Metropolitan water and sewerage demand review 2013

A REPORT PREPARED FOR THE ESSENTIAL SERVICES COMMISSION

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Frontier Economics has been engaged by the ESC to undertake a review and assessment of the demand forecasts prepared by the Victorian metropolitan water businesses for the purposes of their Water Plans for the regulatory period 2013-14 to 2017-18. The outcome of Frontier's review of the demand forecasts are summarised in Table 1.

Frontier's assessment was based on the following five criteria:

- Forecasts are based on appropriate forecasting methodologies.
- Forecasts reflect reasonable assumptions about the key drivers of demand.
- Forecasts use the best available information
- Forecasts are statistically unbiased
- Forecasts account for different or changed tariff structures and elasticities.

For a detailed discussion of these criteria see Section 2.2 of the report

Table 1: Summary of findings

Water Business	Finding
Melbourne Water	MW's demand forecasts are dependent on the demand projections of the other metropolitan water businesses. Frontier has identified a number of issues with the businesses' demand forecasts and has discussed these at length in Part B of this report.
City West Water	This review of CWW's urban demand forecasts found: • Forecasts are based on appropriate forecasting methodologies. • Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users. • Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth. • Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is

	therefore not expected to be statistically biased • Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.
South East Water	This review of SEW's urban demand forecasts found: • Forecasts are based on appropriate forecasting methodologies. • Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users. • Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth. • Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is therefore not expected to be statistically biased. • Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.
Western Water	This review of WW's urban demand forecasts found: • Forecasts appear to be based on appropriate forecasting methodologies. • Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users. • Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth. • Forecasts for water and sewerage services are based on extrapolations of a series of regressions. Frontier did not have access to adequate information to

	access the statistical integrity of these regressions. • Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff consistent with the approach adopted by the metropolitan water retail businesses.
Yarra Valley Water	This review of YVW's urban demand forecasts found: • Forecasts are based on appropriate forecasting methodologies. • Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users. • Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth. • Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is therefore not expected to be statistically biased. • Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.

1 Introduction

In Victoria there are five government owned businesses that provide water and wastewater services to urban communities within the Melbourne Metropolitan area (including Sunbury and Melton).

The services provided vary from business to business. Melbourne Water provides bulk water and sewerage services to the three Melbourne retailers (City West Water, South East Water and Yarra Valley Water) and to Western Water. Western Water differs from the other metropolitan businesses in that the scope of services it provides are more representative of a vertically-integrated regional urban water business..

As monopoly providers these businesses are subject to economic regulation which is administered by the Essential Services Commission (ESC). The ESC is currently conducting a price review to regulate prices for the period 2013-14 to 2017-18. Demand forecasts are a central component of the price review as they have a direct impact on:

- Capital expenditure estimates — particularly where growth is a major driver of system augmentations.
- Operating and maintenance expenditure — particularly for expenditures that are volume related.
- Revenue and prices — for both fixed and volumetric charges.
- Service standards — ensuring that supply-demand balance is achieved, water pressure requirements are met and supply continuity is provided.

Therefore, it is important to ensure that demand forecasts are as accurate as possible in order to reduce regulatory risk and promote efficient regulatory outcomes.

1.1 Objective of the review

Frontier Economics has been engaged by the ESC to undertake a review and assessment of the demand forecasts prepared by the Victorian metropolitan water businesses.

The businesses have prepared these forecasts for inclusion in their water plans for the five years 2013-14 to 2017-18. The ESC is currently undertaking the Water Price Review 2013 that will assess the reasonableness of the proposals set out in the businesses' water plans.

The outcome of Frontier's review of the demand forecasts will be an input into the ESC's consideration of the businesses' water plans.

Frontier has been asked to review whether the forecasts:

- are based on appropriate forecasting methodologies
- reflect reasonable assumptions about the key drivers of demand
- use the best available information, including historical demand trends and relevant Water Supply and Demand Strategies
- are statistically unbiased
- account for different or changed tariff structures and elasticities.

1.2 Structure of this report

This report is structured to provide a broad summary of our key findings as well as providing a more detailed business specific examination of each of the businesses proposed forecasts. The report is structured as follows:

- Summary of findings — a broad overview of Frontier's findings.
- Part A
  - Chapter 1 provides an introduction to the report.
  - Chapter 2 outlines Frontier's approach to assessing the metropolitan Victorian water businesses' demand forecasts for the regulatory period beginning 2013.
  - Chapter 3 provides a broad overview of the different methods adopted by businesses in generating forecasts.
  - Chapter 4 provides an overview of the main assumptions and information sources underlying businesses' forecasts.
- Part B
  - Chapters 1 to 5 — Business specific demand assessments.

2 Frontier's approach

In this chapter, we set out the framework that we have used to assess the approaches that the businesses have adopted to develop their demand forecasts.

2.1 The review process

This report presents Frontier's final advice to the Essential Services Commission regarding the appropriateness of the Victorian water businesses' demand forecasts. The report is the final stage in a process that involved our own analysis and managed consultation with the water businesses.

The initial analytical task was to review the information provided by the businesses in their submitted water plans and information templates. This initial review concentrated on establishing the completeness of the data provided by the businesses and identifying any underlying trends or anomalies in the data that required further investigation. In particular, Frontier identified:

- sudden changes in long-term trends that are unexplained
- changes in trends that are inconsistent with expectations
- inconsistencies with the data requirements of the ESC.

Where any preliminary issues were identified during our initial scan they were addressed through an information/clarification request that was distributed to the relevant businesses. The requests outlined the issue identified and provided guidance on how the businesses should respond.

Where necessary Frontier directly liaised with the businesses on their initial submitted data and their responses to the information requests to ensure that any issues or perceived issues were not due to misunderstanding or basic error in the original submission.

Frontier then assessed the approaches to demand forecasts taken by the businesses based on the information provided in the original water plan and the subsequent responses by the water businesses to information requests. Frontier provided the ESC with a draft report that outlined the approach Frontier had adopted in undertaking its assessment, the initial findings of its review and the recommended amendments to any forecasts deemed inappropriate.

Where Frontier believed the businesses' underlying assumptions were inappropriate we provided the ESC with reasonable, alternative forecasts that reflect more robust assumptions. These alternative forecasts were accompanied by an explanation of the reasoning supporting the alternative estimate, along with a description of the approach adopted by Frontier to generate the estimates.

Frontier's draft report was circulated to each of the businesses for comment. Frontier then undertook a round of consultation where businesses were invited to either meet with Frontier consultants on a face-to-face basis or via a teleconference. This round of consultation allowed the businesses to highlight any issues or concerns they may have had with Frontier's findings and recommendations.

This final report takes into consideration all the information provided with the businesses' water plans and initial information requests along with the businesses' responses to Frontier's initial findings in the draft report.

2.2 Assessment of forecasts

The ESC requested that the demand forecasts be assessed against five criteria:

- Forecasts are based on appropriate forecasting methodologies.
- Forecasts reflect reasonable assumptions about the key drivers of demand.
- Forecasts use the best available information
- Forecasts are statistically unbiased
- Forecasts account for different or changed tariff structures and elasticities.

Frontier has interpreted these criteria in the context of the scope and nature of the review.

- Appropriate forecasting methodologies — businesses have adopted methods for forecasting that are capable of providing reliable forecasts if applied correctly. They may be consistent with sector practice, have been previously subject to regulatory review or broadly acknowledged as appropriate.
- Forecasts should reflect reasonable assumptions about the key drivers of demand — the base assumptions underlying the forecasts should be credible and defendable.
- Forecasts should use the best available information, including historical demand trends and relevant Water Supply and Demand Strategies — all forecasts should not only reference historical data but should also be based on the most recent available data.
- Forecasts are statistically unbiased —Frontier has interpreted this criterion to mean that at a broad level the methods adopted by businesses do not appear to contain inherent systemic bias. Within the scope and time available for this review Frontier was not able to undertake a comprehensive detailed review of the statistical robustness of each businesses' forecasts and forecast models
- Forecasts should account for different or changed tariff structures and price elasticities— Where businesses are proposing to amend their tariff structures the associated demand forecasts should be amended accordingly. For

example, any business proposing to move from a three tier variable tariff to a two tier variable tariff will need to consider the impact of the tariff change on demand. Businesses will also need to consider how they have applied elasticity estimates to their forecasts.

On the basis of the information templates and the responses to information requests supplied by the businesses, Frontier has reviewed the businesses' proposed forecasts against the above criteria. In providing this advice we have had regard to:

- guidance issued by the ESC with respect to how it will assess the businesses' proposed demand forecasts
- the information set out in the businesses' Water Plans (and accompanying information templates), any explanations provided and the businesses's responses to our information requests
- comparison of proposed forecasts against historical trends
- comparisons of different businesses' forecasting methodologies, assumptions, and resulting forecasts
- relevant third party information such as Victorian Government policies which impact on demand and any readily available data and information on key demand drivers.
- Frontier's own experience in preparing and assessing the veracity of forecasts of demand for rural and urban water services in Victoria and other Australian States

A more detailed framework for Frontier's assessment is set out in Box 1.

It should be noted that our review of the proposed demand forecasts was high level in nature, in that it focused on the comparisons against historical trends and on the identification and validation (or otherwise) of the major assumptions underlying the forecasts. The review did not constitute a bottom up detailed audit of the mathematical integrity of each business's forecasting model.

Box 1: Assessment Template

STEP 1 assessment of forecasting methods:

- the method's track record — historical ability to produce forecasts that are consistent with actual outcomes
- the logical validity of the approach
- the acceptance of the approach within the broader sector
- the method's internal consistency

STEP 2 comparison against historical trends

- identify historical trends
- compare proposal against trends
- identify material deviations from trend
- identification of underlying assumptions

STEP 3 comparison across similar businesses

- comparison of assumptions against those referenced by businesses with similar characteristics

STEP 4 consideration of third party evidence

- comparison of assumptions against those relevant evidence provided by third parties

STEP 5 amendment of forecasts where appropriate

- where Frontier has identified incomplete or inappropriate forecasts we will amend forecasts to better reflect more robust assumptions
- Frontier takes the approach that any amendments recommended to forecasts should be robust and defendable and based on observable evidence

2.2.1 Comparison against historical trends

Frontier assessed the scale and causes of any variances between the proposed forecasts and the observable trends based on historical data.

This step involved identifying trends in consumption based on historical data. Forecasts were then compared to historical trends to enable the identification of instances where businesses are assuming step changes in consumption or material deviations from historical trends.

2.2.2 Comparisons across similar businesses

To aid in this assessment Frontier compared and contrasted the assumptions and methodologies adopted by different businesses. Of particular importance in the assessment of the forecasts is the identification and reasonableness of the underlying assumptions regarding the impact of weather on outside water use, the degree of bounceback, consumer behaviour and growth.

In assessing the assumptions underlying demand we adopted the following expectations as a starting point:

- Consumer behaviour and water consumption patterns should not vary significantly between similar businesses. The profile of consumption by residents should not vary to any large degree across metropolitan retailers.
- Consumers will behave in a similar way when confronted with increased water prices assuming prices are set at a similar level. That is, price demand elasticity should be fairly consistent across businesses with similar types of customers.

These expectations are only intended to provide guidance to our assessment. We recognise that there may be local conditions, demographic patterns or other reasons (such as type and prevalence of domestic gardens) that may make it reasonable for a business to use different assumptions to develop its forecasts.

Frontier recognises that there may be valid reasons why the conditions being experienced by a particular business warrant the use of an assumption that deviates from that adopted by other businesses or third party sources. We have engaged with the business concerned to understand why the assumption it has used differs and to request further information or evidence in support of that approach.

2.2.3 Consideration of third party evidence

Frontier also assessed the businesses' forecasts against evidence available from third parties or independent sources. Where possible, we identified independent third party views on:

- bounceback
- behavioural changes in water use including price demand elasticity impacts and the effectiveness of the various non-price water conservation measures proposed by the businesses
- future population and demographic trends
- availability of water resources
- trends in technology and water use and

- demand for commodities and commercial products produced by commercial water users.

2.3 Approach to adjusting forecasts

We have adjusted the businesses' forecasts where the information provided did not support the assumptions businesses had used, where information has not been forthcoming from the businesses, or where businesses have revised forecasts in response to issues raised by Frontier. In most cases, we have adjusted the forecasts to reflect additional data regarding actual consumption for the year 2011-12. This data has a material impact on the assumptions regarding bounceback and affects forecasts for both water and sewage volumes.

Underlying Frontier's approach is a requirement that any amendments recommended to forecasts should be robust, defendable and based on observable evidence. There were instances throughout the review where Frontier expressed concerns regarding certain aspects of forecasts, but where reliable alternative information upon which to base an adjustment was not available. In such instances we adopted a precautionary approach and accepted the businesses' forecasts subject to qualification.

3 Forecasting methods

The adequacy of a business's proposed demand forecasts depends heavily on whether it has adopted an appropriate forecasting method.

Through the course of the review Frontier identified a range of methods for forecasting demand that had been adopted by water businesses across Victoria. This range extends from the extrapolation of historical trends through to the use of regression analysis and data intensive 'end use models' and agent based models.

3.1 Trend extrapolation

This approach is relatively simple and, in our experience, where applied correctly, will in most circumstances produce outcomes that are consistent with more complex forms of forecasting. Under such an approach it is important to ensure that the underlying historical data is complete and sufficient to capture underlying trends. It is also important to ensure that the approach to estimating growth trends is both valid and applied in a consistent manner. The other aspect of extrapolation that requires attention is the appropriateness of any assumptions made regarding any potential step change in any of the key drivers of demand over the forecast period.

Examples of trend extrapolation include YVW's forecast for non-residential customer connections which is based on the forecast for residential customers using the historical relationship between the two series over the last decade.

Another example is SEW's non-residential demand forecast which is an extrapolation of the historical demand per non-residential property per annum. SEW used average non-residential demand per property for the past four years as the starting point and projected demand for water volumes over the regulatory period taking into account a 0.05 per cent annual efficiency gain.

Frontier recognises that trend extrapolation, if conducted in an appropriate manner, coupled with appropriate assumptions regarding changes in key demand drivers over the course of the regulatory period, is capable of generating reasonable demand forecasts. While simple trend extrapolation should not be considered to represent best practice, we also acknowledge that such an approach has been accepted by the water industry in general over the course of many years.

Trend extrapolation is most appropriate where the main assumption is that the future will more or less be a continuation of the past. If the past was unusual (e.g. droughts) or the future is different (e.g. anticipated larger future price increases) then one needs to make appropriate adjustments to the trend analysis.

3.2 End use models

CWW, SEW and YVW utilised end use models to generate forecasts for residential consumption. Such models estimate total demand for water and sewerage demand based on end-uses — that is, the model generates forecasts of the water consumption associated with specific end uses (based on average water use by appliances such as washing machines, dishwashers and toilets, accounting for water use efficiency). The model then aggregates the volumes associated with specific water uses to derive a total water and sewerage demand. The resulting end use model demand forecasts are then adopted by the businesses as baseline forecasts and are further amended to take into account water restrictions, and in some cases conservation strategies and price elasticity of demand.

The principal forecasting method used by CWW, SEW and YVW for forecasting residential potable water demand is the Melbourne End Use Model (MEUM). The model is an extension of the Water Services Association of Australia End Use Model that was previously adopted by the three metropolitan Melbourne retail water businesses. The MEUM disaggregates indoor residential demand into different components of water use including:

- Washing machine
- Dishwasher
- Toilet
- Shower
- Indoor miscellaneous (e.g. bath, taps etc)

The assumptions underlying the MEUM are informed by regular stock surveys undertaken by each of the retailers for their own specific service areas.

Frontier accepts the use of end use models, where applied correctly, as an appropriate approach to demand forecasting. End use models have been utilised in the water sector for a long period of time and have been subject to review and approved by the ESC previously.

3.3 Regression analysis

Metropolitan water businesses also utilised regression analysis. For example YVW used regression analysis to inform its revised level of bounceback and to help establish a weather normalised year for bulk water. YVW regressed daily bulk water usage against climate and dummy variables using multiple regressions to establish a model of usage that accounts for climatic conditions. The regression considered climatic variables such as maximum temperature,

evaporation, rainfall based variables dummy variables to account for factors such as growth (trend variable) or changes in restrictions.

Where utilised in an appropriate manner regression analysis has the potential to add material value to the forecasting of demand for water and sewerage services.

3.4 Agent based models

While no metropolitan water business utilised agent based modelling for its forecasts, some regional businesses have begun to adopt agent-based modelling approaches to forecast demand. Agent-based models are similar to end use models in that they are a bottom-up approach to generating demand forecasts. However, unlike an end use model that relies on historical trends in the adoption of water efficient appliances and practices, agent-based models incorporate 'agents' that react or interact with each other based on a set of pre-defined rules. These models are dynamic in nature and allow for the creation of complex outcomes.

These models are a relatively new approach to forecasting water demand. Frontier accepts the use of agent based models as an appropriate method if applied correctly. We note that it has been accepted by the ESC previously and has also been adopted by the ESC to facilitate its own understanding of demand forecasts.

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4 Assumptions underlying demand

4.1 The context of demand forecasts

Demand forecasts should reflect reasonable assumptions about the key drivers of demand, irrespective of the method adopted. There are many variables that can potentially impact on consumption forecasts for urban and rural water use. The materiality of these variables and their influence on demand will change over time.

For example, regulatory price reviews over the preceding five years focused on the variables associated with drought, such as the availability of water resources and the level of water restrictions. Given recent rainfall, forecasts of water consumption over the next five years are likely to be less affected by these factors.

However, for this price review there is some uncertainty around some of the key drivers of demand. In particular, there is uncertainty about the long-term impact of climate change on water availability and how changing weather patterns will impact on outdoor use. Also with the recent easing of water use restrictions there may be some 'bounceback' in demand, reflecting consumer behaviour changes.

The uncertainty associated with these factors may affect the robustness of demand forecasts, particularly in respect to demand for potable and recycled water.

4.2 Key assumptions for metropolitan urban demand forecasts

The current identifiable drivers of demand include:

a. Population and demographic changes — growth in population and in household density.

b. Climate and water availability — natural rainfall patterns have a direct impact on the demand associated with agricultural and outdoor residential use. Climate also impacts on the amount of water in storage and can influence water availability.

c. The materiality of 'bounceback' — the likely impact of easing water use restrictions given the effectiveness of past demand management initiatives and ongoing permanent water savings.

d. Consumer behaviour — the effectiveness of the various non-price water conservation measures proposed by the businesses.

e. Price demand elasticity impacts — taking into account the price effect of recent supply augmentations.

While population and demographic change, particularly growth in households, is the primary driver for variables associated with fixed charges (such as connection charges or fixed sewerage charges), it will also impact on aggregate forecasts of consumption as the number of customers increases. The other three drivers relate primarily to volumetric water use and where appropriate volumetric wastewater services.

