



Review of Water Consumption Forecasts

REVIEW OF WATER CONSUMPTION FORECAST IN
GOSFORD CITY COUNCIL'S 2008 SUBMISSION TO
IPART ON PRICES TO APPLY FROM 1 JULY 2009

- Final
- 12 December 2008



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1. Executive Summary

The NSW Independent Pricing and Regulatory Tribunal (IPART) is in the process of setting the charges for a range of monopoly services provided by Gosford City Council (GCC). These include potable water and recycled water services.

As part of this process, GCC provided their forecast for future water consumption to IPART. This forecast was based on the demand estimated as part of an Integrated Water Cycle Management Study (IWCM) for Gosford LGA, which was completed in mid 2007. The IWCM study's primary purpose is strategic planning for the water utility. It is a requirement of the NSW Department of Water and Energy (DWE) "Best Practice Management of Water Supply and Sewerage Guidelines 2004" and forms part of a range of initiatives by the NSW Government to improve water management for local water utilities.

The IWCM included an assessment of a range of factors and initiatives affecting water consumption rates and patterns. These include recycled water and water reuse programs, stormwater harvesting, residential retrofit programs, community education, water conservation and demand management for high water users, rainwater tank rebate programs and integration of BASIX requirements for new development.

IPART engaged Sinclair Knight Merz (SKM) to undertake an independent review of GCC's water consumption forecasts over the next five years, comment on the suitability and robustness of the approach used to develop these forecasts and provide a report as to the reasonableness of the data and assumptions used.

This report provided to IPART contains SKM's views on GCC's forecasting methodology and the reasonableness of estimated water savings from water restrictions and demand management programs.

This report provides qualitative comment on the:

- suitability and adequacy of the approach used for water consumption forecasting
- suitability and adequacy of the data and information used as input
- suitability of the assumptions
- application of the methodology
- the balance between the use of historical trends and key drivers in generating the forecasts.



1.1. Forecasting Methodology

The GCC forecasting methodology is based on a calculation of per capita water demand that accounts for variations in climatic conditions, water restrictions and demand management initiatives. A regression model was developed for the per capita demand, which is an appropriate approach, but did not include any demographic or socio-economic variables. SKM suggest that a test of the significance of other potential drivers of water consumption should have been carried out, and that inclusion of significant variables could have slightly improved the reliability of the forecast. Other than this, the approach used by GCC to predict future demand, being based on historical daily water production data, is considered to be reasonable.

A regression model was produced to predict the per capita demand data using daily temperature, rainfall and evaporation data as variables. This provided an estimate of the historical per capita potable water demand which is relatively independent of climate variation and water restrictions. Water meter data from a period without water restriction (three years, between Jan 1999 and Jan 2002) was used to calculate a per capita potable water demand. GCC calculated a climate corrected mean per capita demand of 328L/p/d (GCC 2006). This baseline per capita demand was then used to predict future water consumption based on predictions of population and demand management, including water restrictions. Estimated savings through water restrictions are subtracted from the unrestricted metered consumption forecast in order to arrive at the final estimate of future metered consumption.

The methodology used by GCC to forecast water demand is almost identical to that used by Wyong Shire Council (WSC) in their 2008 submission to IPART.

SKM found that the methodology used by GCC to forecast demand was generally robust. GCC's modelling methodology was supported by reporting on the model development, calibration, historical demand analysis and on the assumptions made in demand forecasting.

SKM suggest that consultation with high water users on their current and future demand management and water conservation program or initiatives could result in a more robust assessment of the forecast. This would replace the assumption that the commercial demand would have the same annual growth as population.

1.2. Input Data and Assumptions

The GCC forecasting methodology is based on population growth rate of 0.6% per annum, which is consistent with that from the NSW Department of Planning (DoP) (DoP 2005). SKM assume the DoP's population projection is a reasonable input for the future growth component of the forecast.

Assumptions that were used in the forecast included:

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1. Demographic or socio-economic variables were assumed to be not significant, and so not included in the regression model.
2. Non-residential demand sectors will increase in line with residential population growth and that no new large water users will be established.
3. The trend towards increasing appliance efficiency is anticipated to continue into the future and will result in changes in household water use per account.
4. Proposed price increases will be implemented and a price elasticity of -0.2 for outdoor use and -0.05 for indoor use apply.

These assumptions are considered reasonable.

1.3. Consumption Patterns

In the financial year 2007/08, GCC supplied approximately 11 GL of water to a residential population of around 158,000. Annual demand for water in Gosford LGA has been decreasing for the last 7 years due to effect of demand management and water conservation initiatives, including water restrictions, and source substitution from rainwater, stormwater and recycled water.

1.4. Water Restrictions

WSC are predicting the progressive lifting of water restrictions, with no water restrictions in place by the end of the determination period.

The assumed water consumption reductions through water restrictions are shown in **Table 1**.

■ **Table 1. Current Restriction Guidelines (WSC 2008).**

Restriction	Initiate Restriction when Total Storage Reduces to	Target Reduction during Restriction Level
Level 1	40%	8 %
Level 2	30%	16 %
Level 2a/ 2b	22%	24 %
Level 3	18%	30 %
Level 4	14%	32 %
Level 5	12%	38 %

SKM is of the opinion that GCC's methodology provides a reasonable assessment of the impact of water restrictions.

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1.5. Demand Management

SKM found that GCC have included the influence of demand management initiatives in their forecast. Due to a lack of historical data and effectiveness reporting, GCC were required to assume the resulting reductions in consumption. GCC assumed that a total of 2.4GL/a is saved through its demand management initiatives. They are, therefore, assuming demand management is reducing consumption by 16% to 22%.

1.6. Water Recycling

GCC quantified the expected savings through existing and proposed water recycling schemes. Details on how these were derived were not included, and so assumed appropriate.

1.7. Water Pricing

GCC assumed a price elasticity of -0.2 for outdoor use and -0.05 for indoor use to include the predicted effect of their proposed price structures in their water consumption forecast. This is generally consistent with the findings of a survey of price elasticity studies conducted by IPART in 2003, although may be slightly underestimating the elasticity of internal demand.

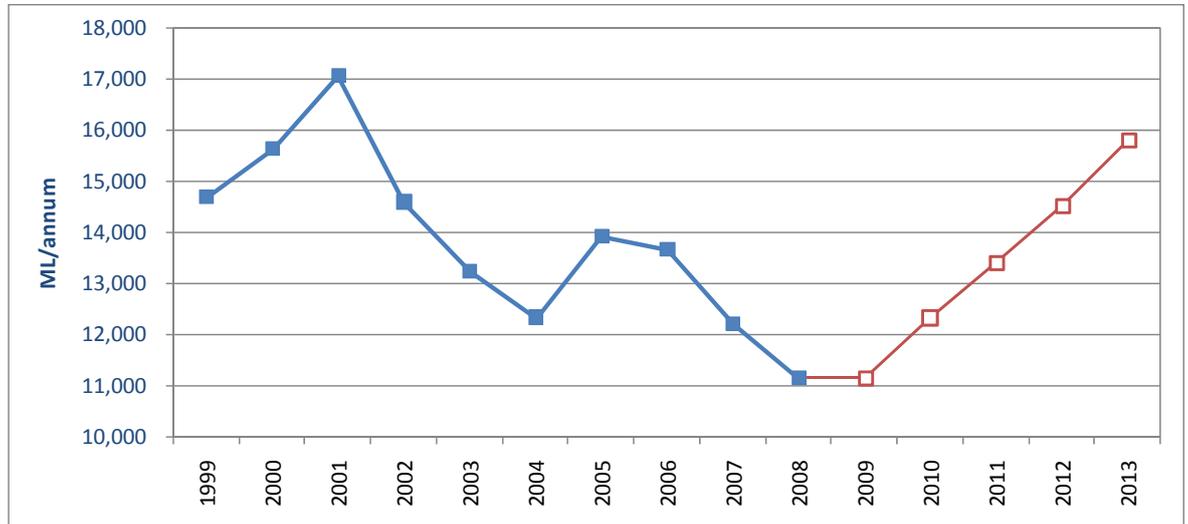
SKM suggest a price elasticity of demand of -0.35 would be more appropriate, in line with the median estimate of price elasticities as collected and analysed by Dalhuisen et al. (2003).

1.8. Bulk transfers

The bulk supply to the Central Coast from Hunter Water is climate dependent and can occur in either direction in response to dam storage levels. The current maximum transfer is 12,800 ML/a. GCC did not include transfers from Hunter Water to the Central Coast in their consumption forecast. Instead GCC considered transfers as a source of water. SKM estimate that annual transfers are likely to be 2000ML/a to 3000ML/a from HWC to the Central Coast in the next few years.

1.9. Forecasted Consumption

Figure 1 shows the metered and forecast water consumption patterns from 1999 to 2013. Consumption is predicted to increase as water restrictions are lifted. The predicted mean water consumption during next the price determination period is 13.4GL/a.



■ **Figure 1. Historic and forecast water consumption**

1.10. Summary

SKM have found the Council have:

- an awareness of their current storage and annual consumption position
- have developed and calibrated a specific forecast model
- documented the majority of their assumptions
- used the calibrated model reasonably

SKM found GCC's forecast to be reasonable, being within historical bounds. GCC have used a sound methodology which included analysis of historical consumption data for forecasting demand for existing customers, population growth consistent with the DoP projections and reasonable account of demand management and water recycling initiatives.

The issues identified around the Council's forecast methodology are relatively minor, and unlikely to significantly impact on the overall consumption forecast. SKM therefore conclude that GCC's forecast is reasonable, being based on a sound methodology, and is within historical bounds.



2. List of Abbreviations

ABS	Australian Bureau of Statistics
AIR	Annual Information Return
BASIX	Building Sustainability Index
DoP	Department of Planning
DoH	Department of Housing
DWE	Department of Water and Energy
GL	Gigalitres
GCC	Gosford City Council
GWCWA	Gosford/Wyong Councils' Water Authority
HWC	Hunter Water Corporation
IWCM	Integrated Water Cycle Management
IPART	Independent Pricing and Regulatory Tribunal
LGA	Local Government Area
ML	Megalitres (1,000,000 L)
SKM	Sinclair Knight Merz
STP	Sewage Treatment Plant
UFW	Unaccounted for water
WSC	Wyong Shire Council
WELS	Water Efficiency Labelling and Standards



3. Introduction

3.1. Purpose of Report

The NSW Independent Pricing and Regulatory Tribunal (IPART) engaged Sinclair Knight Merz (SKM) to undertake a review of Gosford City Council's (GCC's) water consumption forecasts for the next five years, 2009 to 2013. This report provides qualitative review on the:

- suitability and adequacy of the approach for water consumption forecasting
- suitability and adequacy of the data and information used
- suitability of the assumptions, particularly for water savings from water restrictions, and demand management and water conservation programs
- application of the methodology
- the balance between the use of historical trends and key drivers in generating the forecasts

It should be noted that the intention of this draft report is not to provide an alternative water consumption forecast to GCC, but rather comment on the reasonableness of their forecast, and advise if a revised forecast is necessary.

