COMMERCIAL IN CONFIDENCE

FINAL REPORT

Review of demand forecasts for SA Water

Prepared for
Essential Services Commission of South Australia

January 2013

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Executive summary

The Essential Services Commission of South Australia (ESCoSA) is currently developing the regulatory pricing approach for SA Water. ESCoSA will publish its first determination for SA Water in early 2013, covering the three year period from 2013-14 to 2015-16.

ACIL Tasman was commissioned by SA Water to forecast water demand for the regulatory period for the residential, commercial and non-residential sectors.

Subsequently, the CIE was appointed by ESCoSA to review ACIL Tasman's demand forecasts. Our approach to this review involves the following broad steps:

- review the historical analysis of demand drivers, including the validity of the historical data and review of ACIL's model and application of modelling results;
- review of ACIL Tasman's independent projections and demand forecasting methodology, including a review of the method to forecast customer numbers and average consumption per connection;
- provide recommendations where necessary; and
- provide a revised demand forecast based on amendments discussed.

In undertaking our review we found ACIL's model and methodology paper provided a high level of transparency in the data and modelling underpinning the forecast. The approach to forecasting demand was generally sound and our recommendations are largely to improve on particular technical areas of the forecasting approach used and updates to the data used.

For the purposes of price regulation of SA Water, we found two categories of issues we recommend to be addressed in the forecasts.

1 The demand forecasts need to be able to support the requirements of price regulation.

2 Technical amendments to the forecasting approach and methodology that will likely improve on the current forecasts.

Demand forecast should support price regulation

The demand forecasts submitted by SA Water to ESCoSA are to assist ESCoSA in making required regulatory decisions. A key part of this is that forecasts provide information on each aspect of demand that is charged at a separate price. This means that forecasts should include customer numbers where there is a fixed charge per customer and tier 1, 2 and 3 demand projections where there is a different price charged for each tier (or another methodology to arrive at this).

In their current form, the demand projections do not provide sufficient information for ESCoSA to multiply prices by demand to arrive at revenue. Elements which are currently missing include:

- a forecast of the number of non-residential customers which is needed to estimate fixed charges from these customers;
- forecasts of the total number of billed customers;
  - we understand that the customer number projections relate to customers using water but that there is a larger set of customers that is charged for water (i.e. facing fixed but not usage charges);
- forecasts of customer numbers (or property values to which charges are applied) for sewerage services,
  - which we understand to be different to water services; and
- estimation of water demand at each water pricing tier for residential usage or an alternative method to allow for the regulator to calculate revenue from usage projections.

Further, SA Water separately developed forecasts of sewerage connections, value of property against which sewerage charges are levied and quantity of sewerage treatment demanded. The first and second would both potentially be relevant for revenue projections, however these forecasts have not been included in SA Water's submission.

Technical amendments to forecasts

Based on our review of the demand forecasts we recommend amendments to the current model as set out below. These recommendations include updates to historical data and independent projections (where revision has occurred subsequent to ACIL's analysis) as well as amendments to modelling historical relationships and the application of empirical results to forecast customer numbers and average consumption per connection.

We have incorporated these recommendations into ACIL's demand forecast model and provided updated demand estimates. This allows for different possible 'bounceback' scenarios as discussed below.

The consumption outcome for 2011–12 suggests that there has been some bounceback in consumption but that consumption remains lower than the consumption expected given current conditions and the replacement of water restrictions with water wise rules. It is difficult to know how much consumption will continue to increase to the levels expected given current prices, water wise rules and other factors that impact on consumption. Consumption may take a long time to reach the level that would be expected if restrictions have led to people investing in water tanks or low water gardens. It may also take time for people to revert back to using water for activities that they did pre-restrictions.

RECOMMENDATIONS

The possible options for bounceback cover the extent to which consumption reverts back to levels expected for water wise rules (given current prices and other factors) and the timing of this change. Given the uncertainty surrounding the occurrence of bounceback of water consumption, we have modelled the revised forecast of total consumption billed over the forecast period for three bounceback scenarios (table 1).

- Bounceback scenario 1 — allowing for 50 per cent bounceback over two years. This leads to demand being 4.1 per cent lower than ACIL's original forecast over the regulatory period.
- Bounceback scenario 2 — allowing for 75 per cent bounceback over three years. This gives similar demand projections over the regulatory period as ACIL's original forecast.
- Bounceback scenario 3 — allowing for 100 per cent bounceback over four years. Under this scenario expected demand is 2.9 per cent higher than ACIL's original forecast.

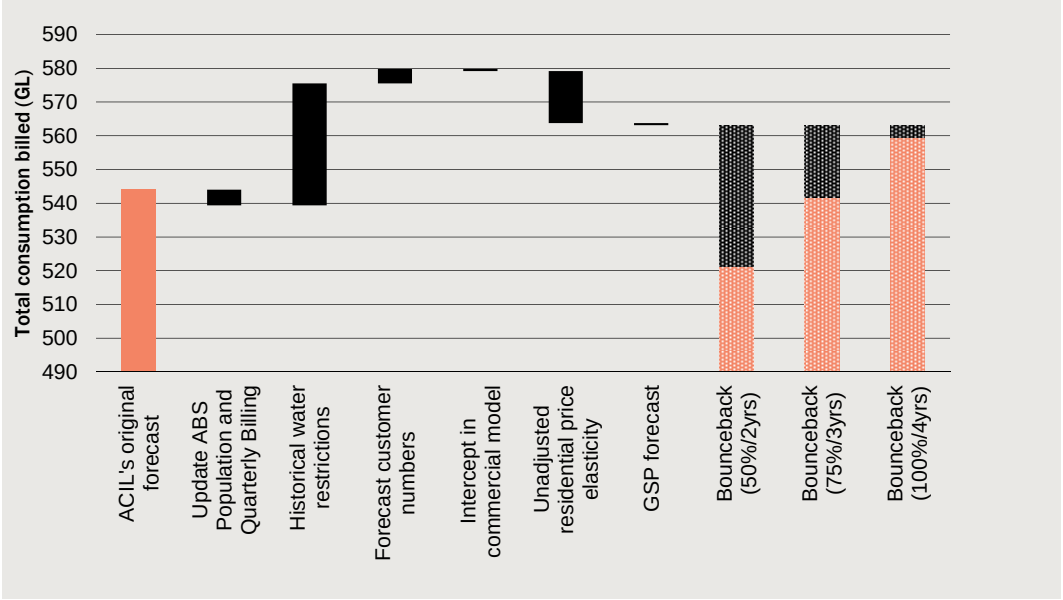
1 Original and amended forecast of consumption billed over regulatory period

Total consumption billed (ML) over regulatory period (2013-14 to 2015-16)	ACIL's original forecast	CIE Amended forecast		
Bounceback assumption	100% over 1 year	50% over 2 years	75% over 3 years	100% over 4 years
Residential	367 592	338 906	355 993	370 958
Commercial	28 716	28 495	29 676	30 703
Non residential	147 707	153 971	156 116	157 931
Total	544 014	521 373	541 785	559 592

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

The impacts of the changes recommended and each bounceback scenario on consumption forecasts are shown in chart 2.

2 Cumulative changes to total consumption billed over regulated period (GL)



Data source: The CIE.

1 Introduction

The Essential Services Commission of South Australia (ESCoSA) has recently been appointed as the economic regulator of the water industry in South Australia. ESCoSA will publish its first determination for SA Water in early 2013, covering the three year period from 2013-14 to 2015-16. ESCoSA will be making a determination of SA Water's drinking water and sewerage prices for 2013-14 to 2015-16 under Part 3 of the ESC Act, as authorised by section 35 of the Water Industry Bill 2011. In order to do this, ESCoSA is required to consider the expected demand for SA Water's services into the future. The demand forecasts include both the number of customers expected to be connected to SA Water's network and the expected level of usage over the upcoming regulatory period.

The role of demand forecasts in economic regulation

Demand forecasts are typically a primary input into decision-making by regulated utilities. They can help to inform:

- pricing structures which may be able to be changed throughout the regulatory period;
- marketing — demand forecasting requires an understanding of the choices customers and potential customers are making, which is useful information for targeting of customers;
- risks and risk management — if demand forecasts have a stochastic component rather than being a single forecast; and
- capital and operating expenditure planning decisions.

Demand forecasts also form a primary input into the decisions by economic regulators. Demand forecasts, for example, can influence:

- the notional revenue allowance through:
  - operating expenditure projections; and
  - capital expenditure projections and hence the regulatory asset base, which in turn impacts on depreciation and the return on capital.
- prices (under a price cap approach) as prices are set so that demand multiplied by prices is equal to the notional revenue allowance.

The role of demand forecasts will depend on the regulatory approach adopted. In Australia, economic regulation typically takes the form of price caps or revenue caps.

- Under a price cap approach, prices are set by the economic regulator based on their assessment of the determined revenue for the business by assessing each of the costs that form the 'building block'. In this instance, expected demand is used to 'translate'

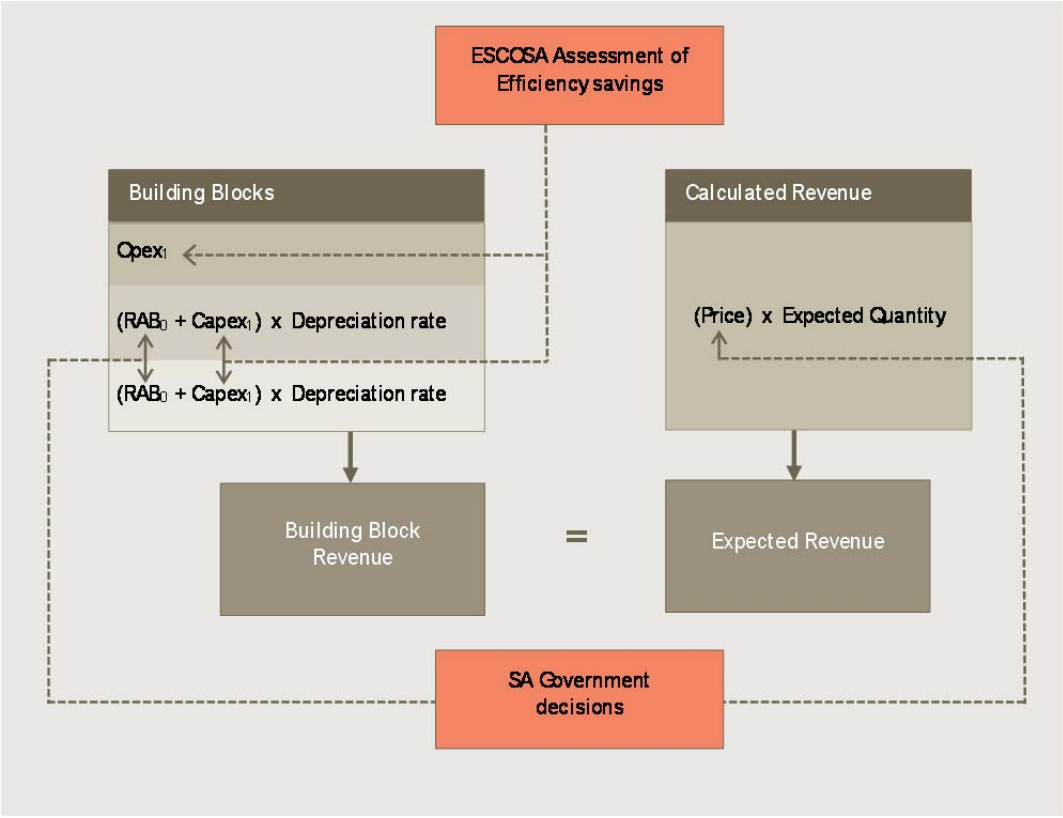
the revenue requirement into prices that are determined by the regulator. The business bears the demand risk where actual demand differs from that forecasted at the regulatory determination. Regulatory mechanisms can be developed to minimise a business' exposure to the demand risk.