While there is a degree of commonality between the businesses, each has assumed a different combination of the drivers when developing their forecasts. For example, some businesses have factored in a price elasticity of demand while others have not. The following discussion examines the approaches adopted for each of these key drivers.

4.3 Population growth and demographic change

Findings

Frontier supports the businesses' use of the Victoria in Future 2012 forecasts of household growth to generate connection and volume based forecasts, subject to allowances being made for differences in the composition of SLA and LGA as used in the VIF and areas for which businesses have a responsibility to provide services.

Frontier has found that most metropolitan businesses have forecast connections greater than those forecast by VIF. The exception was CWW whose forecast was marginally lower than the VIF. These forecasts were accepted by Frontier on the basis that they are consistent with historical trends.

A major driver of water consumption is growth in customer numbers. Of particular concern to the forecaster are population growth, demographic change and household density. All of these factors have a direct impact on residential consumption.

Growth in customer numbers is complicated by the fact that such numbers are based on household connections as opposed to being directly based on population. Consequently, it is important that businesses' forecasts consider not just population change but how such change translates into household numbers over the period and any anticipated trends in household composition. For example, household size may be growing which would imply that growth in household numbers will (all things being equal) be lower than growth in population.

However, where there are changes in demographics (such as decreases in household size and changes in household allotment size) consumption per

connection may decline. This implies that the level of demand attributable to growth may need to be adjusted downward.

4.3.1 Victoria in Future

The principal third party evidence used by Frontier in assessing the businesses' forecasts of customer numbers was the population and demographic forecasts of Victoria in Future 2012 (VIF).

VIF sets out projections of population and households across Victoria. The projections are developed by the Spatial Analysis and Research Branch of the Department of Planning and Community Development (DPCD). VIF 2012 projections cover the period 2011 to 2051 for Victoria, metropolitan Melbourne and regional Victoria. Projections for smaller geographical areas (Statistical Local Areas, Local Government Areas and regional Statistical Divisions) cover the period 2011 to 2031.

The projections are based on the 2011 ABS population estimates and supersede the projections published by DPCD in 2008.

Previously, DPCD published projections after each national Census, based on that Census year (e.g. VIF 2008 used 2006 as its base year). VIF 2012 improves on this process by providing inter-Censal projections based on the latest available Australian Bureau of Statistics (ABS) population estimates at 30 June 2011.

Victoria in Future projections are based on observable historical trends in population. A variety of factors influence the population size, age structure and distribution. When changes resulting from policy changes are observed and measured, DPCD's monitoring tools gather this evidence, and apply it in developing updated projections. Such updates assist the planning and service delivery functions of the Victorian Government.

Applying the VIF

While the VIF is generally considered to be a reliable estimate of population and household growth, several issues must be considered when comparing VIF based growth estimates to the connection growth estimates of businesses.

The major issue is that the VIF statistics are based on defined Statistical Local Areas (SLAs) and Local Government Areas (LGAs). These areas may or may not coincide with the service areas for which businesses are responsible. In some instances a SLA may cover a geographical area that includes within it areas for which different water businesses have obligations to supply services.

This shared nature of SLAs and LGAs can potentially affect the applicability of VIF forecasts. For example, a water business may be responsible for supply in only part of a given SLA. An issue arises when the areas of a business's supply responsibility are not expected to experience growth consistent with the overall

growth rate for the SLA. In such instances the SLA growth rate is not representative of the water business's supply area.

While our expectation is that where possible growth should equate with VIF forecasts, in instances where there are difference between the businesses forecasts and VIF we have considered the consistency of water demand forecasts with trends observed in historical data.

We have also been mindful that businesses have an incentive not to overstate demand. The revenue risk associated with forecasts in the regulatory context means that businesses face an increased risk of insufficient revenue where demand growth is overstated.

Taking these considerations into account Frontier has taken a precautionary approach to its assessment of the forecasts and accepted growth forecasts that differ from VIF where:

- businesses evidenced consistency with historical trends, and
- the difference between the VIF and water businesses' growth rates was immaterial (i.e. one or two percentage points), and or
- businesses' forecast growth exceeded that of the VIF.

4.3.2 Growth in residential water connections

The average per annum compound growth rates for residential water connections proposed by each of the metropolitan businesses in their water plans are outlined below in Table 2. The table also includes the VIF 2012 forecasts for households based on the statistical areas serviced by each water business.

Table 2: Forecast growth rates for residential water connections

Business	Water Plan Proposal (%per annum)	VIF Households (%per annum)
City West Water	2.7	2.9
South East Water	2.3	1.6
Yarra Valley Water	1.5	1.4
Western Water	4.7	4.1

Source: Frontier estimates based on data from Water Price Review 2013 and VIF 2012. Average annual growth is calculated as the average compounding growth rate over the regulatory period.

Frontier was able to replicate growth rates based on VIF 2012 for the metropolitan businesses based on their water supply areas.

All metropolitan businesses relied on VIF 2012 forecasts to some extent. Most of the metropolitan businesses have forecast growth in residential customer

connections above the expected household growth rate forecast by VIF (see Table 2). In this regard businesses are not contributing to overly conservative forecasts. The exception is CWW which forecast growth rates 0.2% lower than the VIF projections.

The businesses acknowledged that they utilised VIF to determine a baseline forecast for demand which they then amended to take into account a variety of other factors. However, few of the businesses explained in their water plan the detailed methodology that they used to translate the VIF forecasts into connection forecasts for their water supply area.

While some noted that they have used planning documents, local council or historical information to adjust the forecasts, there was little detail provided on what specific adjustments were made.

Frontier accepted forecasts where businesses forecasts were within one or two percentage points of VIF 2012, were greater than VIF 2012 and were consistent with historical trends.

4.3.3 Growth in residential sewerage connections

The average per annum compound growth rates for residential sewerage connections proposed by each of the businesses in their water plans are outlined below in Table 3.

Our general expectation is that the growth rate for residential sewerage connections should be broadly similar to the growth rate for residential water connections. It is a common planning requirement in metropolitan areas that most new dwellings be serviced by both sewer and water reticulation services. However, we are also mindful that there are valid reasons that this expectation may not apply to some individual businesses. This is especially the case where businesses service communities where growth relies on onsite sewage treatment (e.g. individual septic tanks).

Table 3: Forecast growth rates for residential sewerage connections

Business	Water Plan Proposal (%per annum)l	VIF (%per annum)
City West Water	2.7	2.9
South East Water	2.6	1.6
Yarra Valley Water	1.6	1.4
Western Water	4.6	4.1

Source: Frontier estimates based on data from Water Price Review 2013 and VIF 2012. Average annual growth is calculated as the average compounding growth rate over the regulatory period

As with water connections Frontier was able to replicate growth rates for residential sewerage connections based on VIF 2012 for the metropolitan businesses based on their sewerage service supply areas.

Again, most businesses relied on VIF 2012 forecasts to some extent. As with water connections businesses have forecast that the growth in residential customer sewerage connections will be above the expected household growth rate forecast by VIF (see Table 3). Frontier notes that residential sewerage connection growth rates are largely consistent with residential water connection growth rates.

4.3.4 Growth in non-residential water, sewage connections and trade waste customers

Forecasting growth in non-residential connections is more difficult than forecasting residential connections. As a group, non-residential customers are much less homogenous both in the quantum of water use and the nature of that use and as such the variables driving growth are much harder to identify.

For this reason growth rates for non-residential water and sewerage connections are generally derived from growth in residential connections. However, businesses have used a variety of methods to derive forecasts of non-residential connections from residential connections — in some instances growth rates for non-residential water and sewerage connections were derived from growth in residential connections, while in others historical trends were used as the basis for forecasting.

Commonly non-residential connections were forecast to grow at a slower rate than for residential connections. The rationale provided by most businesses referenced historical growth rates and information they had received through consultation with commercial customers.

Trade waste customer numbers were commonly forecast to remain constant over the regulatory period, even in instances where a historical trend could be observed. In some instances historical data was highly volatile and as such did not provide for readily observable trends.

4.4 Climate, water availability and rainfall substitution

Findings

No business has forecast restrictions over the course of the regulatory period. Frontier believes that this assumption is consistent with assumed climatic outlook and is appropriate.

Most metropolitan business assumed average climatic conditions over the course of the regulatory period. The exception is Western Water which assumed a 'return to dry' scenario for its demand forecasts.

One of the key factors that the businesses need to consider when developing demand forecasts is their expectations about climatic conditions over the course of the regulatory period. Climate effects water availability (mostly driven by rainfall) which may impact on the supply and security of water supply. Climate also directly impacts demand, for example hot dry weather is expected to increase demand for potable water due to greater outdoor use and wet weather is expected to decrease demand by making available rainfall as a direct substitute for outdoor uses of potable water.

4.4.1 The impact of climate

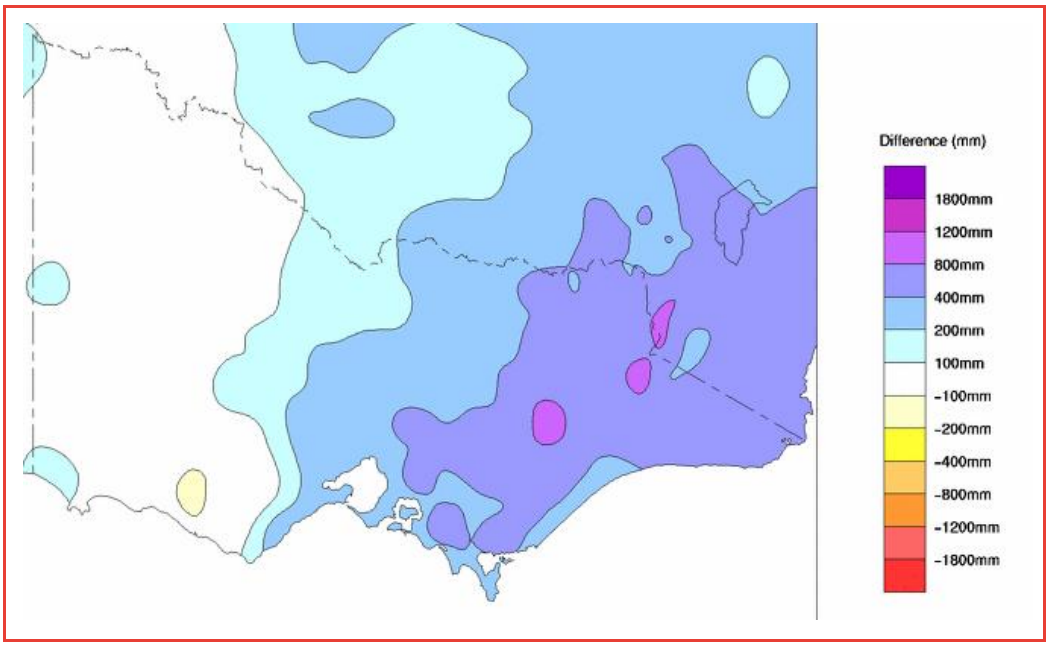
For urban water users rainfall can act as a direct substitute for potable and recycled water for outdoor use. In periods of high rainfall, outdoor use is expected to decline significantly as people no longer need access to potable water to sustain their gardens. Figure 1 shows the difference in rainfall this year (2011-12) compared to three years ago (2008-09). The figure shows a marked increase in rainfall particularly over the eastern parts of Victoria.

The impact of any increase in rainfall on potable and recycled water demand will depend on how the distribution of rainfall relates to seasonal consumption patterns. However, it is reasonable to assume that both domestic potable and recycled water consumption would decrease with increased rainfall (all things being equal). Past trends have been consistent with this prediction. The weighted average annual household water consumption across Victoria fell 6 per cent over the period 2009-10 to 2010-11 as the State returned to wetter conditions. Demand for recycled water fell by much more, around 35 per cent, particularly for agricultural uses[1].

Forecasting levels of rainfall is extremely difficult. Any forecast is invariably subject to high levels of uncertainty. The difficulties associated with forecasting rainfall are exacerbated with the length of the forecast period. The Bureau of Meteorology's own Predictive Ocean Atmosphere Model for Australia only extends out to 90 days.

1 ESC (2011), 'Water performance report: Performance of Urban water and sewerage businesses 2010-11', December 2011 (source: http://www.esc.vic.gov.au/getattachment/45958c7c-4ea6-4aaf-a082-2d08e783cb32/Performance-Report-2010-11-Metropolitan-and-region.pdf)

Figure 1: 3 year inter-annual rainfall difference 2011-12 to 2008-09



Source: Australian Bureau of Meteorology 2012

4.4.2 Climate assumptions

Businesses have observed that water use has declined significantly over the last regulatory period and that rainfall has increased over some of this period which is likely to have impacted on usage.

No business has forecast restrictions over the course of the regulatory period. Frontier believes that this assumption is consistent with assumed climatic outlook and is appropriate.

Three of the metropolitan retail water businesses assumed a medium climate change scenario, with average rainfall and temperature conditions over the regulatory period. The exception is WW which assumed a return to dry scenario over the regulatory period. Frontier notes that given WW's access to potable water supply from Melbourne Water, coupled with the significant augmentation of Melbourne Water's available supply (due to the commissioning of the Desalination Plant during the regulatory period), such an assumption is not likely to result in constrained supply but should result in higher than otherwise levels of demand.

4.5 Conservation and bounceback

Findings

Frontier found that the assumptions regarding water use efficiency implicit in end use models had been updated from the last review and reflected the findings of recent stock surveys.

Frontier was concerned that the level of bounceback assumed by businesses in their water plan was understated. Frontier has amended all water businesses forecasts to reflect increased levels of bounceback.

4.5.1 Bounceback

Another important driver of current levels of water consumption is the extent of 'bounceback'. Bounceback is commonly defined as the degree to which consumption returns to pre-restriction levels once restrictions have been lifted and water use behaviour changes.

Most areas of Victoria are no longer facing the severe drought conditions that were experienced in the last decade, with summer 2010-11 being one of the wettest on record. Restrictions were eased in Melbourne in 2012. This followed a period from 2005 to 2012 where metropolitan customers were subject to high levels of water use restrictions. The Stage 3A restrictions and T155 campaign followed the lowest inflows to Melbourne's storages on record in 2006 and stage 3A and Stage 3 restrictions were maintained over a 4 year period. These measures changed the community's behaviour relating to outdoor water use, resulting in greater water use efficiency (for example, replacement of spray garden water systems with drip garden water systems) and structural changes in garden types to lower water use gardens with native plants.

Weighted average annual household water consumption across Victoria fell 6 per cent from 2009-10 to 2010-11 to a historic low of 143 kilolitres. The degree to which this trend of low levels of water use continues will depend on the amount of bounceback exhibited by water users.

What can be reasonably asserted is that consumption on a per-user or per-connection basis will remain lower than pre-restriction levels due to permanent behavioural change and the uptake of water efficient appliances. However, the actual degree to which bounceback will occur and the period of time over which it may occur are subject to considerable uncertainty.

From the perspective of our review, it was important that the water businesses' forecasts were consistent with trends observable over the last few years of actual consumption and where possible were supported by third party research.

In their water plans the metropolitan water businesses have generally adopted an assumption that bounceback will amount to a once-off 3%increase in

consumption. This assumption is based on *Melbourne Water Corporations, Post Restrictions Bounceback* (Deloitte 2011).

The metropolitan businesses adopted the 3% bounceback assumption in several different ways. For example, City West Water applied a once-off growth assumption to the aggregate volume prediction whereas South East Water incorporated the bounceback assumption by amending its outdoor use assumptions in its end use model.

The only other third party study on bounceback was undertaken for Sydney Water in 2011. The Sydney Water Study resulted in an estimated bounceback that was only marginally higher than the Deloitte study. Sydney Water estimated the impact on water use from replacing level 3 drought restrictions with water saving rules to be an increase in residential water use of 4.4 per cent for houses, 3.4 per cent for townhouses and 4.4 per cent for units and flats.[2]

One of the common concerns with both the Deloitte paper and the Sydney Water paper is that most of the jurisdictions included in the studies have only had restrictions lifted for a maximum of two years and as such caution should be applied in drawing any long-term implications (as noted by Deloitte 2011).

4.5.2 Water conservation

A number of businesses have proposed implementing non-price water conservation measures to affect consumer behaviour over the next regulatory period. These measures may include water efficient appliance programs, indoor retrofitting and business efficiency programs. Businesses should also take into account water savings rules. These rules limit the extent of water use for outdoor activities such as odd/even day watering programs and prohibitions on pavement watering.

All of the metropolitan water businesses have assumed ongoing non-price water conservation savings in their end use models. The resulting efficiency gains are listed in table 3. Compared to the efficiency gains assumed during the last price review it would appear that assumed savings are decreasing over time.

These efficiencies are the result of assumptions regarding increased use of water efficient appliances (e.g. increased roll-out of dual flush toilets).

2 Sydney Water (2011) Submission to IPART 2012 pricing determination.

Table 4: Metropolitan end use models, water use efficiency gains

Major end use	CWW (%)		SEW (%)		YVW (%)	
	2009	*2013*	*2009*	*2009*	*2009*	*2013*
Clothes washers	1.99	0.34	1.45	-0.36	2.27	-1.53
Dishwashers	-0.67	2.45	-0.64	2.44	0.99	1.54
Toilets	0.80	0.67	4.04	-1.74	2.28	-0.66
Showers	4.75	1.90	4.73	-0.04	2.91	0.94
Indoor miscellaneous	0.57	2.57	-0.17	1.18	-0.05	1.47
Outdoor (total)	0.40		0.37			
Lawn and garden			0.40	0.90		5.33
Car washing			-0.25	1.81		

Source: Frontier estimates based on CWW (2012) End Use Model, SEW (2012) End Use Model, YVW (2012) End Use Model.

Impact of lot size on efficiency

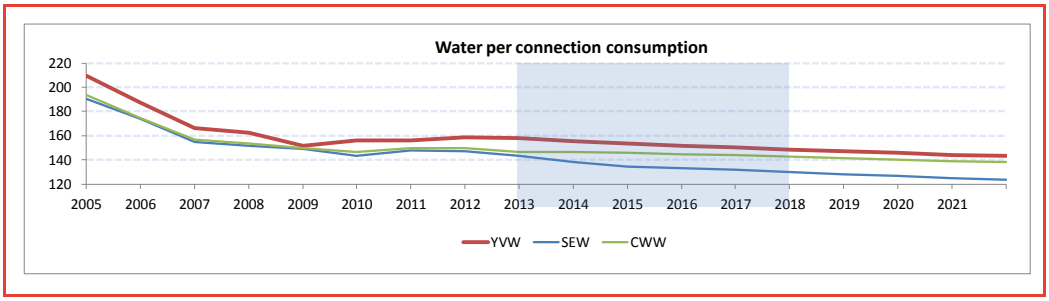
One of the biggest drivers in ongoing water use efficiency for metropolitan water businesses is an assumption that a trend of reducing lot size for new dwellings leads to less outdoor water usage and as a result less water usage per connection. These efficiency gains outweigh any bounceback assumptions the businesses have made.