3.2. Background

GCC's forecast of metered water sales have a direct influence on the future revenue that the Council will receive. Specifically, revenue from water sales is a product of usage charges and metered water sales. If the forecast of metered water sales is not reasonable, then the price determination by IPART will result in GCC over or under recovering its required revenue. Furthermore, water consumption has an impact on GCC's capital and operating expenditure. In the pricing review, IPART is concerned with demand (metered consumption) which will be billed to the customers. SKM has therefore concentrated mainly on reviewing forecasts of billed consumption.

Prudent forecasting requires appropriate data on historical water consumption patterns, the development and calibration of a specific and rigorous methodology, the documentation of assumptions, the implementation of a calibrated model, and understanding of the sensitivity of the issues and of the proposed use of the outcomes. *Appendix C of the GCC 2008 IPART submission* contains some of this information. Additional information is provided in other referenced documents and is at times implied.



3.3. Report Structure

This report is structured to assist with the efficient review of this information, with the following sections:

- Section 1: Introduction
- Section 2: Overview of water consumption
- Section 3: Forecasting methodology and significant aspects
- Section 4: Consumption forecast and assessment
- Section 5: Summary of findings.

3.4. Potable Water Consumption as part of Integrated Water Cycle Management

The consideration and implementation of Integrated Water Cycle Management (IWCM) is a developing initiative within society. Previously, many utilities used a simple and centralised 'one use' system. This generally consisted of the harvest of surface and ground water, treatment, single use and then release to the environment after further treatment. This system produced many benefits, primarily excellent public health outcomes. However, the pressures of reduced yields from traditional supply sources, increased demand and unacceptable environmental impacts have lead to the adoption of a more integrated approach.

This approach of IWCM is developing, and has been considered by GCC as documented in reports: the *Phase 1: Concept Study – Final Report*, November 2006, *MWH and Sub-Plan – Final Report*, July 2007. The recommended IWCM solution includes:

- water use efficiency initiatives
- alternative sources augmenting existing potable water supplies
- substituting potable water for specific uses where 'fit for purpose' water is available, such as from rainwater tanks.

The water use consequences of the diversity of potential sources, the segmentation of use and the impact on cumulative water use are still being investigated and understood. Most previous models assumed reticulated potable water was used for all urban (residential and non residential) needs. This historical precedent has led to the assumption that segmentation of water use will allow the identification of water use from the various sources. The expectation that the 'sum of the parts is equal to the whole' is still to be confirmed. As this review is about a part of the IWCM, being reticulated potable water, and there is significant reliance on the previous consumption data, it is prudent to be cautious of the accuracy of the projections. Notwithstanding that the projection from historical basis requires caution; it is the best available data. The use of segmented end use models

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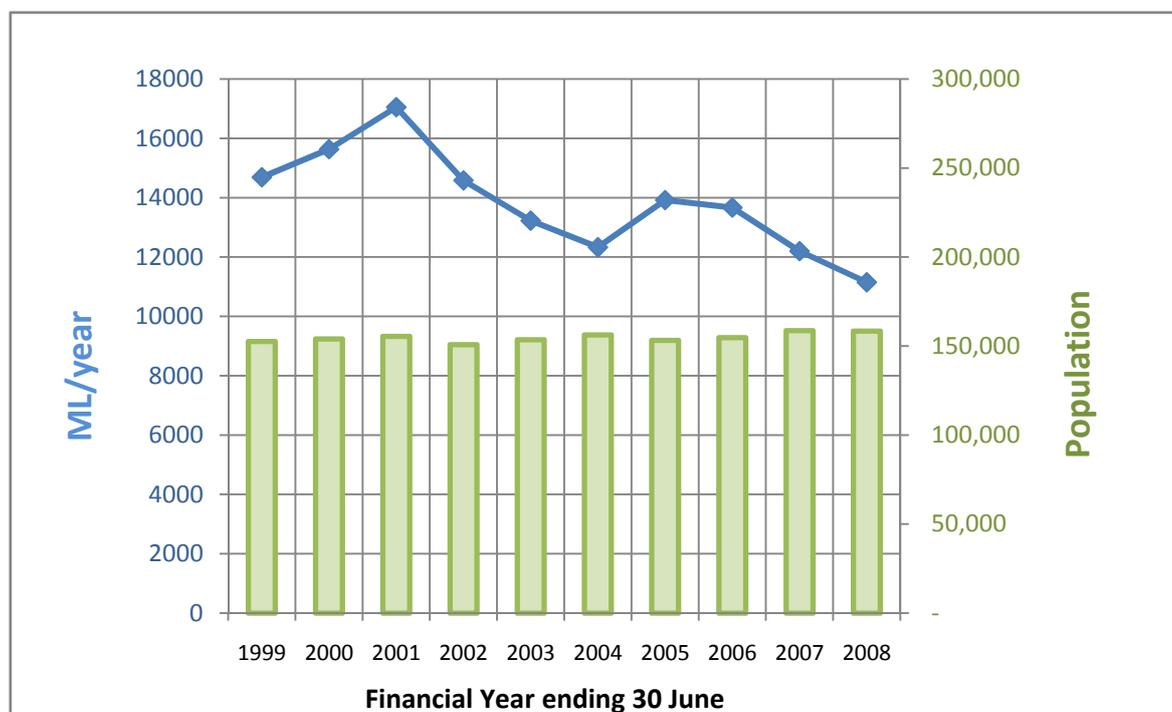
(EUM's) is still developing and requires many assumptions, and as such, is not regarded as more accurate. To at least partially resolve these matters, more 'end use' data recording and information sharing is required.



4. Water Consumption

4.1. Consumption to date

As part of the price review, IPART requested water consumption forecasts from the Council through an “annual information return” (AIR). These were made available to SKM to undertake the review. According to GCC’s AIR, in the financial year 2007/08, GCC supplied approximately 11 GL of water to a residential population of around 158,000 (GCC 2008b). The Council’s 2008 AIR, and submission to IPART, indicated that notwithstanding a relatively constant population served with reticulated potable water, annual demand for water in Gosford LGA has been decreasing for the last 7 years, as shown in **Figure 2**.

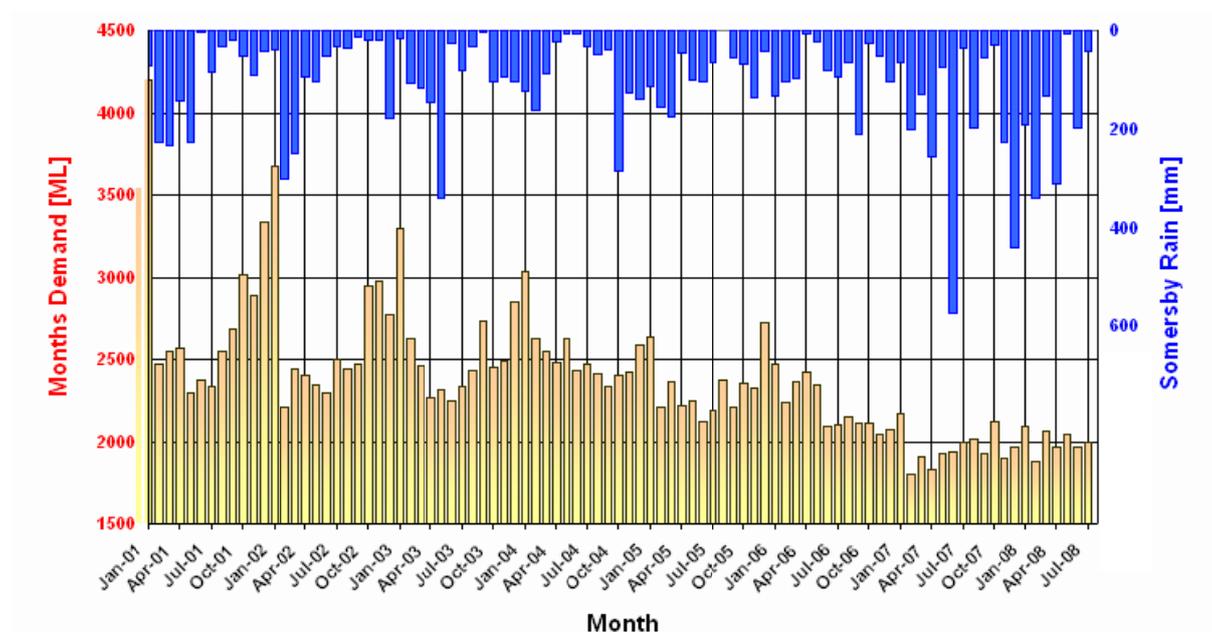


■ **Figure 2. Historical water consumption and population served with reticulated water supply in Gosford LGA (GCC 2008b)**

Part of GCC's explanation for this reduction in water sales since 2002 is the introduction and tightening of water use restrictions as dam storage levels have fallen due to a period of lower than average rainfall. The timing of water restrictions in both Gosford and Wyong Shire LGAs is determined by a joint water authority (Gosford/Wyong Councils' Water Authority – GWCWA). The reduction in water sales is also an outcome of demand management and water conservation initiatives such as BASIX and efficiency retrofits, wastewater recycling schemes, rainwater tank rebates and community education campaigns.



Figure 3 shows monthly rainfall and water consumption data from the GWCWA. It clearly shows a trend of increased consumption during lower rainfall periods.



■ **Figure 3. Monthly rainfall and Demand for combined WSC and GCC system (Gosford/Wyong Council's Water Authority 2008)**

Another influence on the water consumption was the implementation of water usage restrictions. The latest restriction guidelines (adopted in July 2006, reviewed in November 2007) are shown below in **Table 2**.

■ **Table 2. Current Restriction Guidelines, from WSC, 2008.**

Restriction	Initiate Restriction when Total Storage Reduces to	Remove Restriction when Total Storage Rises to	Target Reduction during Restriction Level
Level 1	40%	47%	8 %
Level 2	30%	40%	16 %
Level 2a/ 2b	22%	30%	24 %
Level 3	18%	22%	30 %
Level 4	14%	18%	32 %
Level 5	12%	15%	38 %

The above levels are to be adjusted as follows:

- *During March/April, subtract 2% from all levels.*
- *During September/October, add 2% to all levels.*
- *At all other times, the nominated levels stand.*



The Councils' resolution for adoption of the current restriction guidelines included recognition of the need to consider the application of water restrictions within the overall context of the drought management strategy and other relevant factors influencing risks associated with the security of the supply. The key issues identified in the resolution to be considered in applying the restriction guidelines were:

- The seasonal outlook (for stream flows, rainfall and temperature).
- Achievement of the current restriction target.
- The timing and risk associated with contingency water supplies, and

Details were not included on how the target water consumption reduction levels were set, but they do not appear unreasonable.

