2018. Like the test applied to ACTEW's forecasts, the alternative forecasts should satisfy the reasonableness test.

5.2 Research

5.2.1 South East Queensland

To inform our 2012 review of ACTEW's demand forecast model, we have included a brief case study of South East Queensland's (SEQ) residential water consumption following the relaxation and eventual elimination of water restrictions. These restrictions were enforced as a result of SEQ experiencing the worst drought in the region's recorded history in terms of both length and reduced run-off: the 2001 to 2009 Millennium Drought. Dam levels reached a low of 13.5% in August 2007, with level 6 water restrictions being imposed from November 2007 until July 2008²². In May 2009, Wivenhoe, Somerset and North Pine Dams reached 60 per cent of their combined capacity, signalling an end to the water security crisis for SEQ. (The drought broke in ACT around September 2010.)

From mid-2007 until mid-2009, average residential water consumption in areas under Queensland Water Commission restrictions was 131 L/person/d. Prior to the imposition of restrictions in mid-2005, average residential water consumption in SEQ was 282 L/person/d. This was similar to the demand during the same period in the ACT, assuming 2.5 persons per property²³.

²¹ It may be relevant to review the approach adopted by ICRC when allocating water sales between these two tiers.

²² SEQ Water Strategy, Queensland Water Commission (QWC), 2010

²³ This is a rounding down of the average ACT household size of 2.6 reported in the 2011 Census

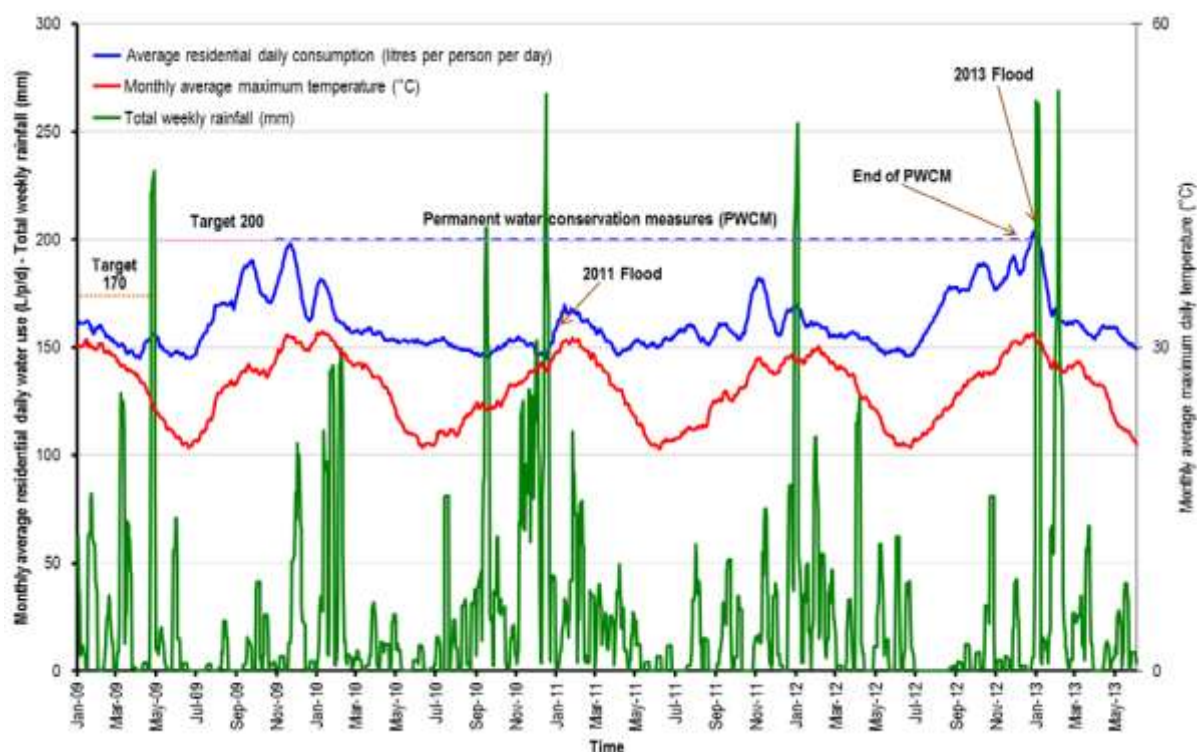


Figure 5-1 Average daily residential water consumption and variation with weather in South East Queensland from Jan 2009 to May 2013

[Source: DEWS²⁴]

In our previous analysis, when SEQ water consumption data was available for the period from January 2009 to September 2012, we noted that the cumulative average residential demand remained at its June 2009 level of around 155 L/p/d for two years. From June 2011 to September 2012, the average demand rose slightly to 157 L/p/d. Average demand grew further at the end of the dataset, in approximately mid-September 2012, to reach 179 L/p/d (a 15% increase over the period when high level restrictions were in place). This increase was initially considered to be the post-restriction behavioural “bounce-back”. However, this level of consumption followed a six-week period where only 0.4 mm of rain fell, with September traditionally being the period of highest external water usage, and so weather could not be excluded as the principle driver behind the increase.

Now, with data accessible to May 2013 (Figure 5-1), we see that the average residential demand in SEQ continued to escalate post-September 2012 and peaked at over 200 L/p/d in January 2013. This, however, can be predominately attributed to the observed recurring seasonal fluctuation in water demand, where there is heightened consumption during the summer.

²⁴ SEQ Water Strategy: Annual Report, 2013

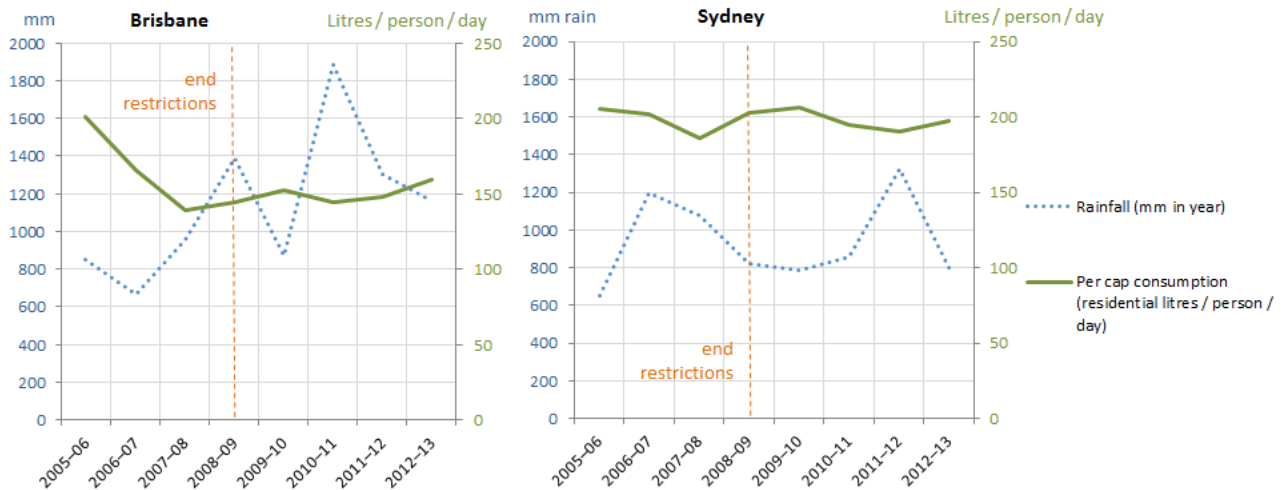


Figure 5-2. Brisbane and Sydney; residential per capita demand

[Source: National Water Commission, National Performance reports indicators W8, C1, Bureau of Meteorology]

From the available information, it appears that after nearly three and a half years, the average residential consumption per person the SEQ has not changed markedly since high level water restrictions were imposed – perhaps due to the high rainfall in recent years. We note that the Queensland Water Commission is planning for a significant “rebound” in consumption, allowing for residential demand of up to 230 litres per person²⁵, per day, but operating to a target of 200.

The average consumption data for Brisbane in the National Water Commission National Performance reports shows that that customer behaviour developed during the severe drought may be embedded for a significant period following the drought. This supports the ICRC hypothesis that long periods of restrictions and highly publicised water shortages can result in a “structural break” in consumption patterns.

5.2.2 Sydney

Sydney is another city which suffered water shortages and the imposition of restrictions between 2003 and 2009. This resulted in a sharp decrease in per capita consumption – indeed one of Sydney Water’s operating licence requirements (WC1) is that overall water abstractions are limited to 329 litres per person, per day.

Abstractions include water for industry and leakage; the average residential consumption in Sydney per property is around 182 kl per year, or 200 litres per person (see Figure 5-2) per day assuming 2.5 occupants per property. The operating licence target for Sydney may be “weather corrected”, allowing for season fluctuations to demand. Sydney Water Corporation’s performance is presented below in Figure 5-3.

²⁵ The South East Queensland Water Strategy (QWC, 2010) cites two examples of rebound where permanent reductions of 10%-5% on pre-restriction levels were seen (Gold Coast and Northern NSW): (page 57). We note that both of these restrictions were in place for short periods of time (12-18 months).

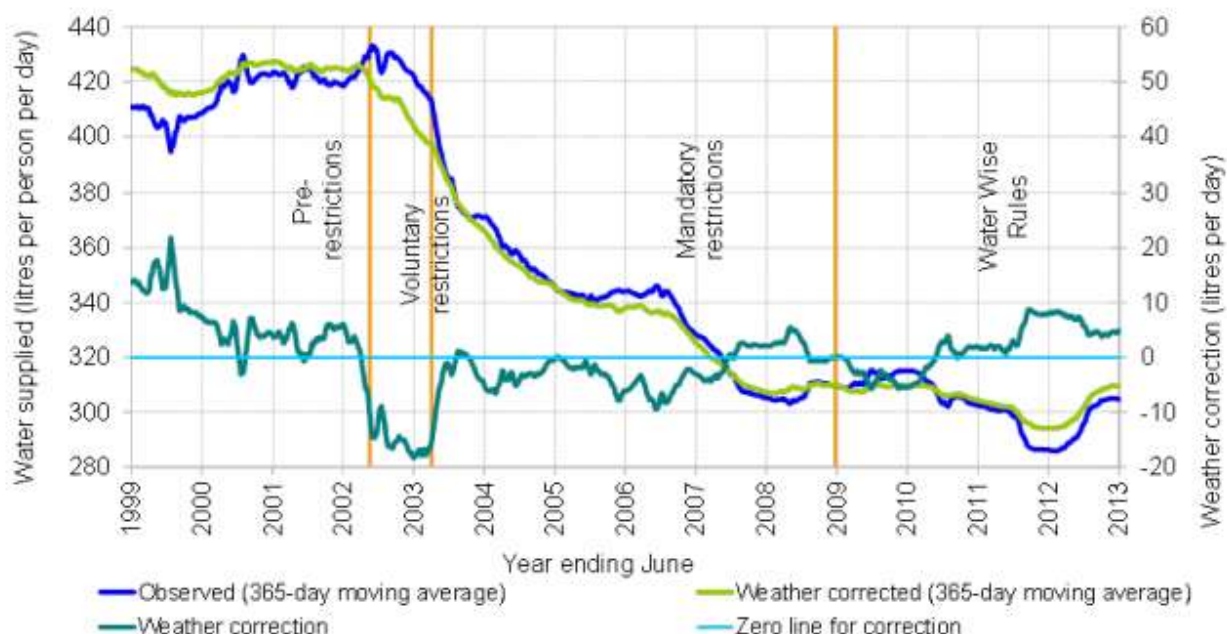


Figure 5-3. Sydney Water total per capita abstractions (Licence standard WC1: 1999 to 2013)²⁶

Despite the ending of restrictions in 2009, Sydney has not seen a significant bounce-back, even when weather is taken into account (see Figure 5-2 and Figure 5-3). This may be due to the implementation of permanent “water wise” rules, or may be due to a structural behavioural break. In the ACT, the permanent water conservation measures (PWMC) may have the same effect.

5.2.3 ACT and Queanbeyan

Figure 5-4 graphs the weekly average daily water consumption in the ACT and Queanbeyan against weekly weather conditions in Canberra and the timing of temporary and permanent water conservation measures. As expected, a seasonal trend is visible in the average daily water consumption in these regions. More explicitly, for the entire period bounded by the chart, water demand from ACTEW’s network rose and fell with the average daily maximum temperature, with the exception of the wet season in 2011/12 when water usage was depressed by the relatively high levels of rainfall. There are substantially higher peaks in demand witnessed in the latter parts of the chart, but these can perhaps be attributed to the lower average and total rainfall that occurred during the wet seasons of 2012/13 and 2013/14 as compared with the immediate post-drought wet season rainfall experienced in 2010/11 and 2011/12.

²⁶ Sydney Water, *Operating Licence 2010-2015 System Performance Standards Report 2012-13*

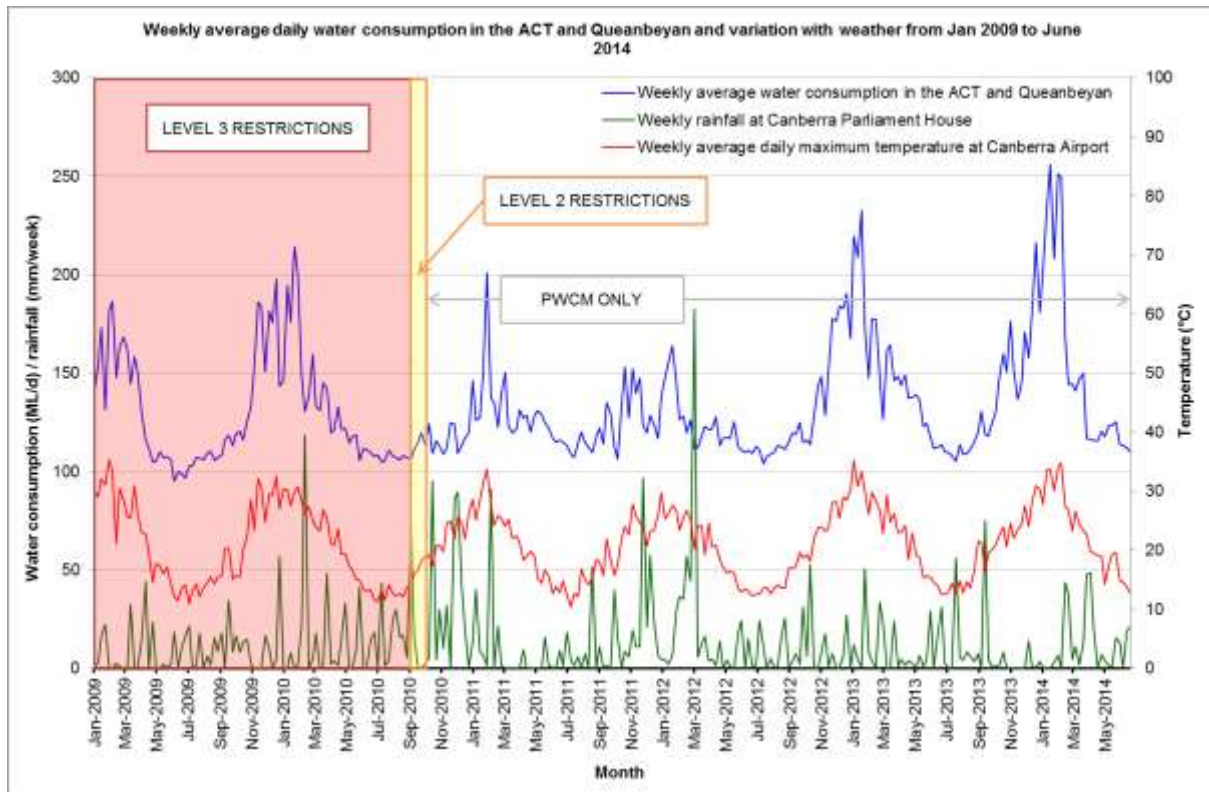


Figure 5-4 Weekly average daily water consumption and variation with weather in the ACT and Queanbeyan from Jan 2009 to May 2014

On an annual basis we can plot the NPR data as we did in Figure 5-2:

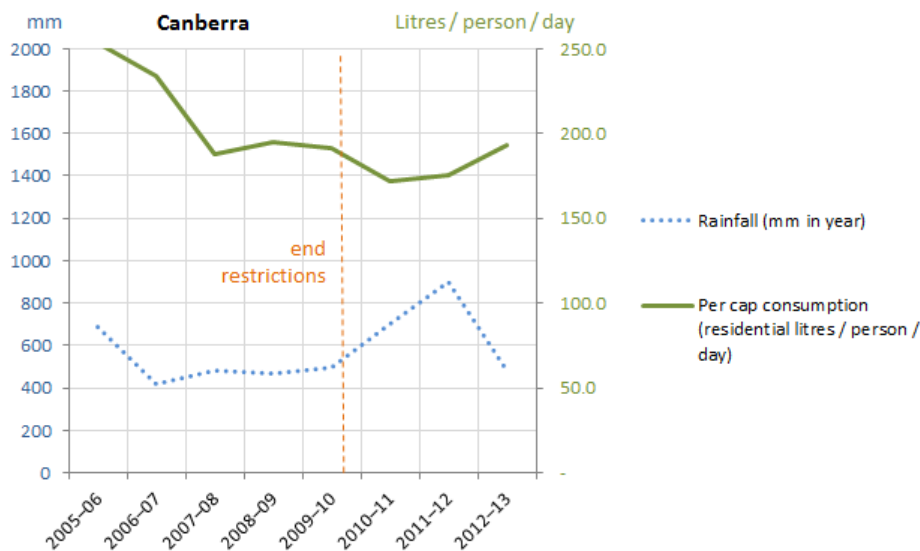


Figure 5-5. ACTEW per capita consumption and rainfall

[Source: National Water Commission, National Performance reports indicators W8, C1, Bureau of Meteorology]

While there has been a jump in demand in 2012-13, this is related to the drop in rainfall and for the moment; we cannot be certain that this represents a genuine rebound, or simply the return to the conditions in 2007-2009.

In summary, it is hard to make the case for a significant post restriction behavioural “bounce back” in the ACT / Queanbeyan at this stage. The increases seen may be entirely weather driven.

5.2.4 **Conclusion**

The conventional wisdom is that utilities should experience a post-drought rebound in consumption. However the evidence for the extent and timing of the rebound is varied. The Queensland Water Commission strategy document refers to rebounds of up to 10%-15% less than the previous per capita consumption, however this was based on two examples where restrictions were in place for a relatively short period.

If we consider the examples of Sydney, Brisbane and Canberra, where restrictions were in place for longer periods and large reductions in consumption were observed, it appears to be too early to forecast a significant, non-weather related underlying bounce-back in demand following the end of a long period of restrictions. This may be due to a structural change in behaviour, or it may be due to the continued imposition of permanent water conservation measures. Either way, for the purposes of projecting demand over the next four years in the ACT, it would be prudent to assume no significant per capita bounce-back.

5.3 **Findings from review of ACTEW demand model**

5.3.1 **Description of model**

- ▶ The demand forecast model is a regression model. The regression model uses historical (observed) data about (supposedly) related events to try to explain one (or more) of the observed phenomena, using the other observed phenomena.
- ▶ ACTEW tried to explain seven variables. These are raw water releases (“releases”), and average and median billed quarterly consumption data for three different customer types (types 1, 2 and 3)²⁷.
- ▶ The variables eventually selected as those which can best explain releases were the following:
 - > A parameter representing evaporation (*cumevap*)
 - > A parameter representing rainfall (*cumrain2*)
 - > Parameters for various levels of restrictions (Stage_0 and Stage_2)
 - > A combination of “summer” and level of restrictions (called Stage0_s)
 - > A combination of rainfall, summer and stage 3 restrictions (called *cumrain2_3_s*).
- ▶ In total, these six parameters, plus an intercept (constant) were selected as the best predictors of releases, based on 4,960 daily observed records²⁸ from the 1st of January 2001 to the 30th of June 2014.
- ▶ The historical observations for the same six parameters (predictors) were then used to develop six more regression models for billed consumed volumes between 2001 and 2014. In this case, the observed variable the models were developed to explain were the following:
 - > Average quarterly consumption for a type 1 customer in the sample
 - > Median quarterly consumption for type 1 customers in the sample
 - > Average quarterly consumption for a type 2 customer in the sample
 - > Median quarterly consumption for type 2 customers in the sample
 - > Average quarterly consumption for a type 3 customer in the sample
 - > Median quarterly consumption for type 3 customers in the sample
- ▶ At this point, ACTEW has seven sets of regression coefficients which it can apply to the observed data (weather, season, restrictions) to predict seven parameters: releases, and average and median consumption for the three customer types in the sample. To get to total demand from the predicted sample demand, the model outputs are scaled up using the ratio of total demand to the sample demand (by customer type, over the period of the sample).
- ▶ In addition to developing these seven sets of coefficients, ACTEW also considered a way of correcting for errors between what the completed models predicted, and the observed variables²⁹. The modelling team

²⁷ Type 1 = stand-alone houses, Type 2 = units, and Type 3 = non-residential customers.

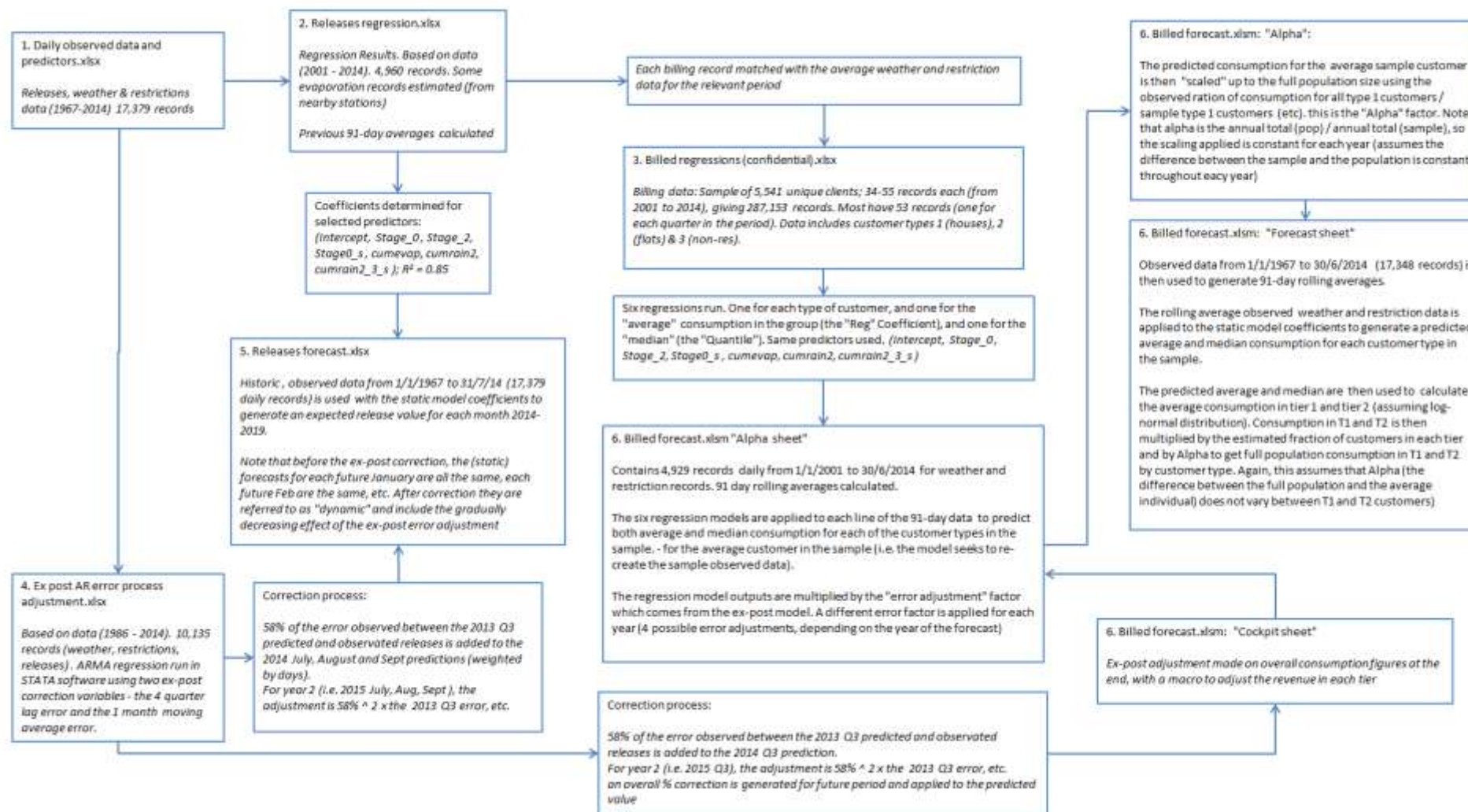
²⁸ Of which the regression used 4,870

chose an “ex-post” or “auto-regressive” method with a one year lag. What this means is that if there was a large difference (error) between what the model predicted at a given point in time, this difference might be expected to re-appear one year later. The difference can therefore be accounted for (and included in the prediction) if the model uses some part of the previous error to correct its one-year-later prediction.

- ▶ A flow chart showing how the various spreadsheets presented relate to one another, and how the model was compiled and calculated, is presented over the page.

²⁹ Even though the observed variables (release, consumption) were used to generate the coefficients in the first place, trying to re-create the observations from the coefficients multiplied by the predictors (weather, restrictions) still leaves some error. In other words, the six predictors can explain most, but not all of the changes in the historically observed release and consumption data.

5.3.2 Model inputs and methodology



5.3.3 Model accuracy and reliability

ACTEW tested the demand forecast model against the historical information which was used to build it (i.e. “in sample” data). The model performs reasonably well against this, as would be expected.