For example, South East Water forecast a long-term annual reduction in lawn and garden consumption attributable to a reduction in the average size of blocks for detached houses from 600 square metres to 480 square metres over 50 years. SEW assumed an average annual reduction in consumption of 80 litres per detached dwelling and 40 litres per unit or flat.

This trend is complemented by a trend in multi-unit dwellings from units or flats to high density apartments (that have no outdoor use). SEW have assumed an annual reduction of 40 litres per unit or flat.

Frontier is concerned that the impact of this trend may be overstated. The historical data indicates that for the period from 2010 to 2012 (during and after high level restrictions) average consumption per connection levelled out.

Figure 2 Residential water per connection consumption



Source: CWW (2012) Water Plan, SEW (2012) Water Plan, YVW (2012) Water Plan.

The data for this period is not consistent with the contention that there are underlying efficiency trends associated with lot size and water use that are causing long-term decreases. In the case of YVW the data from 2010 to 2012 is consistent with an upward trend in residential water consumption per connection. The growth rates for the metropolitan retail business over this period of time are listed in Table 5.

Table 5: Historical average annual growth rate

Business	Per annum compound growth (%)	Time frame
CWW	1.3	2010-11 to 2012-13
SEW	1.2	2010-11 to 2012-13
YVW	1.5	2010-11 to 2012-13
WW	3.7	2010-11 to 2012-13

Source CWW (2012) Water Plan, SEW (2012) Water Plan, YVW (2012) Water Plan.

Frontier recognises that the timeframe being discussed is short. However we are concerned that the inconsistency between recent historical growth rates and forecasts may indicate that forecasts are overly conservative and that the efficiency gains are overstated.

In its draft report Frontier requested all metropolitan businesses rerun their bounceback models to account for the data in the current year to date. In response to Frontier's request, none of the metropolitan businesses reran their bounceback models.

However CWW, SEW, WW and YVW did provide Frontier with update bulk water data for the year to date that indicated growth in 2012-13 water volumes would far exceed that forecast by the businesses in their water plans.

Frontier acknowledges that 2012-13 had to date been abnormally hot and dry and that unanticipated growth in actual consumption is not due solely to bounce back

but is also due to the severity of the current hot dry weather being experienced in Victoria. However, Frontier also notes that the increase in bulk water volumes is also more consistent with a greater than expected level of bounceback.

CWW, SEW and YVW in response to Frontier's draft report undertook analysis to identify that proportion of unanticipated growth associated with weather. Once weather is accounted for the remaining unanticipated growth is attributable to bounceback. CWW, SEW and YVW identified material increases in bounceback and revised their demand forecasts accordingly.

WW attributed the full extent of the unanticipated growth to weather impacts. This assumption was inconsistent with the other retailers and appeared to be done in the absence of any analysis quantifying the weather impact. Frontier also noted that the assumed return to dry scenario underlying WW's forecasts would imply that the hot dry weather being currently experienced is consistent with its climate assumptions and that consequently the current observable increases in demand should be consistent with those expected by WW over the course of the regulatory period.

Through the ESC Frontier was able to access independent agent based modelling of WW's residential volumetric demand. Frontier has amended WW forecasts to reflect the results of this modelling. Frontier suggests that WW rerun its bounceback models in response to the ESC's draft decision.

4.6 Price elasticity of demand

Findings

A number of businesses have applied price elasticity factors to their forecasts. These elasticities are consistent with Frontier expectations.

The effect of changes in prices on demand over the regulatory period can be measured using estimates of the price elasticity of demand, which reflects the extent to which an increase in price will lead to a reduction in demand. Ideally, businesses' forecasts should take into account the impact of changing prices on demand through assumptions about the price elasticity of demand. The materiality of the impact of price elasticity of demand on forecasts will naturally increase the greater the proposed change in price. It is therefore important that where businesses are proposing significant price increases they have factored elasticity into their demand forecasts.

Assumptions regarding the level of price elasticity need to be transparent, as does the manner in which the price elasticity measure adopted has been reflected in the businesses' demand forecasts.

Key issues examined were:

- How businesses treat elasticity in relation to residential and commercial customers when producing the demand forecasts. Residential water use is generally considered to be much less elastic than commercial water use. The reasoning here is that commercial users have both more flexibility in the possible response to price and also have greater incentives to pursue efficiencies given the commercial nature of the activities they undertake. Residential water demand is often considered to be less elastic due to the essential nature of some residential uses (such as basic hygiene and rehydration).

- How metropolitan businesses incorporate the impact of any increase in price on the price elasticity of demand, which the literature shows can change with the overall level of prices.

- How elasticity assumptions are incorporated into their demand forecasts. For example, where metropolitan businesses use end use models to generate forecasts, the long-run elasticity response of customers to price is already captured through direct reference in consumers' investment in water use efficiency. Any assumptions regarding elasticity must refer to short-run changes in behaviour. Otherwise businesses will risk double-counting the impact of elasticity which would lead to overly conservative estimates of consumption.

All metropolitan businesses proposed forecasts that referenced price elasticity of demand. These elasticity factors are outlined in Table 6.

Table 6: Elasticity factors

Business	Elasticity
City West Water	0.0 for Residential Tier 1 -0.1 for Residential Tier 2 -0.14 for Residential Tier 3 -0.0925 for Non residential
South East Water	0.0 for Residential Tier 1 -0.1 for Residential Tier 2 -0.1 for Residential Tier 3 -0.092 for Non residential
Western Water	0.0 for Residential Tier 1 -0.1 for Residential Tier 2 -0.1 for Residential Tier 3
Yarra Valley Water	-0.04 for residential indoor use -0.18 for residential outdoor use

Source: Water plans 2013 for CWW, SEW, WW, YVW

4.6.1 Elasticity and end use models

While we agree that it is appropriate for business to adopt elasticity estimates we note that there are some fundamental differences between the metropolitan retail water businesses' forecasts and those proposed by regional urban businesses. One of the principal differences is that demand forecasts for the metropolitan businesses were generated by an 'end use model' whereas most regional forecasts are based on population growth and assumptions of average consumption.

An end use model by definition makes a number of assumptions about the uptake of water efficient appliances and changes in water use behaviour. Both of these are the primary avenues through which consumers would respond to price increases. Price elasticity of demand by definition measures the responsiveness of demand to changes in price. Where prices increase we would expect to see consumers limiting their demand by adopting more efficient water use practices, the very same practices which may already be factored into future use in the end use model.

For this reason we believe that there is a risk of overstating consumer response to demand by the addition of elasticity assumptions to a baseline demand forecast that already includes a demand response. Frontier notes that PwC as demand consultants for the ESC's Metropolitan Water Price Review 2008, removed elasticity impacts from forecasts generated by end use models.

Ideally any price elasticity of demand adopted by the metropolitan businesses will take into account the fact that the baseline was generated by an end use model.

Frontier also notes that metropolitan businesses generally considered the relationship between elasticity and end use models in applying their elasticity assumptions. For example, YVW acknowledged that one of the medium to long-term responses to price increases is to improve the efficiency of water-using appliances. The forecast from the end use model incorporates this effect through the ongoing replacement of low efficiency appliance stock (clotheswashers, dishwashers, toilets and showers) with more efficient products. YVW accordingly choose an elasticity estimate that was relatively low and consistent with short- run estimates of price elasticities of demand.

However, Frontier considers that given the materiality of the price increases proposed for the forthcoming regulatory period it is important to recognise that there will likely be material behavioural responses by customers to these price increases. For the purposes of this report Frontier has accepted the assumed elasticities, given the low level of proposed elasticities, and the absence in the literature of alternative elasticity estimates that account for end use models.

PART B Business Specific Analysis

Assumptions underlying demand

5 City West Water

5.1 Introduction

This chapter contains the specific analysis undertaken by Frontier in reviewing City West Water's (CWW) demand forecasts for water, sewage and trade waste for the Water Price Review 2013.

5.2 Water Plan proposal

Table 7: CWW Water Plan proposal

Consumption parameter	Forecasted average growth rate (% per annum)
Residential water connections	2.7
Residential water volumes	1.8
Non-residential water connections	2.9
Non-residential water volumes	-2.9
Residential sewage connections	2.7
Residential sewerage volumes	5.0
Non-residential sewerage volumes	2.0
Residential recycled water connections	Material supply augmentation during period
Residential recycled water volumes	Material supply augmentation during period
Non-residential recycled water connections	Material supply augmentation during period.
Non-residential recycled water volumes	Material supply augmentation during period
Trade waste customer numbers	Application fees 2.2 Customer agreement 2.2
Trade waste volumes	BOD: 0.2 SS: -0.2 TN 0.3 TDS: 0.3 Volume: -0.1

Notes: n.a. Not applicable. Percentage change per annum is calculated as the average compounding rate of change over the period. 2011-12 to 2017-18.

Source: CWW 2012 Water Plan

The principal forecasting method used by CWW is the Melbourne End Use Model (MEUM). The model is an extension of the Water Services Association of

Australia End Use Model that was previously adopted by the three metropolitan Melbourne retail water businesses. The MEUM disaggregates indoor residential demand into different components of water use. These components include:

- Washing machine
- Dishwasher
- Toilet
- Shower
- Indoor miscellaneous (e.g. bath, taps etc)

The assumptions underlying the MEUM are informed by regular stock surveys. Water Plan 2013 incorporates the finding of the City West Water Appliance Stock Survey 2012.

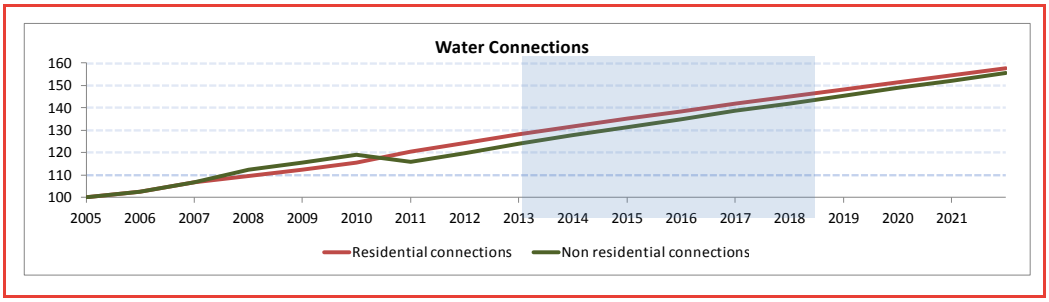
CWW has based its forecasts on a medium climate change scenario, with average rainfall and temperature conditions over the regulatory period. It is not anticipating any restrictions beyond permanent water savings rules.

5.3 Water

Customer connections

CWW has forecast that the growth in residential customer connections (2.7% per annum) will be slightly below the expected population growth rate forecast by VIF (2.9% per annum) (see Figure 3).

Figure 3: CWW: growth in water connections



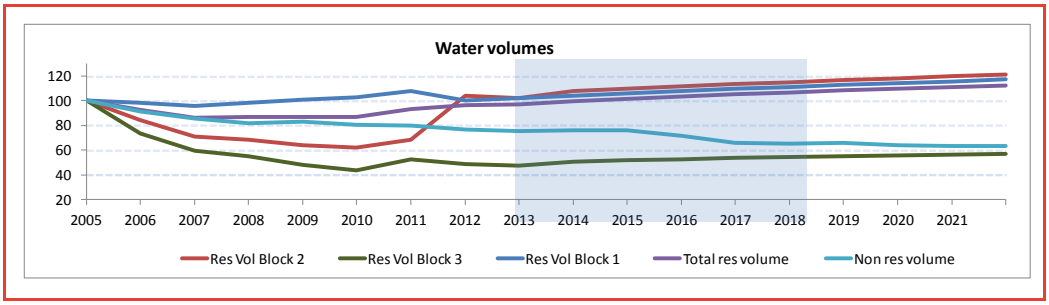
Source: Index based on CWW (2012) Water Plan, 2005=100.

Water volumes

CWW have proposed a growth rate of 1.8% per annum for residential water users and -2.9 for non-residential water users. We note that CWW water volume forecasts, with the exception of residential volume block 2, are all broadly consistent with historical trends, however we also note that for 2010-11 and

2011-12 there appears to be a slightly more positive growth trend observable in the data (see Figure 4).

Figure 4: CWW growth in water volumes



Source: Index based on CWW (2012) Water Plan, 2005=100

Issues

In regard to connections, CWW did not provide the detailed methodology that it has used to translate the VIF forecasts into population forecasts for its water supply area. While it noted that it has used Victoria in Future 2012 as a basis for the forecasts, it also noted it had used Growth Corridor Plans and Precinct Structure Plans to adjust the forecasts. However, there was no detail on how this additional information had been used or what adjustments were actually made.

Frontier has not amended these forecasts, given they not materially different from the VIF forecasts and are consistent with historical trends.

In regard to volume forecasts, the end use model used to generate estimates of water volumes makes a number of assumptions about water conservation due to consumer behaviour and water use efficiency associated with major appliances and major uses. These assumptions are based on a recent stock survey undertaken in 2012 and are broadly consistent with those adopted by CWW in its end use model for the ESC's previous Water Price Review 2009-13 (see Table 8).

Notable differences include a decrease in the frequency of dishwasher use from 4.4 times per week to 3.7 times per week and a decrease in the frequency of toilet use from 3.8 to 3.1 times per day.

Given that the current assumptions are based on a stock survey undertaken by CWW in 2012, Frontier accepts that these assumptions are most likely to represent the current consumer practices and behaviours of its customers.

Table 8: CWW water use assumptions

Major end use	Assumptions	
	Price Review 2009	Price Review 2013
Clothes washer	The frequency of use was based on a survey done by YVW in 2004, whereby frequency equals 2.42 times per week. This is different for multi-unit and detached dwellings. Any new lots are assumed to have front-loading machines.	A front loader is assumed to load 10% more clothes than a top loader. 4-Star front loaders are assumed to increase their market shares by 3% per annum. A one-person household is assumed to use a washing machine 2.49 times per week. An additional person in the households increases the frequency of use by 1.29 times per week.
Dishwasher	Assumed virtually no change in the rate of water used for dishwashers, consistent with the first few years after 2000. The frequency of use is 4.4 times per week per household (or 0.63 per day).	A household is assumed to use its dishwasher 3.7 times per week. A dishwasher is assumed to consume 15 litres of water in each use.
Toilets	Average household found to have 1.5 toilets, of which 80% own a dual flush toilet. The average frequency of use was 3.8 times per day	Each toilet is assumed to leak 3000L of water per annum. 7% of toilets are assumed to be single flush ones, whilst the rest are assumed to have double flushes. Each toilet is assumed to have 3.1 full flushes or equivalent every day.
Showers	Number of showerheads for detached dwellings ranged from 1.43 – 1.73, and 1.03-1.25 for multi-unit dwellings. Each member of a household showers an average of 6.2 times a week	A normal showerhead is assumed to have a flow rate of 15 litres per minute, when an AAA showerheads flows 7 litres of water per minutes, Each shower is assumed to last for 6.3 minutes on average. Each person in a household is assumed to have 0.86 shower per day (6.02 per week)
Indoor Misc	Bath use is assumed to be 0.44 times per week with 123L per use. The assumed use for hand basins was 3.8 per person per day, with an average length of time of 0.35 minutes. The assumed use for kitchen sink was 8.5 times per household, with an average time of 0.6 minutes. Laundry consumption was assumed to be 30L per household per week.	Bath use is assumed to be 0.75 times per week per household with 120L per use. A hand basin is assumed to consume 18 litres of water a day. Kitchen sinks are assumed to be using 28.89 litres of water per day. An insinkerator generates 10% penetration, and is assumed to be used 0.8 times per day. A laundry trough is assumed to consume 30 litres of water per week. An evaporative air conditioner is assumed to consume 15.2 litres of water a day.

Lawn and garden		Each detached and multiunit dwelling is assumed to use 22 and 17.6 litres of water on gardening each day.

Source: PWC (2009) Essential Services Commission Water Price Review: Demand. Frontier estimates based on CWW (2012) End Use Model.

In regard to price elasticity of demand, we note that CWW has based its proposed volumes on estimates generated by an end use model. We believe that there are methodological issues associated with imposing price elasticity of demand impacts on a baseline forecast generated by end use models. A principal element of the end use models employed by water businesses are a number of assumptions regarding the uptake by consumers of more efficient water appliances and more efficient water use.

Ideally any price elasticity of demand adopted by CWW will take into account the fact that the baseline was generated by an end use model. The consumer behaviours generally captured by end use models are commonly associated with long-run elastic responses (i.e. investing in efficient appliances and whitegoods). In order to avoid double counting elasticity estimates should be based on short-run consumer responses. CWW assumed the elasticities outlined in Table 9.

Table 9: CWW assumed price elasticises

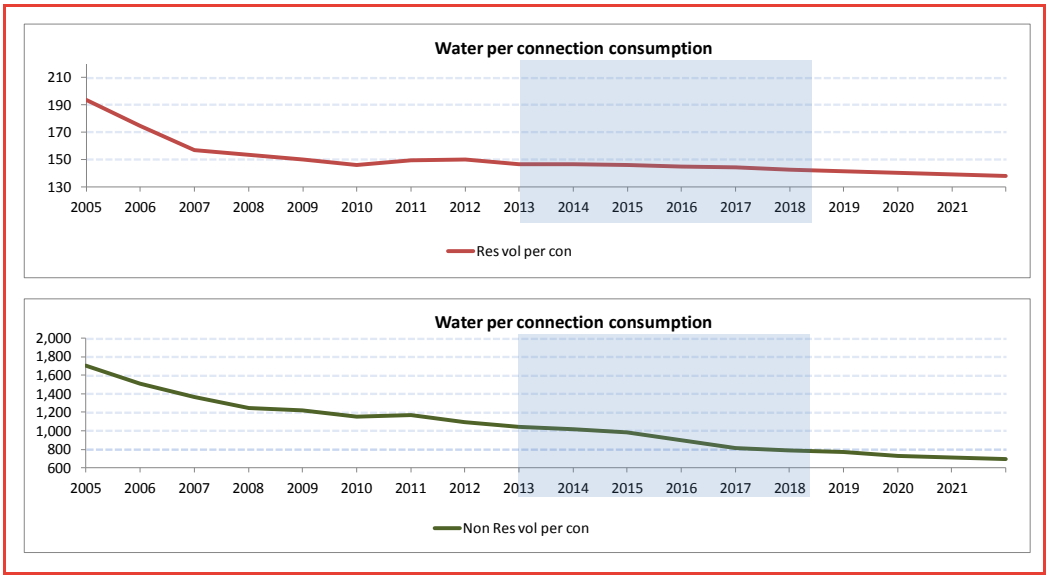
Tariff	Estimated decrease in demand per percentage price increase	Estimated fall In demand with a 40% price increase
Tier one	0.0%	0.0%
Tier two	0.1%	3.3%
Tier three	0.14%	4.67%

Source: CWW (2012) Water Plan

However, while the elasticity estimates are not ideal, Frontier agrees that given the materiality of the price increases proposed for the forthcoming regulatory period that it is important to recognise that there will likely be material behavioural responses for customers in response to price increases.