In response to declining water storage levels water usage, restrictions have been in place on the Central Coast since 2002. A summary of the restriction regime since 2002, including restriction level, target demand reduction and actual demand reduction, is provided in **Table 3** from GCC. **Table 3** illustrates the effectiveness of water restrictions in reducing average system demand with actual demand reductions (except in one case) meeting or exceeding target demand reductions at each restriction level.

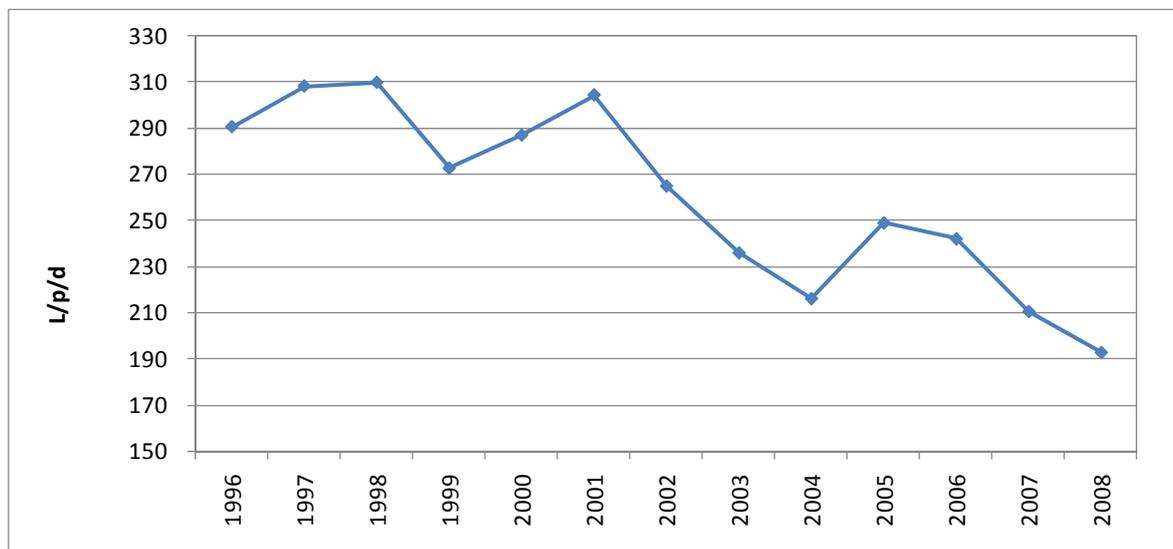
■ **Table 3. Central Coast Water Restriction Summary (GCC 2008a, p8)**

Restriction level	Date introduced	Target demand reduction ¹ (%)	Actual demand reduction ¹ (%)
1	24 February 2002	8.0	11.0
2	17 May 2004	16.0	-2.0 ²
2A	1 August 2004	16.0	20.6
2B	4 December 2005	16.0	21.4
3	3 June 2006	30.0	29.8
4	1 October 2006	32.0	32.0
3	30 March 2008	30.0	35.0

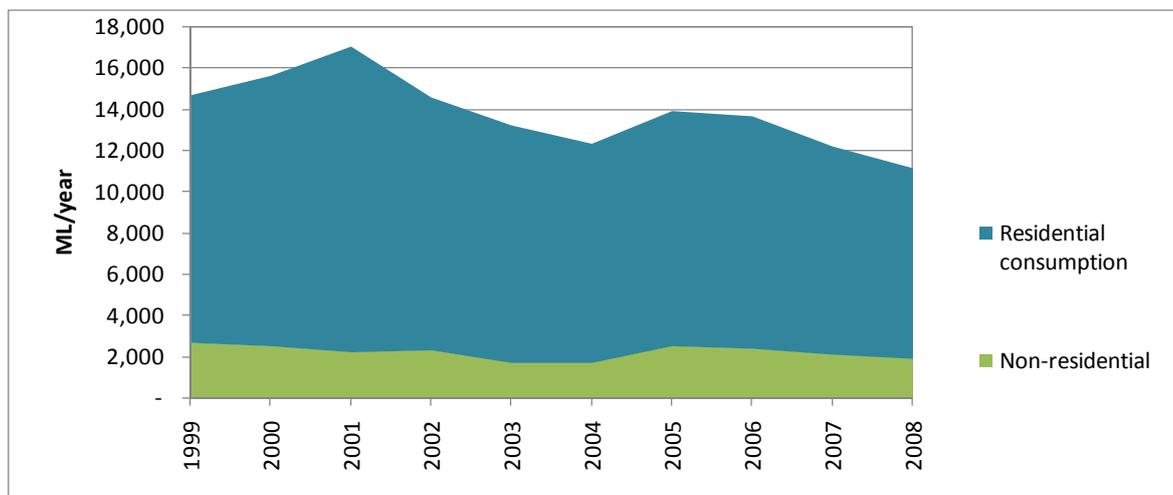
¹ In comparison to unrestricted demand.

² Target demand reduction for level 2 restrictions was not achieved as limited outdoor watering was still permissible in an extremely dry period.

Figure 4 shows the trend in metered consumption per capita per day since 1996. It indicates no clear upward trend in per capita metered consumption prior to 2001, therefore population growth is likely to have been the key driver causing the increasing total metered consumption prior to 2001. The per capita consumption has been decreasing considerably following 2001, which is attributable to water restriction and efficiency improvements.



■ **Figure 4. Per capita average consumption per day for Gosford LGA (GCC 2008b)**



■ **Figure 5. Metered water consumption in Gosford LGA by market segment (GCC 2008b)**

Figure 5 indicates that the relative importance of residential and non-residential consumption has remained fairly constant over the past decade. This is consistent with the assumptions of the previous price path review.

Sectoral consumption demands were calculated using GCC's customer accounts database. The quality of this data was not assessed by SKM, but is assumed to be good.



4.2. Summary

Annual demand for water in Gosford LGA has been decreasing for the last seven years despite the population served with reticulated potable water remaining fairly constant. It has reduced from a peak of 17,000ML/a down to 11,000 ML/a, a reduction of 35%. The reasons for this include recent increases in average rainfall, water recycling and the implementation of demand management programs, including water restrictions, leakage reduction, water management plans for high users and various residential initiatives.



5. Forecasting Methodology

5.1. Background

Multi-variable regression is the most common tool utilised when trying to understand the influence of demand management and other factors on water consumption (DEUS 2006, p3). Models relate annual, monthly and daily water demand to climate variation and other demographic and socio-economic trends. Modelling first requires model calibration against a period of data.

Key drivers of residential consumption include:

- **Population growth.** GCC has forecast population growth of 0.6% per annum.
- **Economic growth rates,** which affect water usage in several ways. High economic growth accelerates trends such as the purchase of more efficient appliances. Conversely, experience shows that higher real incomes brought about by favourable economic conditions result in increased water use through the purchase of more water consuming fittings and appliances.
- **Trends in appliance purchases and usage.** There has been a move towards the installation of larger appliances in residences, such as spa baths, which can increase water usage. The installation of automatic sprinkler systems is also likely to increase water usage. Countering this has been the trend towards more water efficient appliances, such as dual-flush toilets, low-flow showerheads and front-loading washing machines.
- **Demand management and water conservation programs.** There have been efforts by the Councils to undertake community education, promote the installation of water efficient devices and develop other programs that will reduce demand.
- **Pricing structure and level.** The price structures and levels that IPART determines will have some effect on water consumption. The water usage charge is proportional to the volume of water used, and so the price increase may have a reducing influence on the volume of water consumed.
- **Current and proposed water restrictions.** External water usage is strongly influenced by water restrictions, while internal water usage is affected to a lesser degree. Water restriction policies affect consumption while the restrictions are in place and have a residual effect for a period after the restrictions are lifted. The state of storages at the start of the forecasting period provide an understanding of the likelihood and level of water restrictions to be imposed.
- **Government policies** which have a bearing on water use, for example, the implementation of the BASIX program.
- **Household formation patterns,** such as number of dwellings, dwelling density and occupancy rates, in particular, the shift towards multi-unit dwellings and flats. The proportion



of multi-unit dwellings is increasing through urban consolidation and renewal. In addition, the trend towards a lower occupancy rate increases internal water usage on a per capita basis.

Apart from these long-term factors, there are other factors that may result in short-term variations in demand. The most important variable is climate, particularly temperature, soil moisture and rainfall, which can have an impact on outdoor water use, particularly garden watering. Temperature may also impact on water use through evaporative air-conditioning. Tourist numbers will also impact on both short-term and long-term trends in water usage.

Non-residential users include commercial, institutional, industrial and rural potable users. These users have different water demand drivers to the residential users.

Key drivers of non-residential consumption include:

- Business type
- Economic growth
- Irrigation needs
- Process and plant efficiency.

Customers in this group are also affected by water restrictions and the increasing awareness of water conservation, and in some cases have been implementing measures to conserve potable water.

It is expected that the selection of variables for inclusion in a forecasting model is accomplished using a progressive selection process, where there is a systematic and incremental integration of variables into the forecasting model, with statistical analysis of the resulting improvement in the prediction against observed data at each step. In a forward selection process, each variable is added in turn. The variable that results in the largest increase in the correlation co-efficient, while passing a test for variable significance, is added to the model. This process is continued until all variables have been added to the model or the variables are determined to be not significant. A t-test is used to determine the significance of individual variables. Variables exhibiting a t statistic higher than the critical t value are deemed significant. Annual data sets are generally used to provide insights into demographic and socio-economic demand drivers because detailed demographic and socio-economic data sets are generally not available on a shorter time series basis.

A model hindcast then provides a check on the regression model. A stable regression model will provide reasonable demand estimates throughout the full period of climate record. This should include a regular summer/winter demand pattern. An unstable model will predict demands that are well below or above those that can be reasonably expected.



5.2. Method and assumptions

WSC and GCC used the above methodology for estimating future water demand for their 2008 submission to IPART.

The forecasting methodology contains significant issues, including those related to:

- Per capita reticulated potable water use
- Population
- Demand Management, including high water users
- Substitution of potable water
- Prediction of future water restrictions
- Unaccounted for water.

These are discussed separately below.

5.2.1. Forecast per capita consumption

The ICWM approach adopted by GCC includes the use of water use efficiency initiatives and substituting potable water for specific use with 'fit for purpose' water (generally recycled water and rainwater). The inclusion of these initiatives will result in a decrease in per capita reticulated potable water use.