A better test of a model is to test it against “out of sample” data. To our knowledge this has not been done. In their April 2013 submission to ICRC, ACTEW noted that the (updated) model was slightly over-predicting at for recent years. The total amount of billed volumes over-forecast for the year ending 28th Feb 2013 was “around 4GL”³⁰. In the April 2013 submission ACTEW provided the following chart:

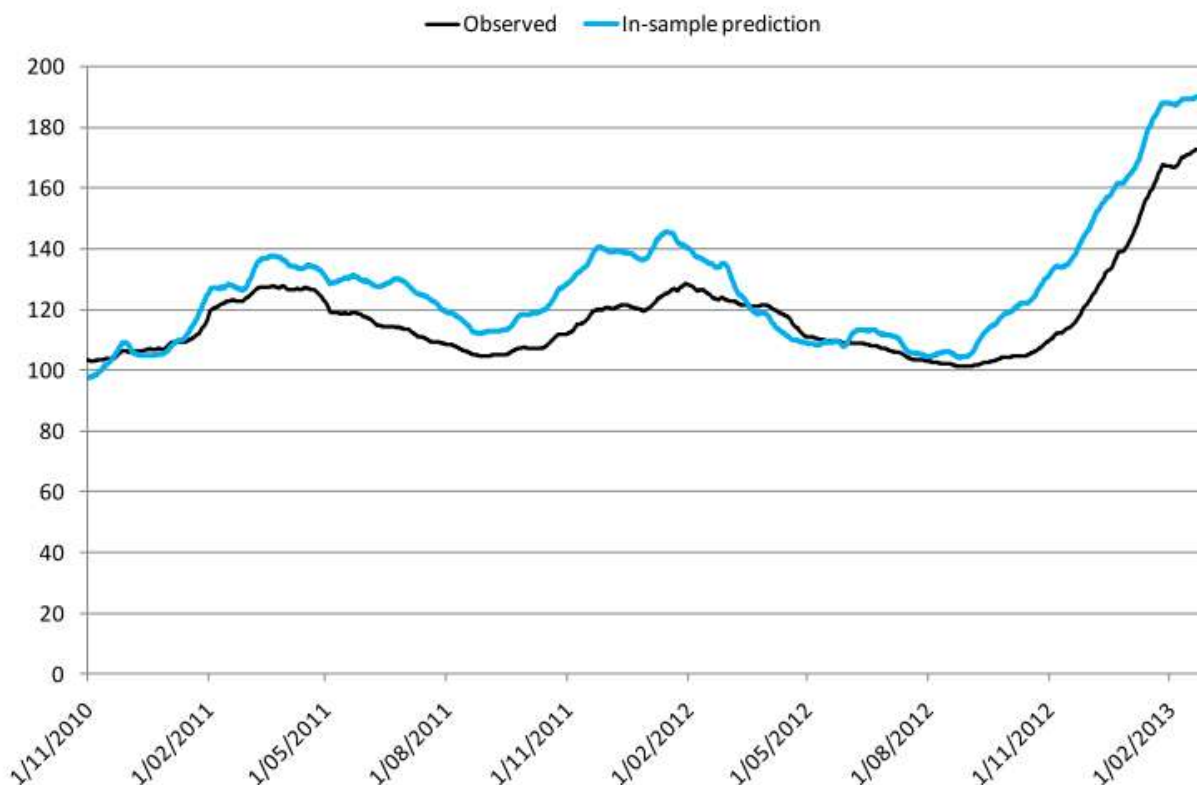


Figure 5-6. ACTEW's demand forecast model: predicted and observed consumption (2010-13)³¹

We do not have any more recent data with which to compare the model, but we note that ACTEW's model essentially predicts the same consumption for the next four years – around 42.5 GL of billed volumes. The corporation notes that the model needs to be updated each year, which improves its accuracy (slightly), but does not necessarily make it suitable for a 4-year price determination forecast.

5.3.4 Comments on the Model

- Our first comment is that it is striking that the explanatory variables used to predict demand **do not include any reference to population**³². This is striking not just because population is an obvious driver

³⁰ “Response to the Draft Report Regulated Water and Sewerage Services 12 April 2013 Public version”, ACTEW Corporation, page 33

³¹ ACTEW: *Information return: demand forecasts 15 August 2014*

³² The modelling team noted that “Using this particular data series, we are not able to investigate the role of population growth”, and speculated that “It may be that water-saving efficiencies are increasing at a rate to roughly offset population growth”. The modellers also noted the difference between a forecasting model and a causal model. They said “So long as the data generating process of conditioning variables is stable, regression techniques produce optimal linear predictors even though the coefficients on conditioning variables may not have a fully causal interpretation”. In layman's terms, this appears to mean that a model can still work, even if the “explanatory variables” used don't appear to have any direct or obvious way of causing the phenomena we are using them to predict. Population is most definitely a “causal

for demand, and that detailed historic population data is available, but also because data about the *expected* population is available and reasonably robust. To the extent that demand can be shown to be related to population, it has the merit of being a useful predictive variable *precisely because we can predict population with some accuracy*. The demand model, however, relies on weather as its key predictive variable (indeed, its only predictive variable if we consider that restrictions are ultimately weather-determined). In order to predict demand with the model, we therefore need to be able to predict the weather (more on this later).

- ▶ Part of the reasoning for excluding population from the explanatory variables was that it could not be disentangled from other phenomena, such as increasing **water efficiency measures** installed by consumers. Indeed population growth and water efficiency are assumed to offset each other. It is interesting that ACTEW has come to this conclusion, which could well be valid. However it might also be useful to carry out some investigative work into the observed impacts of water efficiency measures (e.g. compare demand in new-build customers to those in older housing stock, etc.).
- ▶ The billing data used for the regression appears to use a sample of 5,541 unique properties, all of which have billing data from 2001. This **excludes new build / new customers from the sample**. Note that between 2001 and 2014, the population of the ACT grew by 18.7%. Between 2008 and 2014, ACTEW gained 13% more customers (connections) – a growth rate of 2% per year. Over 14 years this suggests 1/3 of the billing sample should be “new” customers if the sample is to be genuinely representative. Indeed, during the modelling process ACTEW determined that their sample set of customers actually consumes 27.4% more than their average customer, and so scaled down the average sample consumption by 21.5% (so that the sample average was the same as the population average). The scaling was applied to all customer types at all times of the year, so the assumption is that despite the surprisingly large difference in *average* (between the sample and the population), the sample and population *distributions* are nevertheless identical³³.
- ▶ The models have **only been tested against “in sample” data**. In other words, against the same data that was used to build the models. A better test of a model’s predictive ability is to test it against out-of-sample data.
- ▶ It is also striking that the models **do not use any “future data”** to make a prediction about the future. All of the predictions (for the seven parameters) are derived entirely from historical data (back to 1967). This means predicted demand for January 2015 is the same as January 2016, 2017 and 2018, which is driven by the average January (weather) since 1967 (see data below³⁴ from columns A and D of the sheet “ex-post AR model adjust” in spreadsheet “5. Releases forecast.xlsx”).

variable”. Indeed the modellers note that “...population growth would likely be an important factor for long-term forecasting and water-security planning”.

³³ ACTEW indicated in the call that there were little differences in the distributions.

³⁴ When the error adjustment is applied there a very slight difference between years appears. The effect is an adjustment for the error in 2014 which drops off rapidly over time.

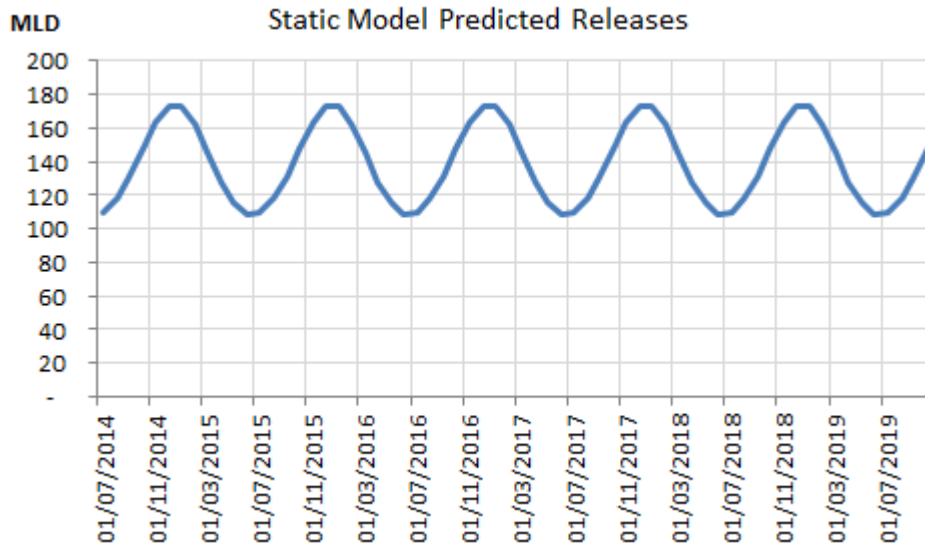


Figure 5-7. ACTEW Model results: predicted releases 2014 - 2019

- ▶ ACTEW noted that for the 5-year timeframe of the forecast, any climate change adjustments to the weather were highly uncertain, and that they felt the previous weather record would be a better indication for demand over the next 5 years. This may be true, but it leaves us with a situation where all of our predictions are based entirely on the past, with no perspectives (even flawed perspectives) about the future. Indeed the one assumption is that the future will be identical to the past³⁵. As a result of this approach, the modelling team emphasise that the model should be updated very frequently (*“at least annually as new behavioral data become available”*). The principle here being if you are going to drive by looking only at the rear vision mirror, at least make sure you check the mirror often³⁶. That said, we are uncertain as to the value that is to be gained by updating the model data frequently. Why ?
 - > The model can be updated in two ways. The first way is to incorporate the new information and re-run the regression, generating a new set of coefficients and a new “fit”. The second way is to incorporate the new information into the long-term averages which are used for the forecast (i.e. the numbers that the coefficients are multiplied by).
 - > Regarding an update of the regression model coefficients: The selection of explanatory variables for the model effectively assumes that – apart from weather and restrictions – nothing influences demand. So, if the “underlying, unchanging factors” (e.g. population, water efficiency, etc) for the period 2001-2014 were 100, and the value in 2015 were 90, the “new information” would simply instruct the model that the true “underlying, unchanging factor” for the whole period 2001 – 2014 is the new average including the additional information $(100 * 14 + 90) / 15 = 99.3$. The possibility of a bend in the road is discounted – the road is still straight, but on a slightly different angle. We note that ACTEW did actually update the model in 2014. The 2013 model (version 17.5) was predicting 40.86 GL. The process of updating the model resulted in significant changes to all of the regression coefficients (typically by decreasing them by 20%). This results in much lower forecasts (e.g. 25%) for a given sample point, however the alpha factor to adjust the overall calculated consumption back to a historical average was increased by 27-35%. If an additional 1.5 year’s billing sample data (515 records added to 4,414 records) can affect all of the model coefficients significantly, then the question arises as to how suitable the coefficients are for predicting out-of-sample events.
 - > Updating the weather data for the purposes of forecasting (i.e. the inclusion of another year’s data to the 47 existing years used to calculate the average, for the prediction) will make a slight difference to the long-term average, but neither the average, nor the additional data, will provide much guidance as to what the actual weather will be in the coming year. In other words, the small

³⁵ “This study necessarily makes forecasts based on historical patterns of use over a limited time period. We emphasise that the forecasts assume that future use patterns will be the same”. (Page 4 of the Final Model report).

³⁶ ICRC’s Regulated Water and Sewerage report (June 2013) indicated that one of the main disagreements between ACTEW and ICRC was the frequency with which demand forecasts should be made.

adjustments in the coefficients caused by updating the data will always be outweighed by the “weather variance”.

- ▶ Updating the data will have the effect of updating the ex-post auto regressive correction, although the impact of this is small (or negligible after the model has a “good year”).
- ▶ As mentioned above, the demand model predicts average and median consumption for the three customer types (it also predicts releases, but this does not appear to be used for the final demand model). Although the regression model produces average and median values, we need to know what the consumption distribution is so that we can determine how many customers pay the Tier 1 rate, and how many pay the Tier 2 rate (and for what volumes). The modellers used a formula to estimate the distribution for a given average and median value. The formula assumes a log-normal distribution of the set of underlying values which make up the average and median. We checked the distribution. It is approximately log-normal for Type 1 and Type 3 customers, but not for Type 2. This is possibly because Type 2 customers are units on shared meters. Both Type 1 and 3 customers are almost always 1 customer per meter, however Type 2 has an average of 11 customers per meter. The way the sample data is constructed presents two problems:
 - > All blocks of flats have equal weight (a block with 5 flats, and a block with 50 flats) – both occupy one record and the average consumption per flat is used
 - > Variance within blocks of flats is effectively hidden – possibly the reason the distribution is not log-normal.
- ▶ To check the impact of this issue, we compared the observed revenue with that predicted by the model (for the sample data). The differences between observed and predicted revenue were:
 - > Type 1: predicted = 98.18% of observed
 - > Type 2: predicted = 95.56% of observed
 - > Type 3: predicted = 99.69% of observed
- ▶ The distribution function used is a good approximation for the observed distribution, but is perhaps less accurate for Type 2 properties due to the nature of the data used to build the model.

5.3.5 Conclusions

The most important thing to note about ACTEW's demand forecast generated by the Breusch-Ward model, is that the model was not conceived to project demand for four years. ACTEW did not provide a four year forecast to ICRC, and ACTEW only generated one at the request of the Industry Panel, noting that their approach was to update the model each year to account for new information.

ACTEW's preferred approach is to project demand on an annual basis, with regular updates, rather than to make a four-year forecast.

Essentially, ACTEW rejected the standard regulatory approach which requires a demand forecast for each year of the regulatory price period, and therefore did not construct³⁷ a model which was suitable for medium term demand forecasting.

If a four year forecast without annual updates is required, we would suggest developing a slightly different demand forecast model; one which includes some demographic growth components and which quantifies the variance that could be caused by weather.

We have developed an alternative demand forecast model which could assist the Panel in assessing ACTEW's demand forecast and appropriate pricing over the period 1 July 2014 to 30 June 2018.

³⁷ “In the **absence** of a water volumes forecasting model in the Final Report and **consistent with the form of control proposed** above, ACTEW proposes annual application of the model submitted with its revised proposal of April 2013.” – ACTEW's statement of Facts and Contentions, 31 July 2014 (our highlighting).

5.4 Alternative water sales forecasts

5.4.1 Approach

5.4.1.1 *Introduction*

Our approach to demand forecasting has been to follow the guidelines in the National Water Commission paper “Integrated resource planning for urban water”³⁸ to the extent possible with the data (and time) available for this review.

The “primary” methods for forecasting demand are described in the guidelines as follows:

- 1. The simple litres per capita per day (LCD) method of analysing historical bulk (aggregated) water demand to determine an overall LCD figure, which is then multiplied by the projected population. In more recent times historical demand is occasionally corrected for the influence of climate and weather using various regression techniques to obtain a “climate neutral” average LCD demand for forecasting (as discussed in this paper).”*
- 2. A sector-based approach, which at minimum investigates residential demand (single and multiresidential properties), non-residential demand (commercial, industrial and institutional sectors and subsectors) and non-revenue water (real and apparent losses). With a better understanding of how water is being used, demand is then projected according to population growth or other sector-specific base units (for example, the number of properties or utility accounts, employment, floor space), as deemed appropriate.*
- 3 An end-use analysis, which uses a ‘bottom-up’ approach to explain historical demand (predominantly in the residential sector) associated with typical end uses such as toilets, washing machines and evaporative air conditioners. The demand for that end-use is translated into aggregate demand by multiplying an individual end-use demand by frequency of usage, projected demographic growth (population, single and multiresidential dwelling numbers, and occupancy as appropriate), and functions that reflect changes in the efficiency of the technology and mix of stock over time.*

We have sought to disaggregate demand to a per-capita (or customer) level so that population projections can be used. ACTEW also considered per-capita consumption, but only for the purposes of estimating Tier 1 and Tier 2 consumption. No population or other demographic data was used to make their projections.

We attempted to disaggregate the competing factors of population growth, and declining per capita consumption to make our forecasts.

Recognising ACTEW’s finding that weather and restrictions play a large part in the annual consumption variance, we also included these variables.

We did not complete any “end use” analysis as discussed in point 3 of the NWC guidelines.

Our broad approach is outlined in the figure below:

³⁸ Institute for Sustainable Futures Waterlines Report Series No. 41, March 2011

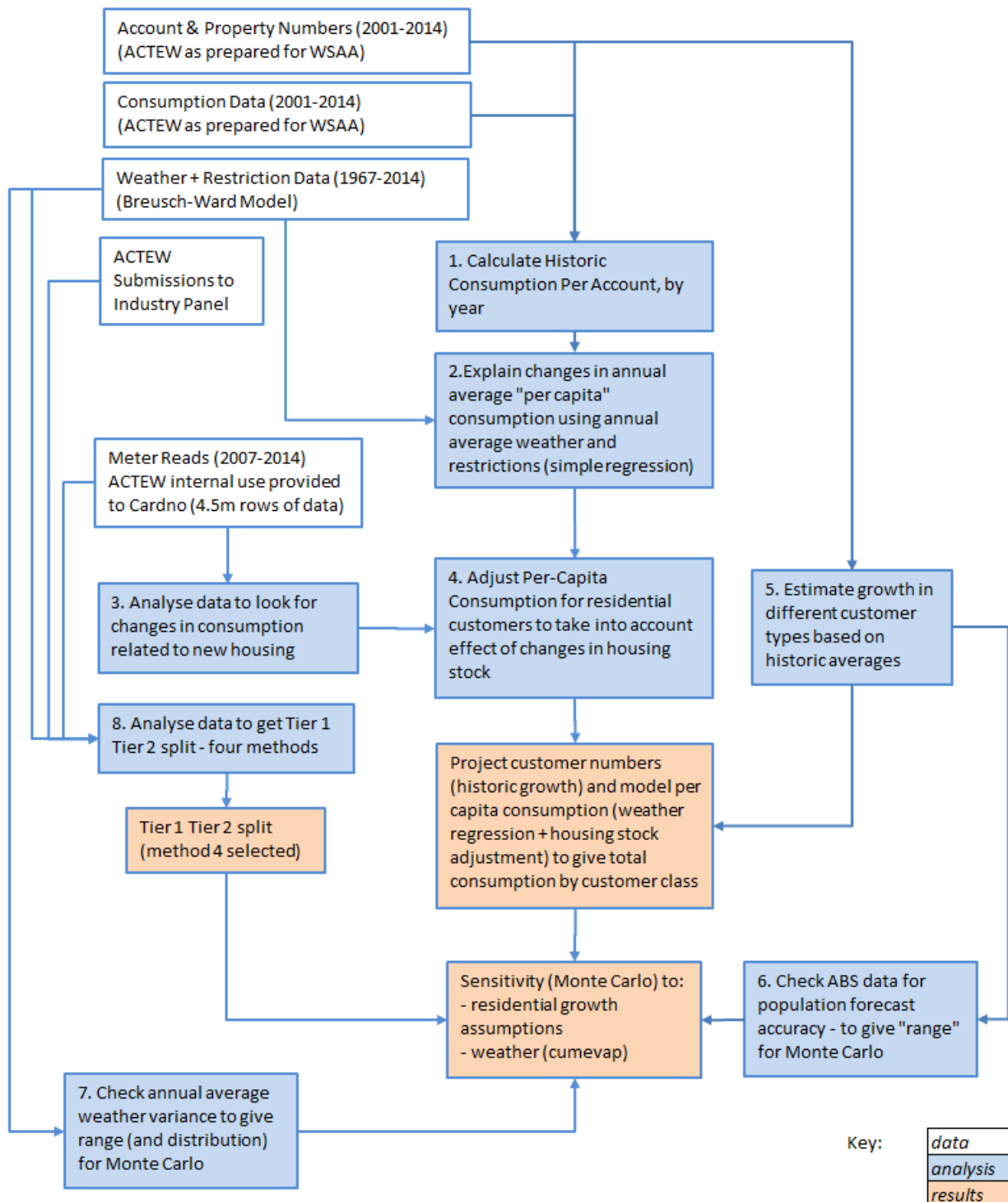


Figure 5-8. Cardno demand forecast model methodology

ACTEW's approach can be summarised as:

- Use weather
- Use restrictions
- Ignore population (assumed to cancel out effects of behaviour and housing stock changes)
- Ignore behaviour change (for reason above)
- Ignore changes in housing stock (for reason above)
- Consider price elasticity

- Build a detailed regression model of daily average (and median) consumption using a sample of billing data, by customer category
- Generate a lognormal distribution of sample data based on a regressed mean and median to predict the Tier 1 and Tier 2 split.

Our approach was:

- Use weather
- Use restrictions
- Use population growth (trends in customer growth)
- Account for behaviour change (if possible)
- Use available data about the effect of new properties (houses / units split)
- Ignore price elasticity in forecasts; but assume it forms part of “behavioural change” in historic observations
- Build a regression model for consumption using annual average data, by customer category
- Use ACTEW’s historic observed Tier 1 Tier 2 split as a function of average per property consumption to predict the Tier 1 and 2 fractions.

5.4.1.2 Step 1: Calculate per property consumption

We calculated per property (or more accurately, per account) consumption figures from actual consumption data provided by ACTEW for WSAA for the period 2001-02 to 2013-2014. The information was provided in the file “WSAA reports compiled_Industry Panel review.xlsx”.

5.4.1.3 Step 2: Weather and Restrictions Regression Model

We used the weather and restrictions data compiled by Drs Breusch and Ward for the development of the ACTEW model.

- ACTEW provided annual total volumetric consumption by customer charge class for the period 2001-2014 (the information used for WSAA reporting). The same data also contained customer numbers (accounts) by charge class. This enabled us to calculate annual per property (or per account) consumption averages
- We split customers into 4 broad categories: freestanding residential, units, govt/commercial and all other minor categories. Queanbeyan was excluded.
- We used annual average weather and restrictions values compiled by Breusch and Ward to generate a regression model which attempted to explain changes in per property consumption and total volumes by customer type using (average) cumevap, cumrain and restrictions (3 variables x 13 years of data). The results were:
 - Total volumes by category: Quite good correlations for 2002-2014 for freestanding residential housing, govt / commercial and minor categories. Failings are initial “under prediction” and final “over prediction”, which suggests that consumption is falling faster than the model can explain. Not good at explaining units - presumably because they are less sensitive to weather / restrictions, and also because flat numbers are growing strongly.
 - Per property consumption by category: good correlations for all residential and government / commercial (but poor for minor customers). Generally, the model suffers from under prediction in the early years and over prediction in the later years (see: Figure 5-9)
 - Rainfall (as described by the variable “cumrain”) was not a useful predictor of consumption, as it is loosely related to evaporation when annual averages are considered. The variability in annual consumption can be explained evaporation alone; adding rainfall did not improve the model. As a result, we eventually dropped cumrain from the explanatory variables and retained cumevap and restrictions in the final model.

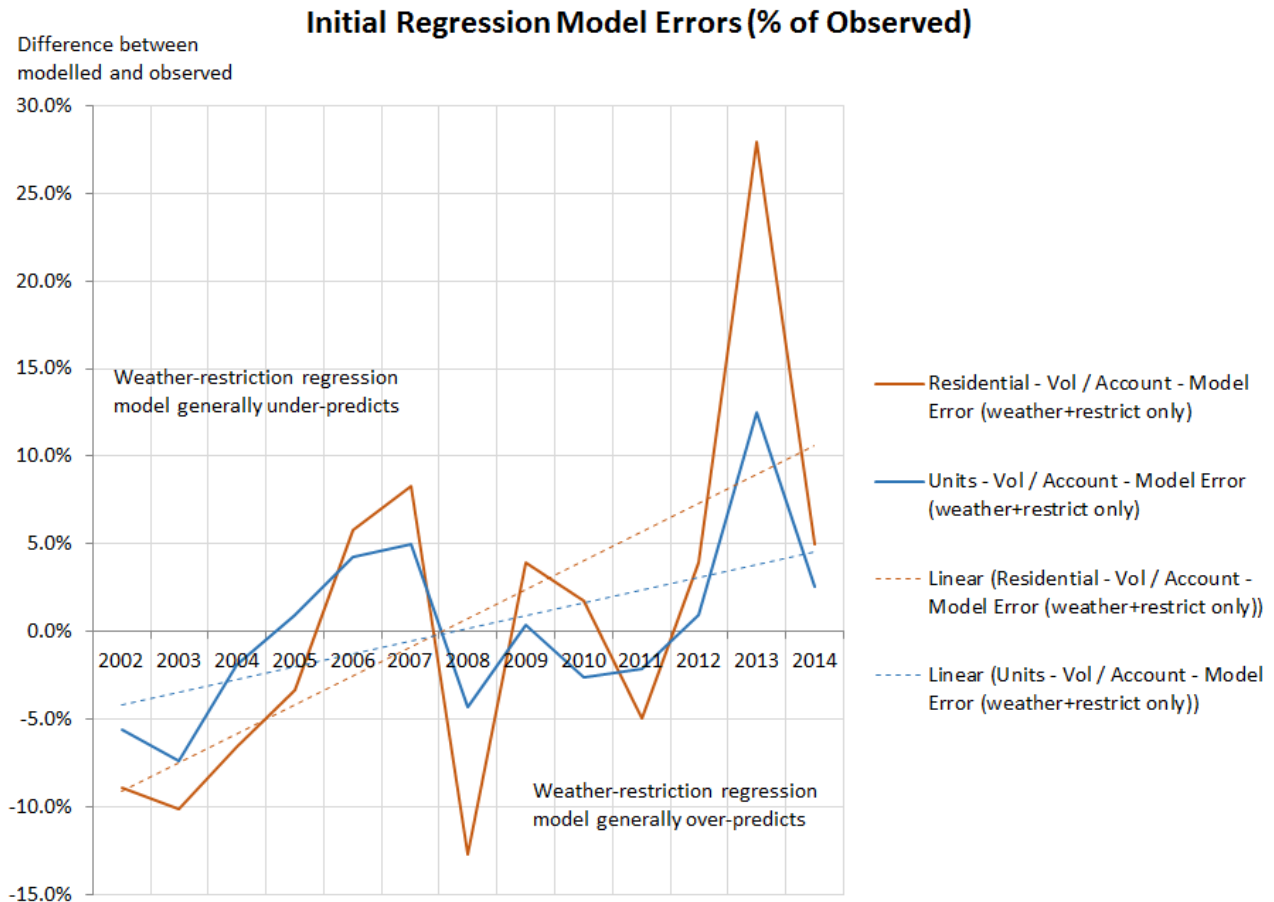


Figure 5-9. Annual Average Weather Regression Model – differences between model and observed data

- As shown in Figure 5-9, the regression model developed from the weather + restrictions data showed a consistent “time bias”. Changes in restrictions and weather were inadequate to completely explain the drop in per-capita consumption.
- As a result, we considered that “something else must be going on”. This points towards what ICRC referred to as a “structural break” in water consumption patterns. We considered that this may be due to changes in the housing stock and requested detailed billing data from ACTEW to investigate this possibility and quantify any impact.