In the draft report the most material issue raised by Frontier related to CWW's assumptions around the materiality of bounceback. Frontier noted that while CWW was proposing increasing volumes over the course of the regulatory period, these volumes did not appear to be consistent with the relatively greater growth rates for connections. The primary driver for the relatively low growth in volumes was an assumed increase in water use efficiency over the regulatory period (see Figure 5) that outweighed any impact of bounceback. This was inconsistent with observable overall positive growth in recent water consumption per connection from 2010-11 through to 2011-12.

Figure 5: CWW: growth in water per connection consumption



Source: Index based on CWW (2012) Water Plan, 2005=100

The CWW forecast included a bounceback assumption of 3% in the year 2012-13. However, ongoing efficiencies were assumed to outweigh any impact from bounceback in demand. The assumed increase in water use efficiency over the subsequent years was largely the outcome of assumed decreases in lot size.

In the draft report Frontier stated that it was concerned that the forecasted volumes may be understating bounceback. In the draft report Frontier did not amend CWW's volume forecasts to reflect its concerns, but rather requested CWW rerun its bounceback model to include the most recently available data. Frontier also requested CWW provide it with consumption data for the current year to date. In response to Frontier's draft report CWW did not rerun its bounceback model but did provide the following additional information:

- an additional five months of bulk water purchase data covering late spring and the summer months of 2012-13
- analysis conducted by Yarra Valley Water (YVW) which has estimated the influence of warmer than average, and exceptionally dry, summer weather on water consumption in Melbourne.

The additional eight months of bulk water purchase data for 2012-13 exhibits higher than forecast bulk water purchases (see Table 10).

Table 10: CWW Bulk Water purchases (year to date)

Month	2011-12	2012-13	% increase
Jul	7,594	7,777	2.4%
Aug	7,723	7,913	2.4%
Sep	7,606	7,711	1.4%
Oct	7,752	8,324	6.9%
Nov	7,626	8,691	12.3%
Dec	8,240	9,003	8.5%
Jan	8,963	10,290	12.9%
Feb	8,774	9,459	7.2%
TOTAL	96,330	69, 168	7.6%

Source: CWW (2013) Response to Frontier Draft Report

CWW acknowledged that an increase in bulk water purchases persists even after normalising for weather (warmer and dryer than average summer -conditions) and accounting for the bounceback effect assumed in the Water Plan. It is reasonable to assume that the unforeseen increase in weather normalised demand is due to unanticipated bounceback.

Table 11 shows the relative lack of rainfall in the current year for Laverton.

Table 11: Laverton historic mean rainfall, 2011-12 and 2012-13 (mm)

Month	Mean Rainfall	Actual Rainfall 2011-12	Actual Rainfall 2012-13	2012-13 percentage of mean
Jul	38.6	30.0	30.0	*78%*
Aug	44.7	40.2	40.2	*90%*
Sep	49.2	27.0	27.0	*55%*
Oct	56.9	20.0	20.0	*35%*
Nov	53.1	39.4	39.4	*74%*
Dec	46.0	29.8	29.8	*65%*
Jan	39.3	22.6	6.8	*17%*
Feb	47.3	40.6	53.4	*113%*
Mar	35.4	40.8	n.a.	n.a.
Apr	45.6	38.8	n.a.	n.a.
May	46.8	67.4	n.a.	n.a.
Jun	38.3	69.2	n.a.	n.a.

Source: CWW (2013) Response to Frontier Draft Report, n.a. not available.

CWW's response provided revised forecasts for water consumption for residential customers that included an increased bounceback assumption of 4.5% in 2012-13 and 1.5% for every year thereafter. CWW has also revised non-residential volumes consistent with its residential revision.

Findings

Frontier has amended CWW's water plan forecasts for residential and non-residential water consumption to allow for a greater degree of bounceback than originally assumed by CWW. The increased bounceback reflects the most recent data available for 2012-13.

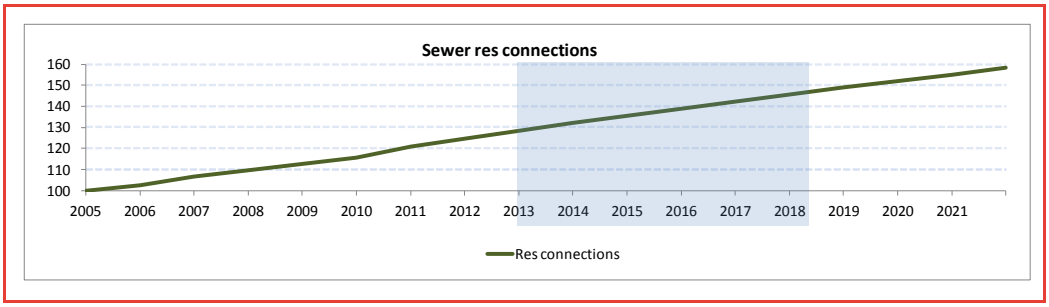
5.4 Sewage

Customer connections

CWW sewerage connections growth numbers equate with those used for water connections. It is reasonable to assume that new dwellings will be serviced by

both water and sewerage. We also note that proposed connections are broadly similar to historical trends (see Figure 6).

Figure 6: CWW. Growth in sewerage residential connections



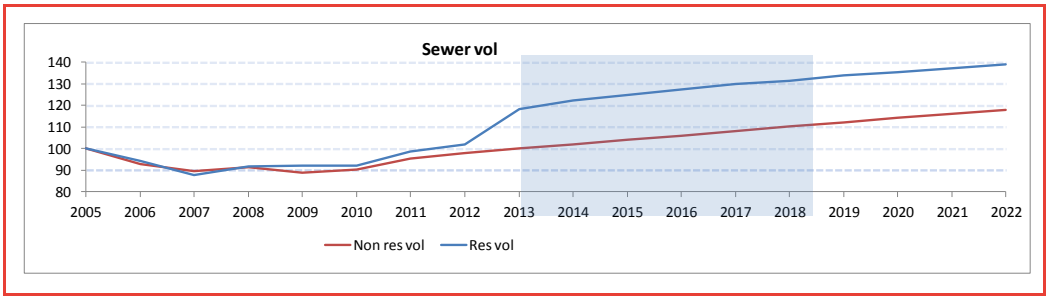
Source: Index based on CWW (2012) Water Plan, 2005=100

Volumes

Non-residential sewage volumes appear to be growing at a rate consistent with historical trends and with proposed growth for non-residential sewerage connections (see Figure 7).

Frontier notes that there appears to be a step increase in forecast sewage volumes for residential customers from 2012-13 to 2013-14 (the first year of the regulatory period). This step increase appears inconsistent with the low forecast growth in water demand.

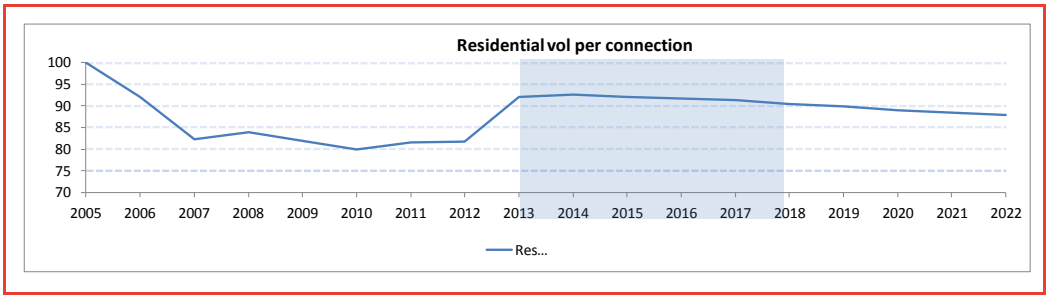
Figure 7: CWW: Growth in residential and non-residential sewage



Source: Index based on CWW (2012) Water Plan, 2005=100

Over the regulatory period CWW is proposing a low constant growth in sewage volumes that would appear to be inconsistent with the strong growth forecast for sewerage connections. On a per connection basis it would appear that CWW is assuming the same efficiency assumptions as it did for water volumes (see Figure 8). This correlation result from CWW's forecast for sewage being derived directly from its water volume forecasts.

Figure 8: CWW: growth in residential sewage per connection



Source: Index based on CWW (2012) Water Plan, 2005=100

Issues

Residential sewer volumes as proposed do not reflect appropriate assumptions regarding bounceback in water use (see discussion in section 5.3). Given that sewage forecasts are derived directly from forecast water volumes, increased volumetric consumption of water will result in an increased forecast for sewage.

Frontier notes that in revising its forecasts to account for a greater degree of bounceback CWW did not amend non-residential sewage volumes to reflect the higher level of volumetric water consumption.

Finding

Frontier has amended CWW's volumetric forecasts for residential sewage to reflect the amendments made to forecasts of residential water volume.

Frontier has amended CWW's volumetric forecasts for non-residential sewage based on the originally forecast ratio of non-residential sewage to non-residential water volumes.

5.5 Trade waste

Applications and agreements

Total application and agreement numbers are forecast to grow by 2.2 % per annum compounding. This rate is broadly similar to Non-residential connections (2.9%). The forecast growth in applications and agreements is broadly consistent with actual growth over the preceding 8 years (see Figure 9).

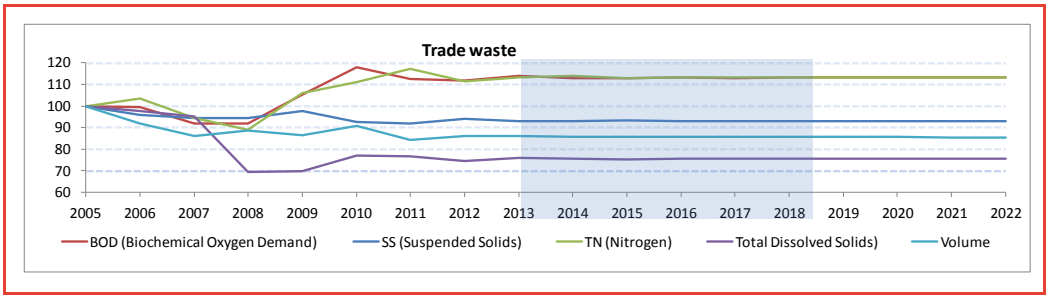
Figure 9: CWW: Growth in trade waste applications and agreements

Source: Index based on CWW (2012) Water Plan, 2005=100

Volumes and parameters

CWW has forecast trade waste volumes broadly consistent with historical actual consumption from 2009-10 to 2010-11 (see Figure 10)

Figure 10: CWW: growth in trade waste volumes



Source: Index based on CWW (2012) Water Plan, 2005=100

Finding

Frontier has not amended the trade waste fixed and volumetric forecasts proposed by CWW.

5.6 Recycled water

Customer connections and volumes

Consumption of alternative water is forecast to rise significantly over the period as new alternative water supplies are commissioned.

For residential customers water demand is calculated based on toilet and garden water use of 70kL per year per household multiplied by the forecast annual growth in houses built and occupied in West Werribee and Point Cook.

Non-residential recycled water demand estimates are project specific and they are based on:

- Historical records of metered water consumption of existing users

- Consultation with customers
- Customer estimates
- Irrigation rules of thumb per hectare

Given the extent of structural change being proposed in this area of CWW's service provision, historical information provides very little to no guidance on the validity of forecasts for the regulatory period.

Finding

Frontier has not amended the recycled water forecasts proposed by CWW. Frontier notes that the Commission may need to amend these forecasts to reflect its regulatory decision in relation to expenditure forecasts for recycled water projects. Where these projects are not approved by the Commission, the Commission will need to adjust CWW forecasts accordingly.

5.7 Revisions to forecasts

Table 12: CWW revisions to forecasts

	Tariff	2013-14	2014-15	2015-16	2016-17	2017-18
Water Plan	Residential Block 1 Water	35,660,408	36,292,339	37,030,790	37,725,625	38,410,803
Revision	Residential Block 1 Water	36,195,000	36,837,000	37,586,000	38,292,000	38,987,000
Water Plan	Residential Block 2 Water	12,989,347	13,675,374	13,953,631	14,215,453	14,473,636
Revision	Residential Block 2 Water	13,184,000	13,881,000	14,163,000	14,429,000	14,691,000
Water Plan	Residential Block 3 Water	2,463,497	2,629,880	2,683,391	2,733,741	2,783,392
Revision	Residential Block 3 Water	2,500,000	2,669,000	2,724,000	2,775,000	2,825,000
Water Plan	Non-Domestic Usage	35,529,069	35,742,000	35,712,807	33,550,907	31,059,098
Revision	Non-Domestic Usage	36,062,000	36,278,000	36,248,000	34,054,000	31,525,000
Water Plan	Residential SDC	38,334,939	39,639,164	40,498,238	41,305,522	42,106,245
Revision	Residential SDC	38,910,000	40,234,000	41,106,000	41,925,000	42,738,000
Water Plan	Non-residential Sewage	16,903,805	17,256,389	17,603,588	17,942,629	18,282,881
Revision	Non-residential Sewage	17,157,360	17,515,173	17,867,396	18,211,677	18,557,133

5.8 Summary

This review of CWW's urban demand forecasts found:

- Forecasts are based on appropriate forecasting methodologies.
- Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users.
- Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth.
- Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is therefore not expected to be statistically biases
- Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.

6 Melbourne Water

6.1 Introduction

This chapter contains the specific analysis undertaken by Frontier in reviewing Melbourne Water's (MW) demand forecasts for water, sewage and trade waste for the Water Price Review 2013.

6.2 Water Plan proposal

Table 13: MW Water Plan proposal

Consumption parameter	Proposed average growth rate (% per annum)
Sewerage: eastern	
SEW	0.82%
YVW	0.78%
Total	0.79%
Sewerage: western	
CWW	0.00%
SEW	0.00%
YVW	-0.64%
Total	-0.26%
CWW	
Trade waste - BOD Western	0.20%
Trade waste - SS Western	-0.21%
Trade waste - TDS/inorganic TDS Western	-0.36%
Trade waste - TN/TKN Western	0.35%
SEW	
Trade waste - BOD Western	0.25%
Trade waste - SS Eastern	0.25%

Trade waste - SS Western	0.25%
Trade waste - TDS//inorganic TDS Eastern	0.53%
Trade waste - TDS/inorganic TDS Western	0.57%
Trade waste - TN/TKN Eastern	0.25%
YVW	
Trade waste - BOD Eastern	0.00%
Trade waste - SS Eastern	0.00%
Trade waste - SS Western	0.00%
Trade waste - TDS/inorganic TDS Eastern	25.26%
Trade waste - TDS/inorganic TDS Western	21.30%
Trade waste - TN/TKN Eastern	6.15%
Trade waste - TN/TKN Western	0.00%
Water	
Headworks	
CWW	-0.61%
GW	0.00%
YVW	0.28%
SEW	0.14%
Transfers	
CWW	-0.61%
SEW	0.14%
WW	-3.38%
YVW	0.28%

Source: MW 2012 Water

Notes: Plan Percentage change per annum is calculated as the average compounding rate of change over the period. 2011-12 to 2017-18

As the wholesale or bulk water supplier to the three metropolitan water businesses MW's demand forecasts are dependent on the demand projections of the other metropolitan water businesses.

Correspondingly, MW's approach to developing demand forecasts has been to work with the businesses in developing their metropolitan retail forecasts. Accordingly they have participated in the establishment of an agreed set of assumptions in addition to undertaking reviews of the retail water businesses forecasts to confirm they are reasonable.

6.3 Water

Melbourne Water's water demand forecasts are based on the following assumptions agreed with the metropolitan water retailers:

- Stage 1 water restrictions in 2011–12 and permanent water saving rules in subsequent years.
- The bounce-back in demand being limited to a 3% increase. This was confirmed through a Deloitte analysis commissioned by Melbourne Water and the metropolitan water retailers.
- Ongoing replacement of washing machines, toilets and showers to more water efficient appliances as per the end use model assumptions adopted by retail water businesses.
- Household and population growth based on Victoria in Future 2012 forecasts and/or retailer estimates of lot/population growth and occupancy rates.
- Retail potable substitution savings will increase from 10GL in 2013–14 to around 19GL in 2017–18. Contributing projects include the Altona Industrial and Golf Courses Project (up to 7,570ML/year), Hastings Industrial Project (660ML/year),
- Price elasticity of demand will have a material effect on water users' behaviour.

Issues

MW's demand forecasts are dependent on the demand projections of the other metropolitan water businesses. Frontier has identified a number of issues with the businesses demand forecasts and has discussed these at length in the relevant businesses section of part B of this report.

Findings

Frontier has amended MW's forecasts to reflect the amendments made to the retail businesses forecasts. These amendments primarily relate to the revision of

bounceback assumptions and consequent increase in the forecasted volumes for water over the regulatory period.

For CWW and YVW, amended transfer volumes were based on the businesses' revised estimation of bulk water purchases taking into account additional bounceback in residential and non-residential volumes.

SEW did not revise bulk water purchases in response to the draft report. Frontier is aware that MW's demands include a non revenue component and that the estimation of non revenue water is complicated. In order to account for non revenue water Frontier has adopted the approach previously used by ESC demand consultants which is to base the revised forecasts on the ratio of the retail businesses water plan forecasted consumption and the bulk water transfer forecasted by MW in the water plan. Frontier adopted this approach for SEW.

6.4 Sewerage

MW sewage volume forecast is affected by changes in water demand. MW and the retailers adopted the following assumptions for the sewage forecasts:

- A permanent decrease in domestic sewage volumes due to the flow-on effects of an observed decline in water demand within households, taking into account household and population growth. Domestic load forecasts reflect assumed load per household and household growth
- Household and population growth is consistent with Victoria in Future 2012 forecast and/or retailer estimates of lot/population growth
- Transfer of some sewage load and volume to local treatment plants operated by the retail water companies
- Commercial and greasy waste grow in proportion to domestic growth rates, with some adjustment for more efficient appliances
- Domestic volumes reflect population growth forecasts consistent with water demand assumptions
- Discharges from trade waste customers reflect individual water retailer strategies and:
- reflect the overall level of economic activity overlaid with the effect of cleaner production initiatives
- new customers are expected to employ water-saving and waste minimisation technologies
- Inflow and infiltration will return to average levels as a result of the effects of ageing sewers being offset by rehabilitation measures, new technologies and network expansion

- Further reduction in demand associated with the implementation of real price increases for all customers.