As would be expected, this reduction has been allowed for as illustrated in **Table 4**, which is an excerpt of *Table 3-3 Forecast with BASIX/WELS* from the IWCM report.

■ **Table 4. Forecast unrestricted water demand (GCC/MWH 2006, p52).**

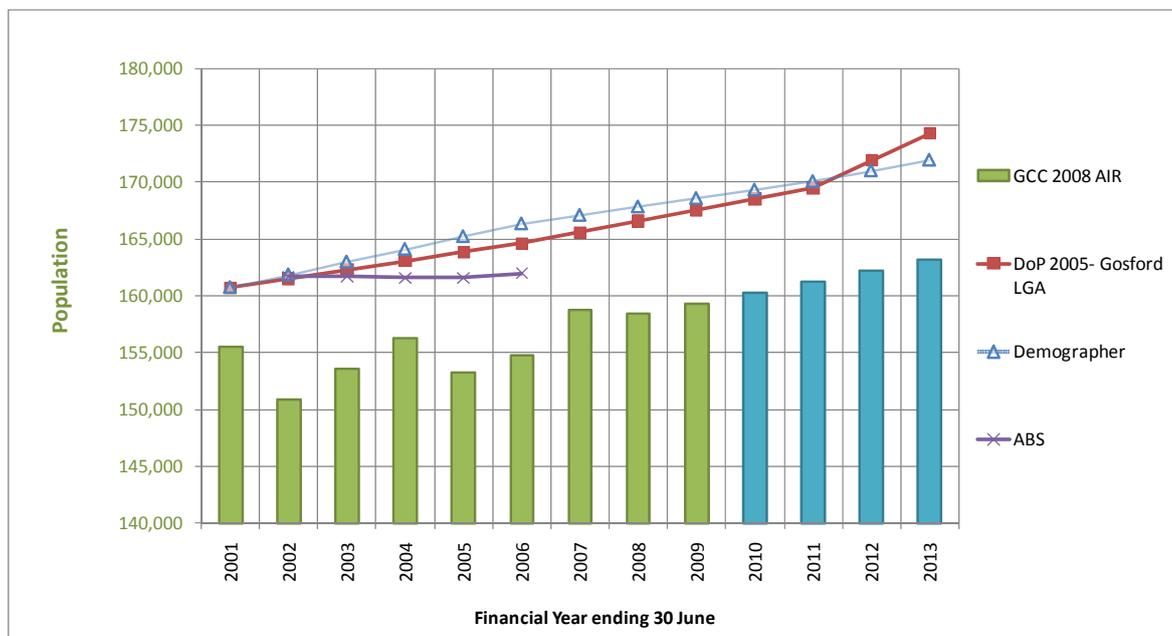
Year	2005	2010	2015
Per Capita Water Demand (L/p/d)	323	314	307

5.2.2. Review historical and forecast population

Figure 6 shows GCC's historic and forecast population as indicated in the Council's 2008 AIR and submission to the Tribunal. It also shows the population projection of a demographer commissioned by GCC (*Forecast.id 2007, p2*). It also shows the population projection for the Gosford LGA from the NSW Department of Planning (DoP) and census data from the Australian Bureau of Statistics (ABS). Note that these population estimates from DoP and ABS do not subtract the population within the LGA not served with reticulated water.



The difference between the GCC AIR and DoP estimates ranges from 8,240 higher population in 2009 (DoP 5.2% higher) up to 11,101 higher population in 2013 (DoP 6.8% higher). In 2006, the ABS estimate is approximately 7,300 more people than the GCC estimate.



■ **Figure 6. Population served with potable water (GCC 2008b, ABS 2008 and DoP 2005)**

GCC indicated in discussions that there is little green-field development expected for the Gosford LGA, and population growth is expected to occur through brown-field urban development. GCC has projected a 0.6% p.a. increase in the population supplied with potable water. **Table 5** shows the projected average annual population growth for Gosford Local Government Area from the DoP.

■ **Table 5. Projected average annual population growth for Gosford LGA (DoP 2005)**

Period	Persons	Projected Growth
2001-06	770	0.5%
2006-11	980	0.6%
2011-16	1,260	0.7%
2016-21	1,120	0.6%
2021-26	1,080	0.6%
2026-31	1,160	0.6%

GCC's population growth projection is the same as adopted by the DoP. **Figure 6** shows the actual population, as measured by the ABS, was lower than the 0.5% predicted by the DoP.



5.2.3. Demand management programs

GCC have commenced a number of demand management measures as part of the drought response and ongoing prudent management of water resources. These are listed below. Further details on the status of demand management measures and alternative water source options (as at 31st December, 2007) are provided in **Appendix A**.

- Residential Refit Programme (Incorporating residential and Department of Housing programs)
- Water Usage Audits of Non-Residential Properties
- Disconnect taps at all fish cleaning tables
- Disconnect showers at beaches & hose facilities at boat ramps
- Improving Water Efficiency of Council buildings
- Energy Performance Contract
- Council Properties Water Management Audit
- Operational changes to minimise loss of water during main breaks
- Amendments to operational procedures to reduce water losses during reservoir and mains cleaning
- Reticulation System Leakage Detection Programme
- Trunk System Leakage Detection Programme
- System Pressure Reduction Programme
- Community Water Grants - Round Two
- Washing Machine Rebate
- Smart Water Meters
- Level 2b Water Management Plans – Gosford
- Level 3 Water Management Plans – Gosford
- Community Water Grants: Round 3.

The reductions achieved through these initiatives will depend upon the level of commitment from residents, businesses, the water agency and other sections of the local government, community groups and the state government. SKM expects levels of commitment to fall if dam storage levels return to levels where restrictions are removed.

High Water Users

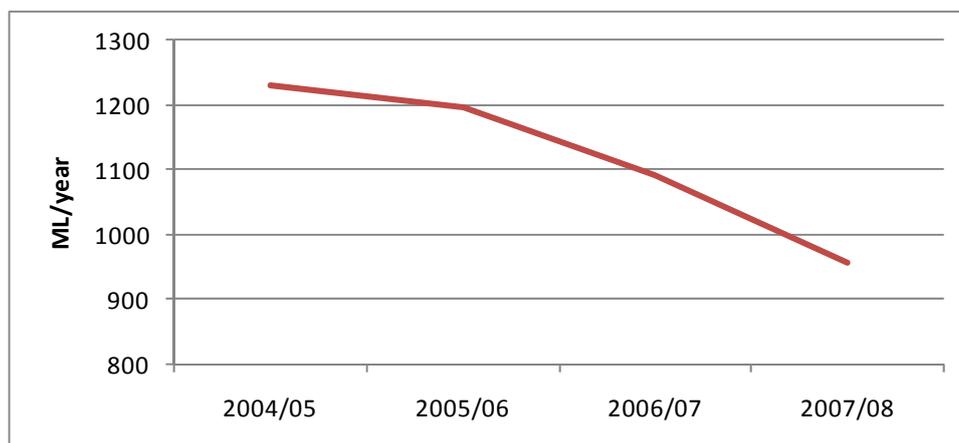
GCC defines high water users as those with annual water consumptions greater than 6ML/a. The Council has worked with some of its non-residential high water users to develop water management plans for when restrictions are in place, but few details were available. These are an



industrial and commercial retrofit and water saving programs. It involves developing strategies to improve plant and process water efficiency. Some high water users may also have their own sustainability programs, which require actions for reduction of water and energy use.

GCC did not provide any detail of outcomes from consultation with high water users, or analysis of trends in past water usage for the high water users. They did state that their high water users had relatively low consumptions compared to the Hunter, Wyong and Sydney regions.

Figure 7 indicates that the high water users' water consumption has been trending downwards for the last two years. This indicates the water management plans implemented by the council are having the desired effect of reducing water consumption. Consumption by the high users is expected to increase when restrictions are lifted, but not to the pre-management plan level, since some efficiency measures and water recycling schemes will remain.



■ **Figure 7. Top 20 water users' consumption history (GCC billing data 2008)**

5.2.4. Water recycling initiatives

Recycled water schemes reduce potable water consumption but have a biased pricing arrangement. Recycled water charges are lower than potable in order to encourage usage, although recycled water is generally more expensive for the utility to produce.

Nevertheless, these schemes are supported because they:

- Defer water supply augmentation
- Reduce effluent discharge to waterways
- Have higher supply reliability than rainwater or stormwater harvesting
- Contains nutrient, reducing the need for fertilizers in agricultural applications

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Recycled water schemes implemented by GCC are listed below. Further details on the status of water recycling initiatives (as at December 31st, 2007) are included in **Appendix A**.

- Internal effluent reuse at Woy Woy and Kincumber sewage treatment plants
- Tertiary and disinfection upgrade of Woy Woy and Kincumber sewage treatment plants to provide recycled water for reuse via tankers
- Ground water programme for irrigation uses
- Groundwater programme for water tankers
- Rainwater Tank Rebate – Residential
- Pilot Rainwater Tanks to High Schools Pre Schools and Child Care Centres
- Water Saving In Schools Programme
- Community Water Grants Schools Partnership Project (Round 1)
- Public Education
- Rural Fire Services
- Erina Depot - Nursery Redevelopment
- Water Efficient Car Wash Solution
- Erina Depot Rainwater Tank Wash Down Recycling System
- Graham Park – Central Coast Stadium
- Kincumber Treatment Plant Rising Main Surge Vessel / Internal Effluent Reuse Upgrade
- High Pressure Water Jetters
- Alternative water supply for Council sports facilities and amenities
- Duffys Reserve stormwater harvesting and groundwater project
- Worthing Creek Stormwater Harvesting Project.

SKM consider it is likely that these recycled water schemes will continue, regardless of the dam storage levels, and so the reduction in the per capita unrestricted demand will also remain.

Given that:

- population growth is to occur predominantly through urban consolidation rather than greenfield development
- the existing ocean outfall based sewerage system is very centralised, with large distances between the sewage treatment plants and potential users and
- there is little agricultural production nearby to the STPs.

SKM consider it unlikely any significant residential dual reticulation schemes will be operating within Gosford LGA within the determination period.

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Details were not included on how the estimated water savings associated with water recycling were calculated, and so were assumed to be correct. Some error is possible if the recycled water volumes are based on capacity of the recycled water treatment, rather than the historical potable water consumption, since recycled water may replace current stormwater harvesting or river extractions. It may also be used to irrigate areas that would otherwise not be irrigated, resulting in no potable water savings. The estimate of potable water savings also needs to consider whether potable water is used as top-up to meet any deficit in capacity of the recycled water system during peak demands. Given there is limited scope for water recycling in Gosford LGA, the possible error within these calculations is not significant to the overall forecast.