- Under a revenue cap approach to regulation, the regulator determines the revenue requirement. In this instance, the business has control over prices. For example, businesses can raise or lower prices to achieve the determined revenue requirement, taking into account the demand side factors.

Regulatory approach for SA Water

The regulatory approach for SA Water is still being developed and there are elements of the approach that will need to be explicitly determined by ESCoSA. Chart 1.1 provides an overview of the broad regulatory framework currently being considered for SA Water.

1.1 Overview of regulatory approach for SA Water



Source: The CIE

The regulatory approach for SA Water includes the following.

- The expected revenue in each year of the regulatory period that SA Water will receive will be based on:
  - prices set by the South Australian Government. In its May 2013 Regulatory Statement, the Government will set the 'price path forecast' for 2013-14 to 2015-16.[1]
  - ESCoSA will determine the expected number of customers and water use.[2]
- The estimated Building Block Revenue requirement in each year of the regulatory period will be based on:
  - ESCoSA's estimates of the efficient operating and appropriate capital allowance. The later item will require an assessment of the efficient level of capital expenditure, the Weighted Average Cost of Capital, the appropriate asset depreciation rates and useful life of assets.[3]
  - the South Australian Government's estimate of the *opening* Regulatory Asset Base.[4] The opening RAB is expected to be 'back-solved' to ensure that the Building Block Revenue over the 3 year regulatory period equates to the expected revenue over the three year period.

Demand forecasts for the regulatory period should be presented in a way that allows ESCoSA to understand the revenue implications of particular price paths or the price implications of particular revenue paths. This requires the submission of separate demand forecasts for each of the price elements that SA Water levies.

This report

The purpose of this project is to provide ESCoSA with advice on the *reasonableness* of SA Water's projections and to provide an alternative demand forecast where gaps have been identified. The focus of the analysis is on *average* demand in each year of the

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1 The South Australian Government indicated that it "does not expect water prices to grow significantly faster than inflation. However, the actual change in water prices will depend on the initial value of the Regulated Asset Base, which the Treasurer will set in May 2013" http://www.escosa.sa.gov.au/library/121015-ClarifyWaterIssues-MediaRelease.pdf

2 The Pricing Order requires the Commission to "include a mechanism which allows for the adjustment of allowable revenue to be derived where the Commission determines there to be a material variation between forecast and actual water consumption or sewerage connections". In its regulatory submission SA Water has proposed a 'banking mechanism' which would be carried forward to adjust the revenue requirement at the next regulatory determination.

3 The operating and capital expenditure requirements will also need to be consistent with the forecast customer numbers and water use, given that these factors are one of the drivers of expenditure.

4 The opening RAB will the value as at 1 July 2013. The RAB at 1 July 2014 and future years will be based on rolling forward capital expenditure incurred during previous year with adjustments such as depreciation.

regulatory period, rather than peak demand.[5] While the average demand is presented for each year, regulators typically do not seek to capture the potential year on year demand volatility due to changing rainfall and temperature patterns. In this sense, the annual predictive capacity of any demand forecasting model is less important than the model results being correct *on average* over the regulatory period.

Our final report provides our expert view on a number of specific aspects including whether the demand forecasts:

- recognise and reflect the key drivers of demand (eg demographic change, price effects, economic factors, weather related factors, policy factors);
- are based on sound assumptions, apply best practice principles and utilise the best available information;
- are consistent with other available forecast methodologies;
- are based on the most recently available data;
- are based on sound and robust accounts of current market conditions and future prospects;
- are based on valid methodology and assumptions;
- have been subject to appropriate testing and validation exercises;
- are free from statistical bias; and
- contain any actual or potential weaknesses, uncertainties and risks.

The findings have required, where possible, testing the assumptions included in SA Water's modelling based on data from other independent sources. Our effort has been focused on those factors that materially impact on the results.

Finally, this report focuses on the forecasts relating to potable water demand. At this stage recycled water is not subject to ESCoSA's regulatory review and prices will continue to be set by the South Australian Government.[6]

5 The analysis of peak demand is more relevant for opex/capex reviews, given that peak demand is a driver of investment decisions.

6 Currently the price of recycled water for residential customers that receive dual reticulation services is 75 per cent of the second tier residential potable water usage price.

2 Structure of demand forecasts

In a regulatory setting the regulator is required to determine forecasts of all elements that are required to be set. That is, there needs to be a specific quantity to apply to the price in order to determine the revenue implications.

Current prices for SA Water services

The prices currently set for SA Water's services include the following[7]:

- For **potable water** services:
  - A water supply charge per property with access to the potable water network.[8]
    - For residential customers a fixed charge applies. In 2012-13 the charge was $73.25 per quarter.
    - For commercial customers the water supply charge is based on the value of their property, subject to a minimum charge ($73.25 per quarter in 2012-13).[9]
    - For other non-residential customers a fixed charge applies (($73.25 per quarter in 2012-13).
  - A usage charge based on the volume of water consumed during the year. An inclining block usage charge applies for both residential and non-residential customers.
    - For residential customers different prices apply to 3 blocks of usage (0 to 30 kL, 30 to 130kL and above 130kL of quarterly usage). The last block only applies to single dwellings. For multiple dwellings (eg blocks of flats) only the first two tiers apply.
    - For commercial and other non-residential customers a single usage charge applies irrespective of the level of usage.[10]
- For **wastewater** services, a fixed supply charge applies to each property connected to the wastewater network. The charge is based on the capital value of the property. No usage charge currently applies.

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7 This information is drawn from SA Water's website http://sawater.com.au/SAWater/YourBusiness/YourAccountBillPaymentCharges/Pricing+Information.htm

8 This includes vacant land that is connected to the network but currently does not consume water.

9 The capital value of the property is assessed by the Valuer-General in South Australia.

10 In 2011-12 and earlier years a two tiered usage charge was applied (0 to 30 kL, above 30kL of quarterly usage) for commercial and other non-residential customers.

- For dual reticulation **recycled water** customers , a usage price of 75 per cent of the second tier price for residential usage applies. No additional fixed supply charge applies.

The prices for these services are applied uniformly on a state-wide basis. For this determination ESCoSA is responsible for regulating potable water and wastewater services delivered by SA Water. As noted earlier, recycled water services delivered by SA Water will continue to be regulated by the South Australian government.

Structure of SA Water's forecasts

In developing its demand forecasts for this determination SA Water engaged the services of ACIL Tasman to develop the demand forecasts for potable water prices.[11] ACIL's approach involved three steps.

- Identifying the key drivers of customer numbers and the average consumption per customer
- Estimating the impact of each of the drivers using historical billing data from the Ratings Analysis reports extracted from SA Water's quarterly billing database.[12] ACIL also used monthly bulk water supply as a cross check of the analysis. The bulk water supply data also includes leakage and unbilled customers.
- Generating projections for customer numbers and average consumption per customer (based on projections of the key drivers and the estimated impacts of each of the drivers derived from the previous step).

ACIL Tasman's forecasts of customer numbers are presented in table 2.1. Separate forecasts are presented for the two customer categories, residential and commercial. This division reflects the view that the drivers of customer numbers (and usage) are likely to differ across the residential and commercial sectors and, therefore, separate analysis is required. It should be noted that SA Water's billing system includes a further disaggregation of the customer categories. For example, the residential category is made up of 10 sub-categories which include single dwellings, home units and flats.

11 Demand projections relating to wastewater services were developed separately by SA Water. These do not form part of our review which is focused on potable water demand.

12 SA Water has indicated that recycled water usage and customer numbers have been removed from the Ratings Analysis report. Billed recycled water usage in 2010-11 was approximately 2.4 GL which was almost double the usage in 2009-10. There were 7 514 billed recycled water customers in 2010-11.

2.1 Forecast number of customers connected to potable water network

Customer type	2012-13 '000 customers	2013-14 '000 customers	2014-15 '000 customers	2015-16 '000 customers
Residential	655.7	665.2 (1.4)	674.7 (1.4)	684.2 (1.4)
Commercial	27.4	27.7 (1.1)	28.0 (1.1)	28.3 (1.1)

Note: Figures in parentheses present the growth compared to the prior year. We understand that customer numbers includes only customers that use water and that there are additional customers that are charged but that do not have any water usage. SA Water has not provided projections of customer numbers for the non-residential sector.

Source: SA Water Regulatory Business Proposal, table 5-7.ACIL Tasman (2012) tables 10 and 13.

SA Water's potable water usage forecasts by customer category are presented in table 2.2. An additional category of other 'non-residential' customers is included. The usage forecasts are presented as an aggregate for each customer category.

2.2 Forecast potable water use by customer category

Customer type	2012-13 GL	2013-14 GL	2014-15 GL	2015-16 GL
Residential	119.0	120.8 (1.5)	122.5 (1.4)	124.3 (1.5)
Commercial	9.1	9.3 (2.2)	9.6 (3.2)	9.8 (2.1)
Other non-residential	48.2	48.7 (1.0)	49.3 (1.2)	49.7 (0.8)
Total	176.3	178.9 (1.5)	181.4 (1.4)	183.8 (1.3)

Note: Figures in parentheses present the growth compared to the prior year.

Source: SA Water Regulatory Business Proposal, table 5-7.

SA Water's model

To calculate the value of Expected Revenue flowing from regulated prices, a tariff model that is able to link prices/tariffs to changing customer numbers and total water usage is usually employed. Currently a detailed tariff model is not available for the calculation of Expected Revenue estimates in South Australia.

A tariff model will be required in the future following, or developed in line with, the correction of a number of gaps in SA Water's forecasts. The information gaps are:

- Residential sector
  - The forecasts have been prepared at an aggregate level and separate forecasts have not been provided for each of the three tiers. It could be expected that water usage in each tier would grow at a different rate. SA Water has subsequently provided an estimate of the marginal price for all customers. We have not verified whether this marginal price is reasonable.