5.4.1.4 Step 3: Analyse Detailed Billing Data

- Using meter reading data (4.5 million records from 2006-14³⁹) we were able to reconcile residential housing and units consumption with ACTEW’s figures to within 1% of ACTEW’s total consumption figures and customer numbers.
- We were not able to reconcile Govt / Commercial or the Minor Categories with total consumption values (the ACTEW data provided to WSAA), possibly due to more frequent meter changes or complex metering arrangements (more use of sub-meters, check meters, etc). We were not able to reconcile Queanbeyan either (although there is only one account for Queanbeyan).
- Analysis of the billing records shows that newer housing stock consumes less water than stock existing at 2007 (see Figure 5-10)
- Behaviour changes in existing housing stock can then be compared to behaviour change in newer housing stock – the impact of high rainfall in 2011-12 appears to be slightly larger for older housing

³⁹ Although 2006, 2007 and 2014 were incomplete years and eventually had to be discarded from the results

stock, suggesting less outdoor use for newer houses. This would also agree with the lower per-capita consumptions for newer housing (a “smaller garden” hypothesis).

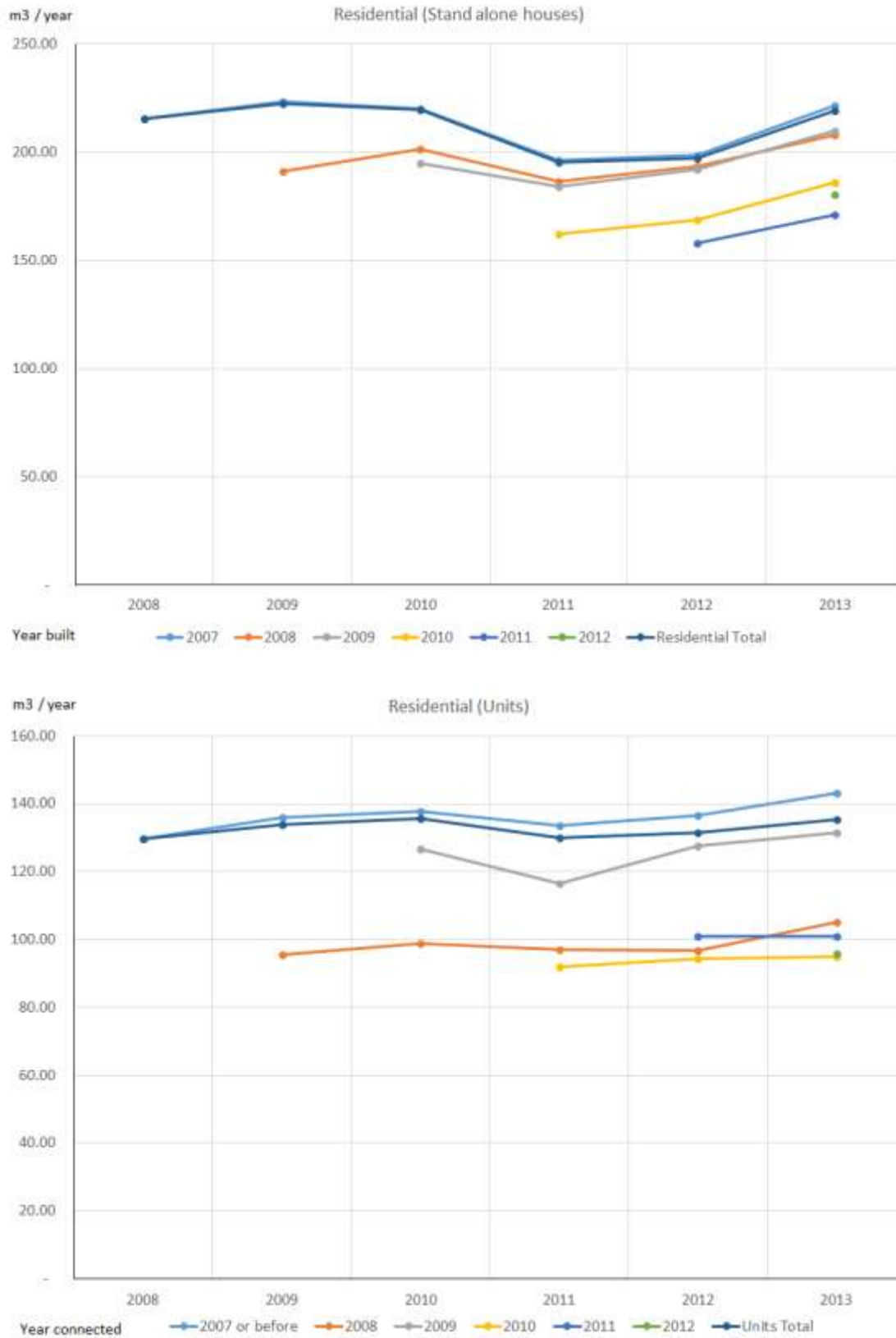


Figure 5-10. Average annual consumption in residential customers by year of “construction”: Houses (top) and Units (below)

- The relatively small number of houses added to the free standing house stock (around 1-2% per year), means that their impact on average per property consumption is quite small, despite large differences in consumption in the new houses (from -5% to -20%, averaging -15%). Overall, the cumulative impact of new housing stock additions from 2008 to 2013 was about -1.1% on per-capita consumption for free standing housing. In any given year, the impact of adding new housing is - 0.05% to -0.5% on per-capita consumption.
- However, unlike new freestanding houses, new residential units do have a significant impact on per capita consumption for units overall. The reasons for this are twofold: Units are experiencing higher growth rates than houses (about 4.5% vs 1%), and also newer units appear to consume considerably less water than older ones (on average: 28% less)⁴⁰. The cumulative effect of new units was to reduce per property consumption by 5.5% in all units over the 2008-13 period. The combination of more units, and a greater reduction in consumption can actually explain the entire (average) residual error in the regression model.
- The decreased water use in both freestanding houses and units could in theory be caused by smaller families. We checked this possibility by analysing trends in population (from the ABS) and dividing by the total number of residential customers. The number declined slightly since 2002 (see Figure 5-11).

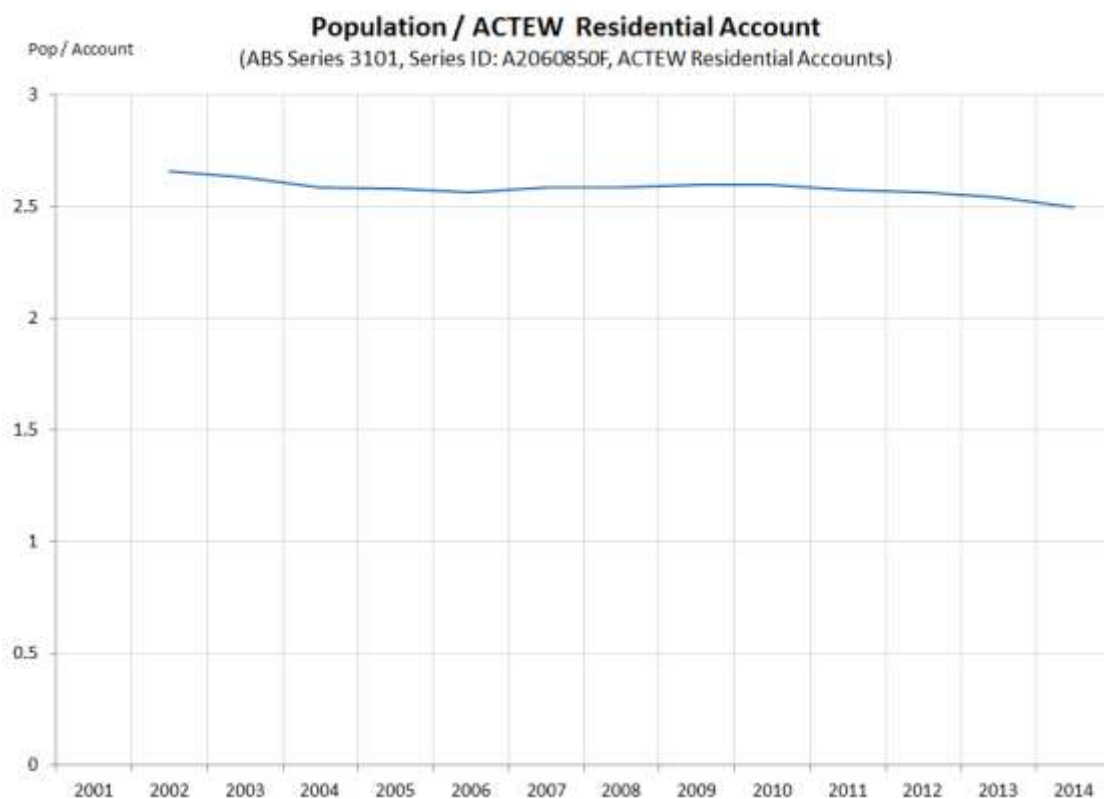


Figure 5-11. ACT population per ACTEW residential account (2002-2014)

- We cross-checked this finding by an analysis of the census data which does not show any clear trend in housing occupancy (and is slightly uncertain by differences between census and ABS population figures for a given year, possibly due to different geographical basis):

⁴⁰ Perhaps because they are smaller, have more efficient appliances, or simply have fewer occupants

Table 5-1. ABS Population and Housing Data

Year	Population	(source)	Occupied Dwellings	(source)	Pop / Dwelling (calculated)
1991	289,320	(1)	104,263	1991 (3)	2.77
1996	309,629	(1)	120,202	1996 (3)	2.58
2001	321,538	(1)	130,256	2001 (3)	2.47
2011	327,690	(2)	129,101	2011 (2)	2.54
2011	367,985	(1)	129,101	2011 (2)	2.85

Sources:

(1) ABS Series 3101

(2) Census B31 DWELLING

(3) Census T18 DWELLING

We have limited household occupancy data by household type from the 2001 and 2011 census for the ACT. The results show a very slight decrease in “total occupied private dwelling” household size (from 2.58 to 2.53, or 1.7% over 10 years).

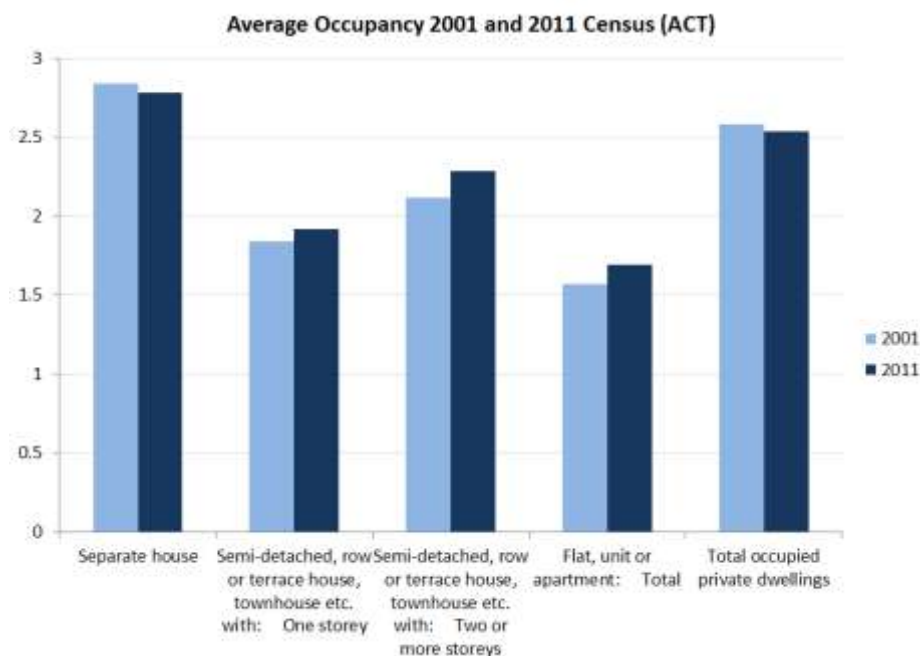


Figure 5-12. ABS census data with household occupancy rates by household type

In conclusion, there may be a slight declining trend in household occupancy which is contributing to declining per property consumption. Declining occupancy rates could be a combination of two factors:

- Fewer occupants in existing housing stock (e.g. decreasing family size)
- Fewer occupants in new housing stock (e.g. smaller houses / relatively more flats).

We don't have any information to disentangle the two possibilities here, because census data (which shows a slight decrease in average household sizes) does not distinguish between existing houses and new builds, and ACTEW data (which does allow us to distinguish between new and old houses) does not have any information about family size / occupancy.

The simplest approach will be to assume that future changes in occupancy rates are included in the declining average per property consumption we have observed from the ACTEW data (detailed below).

Having completed this analysis, the next step was to adjust the per property consumption figures to take into account the impacts of new housing stock, and observe the effects on the regression model. Specifically, could the regression model bias we noticed be corrected by accounting for changes in housing?

5.4.1.5 Step 4: Adjust the predicted per-capita consumption to account for changes in housing stock

We adjusted the model outputs to account for likely impacts due to the addition of new, more “water efficient” housing. The result was that new-build effects, combined with weather and restrictions can roughly explain annual changes in per property consumption for units, but it *cannot* explain why free-standing housing consumption is lower than would otherwise be the case⁴¹.

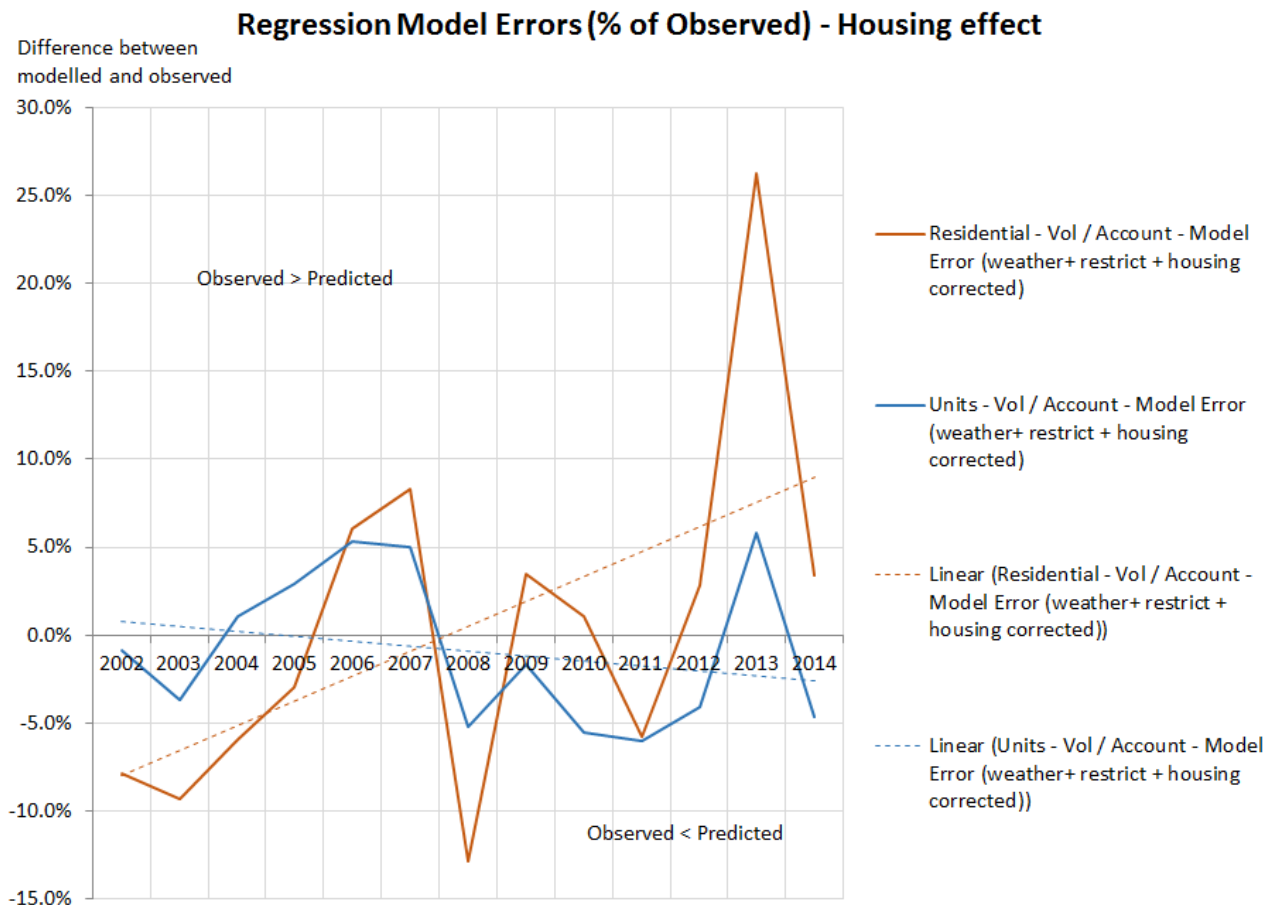


Figure 5-13. Weather Regression Model + Housing Adjustment – differences between model and observed data

Note that the adjustments made to the values predicted by the weather and restriction model were: -0.22% from per property consumption per year for freestanding houses, and -1% for units, reflecting the results from the billing analysis ($\approx 1.1\%$ for freestanding houses over 5 years, $\approx 5\%$ for units over the same period).

The inability of changes in housing stock to explain the freestanding consumption decline points towards what ICRC referred to as a “structural break” in water consumption patterns.

⁴¹ Note that if cumulative new builds are “thrown into the regression”, the observed model error over time (low, then high) can be entirely eliminated. This is because any growing number will eliminate it in the regression calculations. Moreover, the regression model “concludes” that for every 1,000 new houses, average per capita consumption will decrease by 7 kl. There are two problems with this finding. The first is that it contradicts our analysis which shows that although new builds consume about 15% less than existing stock, there are relatively few additions each year and their overall impact is pretty small (about $0.22\% = 0.5$ kl in a given year). Secondly, we know that building 1,000 new houses cannot lower the average per capita consumption by 7 kl indefinitely (i.e. to zero within 30 years).

The Structural Break hypothesis

ICRC rejected the ACTEW / Breusch-Ward methodology on the grounds that a “structural break” exists between historic and current levels of consumption. This idea is broadly supported by the per property data (at least, for freestanding houses): our regression models of annual per property consumption tend to under predict consumption in the early years, and over predict in the later years.

In other words, over the period 2001 to 2014, per property consumption fell at a faster rate than can be explained through weather or restrictions alone. We considered if this fall might be due to changes in the housing stock (more efficient appliances, smaller houses, smaller gardens, native garden vegetation or paved gardens instead of lawns, etc).

As mentioned above, the impact for 2008-13 of new housing stock on average per property consumption in stand-alone housing is about 0.2 to 0.3% per year. Over 5 years, the impact was 1.1%, but the difference between what the weather / restriction based regression model predicts and the observed value was still 5% out (too high) in 2014 and 9% out in 2002 (too low). (Note that the model was “correct” in 2007, when the model line crosses over the observed line).

Clearly, the impact of including the effect of new, freestanding housing is too small to account for these differences.

This finding supports the view that there is “something” going on with per property consumption beyond changes in the weather, restrictions and the gradual changes in freestanding housing stock.

The general direction of the error means that *any* additional explanatory variable which we add into the regression model will improve the residual error as long as the variable either consistently increases (which will give it a negative coefficient) or consistently decreases (resulting in a positive coefficient).

As previously mentioned, population could be such a variable. If population is included (an “arbitrary” increasing number), it is given a negative coefficient by the regression calculation. This is clearly a spurious result. We know that an increasing population does not necessarily result in a decreasing per property consumption (and certainly not in a decreasing volumetric consumption – which is the outcome of a volume regression as well as the per property regression), yet that is what the regression would have us believe, because it is trying to “explain” the underlying tendency.

Our approach was to adopt the ICRC hypothesis of a “structural break” in behaviour and to model this using a new variable which is the cumulative sum of the restrictions values. We refer to this variable as the “**water aware**” variable which represents *the cumulative effect of restrictions on consumer behaviour*. In 2001-02 the value is 0, and it rises to 26.67 by 2014, which is the sum over the average level of restrictions in place during the years 2002-2014.

A full discussion of the ‘water aware’ variable is detailed further down as part of this section

The final per-capita regression model results and observed values (ACTEW data) are shown below:

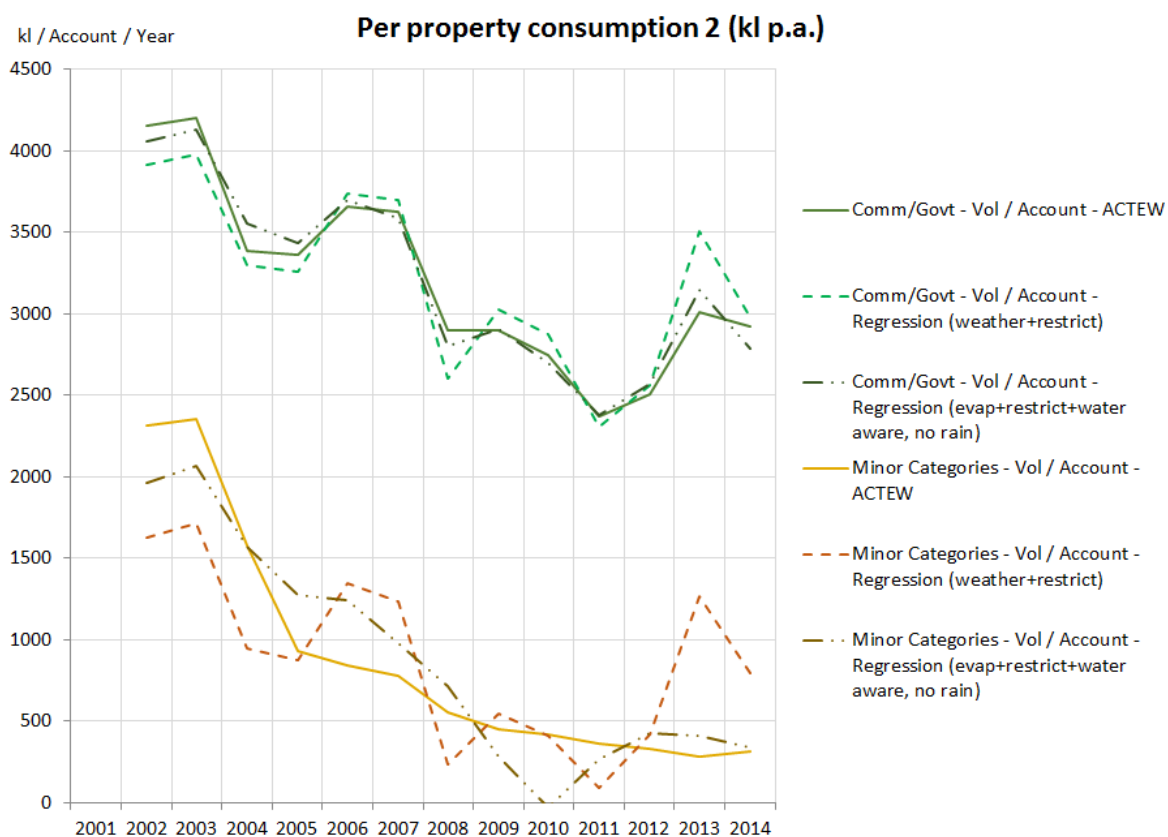
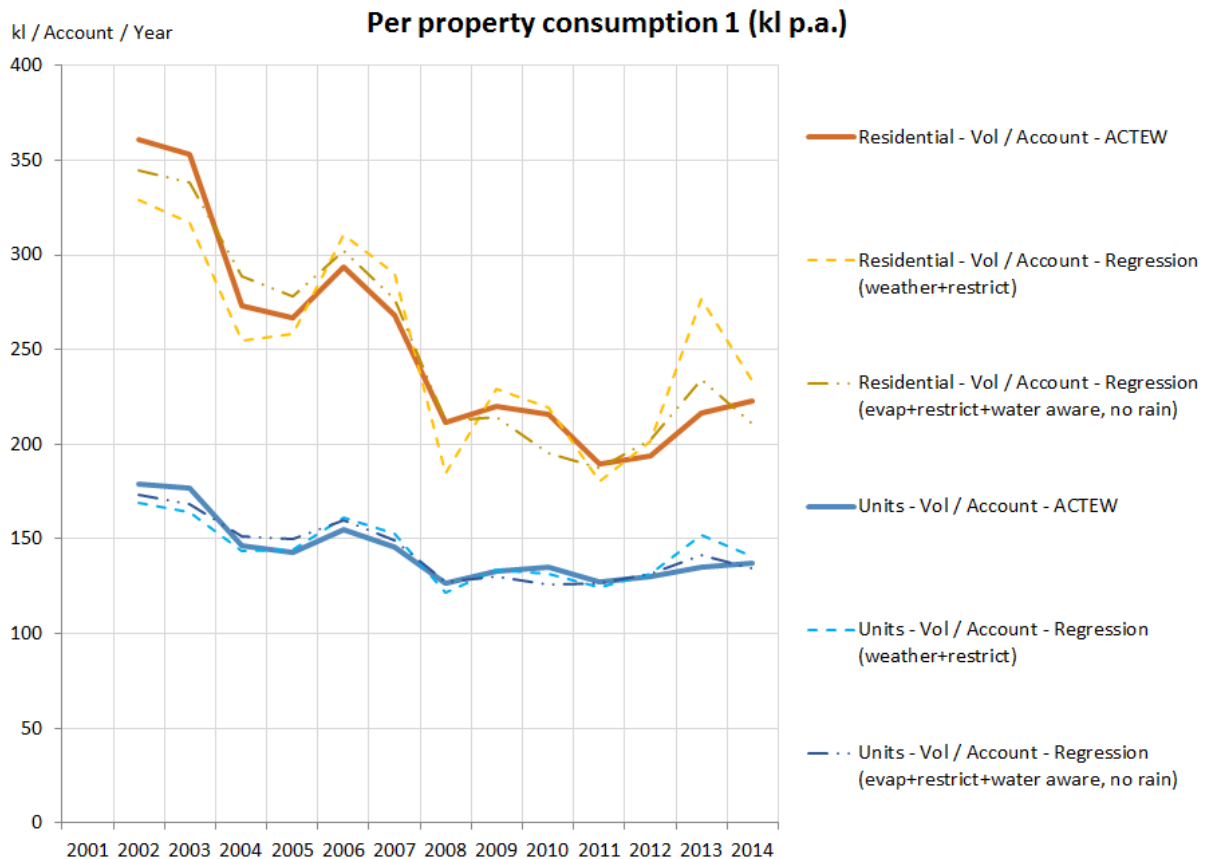


Figure 5-14. Per-capita regression models and observed values

Note that the per-capita model did not explain changes in minor customer consumption patterns so a total volume approach was adopted (see Figure 5-15).