5.2.5. Unaccounted-for-water

Unaccounted-for-water (UFW) is defined as the difference between the bulk water production and total metered consumption. UFW is the total of:

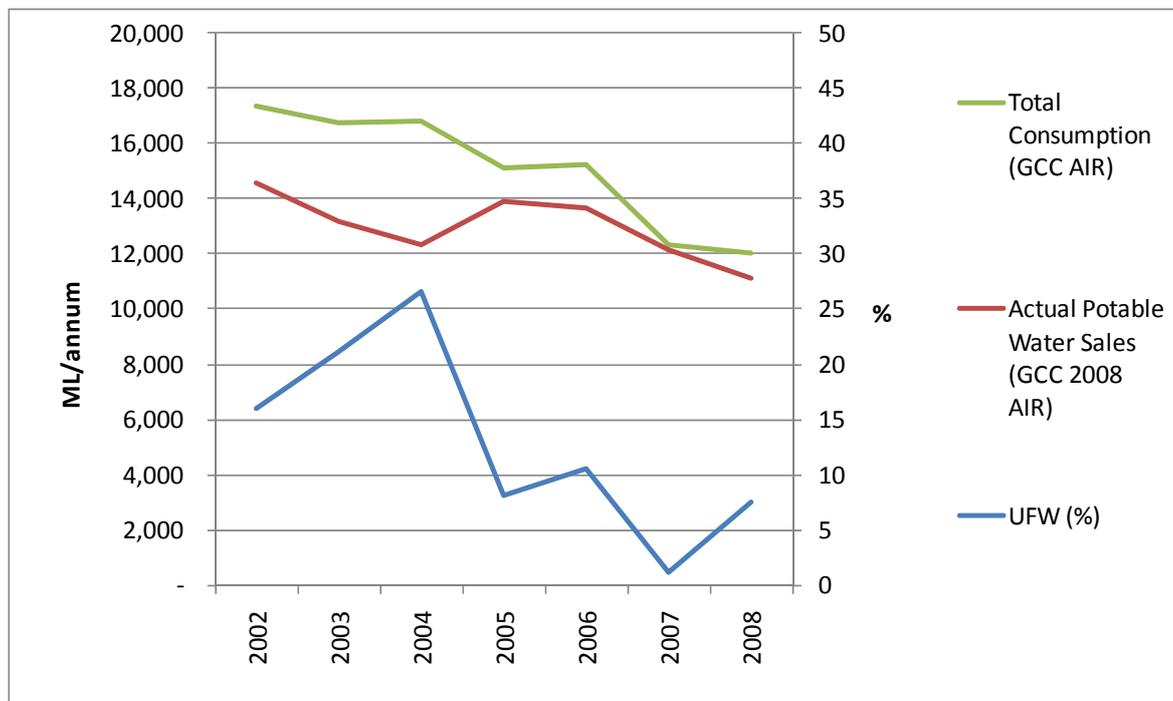
- Apparent losses – caused by under-reading of customer meters
- Unauthorised unmetered consumption – such as water theft
- Authorised unmetered consumption- such as mains flushing
- System losses – such as water main breaks and leakage prior to the property water meter.

It is possible to convert components of UFW into metered consumption, such as improving the accuracy of water meters and readings, metering standpipes, and the introduction of measures to prevent possible water theft. Similarly, metered water consumption could decrease if UFW mitigation measures such as the renewal of water meters are neglected. The incentive for possible water theft will increase with the increasing price of water, but this is not expected to be significant.

GCC estimated UFW using available records from water metering (**Figure 8**). Total water production figures are based on volumes produced at the water filtration plant, and are compiled on a daily basis. Consumption is based on a twice yearly meter reading cycle, and is annualised for the financial year.



GCC's calculation of total UFW on an annual basis varied between 1% and 27%.



■ **Figure 8. Total Annual Production, Consumption and Unaccounted for Water (UFW) – 2002 to 2008 (GCC 2008b)**

GCC suggested that the variation in UFW does not necessarily reflect changes in leakage and may be related to data recording issues, such as lagging or missing data. Also, UFW varies dramatically across the period of records. SKM suggest that this year to year variation may be due to UFW being the residual after metered consumption is accounted for, and so the variation reflects inaccuracies in metering of consumption. This is potentially explained by GCC's twice yearly meter reading cycle, and the difficulties in reconciling differing cycles for the financial year for a large number of properties. The variability in values for leakage could potentially be improved by a shorter meter reading cycle, more frequent or improved meter maintenance, calibration and renewal, or introduction of smart metering.

GCC's projections of metered consumption were obtained by assuming a constant value of 10% for the percentage of unaccounted for water. This was obtained by averaging the estimate of UFW for the last 5 years. This method of assuming a constant UFW percentage is used because of the irregularities in UFW estimates.

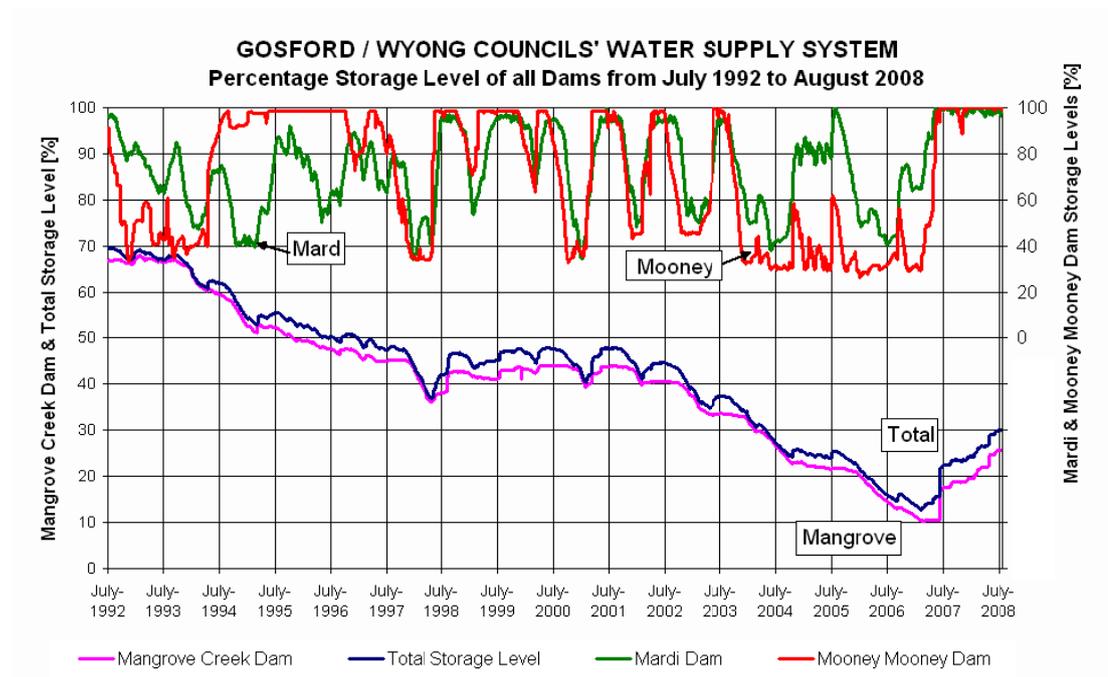


Leakage tests carried out in recent years indicate a typical leakage rate of 5% of total water produced. Given that total water produced in 2007/8 was 11,151ML, leakage equates to about 558ML/a.

For comparison, leakage tests carried out on the Wyong Shire Council system in recent years indicate a typical leakage rate of 4.7% of total water produced. It would be expected that since GCC has a higher average age of its pipeline network, it is expected to have higher losses.

5.2.6. Prediction of future water restrictions

The implementation and enforcement of water use restrictions has had, and will continue to have, an effect on the reticulated potable water consumption. Consequently, the prediction of their continuation and the level of restriction is a key issue for the period being considered. When considering the likelihood of restrictions being tightened or reduced, GCC needs to consider current storage levels, predicted yield and future consumption. GCC have predicted a return to unrestricted usage by the end of 2012/13. **Figure 9** illustrates the historic storage levels in the Central Coast dams.

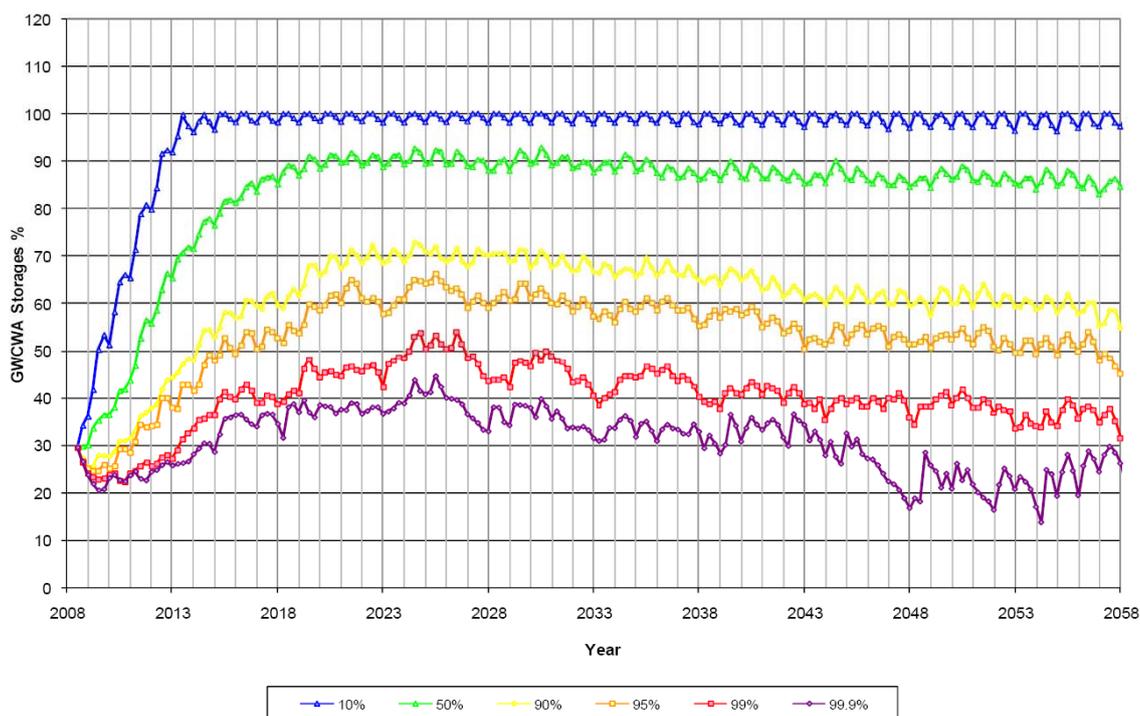


- **Figure 9. Historic storage levels**
(GWCWA, 2008- online- www.gwcwater.nsw.gov.au, accessed on 03/11/2008)

The prediction of the response of dams to future rainfall was estimated by GCC via a stochastic assessment using 1000 time series replicates, as shown in **Figure 10**. Details of this assessment are



included in *Appendix C of the GCC 2008 submission to IPART*. The assessment indicates the probability of the storage levels exceeding a storage volume. The stochastic analysis includes recent system upgrades and assumes proposed system upgrades will be implemented.