Issues

MW's demand forecasts are dependent on the demand projections of the other metropolitan water businesses. Frontier has identified a number of issues with the businesses' demand forecasts and has discussed these at length in the relevant businesses section of part B of this report.

Findings

Frontier has amended MW's forecasts to reflect the amendments made to the retail businesses forecasts. These amendments primarily relate to the reassessment of bounceback assumptions and consequent increase in the forecasted volumes for sewerage over the regulatory period.

As with water volumes Frontier recognised that the estimation of sewerage flows is complicated. In addition to those flows included in the retail businesses demand forecasts, flows to Melbourne Water will also contain such things as rain dependent inflow, infiltration and unaccounted for sewage. Frontier are also aware that MW employs a 'mass balance method' to allocate flows to treatment plants.

Frontier has adopted the approach previously used by ESC demand consultants. The amendments made by Frontier are based on the ratio of the businesses' water plan forecast discharges and MW's total discharge for each business.

6.5 Waterways and drainage

Unlike the retail water businesses MW is responsible for the waterways and drainage services. These services are aimed at improving and protecting the health of rivers and creeks, as well as drainage infrastructure to provide a safe level of flood protection. All rateable properties across Melbourne Water's waterways management district pay a charge for the provision of these services.

Melbourne Water's customer forecasts reflect likely property growth, taking into account inputs from the water retailers and *VIF 2012*. These forecasts are assessed for reasonableness by Melbourne Water by comparing them against historical growth rates and other forecasts such as the Australian Bureau of Statistics.

Melbourne Water's overall average growth rate across all customer groups is 1.8% per annum over the 2013 Water Plan period.

Table 14: MW proposed connections (000s)

	2013-14	2014-15	2015-16	2016-17	2017-18
Residential	1,676	1,706	1,736	1,765	1,794
Non-residential min	39	39	40	40	41
Non-residential >min	103	104	106	107	109
Rural	100	102	104	106	107
Previously exempt farms	3	3	3	3	3
Koo Wee Rup	4	4	4	4	4
Total	1,924	1,958	1,991	2,024	2,057

Source: MW (2012) Water Plan

Issues

The connections forecast by MW are broadly consistent with the total connections forecast by CWW, SEW, WW and YVW.

Based on the 2011-12 and 2012-13 Frontier, there is a consistent difference observable between the MW connections and the connections of the retail water businesses. Historically the combined connection of the retailers accounts for approximately 86% of MW residential connections and approximately 92% of MW non-residential connections. MW's forecasts are consistent with these differences.

Table 15: MW residential connections comparison (000s)

	2013-14	2014-15	2015-16	2016-17	2017-18
CWW residential connections	349	359	368	377	386
SEW residential connections	617	639	662	671	681
YVW residential connections	624	633	643	653	662
WW residential connections	54	56	59	62	65
Total residential connections	1,644	1,688	1,733	1,763	1,795
MW residential connections	1,676	1,706	1,736	1,765	1,794

Source: MW, CWW, SEW, WW and YVW (2012) Water Plan

Table 16: MW non-residential connections comparison (000s)

	2013-14	2014-15	2015-16	2016-17	2017-18
CWW non-residential connections	34	35	36	37	38
SEW non-residential connections	52	53	54	55	56
YVW non-residential connections	42	43	43	44	45
WW non-residential connections	3	3	3	4	4
Total non-residential connections	131	134	137	140	142
MW non-residential connections	141.6	143.5	145.4	147.3	149.2

Source: MW, CWW, SEW, WW and YVW (2012) Water Plan

Finding

Frontier has not amended MW's forecasts for waterways and drainage customers on the basis that they are broadly consistent with the other metropolitan water businesses forecasts for residential and non-residential connections. And that any difference between the two is consistent with historical differences between waterways and drainage connections and the residential and non-residential connections of the water businesses.

6.6 Revisions to forecasts

Table 17: MW revisions to forecasts

	Tariff	2013-14	2014-15	2015-16	2016-17	2017-18
Water Plan	CWW Transfer	95,564	97,398	98,545	97,272	95,620
Revision	CWW Transfer	96,959	98,859	100,024	98,731	97,054
Water Plan	SEW Transfer	130,813	129,958	131,042	132,034	132,535
Revision	SEW Transfer	134,171	133,369	134,529	135,600	136,173
Water Plan	YVW Transfer	139,373	139,068	139,913	140,113	140,475
Revision	YVW Transfer	141,844	141,532	142,394	142,597	142,966
Water Plan	CWW Sewerage Western	75,564	77,286	78,598	79,847	81,093
Revision	CWW Sewerage Western	76,698	78,445	79,777	81,044	82,309
Water Plan	SEW Sewerage Western	26,677	26,357	26,235	26,509	26,736
Revision	SEW Sewerage Western	27,439	27,125	27,008	27,301	27,546
Water Plan	YVW Sewerage Western	65,413	64,522	63,945	63,950	64,002
Revision	YVW Sewerage Western	70,137	69,042	68,273	68,124	68,021
Water Plan	SEW Sewerage Eastern	76,586	77,291	77,897	78,436	78,987
Revision	SEW Sewerage Eastern	78,775	79,542	80,192	80,778	81,378
Water	YVW	49,347	48,674	48,239	48,243	48,282

Plan	Sewerage Eastern					
Revision	YVW Sewerage Eastern	52,911	52,084	51,504	51,392	51,314

6.7 Summary

MW's demand forecasts are dependent on the demand projections of the other metropolitan water businesses. Frontier has identified a number of issues with the businesses demand forecasts and has discussed these at length in the relevant businesses section of part B of this report.

7 South East Water

7.1 Introduction

This chapter contains the specific analysis undertaken by Frontier in reviewing South East Water's (SEW) demand forecasts for water, sewage and trade waste for the Water Price Review 2013.

7.2 Water Plan proposal

Table 18: SEW Water Plan proposal

Consumption parameter	Forecasted average growth rate (% per annum)
Residential water connections	2.3.
Residential water volumes	Block 1 0.0 Block 2 0.4 Block 3 0.7
Non-residential water connections	1.7
Non-residential water volumes	-0.3
Residential sewage connections	2.6
Residential sewerage volumes	1.9
Non-residential sewage connections	1.9
Non-residential sewerage volumes	-0.2
Residential recycled water connections	Material supply augmentation during period
Residential recycled water volumes	Material supply augmentation during period
Non-residential recycled water connections	Material supply augmentation during period
Non-residential recycled water volumes	Material supply augmentation during period
Trade waste customer numbers	Tariff restructuring during period
Trade waste volumes	BOD 0.5 SS 0.5 TN 0.5 OSD -100.0 Volume 0.6

Notes: n.a. Not applicable, Percentage change per annum is calculated as the average compounding rate of change over the period. 2011-12 to 2017-18

Source: SEW 2012 Water Plan

The principal forecasting method used by SEW is the Melbourne End Use Model (MEUM). The model is an extension of the Water Services Association of Australia End Use Model that was previously adopted by the three metropolitan Melbourne retail water businesses. The MEUM disaggregates indoor residential demand into different components of water use. These components include:

- Washing machine
- Dishwasher
- Toilet
- Shower
- Indoor miscellaneous (e.g. bath, taps etc)
- Outdoor

SEW uses the MEUM to generate a baseline demand. The baseline demand is then modified to take into account the impact of Class A recycled water, WSDS, CRWS initiatives and MAC recommendations.

In regards to climate SEW has based its forecasts on a medium climate change scenario, with average rainfall and temperature conditions over the regulatory period. SEW is not anticipating any restrictions beyond permanent water savings rules.

7.3 Water

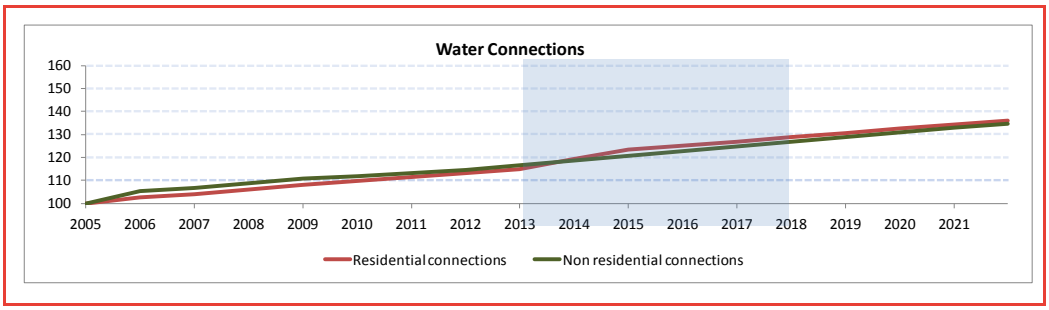
Customer connections

SEW used VIF 2012 as the basis for its connections forecasts. The VIF forecasts were adjusted to account for a movement towards dwelling based charges that will see an additional 20,000 customers subject to SEW charges. These customers are intended to be rolled into the SEW customers base over a four year period from 2014-15. A slight kink is observable in SEWs forecasted growth rates outlined in Figure 11 below.

SEW has forecast that the growth in residential customer connections (2.3% per annum) will be above the expected population growth rate forecast by VIF (1.6 per cent per annum). Frontier notes that the difference between the two forecasts is attributable to the role in of the new customers.

Frontier accepts SEW's forecasts for connections on the basis that SEW's variation from VIF growth rates is explained by the roll in of additional customers and the forecasts are broadly consistent with historical trends (see Figure 11).

Figure 11: SEW: growth in water connections

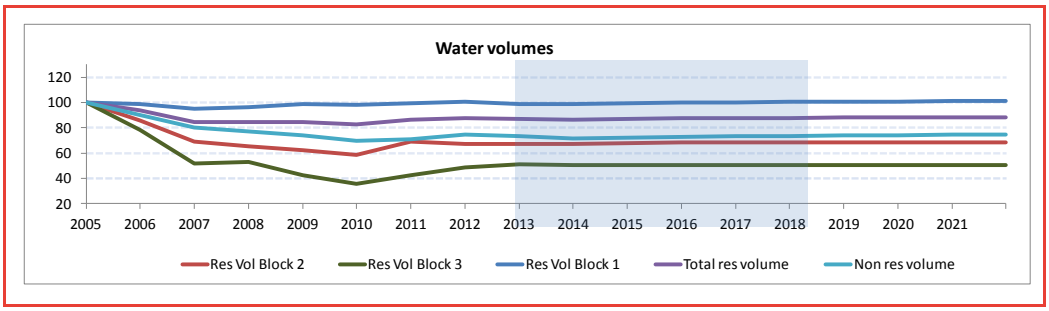


Source: Index based on SEW (2012) Water Plan, 2005=100.

Water volumes

We note that SEW water volume forecasts are broadly consistent with historical trends (see Figure 12).

Figure 12: SEW growth in water volumes



Source: Index based on SEW (2012) Water Plan, 2005=100

Issues

Water volumes and end use models

The end use model used to generate estimates of water volumes makes a number of assumptions about water conservation and water use efficiency associated with major appliances and major uses. These assumptions are based on a recent stock survey undertaken in 2012 and are broadly consistent with those adopted by SEW in its end use model for the previous ESC's Water Price Review 2009 (see Table 19). Other documents used by S//EW to update its end use model include:

- Yarra Valley Water's 2011 Appliance Stock and Usage Patterns Survey 2012
- Post Restrictions Bounceback Report December 2011 (Deloitte)
- South East Water's Appliance Stock Survey – Residential ENs Use Measurement Study 2010
- 2005 appliance stock and usage patterns survey.

Given that the current assumptions are based on a stock survey undertaken by SEW in 2012, Frontier accepts that these assumptions are most likely to represent the current consumer practices and behaviours of its customers.

Table 19: Water use assumptions

Major end use	Assumptions	
	Price Review 2009	Price Review 2013
Clothes washers	Assumed 2004-05 market share of 70% for top loaders and 30% for front loaders. Assumed that front-loaders market share will increase by 2%per year	A single-person household is assumed to use a washing machine 2.42 times per week, and each additional person in the household increase the usage by 1.23 times per week. Assumed that front loaders market share will increase by 3% per year.
Dishwashers	Frequency of use is assumed to be 0.62 per household per day.	All water consumed by a dishwasher is assumed to go to sewage. Each household is assumed to use a dishwasher 4 times per week. It is assumed that each dishwasher use consumes 19.9 litres of water.
Toilets	Use was calculated on per capita per day basis, with an average of 3.5 times per day. Frequency of flushing per household in two (or more) toilet households is assumed to be 20% higher than for one toilet households. Average household had 1.5 toilets, of which 80% own a dual flush toilet.	Assume that 90% of toilets in 2012/13 will be double flush toilets.
Showers	Calculate the AAA rated showerhead penetration based on the Melbourne Water Supply Demand Strategy outcome that the penetration must be 50% of existing homes by 2020.	Assume a normal shower head and an AAA showerhead have flow rates of 10.5 and 6.7 litres of water respectively, and a shower is assumed to last for 6.8 minutes. A person is assumed to take 0.91 showers each day.
Indoor miscellaneous	Bath use is assumed to be 0.44 times per week with 123L per use. The assumed use for hand basins was 3.8 per person per day, with an average length of time of 0.35 minutes.	Bath use is assumed to be 0.44 times per week with 123L per use. The assumed use for hand basin was 3.8 per person per day, with an average length of time of 0.35 minutes.

	The assumed use for kitchen sink was 8.5 times per household, with an average time of 0.6 minutes. Laundry consumption was assumed to be 30L per household per week.	The assumed use for kitchen sink was 8.5 times per households, with an average time of 0.6 minutes. Laundry consumption was assumed to be 30L per household per week.
Lawn and garden	From 2005-06 onwards, adjustments built in to take account of reducing block sizes for detached houses. This adjustment applies to the new separate homes built each year. Expected to be reduction of 20% over 50 year period – reducing block size from 600 to 480 square metres.	Each detached and multiunit dwelling is assumed to use 57.7 and 18 litres of water on gardening each day, respectively.
Car washing		50% of car washes are taken by hoses, using 15 minutes with a flow rate of 10 litres per minute. Each bucket wash of cars is assumed to use 100 litres of water. Each swimming pool is assumed to use 20 litres of water a day.

Source: Frontier estimates based on CWW (2012) End Use Model, SEW (2012) End Use Model, YVW (2012) End Use Model.

Water volumes and elasticity of demand

SEW assumed the elasticities outlined in Table 20. Frontier agrees that the materiality of the proposed price increases will have material impacts on customer's behaviour. Frontier has accepted the proposed elasticities, on the basis that they are conservative and the absence in the literature of alternative elasticities for water use that account for end use models.

Table 20: SEW assumed price elasticises

Tariff	Elasticity factor
Tier one	-0.05
Tier two	-0.10
Tier three	-0.10

Source: SEW (2012) Water Plan

Water volumes and connections

While SEW is forecasting increasing volumes over the course of the regulatory period, these volumes would not appear to be consistent with the relatively greater growth rates associated with connections. The primary driver for the

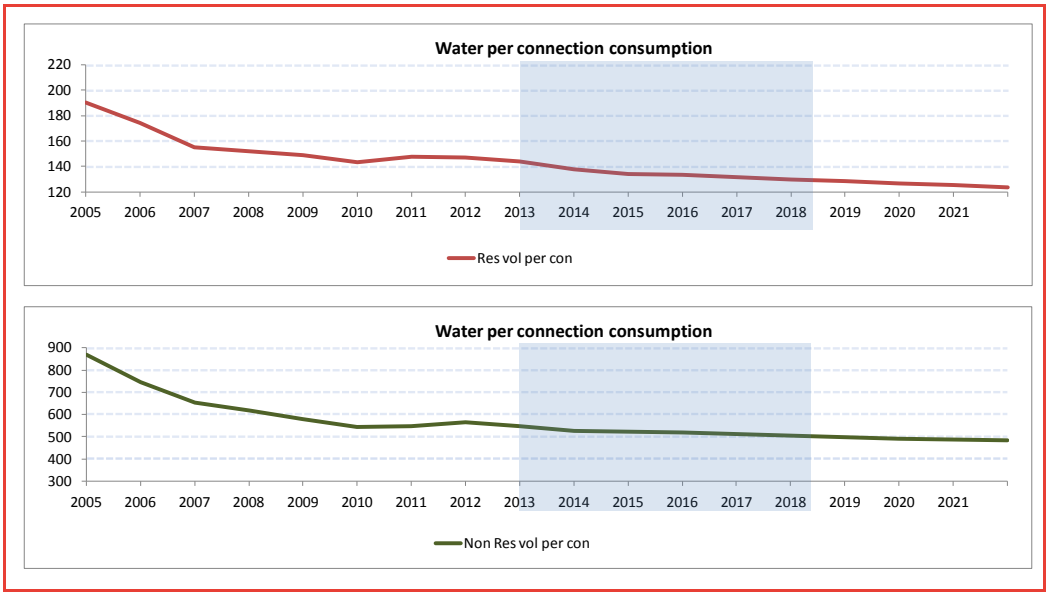
relatively low growth in volumes is an assumed increase in water use efficiency over the regulatory period (see Figure 13).

SEW have applied bounceback to their demand forecasts by increasing average lawn and garden consumption in its end use model for detached dwellings to 39.95 kL per annum.

This increase in usage is outweighed by a long-term annual reduction in lawn and garden consumption attributable to a reduction in the average size of blocks for detached houses from 600 square metres to 480 square metres over 50 years. SEW have assumed an average annual reduction in consumption of 80 litre per detached dwelling and 40 litres per unit or flat.

This trend is complimented by a trend in multi unit dwellings to move from units or flats to high density apartments (that have no outdoor use). SEW have assumed an annual reduction of 40 litre per unit or flat.