Minor Customer Volume Regression

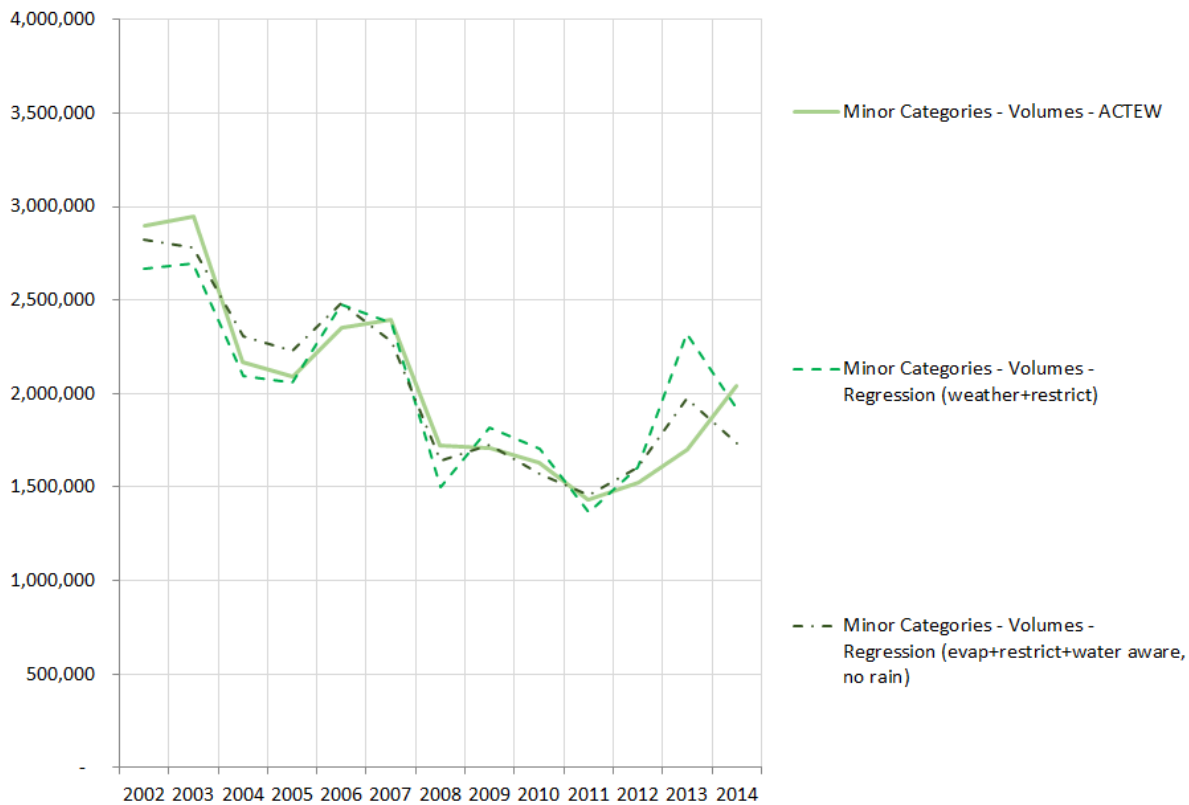


Figure 5-15. Total volume regression model results for minor customers

The final regression model used the following parameter coefficients:

Parameter	Units	Freestanding Res	Unit Res	Govt / Commercial	Other Minor
Predicted Variable		Per customer consumption / year	Per customer consumption / year	Per customer consumption / year	Total volume consumption / year
Constant	kl	178.4432	120.4599	1,320.346	971,581.4
<i>Cumevap</i>	kl / mm / year	2.702961	0.842526	44.93274	30,106.8
restriction	kl / no / year	-20.4486	-7.76467	-222.024	-202,433
"water aware / structural break"*	kl / no / year	-3.37002	-0.82696	-26.2869	-23,476.3
Adjustment for new (i.e. growth) customers?	%	Yes: -15% of modelled per customer consumption	Yes: -28% of modelled per customer consumption	No	No

* defined by the cumulative sum of restriction values from 0 in 2001 to 26.67 in 2014.

The values which the coefficients are multiplied by are as follows:

Predictive Variable	Units	Value 2014-15 to 17-18 (central estimate)
<i>Cumevap</i> - Av. Over year	mm	60.0
Restriction - Av. Over year	Number (1-4)	1.00
Cumulative Restrictions	Number (0 – 26.67)	26.67

As seen in Figure 5-14 and Figure 5-15, the inclusion of the “**water aware**” variable significantly improves the historical fit of the regression model. Partly, this is because it is an increasing number, which the regression uses to completely correct the time-bias obtained when only *cumevap*, *cumrain* and restrictions are used.

The main questions about using this variable are:

- What does the variable represent?
- How does the *water aware* variable fit in with changes in housing?
- How do we predict future *water aware* values for the purpose of forecasting?

Our approach is as follows:

- The *water aware* variable is calculated as the cumulative sum of the average restriction level values in place during the previous years (i.e. levels 1 to 4). At the beginning of the historical data period it is 0, and by the end, it is 26.67 (see Figure 5-16). The *water aware* variable represents a number of factors in the historical data; the addition of *new* housing stock, changes in internal equipment (e.g. appliances) in *existing* houses, behaviour and possibly price elasticity). Note that going forward, the variable should only account for further changes to the latter three, as we account for changes in new housing separately. As a result, we have held it constant (i.e. assuming no further changes to appliances in existing houses, behavioural change or price elasticity).

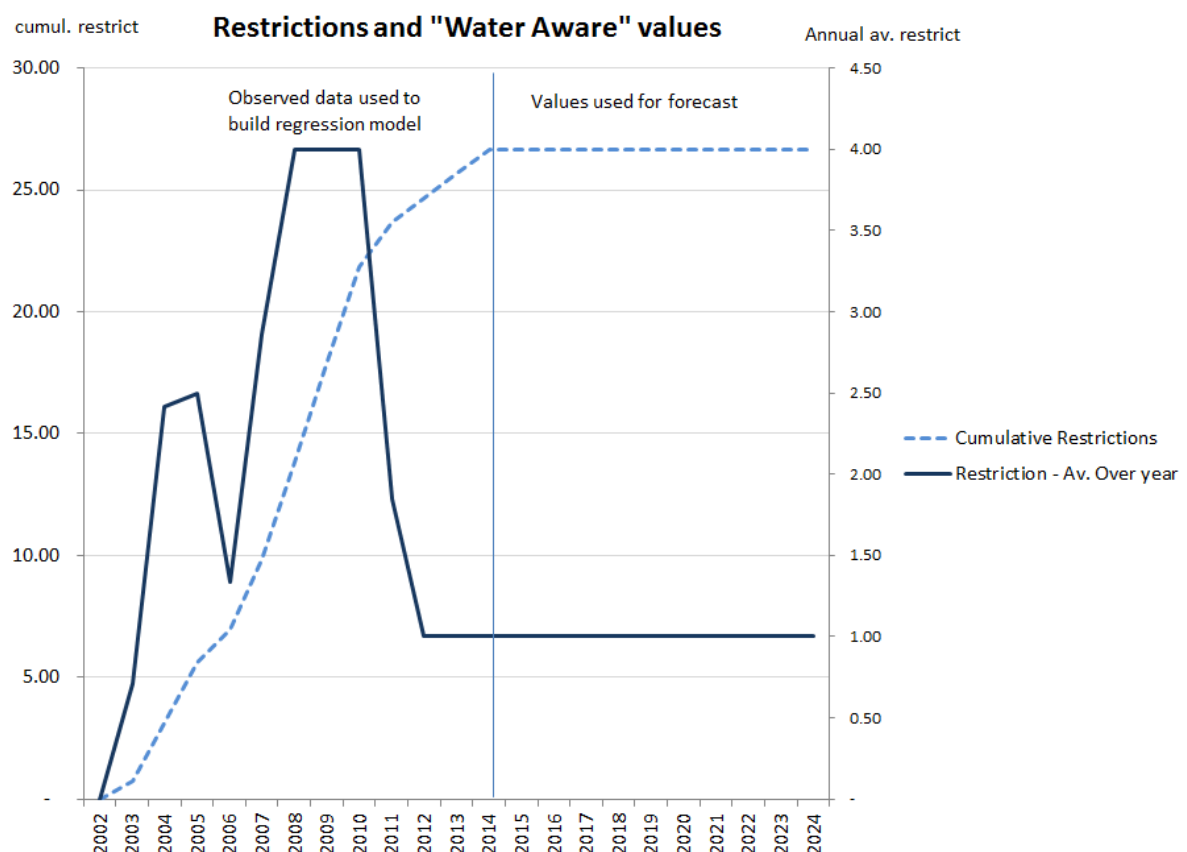


Figure 5-16. Annual average and cumulative restrictions (*water aware*): 2002-2024

- Regarding the effect of new housing; we have used the *water aware* variable to achieve a better fit with the historical data, rather than attempting to separately estimate the effects of historic changes in housing. In other words, the impacts of new housing stock in the *historical* data have been rolled into the “catch all” variable *water aware*. We did this because in the case of freestanding houses, changes in housing stock do not explain much of the per property decline, and so the use of another explanatory factor was required anyway. In the case of units, we *could* have estimated the impact of changes in housing stock and included this in the historical “fit”, and not bothered with the *water aware* variable. However for simplicity and consistency between freestanding and units, we also

used *water aware* for units, accepting that it probably represents changes in housing stock (and not changes in behaviour) for units. Note that the coefficient for freestanding houses is -3.3 kl /point of *water aware* value, while for units it is only -0.8. An increase in the *water aware* value of 1 would therefore reduce per property consumption in freestanding houses by 3.3 kl, but only by 0.8 kl in units (and vice versa).

- For the reasons outlined above, we considered that for future modelling, the *water aware* variable should be held constant. In the case of freestanding houses, this choice is partly subjective⁴². We do not know exactly what the variable represents – we assume it is a combination of changes in housing stock, behaviour, household infrastructure, garden size / type and price elasticity. Our default position is that we will include only the future effects which we are reasonably certain about: continued changes in housing stock. Other factors are assumed to remain constant (i.e. no further reductions in per property consumption due to changing appliances or price elasticity, and no “forgetting” of learned behaviour which leads to increases in consumption). This approach is reasonably conservative: we effectively state that a structural break has occurred and is complete – we do not make any assumptions about a possible increase or decrease of the value in the future. Assuming a constant level of *water aware* means that we are assuming no “bounce-back”, as discussed in Section 5.2.4. It also means that any “bounce-back” would be related to the factors rolled up in the *future water aware* parameter (i.e. appliances in existing houses, behaviour and price elasticity). It may be that some sort of bounce-back will eventually occur, but we do not yet have enough evidence from Sydney, the ACT or South East Queensland to be confident about the extent of consumer bounce-back. Our model therefore works on the basis that future consumption will only be effected by growth, weather, the addition of new, “water efficient” housing stock and temporary restrictions. The long-term behavioural aspects captured in *water aware* are now constant. There is no assumed “bounce-back”.

5.4.1.6 Step 5: Estimate growth in customer base

Our approach to expected growth involved three steps:

1. Analyse historic trends in customer growth from ACTEW’s data as submitted to WSAA
2. Analyse population trends from the ABS for the ACT, and compare these to changes in ACTEW customer numbers (to look for a relationship)
3. Obtain ABS population forecasts for the ACT.

Step 5.1 – Historic Trends in customer growth (ACTEW data).

Between 2002 and 2014, ACTEW’s data showed an average growth in freestanding houses of 1.1% p.a. Units grew at 4.4% p.a, Government / commercial customers actually declined slightly (-0.07%p.a.) and minor customer accounts rose rapidly (14.75% p.a.). Note that apart from residential units, total volumes in all categories declined, reflecting steep drops in per property consumption (shown in Figure 5-14).

Changes over the period are show in Figure 5-17.

⁴² In the case of units, it is reasonable to hold *water aware* constant because we know that the impact of *water aware* is more or less the same as the changes in housing stock, and we do account for changes in housing stock in the future. Including a rising *water aware* variable into the future would be “double counting” the effect of changes in housing stock. Including a declining *water aware* variable would suggest that some water efficient behaviour is being “forgotten” (and per capita consumption in units should increase). However for units, consumption is much less influenced by restrictions than in freestanding houses. i.e. the decline is not really about consumer behaviour. Rather, it appears to be related much more to unit “hardware” (infrastructure, size, etc). There is therefore nothing to “forget”.

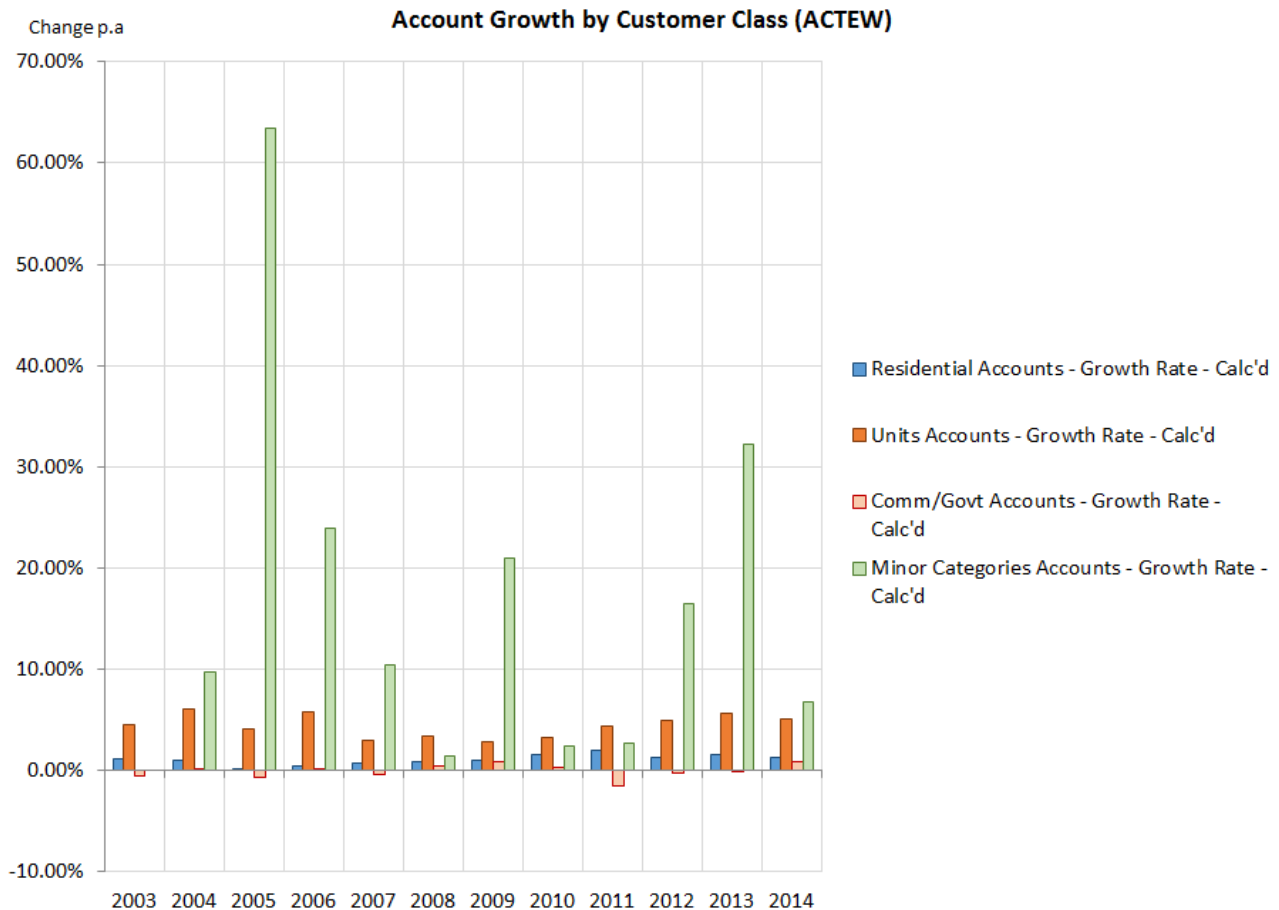


Figure 5-17. Account growth by customer class 2003-14

For the purpose of forecasting changes in customer numbers, we adopted the growth rate over the past 5 years for residential customers. Government / commercial account numbers were assumed to be constant, while minor customers were assumed to grow at the same rate as residential units.

This gave the following central estimates for customer account growth:

Growth in Residential (freestanding)	%	use past 5 year average	1.54%
Growth in Residential (unit)	%	use past 5 year average	4.67%
Growth in Govt / Commercial	%	assume constant	0%
Growth in Other (minor category)	%	assume identical to residential flats ⁴³	4.67%

Step 5.2 Compare population growth (ABS data) to ACTEW Account growth

The average growth rate in ACTEW's accounts was 2.15% p.a between 2002 and 2014⁴⁴, while the ACT population increased by 1.41% over the same period. While there is not a clear link between the growth in account numbers and the growth in population in a given year, both are positive and related over the long term, for example:

- The average account growth rates and population growth rates between 2002 and 2008 (6 years) were 1.81% and 1.18% respectively (accounts growing about 50% faster than the population).

⁴³ The number of accounts is not used in the demand forecast model for minor customers as the regression was performed on total volumes only. However a forecast was required by the Industry Panel to estimate the number of supply (i.e. fixed) charges ACTEW would collect. Note that for both Government / Commercial and minor category customers volumes consumed tend to be very high compared to the standing charge and mean that the fixed revenue component will be a relatively small part of the total revenue.

⁴⁴ Residential alone was 1.94%

- For the period 2008-2014 (6 years), accounts grew at 2.51% p.a while the population grew at 1.64% p.a. Again, accounts grew about 50% faster than the population.
- The ratio of population per account is remaining roughly constant (as shown in Figure 5-11 and Figure 5-18).

ACT Population & ACTEW Accounts

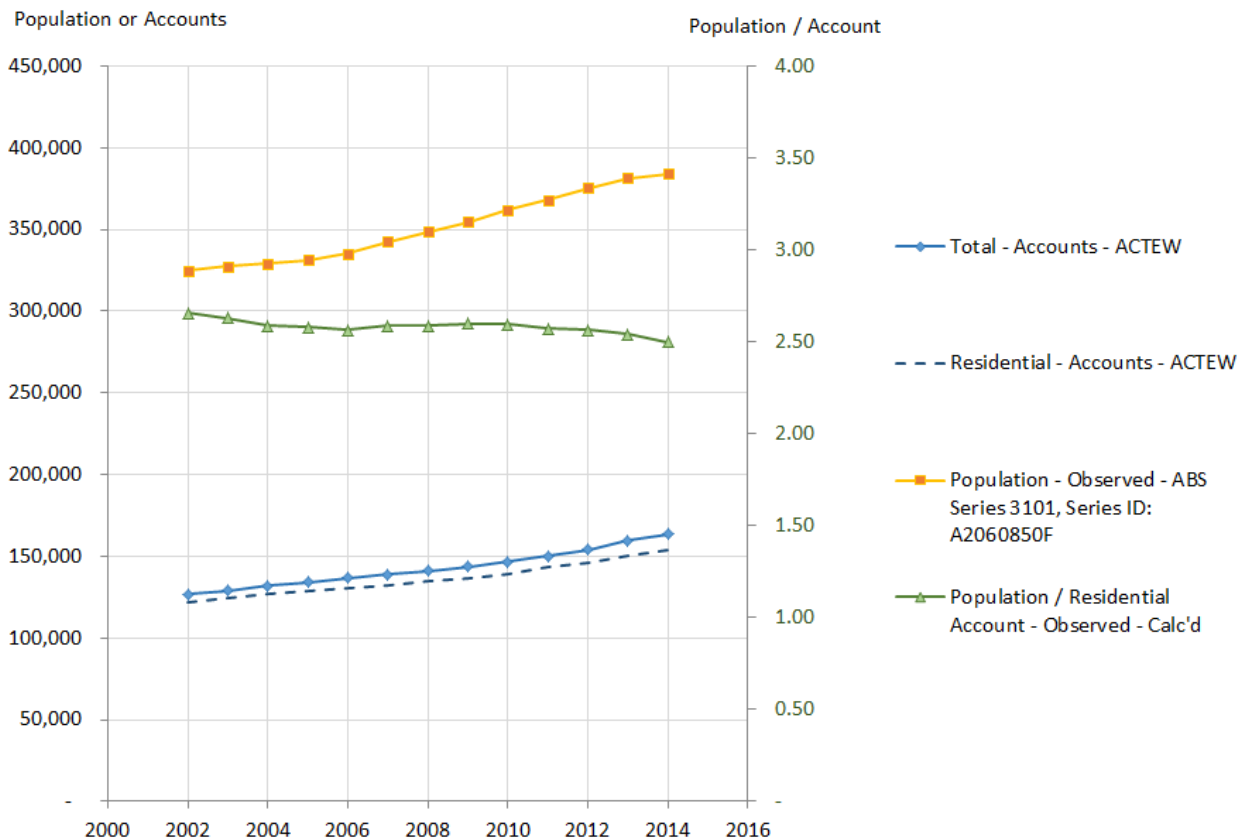


Figure 5-18. ACT population & ACTEW accounts 2002 - 2014

Clearly, accounts cannot grow faster than the population indefinitely without decreasing the average number of occupants per account. However for the moment, for our purposes we are mainly interested in the accuracy of growth projections.

Step 5.3 Obtain ABS population forecasts for the ACT

The ABS and the ACT government have made population forecasts for the ACT in the past, and the most recent ones date from 2012 – 13. The historic and latest projections, with actual population estimates, are shown in Figure 5-19.

The most recent projections from the ABS show the population increasing at 1.7% p.a. for the next 4 years.

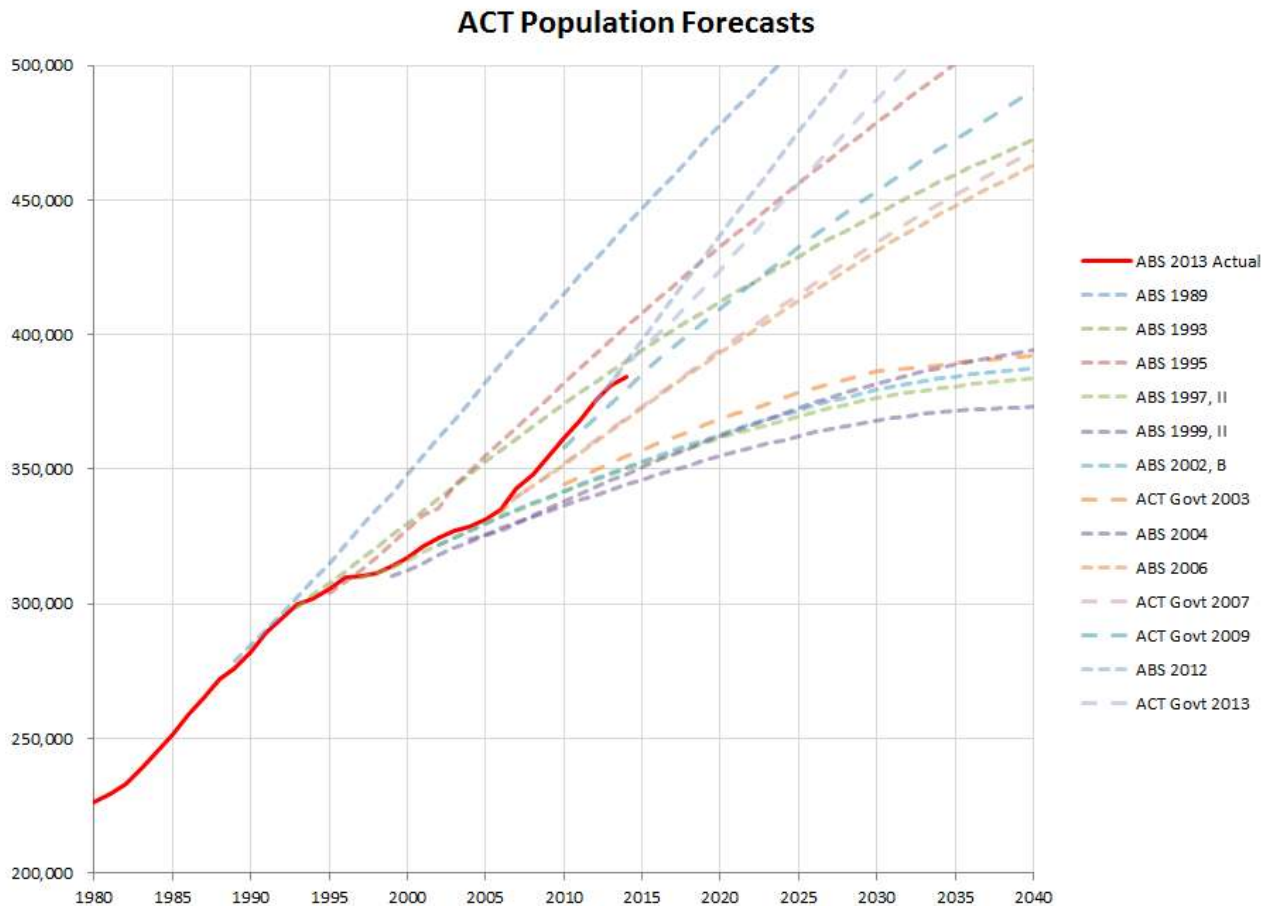


Figure 5-19. ACT population forecasts and outturn values (1980 to 2013)

5.4.1.7 Step 6 Compare ABS historical forecast accuracy

We analysed the results of 13 population projections made by the ABS and the ACT government for the ACT between 1989 and 2013, and compared their predictions to the actual observed population at various time horizons (2, 5, 10, 15 years and 20 years out).