■ **Figure 10. GCC stochastic analysis of storage levels (GCC 2008a, pC3)**

The probabilities included are 10% 50%, 90% 95%, 99% and 99.9%. GCC have chosen to use the 50% probability to determine the recovery period to 47% storage, which is when restrictions are scheduled to be removed. GCC have assumed a linear response for the intermediate timeframes.

It should be noted that under the 90% scenario, restrictions would continue throughout the determination period. IPART is required to reach its own conclusions regarding what is an appropriate probability scenario to use in setting prices.

IPART has previously taken the position that consumers should not face increased prices because of temporary restrictions. However, in the case of GCC and WSC, restrictions have been in place since 2002 and water restrictions could remain in place until at least 2012/13. Therefore, for the purposes of this determination, water restrictions could be considered a fixed feature.

SKM also consider it may have been appropriate to include in this analysis an allowance for the higher probability of a lower than average rainfall year following a lower rainfall year. This is



further detailed in the SKM report on review of the yield estimates. IPART may require the generation of an independent stochastic analysis to better appreciate the significance of this approach.

5.2.7. Bulk Water Supplies

Transfers between Hunter Water and the Central Coast

HWC has been supplying water to the Central Coast since 2004/05 due to very low levels in the Gosford/Wyong's dam storages. In December 2006, the link between HWC and the Central Coast was augmented to transfer up to 27 ML per day and again in March 2008 to provide capacity to transfer up to 35 ML per day. This provides capacity to transfer up to 12,700ML/a between the two systems. The amount of water transferred each day is determined by the relative storage levels in the two systems (HWC 2008, p.45). Transfers to and from the Central Coast are made according to the following rules:

- Water is transferred from the Hunter to the Central Coast if the GWCWA storages are lower than the HWC storages. Opportunistic transfers to the south occur if the GWCWA storages are less than 70% and more than 2.5% below the HWC storages. More water is transferred to the south if the GWCWA storages are less than 60% and more than 7.5% below the Hunter storages and Mardi Dam is less than 80%.
- Transfers to the north occur if the HWC storages are below the GWCWA storages. Opportunistic transfers to the north are made if water is spilling at Lower Wyong and HWC storages are below 70% in order to delay the onset of HWC restrictions. Water is transferred to the north if the Hunter region is under restrictions and GWCWA storages are more than 7.5% higher than the Hunter storages.
- There is a 5% no transfer gap when the HWC and GWCWA storages are close to, or equal to one another, in order to avoid frequent transfers.

Based on modelling undertaken by Afton Water Solutions, it is estimated that annual transfers to the Central Coast are likely to be 2,000 ML/a to 3,000ML/a for the period 2009-2013.

GCC did not explicitly include transfers between itself and Hunter Water in its water consumption forecast. Hunter Water is considered as a water source, rather than a potential customer. A reversal in the direction of transfer may occur in the future, but this is not expected to occur within the determination period.



5.2.8. Assumptions

The following is a summary of the key assumptions made by GCC:

1. The size of the population supplied with potable water was calculated based on the number of potable water billing accounts and estimates of housing occupancy and vacancy rates.
2. Assumed annual growth in population of 0.6%.
3. It is assumed that housing occupancy rates will fall to below 2.5 occupants per household.
4. Water meter data from a period without water restriction (three years, between Jan 1999 and Jan 2002) was used to calculate a per capita potable water demand (L/p/d).
5. GCC used a 3 year calibration period for the daily model, in a period without the influence of restrictions.
6. A regression model was produced to predict the per capita demand data using daily temperature, rainfall and evaporation data as variables. This provided an estimate of the historical per capita potable water demand which is relatively independent of climate variation and water restrictions.
7. No demographic or socio-economic variables were included in the regression model.
8. No details were included on the interpolation technique used to fill data gaps.
9. There is no allowance for climate change in the water consumption forecast. Natural variability in weather is expected to dominate any variation in rainfall and evaporation due to climate change within the determination period. It would nevertheless be appropriate to look at the full range of historical meteorological data and select high and low periods of rainfall, temperature and evaporation for use as upper and lower bounds for consumption forecasting.
10. GCC calculated a climate corrected mean per capita demand of 328L/p/d (GCC 2006). This baseline per capita demand was then used to predict future water consumption based on predictions of population and demand management, including water restrictions.
11. Estimated savings through water restrictions are subtracted from the unrestricted metered consumption forecast in order to arrive at the final estimate of future metered consumption.
12. When the Consumer Price Index is considered, relative incomes in Gosford LGA have generally remained constant. As such, household income was not anticipated to be a strong driver for increasing water demands at this time.
13. The number of holiday houses on the Central Coast is decreasing. Changes in the annual number of tourists is contained in the decreasing residential vacancy rate, representing the change in holiday houses to permanent dwellings, and so does not require separate consideration.
14. The non-residential demand sectors will increase in line with resident population growth and that no new large water users will be established.



15. The trend towards increasing appliance efficiency is anticipated to continue into the future and will result in changes in household water use.
16. WELS and BASIX will further increase the uptake of water efficient fixtures and appliances, particularly showerheads and washing machines. As the WELS and BASIX programs are mandatory, their influence on demand forecasts should be included in the baseline forecast. Assumptions made in the IWCM study were:
 - The WELS will increase the uptake of efficient washing machines by 10%, low flow showerheads by 10% and efficient tap fixtures by 10%. Participation of 5% for new accounts and 1% per annum for existing accounts.
 - It was assumed that the WELS scheme will have a negligible impact on toilets sales. The rationale was that the current standard for toilets in Australia is the 6/3L dual flush toilet and that efficiency labelling for toilets was almost universal under the voluntary scheme.
 - It assumed that the BASIX requirement of a 40% water use reduction will be satisfied through the use of efficient taps/sinks (90% of new residential accounts), efficient showerheads and rainwater tanks (90% of new residential accounts).
17. Public Education - 50% of all customers will be influenced by the program. Those influenced result in 1 to 5% reduction in all uses except outdoor use, which achieves an 8% reduction. GCC do not explain how they arrived at the assumption that 50% of customers will be influenced by the program.
18. IWCM Education Program. A stepped-up education program could achieve an extra 2% reduction in outdoor use.
19. Currently planned price increases - Price elasticity of -0.2 for outdoor use and -0.05 for indoor use.
20. Residential retrofit of taps and showers - Replacement rate of 3% per annum for four years for all types of taps and sinks. Replacement rate of 8% per annum for all types of shower heads. 10% savings for taps and sinks.
21. Washing machine rebate - Annual replacement rate assumed to be 12%.
22. Dual flush toilet retrofit - Annual replacement rate assumed to be 5% per annum for three years.
23. High water user management plans for existing customers - 1% of non-residential customers per annum. 10% savings in all targeted water uses except for leakage. Temporary (3 year life) 50% leakage saving applied.
24. Pressure reduction and leak repair - 30% of the reticulation system covered by pressure reduction and 29% reduction in leakage.



25. Metering Individual Dwellings in Multi-unit Development - 5% savings in showers, baths and taps. SKM suggest that this is an underestimate, with savings of 10-20% more likely, based on the effect of the introduction of volumetric pricing on detached housing.

SKM suggest the methodology could be improved by inclusion of sensitivity testing for some of the above assumptions, but the resulting impact on the overall demand forecast is unlikely to be significant.



6. Forecasted Water Consumption

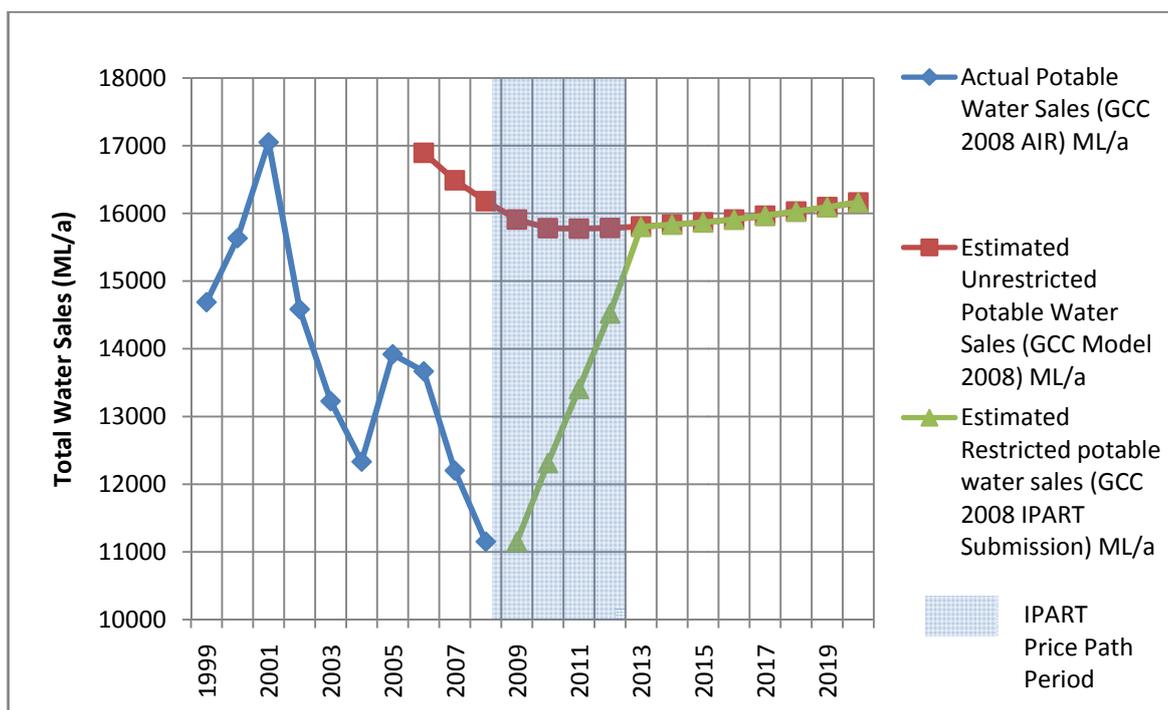
6.1. Water Consumption Forecast

The resulting forecasts are shown in **Table 6**. Water demand over the approaching determination period of 2009-13 is expected to range from 12,311 ML/a to 15,810 ML/a,

■ **Table 6. Predicted Water Sales (GCC 2008a, pC3)**

	2009/10	2010/11	2011/12	2012/13
Residential	10,218	11,129	12,053	13,122
Non residential	2,093	2,280	2,469	2,688
Total	12,311	13,409	14,522	15,810

These projections are illustrated together with the consumption to date and the projected unrestricted consumption data in **Figure 11**.