  - Customer number forecasts are not for charged customers but only for those that use water. SA Water also charges properties with access to water but with no usage. These are not included in the forecasts and the expected number of such customers is required to calculate this revenue item.
- Commercial sector
  - The average property values have not been provided to estimate the revenue from the water supply charge; instead, only commercial customer numbers have been projected. This may be a problem where new commercial customers have a different average property value to existing customers.
- Other non-residential sector
  - Forecast customer numbers have not been provided, which means that fixed supply revenue from this category cannot be projected.

No information has been provided that would allow wastewater revenue to be calculated.

3 Historical analysis of demand drivers

Overview of approach

ACILTasman has used historical data to identify relationships between key drivers and both customer numbers and average consumption per connection.

The historical data on drivers of demand in the residential, commercial and non-residential sectors used to forecast customer numbers and total consumption of water billed for each sector are detailed in table 3.1.

ACIL Tasman explained in its methodology paper that other possible demand drivers such as demand management activities, were excluded based on a lack of statistical significance in the modelling.

3.1 Demand drivers used in ACIL's demand forecasts

Demand drivers	Residential		Commercial		Non residential	Total Bulk water supply
	Customer numbers	Average usage	Customer numbers	Average usage	Total usage	(monthly)
Population (% annual growth)	✓					
Economic activity (Gross State Product)			✓	✓	✓	✓
Price of water ($/kL, second tier)		✓		✓	✓	✓
Temperature (CDD18)		✓		✓	✓	✓
Water restrictions (level)		✓		✓	✓	✓
Rainfall (mm)						✓
Evaporation(mm)						✓

Source: ACIL, 2012, *SA Water's demand forecasting: a report on the development of Demand Forecasting Methodology, Model and Supporting Documentation.* Attachment E.1 Demand Forecasting Methodology.

We reviewed the data and methodology used in ACIL Tasman's demand forecast and found that:

- the historical data used is reasonable with the exception of the treatment of water restrictions in 2010-11 and the adjustment for quarterly billing in 2009-10;
- the data used was up to date at the time of the development of the forecasts but there is now improved information on historical population growth from the 2011 census; and
- the broad method of ordinary least squares regression is sound but that there are methodological issues regarding the use of this technique in some instances.

The areas where we consider that there are issues with the forecasts are set out below. Notwithstanding these, in large part the methodology used is considered reasonable.

Validity of historical data

Historical population data

The Australian Bureau of Statistics revised its published Estimated Resident Population data for South Australia subsequent to ACIL's analysis. Revisions were made to the South Australian series of the ABS Estimated Resident Population data for each year between 2006-07 and 2010-11 (table 3.2).

3.2 Revised ABS historical population data

Year	Original data used in ACIL's modelling	Updated data	Difference
2007	**1 585 794**	1 582 559	**- 3 235**
2008	**1 603 985**	1 597 343	**- 6 642**
2009	**1 624 512**	1 614 375	**- 10 137**
2010	**1 644 152**	1 629 434	**- 14 718**
2011	**1 657 001**	1 638 232	**- 18 769**

Source: ABS, Australia Demographic Statistics. Table 4: Estimated resident population, states and territories. Cat. No. 3101.0.

Note that the use of these revised projections makes a substantial difference to the residential customer number model used by ACIL.[13]

RECOMMENDATION

1 Historical population data be updated within ACIL's demand forecasting model.

Adjustment for quarterly billing data

SA Water changed its billing method in 2009-10 from six monthly to quarterly billing. ACIL adjusted the annual consumption data to avoid the 2009-10 data overstating the billed water sales. This adjustment was made across the three customer classes (residential, commercial and non-residential). However, as noted in ACIL's report, the large non-residential customers were billed quarterly prior to 2009-10 and these customers constitute the majority of water consumption for this sector. Therefore, ACIL's adjustment methodology leads to water consumption for residential and commercial customers to be overstated and non-residential water consumption to be understated for 2009-10.

We have adjusted the annual billings data in 2009-10 to reflect that the majority of non-residential water consumption was already billed quarterly (table 3.3). This makes no adjustment to non-residential data. If there is information on the share of non-

13 We updated ACIL's residential customer numbers model with the revised ABS historical population data. The coefficient on the single explanatory variable increased from 0.59 (estimated in ACIL's original model) to 0.65. The estimate on the coefficient implies that for a given increase in the population of 100 people, SA Water's customer base will increase by 65 customers.

residential consumption that moved from six monthly to quarterly billing then this share could instead be used.

3.3 Transition to quarterly billing

Annual consumption billings 2009-10	ACIL's amendment to quarterly billing data (ML)	CIE's amendment to quarterly billing data (ML)
Residential	123 267	117 703
Commercial	9 908	9 461
Non residential	52 455	58 466
Total	185 630	185 630

Source: ACIL, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

RECOMMENDATION

2 Annual billing data in 2009-10 should be adjusted to reflect that a large part of non-residential water consumption was billed quarterly prior to 2009-10.

Aggregation of water restrictions

In the historical data, each year is allocated to either no restrictions, or level 1, 2 or 3 restrictions based on the level of restriction experienced for the majority of the financial year. This approach is problematic when multiple water restrictions levels applied in a given financial year. For example, in 2010-11 level 3 water restrictions applied from July until December, which were relaxed to level 1 water restrictions from December until June (with the exception of the Eyre Peninsula).

In its modelling ACIL assumed level 1 water restrictions applied for the entirety of 2010-11. This does not capture the five month period between July and December where customers faced level 3 water restrictions.

We tested the sensitivity of ACIL's assumption and re-estimated the water consumption models for residential, commercial and non-residential with the assumption that both level 1 and level 3 water restrictions each applied for half of 2010-11 (table 3.4)[14]. The parameters were very sensitive to this assumption.

3.4 Changes to model results with amendment to historical water restriction data

Demand drivers	Residential		Commercial		Non-residential	
	Original	Amended	Original	Amended	Original	Amended
Intercept	4.57	4.65	0.00	0.00	6.46	6.41
GSP	na	na	0.47	0.48	0.36	0.37
Cooling degree days (CDD 18)	0.15	0.14	0.12	0.11	0.10	0.09
Real price residential	-0.38	-0.27	-0.37	-0.27	-0.32	-0.28

(Continued on next page)

14 Results in table 3.4 are from amending historical water restriction data in 2010-11, holding all else constant.

Demand drivers	Residential		Commercial		Non-residential	
	Original	Amended	Original	Amended	Original	Amended
Level 1	-0.11	-0.10	-0.11	-0.10	-0.12	-0.12
Level 2	-0.15	-0.14	-0.15	-0.15	-0.14	-0.14
Level 3	-0.27	-0.29	-0.25	-0.27	-0.19	-0.19

Note: na not applicable because demand driver not included in model

Source: ACIL, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

The estimates for both sales per residential connection and total residential consumption billed increase by approximately 7.6 per cent in each forecasted year when level 3 restrictions are included in the historical data for half of 2010-11 (table 3.5).

3.5 Sensitivity of historical water restriction data

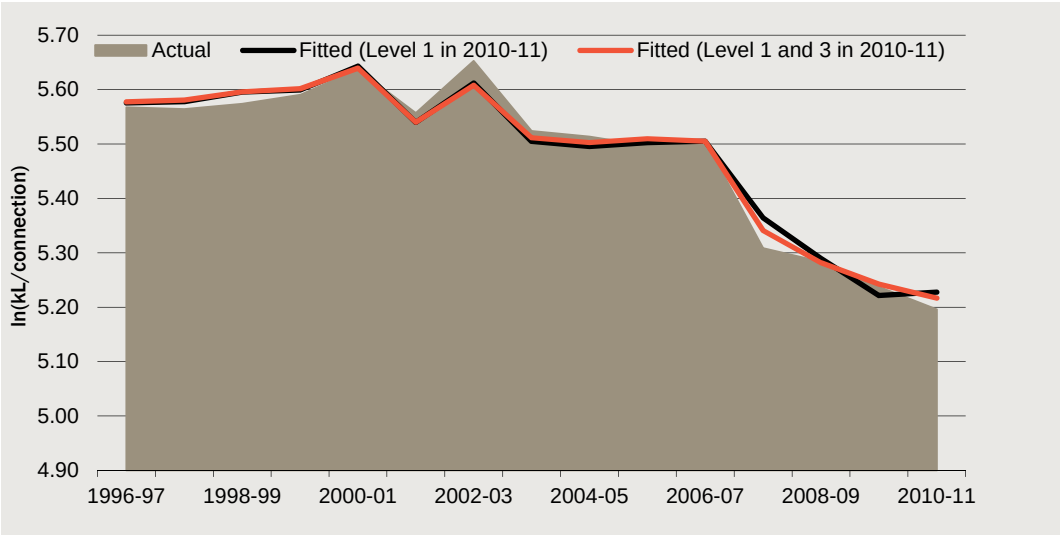
	Assumed level 1 restrictions in place in 2010-11[a]	Assumed level 1 and level 3 restrictions both applied in 2010-11[b]
Changes to estimated residential sales per connection		
2013-14	181.57	195.32
2014-15	181.61	195.35
2015-16	181.65	195.39
Changes to estimated total residential consumption billed (ML)		
2013-14	120 775	129 919
2014-15	122 530	131 801
2015-16	124 286	133 684

[a] Original estimates from ACIL's modelling. [b] Estimates from ACIL's model with an amendment to historical water restrictions in 2010-11.

Source: The CIE.

The model fit to actual historical data improves slightly when level 1 and level 3 water restrictions are applied equally in 2010-11 (chart 3.6).

3.6 Fitted residential model with adjustment to historical water restrictions



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

This issue has been raised with SA Water and SA Water supports ACIL's assumption. SA Water indicated that the South Australian Government had signalled its intention to move to level 1 restrictions approximately 3 months prior to December 2011. SA Water believed that it is reasonable to expect that consumers changed their water use behaviour from the date which the Government signalled its intention. SA Water also indicated that water restrictions predominantly impact water use in the months of January and February. Therefore, it did not consider whether level 1 or level 3 water restrictions were applied in the July to December 2010 would materially impact the results. SA Water has not, however, provided any empirical analysis to support its views.

Given this and the improvement in the empirical fit of the model we consider that an adjustment should be made to allow for level 3 restrictions to apply for part of 2010-11.

RECOMMENDATION

3 The demand forecasting model be adjusted to reflect that both level 1 and 3 water restrictions applied in 2010-11.

Review of model estimation and application of model results

Estimating coefficients for customer numbers model

Modelling non-stationary series

ACIL estimated the relationship between historical residential customer numbers and population growth, and similarly the relationship between historical commercial customer numbers and gross state product.