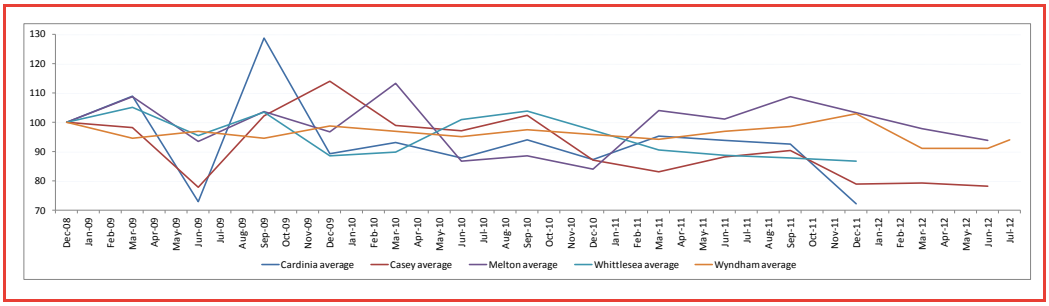
Figure 13: SEW: growth in water per connection consumption



Source: Index based on SEW (2012) Water Plan, 2005=100

Figure 14 shows the average lot size per release over the period 2008- 2012. While the data must be treated with caution as it has not been amended to control for numbers of lots released, it would appear to be indicative of a slow long-term downward trend in lot size. However, Frontier is concerned that the impact of such a long-term trend on the five years of the regulatory period may be overstated.

Figure 14: Average lot size, Melbourne growth corridors



Source: DPCD Residential Land Bulletins (2008 to 2012)

In the draft report Frontier stated that it was concerned that the forecasted volumes may be understating bounceback. In the draft report Frontier did not amend SEW's volume forecasts to reflect its concerns, but rather requested SEW rerun its bounceback model to include the most recently available data. Frontier also requested SEW provide it with consumption data for the current year to date. In response to Frontier's draft report SEW did not rerun its bounceback model but did provide the following additional information:

- an additional five months of bulk water purchase data covering late spring and the summer months of 2012-13
- an estimation of the influence of warmer than average, and exceptionally dry, summer weather on water consumption in Melbourne.

South East Water has indicated that it has experienced bulk water volumes to the middle of February 2012-13 that are 8.2% greater than over the same time in 2011-12 and that forecast for 2012-13 in the Water Plan. South East Water has also acknowledged that the increase in bulk volumes will translate into higher than anticipated sales volumes.

In normalising 2012-13 for weather SEW has considered water use and weather patterns from 2001-02 through to 2011-12. SEW normalised 2012-13 by identifying years with the same climatic conditions and associated increase in water use based compared to normal weather years. SEW prescribed the difference between the abnormal and normal years as weather driven. For 2012-13 the amount of growth that exceeded this level of identified weather driven growth was attributed to bounceback. SEW estimate this additional bounceback to be 2.5%.

In amending their forecasts SEW did not amend non-residential water use.

Findings

Frontier has amended SEW's water plan forecasts for residential water consumption to allow for a greater degree of bounceback than originally assumed by SEW. The increased bounceback reflects the most recent data available for 2012-13.

Frontier did not revise SEW forecasts for non-residential customers volumes as forecasts for these customers were developed separately by SEW based on historical usage patterns and are therefore independent of bounceback in residential use.

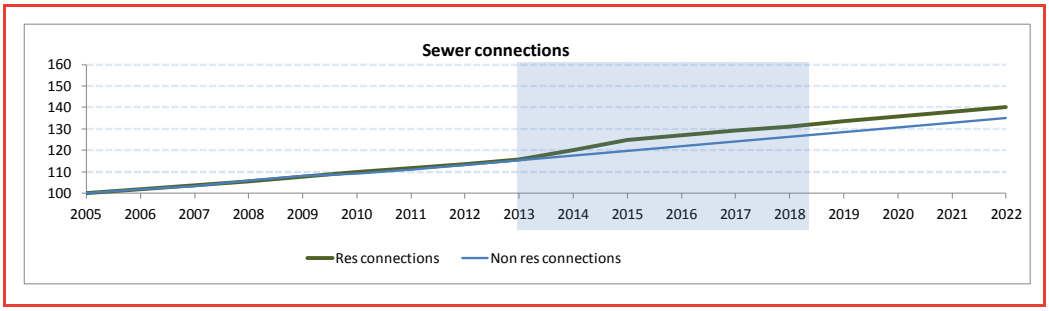
7.4 Sewage

Customer connections

SEW sewerage connections growth numbers equate with those used for water connections. It is reasonable to assume that growth dwelling will be serviced by both water and sewerage. We also note that forecast connections are broadly similar to historical trends (see Figure 15).

The kink observable half way through the regulatory period is consistent with water connections and attributable to tariff structure change.

Figure 15: SEW. Growth in sewerage connections

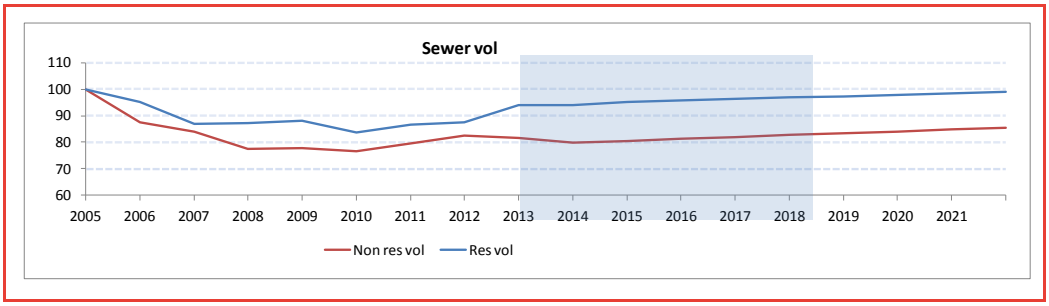


Source: Index based on SEW (2012) Water Plan, 2005=100

Volumes

Non-residential; sewage volumes appear to be growing at a rate consistent with historical trends and with forecast growth for residential customers (see Figure 16).

Figure 16: SEW: Growth in residential and non-residential sewage

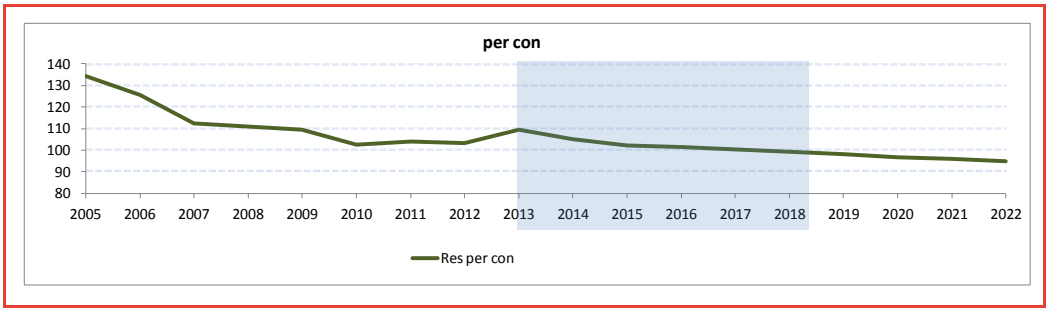


Source: Index based on SEW (2012) Water Plan, 2005=100

Over the regulatory period SEW is proposing a low constant growth in volumes that would appear to be inconsistent with the strong growth forecast for connections.

Frontier recognises that residential sewerage volumes are derived from water volumes for pricing purposes and that while actual flows may exceed those forecast by business, billed flows will not (assuming the algorithm for determining volume is unchanged).

Figure 17: SEW: growth in residential sewage volumes per connection



Source: Index based on SEW (2012) Water Plan, 2005=100

Issue

Frontier has amended SEW's forecasts for the volumetric supply of potable water. Given that sewage volumes are derived from forecasts of water volumes the water plan forecasts for sewage volume are no longer appropriate.

Finding

Frontier has not amended the forecast for residential and non-residential sewerage connections and the forecasts for non-residential sewage volume by SEW.

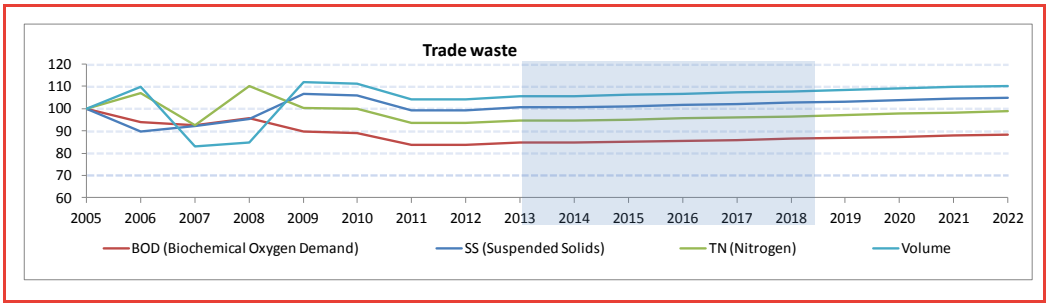
Frontier has revised SEW's residential sewage volume forecasts to reflect amendments made to SEW's residential water volume forecasts.

7.5 Trade waste

Connections and volumes

Current trade waste flows are taken from SEWs customer billing database. Forecasts are based on residential and non-residential billed sewerage. SEW is proposing forecasts of trade waste volumes that are broadly consistent with historical actual consumption from 2009-2010 (see Figure 18).

Figure 18: SEW: growth in trade waste volumes



Source: Index based on SEW (2012) Water Plan, 2005=100

Finding

Frontier has not amended the trade waste fixed and volumetric forecasts provided by CWW.

7.6 Recycled water

Customer connections and volumes

Demand forecasts for dual pipe Class A recycled ware are based on the long-term broad hectare projections derived from the Urban Development Program 2010. A significant majority of areas that will have Class A recycled water access are located in areas South East Water has mandated for recycled water supply. The usage rate for residential purposes is approximately 60kl per year per lot. As with residential outdoor demand, long-term reduction in lot sizes and reduction in total outdoor land area for irrigation have a small impact on medium term property consumption with a reduction of 0.05kl per annum from the 2012-13 per property baseline of 60kl. The demand forecasts for other class a recycled water schemes are based on customers expressions of interest and design data as the project is confirmed.

Finding

Frontier has not amended the recycled water forecasts provided by SEW.

7.7 Revisions to forecasts

Table 21: SEW revisions to forecasts

	Tariff	2013-14	2014-15	2015-16	2016-17	2017-18
Water Plan	Residential Block 1 Water	67,590,256	67,332,450	67,766,821	68,140,463	68,343,297
Revision	Residential Block 1 Water	69,440,289	69,216,820	69,696,541	70,118,777	70,367,765
Water Plan	Residential Block 2 Water	15,527,774	15,429,022	15,598,969	15,727,895	15,764,469
Revision	Residential Block 2 Water	16,470,661	16,374,619	16,561,386	16,705,873	16,753,103
Water Plan	Residential Block 3 Water	5,479,331	5,443,014	5,454,558	5,463,213	5,462,573
Revision	Residential Block 3 Water	5,695,458	5,660,916	5,675,334	5,687,177	5,689,608
Water Plan	Residential SDC	64,587,519	64,520,722	65,216,358	65,764,400	66,106,654
Revision	Residential SDC	66,855,380	66,819,968	67,566,619	68,167,533	68,557,038

7.8 Summary

This review of SEW's urban demand forecasts found:

- Forecasts are based on appropriate forecasting methodologies.
- Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users.
- Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth.
- Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-

residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is therefore not expected to be statistically biased.

- Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.

8 Western Water

8.1 Introduction

This chapter contains the specific analysis undertaken by Frontier in reviewing Western Water's (WW) demand forecasts for water, sewage and trade waste for the Water Price Review 2013.

8.2 Water Plan proposal

Table 22:WW Water Plan proposal

Consumption parameter	Forecasted average growth rate (% per annum)
Residential water connections	4.7%
Residential water volumes	2.1%
Non-residential water connections	4.5%
Non-residential water volumes	1.3%
Residential sewage connections	4.6%
Residential sewerage volumes	n.a.
Non-residential sewage connections	4.4%
Non-residential sewerage volumes	n.a.
Recycled water connections	26.3%
Class A recycled water volumes	21.7%
Recycled water peak volumes	29.9%
Off peak recycled water volumes	40.4%
Trade waste volumes	BOD 2.0% Application 0.0% Management Fee 3.0% Vol RR3 1.0% Vol RR4 2.0% SS 2.0% TDS 2.0%

Notes: n.a. Not applicable. Percentage change per annum is calculated as the average compounding rate of change over the period. 2011-12 to 2017-18.

Source: WW 2012 Water Plan

WW's forecasting method combines the regression analysis of several existing data sets and their corresponding extrapolations. The data sets considered by WW are:

- historical Western Water reports, both prior to and post-utilisation of persons per-household as a key parameter.
- historical and current census data.
- water usage growth in Western Water's supply areas.
- VIF projections.
- new housing growth projections based on planning applications.
- Growth Strategy report.

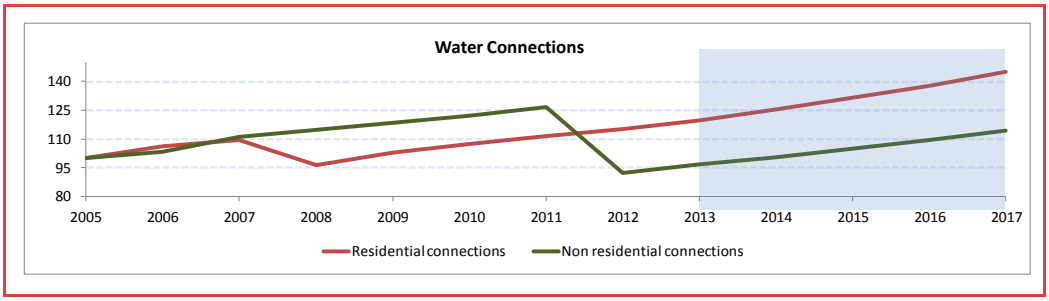
Unlike the other metropolitan water businesses that assumed an average climate scenario, WW has assumed a "return to dry" scenario. WW has based its assumption on historical trends in the average rainfall specific to its region.

Customer connections

WW has based its forecast connections on the population growth observed in individual supply systems. WW has also based non-residential growth rates in connections on population growth. In its water plan WW did not provide the detailed methodology that it has used to translate the population forecasts into connection forecasts for its water supply area.

WW is proposing residential connections grow at an average annual rate of 4.4% compounding over the regulatory period. Non-residential customers are forecast to grow at an average annual rate of 4.6% compounding over the regulatory period. The equivalent VIF 2012 forecast growth for households in the WW supply areas is approximately 4% over the same period (see Figure 19).

Figure 19: WW: growth in water connections



Source: Index based on WW (2012) Water Plan, 2005=100.

Issues

Frontier notes that the forecasts for both residential connections are greater than the VIF 2012 forecasts for households. However, the forecasts are within a percentage point of the VIF forecasts and are broadly reflective of historical trends.

However we do note that the forecasts for non-residential connections do not appear to be consistent with historical trends. There is a material drop from the final year of actual historical data 2011-12 to the first year of predictions 2012-13. This material drop in growth rates is not explained in the water plan.

In the draft report Frontier amended the forecast for non-residential connections such that 2012-13 was consistent with the final year of observed actual connections in 2011-12. Non-residential forecasts were then rolled forward over the regulatory period based on the growth trend forecast by WW.

In response to the draft report Western Water indicated that the observed drop in non-residential connections was associated with data cleansing efforts, and improved reporting resulting from a new billing system. WW state that the new system is more rigorous in its customer classification and ID requirements and that the observed step decline reflected a correction in its billing system primarily based on the identification and elimination of duplicate entries.

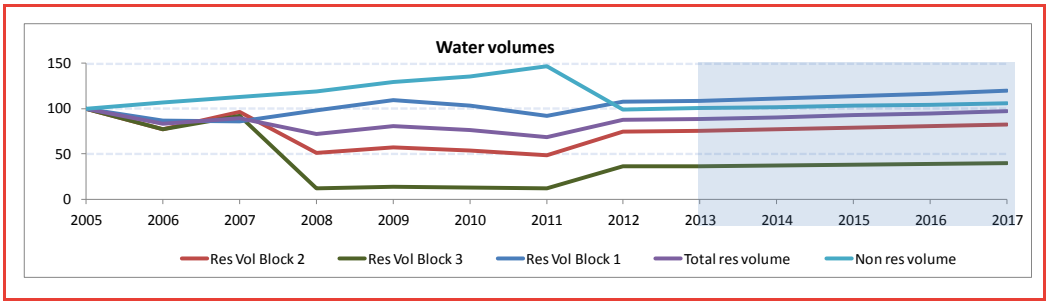
Finding

Frontier has not amended WW forecasts for non- residential customers.

Water volumes

WW is proposing average annual growth in residential volumes of 2.1% compounding for all tariff blocks and 1.3% annual growth for non-residential volumes. We note that WW water volume forecasts are all broadly consistent with historical trends from 2008-09 onwards (see Figure 20), the exception being non-residential volumes which show a steep decline in 2012-13. This decline is not explained by the Water Plan.

Figure 20: WW growth in water volumes

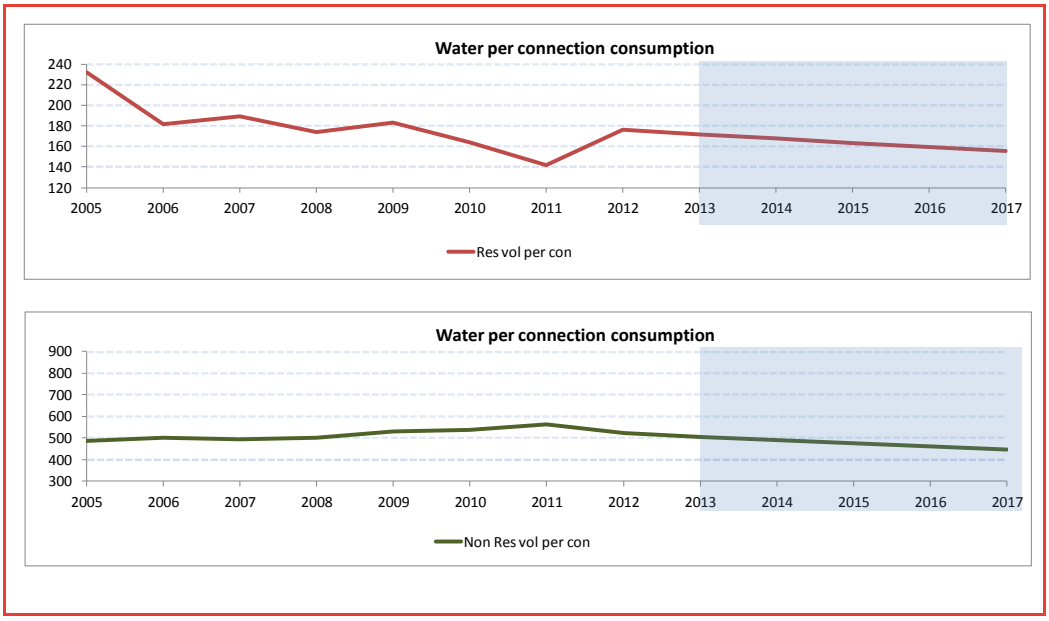


Source: Index based on WW (2012) Water Plan, 2005=100

Issues

In the draft report Frontier amended non-residential water volumes to be consistent with amendments made to non-residential water connections. Frontier made the amendment by adopting the average water consumption for non-residential customers in 2011-12 for the year 2012-13 (see Figure 21) and then extrapolating to total water volumes based on the amended customer numbers.