■ **Figure 11. Historical and forecast water sales (GCC AIR 2008b)**

Table 7, with values from GCC's 2008 AIR, provides a comparison of the past forecast and actual consumption values, as well as a breakdown of the current forecast by customer type.



It shows consumption over the last 4 years was 6-16% lower than that predicted in the previous IPART determination. This suggests GCC may have previously slightly overestimated the potential demand.

■ **Table 7. Comparison of the past forecast and actual consumption values, and breakdown of the current forecast by customer type (GCC 2008b)**

Source	Units	Financial Year Ending 30 June (ML 000's)						
		2007	2008	2009	2010	2011	2012	2013
GCC Submission 2007-09	ML/a	13637	13782	13847				
IPART Determination 2007-09	ML/a	12939	13128	13245				
Actual Outcome 2007-09	ML/a	12201	11151	11152				
Variation from IPART Determination		-5.7%	-15.1%	-15.8%				
GCC Submission 2010-13	ML/a				12,311	13,409	14,522	15,810
Residential Consumption	ML/a	10,095	9,249	9,250	10,211	11,122	12,045	13,113
Non Residential Consumption	ML/a	2,106	1,902	1,902	2,100	2,287	2,477	2,697
Total	ML/a	12,201	11,151	11,152	12,311	13,409	14,522	15,810
Population		158,740	158,386	159,336	160,292	161,254	162,222	163,195
Residential Connections		62,937	63,936	64,320	64,706	65,094	65,484	65,877
Non Residential Connections		2,790	3,047	3,065	3,084	3,102	3,121	3,140
Total Connections		65,727	66,983	67,385	67,790	68,196	68,605	69,017
Household consumption	kL/property/a	160	145	144	158	171	184	199
Per capita Residential Consumption	L/c/d	174	160	159	175	189	203	220
Per capita Total Consumption	L/c/d	211	193	192	210	228	245	265
Non Res Consumption per property	kL/property/a	755	624	621	681	737	794	859



6.2. Assessment of forecast

SKM has reviewed the provided information and notes the following:

6.2.1. Regression analysis

The use of regression analysis is appropriate for this assessment. However SKM believe the modelling methodology could be improved through inclusion of more variables. **Table 8** shows which of the potential influences on the per capita demand for water were included in GCC's regression modelling. Additional variables could be tested for impact, with significant variables included and insignificant variables discarded. The impact of all factors would then be transparent.

- **Table 8. Potential variables to be tested for significance in regression modelling of per capita demand**

Potential Driver	Tested
Temperature	Yes
Evaporation	Yes
Rainfall	Yes
Housing Occupancy Rates	No
Measures of commercial and industrial development	No
Consumption trends for high water users	No
Water pricing	No
Number of rainwater tank rebates	No
Restrictions	No
Economic indicators, such as per capita income	No

The additional significant variables, if included, would still result in the forecasts being considered as indicative only, as the limitations on development of accurate models include

- lack of good data for many variables,
- high correlation exhibited between some of the explanatory variables and
- unpredictability in short-term weather variables.

6.2.2. Population

Generally, when compared to the DoP population projection and ABS census data, GCC is underestimating the population it services.



6.2.3. Review of demand management programs

SKM carried out a qualitative evaluation of demand management programs, initiated by either GCC or state or federal governments, which would have potential to affect the demand over the forecasted period. Due to a lack of data upon which to base predicted reductions, the actual reductions achieved through the various initiatives may differ from those assumed. It is suggested that household specific initiatives, such as retrofits and rainwater tank rebates, be included in the customer database together with the water consumption to allow future analysis of actual reductions.

The range of demand management initiatives appears reasonable, not being overly ambitious or neglecting to include likely initiatives.

We qualitatively considered the implications of the demand management program on consumption forecasts, and checked the allowance for reduction in consumption that have been included in the agencies' forecast. The total estimate of potential volume of potable water saved through these water recycling and demand management initiatives is 2.4GL/a. Considering the total unrestricted demand estimate is of the order 11-15 GL/a, this volume is significant.

The reductions achieved through these initiatives will depend upon the level of commitment from residents, businesses, local government, community groups and the state government. SKM expects levels of commitment to fall if dam storage levels return to levels where restrictions are removed, but this is not expected to significantly affect the accuracy forecast, as it has been somewhat allowed for in the reduction in consumption through restrictions.

6.2.4. High water users

GCC did not provide any detail of outcomes from consultation with high water users. GCC did identify its highest water users, at about 120ML/a. GCC have implemented water management plans for high water users when restrictions are in place, but no details were provided. Again, this is not expected to significantly affect the accuracy forecast, as it has been somewhat allowed for in the reduction in consumption through restrictions.

6.2.5. Prediction of future water recycling initiatives

SKM consider it likely that existing schemes will continue, regardless of the dam storage levels, and so the reduction in the per capita unrestricted demand will remain.

SKM consider there is increasing public acceptance and even encouragement of water recycling schemes, and so the extent of recycling schemes is likely to increase over time, it does not appear that this trend has been allowed for in the unrestricted demand forecast. GCC may therefore be overestimating the volume of water they will sell during the determination period, but this is not



expected to significantly affect the accuracy forecast due to the limited scope for water recycling in the Gosford LGA.

6.2.6. Unaccounted for water

Leakage tests carried out by GCC indicate a leakage rate of 5% of total water produced for GCC. This equates to about 558ML/a. This is not expected to significantly affect the accuracy of the forecast, since with such a low leakage rate there is little scope for leakage to be converted into metered consumption.

Unrealistic UFW values may indicate metering inaccuracies, which may need addressing through improvement of water meter calibration and maintenance programs.

6.2.7. Prediction of impact of future pricing changes

The price of water can impact on use of water. **Table 9** shows the proposed increase from *Table 20 of GCC's 2008 submission, p51*.

■ **Table 9. Proposed Water Prices**

Charge	2009/10	2010/11	2011/12	2012/13
Water usage charge (\$/kL)	1.77	1.82	1.89	1.95

GCC assumed a price elasticity of -0.2 for outdoor use and -0.05 for indoor use to include the predicted effect of their proposed price structures in their water consumption forecast. This is generally consistent with the findings of a survey of price elasticity studies conducted by IPART in 2003, although may be slightly underestimating the elasticity of internal demand.

SKM suggest a price elasticity of demand of -0.35 would be more appropriate, in line with the median estimate of price elasticities as collected and analysed by Dalhuisen et al. (2003).

6.2.8. Prediction of future water restrictions

GCC has developed their forecast based on the 50% exceedance line for the stochastic assessment to a storage level of 47%, which is where the restrictions are removed. The use of stochastic exceedance modelling is regarded as appropriate and contemporary practice. However SKM have identified the following issues with the prediction approach:

- The lack of allowance for climate change.



- GCC's use of a linear interpolation, for intermediate forecast, notwithstanding that intermediate data was produced from the same assessment.
- The use of the 50% exceedance line, based on its use and impact on the pricing.

GCC's consumption forecasts take into account an estimate of future restriction regimes which, to a large extent, are dependent upon future rainfall. While this inherently has a considerable level of uncertainty, the above estimates are considered reasonable for the following reasons:

- SKM agree with GCC's assertion that its water supply system is not sensitive to single rainfall events and it will take several years of average or above average rainfall before the storages recover to a point that restrictions can be fully removed.
- The only event that would lead to restrictions being lifted early would be sustained wet weather. Associated with such an occurrence would be reduced water consumption due to continued low levels of outside watering. Therefore, it is unlikely that such an event would lead to increased water sales.
- It is also agreed that the communities' water usage habits change slowly when restrictions are eased. As such, it is anticipated that there will be a gradual return to increased water usage as restrictions are eased rather than a series of stepped changes which occurs when restrictions are introduced. Only physical influences, such as periods of high rainfall, could produce step changes in consumption. Many of the demand reductions, such as through the previous installation of rainwater tanks, efficient appliances, BASIX and recycling schemes, will remain.
- BASIX and water efficiency improvements (such as water efficient washing machines) will continue to progressively penetrate the area, and this will have the effect of reducing the per-capita demands, and therefore unrestricted demand.
- It is agreed that based on the above, and a relatively low population growth rate, it can be reasonably expected that metered water sales will be less than pre-restriction levels for at least the next 3-5 years.

Should measures such as the construction of the Mardi Dam to Mangrove Creek Dam link not restore storage levels, water restrictions may remain in place, and GCC may be overestimating the volume of water they will sell. This could lead IPART to set the price for water too low, resulting in GCC not earning a sufficient revenue stream over the determination period.



7. Summary

This section summarises the issues that SKM has identified in the GCC water consumption forecasts.

The approach used by GCC to predict demand is considered reasonable, and is an improvement on their previous IPART submission. It is to be noted that the forecast is a secondary outcome of an IWCM, which required many assumptions to be made due to appropriate input data not being available.

SKM have found the Council have:

- an awareness of their current storage and annual consumption position
- have developed and calibrated a specific forecast model
- documented the majority of their assumptions
- used the calibrated model reasonably

SKM identified the following issues in relation to GCC's water consumption forecasts:

- More information on the operation of the model would improve the transparency of their modelling work.
- Fuller explanations of their recycled water volume calculations and how the values were incorporated into the overall consumption prediction would improve transparency of their predictions.
- More drivers in the regression model development and sensitivity testing of some of their assumptions could improve the reliability of the forecasts.
- Consultation with the Council's high water users regarding their expected growth and changes in business type or process could be included in the water demand forecasting process.
- Details on how the water restriction target water consumption reduction levels were set were not included, but the targets do not appear unreasonable, and are close to the reduction achieved under their influence.
- Climate change in the water consumption forecast was not undertaken but this is acceptable due to the short term nature of the projection.
- GCC has used a realistic estimate for achievable savings under a combination of water restrictions, price increases and demand management activities. The estimate of savings for demand management could be improved through comparison of meter data for properties with and without the various initiatives.



- The method used to generate the stochastic analysis of dam storage may not be conservative enough, but IPART must reach its own conclusions if this is the case.

These above issues are relatively minor, and unlikely to significantly impact on the overall consumption forecast. SKM therefore conclude that GCC's forecast is reasonable, being based on a sound methodology, and is within historical bounds.