The ABS projects a population growth of 1.95% p.a. for the 2015-18 period, while the ACT government is projecting 1.43% p.a.

Our residential account growth forecasts averages 2.5%, noting that this is lower than the historically observed ACTEW growth in accounts over the last 12 years was 2.15% while population growth was 1.41%.

Historically, growth in accounts is about 50% higher than population growth.

The purpose of analysing population forecast predictions was not specifically to use the ABS population forecasts, because the demand forecast model is made up of projected new accounts and per property consumptions. Rather, it was to:

- check that the ratio of expected growth in property to expected growth in population was roughly similar to that observed historically (which it is: the average of the ABS and ACT government forecasts is 1.69% p.a. Our property growth forecast of 2.5% $\approx 1.5 \times 1.69\%$)
- set realistic upper and lower confidence limits to our expectations about growth in property numbers, based on the average accuracy of historic population projections.

The results are presented in Figure 5-20.

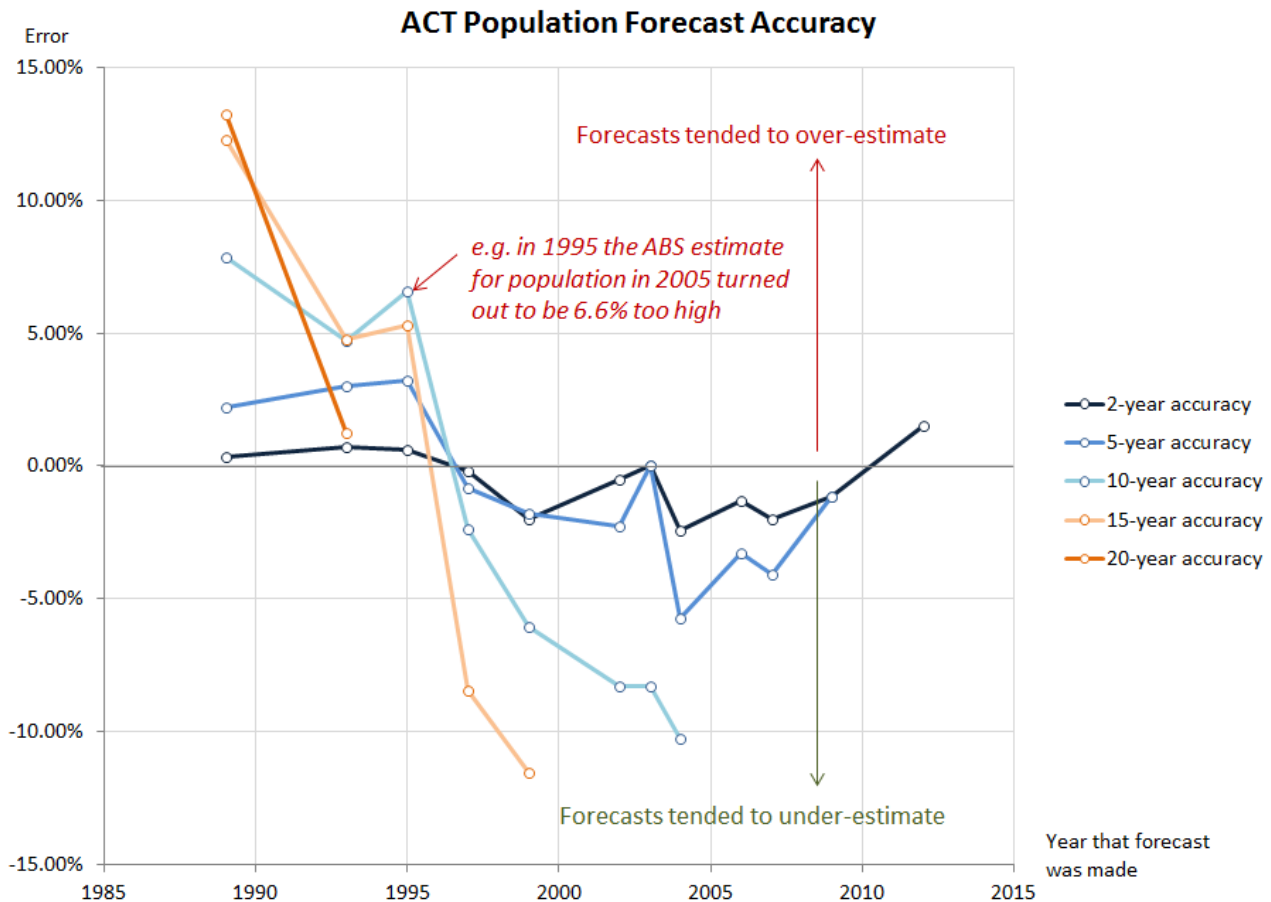


Figure 5-20. ACT population forecast accuracy since 1989

Unsurprisingly, the closer the forecast is made to the date of the forecast, the more accurate the prediction. Forecasts made in the late 80s and early 90s tended to be over-optimistic about population growth, while those made since the late 90s under-estimated growth. The most recent estimate (2012) slightly overestimated at the 2 year time horizon.

Figure 5-19 is instructive because it shows the nature of population forecasting: the forecasts inevitably reflect the most recent population trends, which are then extrapolated out for 20 years. Slow growth in the late 90s was expected to continue indefinitely. The “bends” witnessed in 1995 and 2007⁴⁵ were not foreseen.

We have used Figure 5-20 to set confidence intervals around our growth forecasts. Essentially, at the 2-5 year time horizon we can expect the actual population to be within 5% of the forecast value. This gives the following upper and lower limits to growth projections:

Table 5-2. Upper and lower limits to projected growth

ACT population forecasting	ABS 2012	ACT Govt 2013
Value in 2014	390,080	388,655
Estimated in 2018	421,430	411,401
Growth rate (central estimate)	1.95%	1.43%
Accuracy limit 2018	5%	5%
	442,502	431,971

⁴⁵ Which, curiously, correspond to changes in the federal government

Growth rate (upper)	3.20%	2.68%
Accuracy limit 2018	-5%	-5%
	400,359	390,831
Growth rate (lower)	0.65%	0.14%

Overall, population growth rate forecasts appear to be accurate within $\pm 1.5\%$ at the 5 year time horizon. Given the higher growth rate shown by ACTEW accounts, and higher variability than population, we used the central estimate $\pm 3\%$ for any given year⁴⁶ for the sensitivity analysis (using a uniform distribution).

The values used in the sensitivity analysis were therefore as follows:

Model Parameter		Central Estimate	Upper*	Lower*	Upper 95%ile over 4 years	Lower 95%ile over 4 years
Growth in Residential (freestanding)	%	1.54%	4.54%	-1.46%	2.91%	0.16%
Growth in Residential (unit)	%	4.67%	7.67%	1.67%	6.08%	3.28%
Growth in Govt / Commercial	%	0%	Not varied		Not varied	
Growth in Other (minor category)	%	4.67%	Not varied (not used)		Not varied (not used)	

* in any given year (not on average over the whole 10 years).

5.4.1.8 Step 7 Analyse Weather Variance distribution for sensitivity analysis

We analysed the variance in the annual averages of the weather data collated for the Breusch-Ward model and plotted this to determine an appropriate distribution for use in the sensitivity analysis.

At the annual average level, weather is clearly a lot less variable than on a daily, weekly or monthly basis.

The Breusch-Ward data contained daily evaporation and rainfall records for the period 1967 to 2014, covering 47 years. We took the average for each year of the cumulative variables “cumevap” and “cumrain” and used this in our annual regression model.

One of the drawbacks of the Breusch-Ward model is that while weather might be a good explanatory variable for historical variation in demand, it's hardly a good predictive variable; weather being difficult to predict more than about three days in advance. The Breusch-Ward model forecasts a central scenario for demand using the average daily evaporation and rainfall values calculated over the 1967-2014 period, assuming that any climate change impacts in the near future will be relatively insignificant. We have taken a similar approach for our central scenario, taking the average annual values (as our model does not predict daily demand, but only annual averages).

However for the sensitivity analysis, we need to estimate what the impact of the weather could be in a given year.

To forecast variability in weather, models often simply use a set of historically observed data. We only have 47 years of data and our Monte Carlo analysis uses 1,000 runs of ten years, giving 10,000 years of random “weather” which we need to generate. We analysed the annual averages for *cumevap* and *cumrain* and found them both to be approximately normally distributed (see Figure 5-21)

⁴⁶ This results in a lower average variance over 5 years (as the randomness is compounded and averaged). In our model the maximum spread over 5 years was +4% to -1% (i.e. $\pm 2.5\%$), while the 95%ile spread was +2.91% to 0.16% (i.e. $\pm 1.4\%$)

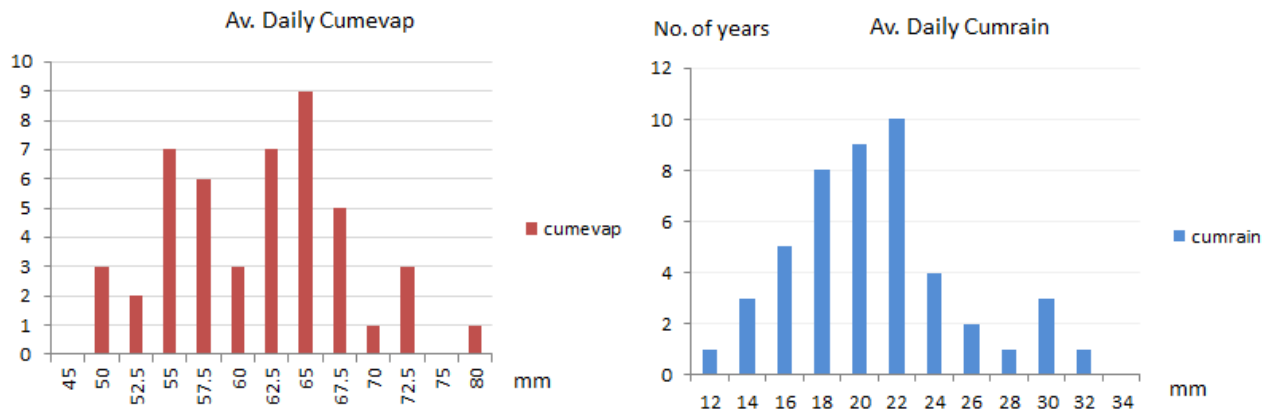


Figure 5-21. Average annual weather parameter distribution (47 years of data)

The distributions are not obviously normal, but we considered that a normal distribution would be approximately correct and if anything, give a slightly wider variance than historically observed. We used the same sample average value (60 mm) with a standard deviation of 7 (historically observed SD = 6.64).

The distribution used in our sensitivity testing (for *cumevap*) is shown below in Figure 5-22.

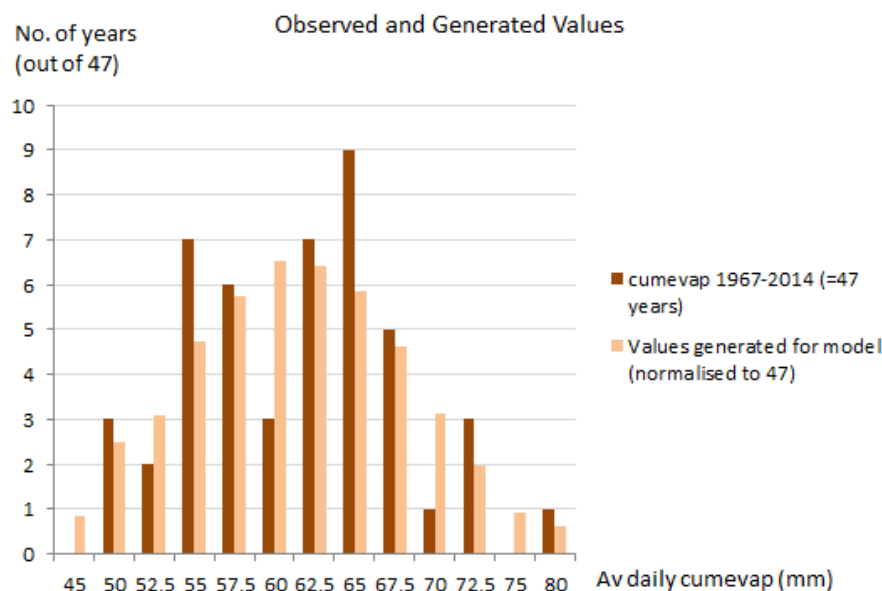


Figure 5-22. Observed and randomly generated annual evaporation distributions

As mentioned in Section 5.4.1.3 on page 63, during the regression modelling we determined that *cumrain* added no additional predictive power to the regression models. The coefficients obtained were often counter-intuitive (more rainfall = more water demand), and the P-values were consistently very low. It appears that at an annual average level, *cumevap* and *cumrain* are to some extent opposite sides of the same coin (as one might expect), and so the variance explained by *cumevap* is the same as the variance which could be explained by *cumrain*⁴⁷. The relationship is shown in Figure 5-23.

⁴⁷ Note that on a *daily* basis, *cumevap* and *cumrain* appear to be quite independent and so are appropriately included as separate predictive variables in the Breusch-Ward model.

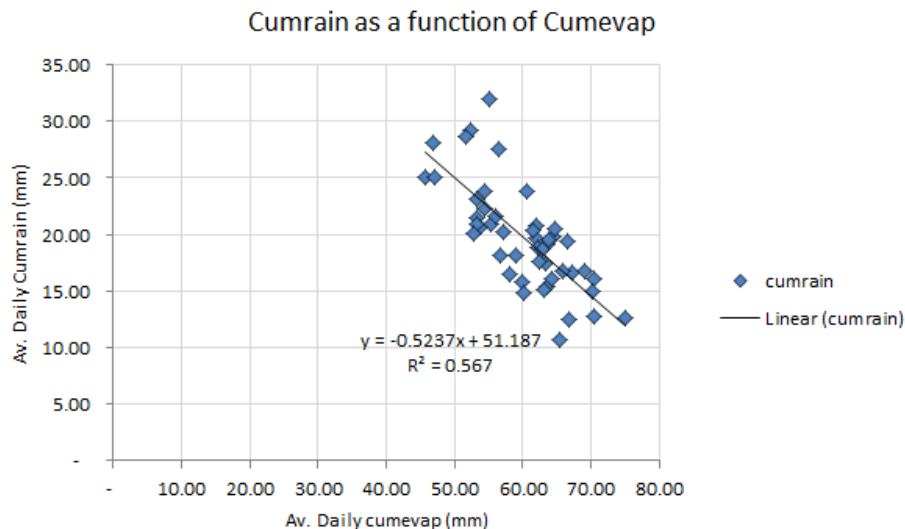


Figure 5-23. Relationship between annual averages of daily *cumrain* and *cumevap* (47 data points 1967-2014).

For the reasons outlined above, the annual average of daily *cumevap* values was the only “weather” variable retained for the regression model and Monte Carlo sensitivity analysis.

5.4.1.9 Step 8. Analyse data to determine a Tier 1 / Tier 2 split

The last analytical task required for the demand forecast was to determine the fraction of water which would be sold under the different prices of the rising block tariff.

The Breusch-Ward approach to this is discussed above. Their model made use of two regressions for each of the three customer types; one for the consumption average for all customers in that class, and one for the median consumption. Using the average and the median, a log-normal distribution can be artificially generated which approximately represents the likely observed distribution of consumers in that class. For stand-alone housing and non-residential customers, the modelled approach very closely represents the observed data in the sample (we have discussed this in Section 5.3.4).

To calculate the fraction of consumption billed at Tier 2 prices, we tried four methods:

1. Checking to see if there was a strong relationship between the average and the median values predicted by the Breusch-Ward regression models. If there was, we would have used this relationship to calculate an annual median consumption, and used the same equation Breusch and Ward used to get a log-normal distribution of consumption, and then calculate the Tier 2 values.
2. The second approach is essentially to follow the first, but instead used the relationship between the average and the median for each customer class (using an equation) to directly solve the regression for the fraction of consumption which is in Tier 2. In other words, we checked for a relationship between average consumption and the Tier 2 fraction directly, and used that.
3. The third approach is based on our analysis of the meter read data provided by ACTEW. We analysed this to check what fraction of the 4.5 million meter reads resulted in some Tier 2 consumption, and then tried to establish a (linear, regression) relationship between average annual per-capita consumption and the fraction consumed in Tier 2 for the different customer classes.
4. The last approach was to use ACTEW’s observed figures, fitted with a least-squares polynomial (the “ACTEW Curve”). This has the advantage of being non-linear (unlike the regressions, which are linear), and corresponds exactly with the split observed by ACTEW. A disadvantage is that the polynomial will not “work” outside the range of observed figures provided. A second disadvantage is that we only have data for the total split, not disaggregated by customer class.

Note that non-residential consumption is almost all Tier 2, and the fraction which is Tier 2 is relatively constant. The regression model used in Method 3 could predict the Tier 2 fraction within 0.77% of the total volume consumed, and we considered this to be sufficiently accurate. Note that we could not use the

Breusch-Ward regression models for our non-residential categories because the Breusch-Ward model considered all non-residential customers together, while our demand forecast splits them into two groups (govt /commercial and “other minor categories”).

However, we tried all three methods for the stand-alone housing and unit residential customers. The results of the first three methods are presented below:

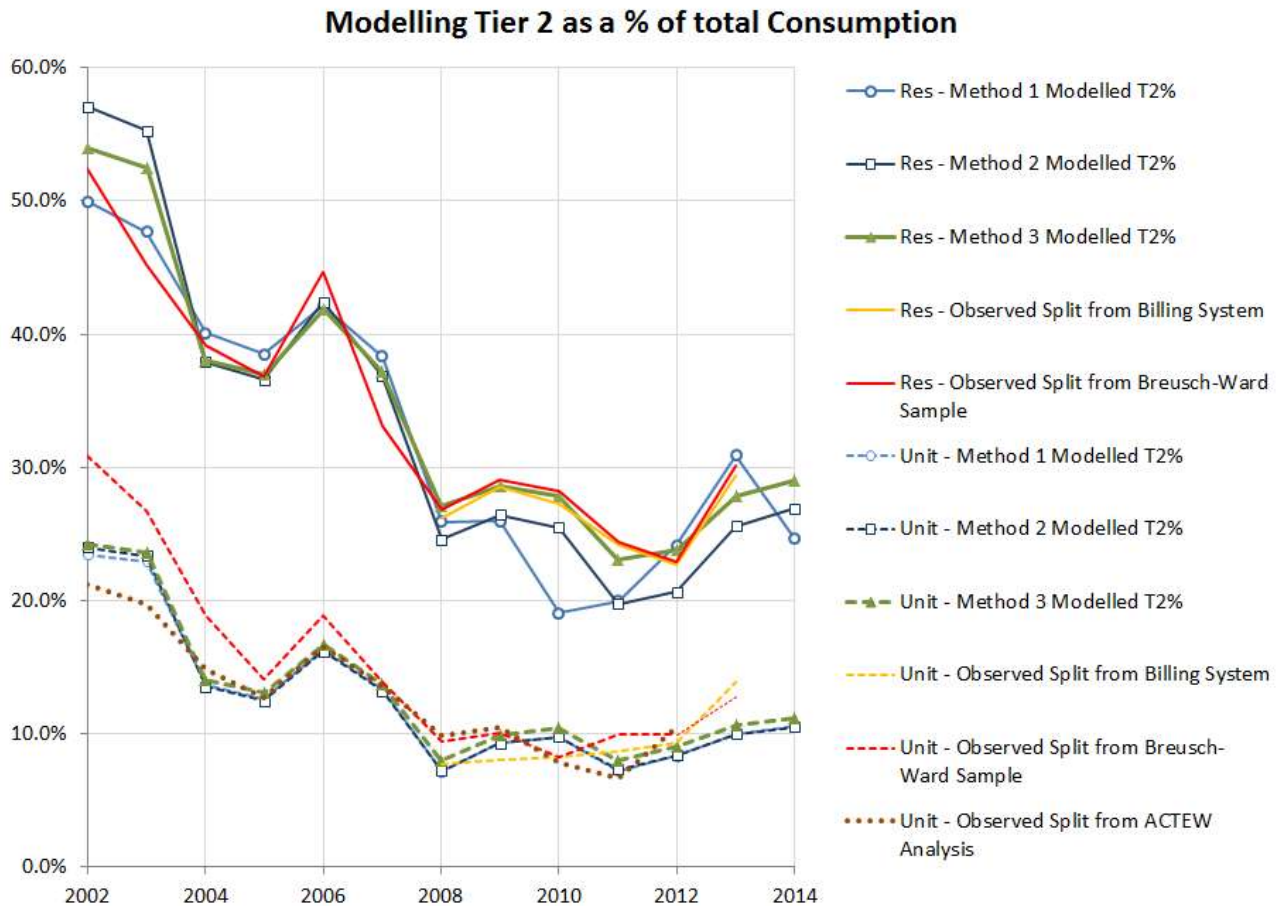


Figure 5-24. Tier 2 fraction modelling (stand-alone housing “Res” and units “Unit”)

Figure 5-24 shows the combined modelled (i.e. predicted) values and observed values from two sources of data: the 4.5 million billing records provided by ACTEW for this review, and the sample used by Breusch and Ward to develop their model. In both cases, we were able to analyse what the three methods predict compared to the observed Tier 2 split from the underlying data used to build the model.

Methods 1 and 2 performed less well than Method 3. Method 3 also has the advantage of being relatively simple.

A further check on our projected Tier 2 split was possible using some information contained in ACTEW’s submission to the Industry Panel⁴⁸. ACTEW provided data on the overall Tier 1 % as a function of ML per account per year, and also some analysis of Unit Tier 1 consumption contained in the file “80 Water cons2008-2012BM2.xlsm”. On page 13 of this document, ACTEW provides the outturn Tier 1 % of total volumes sold as a function of ML per supply charge. We have included a copy of ACTEW’s results below:

⁴⁸ Information return: demand forecasts 15 August 2014, Submission to the Industry Panel review of the Price Direction for regulated water and sewerage services determined by the Independent Competition and Regulatory Commission in June 2013

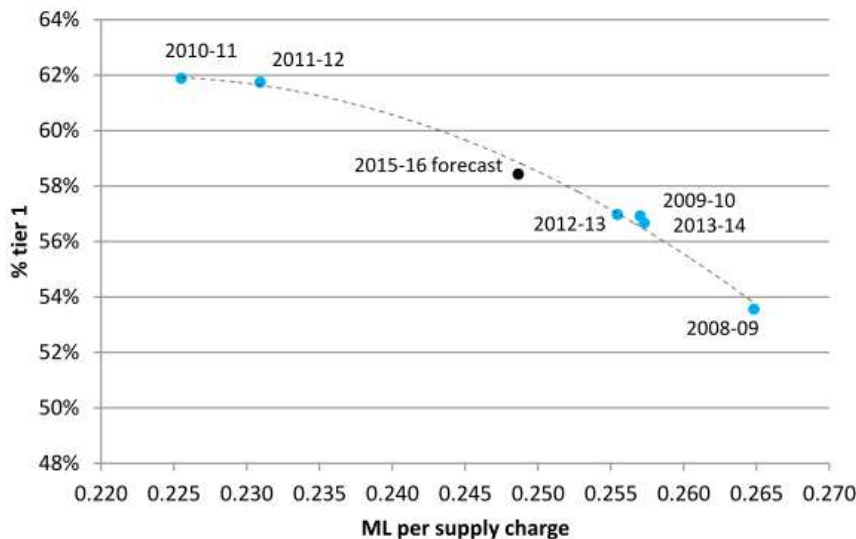


Figure 5-25. ACTEW Tier 1 observed split (submission to Industry Panel)

We extracted the results from ACTEW's overall consumption analysis and compared them to those predicted by the regression model developed using Method 3. We used the ACTEW observed values to generate a polynomial curve (Method 4). The results are below in Figure 5-26.