Figure 21: WW: growth in water per connection consumption



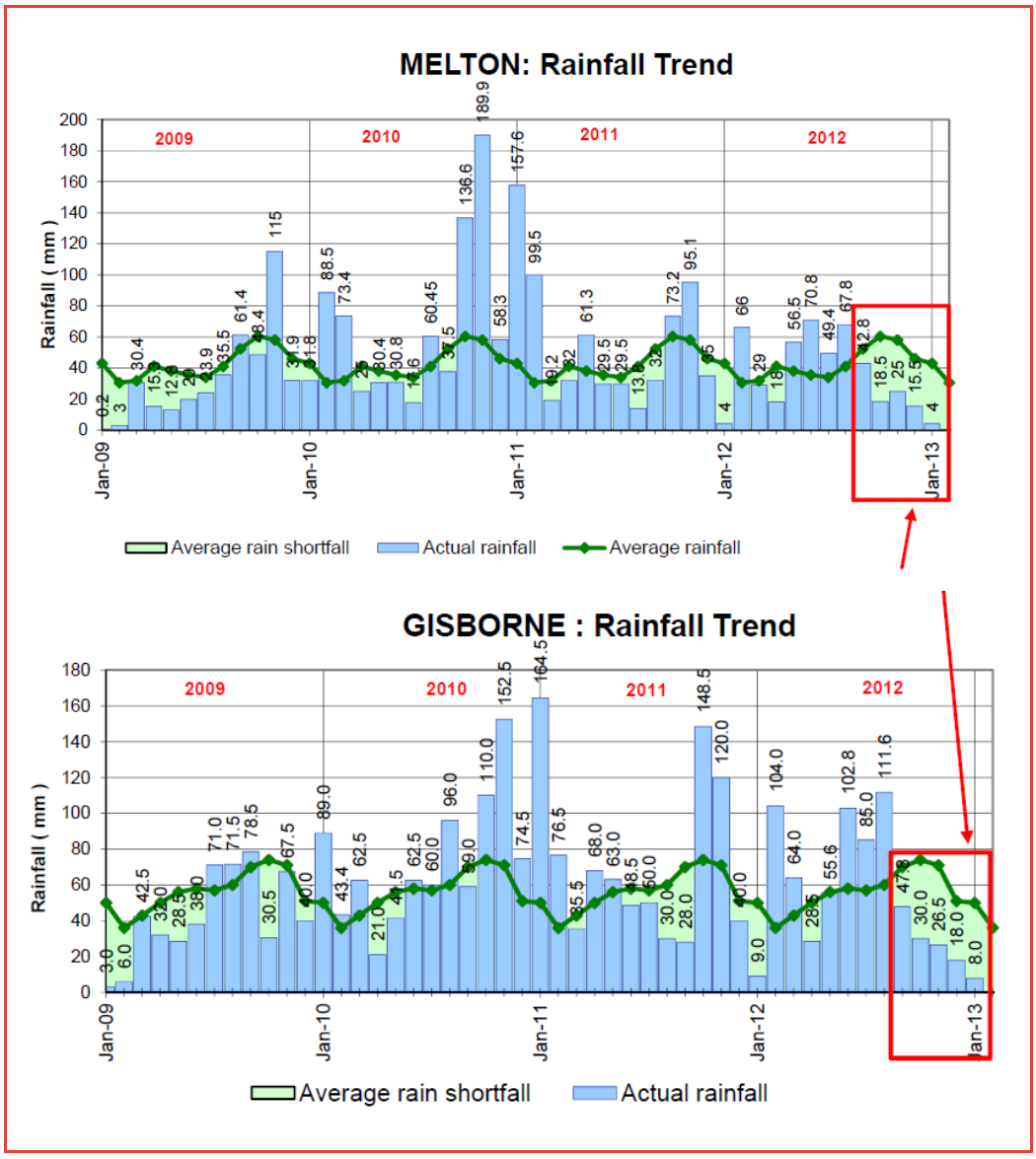
Source: Index based on WW (2012) Water Plan, 2005=100

WWs response to the draft clearly indicated that the step decline in non-residential volumes is consistent with connections and that both reflect a correction in its billing system primarily based on the identification and elimination of duplicate entries.

As with the other metropolitan retail water businesses, in the draft report Frontier stated that it was concerned that the forecasted volumes may be understating bounceback. In the draft report Frontier did not amend WW's volume forecasts to reflect its concerns, but rather requested WW provide it with consumption data for the current year to date.

In response to Frontier's draft report WW indicated that the residential demand of the current period is much greater than restricted years. WW considers this to be directly attributable to an extreme rain shortfall experienced since September 2012 and a five month period of continuous high temperatures (see Figure 22). WW state that water consumption during and following consecutive days of high temperatures is greater than isolated hot days.

Figure 22: WW rainfall trends



Source: WW (2013) Response to draft report.

Unlike the other metropolitan retail water businesses WW has not sought to revise its demand forecasts in response to greater than anticipated water use in the current year 2012-13.

Western Water is of the view that residential water use trends will return to the levels marginally above those seen in drought and restricted years when temperatures decrease and rainfall increases in the autumn, winter and spring months. This expectation is based on assumption of behaviour change and permanent water savings. WW notes that water saving infrastructure has been fitted to many households that will provide for permanent water savings. Common infrastructure examples include:

- Water efficient shower head
- Dual flush toilet
- Rain water tank
- Garden watering timer
- Drip feed garden watering system
- Grey water usage
- Drought tolerant gardens
- Water efficient appliances (washing machine, dishwasher)

Unlike the other metropolitan retailers WW has not sought to identify what its expectations are for a normalised weather year, nor is it apparent they have undertaken any analysis to determine if any unanticipated bounceback is identifiable based on historically comparable years. Frontier is concerned that the assumption that unanticipated growth in 2012-13 is solely attributable to weather may understate the level of bounceback associated with residential water use. Frontier also notes that this assumption is not supported by the analysis undertaken by the other metropolitan water businesses.

Frontier, through the ESC was able to obtain independent modelling of per connection consumption for WW. The ESC commissioned Intelligent Software Development (ISD) to utilise the SimulAIt and SimulAIt Online water behaviour models to configure a model for Western Water (WW), and produce future forecasts.

The ISD WW demand model was used to forecast and compare different scenarios and levels of permanent behaviour maintenance from 2008-2023. The model defines permanent behaviour maintenance as the level of behaviour change that consumers persist with permanently as influences ease (e.g. restrictions, drought conditions and associated communications), due to consumers becoming accustomed to their changed behaviours which they have persisted with over a period of time. The greater the level and duration of behaviour change by consumers, whether voluntary or enforced through policy, the greater the level of behaviour maintenance.

The ISD demand forecasts compare a baseline scenario comprising a standard level of behaviour maintenance, with scenarios comprising a 33% increase and decrease in behaviour maintenance and a 'no influences' scenario which represents the water demand that would likely have occurred had no restrictions or other influences been implemented in the past.

The no influence scenario shows the natural gradual decline in water demand from population changes and uptake of efficient appliances. ISD's no influences scenario represents the 'theoretical maximum' bounce-back in demand if consumers reverted back to their previous water usage behaviours. The difference between the no influences scenario and the other scenarios represents the reduction in water demand from permanent behaviour maintenance/change.

ISD forecasts show that the future water demand is expected to increase to 180-192 kL per household per annum in 2013-14, assuming climate conditions return to normal levels. The bounce-back is expected to be less than the pre-drought demand level of approximately 233 kL per household per annum (see Table 23).

Frontier notes that WW have assumed a return to dry scenario for its demand forecasts. Under such a climatic scenario the expectation is that per connection consumption would increase due to hotter and dryer weather, in which case the ISD forecasts should be viewed as conservative in nature.

Table 23: WW, water plan forecasts and ISD forecasts

(kL)	2013-14	2014-15	2015-16	2016-17	2017-18
ISD per connection consumption of water	189.3	186.4	182.9	179.5	176.3
WW forecast per connection consumption of water	171.8	167.6	163.6	159.7	155.9

Source: WW (2012) Water Plan, ISD demand forecasts

Finding

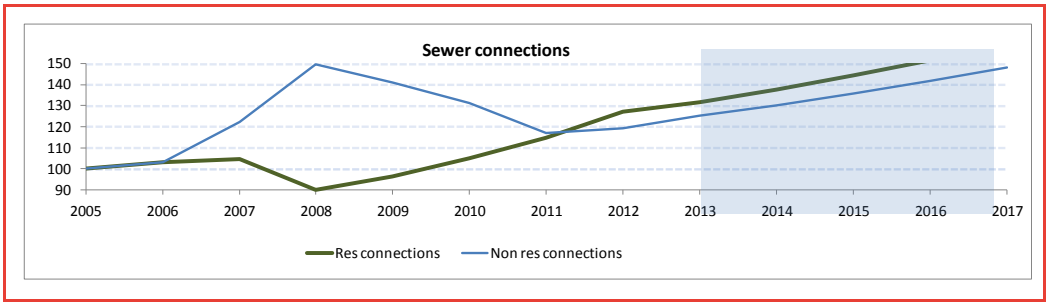
Frontier has amended WW's forecasts for residential water volumes to reflect the per connection forecasts provided for in the ISD model.

8.3 Sewage

Customer connections

WW is forecasting growth in sewerage connections of 4.4% per annum for residential customers and 4.6% per annum for non-residential customers (see Figure 23).

Figure 23: WW. Growth in sewerage connections



Source: Index based on WW (2012) Water Plan, 2005=100

Issues

These growth rates are consistent with both residential and non-residential growth in water connections and are within a percentage point of the VIF 2012 forecast growth rates. On this basis we have not sought to amend WW forecasts.

However, we note that there appears to be some variability evident in the historical data associated with sewerage connections. Although it does not affect the forecasts we suggest WW revisit its historical data.

Findings

Frontier has not amended WW forecasts for residential and non-residential sewerage connections.

8.4 Trade waste

Connections and Volumes

There is very little historical information on which to assess the WW trade waste forecasts. There is also very little information provided in the water plan. Frontier has not adjusted WW's forecasts.

Frontier notes that WW is providing growth forecasts that are materially greater than any of the other metropolitan businesses (see Table 24). In response to the draft report Frontier requested WW outline the primary drivers for trade waste over the regulatory period.

In response to the draft report WW stated that the impacts of high growth in non-residential customers connections is expected to flow into the area of trade waste. WW also indicated that its forecasts were consistent with historical trends.

Table 24: WW forecast growth in trade waste

Trade Waste Parameter	Per annum compounding growth (%)
BOD Quality Fee	2.0%
Application Fee	0.0%
Management Fee	3.0%
Vol Fee RR3	1.0%
Vol Fee RR4	2.0%
SS	2.0%
TOS	2.0%

Source: WW (2012) Water Plan

8.5 Recycled water

Customer connections and volumes

WW is proposing high levels of growth across all recycled water services. One of the principal drivers for these high levels of growth is assumed step declines in 2012-13. The forecast per annum growth rates are listed in Table 25.

In the draft report Frontier did not amended these forecasts but did note that there is a lack of evidence supporting them in the Water Plan and was concerned that they may be overly optimistic. Frontier also noted that the volatility in the historical data makes it difficult to form a strong view on forward consumption.

Table 25: WW forecast growth rates for recycled water services

Recycled water service	Forecast per annum growth rate (%) compounding
Connections	26.3%
Class A vol	21.7%
Peak	29.9%
Off peak	40.4%

Source: WW (2012) Water Plan

Issues

In the draft report Frontier requested WW review both its forecasts and historical data and either resubmit revised forecasts or alternatively provide more supporting information for the forecasts it is proposing. Specifically, WW should identify the drivers behind growth in recycled water and the quantum it is attributing to each driver.

In response to the draft report WW indicated that it had identified errors in the historic data that lead to the high growth rates reported by Frontier. Based on the data provided by WW the underlying growth rates in the water plan forecasts would appear to be consistent with historical growth.

8.6 Revisions to forecasts

Table 26: WW revisions to forecasts

	Tariff	2013-14	2014-15	2015-16	2016-17	2017-18
Water Plan	Residential Block 1 Water	6,774,025	6,910,495	7,072,238	7,247,657	7,433,749
Revision	Residential Block 1 Water	7,463,989	7,686,457	7,905,468	8,144,117	8,406,224
Water Plan	Residential Block 2 Water	1,855,897	1,893,286	1,937,600	1,985,659	2,036,644
Revision	Residential Block 2 Water	2,044,929	2,105,879	2,165,882	2,231,265	2,303,075
Water Plan	Residential Block 3 Water	649,564	662,650	678,160	694,981	712,825
Revision	Residential Block 3 Water	715,725	737,058	758,059	780,943	806,076

8.7 Summary

This review of WW's urban demand forecasts found:

- Forecasts appear to be based on appropriate forecasting methodologies.

- Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users.
- Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth.
- Forecasts for water and sewerage services are based on extrapolations of a series of regressions. Frontier did not have access to adequate information to access the statistical integrity of these regressions.
- Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff consistent with the approach adopted by the metropolitan water retail businesses.

9 Yarra Valley Water

9.1 Introduction

This chapter contains the specific analysis undertaken by Frontier in reviewing Yarra Valley Water's (YVW) demand forecasts for water, sewage and trade waste for the Water Price Review 2013.

9.2 Water Plan proposal

Table 27: YVW Water Plan proposal

Consumption parameter	Forecasted average growth rate (% per annum)
Residential water connections	1.5
Residential water volumes	Block 1 0.4 Block 2 .0.4 Block 3 0.4
Non-residential water connections	1.5
Non-residential water volumes	-0.2
Residential sewage connections	1.6
Residential sewerage volumes	0.8
Non-residential sewerage connections	1.7
Non-residential sewerage volumes	0.7
Residential recycled water connections	Material supply augmentation during period
Residential recycled water volumes	Material supply augmentation during period
Non-residential recycled water connections	Material supply augmentation during period
Non-residential recycled water volumes	Material supply augmentation during period
Trade waste volumes	BOD 0.4 SS 0.0 Volume 0.3

Notes: n.a. Not applicable. Percentage change per annum is calculated as the average compounding rate of change over the period. 2011-12 to 2017-18

Source: YVW 2012 Water Plan

The principal forecasting method used by YVW is the Melbourne End Use Model (MEUM). The model is an extension of the Water Services Association of Australia End Use Model that was previously adopted by the three metropolitan

Melbourne retail water businesses. The YVW demand forecast for residential water usage is made up of six individual end-use forecasts:

- Shower
- Toilet
- Clothes washing
- Dishwashing
- Outdoor Use (garden irrigation, car washing, swimming pool use)
- Indoor Miscellaneous (tap use in kitchen, bathroom and laundry, bath, evaporative cooler and leakage).

To support the end-use modelling approach Yarra Valley Water relies heavily on its extensive end-use research program. The studies that have been undertaken are:

- 1999 Residential Forecasting Study – 1000 household telephone survey & rudimentary data logging on 30 homes with diaries
- 2003 Appliance Stock & Usage Patterns Survey (ASUPS) – 840 household visits
- 2007 Appliance Stock & Usage Patterns Survey (ASUPS) – 850 household visits
- 2011 Appliance Stock & Usage Patterns Survey (ASUPS) – 1241 household web survey plus 247 household visits
- 2004 Residential End-Use Measurement Study – 2 weeks in each of summer & winter, high resolution data logging 100 of the ASUPS homes
- 2010-2012 Residential End-Use Measurement Study – analysis of 100 homes 2 weeks winter usage 2010 and 2 weeks summer usage 2012.

YVW also referenced:

- ABS Environmental Issues Publications 1998, 2001, 2004, 2007, 2010 (ABS 4602.0)
- Melbourne's Water Supply Demand Strategy Customer Research Report (GA Research August 2011)
- Melbourne Water Corporation's Post Restrictions Bounceback Research (Deloitte October 2011).

YVW has based its forecasts on a medium climate change scenario, with average rainfall and temperature conditions over the regulatory period. It is not anticipating any restrictions beyond permanent water savings rules.

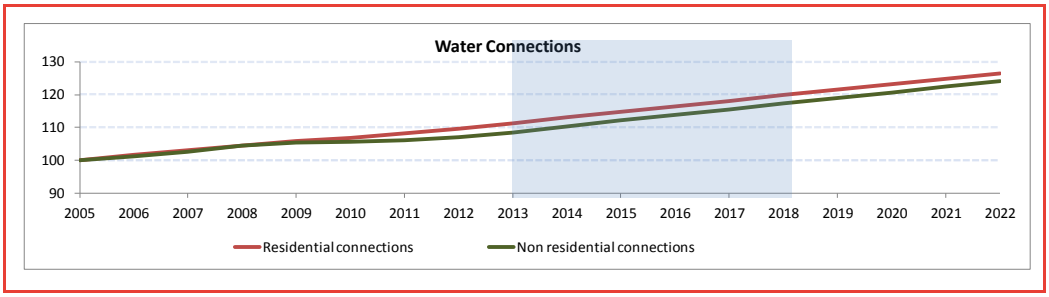
9.3 Water

Customer connections

YVW has based its forecast connections on VIF 2012. Although YVW did not provide the detailed methodology that it has used to translate the VIF forecasts into population forecasts for its water supply area. Frontier notes that the VIF forecasts of 1.4% are very close to the YVW forecasts of 1.5%.

YVW forecasts do not differ materially from the VIF forecasts and are broadly consistent with historical trends (see Figure 24).

Figure 24: YVW: growth in water connections

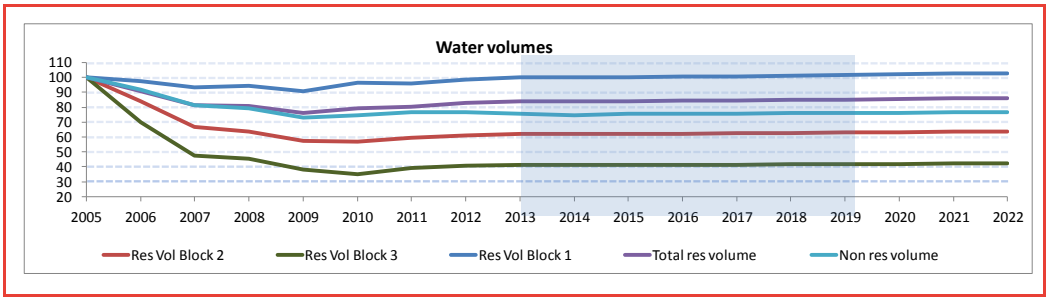


Source: Index based on YVW (2012) Water Plan, 2005=100.