In both the residential and commercial customer numbers models, the dependent variable (customer numbers) and the single independent variable (population in the residential model and gross state product in the commercial model) are clearly non-stationary series (chart 3.7).[15]

In this case the series are non-stationary because there is a persistent long run trend of the customer numbers, population and gross state product over time. (No trend has been allowed for in the regression analysis.) Modelling two non-stationary series as has been done can estimate a spurious relationship because the two series are trending over time. Where this is the case the relationship and goodness-of-fit results represented by the R-squared will be misleading.[16]

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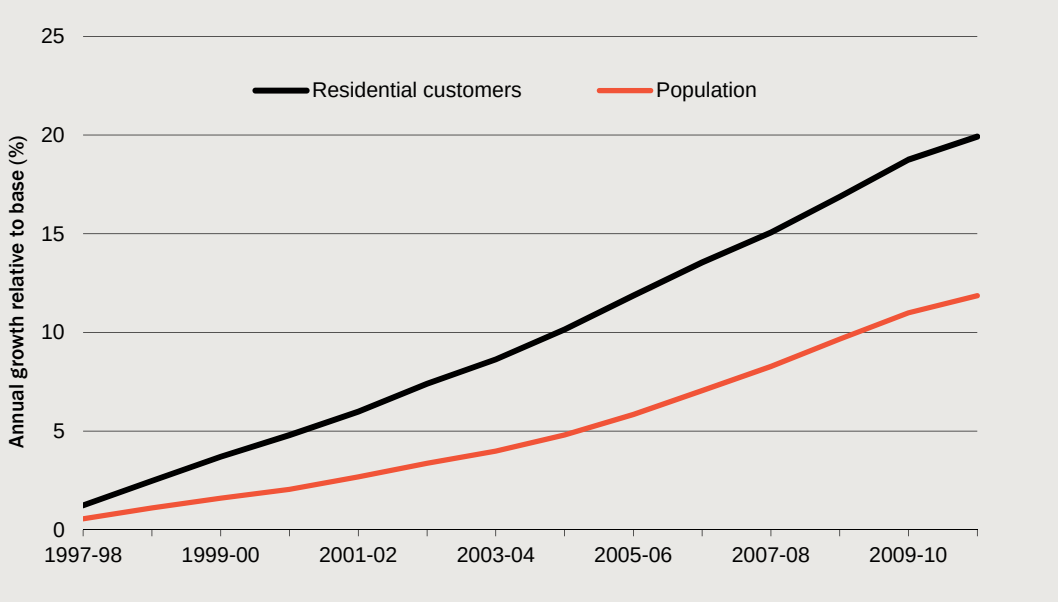
15 SA Water has indicated the low power of unit root tests. Customer number series, population and GSP are clearly non-stationary in the absence of any allowance for trends, as used in ACIL's regressions, and there is no need to refer to unit root tests.

16 Granger CWJ and Newbold P (1974), Spurious regressions in econometrics, Journal of Econometrics, 2, pp 111-120.

3.7 Two non-stationary series



Data source: ABS, Australia Demographic Statistics. Table 4: Estimated resident population, states and territories. Cat. No. 3101.0 and SA Water.

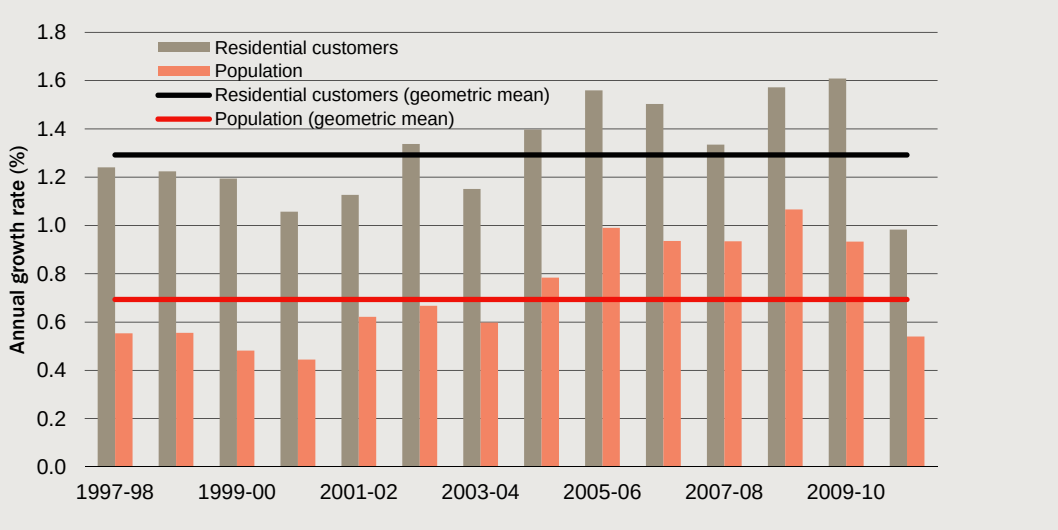
RECOMMENDATION

4 An alternative approach be used for developing forecasts of customer numbers. Options are set out in chapter 4.

Residential customer number and population growth

The annual growth of SA Water's customer base has exceeded annual population growth over the past decade (chart 3.8). Over the past decade, the average annual growth rate in customer numbers is almost double the population growth rate. However, this difference in growth rates has been slowing over the past decade (chart 3.9).

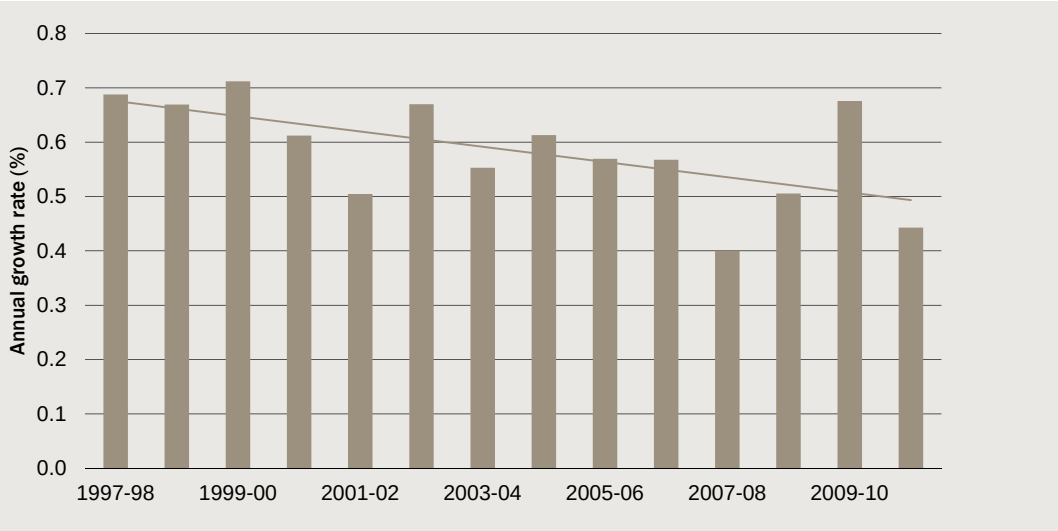
3.8 Annual growth in population and SA Water customers



Note: Population series based on most recent ABS data for Estimated residential population.

Data source: ABS, Australia Demographic Statistics. Table 4: Estimated resident population, states and territories. Cat. No. 3101.0 and SA Water.

3.9 Historical customer growth less population growth



Data source: The CIE.

It is important to understand the reasoning behind these different growth patterns for demand forecasting. Possible explanations include:

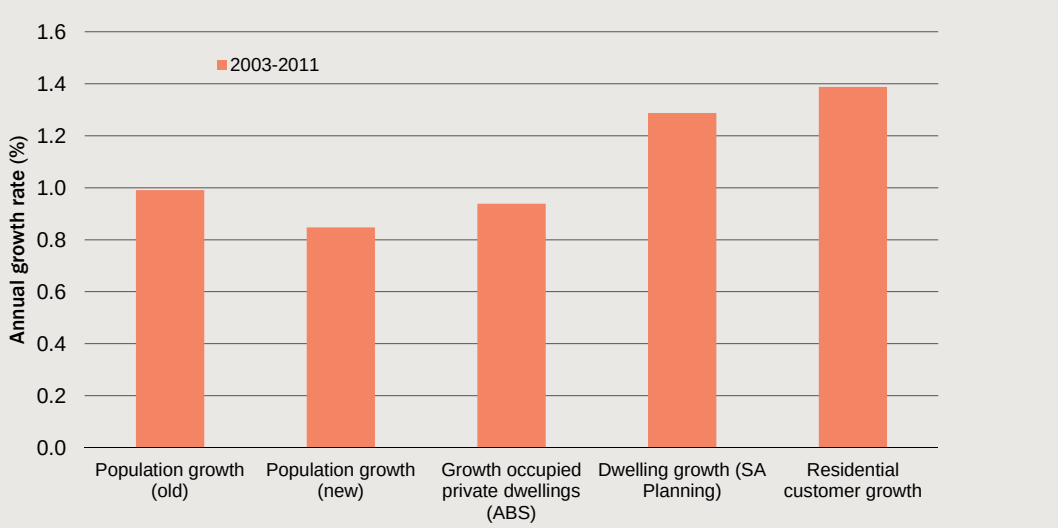
- SA Water has expanded into new growth areas;
- the average occupancy rate per household has declined in South Australia; and/or
- water customers previously not with SA Water have migrated to the SA Water network.

We have reviewed available data to better understand what is driving the higher annual growth rate in customers relative to annual population growth (chart 3.10). From this, it appears that the growth in customer numbers reflects growth in unoccupied dwellings (such as beach houses, second houses etc). Customer number growth has been far

higher than growth in occupied dwellings. This was the likely reason put forward by ACIL. (The addition of second dwellings may have implications for per customer usage that are not further considered here.)

The recent narrowing of the gap between customer growth and population growth suggests that growth in unoccupied dwellings may have slowed. Whether or not this will continue is beyond the scope of this work. However, it would appear reasonable to expect a long period, such as the last decade, would provide too optimistic a view on the additional growth to customer numbers that would occur from second dwellings over the coming regulatory period.

3.10 Difference in average annual growth rates for population, dwelling and customer growth



Data source: ABS, 3101.0 Australian Demographic Statistics. Table 4: Estimated resident population, states and territories. ABS Australian Social Trends, cat. No. 4102.0, SA Department of Planning, Transport and Infrastructure. SA Water.

Commercial customer numbers and GSP

The commercial customer numbers model is based on a regression of historical commercial customer numbers and GSP. As noted earlier, there are concerns regarding the approach to modelling historical growth in commercial customer numbers for two trending series. Chart 3.11 shows that there is no real relationship between annual growth of commercial customers and GSP. That is, periods of higher GSP growth have only a very weak (and statistically insignificant) relationship to periods of high growth in commercial customer numbers. For example, in 2007-08 GSP grew at close to 6 per cent compared to a growth in the number of commercial customers of 1 per cent. In the subsequent year, the growth rate in customer numbers was also close to 1.5 per cent, despite GSP also growing at only 1.5 per cent.