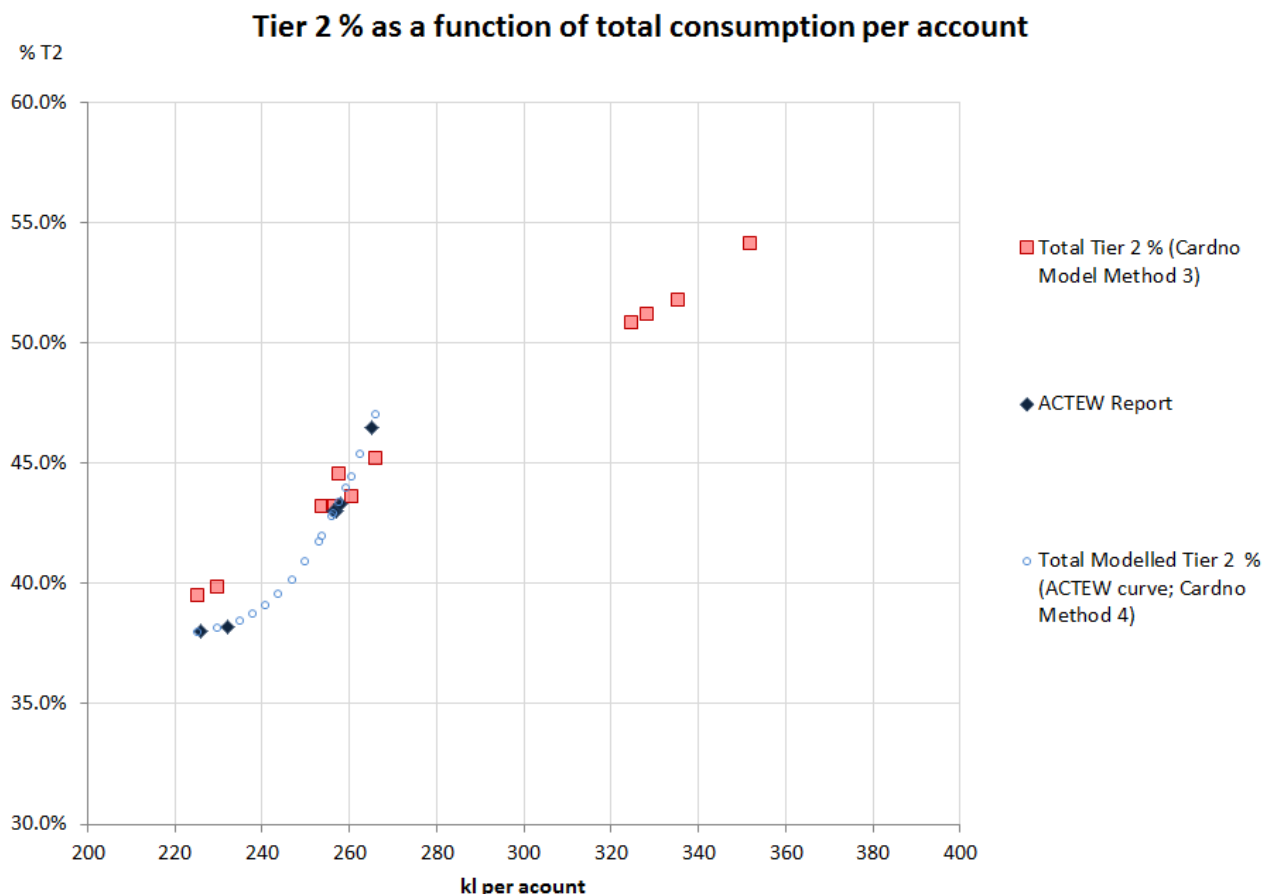


Figure 5-26. Cardno Modelled Tier 2% and ACTEW observed as a function of consumption

A drawback of Method 3 is that it is a linear regression model, which necessarily means that the relationship between consumption and the Tier 2 split is linear. ACTEW's observed data suggests that it is non-linear (see Figure 5-25, and the blue ACTEW points in Figure 5-26).

This means that for per property consumption values significantly different from those used to build the model (which were all in the 230-265 kl/yr/property range which occurred during 2008-2013), the Method 3 model may over or under predict. The presumed error would be over-predicting Tier 2 % consumption for high per property values, and under predicting for low per property values. However, for per property values within the range 250-270 kl/yr/property, the model has reasonably good predictive power (as seen by the comparison with ACTEW's observed values and the predicted values).

If a Tier 1 / 2 split is required for different customer categories, Method 3 would be required.

However all that is required for the purposes of revenue modelling is the overall split. As such, we have adopted **Method 4** (the ACTEW Curve), which will give more accurate results for the range of per-property consumptions obtained from the central forecast.

5.4.2 Forecasts

5.4.2.1 Basic model results (presented as per capita consumption)

The regression model we developed uses weather (as defined by the Breusch-Ward variable for evaporation: "cumevap"), restrictions and *water aware* (the cumulative sum of restrictions) to project variation in per-property demand. The way the model works is demonstrated in Figure 5-27:

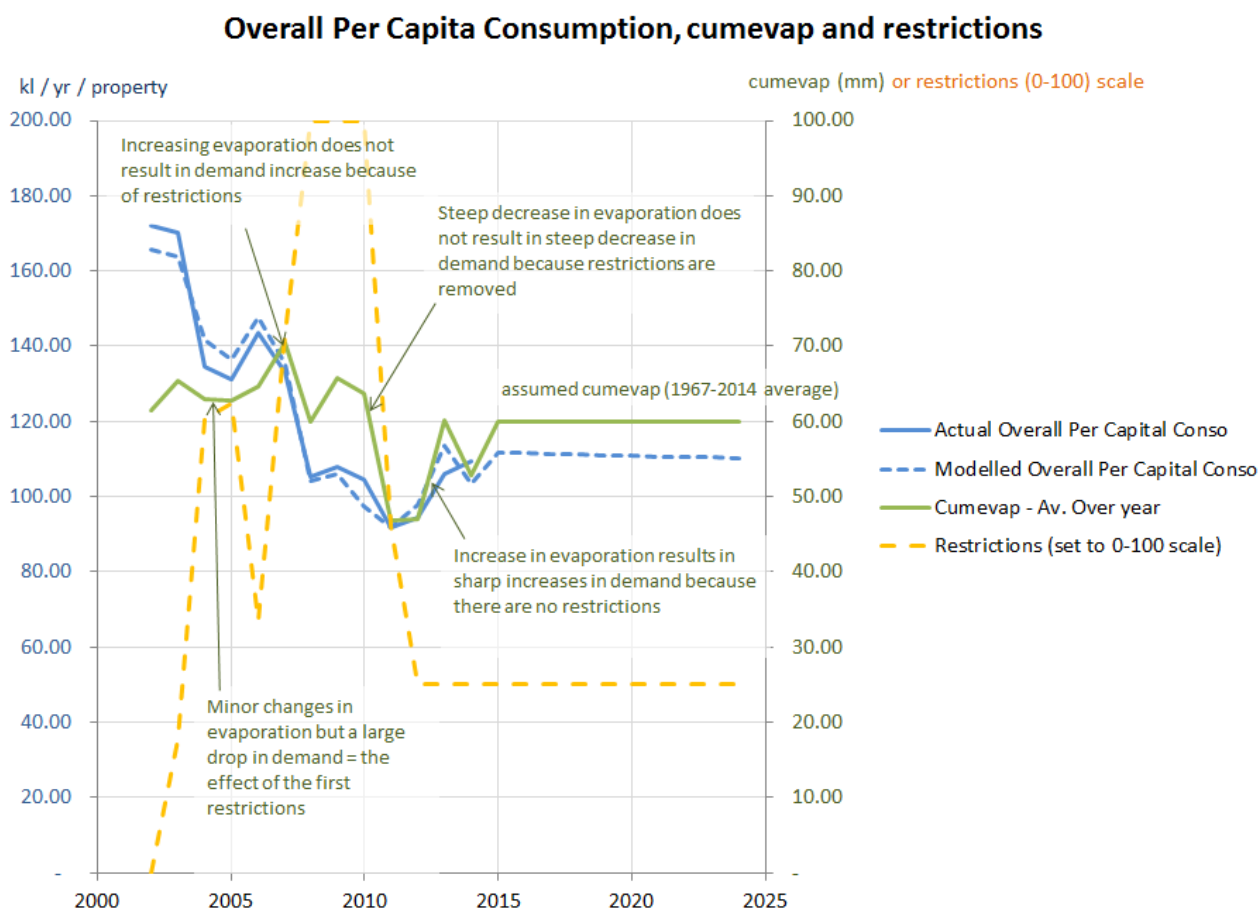


Figure 5-27. How the *cumevap* and restrictions work in the regression model

Essentially, changes in per property consumption are “explained” through changes in *cumevap*, restrictions and *water aware*. The per-property numbers are then adjusted for the effect of new housing stock, and multiplied by the projected total customer numbers to give a total demand.

In Figure 5-27 we have shown the overall “per capita” consumption, obtained by dividing total demand by the estimated population of the ACT (ABS figures). This shows that we are forecast a slight decrease in per capita consumption going forward (assuming constant weather), which is reflective of the new water efficient

housing stock being added to the customer base. Consistent with the gradually decreasing per capita consumption, the fraction in Tier 1 gradually increases over the period.

5.4.2.2 Central scenario

The demand forecast model predicts the following central scenario:

Item	20014-15	2015-16	2016-17	2017-18
Total consumption* (kl)	44,037,950	44,594,941	45,167,519	45,756,252
Total consumption at Tier 1 (kl)	24,069,261	24,989,737	25,850,109	26,655,187
Total consumption at Tier 2 (kl)	19,968,689	19,605,204	19,317,411	19,101,065

* excluding Queanbeyan and non-potable

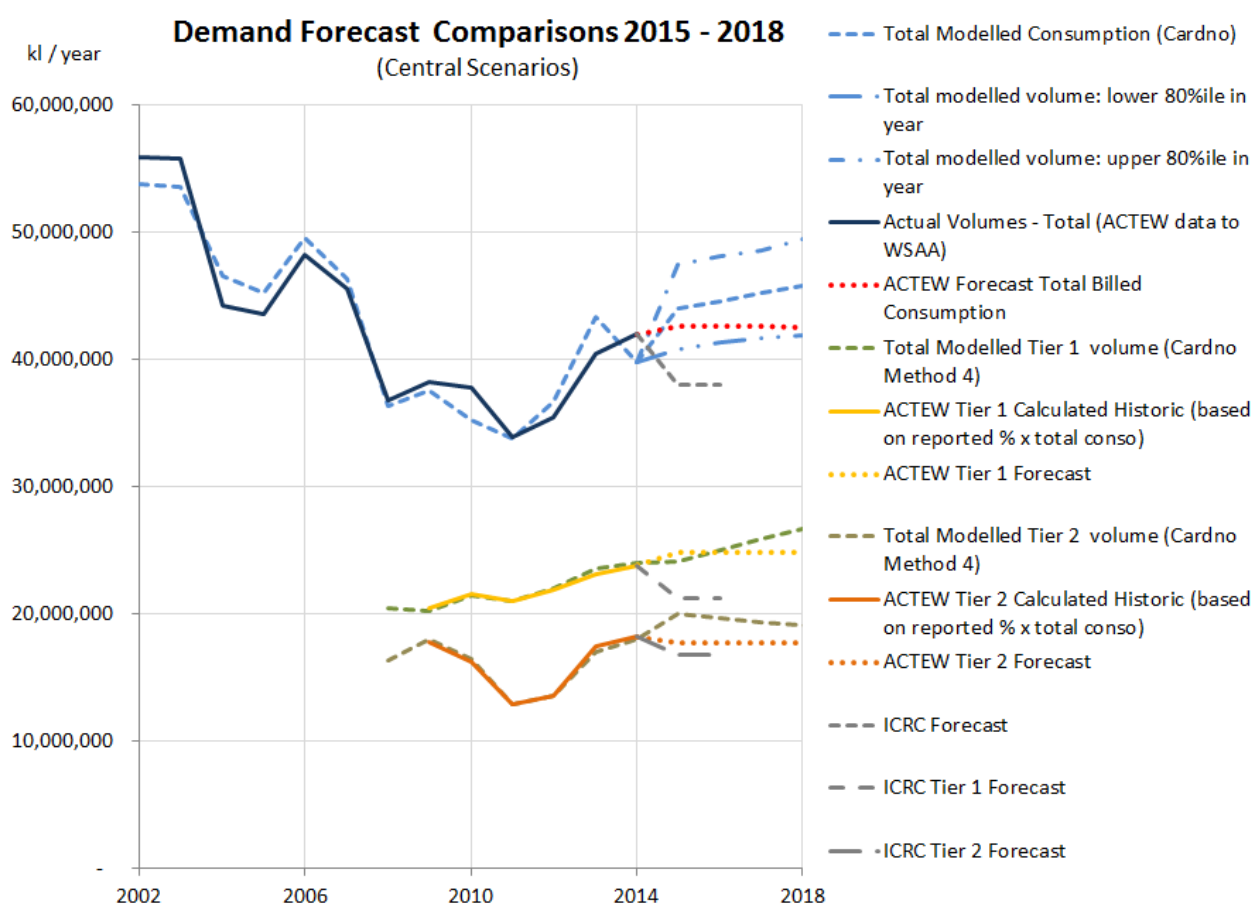


Figure 5-28. Cardno demand forecasts 2015-18; comparison with ACTEW and ICRC

As seen in Figure 5-28 (and discussed previously), ACTEW's demand forecast is an essentially static 42.5 GL / year. We project a slightly higher volume than this, but the uncertainty due to weather means that it is possible that ACTEW will only sell 42.5 GL / year on average over the period (but unlikely).

We have included the demand forecast generated by ICRC in the 2013 price determination in Figure 5-28. ICRC projected a static demand of 38 GL for the two year period 2013-14 and 2014-15, with 21.2 GL in Tier 1 (55.8%).

Our expected values are higher than those forecast by ACTEW and ICRC, reaching 45.7 GL by the end of the period (about 7.5% higher than ACTEW's forecast). We estimate the probability of ACTEW's average forecast being exceeded at 89%. The probability of ICRC's average forecast being exceeded for the first two years is 95%.

The reason for the large step up between (financial year ending June) 2014 and 2015 in our projections is the use of “average” weather conditions for the projections⁴⁹. Previous large variations in *cumevap* have not resulted in large jumps in consumption due to the countervailing effect of restrictions. However, in future we are not expecting any restrictions, and as such the level of restrictions for the regression model forecast values is set at 1 only (Permanent Water Conservation Measures). The lack of future restrictions means that a jump in the *cumevap* value to the historical average will have a significant impact on consumption.

Figure 5-28 includes the results from the sensitivity analysis, showing our 80%ile confidence bands for total consumption in any given year. We chose the 80%ile years for each year, because the accumulation of this confidence band gives a 95%ile confidence for the average consumption over the price period. This is discussed in detail below in Section 5.4.2.4.

Our demand forecast split into the separate consumer components is show in Figure 5-29.

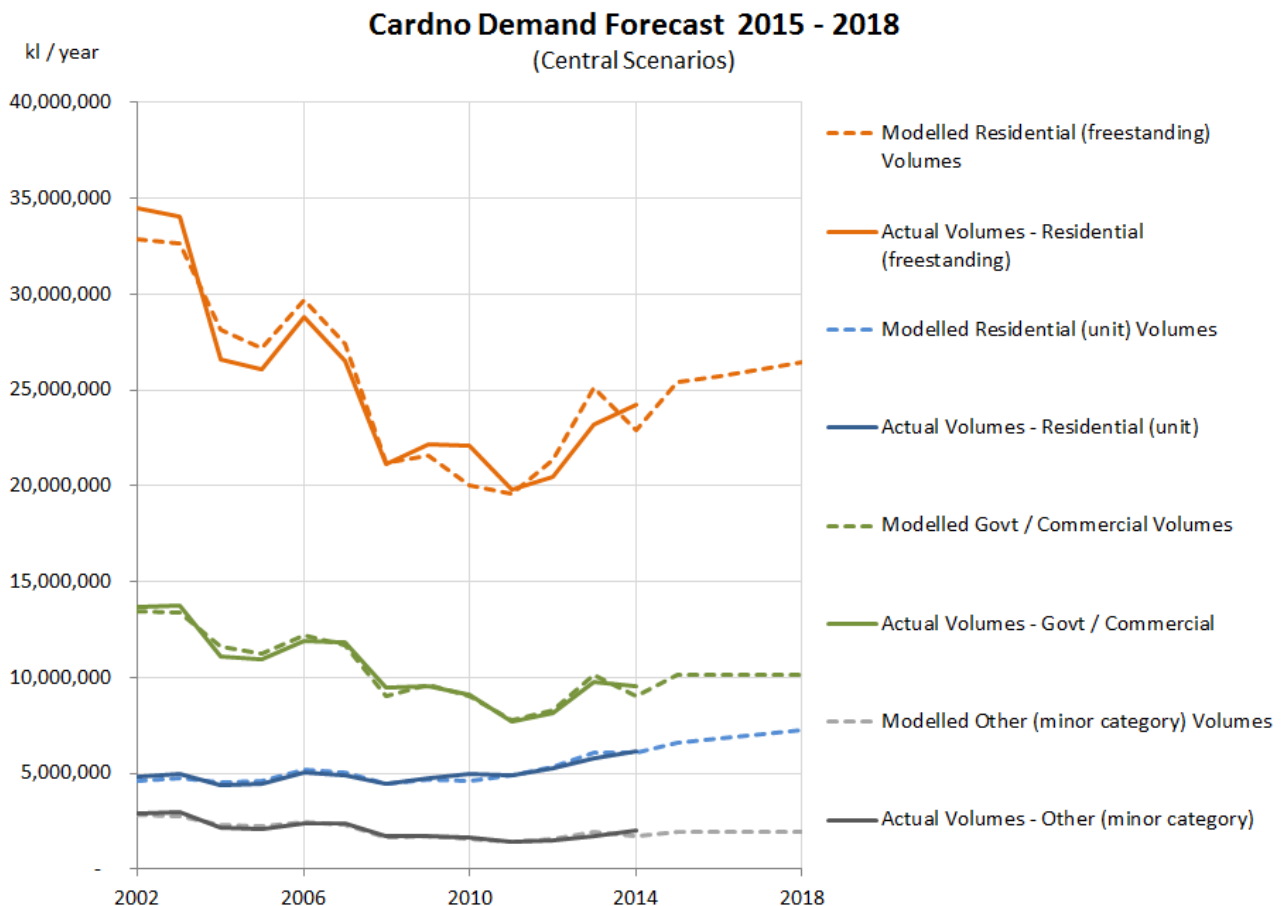


Figure 5-29. Cardno demand forecast by component

As can be seen above, growth in demand is driven by the residential customer categories. This reflects the underlying assumptions used in the forecast.

5.4.2.3 Assumptions

In developing the forecasts we made the following assumptions:

Freestanding Residential customers

- Model: per property regression x projected customer numbers
- Assumed average growth in customer numbers 1.54% p.a. (average outturn of last 5 years)
- Sensitivity distribution for growth: uniform $\pm 3\%$ in any given year

⁴⁹ *Cumevap* in 2014 was 52.7 mm, while the central forecast scenario uses 60 (the historical average). Each point of *cumevap* increases results in 2.7kl more consumption per freestanding house. So a 7 point increase gives an extra 20kl per house, which is about 10% of household consumption. Such large variations have been observed historically (e.g ACTEW's observed data shows a jump of 14% in 2012-13).

- Assumed effect of new water-efficient housing stock: -15% off per property consumption for new customers (no sensitivity included)
- Assumed weather: 1967-14 average for *cumevap*, *cumrain* not used
- Assumed restrictions level = 1 (PWCM)
- Assumed *water aware* factor (cumulative sum of restrictions) = constant (value = 26.67)
- Sensitivity distribution for weather: normal (average 60 mm, std dev 7 mm).

Unit Residential customers

- Model: per property regression x projected customer numbers
- Assumed average growth in customer numbers 4.67% p.a. (average outturn of last 5 years)
- Sensitivity distribution for growth: uniform $\pm 3\%$ in any given year
- Assumed effect of new water-efficient housing stock: -28% off per property consumption for new customers (no sensitivity included)
- Assumed weather: 1967-14 average for *cumevap*, *cumrain* not used
- Assumed restrictions level = 1 (PWCM)
- Assumed *water aware* factor (cumulative sum of restrictions) = constant (value = 26.67)
- Sensitivity distribution for weather: normal (average 60 mm, std dev 7 mm).

Govt. / Commercial customers

- Model: per property regression x projected customer numbers
- Assumed average growth in customer numbers 0% p.a. (average outturn of last 10 years)
- Sensitivity distribution for growth: none (sensitivity not tested)
- Assumed effect of new water-efficient housing stock: None (analysis showed no trend).
- Assumed weather: 1967-14 average for *cumevap*, *cumrain* not used
- Assumed restrictions level = 1 (PWCM)
- Assumed *water aware* factor (cumulative sum of restrictions) = constant (value = 26.67)
- Sensitivity distribution for weather: normal (average 60 mm, std dev 7 mm).

Minor Category customers

- Model: total volume regression
- Assumed average growth in customer numbers 4.67% p.a. (as per units; historically has been very variable). However, customer numbers not used in model as model is volumetric
- Sensitivity distribution for growth: none (sensitivity not tested)
- Assumed effect of new water-efficient housing stock: None (analysis showed no trend).
- Assumed weather: 1967-14 average for *cumevap*, *cumrain* not used
- Assumed restrictions level = 1 (PWCM)
- Assumed *water aware* factor (cumulative sum of restrictions) = constant (value = 26.67)
- Sensitivity distribution for weather: normal (average 60 mm, std dev 7 mm).

5.4.2.4 Sensitivity Analysis

Part of our scope was to consider the impact of weather on demand forecasts. A rainy year resulting in suppressed demand can result in significant revenue shortfalls for the corporation. Alternatively, a dry year can result in windfall gains and higher than necessary unit prices for consumers.

To estimate the effect of weather, we performed a Monte Carlo analysis varying four of the key assumptions to the central demand estimate:

- Freestanding residential housing growth (1.5% p.a. $\pm 3\%$ in any given year)
- Residential unit growth (4.6% $\pm 3\%$ in any given year)
- Weather (*cumevap*) (60 mm, normally distributed with a standard deviation of 7 mm)
- Regression model error (adding a uniformly distributed error to the central forecast based on the observed regression model error; typically $\pm 4.3\%$ of the value predicted for freestanding residential, $\pm 3\%$ for units, $\pm 2.5\%$ for govt / commercial and $\pm 6\%$ for minor categories).

Clearly, more assumptions could have been varied (e.g. government / commercial consumption, our assumptions about the per property reductions resulting from new builds, etc). We limited ourselves to the most material assumptions in the model, conscious of the fact that weather was likely to be the predominant source of uncertainty, and that the marginal benefit gained by adding in increasing numbers of minor assumptions would be small.

We structured the model such that the variability of each of the components could be switched on or off. This way the effect of variability for each component could be studied in isolation, or in combination with all of the other sources of variance applied. The interrelated impacts of variability are shown below.

Table 5-3. Effect of uncertainty on total demand in 2015

	At 80%ile limit (yearly basis)	
Distribution	Effect of turning on distribution while all other variance is off	Effect of turning off distribution while all other variance is on
All off	±0% (i.e. central forecast)	
Regression Model Error variance	+4.52% to -4.38%	Reduces upper limit by 0.73%, lower limit by 0.45%
Freestanding Growth variance	+0.89% to -0.85%	None
Unit Growth variance	± 0.18%	None
Weather variance (<i>cumevap</i>)	+6.83% to +6.91%	Reduces upper limit by 2.82%, lower limit by 3%. Drops total variance to +4.6% to -4.45%
Total variance all parameters "on"	+7.45% to -7.48%	

The two main contributions to uncertainty about the future come from the weather and the errors in the regression coefficients we are using for the forecast. However when all sources of variability are included, the regression errors tend to be drowned out in the weather related variance. To determine the impact of weather we will consider two cases.

Case 1: The central forecasts of the model do not contain any errors; deviations from the central forecasts are entirely due to variation in the explanatory variables (weather, growth)

The results in terms of volumes are as follows:

Table 5-4. Volume effect of sensitivity analysis (80%ile)

	(FY ending) 2015	2016	2017	2018
Central estimate (forecast model)	44,037,950	44,594,941	45,167,519	45,756,252
Lower 80%ile with weather	41,062,632	41,629,429	41,840,929	42,456,123
Lower 80%ile without weather	43,678,003	44,125,339	44,608,650	45,089,162
Upper 80% with weather	47,138,920	48,068,351	48,305,109	48,869,273
Upper 80%ile without weather	41,062,632	41,629,429	41,840,929	42,456,123
% of Upper Variance (weather)	91.5%	88.7%	78.1%	75.8%
% of Lower Variance (weather)	84.2%	80.1%	84.8%	82.0%

* the averages from the Monte Carlo should be equal to the central estimate but are slightly different due to the random distributions. They are within 0.3%

We have presented the same results graphically in Figure 5-30.