Water volumes

YVW water volume forecasts are all broadly consistent with historical trends from 2008-09 onwards (see Figure 25).

Figure 25: YVW growth in water volumes



Source: Index based on YVW (2012) Water Plan, 2005=100

Issues

The end use model used to generate estimates of water volumes makes a number of assumptions about water conservation what water use efficiency associated

with major appliances and major uses. These assumptions are based on a recent stock survey undertaken in 2011 and are broadly consistent with those adopted by YVW in its end use model for the previous ESC's Water Price Review 2009 (see Table 28).

Table 28: Water use assumptions

Major end use	Assumptions	
	Price Review 2009	Price Review 2013
Clothes washer	Assuming the stock of 4-star front-loading washing machines increasing from 10% in 2007-08 to 34% by 2012-13. Assumed that by 2012-13 an average of 4.9 loads per week (above the 2007-08 level of 4.6, but below the 2005-06 level of 5.3). This will result in an average decrease of 2.7% per year for total consumption.	It is assumed that a house uses its clothes washer 4.56 times per week, and a multi-residential resident washes its clothes 3.49 times per week.
Toilet	Continued replacement of single-flush toilets with dual-flush toilets assumed at the historical rate of change-over. This is expected to result in an average decrease of 1% per year for total consumption	A person is assumed to flush a toilet 4 times a day, and a toilet is assumed to have a useful life of 26 years. Each toilet is assumed to leak 3000L of water per annum.
Shower	New home regulations and retrofit programs will result in AAA-rated showers increasing from approximately 20% in 2006-07 to 56% in 2012-13. This will reduce shower demand by an average of 2.8% per year for total consumption	It is assumed that an average shower takes 6.8 minutes, and a person is assumed to shower 0.9 times per day. A standard showerhead is assumed to have a flow rate of 8.7 L/min, when an efficient showerhead is assumed to flow 6.7L/min.
Indoor Misc		Bath is assumed to be used 0.44 times per week, and 120L water is used each time it is used. A tap in a laundry is assumed to use 15L water per week. Hand basins are assumed to use 30.24Lwater per week. Kitchen taps are assumed to use 37.8Lwater per week. Use of dishwashers is assumed to decrease usage for kitchen sinks by 1500L per annum.

		An evaporative air conditioner is assumed to use 15.2L water each day.
Lawn and garden		20% of total water demand for gardens is assumed to be met by rainwater tanks. Each detached and multiunit dwelling is assumed to use 43 and 14.8 litres of water on gardening each day, respectively.

Source: PWC (2009) Essential Services Commission Water Price Review: Demand. Frontier estimates based on YVW (2012) End Use Model.

Based on the information Frontier had for the draft report it was not clear if YVW have applied price elasticity to its demand forecasts. In the draft report Frontier requested YVW provide information that evidences how its forecasts reference elasticity.

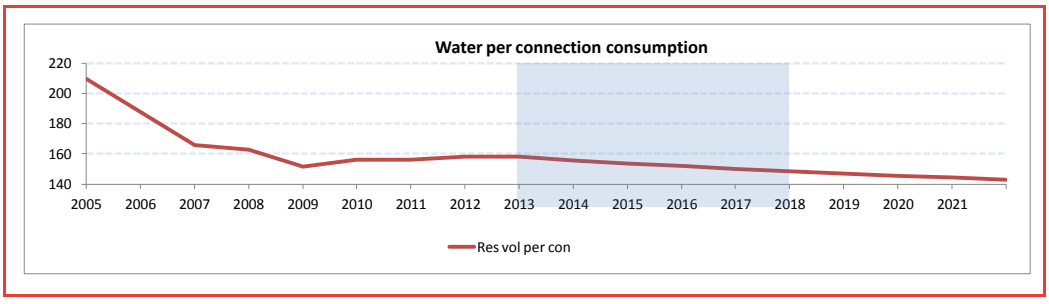
In response to the draft report YVW stated that it assumed that the 34% bill increase will have the effect of reducing demand by just 1.9% over a year which is equivalent to an elasticity of -0.057. This effect has been applied by YVW as a -0.04 elasticity on indoor uses and -0.18 on outdoor uses.

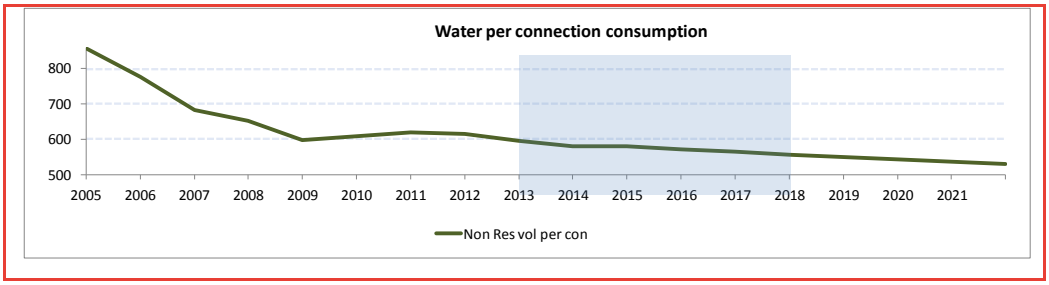
Large non-residential users are considered to be more price elastic by YVW than smaller commercial users. YVW applied an elasticity of -0.1 to demand for customers > 10 ML per annum whilst for all other an elasticity of -0.05 has been applied.

For the whole non-residential sector this represents a weighted price elasticity of -0.07. This results in an overall volume effect of -2.5% in response to a 35% increase in price.

While YVW was proposing increasing volumes over the course of the regulatory period, these volumes would not appear to be consistent with the relatively greater growth rates in connections. The primary reason for this is that the Water Plan forecast are based on an assumed increase in water use efficiency over the regulatory period. This assumption is evident when the forecasts are broken into residential and non-residential water consumption per connection forecasts (see Figure 26).

Figure 26: YVW water consumption per connection





Source: Index based on YVW (2012) Water Plan, 2005=100

Based on the data available to Frontier it was not clear how YVW had incorporated bounceback into its forecasts.

In the draft report Frontier requested YVW provide additional information regarding forecast and bounceback. YVW's response noted that the increase in average daily per capita usage from the low point in 2010/11 (148 litres) to 2012/13 (154.6 litres) is 4.4%. YVW stated that this increase is in line with Sydney Water's bounceback estimates of around 3.4% to 4.4% due to moving from Level 3 restrictions to Water Wise Rules (after 15 months).

YVW identified rainwater as one of the primary drivers behind ongoing efficiency in water use. Yarra Valley Water's 2011 Appliance Stock and Usage Patterns survey (ASUPS 2011) found that 30% of homes have a rainwater tank and 9% of homes now have a rainwater tank connected to a toilet whilst a further 3% of homes have their rainwater tank connected to a laundry. YVW also estimated that 20% of garden use is met by rainwater.

YVW estimated that without the use of rainwater YVW's per capita demand would increase by around 7 litres per day. YVW believe that this increased use of rainwater as an alternative to potable water limits the potential for a post-restrictions increase in potable water.

In the draft report Frontier stated that it was concerned that the forecasted volumes may be understating bounceback. In the draft report Frontier did not amend YVW's volume forecasts to reflect its concerns, but rather requested YVW rerun its bounceback model to include the most recently available data. Frontier also requested YVW provide it with consumption data for the current year to date. In response to Frontier's draft report YVW did not rerun its bounceback model but did provide the following additional information:

- an update of water usage for the current year based on an additional five months of bulk water purchase data covering late spring and the summer months of 2012-13
- analysis which has estimated the influence of the current he current years climatic conditions on water consumption in Melbourne.

YVW stated that actual bulk water usage for 2012-13 (to date) is 11.2% higher than the same period in 2011-12. In terms of an annual forecast YVW believe that this increase over the year observed to date will translate in to an annual increase of 9.2% on 2011-12

After correcting for weather YVW estimate that the demand forecast for 2012-13 will represent a 5.7% increase on 2011/12. The likely actual volume for bulk water in 2012-13 will be 146,000 ML and the weather normalised volume will be 141,500 ML. This latter figure is the estimated total water usage after allowing for differences caused by weather conditions. This weather normalised growth encapsulates any associated bounceback.

YVW stated that there was some uncertainty regarding how the increase in bulk water volumes translated into changes to the residential, non-residential and non-revenue segments. Accordingly, YVW has assumed that Non Revenue Water has not changed and that only customer usage needed to be adjusted. After allowing for customer growth and efficiency gains the 5.7% growth translates into an underlying increase of 4.8%.

Water plan residential forecast have an underlying bounceback increase of only 2.9%. YVW has revised its forecasts to better account for bounceback by increasing residential forecasts by a flat 2%. This additional 2% increase combined with the underlying assumed 2.9% bounceback assumed in the water plan forecasts approximates the expected 4.8% bounceback.

The same rate (2% increases) has been applied to non-residential water volumes.

Finding

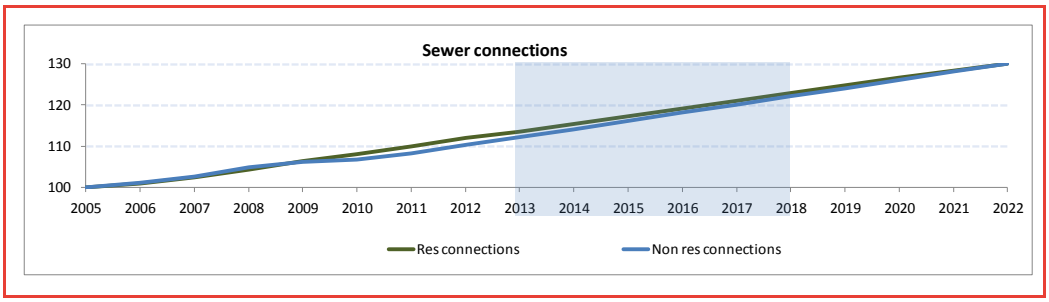
Frontier has amended YVWs forecasts for both residential and non-residential water volumes to better account for more recent data regarding bounceback. The revision is consistent with YVW's response to Frontier's draft report.

9.4 Sewage

Customer connections

YVW sewerage connections growth numbers are consistent with those used for water connections. It is reasonable to assume that growth dwellings will be serviced by both water and sewerage. We also note that forecast connections are broadly similar to historical trends (see Figure 27).

Figure 27: YVW. Growth in sewerage connections



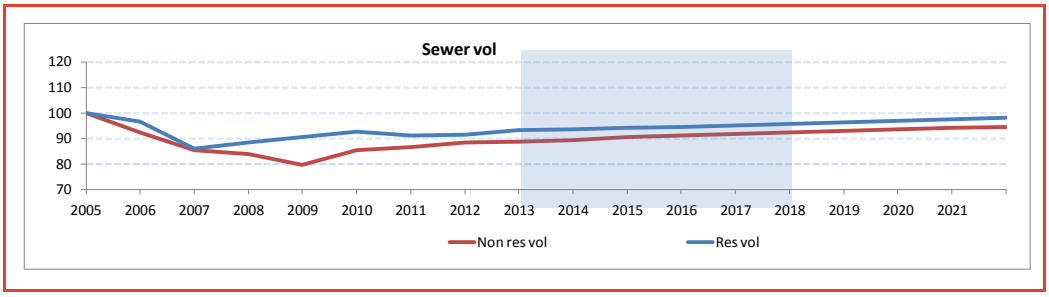
Source: Index based on YVW (2012) Water Plan, 2005=100

Volumes

Non-residential; sewerage volumes appear to be growing at a rate consistent with historical trends and with forecast growth for residential customers.

Similarly residential water use is appears to be consistent with historical rates of growth (see Figure 28).

Figure 28: YVW: Growth in residential and non-residential sewage



Source: Index based on YVW (2012) Water Plan, 2005=100

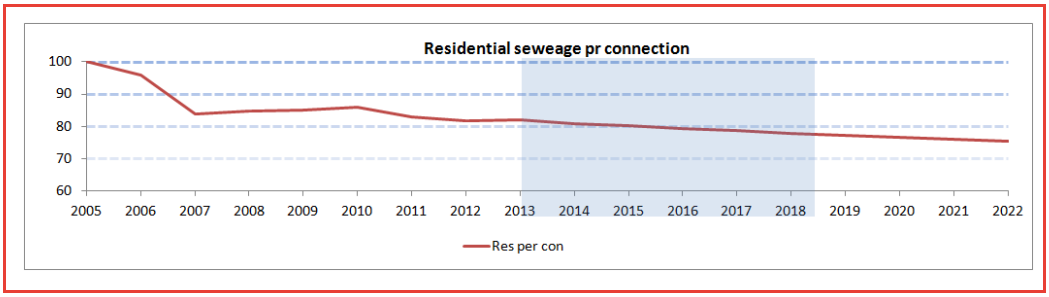
However we do note that over the regulatory period YVW is forecasting a low constant growth in volumes that would appear to be inconsistent with the strong growth forecast for connections.

Issues

On per connection basis it would appear that YVW is assuming the same efficiency assumptions as it did for water volumes (see Figure 29). This assumption may result from YVW's approach to forecasting being that sewer volumes are derived from water volumes.

In the draft report Frontier recognised that residential sewage volumes are derived from water volumes for pricing purposes and that while actual flows may exceed those forecast by business, billed flows will not (assuming the algorithm for determining volume is unchanged). In this context Frontier's principle concern is that the appropriate method for deriving sewage volumes had been adopted.

Figure 29: YVW: growth in residential sewage per connection



Source: Index based on YVW (2012) Water Plan, 2005=100

In response to the draft report YVW stated that the current assumption for the volume of water returned to sewer is around 70% of total water usage (including volumes of water to customers who have a water service only). For residential houses connected to the sewerage system the SDC formula assumes around 75% of the measured water will be returned to the sewer under minimum stage of restrictions – permanent water savings rules.

However, YVW notes that customers have changed their behaviour to be more efficient in their use of water, particularly with regard to the use of potable water for outdoor purposes such as garden watering and that the current approach is no longer appropriate. YVW propose to apply a factor that equates to 75% of the total volume of water used by customers with a water and sewerage service.

Finding

Frontier has amended the residential sewage volumes to reflect the increase in potable water use. These amendments are based on YVWs stated method of measuring sewage as 75% of water use.

Non-residential SDC volumes were amended based on the ratio of non-residential SDC to non-residential water volumes forecast in the water plan for each year of the regulatory period.

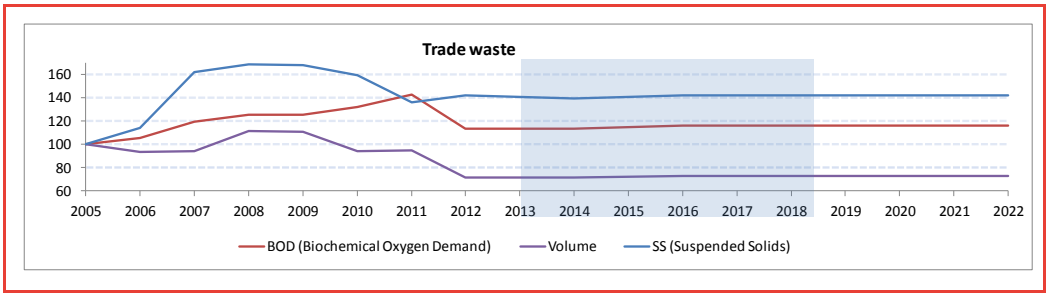
9.5 Trade waste

Connections and Volumes

YVWs water plan does not provide any information regarding the method and reasoning behind YVW's forecast trade water forecasts. However, Frontier notes that with the exception of BOD, recent historical data indicates that trade waste volumes may be declining over time (see Figure 30).

Given this trend and YVW's forecast to hold volumes constant, Frontier does not believe YVW's forecasts are overly conservative.

Figure 30: YVW: growth in trade waste volumes



Source: Index based on YVW (2012) Water Plan, 2005=100

Finding

Frontier has not amended the trade waste fixed and volumetric forecasts forecast by YVW.

9.6 Recycled water

Customer connections and volumes

Consumption of recycled water is forecast to rise significantly over the period as new alternative water supplies are commissioned.

Finding

Frontier has not amended the recycled water forecasts proposed by YVW.

9.7 Revisions to forecasts

Table 29: YVW revisions to forecasts

	Tariff	2013-14	2014-15	2015-16	2016-17	2017-18
Water Plan	Residential Block 1 Water	75,236,481	75,199,701	75,534,380	75,704,186	75,917,071
Revision	Residential Block 1 Water	76,741,211	76,703,695	77,045,068	77,218,270	77,435,412
Water Plan	Residential Block 2 Water	17,504,805	17,496,248	17,574,115	17,613,623	17,663,154
Revision	Residential Block 2 Water	17,854,901	17,846,173	17,925,598	17,965,896	18,016,417
Water Plan	Residential Block 3 Water	5,752,688	5,749,875	5,775,465	5,788,449	5,804,727
Revision	Residential Block 3 Water	5,867,741	5,864,873	5,890,975	5,904,218	5,920,821
Water Plan	Non-Domestic Usage	25,004,561	24,736,217	25,129,299	25,090,067	25,168,999
Revision	Non-Domestic Usage	25,504,652	25,230,941	25,631,885	25,591,868	25,672,379
Water Plan	Residential SDC	69,648,236	69,776,993	70,266,355	70,612,348	71,003,462
Revision	Residential SDC	75,347,890	75,311,056	75,646,230	75,816,288	76,029,488
Water Plan	Non-residential Sewage	12,815,534	12,910,643	13,073,461	13,150,405	13,244,588
Revision	Non-residential Sewage	13,071,845	13,168,856	13,334,930	13,413,413	13,509,480

9.8 Summary

This review of YVW's urban demand forecasts found:

- Forecasts are based on appropriate forecasting methodologies.
- Forecasts generally reflect reasonable assumptions about the key drivers of demand. The exception is an understated bounceback assumption for residential potable water users.
- Forecasts generally use the best available information such as the VIF's 2012 estimates of dwelling growth.
- Forecasts for residential services generally rely on well developed end use models and are therefore not expected to be biased due to method. Non-residential water and sewerage use is based on the extrapolation of historical trends regarding average consumption and is therefore not expected to be statistically biased.
- Forecasts do account for price elasticity. Elasticity has been applied to residential use based on the variable block tariff.

FRONTIER ECONOMICS | MELBOURNE | SYDNEY
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com
ACN: 087 553 124 ABN: 13 087 553 124