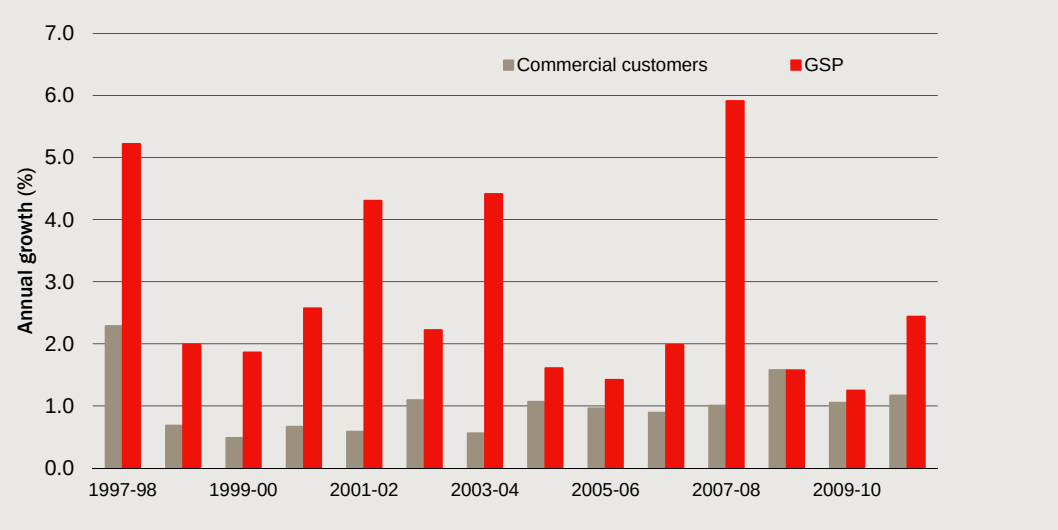
SA Water has suggested that:

> The advantage of our approach would be seen if, for example, a significant change in economic activity was forecast. Consider a case where a recession was forecast (or a boom). Our model would project a slowing in customer number growth (or an acceleration). A trend based

approach would miss that slowing and then have growth slow after the recession (or accelerate after the boom.

In our view this is precisely the disadvantage of SA Water's approach. History suggests that when there is a boom or recession this does not impact on customer number growth. Hence to allow for this is forecasts is not reasonable.

3.11 Annual growth rate of commercial customers and GSP



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water.

Estimating the coefficients for average consumption per customer model

Climate

The consumption models for the three sectors estimated the impact of temperature on water demand using cooling degree days (CCD 18) sourced from the Bureau of Meteorology's annual weather data.

ACIL Tasman found a strong relationship between water demand and temperature. However, the relationships between water demand and either rainfall or evaporation were not as strong.

ACIL's incorporation of CDD 18 as a climate variable to model average consumption per customer is valid.

Price elasticity

The average consumption per customer is influenced by the assumptions regarding how consumers respond to future prices. The price elasticities used to forecast commercial and non-residential water usage were estimated as the coefficient on the price variable in the respective annual regression models for each sector, noted in the previous section.

The price elasticity used to forecast residential water usage was estimated as the midpoint between the coefficient on the price variable estimated in the regression model and the residential price elasticity in the literature. ACIL provided an explanation for this approach in the methodology report. We consider this to be a reasonable approach because it reflects the sensitivity of elasticities to different model assumptions.

It is important to note however, that changes to the underlying data that have been recommended in this report would substantially change the estimates of price elasticity. This is expended on in chapter 4 of this report.

Water restrictions

ACIL estimated the relationship between level 1, 2 and 3 historical water restrictions on water demand in all three sectors. In all cases there was a strong relationship between water demand and water restrictions. The estimated coefficients for water restrictions were used to estimate average consumption per connection for residential, commercial and non-residential customers.

This approach to estimate the influence of water restrictions on water demand is valid. While we do not suggest changes to ACIL's approach, we note that the strong and significant impact of water restrictions on consumption amongst commercial and other non-residential customers is unusual. Commercial and other non-residential customers are not expected to have a significant component of outdoor water usage (the exception being municipal parklands) and would not be expected to be impacted by water restrictions to the same extent as residential customers. Over the forthcoming regulatory period we would recommend that SA Water conduct further analysis to better understand the usage patterns of these customer classes. This would enable further testing of the potential impact of water restrictions on these customers.

Intercept in commercial model

In estimating the average commercial consumption model ACIL set the intercept to zero.

ACIL do not provide evidence to explain this assumption in the report. Information has subsequently been provided to indicate that the intercept was dropped because it was not statistically significant.

This is a restrictive assumption which is generally used only in rare occasions requiring the fitted line to pass through the origin. Some regression statistics (such as R2) can be interpreted only where there is a constant (or non-zero intercept) in the model. Given the substantial impact on parameter values from restricting the constant to be zero, we recommend that this assumption be relaxed. Incorporating this amendment alters the coefficients on the key drivers of commercial demand (GSP, price of water, temperature and water restrictions) (table 3.12).[17]

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17 Results in table 3.12 are from amendment to intercept in the commercial model, holding all else constant.

Note that when an intercept is allowed for in the model and the adjustment is made to 2009-10 data, we find that a number of the driver variables become statistically insignificant. This is not the case when the restrictions are allowed to be partly level 1 and partly level 3 for 2010-11.

3.12 Commercial average consumption model

Independent variables	Commercial average consumption model	
	Intercept set to origin	Intercept not set to origin
Intercept	0	2.48
GSP	0.47	0.26
Cooling degree days (CDD 18)	0.12	0.10
Real price commercial	-0.37	-0.33
Level 1	-0.11	-0.08
Level 2	-0.15	-0.11
Level 3	-0.25	-0.20
Adjusted R Square	0.91	0.87

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

RECOMMENDATION

5 The restriction that the constant is zero for the commercial usage model be removed.

Excluded variables

There are additional drivers that may influence water demand that have not been included in ACIL's demand forecast. These include:

- income;
- household size and composition;
- type of dwelling (detached, units, townhouses); and
- quantity and use of recycled water.

Exclusion of some drivers can result in omitted variable bias. This can lead to estimates of other parameters, such as price elasticities, being higher or lower than their true level because of relationships between omitted variables and included variables.

We have tested whether income was a significant driver of usage, through using gross state product as a proxy for income. This was not significant in the model and may have been excluded for this reason.

Inclusion of other drivers at the household level would generally require more detailed analysis than was undertaken. The drivers mentioned above may lead to longer term deviations in water use per dwelling. As such, the model may find it difficult to accommodate structural changes relating to dwelling composition, water recycling and household composition. It is not possible to know the impact that this could have on the forecasts in the absence of an understanding of the importance of these factors in South Australian water demand.

It is likely that the impacts in the 3 years of the regulatory period will be relatively small, although they could lead to persistent errors in forecasting. Given this, we consider ACIL's approach to be reasonable. That said, there may be scope to include additional variables in future determinations where it is found that these are important.

The modelling conducted does not include any consideration of lags in consumption and lags for restrictions. We consider this to be reasonable in light of the available data. However, inclusion of lags is likely to become more important in future modelling in order to consider the extent to which bounceback of demand has occurred. A model that does not include lags will lead to biased estimates of the impact of restrictions and water wise rules if there is a substantial part of the data in the post-restrictions period.

4 Projecting forward demand

In the previous section we discussed ACIL's approach to using historical data to estimate the coefficients for each of the underlying drivers of customer numbers and average consumption per customer. Drivers included price, GSP, weather and water restrictions. The coefficients estimate the relationships between key drivers and both customer numbers and average consumption per connection.

ACIL apply the estimated coefficients to projections of the key drivers (e.g. GSP and climate data) to forecast customer numbers and average consumption per customer. In this section we review ACIL's approach to applying this information to develop future demand forecasts.

Forecast customer numbers

Forecast applied as change rather than applied to the level

There are two alternative methods to apply estimated coefficients to projected drivers to forecast customer numbers and average consumption per connection. The first is to apply the estimated coefficients to the 'level' of the relevant variables, for example, the real price of water in a given year, to give an expected level of water consumption. The second is to apply the estimated coefficients to the 'change' of the relevant variable, for example, the change in the real price of water relative to the previous year, to derive an expected change in water consumption. A level approach will perform better where data tends to revert quickly to some mean level (in technical terms it is stationary) and where there is little likelihood of structural change. A change approach will perform better where data does not revert to some mean level (is non-stationary) and where structural change is more likely.

ACIL uses a level approach for all its analysis. This is considered to be a reasonable approach for forecasts of the usage per customer, although there is a risk that there is structural change not being factored in (such as related to post water-restriction consumption behaviour). For customer numbers this approach is not considered to be reasonable, as discussed below.

A levels approach to customer numbers can be best understood through a simple example, as follows.

- There are 100 customers in 2012
- A model indicates that on average a 1 per cent higher level of population is associated with 1 per cent higher number of customers.

- The level model has a forecast of 105 customers for 2012, which is higher than actual.
- Population growth in 2013 is expected to be 1 per cent.

Under the above example, a level model would project that customer numbers in 2013 would be 105*1.01 = 106 customers. That is, it will be based off the projection for 2012. In comparison, applying as a change would suggest customer numbers of 100*1.01= 101 customers for 2013 and is based off actual customer numbers for 2012.

This is exactly what happens in ACIL's projections (chart 4.1 and chart 4.2).

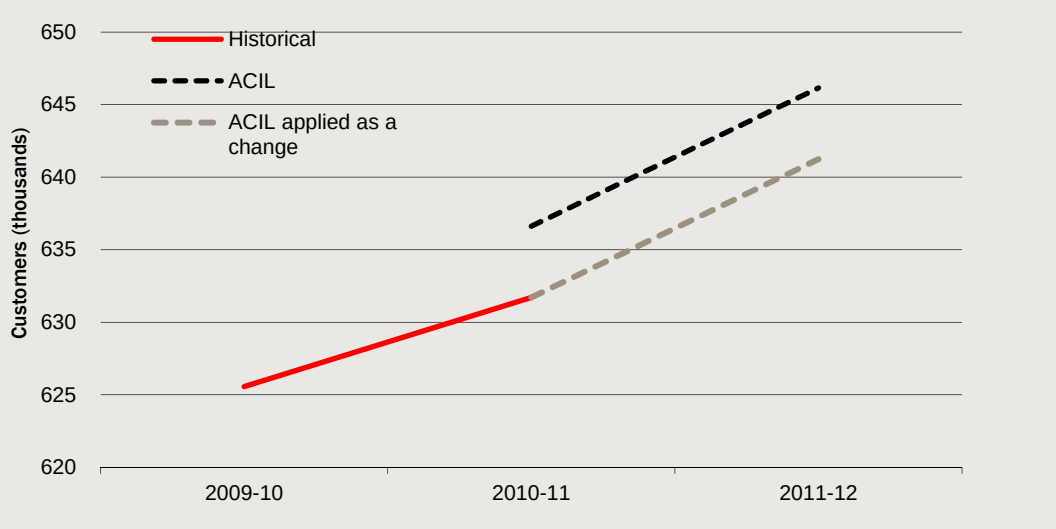
In technical terms, the level model includes the error in the most recent forecast into projections. This is okay for stationary series because the error in one year does not impact (or impacts less) on future years. It does not make sense for non-stationary series because errors are permanent.