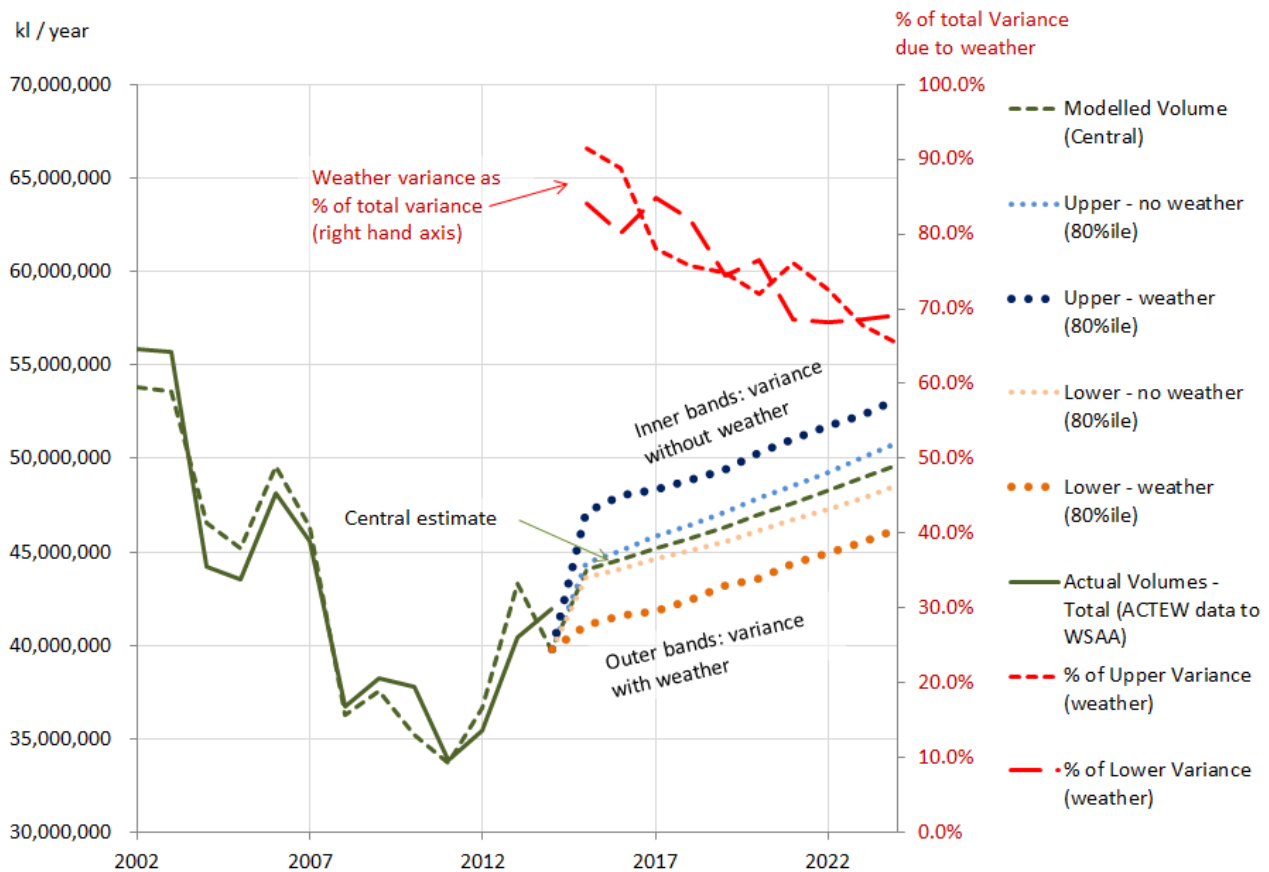


Figure 5-30. Sensitivity analysis results – effect of weather – no model errors

Figure 5-30 shows the effect of variance “with weather” and without (i.e. the effect of the growth assumptions alone). We have plotted the % of variance cause by weather on the right hand axis, which in the short-term is 90%, but declines over time (as we could expect, when growth assumptions compound and become more important, while weather averages out).

To interpret the right hand axis in Figure 5-30, in 2015, at the 80%ile level of total variability, weather will account for +80% to -70% of the total variance. We’re 80% confident that the total variance should be within $\pm 7\%$ of the forecast value in a given year (the thick dotted lines). Of this 7%, weather accounts for about 6.2% (in 2015, 5.5% in 2018), with uncertainty about growth and the accuracy of the regression model coefficients accounting for the other 0.8% (in 2015, 1.5% in 2018).

In summary, over the 2014-15 to 17-18 period, we are 95%⁵⁰ confident that weather should account for an average of 83% of the variance from the central demand forecast – assuming the model has no regression errors and the central forecasts are correct.

Case 2: The central forecasts of the model contain errors; deviations from the central forecasts are due to variations in the explanatory variables (weather, growth) but also to modelling errors

Carrying out the same analysis as above, but including model errors, although the overall chance of an incorrect forecast is not much higher, we see that the modelling errors could explain a significant part of the observed deviation.

⁵⁰ This is the cumulative effect of a number of 80% annual confidence limits

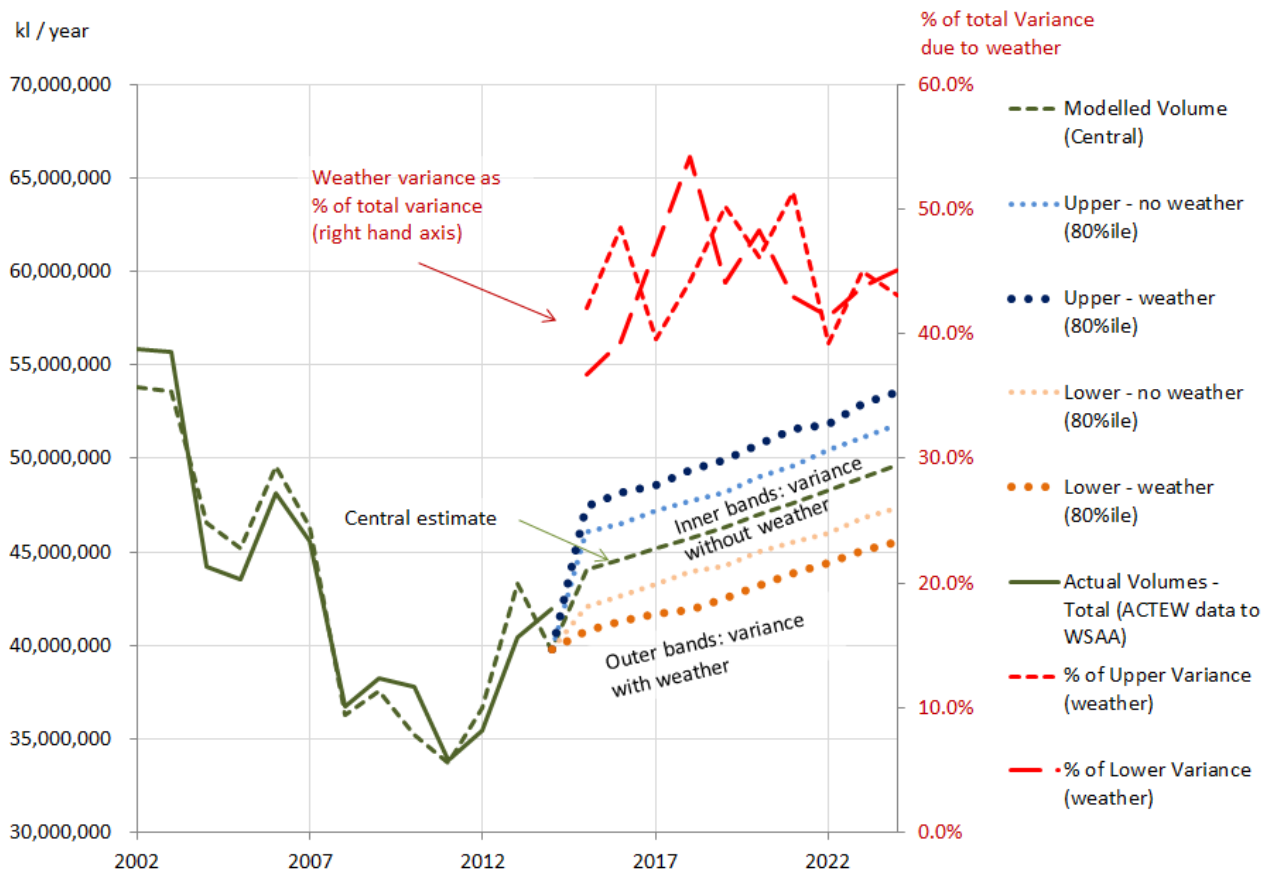


Figure 5-31. Sensitivity analysis results – effect of weather – including regression model errors

In **Figure 5-31** we see that the overall error bands (at the 80%ile level) have not significantly increased; the error increased from $\pm 7\%$ to $\pm 7.5\%$, but the fraction of the error which could be caused by non-weather factors has increased. The overall “weather contribution” to uncertainty is only between 40-50%, and does not decrease significantly over time.

In summary:

- If the forecast model were perfectly able to explain changes in demand from the explanatory variables of growth and weather, we would expect changes in weather to account for about 83% of the variance from the central forecast in the future.
- However, if we accept that our model is necessarily imperfect, then we can expect that weather will only contribute to about half of the uncertainty in forecasts, with the remaining coming from model errors, and to a minor extent, our assumptions about growth.

5.4.3 **Task 2 Conclusions and Recommendations**

5.4.3.1 ***An appropriate demand forecast model***

ACTEW has developed a sophisticated regression model which can explain historical changes in demand on a daily basis, using a combination of weather and restriction information.

We previously noted that ACTEW did not build their demand forecast model for the purpose of predicting demand over four years. As discussed in section 5.3.5, ACTEW's model suffers from a number of drawbacks from the perspective of a four-year regulatory demand forecast:

- It relies on weather as the key explanatory variable, which is impossible to predict. As a result, the central scenario is based on historic weather averages for all years in the price period, resulting in virtually constant demand.
- Demographic changes are not used, and assumed to be constant in the medium term forecast by the model (or explained by the model autoregressive error factor in the short term).
- The model is based on a set of sample data which is not representative of ACTEW's wider customer base (all are existing customers since 2001). These customers consume considerably above the average, and require a substantial "correction factor" to adjust their average demand to the population average.
- The model appears only to have been tested using "in-sample data". When additional data was added to the model (i.e. when it was updated), this resulted in significant changes to the regression coefficients and the predicted outcomes. If the addition of a relatively small amount of new sample data significantly changes the model's medium term predictions, we have less confidence in its predictive powers. ACTEW's original intention when building this model was to update it frequently (annually)⁵¹.

As such, the ACTEW model is not suitable for determining prices over the remainder of the regulatory period.

We have sought to construct a demand forecast model which is more typical of those used for medium to long-term demand forecasting, consistent with the principles outlined by the National Water Commission in Section 5.4.1.1 of this report. This model recognises that demand in a given year is strongly influenced by the weather, but over the longer term demographic factors are taken into account. We have included both weather and demographic factors in our projections.

Given that the Panel needs a demand forecast for the four-year period from 1 July 2014 to 30 June 2018, we recommend the demand forecasts included in this section of the report be used rather than those developed by ACTEW.

5.4.3.2 ***Confidence in the alternative demand forecasts in this report***

Noting that forecasts are necessarily uncertain, we have sought to quantify the various sources of uncertainty about our forecasts. The uncertainty can be grouped into three components:

- Uncertainty about our weather forecasts
- Uncertainty about (population / property) growth forecasts
- Uncertainty the accuracy of the coefficients in our model, which are approximations based on historical data from 2001 to 2014.

Of these sources of uncertainty, weather is the most important in a given year. Over the long term, weather declines in importance as a source of uncertainty and assumptions about population growth become more

⁵¹ "...we recommend that the forecasting procedures identified in this report be updated at least annually as new behavioral data become available, and any water use policies based on these forecasts be correspondingly updated to reflect the latest information." Building a forecasting model of ACT water use Final report. Ward, Breusch, June, 2012. Page 4.

important. However, over the next four years, weather will still remain the predominant source of variance between what our model predicts and what is actually observed.

After weather, errors in the model will account for some of the difference between predicted and observed consumption. Finally, the difference between our assumptions about demographic growth and the reality will also account for relatively small errors in the predictions.

Our forecasts contained in Figure 5-28 include 80%ile confidence bands for the central estimate in each year. We are 80% confident that the observed demand in any given year we will between these lines. Over the four-year period, we are 95% confident that the average demand will lie in the band created by these lines (av. lower bound = 41.75 GL, av. upper bound = 48.3 GL).

5.4.3.3 *Comments on probability of demand exceeding ACTEW's forecast*

Our demand forecast model allows us to form a view on the likelihood of ACTEW's projected average annual consumption of 42.5 GL being correct. We used the Monte Carlo component of the model to estimate what the likelihood of average total demand over the 2014-15 period being equal to 42.5GL. Our central estimate average for 2014-15 to 2017-18 was 44.9 GL (rising from 44.0 GL to 45.7 over the period).

- If our regression model contained no errors, we would estimate the chance of the actual average for the period being equal to or below 42.5 GL at **10%**. In other words, the probability of exceeding this value is about 90%.
- However, given the regression model does contain errors, the chance of the actual average for the period being equal to or below 42.5 GL is slightly higher, at **11.5%**. In other words, the probability of actual demand exceeding ACTEW's prediction is about 88.5%.

We would therefore not recommend ACTEW's demand forecast be used for pricing over the next four years.

5.4.3.4 *Comments on probability of demand exceeding ICRC's forecast*

We can also use the demand forecast model to estimate the likelihood of ICRC's forecast of 38 GL being achieved in the 2014-15 and 2015-16 period.

Over this period, our central demand forecast is an average of 44.3 GL (excluding Queanbeyan, non-potable and leakage). An average demand of 38 GL is possible (for example, if the weather were unusually cool and rainy), however we estimate the chance of demand being 38 GL or below at about 5%. In other words, the probability of demand exceeding this level, on average, over the next two years, is 95%.

We would therefore not recommend ICRC's demand forecast be used for pricing over the next four years (or even over the next two years as was originally intended).

6 Task 3: Regulatory treatment of the water security projects

6.1 Scope of works

As specified in the Panel's Terms of Reference, Task 3 consists of two alternative activities:

- ▶ a) Advice on the proportion of the \$570 million that ACTEW spent on the Enlarged Cotter Dam (ECD) (\$420 million) and the Murrumbidgee to Googong Pipeline (M2G) (\$140 million) that can be attributed to existing customers (i.e. the proportion that delivers benefits to customers in the period to 30 June 2018 versus customers in the period 1 July 2018 to 30 June 2023 or post 30 June 2013) and advice on when ACTEW should start to recover the residual capital costs.
 - This would take the form of an estimate of the reasonable capacity expansion that was required to meet ACTEW's security of supply standard at the time and over the term of the next regulatory period, compared to the actual capacity installed.
- ▶ b) As an alternative to (a), advice on aligning the profile of the recovery of the capital costs associated with the water security projects with the profile of benefits that customers can expect to derive from the projects.
 - This would take the form of an estimate of the benefits that customers will derive from the water security assets over the economic life of those assets, and could utilise long-term water demand forecasts and/or forecast population growth. To the extent possible, customer benefits in the initial stages of the assets' lives should reflect the value of water security and not just capacity.

Cardno understands that this analysis will be used to inform the Panel's assessment of how much of the capital costs associated with the ECD and M2G can reasonably be attributed to customers in this regulatory period (1 July 2013 – 30 June 2018) versus future customers (i.e. to achieve some degree of intergenerational equity).

6.2 Determination of capacity expansion required (alternative (a))

The purpose of this review is not to consider the prudence of the decision to construct the ECD and the transfer from the M2G ("the selected options"), which has been considered elsewhere. However, in considering what capacity is required for the period 2013-14 to 2017-18 and an appropriate cost of this capacity, we are necessarily considering alternative ways that this capacity could be achieved for the current regulatory period, and the associated cost.

As described above, our purpose under this alternative is to:

estimate the reasonable capacity expansion that was required to meet ACTEW's security of supply standard at the time and over the term of the next regulatory period, compared to the actual capacity installed

In order to estimate the capacity expansion required, we need historic information on river flows, inflows and dam levels so that we can determine the total amount of water spilled from existing dams and flowing in exiting catchments, which could have been retained if capacity had been expanded through the enlargement of capacity in an existing valley or construction of a dam in a new one. This information could help form a view on the total capacity expansion required in the Cotter River valley for the 2014-18 regulatory period, assuming various demand profiles (e.g. the demand profiles built up in Task 2) and rainfall / inflow rates.

This exercise would have required either detailed hydrological modelling or some broad approximations to arrive at an estimate of the capacity needed for the next regulatory period, and the cost of constructing that. Unfortunately, reconstructing and re-running the hydrological models was outside the scope of this limited review, so we were unable to progress this option.

6.3 Determination of benefits from water security projects (alternative (b))

ACTEW provided us with a profile of benefits over time for the water security projects implemented (ECD and M2G) (shown in Figure 6-1). In this section we will consider if these benefits can be used for the purpose of splitting costs between current and future customers.

While the purpose of this section is not to consider if the water security projects were justified or not, we will consider the overall magnitude of the benefits estimated by ACTEW to determine if they can be used to determine the proportion of costs that can be reasonably attributed to current customers versus future customers.

As part of the business case and optioneering exercise for its water security program, ACTEW considered the costs and benefits of various schemes. Benefits were defined as the value of avoided restrictions; restrictions were determined to impose a social cost, and so avoiding them was equated to a benefit for consumers⁵².

As previously noted by the ICRC⁵³, ACTEW adopted a set of assumptions which were highly favourable to the justification of a large capital investment in water security; higher bound willingness-to-pay, extreme drought scenarios, and upper bound population forecasts (which puts pressure on demand as well as generating more benefits from a larger population).

ACTEW described these assumptions as “conservative”⁵⁴ and “prudent”⁵⁵. They are conservative from the perspective of avoiding the risk to water security. However they are not conservative from the perspective of avoiding the risk of early or unnecessary capital investments, keeping prices low, or taking service levels well above the minimum standards. One of the “conservative” decisions was to assume that the climate change forecast for 2030 by the CSIRO had already occurred, based on the reduced inflows during the 2001-2006 drought. However, a standard statistical test comparing the recent average flow with the time series available would not have convincingly supported the view that 2001-2006 was strong evidence of climate change⁵⁶.

Finally, in estimating the cost of restrictions (i.e. the benefit of avoided restrictions), ACTEW decided to multiply their estimated cost of Stage 4 restrictions by a factor of 3.5, referred to as a “risk aversion factor”⁵⁷. This increased the 2007 value of avoiding Stage 4 restrictions from \$139.6M to \$488.5M. It is unclear why the results expressed by customers in the willingness-to-pay survey needed to be scaled up in this way. Presumably customers were considered to be too willing to accept risk. Instead, the view was taken that they would rather buy three Cotter Dams each year (i.e. pay \$1,200 per person, per year) rather than face Stage 4 restrictions⁵⁸. On the face of it, this does not seem very reasonable. However, part of ACTEW’s justification of this “risk aversion factor” was to reflect the risk of physically running out of water as lower and lower volumes become available. The willingness-to-pay to avoid this is presumably very high, and not captured in the willingness-to-pay survey results. ACTEW’s approach was therefore effectively to draw a “line in the sand” at Stage 4 (115 kl / account / year of water resources available), rather than some lower level of water availability.

⁵² Note these benefit are mostly “economic” (typically, time saved), not financial (unless residents are somehow able to turn the time saved into money). It is unwise to rely purely on theoretical economic benefits, particularly for poorer customers, if customers cannot turn the benefits into the real money that they need to find to pay the increased water bills. Taken to the extreme, \$20,000 per year of theoretical economic benefits for a customer would not necessarily allow her to pay a \$10,000 water bill, even if it can be used to justify the project.

⁵³ ICRC, Final Report Enlarged Cotter Dam Water Security Project Report 9 of 2010 June 2010

⁵⁴ “Water Security for the ACT and Region”, ACTEW July 2007, Section 1.3 Page 3

⁵⁵ “FUTURE WATER OPTIONS REVIEW, Water Security Program”, July 2007, ACTEW Page 34

⁵⁶ ICRC, Final Report Enlarged Cotter Dam Water Security Project Report 9 of 2010 June 2010, page 64

⁵⁷ “Water Security for the ACT and Region”, ACTEW July 2007, Page 42

⁵⁸ No watering of gardens with potable water, no topping up of swimming pools, no vehicle washing. Pet fish, however, are spared - their ponds can be topped up. Note that customers who live in apartments and therefore don’t have large gardens are included in this figure. If the value of benefits were divided by freestanding house customers, it would rise to \$1,800 per person per year, or \$4,500 per household, as an average willingness-to-pay to water a garden with potable water.

ACTEW's benefits calculations were carried out with the assistance of the consultancy Centre of International Economics (CIE). Working with ACTEW's hydrological modellers and drawing from a number of willingness-to-pay studies, ACTEW calculated the following benefits profile from the selected option (ECD and M2G).

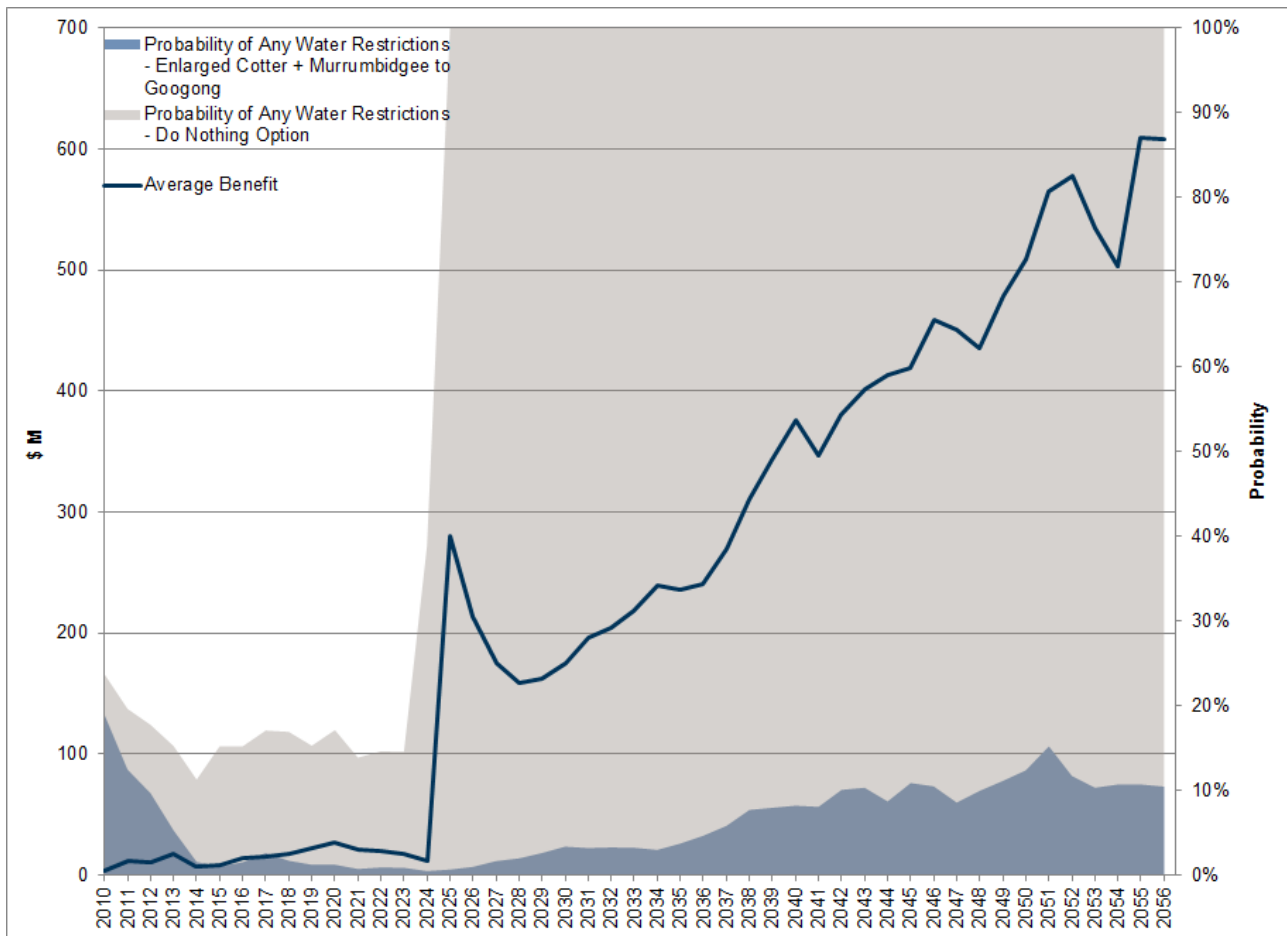


Figure 6-1 ACTEW's average estimated benefits (ECD and M2G project).

The large jump in benefits that occurs in 2025 was explained by CIE as follows:

"...in the 2007 modelling, the Do Nothing option became unfeasible in this year. It was found that there was a possibility of running out of water altogether if the system was not augmented by this date. In order to minimise this possibility, severe water restrictions were applied much more frequently in the Do Nothing option after 2025 and some level of water restrictions applied all the time."

We do not have access to ACTEW's benefit model; only the results. The benefit modelling was a sophisticated process which linked hydrological and climate modelling to willingness-to-pay data, and could not easily be replicated for the purposes of this exercise, even if the model had been made available.

We have noted that absolute *quantity* of benefits may be overstated because of the "conservative" assumptions mentioned previously. However, without the ability to re-create the modelling, we are obliged to accept ACTEW's analysis regarding the *timing* of benefits. The CIE profile shows that 91% of economic benefits occur after 2025 (in NPV terms, using ACTEW's pre-determination WACC of 9.65%). Only **0.5%** of the total nominal benefits occurs between 2013-14 and 2017-18, or **6%** in NPV terms (assuming a WACC of 9.65%). If the ICRC Draft Determination WACC of 7.2% is used, the NPV benefit during the period is only **3.6%**.

Having noted that ACTEW's benefit calculations show between 0.5% and 6% of the benefits occurring during the 13-14 to 17-18 regulatory period, we would caution against using these figures to apportion costs. Why ?

- Firstly, we do not have access to the benefit calculation model, which as noted above may have overstated benefits, undermining confidence in the overall figures and timing, and as a consequence, the fraction which can be attributed to current customers.
- Secondly, while ACTEW's analysis may show that the investments are not cost-beneficial for customers in the short term, we note that ACTEW's mandated service level is to ensure less than a 5% risk of water restrictions. This service level may not be well supported by willingness-to-pay survey data, but the Corporation is nevertheless required to achieve it. Using the benefits in the CIE report as a means of reimbursing costs to ACTEW effectively means the Corporation will not recover investments required to meet its mandated level of service.

In conclusion, we recommend the panel consider an alternative approach to the question of intergenerational equity. This approach is outlined below.

6.4 Tantangara transfer counterfactual

Given the issues outlined above with alternatives (a) and (b), we have given further thought to whether the costs of the ECD and M2G can be allocated to current versus future customers by having regard to the cost of achieving **an equivalent level of water security** for customers during the 2013-14 to 2017-18 period using an alternative source of supply. This approach ignores the relative level of benefits between current and future customers, and simply considers **the short-term cost of achieving the same service level of water security** (which is within ACTEW's mandated standards of a 5% chance of restrictions in any given year).