The typical approach to forecasting for non-stationary series is to apply growth projections to the most recent year. (This method is also illustrated in chart 4.1 and 4.2 as a continuation of the historical series.) This is the approach that we recommend applying for SA Water's customer numbers.

RECOMMENDATION

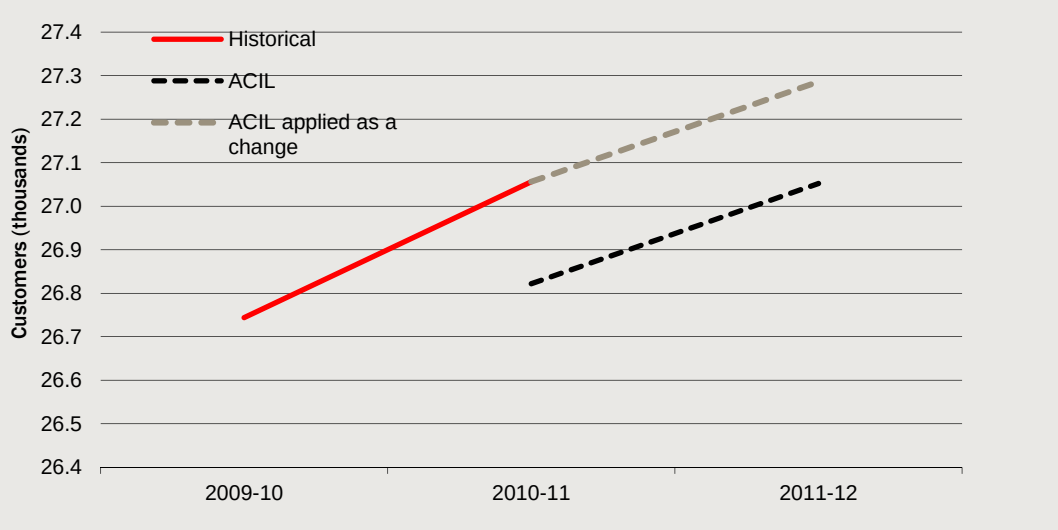
6 The methodology used to forecast residential and commercial customer numbers be amended to apply growth to the most recent data on customer numbers rather than forecasting the level of customer numbers.

4.1 Forecast of residential customers



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

4.2 Forecast of commercial customers



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

Alternative approaches

As noted in the previous section we have concerns regarding the approach to estimating the key drivers of customer numbers by regressing two non-stationary series. Given this, we believe that an alternative method for generating estimates of future customer numbers, residential and commercial, should be used.

It is beyond the scope of this project to consider all options for alternative forecasting approaches. We consider that approaches that would be reasonable could include:

- applying a trend in historical growth in customer numbers, say over the past 5 years; or
- applying ABS's forecasted population growth with an adjustment factor to account for the difference between annual customer growth and population growth over the past five years.

Of these the second is considered preferable because it incorporates information on population projections. We provide estimates of customer numbers and demand using this approach.

In the case of commercial customers, as noted earlier there does not appear to be a relationship between GSP growth and growth in commercial customer numbers. One approach that we would consider to be reasonable would be to use an average growth for an historical period, such as the last 5 years. We show projections using this approach in chapter 5.

Gross State Product forecasts

Subsequent to ACIL's analysis, the GSP forecasts produced by the South Australian government were revised for the period between 2011-12 and 2015-16 (table 4.3).

4.3 Revised Gross State Production forecasts

Financial year	Original GSP forecast used in ACIL's modelling [a]	Revised GSP forecast [b]
	%	%
2011-12	2.25	1.50
2012-13	3.00	2.75
2013-14	3.25	3.00
2014-15	3.00	3.00
2015-16	2.45	3.25

[a] Sourced from South Australian Government 2011-12 Mid-Year Budget Review. [b] Sourced from South Australian Government, 2012, *2012-13 Budget Statement*, http://www.statebudget.sa.gov.au/budget_papers.html. [c] Forecast for 2015-16 was not included in original GSP forecast, ACIL estimated 2.45 based on the historical average.

ACIL's analysis uses the GSP forecasts for forecasting commercial customer numbers and forecasting average commercial consumption per customer and annual non-residential consumption. As noted earlier, the CIE does not support ACIL's modelling to forecast commercial customer numbers.

The updated GSP forecasts should be incorporated into ACIL's model to forecast average consumption per commercial customer and total annual non-residential consumption. Incorporating the updated GSP forecasts decreases the total commercial and non-residential consumption billed over the forecasting period by approximately 0.4 per cent relative to ACIL's forecast.

RECOMMENDATION

7 Updated GSP forecasts should be incorporated into the demand forecasting model used to generate average consumption per commercial customer and total annual non-residential consumption.

Climate

ACIL forecasted cooling degree days (CDD 18) based on the annual median CDD 18 over the period 1977-78 to 2010-11. The forecasted annual CDD 18 was 682 days per year. The forecasted CDD 18 was applied in the residential and commercial average consumption per connection models and the non-residential total annual consumption model.

In the absence of other climate forecasts, ACIL's approach to forecast CCD 18 is valid. We consider that the mean should be used instead of the median, as the forecasts are seeking to measure expected demand, not median demand. This is because a regulator is seeking to ensure that the expected revenues of a business match its expected costs, rather than that its median revenues match its expected cost. However, the difference between the median and mean for CDD 18 was not material enough to warrant amendment.

It is interesting and surprising that rainfall did not appear as significant in the forecasting model. It may be possible that variations in climatic variables or their interaction might show an influence from rainfall.

Time in water restrictions

The future projections of average consumption per customer assume that level 1 water restrictions remained in place during the forecast period. It is difficult to forecast the likelihood of water restrictions, however, it is important to assess the sensitivity of the forecast to key assumptions. For instance, if water restrictions do not apply in the forecast period the forecasted total water consumption would increase by approximately 12 per cent. Conversely, if level 3 water restrictions apply the forecasted total water consumption would decrease by approximately 12.5 per cent.

Note that demand does not bounceback to the expected level of consumption at level 1 restrictions prior to level 3 restrictions being in place then the impacts of the time in different restriction periods would be smaller.

The CIE believes that ACIL's assumption regarding the time in restrictions is reasonable, given the relatively high storage levels, the operation of the Adelaide Desalination Plant and the recent investments in recycled water facilities.

Price elasticities

Adjusting modelled residential price elasticity

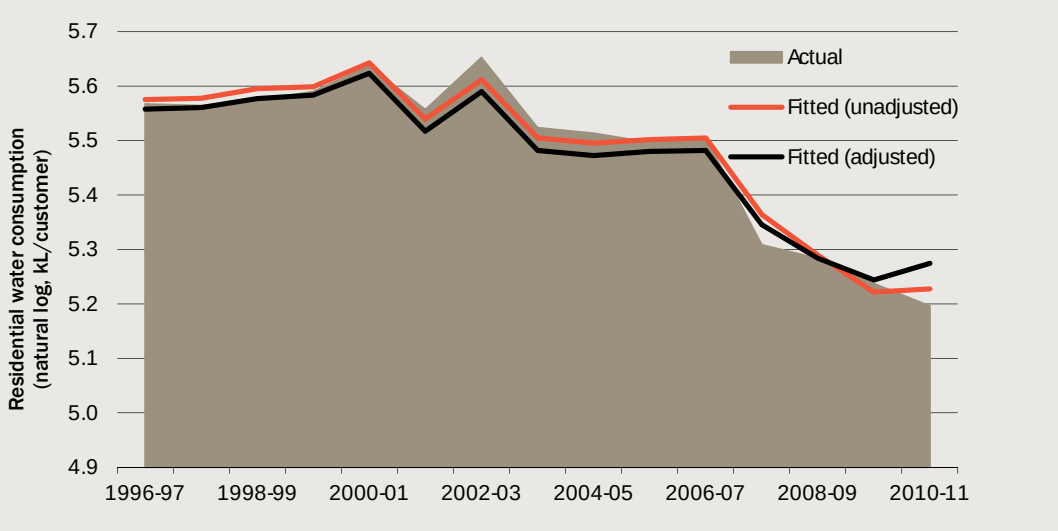
ACIL has assumed that the price elasticity used to forecast residential water usage was the midpoint between -0.18 (estimated from the literature) and -0.38 (estimated coefficient from ACIL's residential annual regression model).

There can be good reasons to change model parameters as ACIL has done, as statistical analysis will always require a degree of judgement. Adjustments have to be done carefully in order to ensure that the model remains robust. We consider that adjustments to parameters could be made, if there are good reasons **and** the model is seeking to apply growth rates to existing usage figures. In the case of ACIL's forecasting method, which models the level of water usage, we consider that model parameters should not be adjusted.

Adjustments to the model's parameters in a level model change the fit of the model historically and may lock in a different level of consumption. For example, in chart 4.4 we show the performance of the ACIL model for residential consumption per customer and its performance once the adjustment has been made to the price elasticity. By adjusting the price elasticity figure, the model significantly overestimates recent consumption. We understand that this is not the intention of the adjustment made, with ACIL noting that there are factors not included in the model that have likely meant that the historical relationship between price and consumption is overstated. ACIL's intention is to apply the adjustment only to future price changes rather than to alter the impact of past price changes. This would have to be done using two elasticity

parameters one to the existing price and one to subsequent price changes or through using a model of the change in consumption.

4.4 Review of adjustment to residential price elasticity



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model and actual by the CIE.

ACIL's original forecast for total water consumption in 2011-12, using an adjusted price elasticity of -0.28 and adjusted to reflect actual weather outcomes for this year, was 188.0 GL. This is 6.2 per cent above actual water consumed in 2011-12. The forecast using an unadjusted residential price elasticity in ACIL's original model, provides a closer fit, 2.4 per cent above actual water consumed in 2011-12 (table 4.5). When the adjustment to the elasticity is removed a larger reduction in water usage is implied for 2012-13, reflecting the price increase in that year.

4.5 Total water consumption forecast with adjusted and unadjusted price elasticities

Year	ACIL's original model	
	Adjusted price elasticity[a]	Unadjusted price elasticity
2011-12 actual	177.0	177.0
2011-12 forecast	188.0	181.2
deviation from actual in 2011-12	*6.2%*	*2.4%*
2012-13	176.3	167.7
2013-14	178.9	170.2
2014-15	181.4	172.6
2015-16	183.8	174.9

[a] ACIL's original forecast for total water consumption

Note: ACIL's original forecast for 2011 12 has been adjusted for weather.

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

RECOMMENDATION

8 The unadjusted price elasticity, as estimated in the residential consumption model, should be used to forecast average residential water consumption per connection.

Revision to price elasticities

The changes to historical data and method impact on the measured price elasticities. The historical changes to data and method recommended are:

- update of ABS historical population data and amendment of ACIL's adjustment for quarterly billing in 2009-10;
- inclusion of both level 1 and 3 water restrictions in the historical data for 2010-11; and
- allowing the commercial average consumption model to estimate the intercept rather than applying ACIL's assumption of setting the intercept to zero.