One alternative source of supply that ACTEW has previously identified is the option of securing releases from Tantangara Dam⁵⁹. In the optioneering documents that were provided⁶⁰, Tantangara appears only to have been considered as a long-term solution (i.e. over 25 years), and the sum of what are effectively operating costs (payments to Snowy Hydro for water storage) were capitalised at their present value for comparison with other options⁶¹.

We do not know if Tantangara was considered as an interim solution pending greater certainty that the climate had, in fact, changed. A hypothetical Tantangara transfer was considered in some of the options modelling, but we do not have details of the results. The option of Tantangara and M2G alone was not presented in the CIE report⁶², but Tantangara transfers are included in some of combination options, and we note that ACTEW has been purchasing high security entitlements to Tantangara water in what appears to be a parallel strategy for water security (in addition to construction of the ECD). In the Future Water Options Review, every combination option included the Enlarged Cotter Dam. In the CIE report, four combinations of schemes were considered: ECD alone, M2G (Angle Crossing) alone, ECD and M2G without additional releases from Tantangara, and ECD and M2G with Tantangara. It is unclear why Tantangara was not considered alone (or in combination with M2G) in this report, and we cannot disentangle the marginal benefits of Tantangara from the combined schemes⁶³. Given the large amount of water yield that both the ECD and Tantangara can independently provide, it is unclear why both options would be pursued simultaneously.

⁵⁹ "Water Security for the ACT and Region", ACTEW July 2007, executive summary notes that the Tantangara "... proposal has always been very attractive in theory, but ... involves a high level of legal and political assurance". The report goes on to state that "either of the Tantangara transfer or Water Purification Scheme is an essential element of any mix of options for the future".

⁶⁰ *ibid*

⁶¹ "FUTURE WATER OPTIONS REVIEW, Water Security Program", July 2007, ACTEW Appendix D

⁶² Centre for International Economics, "Economic benefits of new water supply options - Using 2030 and 2070 climate sequences" 17 August 2009

⁶³ Although, Tantangara and Angle Crossing (i.e. M2G) appear to have been considered as a stand-alone project on page 47 (Figure 8-6) of "Water Security for the ACT and Region", ACTEW July 2007, and the Tantangara transfer was considered as a stand-alone option in the Future Water Options Review (July 2007) Appendix B, Option 5.

Tantangara reservoir receives large inflows (typically 300 GL / year), and ACTEW noted that that “even in tough times, some water will be available to top up ACT reservoirs”⁶⁴. As such, we can consider Tantangara and M2G alone as a potential counter-factual to the ECD and M2G and estimate a hypothetical cost of using this option during the current regulatory period as a means of providing the level of water security required by current users. Indeed, this option was explicitly analysed in one of the public submissions to the ICRC by the BDA Group, who determined that the Tantangara option could provide the required level of water security for a lot less than the cost of the ECD⁶⁵.

We quote from the conclusions of the ACTEW-commissioned CIE report⁶⁶ which considers what a robust strategy would look like:

From both sets of sequences, Angle Crossing emerges as clearly robust. In the 2030 sequences, the status of the Cotter Dam depends very much on how the total costs emerge. In the 2030 sequences, with a very high cost dam, Cotter does not appear to contribute to improved economic outcomes when it is combined with other options. It does, however, make a significant contribution in the 2070 sequences, even when it is high cost. In the 2070 sequences, Angle Crossing remains a robust option, superior in fact to Cotter as a stand-alone option. Also under the 2070 sequences, the incremental contribution of Tantangara to economic benefits is substantial — higher in fact than the benefits of Cotter alone. This implies that Angle Crossing and Tantangara provide a robust strategy in the 2070 climate sequences.

The report goes on to caveat Tantangara as a water security option based on the politics of negotiating with competing water users. However, elsewhere ACTEW assumes that it would purchase the consumptive water rights from irrigators, and compensate Snowy Hydro for the hydro-electric opportunity cost⁶⁷. Indeed, ACTEW did purchase some high security (and general security) water rights for water in Tantangara, which were capitalised into the RAB⁶⁸ in 2012-13. We understand that as of March 2012, ACTEW owned a portfolio of 9.55 GL of high security and 12.5 GL of general security entitlements from the Murrumbidgee Regulated River Source. Furthermore, the *Water Act (2007)* states clearly that critical human water needs are the highest priority use within the Murray Darling Basin, where these are defined as “core human consumption requirements” and “non-human consumption requirements” that would result in high social or economic costs if they were not met⁶⁹. It is hard to imagine that irrigation entitlements could take indefinite precedence over Canberra’s urban needs.

For the purposes of this counterfactual, we have assembled the various costs cited by ACTEW to develop an estimate of providing the same level of water security as the ECD in the table below. We have included the costs of M2G in this, because without hydrological modelling or modelling ACTEW’s supply systems, we cannot be certain that the level of security provided by Tantangara alone (without ECD or M2G, but with an expanded Murrumbidgee to Cotter pumping capacity) would be identical to that provided by ECD. By including M2G in the Tantangara counter factual we are more confident that the option represents a comparable level of water security.

We should caveat this counterfactual by stating that with the limited amount of information and time available for this review, and without detailed knowledge of the hydrological modelling or legalities of purchasing high security water from the Tangantara Catchment (compared to retaining flows and reducing downstream water availability in the Cotter / Murrumbidgee Catchment), we cannot form an opinion about the best long-term

⁶⁴ “Water Security for the ACT and Region”, ACTEW July 2007, Section 5.3 Page 34

⁶⁵ http://www.icrc.act.gov.au/wp-content/uploads/2013/02/Submission2_30_November_2009_BDA_Group.pdf

⁶⁶ Centre for International Economics, “Economic benefits of new water supply options - Using 2030 and 2070 climate sequences” 17 August 2009, Pages 8-9

⁶⁷ “FUTURE WATER OPTIONS REVIEW, Water Security Program”, July 2007, ACTEW Appendix D

⁶⁸ The capitalization of Water Entitlements into RAB raises a number of questions from a consumer’s perspective; 1) should the entitlements be depreciated if they are permanent assets, like land? and 2) should ACTEW earn a normal return on the entitlements (i.e. at WACC) when the corporation can sell the allocations to irrigators in wet years, effectively earning a “double” return by charging both customers and irrigators for the same asset?. Furthermore, given that ACTEW would not need (many) general security entitlements in a wet year (when the dams are full), and could not use them in a drought (because of the 0% allocation), owning a large volume of general security entitlements does not seem to be necessary, and could impose unnecessary costs on customers through depreciation and WACC.

⁶⁹ Water Act (2007), Section 86A

water security option. The counterfactual is mainly theoretical and for the purposes of a short-term cost allocation.

Table 6-1. Assumed costs of Tantangara Option (\$ 2007)

Item	Value	Units	Source
Entitlements Available	17.5	GL / yr	
Annual Average Volume Required = 35% of entitlement	6.125	GL / yr	Calc'd - also see Option 2 ECD Volumes Page 143
Transmission losses	30%		ACTEW Future Water Options (page 6)
Average Release required	8.75	GL / yr	ACTEW Future Water Options (Option 5)
Purchase of High Security Water Rights (up to 17.5 GL)	38,000,000	\$	Water Security for the ACT and Region, July 2007 Section 5.4 ⁷⁰
Capex for M2G (ICRC allowed of \$135.4m , scaled to \$2007-08)	123,730,000	\$	ACTEW Future Water Options Appendix B (Option 14)
WACC	7.20%		(Industry Panel draft decision)
Energy value to Snowy Hydro	341	\$ / ML	ACTEW Future Water Options (page 112)
Delivery costs to Googong	170	\$ / ML	ACTEW Future Water Options Appendix B (Option 14)
Treatment costs @ Googong	20	\$ / ML	ACTEW Future Water Options Appendix B (Option 14)
Total Variable Cost of Tantangara Water	531	\$ / ML	<i>calc'd</i>
Average Annual Volumetric Cost @ 35% of 17.5 GL	3,252,375	\$ / yr	<i>calc'd</i>
Assumed value of Water Allocations Revenue from sale of Water	100	\$ / ML	Water markets ⁷¹
Allocations (65% of 17.5 GL)	-1,137,500	\$ / yr	<i>calc'd</i>
Annualised cost of water entitlements (up to 17.5 GL)	2,736,000	\$ / yr	<i>calc'd (WACC x Capex of \$38m)</i>
Annualised Capex for M2G capacity	8,908,560	\$ / yr	<i>calc'd (WACC x Capex)</i>
Storage Charge (fixed) to Snowy Hydro	5,000,000	\$ / yr	ACTEW Future Water Options Appendix D (v)
Annual Total @ 35% of 17.5 GL	18,759,435	\$ / yr	<i>calc'd</i>
Escalation factor	1.16876	Index	ABS series A2325841T (Canberra CPI)
Adjusted to \$2013	21,925,223	\$ / yr	<i>calc'd</i>

We note that the effective price per ML paid to Snowy Hydro is far in excess of their average revenues per ML of releases, and suggest that it has been overestimated. Based on Snowy Hydro annual reports, total

⁷⁰ We don't know what the \$38m was based on. We don't know how many HS entitlements ACTEW possessed in 2007, or what the price at that time was. Historic prices for high security water rights in the Murrumbidgee regulated river area are not easy to find, possibly because no transactions were made in some years. In 2012 ACTEW refers to a price of \$3,379 / ML which it paid in 2010. Other sources of information (http://www.wilkswater.com.au/past-newsletter/tag/water_entitlements/) indicate prices from \$1,663 / ML in 2012, to \$2,200 in 2014. We have taken the ACTEW quoted figure, assuming that somewhere between 12 and 17 GL would have needed to be purchased.

⁷¹ e.g. <http://www.ruralcowater.com.au/waterreports.aspx> , http://archive.nwc.gov.au/_data/assets/pdf_file/0015/11346/Sec4.4.pdf

revenue per total ML released was \$186 in 2004, \$190 in 2005 and \$169 in 2006. These values necessarily include all storage and energy costs. We would therefore expect that ACTEW could secure average prices closer to \$200 per ML for the right to access the water, perhaps slightly more allowing for the higher elevation of Tantangara reservoir. \$541 per ML (including storage charges) seems excessive, and ACTEW did not provide any build up to this cost estimate.

However, even accepting ACTEW's cost estimates for this assumption can provide a yardstick to measure the immediate benefits provided by the ECD and M2G schemes.

If ACTEW had needed the full 17.5 GL⁷² to be delivered from Tantangara (i.e. 25 GL to be released), ACTEW's various cost estimations (including the outturn costs of the M2G Project, and paying \$341 / ML to Snowy Hydro for foregone energy income, plus \$5M in storage charges) indicate that it would have cost about \$25.9M per year (in 2007). This is about \$30.3M in \$2013.

The important thing about this value, which is approximate and does not necessarily take into account all of the information available to ACTEW, is that the Tantangara option is an option. That is, water could be purchased if and when required. Indeed ACTEW note that their hydrological modelling indicates that they would only need to purchase water in this way during three to four years in every ten⁷³. Therefore, the opportunity costs of not selling the water allocations or generating hydropower would only need to be paid as and when water is required. Assuming that 17.5 GL is only required 35% of the time⁷⁴ results in an average cost during the period 2013-14 to 2017-18 of \$21.9M p.a. (in real \$2013 terms).

As it turns out, by choosing to construct a dam rather than adopt a "wait and see" approach by buying water from Tantangara, ACTEW actually *assumed* climate risk from a price perspective (i.e. it committed to capital costs despite the possibility of the drought breaking). If ACTEW were required to assume the climate "price risk" that it took, the "counterfactual" cost of the Tantangara option which actually materialised (i.e. no transfers were required, all the water allocations could have been sold), would have been only \$17.4M p.a.

6.5 Conclusion

- The purpose of this task is not to consider the prudence or efficiency of the water security projects, which has been considered elsewhere. Our task is to consider if and how the costs can be aligned with the benefits conferred by the projects. We do not have detailed information about ACTEW's benefit calculations and capacity modelling. As such, we cannot form a view on the overall quantity of the benefits proposed for the 2014-18 period, noting only that ACTEW's assumptions may mean that the total benefits are overstated (for all periods).
- Without detailed modelling, we are obliged to accept ACTEW's timing of benefits. ACTEW's benefit model shows that 91% of economic benefits occur after 2025 (in NPV terms). Only **6% of the NPV⁷⁵ of the benefits from 2010 to 2056 occur during the period 2013-14 to 2017-18.**
- An alternative to trying to assess the current component of benefits of a long-term infrastructure project is to consider the costs of achieving the same service level using an alternative, short-term source of supply. In the absence of a hydrological capacity or benefit model, we have presented a Tantangara "counterfactual" based on some of ACTEW's assumptions and figures. The purpose of this is to consider if Tantangara (and M2G) represents a viable short-term solution to the ECD and M2G, and if so, what it would cost over the regulatory period.
- Using the ACTEW information that we have gathered from various reports (which sometimes appear inconsistent⁷⁶), the *worst case* value of this is around \$30.3M p.a. in \$2013. The fact that the drought

⁷² ACTEW refers to the need to release 25 GL and assumed 30% transmission losses (Appendix . This results in 17.5 GL delivered, which is also approximately equal to the yield of the ECD (Appendix F, Future Water Options, Page 143)

⁷³ "Water Security for the ACT and Region", ACTEW July 2007, Section 5.3 Page 34

⁷⁴ Which, in addition to reducing operating costs, allows 65% of the water allocations to be sold

⁷⁵ Using a discount rate of 9.65%

broke, if taken into account in the customer's favour, would reduce this value to the fixed storage, and $WACC \times (\text{water use rights} + \text{M2G capital cost}) = \text{approx. } \$17.4\text{M p.a. in } \$2013$. Using ACTEW's estimate that Tantangara would only be needed 3-4 years per decade gives an average volume abstracted of $3.5 / 10 \times 17.5 \text{ GL} = 6.125 \text{ GL}$. This could cost about **\$21.9M** in \$2013, using the various ACTEW cost estimates we have gathered. One alternative that the Panel could therefore consider using when trying to determine what proportion of the costs of the ECD and M2G projects can be attributed to current customers vs future customers is to just allow \$21.9M p.a. to be recovered over the regulatory period. The difference between what ACTEW would otherwise have recovered for the ECD and M2G projects using the standard straight line building block approach and this amount could then be deferred and recovered in subsequent regulatory periods in the standard manner.

⁷⁶ E.g. the Report "Water Security for the ACT and Region", ACTEW July 2007, refers to \$3.4m p.a. annual costs for the Tantangara option (Page 34), ACTEW Future Water Options (Option 5) refers to \$341 / ML, and ACTEW Future Water Options Appendix D, (v) refers to \$640 / ML.

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APPENDIX

A

TERMS OF REFERENCE



Terms of Reference

Background

On 26 June 2013, the Independent Competition and Regulatory Commission (ICRC) made a price direction in relation to water and sewerage services in the Australian Capital Territory (ACT). The price direction covers the period from 1 July 2013 to 30 June 2019, and was made in accordance with Part 4 of the *Independent Competition and Regulatory Commission Act 1997* (the Act), and terms of reference issued by the ACT Treasurer (known as ‘the referring authority’).

Part 4C of the Act allows either the referring authority (the Treasurer) or ACTEW Corporation Limited (‘ACTEW’) – the only utility providing water and sewerage services in the ACT – to apply for a review of a price direction. Part 4C of the Act also outlines the process for the review of a price direction, which requires the review to be heard by an Industry Panel of three members.

On 26 September 2013, the ICRC received an application from ACTEW for a review, triggering the review process provisions in the Act. As required by the Act, the referring authority (the Treasurer) appointed an Industry Panel (‘the Panel’), comprising the following members:

- Ms Mary Anne Hartley QC (presiding member)
- Ms Sally Farrier
- Ms Claire Thomas PSM

In undertaking its review, the Panel has the same powers as the ICRC in conducting a price regulation investigation. It must prepare a draft and a final report, and must invite public submissions and conduct public hearings.

The Panel intends to release its draft report by the end of September 2014, with the final report being presented to the Treasurer by the end of November 2014.

To assist it with its review, the Panel has established a Secretariat, comprising a project director, officers from the ACT Government, and a number of technical specialists, with expertise in regulatory economics and modelling. It also has the ability to engage consultants to undertake defined tasks during the course of its review.

Description of the services required

In making its price direction, the Panel needs to take account of, inter alia, the cost of providing the regulated services, and the quality, reliability and safety of regulated services. To inform its decision, the Panel is compiling its own estimates of ACTEW’s revenue requirement over the regulatory period, based on projections of efficient operating and capital expenditure to provide the regulated services. Another key component in setting prices is forecasts of water sales over the regulatory period. Finally, the terms of reference for this review requires the Panel to consider the ability of the pricing path to match revenue recovery requirements to the consumer benefits accrued from the water security program.

Accordingly, the Panel requires the consultant to provide the following services:

Task 1: ACTEW's operating and capital expenditure forecasts for 2013/14 to 2017/18

- a) Advice on the key assumptions that are driving expenditure (eg asset replacements, demand forecasts, growth assumptions, environmental requirements, service standard requirements) and the impact of changes in these drivers on expenditure levels.
- b) Review of ACTEW's forecast capital expenditure for sewerage over the period 2013/14 to 2017/18 and advice as to whether these forecasts are efficient and prudent. If the consultant concludes that these forecasts are not efficient and prudent, then the consultant should propose an alternative forecast that it considers is efficient and prudent.
- c) Strategic review of ACTEW's governance processes around capital expenditure decision-making and advice as to whether ACTEW's current processes address the concerns identified in relation to this issue during the last price review. In particular the consultant should provide advice as to whether these processes are a) reasonable and b) sufficient to manage the risks in delivering its capital program (especially the sewerage program referred to above).

Task 2: ACTEW's water sales forecasts for 2013/14 to 2017/18

- a) A review of ACTEW's methodology for forecasting water sales and advice as to whether this methodology and the demand forecasts produced are reasonable for the purposes of setting prices.
- b) Provision of alternative water sales forecasts broken down into Tier 1 and Tier 2 consumption levels, if the consultant concludes that ACTEW's forecasts are not reasonable. Tier 1 is defined water demand between 0-548 litres per day (~200 kL per annum), while Tier 2 is defined as demand in excess of 548 litres per day (>200 kL per annum).⁷⁷

In assessing ACTEW's water sales forecasts the consultant is required to conduct a review of ACTEW's water sales forecast model and provide advice on the:

- suitability and adequacy of the model or approach to developing the water sales forecasts
- suitability and adequacy of the data and information used
- suitability of the assumptions, particularly for water savings from water restrictions (if applicable), and demand management and water conservation programs
- application of the methodology
- the balance between the use of historical trends and key drivers in generating the forecasts.

If the consultant considers that ACTEW's water sales forecasts are not sufficiently robust for the Panel's purposes, the consultant should prepare revised, independent, annual financial year forecasts for ACTEW's water sales (Tier 1 and Tier 2) over the period 1 July 2013 to 30 June 2018. Like the test applied to ACTEW's forecasts, the alternative forecasts should satisfy the reasonableness test outlined below. These forecasts

Task 3: Regulatory treatment of the water security projects

- Advice on the proportion of the \$570 million that ACTEW spent on the Enlarged Cotter Dam (\$420 million) and the Murrumbidgee to Googong Pipeline (M2G) (\$140 million) that can be attributed to existing customers (ie the proportion that delivers benefits to customers in the period to 30 June 2018 versus customers in the period 1 July 2018 to 30 June 2023 or post 30 June 2013) and advice on when ACTEW should start to recover the residual capital costs

⁷⁷ It may be relevant to review the approach adopted by the ICRC when allocating water sales between these two tiers.

- This would take the form of an estimate of the reasonable capacity expansion that was required to meet ACTEW's security of supply standard at the time and over the term of the next regulatory period, compared to the actual capacity installed.
- As an alternative to (a), advice on aligning the profile of the recovery of the capital costs associated with the water security projects with the profile of benefits that customers can expect to derive from the projects
 - This would take the form of an estimate of the benefits that customers will derive from the water security assets over the economic life of those assets, and could utilise long-terms water demand forecasts and/or forecast population growth. To the extent possible, customer benefits in the initial stages of the assets' lives should reflect the value of water security and not just capacity.

Efficient and prudent test

The efficient and prudent test will be used to determine the proportion of ACTEW's sewerage capital expenditure that should go into its revenue requirement over the regulatory period (potentially 2013/14 to 2017/18). This test assesses whether the expenditure is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of delivering water and sewerage services.

Reasonableness test

The reasonableness test will be used to determine:

- The appropriate water sales forecasts to use to derive prices over the regulatory period (potentially 2013/14 to 2017/18)
- The proportion of capital expenditure on the water security projects that delivers economic value to existing customers.

For water sales, the reasonableness test assesses whether the forecasts represent the best forecast or estimate possible in the circumstances.

In considering the regulatory treatment of the water security projects, the reasonableness test assesses the capacity expansion that a prudent service provider would consider sufficient, appropriate, and not excessive in usual and ordinary circumstances.

Point in time for provision of the services

In providing the services, the consultant should consider the circumstances (including the information available) prevailing at the time of the ICRC's Final Decision (ie, June 2013). However if there has been any substantive change in circumstances that the consultant considers the Panel should be aware of, then the consultant should document these issues in its reports.

Inputs

- Capex: list of individual projects 2013-18
- Capital Expenditure Initiation and Approval Manual
- Project Phase Management Funding and Approval Process
- Business case for the Filters Upgrade and Aeration Renewal
- Revised opex step change document
- Opex and Capex actual outturn data for 2012/13 and 2013/14.

- Water demand forecast model
- Water demand actual outturn data 2012-13 and 2013-14
- Methodology applied by ACTEW to calculate the yield
- Relevant operating log sheets
- Dam releases

Required Outputs

The consultant must produce reports which include detailed outcomes or findings for each of the tasks listed above. For Task 1a the consultant is required to provide an overview of cost drivers and their impact on expenditure (rather than a detailed analysis). Reports should be submitted to the Panel as each Task is completed. All reports should be submitted by Friday 12 September 2014.

The consultant's reports must include a clear explanation of the consultant's reasons or rationale for each of the outcomes or findings, including information sources, approach and any key assumptions used.

The consultant's report should report dollar values in \$2012/13. (plus assumptions re CPI)

Scope of work and quote

The consultant should submit a scope of work and quote that contains the following information:

- the scope of the services to be provided and a proposed work plan, including a timetable setting out the proposed date for completion of each task. The consultant should identify any risks to meeting the timetable;
- the personnel proposed to undertake the services; and
- a written quote specifying the cost for each task and the total cost of the services.

Technical report

APPENDIX

B

LIST OF
DOCUMENTS
REVIEWED



Document title	Corporate author	Time of publication
Primary documents		
Main Submission to the ICRC: Regulated Water and Sewerage Services from 1 July 2013	ACTEW	July 2012
Response to the Draft Report: Regulated Water and Sewerage Services	ACTEW	12 April 2013
Application for Review	ACTEW	26 September 2013
Statement of Facts and Contentions	ACTEW	31 July 2014
Final Report: Regulated Water and Sewerage Services – Report 6 of 2013	ICRC	26 June 2013
Approach Paper	Industry Panel	June 2014
Terms of Reference	Industry Panel	21 August 2014
Ancillary documents		
Building a forecasting model of ACT water use	Breusch and Ward	June 2012
Cost Escalation Report	KPMG	April 2013
National Performance Review of Urban Water Utilities	National Water Commission	April 2014
Australia’s Urban Water Sector	Productivity Commission	31 August 2011
Meeting presentations		
Operating expenditure	ACTEW	4 September 2014
Improving Project Outcomes: Program Reporting	ACTEW	4 September 2014
Investment Planning and Delivery (IPaD)	ACTEW	4 September 2014
LMWQCC Major Projects Update	ACTEW	4 September 2014
Notes on future water option evaluation	The CIE	4 September 2014

Document title	Time of publication
Information returns and other documents supplied by ACTEW	
Future Water Options Review: Water Security Program	31 July 2007
Water Security for the ACT and Region: Recommendations to ACT Government	31 July 2007
Economic benefits of new water supply options: Using 2030 and 2070 climate sequences	17 August 2009
Business Case: CX10677 LMWQCC Solids Handling System Upgrades	29 January 2013
CX10534 – LMWQCC Secondary and Tertiary Systems Upgrade Concept and Preliminary Design Phase: Project Progress Report	October and November 2013
Lower Molonglo Water Quality Control Centre (LMWQCC) Secondary and Tertiary Systems Upgrade: Request for Tender No. 1122/13 Supply of Aeration Blowers – Tender Evaluation Report	24 January 2014
Board Paper: ACTEW Corporation Draft Budget and Forecast Assumptions for 2014-15 to 2017-18	26 March 2014
Extract of Board meeting no. 221 minutes approval (page 6 of 8)	26 March 2014
Combined organisational charts	16 July 2014
Information return: demand forecasts (response to items 1 and 2)	15 August 2014

Document title	Time of publication
<i>Information return: demand forecasts (response to item 3)</i>	22 August 2014
<i>CX10534 & CX10755 LMWQCC Secondary and Tertiary Systems Upgrade Project Specific Control Group – Minutes of Meeting No. 6</i>	4 September 2014
<i>Investment Review Committee Approvals and Rejections (11 September 2013 – 8 September 2014)</i>	8 September 2014
<i>Water treatment step change analysis</i>	8 September 2014
<i>What is driving the increase in water costs for OPEX?</i>	8 September 2014
<i>Investment Review Committee minutes (meeting nos. 1, 8, 9, 11, 14, 15, 16, 18 and 20)</i>	Package received on 10 September 2014
<i>IPaD guidance documents</i>	Package received on 10 September 2014
<i>Cardno information request – Item 6</i>	15 September 2014
<i>Total capex nominal</i>	17 September 2014
<i>Water security projects: Benefits and probability of restriction profile</i>	17 September 2014
<i>ACTEW 2013-18 capex reforecast</i>	24 September 2014