The change to the price elasticities resulting from these amendments are detailed in table 4.6. The changes in estimated elasticities are substantial and should be reflected in demand projections. We note that the removal of the adjustment to the residential price elasticity and the other adjustments above generate a price elasticity close to that originally used by ACIL.

4.6 Original and revised price coefficients from annual regression models

Sector	Estimated coefficient on price			
	Original estimates in ACIL's model	Amendment to ABS population data and quarterly billing adjustment	Amendment to water restriction data in 2010-11	Amendment to commercial model to include intercept
Residential (unadjusted price coefficient)	-0.38	-0.40	-0.29	-0.29
Residential (adjusted price coefficient)	-0.28	-0.29	-0.23	-0.23
Commercial	-0.37	-0.39	-0.29	-0.28 [a]
Non-residential	-0.32	-0.26	-0.23	-0.23

[a] Amendment to commercial model to include an intercept only changes price coefficient in commercial sector.

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

Bounceback

ACIL Tasman has assumed 100 per cent bounceback from level 3 water restrictions over the forecast period to level 1 water restrictions, which are considered to be similar to waterwise restrictions now in place. However, in discussions with SA Water it indicated that 100 per cent bounceback does not appear to have occurred since level 3 water restrictions were replaced with water wise measures and suggested that many of the changes in water consumption arising from level 3 restrictions have been locked in to some extent.

It is difficult to directly observe the extent of any 'bounceback' in consumption as climate conditions and other external factors also vary and the time period since level 3 restrictions were removed has been short. Deloitte reviewed experiences of bounceback

in water usage across Australian jurisdictions,[18] however the limited time series data available did not provide clear trends of bounceback and the analysis conducted did not allow for consumption to gradually change after the removal of restrictions. The extent of bounceback in other jurisdictions has been:

- *Sydney Water* — recent submission to the Productivity Commission Sydney Water noted there was no observed bounceback over the first three months of 2010-11, following replacement of level 3 restrictions with water wise rules in June 2009.[19]
- *Victorian water utilities* — Victorian urban water utilities have assumed some level of bounceback between 70 per cent and 90 per cent of pre-restriction levels.[20] At this stage, we are not aware of any analysis that has been undertaken to confirm the robustness of the Victorian water utilities' assumptions.
- *ActewAGL* — sought to test the extent of any bounceback, although it has been limited by insufficient observed historical data following the lifting of water restrictions.

Based on discussions with SA Water regarding bounceback and consumption outcomes in 2011-12, we consider that the assumption of immediate bounceback to usage at level 1 restrictions is unreasonable and that this adjustment will take some time.

ACIL's total consumption forecast assumed full bounceback to water wise consumption levels in the first year. Using this bounceback assumption, ACIL's forecast was 188 GL, or 6.2 per cent above actual consumption data in 2011 12, after adjusting for weather. Given the consumption outcome for 2011-12, it appears likely that consumption bounceback has been about 25 per cent towards the levels expected for water wise rules (table 4.7).

4.7 Deviation of forecasts from actual consumption data in 2011-12

2011-12	Total water consumption GL	Deviation to actual Per cent
Actual	177.0	
ACIL forecast	188.0	6.2
25 per cent bounceback	175.9	-0.6

Note: Total water consumption forecasts in 2011 12 were adjusted for weather.

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

18 Deloitte, 2012, *Measuring 'bounceback' in water usage.* Presentation to the ESC Demand Forecasting Workshop. http://www.esc.vic.gov.au/getattachment/8d0e817a-ee72-4c79-829d-d20b4491c95f/Deloitte-Presentation-Demand-forecasts-workshop-Wa.pdf

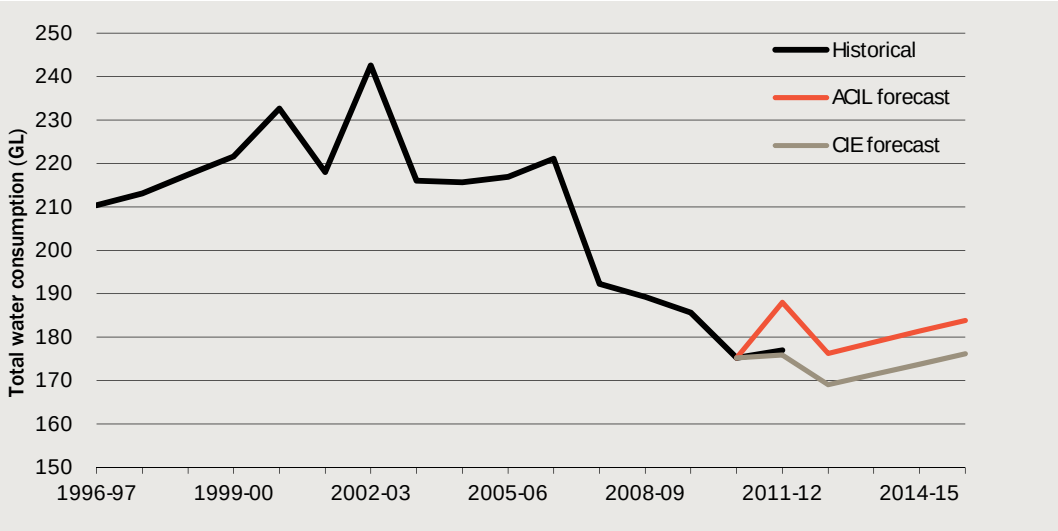
19 Sydney Water 2010, Australia's Urban Water sector, A submission to the Productivity Commission. November, p.34.

20 Pricewaterhouse Coopers (PwC) 2009, *Water Price Review 2009: Demand*, Report for Essential Services Commission, p. 13 http://www.esc.vic.gov.au/NR/rdonlyres/E19898BE-3012-4619-999E-880367FD0615/0/RPTPWCWaterBusinessesdemandreport120090417.pdf Accessed 2011.

We have modelled three bounce back scenarios which vary the extent of total bounceback and the length of the bounce back period. The 2011-12 total water consumption data recently released was used as a benchmark to derive the three bounceback scenarios, setting an annual bounce back of 25 per cent in each year of the bounceback period. The three bounceback scenarios are:

- 50 per cent over 2 years (chart 4.8): during the regulatory period, CIE's forecast of total water consumption is approximately 4 per cent lower in each year than ACIL's original forecast.
- 75 per cent over 3 years (chart 4.9): during the regulatory period, CIE's forecast of total water consumption is approximately 0.4 per cent lower in each year than ACIL's original forecast.
- 100 per cent over 4 years (chart 4.10): during the regulatory period, CIE's forecast of total water consumption is between 1.5 per cent higher in the first year, increasing to 3.6 per cent higher at the end of the regulatory period compared to ACIL's original forecast.

4.8 Bounceback of 50 per cent over 2 years



Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

4.9 Bounceback of 75 per cent over 3 years

Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

4.10 Bounceback of 100 per cent over 4 years

Data source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

In the absence of additional data on bounceback, the three bounceback scenarios provide a range for forecasts of total water consumption.

Choosing between bounceback scenarios is difficult, given that there has not been substantial experience with bounceback in South Australia to draw on. It may be possible to better understand bounceback through modelling of monthly data to see if there has been any convergence between the actual figures and a model with 100 per cent bounceback over the two years since level 3 restrictions were removed. It may also be possible to use other jurisdictions as an example, where these jurisdictions have had a longer time out of restrictions. Historical data for Hunter Water might be one option for this. However, it is not clear that all jurisdictions will be the same. The amount of bounceback may also depend on other factors such as the duration of restrictions.

Consumption data available for the most recent two years since water restrictions were replaced suggests that there has been some level of bounceback, likely around 25 per cent per year. It is not clear whether consumption will bounceback in full to the level expected by modelling given today's prices and level 1 restrictions.

RECOMMENDATION

9 An adjustment should be made to the projections to allow for water demand to recover gradually to expected consumption which also reflects bounceback of water consumption experienced in 2011-12.

5 Revised forecasts

In previous chapters we recommended updates and amendments to the data and modelling specification used in ACIL's demand forecasts, including discussion of the change to the forecast of amending each in turn, holding all else constant.

In this chapter we step through the suggested updates and amendments to data and modelling and report the cumulative change to the total forecasted water usage relative to ACIL's original forecast of total water consumption billed for the forecast period between 2013-14 and 2015-16.

Our revised forecasts for customer numbers and consumption billed over the regulatory period are provided in table 5.1 and 5.2. Given the uncertainty surrounding the occurrence of bounceback of water consumption, we have modelled the revised forecast of total consumption billed over the forecast period for three bounceback scenarios. For the three scenarios, the CIE's revised forecast is:

- Bounceback scenario 1: demand approximately 4.1 per cent lower than ACIL's original forecast with 50 per cent bounceback over 2 years.
- Bounceback scenario 2: demand approximately 0.4 per cent lower than ACIL's original forecast with 75 per cent bounceback over 3 years; and
- Bounceback scenario 3: demand approximately 2.9 per cent higher than ACIL's original forecast with 100 per cent bounceback over 4 years (table 5.2).

Annual forecasts of total, residential, non-residential and commercial water consumption billed for the three bounceback scenarios between 2011-12 and 2015-16 are provided is Appendix A.1.

5.1 Original and amended forecast of customer numbers

Year	Residential customers		Commercial customers	
	ACIL	CIE	ACIL	CIE
2011-12	646 143	641 149	27 052	27 364
2012-13	655 659	650 660	27 365	27 675
2013-14	665 173	660 252	27 715	27 990
2014-15	674 689	669 926	28 048	28 309
2015-16	684 207	679 683	28 329	28 631

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

5.2 Original and amended forecast of consumption billed over regulatory period

Total consumption billed (ML) over regulatory period	ACIL's original forecast	CIE Amended forecast		
Bounceback assumption	100% over 1 year	50% over 2 years	75% over 3 years	100% over 4 years
Residential	367 592	338 906	355 993	370 958
Commercial	28 716	28 495	29 676	30 703
Non residential	147 707	153 971	156 116	157 931
Total	544 014	521 373	541 785	559 592

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

The extent of the amendments to forecasted total, residential, commercial and non-residential water consumption billed is illustrated in chart 5.3, 5.4, 5.5 and 5.6.

- *Population data and quarterly billing* — update the ABS historical population data and amend the estimation of water consumption billed in 2009-10.
- *Disaggregation of historical water restrictions* — revise the historical water restriction data to include level 1 and level 3 water restrictions in 2010-11.
- *Forecast customer numbers* — the projection of residential customer numbers is based on the ABS population forecast adapted to include the five year average historical difference in growth rates of customers and population (chart 3.8). Commercial customer numbers are projected based on an average historical growth in customer numbers over the most recent five years.
- *Incorporate intercept in commercial model* —the assumption that the intercept is set to zero in the commercial model was relaxed.
- *Unadjusted residential price elasticity* — the modelled residential price elasticity is used to forecast average consumption per connection instead of an adjusted price elasticity as used by ACIL.
- *Update GSP independent forecast* — updated GSP independent forecasts were incorporated into model.
- *Bounceback* — we have modelled three bounceback scenarios, 50 per cent over 2 years, 75 per cent over 3 years and 100 per cent over 4 years.

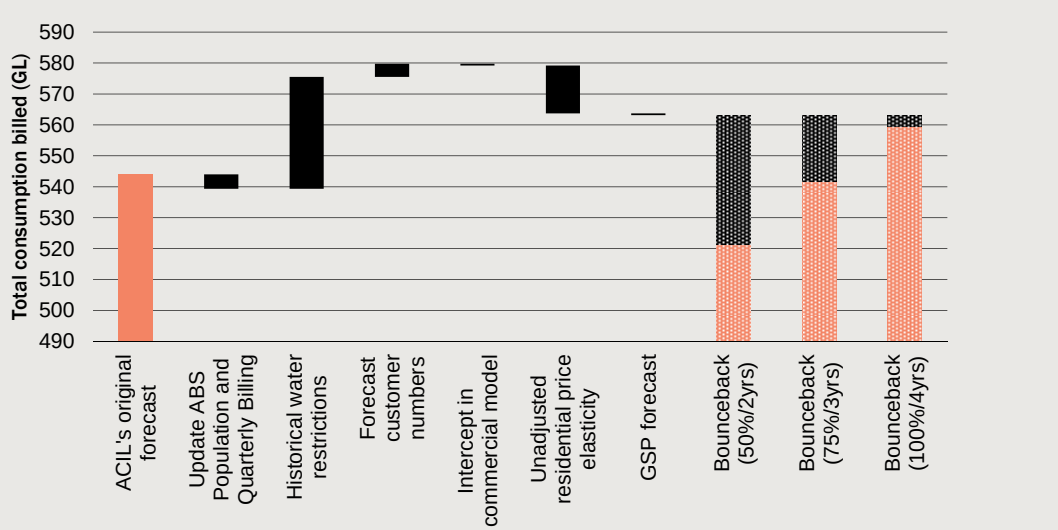
Adjusting the historical water restriction data to incorporate both level 1 and 3 water restrictions in 2010-11 caused the largest change to the forecast. This is because this amendment substantially changed the estimated coefficient on the price variable for residential, commercial and non-residential demand. For example, the coefficient on the price variable in the residential model changed from -0.38 to -0.27 (table 3.4), which resulted in the price elasticity used in the residential model changing from -0.28 to -0.23.[21] The amendment makes demand relatively more inelastic and therefore less responsive to price increases over the forecast period.

[21] Because of the ACIL's approach to estimate the residential price elasticity as the midpoint between -0.18 and the estimated coefficient on the price variable, the adjusted price elasticity when the historical water restriction data was amended was -0.23.

Residential water consumption decreased when the unadjusted residential price elasticity was applied into the model. The unadjusted price elasticity is more elastic than the adjusted price elasticity used by ACIL which makes demand more responsive to the forecasted increase in price in 2011-12 and 2012-13.

Forecasted water consumption decreases across all three sectors when we limit bounceback relative to ACIL's assumption of full bounceback. The scale of decline in consumption is relative to the bounceback assumption.

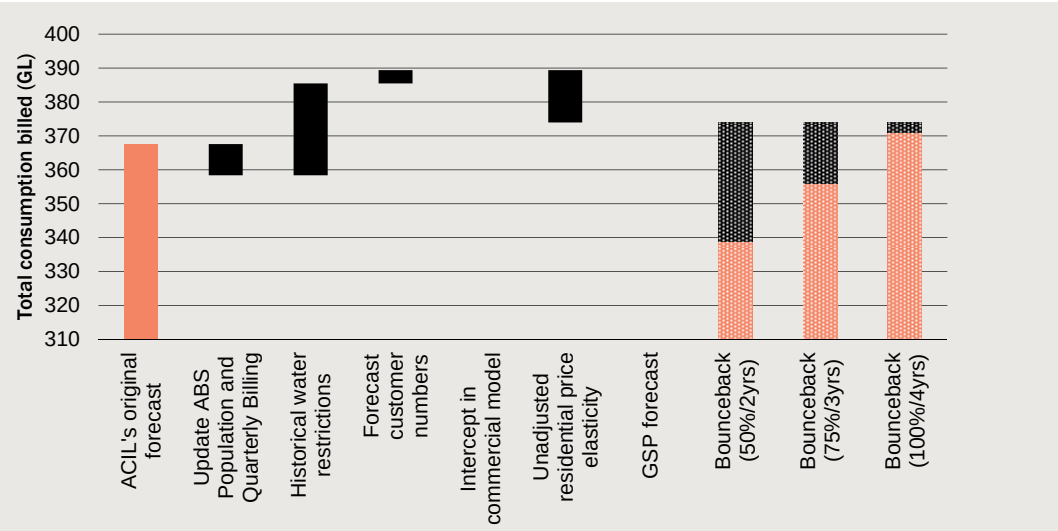
5.3 Cumulative changes to total consumption billed over regulated period (GL)



Note: Cumulative change presented for the three bounceback scenarios

Data source: The CIE.

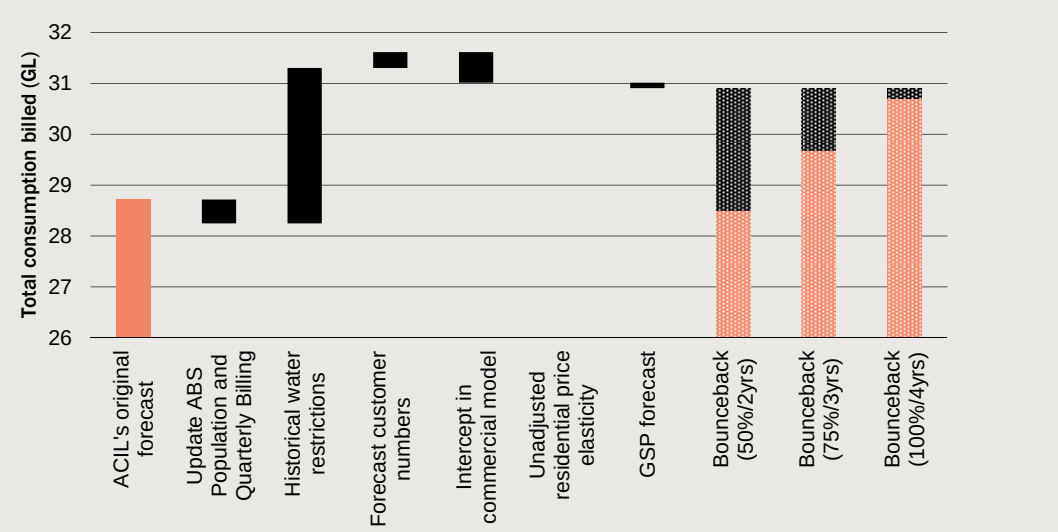
5.4 Cumulative changes to residential consumption billed over regulated period (GL)



Note: Cumulative change presented for the three bounceback scenarios

Data source: The CIE.

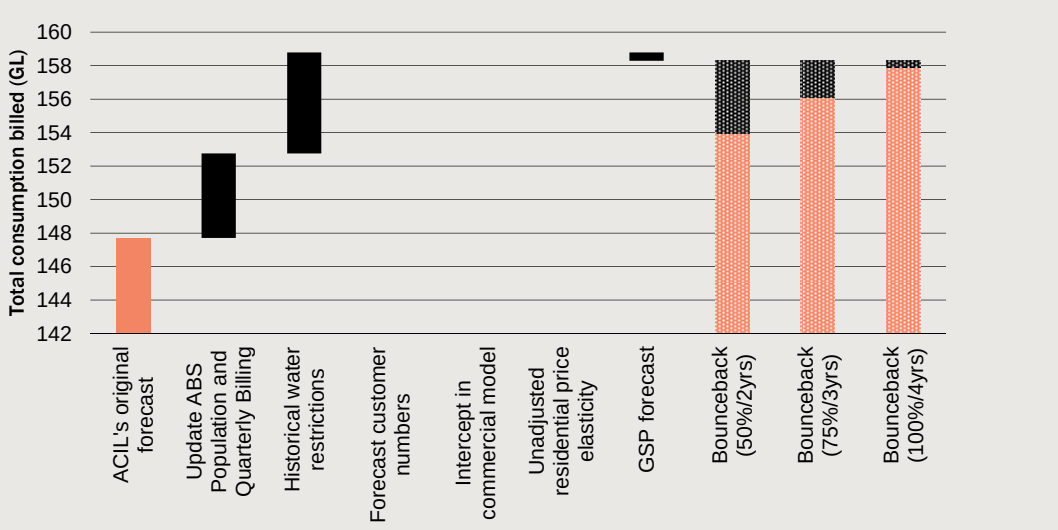
5.5 Cumulative changes to commercial consumption billed over regulated period (GL)



Note: Cumulative change presented for the three bounceback scenarios

Data source: The CIE.

5.6 Cumulative changes to non-residential consumption billed over regulated period (GL)



Note: Cumulative change presented for the three bounceback scenarios

Data source: The CIE.

A Forecast of annual water consumption billed

A.1 Forecast of annual water consumption billed (GL)

Year	ACIL's original [a]	CIE		
Bounceback scenario	100% over 1 year	50% over 2 years	75% over 3 years	100% over 4 years
		Total water consumption billed (GL)		
2011-12	188.0	175.9	175.9	175.9
2012-13	176.3	169.1	172.3	172.3
2013-14	178.9	171.4	178.1	181.6
2014-15	181.4	173.8	180.6	187.7
2015-16	183.8	176.2	183.1	190.3
		Residential water consumption (GL)		
2011-12	126.8	113.7	113.7	113.7
2012-13	119.0	109.7	112.4	112.4
2013-14	120.8	111.3	116.9	119.8
2014-15	122.5	113.0	118.7	124.6
2015-16	124.3	114.6	120.4	126.5
		Non-residential water consumption (GL)		
2011-12	51.5	52.9	52.9	52.9
2012-13	48.2	50.3	50.7	50.7
2013-14	48.7	50.8	51.5	51.9
2014-15	49.3	51.3	52.0	52.7
2015-16	49.7	51.9	52.6	53.3
		Commercial water consumption (GL)		
2011-12	9.7	9.3	9.3	9.3
2012-13	9.1	9.1	9.3	9.3
2013-14	9.3	9.3	9.7	9.9
2014-15	9.6	9.5	9.9	10.3
2015-16	9.8	9.7	10.1	10.5

[a] ACIL's forecast in 2011-12 has been adjusted for weather.

Source: ACIL Tasman, 2012, SA Water's Demand Forecasting. Prepared for SA Water. With amendments to model by the CIE.

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