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Appendix A Demand Management and Water Recycling Initiatives

Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Residential Refit Programme (Incorporating residential and Department of Housing programs)	Estimated savings of 88.5ML/a achieved to date	<p>This programme provides subsidies for the retrofitting of water efficient appliances ie AAA showerheads, hose trigger nozzles and tap aerators</p> <p>As of 31st December 2007 a total of 8507 residential properties have been fitted in the Gosford and Wyong area of operations.</p> <p>On 5th November 2007 the Department of Housing (DoH) refit program commenced. This program will see water efficient devices fitted to the 4000 DoH properties on the Central Coast. It is anticipated that the program will be completed by March 2008.</p>
Water Usage Audits of Non-Residential Properties	78 ML/a current achievement (Based on pre and post audit consumption, excluding Festival Development Corp. as audit revealed metering error)	<p>This programme funds audits of major non-residential water users to identify and implement water savings. All properties below have been audited and implementation of identified actions is being monitored through the Level 3 WMP process.</p> <p>Council Chambers</p> <p>Sara Lee</p> <p>Chickadee Chicken</p> <p>CSR Hebel</p> <p>Crowne Plaza Terrigal</p> <p>Erina Fair</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		Festival Development Corporation – Mt Penang Wella Gosford Hospital
Disconnect taps at all fish cleaning tables	1 ML/a achieved	Programme complete. All fish tables have had water disconnected. Council had resolved to leave these in operation under previous restrictions. Under Level 4 all are now disconnected.
Disconnect showers at beaches & hose facilities at boat ramps	9 ML/a achieved	Completed
Improving Water Efficiency of Council buildings	1 ML/a achieved to date	<p>This programme involves reducing of flush cistern or waterless toilets as appropriate, flow reducing devices (on basins) and AAA showerheads in Council buildings.</p> <p>The following have been completed:</p> <p>Chambers (July 30, 2004)</p> <p>Flow restrictors fitted to all Council showers/hose cocks (July 30, 2004)</p> <p>AAA shower heads fitted to all oval amenity showers (July 30, 2004)</p> <p>Senior Citizens (Dec 2004)</p> <p>Surf Life Saving Clubs (Dec 2004)</p> <p>Rainwater Tank installed and connected to</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		toilets at Councils Terrigal Childcare centre (Dec 2005)
Energy Performance Contract	1ML/a	<p>Complete: Installation of Waterless Urinals in Council Chambers plus installation of flow restrictors on all tapware. Also energy/water efficiency improvements at the following buildings:</p> <p>Arts Centre</p> <p>Erina Depot</p> <p>Ettalong Senior Citizens</p> <p>Gosford Library</p> <p>Gosford Pool</p> <p>Kincumber Library</p> <p>Kincumber STP</p> <p>Laycock Theatre</p> <p>Railway Car Park</p> <p>Woy Woy Depot</p> <p>Woy Woy Library</p> <p>Woy Woy Major Sewer Pumping Station</p> <p>Woy Woy STP</p> <p>132 kW micro hydro electrical plant at Somersby Water Treatment Plant</p> <p>PV solar panels at Kincumber, Gosford and</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		<p>Woy Woy Libraries</p> <p>Kincumber and Woy Woy STP variable pump speed drives</p> <p>Kariong Oval subsurface irrigation</p> <p>Estimated to save 1ML/a.</p>
Council Properties Water Management Audit	<p>9ML/a</p> <p>Water savings to date are based on leaks identified and fixed.</p>	Complete: A total of 4009 Water audits have been undertaken.
Operational changes to minimise loss of water during main breaks	<p>10 ML/a in major mains</p> <p>50 ML/a on normal main breaks</p>	Crews are required to provide a rapid response (24 hrs per 7 days) for all reported water leaks. All leaks are treated as high priority
Amendments to operational procedures to reduce water losses during reservoir and mains cleaning	<p>10 ML/a achieved</p>	This involves directing flushed water from pipes and reservoirs into tankers for re-use
Reticulation System Leakage Detection Programme	<p>570ML/a</p> <p>In progress</p> <p>(further savings may be made with regular updates)</p>	<p>This programme commenced January 7, 2004 and is designed to identify and reduce the level of leakage in the water supply system.</p> <p>The entire reticulation network has been surveyed and a second round of leak detection works has commenced.</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		In addition to the field survey, water meters will be installed throughout the network to monitor bulk flow water movements. This will enable calculation of base flows within supply zones to assist with the identification of leakage.
Trunk System Leakage Detection Programme	1.5ML/a	All accessible trunk mains have now been tested for leakage. Programme complete.
System Pressure Reduction Programme	150ML/a	<p>This programme provides for the reduction of leakage from the reticulation network and end usage by lowering pressures where practical. Area's identified to be addressed are:</p> <p>Woy Woy ~120ML/a, Status: Booster pump station works complete and tested, gradually reducing pressure to minimise operational issues</p> <p>Patonga ~4ML/a & St Hubert's Island ~8ML/a. \$30K funding assistance has been provided by the Water Loss Management Program for this project. Installation will commence early 2008.</p> <p>Pearl Beach ~7ML/a Funding assistance will be sought for additional leakage reduction projects under the Water Loss Management Program in Jan 2008.</p>
Internal Effluent reuse at Woy Woy & Kincumber	364ML/a	Implemented. Water used for wastewater treatment plant maintenance



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
treatment plants		
Tertiary and disinfection upgrade of KTP & WWTP to provide recycled water for reuse via tankers	25ML/a (When both plants commissioned)	This programme will supply tertiary disinfected recycled water from the Kincumber and Woy Woy STP for dust suppression, roadwork and watering of landscaped areas such as traffic islands, medium strips, etc. The Kincumber plant has been commissioned.
Ground water programme for irrigation uses	65 ML/a	<p>This programme provides for ground water to Council reserves and playing fields</p> <p>All the sport fields on the Woy Woy peninsular are now supplied with groundwater for irrigation.</p> <p>Groundwater is currently supplied to the following fields:</p> <p>Graham Park</p> <p>Leagues Club Field (from GP)</p> <p>Carington Oval</p> <p>Umina Oval (x2)</p> <p>James Brown</p> <p>McEvoy</p> <p>Woy Woy Oval</p> <p>Ettalong Oval</p> <p>Rodgers Park (x2)</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		Austin Butler Unsuccessful Bores completed include, Terrigal Haven, Haezlet Park Avoca, Frost Reserve and Adcock Park
Groundwater programme for water tankers	20ML/a	This project is supplying groundwater to fill non-drinking tankers with groundwater to replace town water. The Grahame Park & Woy Woy depot filling stations have been commissioned.
Rainwater Tank Rebate – Residential (Gosford)	163 ML/a	This programme subsidises the retrofitting of rainwater tanks, on existing (commencing January 1, 2003) residential properties, for non-drinking purposes. As at December 31, 2007, 4656 tanks had been approved for subsidy. Savings based on a 5,000L tank. The uptake this quarter (369) has increase from last quarter probably due to the State government rebate programme making rainwater tanks more cost effective.
Rainwater Tanks (DCP 165)	48ML/a	BASIX for alterations and additions came into effect 1 October 2006 and supersedes the DCP 165 completely. DCP 165 was implemented for DA's approved after October 1, 2003 incorporate a rainwater tank for non-drinking uses. 1368 water tank approvals were issued under the DCP scheme.
Pilot Rainwater Tanks to High Schools Pre	1ML/a (3 properties)	Council ran a pilot rainwater tank rebate in schools programme (valued up to \$15,000) to 1 high school, 1 primary school, 1 council



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Schools & Child Care Centres		<p>Childcare Centre. A package was also offered for a private preschool (\$7,500.00 for preschools) but no eligible applications were received.</p> <p>The tanks were installed at Council's Terrigal Childcare Centre, Narara Valley High School and Kincumber Primary. Smart water meters were installed at the schools to monitor water savings.</p>
Water Saving In Schools Programme	1.5 ML/a	<p>Gosford City Council has introduced a water saving initiative for local high schools, primary schools and non-profit early childhood centres and preschools. The Water Savings in Schools Programme is offering ten grants per year, of up to \$5,000 per school, to fund water saving projects.</p> <p>Schools can choose from three standard projects developed by Council including:</p> <p>Smart water meters,</p> <p>Waterless Urinals, or</p> <p>Rainwater tanks</p> <p>Alternatively, schools may propose other water saving projects. For example, refitting water efficient devices such as tap aerators and AAA showerheads.</p> <p>To date seventeen (17) project grants have been approved.</p>
Community Water Grants Schools	5.7 ML/a	Fifteen (15) schools and childcare centres were assisted by GCC officers with the



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Partnership Project (Round 1)		<p>concept design and application for CWG federal funding for water saving projects. The schools were encouraged to conduct water conservation audits as part of their water saving projects.</p> <p>Twelve (12) schools were successful.</p>
Public Education	1 ML/a	Council has an ongoing commitment to public education on water issues and funds education programmes in schools etc, and annual major events
Rural Fire Services	5 ML/a	<p>Implemented</p> <p>The use of groundwater by the Rural Fire Service for training purposes. Fill points are available at Woy Woy Depot and Graham Park.</p>
Erina Depot - Nursery Redevelopment	2.9 ML/a	<p>Implemented</p> <p>This project involves the redevelopment of the Nursery located at the Erina Depot. The objective is to make the nursery self sufficient for its water supply. This will be achieved through improved irrigation efficiency, capturing all stormwater (135kL storage) and irrigation water, treating and reusing it.</p> <p>Project expanded with additional 90kL storage to supply tankers for roadside and CBD garden watering.</p> <p>Savings based on metered data.</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Water Efficient Car Wash Solution	1 ML/a	Implemented. This Fleet Services Initiative will be introduced in October 2005. The water efficient car wash kit consists of a small bucket, chamois, mitt and 50ml container of the car wash solution. This solution allows a car to be washed using 4L of water with no pre or post rinsing.
Erina Depot Rainwater Tank Wash Down Recycling System	2 ML/a	Implemented. Sixteen 9KL and two 10kL rainwater tanks have been installed and are connected to wash down area for all fleet vehicles. There is also a water recycling system in place to collect and recycle the wash down water.
Graham Park – Central Coast Stadium	20 ML/a	Membrane plant is currently leased and investigations are underway for procurement of a permanent treatment plant. Membrane filtration treatment plant is installed to treat the groundwater. A total of 222kL storage has been installed for rainwater harvesting. The two alternative water sources are utilised on the playing surface, the bowling green, the leagues club and via a tanker filling point. Savings exclude rural fire service tankers reported above.
Kincumber Treatment Plant Rising Main Surge Vessel / Internal Effluent Reuse	4 ML/a	Complete. Replacement of drinking water with recycled water to fill surge vessel and truck wash down facilities.



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Upgrade		
High Pressure Water Jetters (used for cleaning sewers)	0.1 ML/a	High pressure water jetters are used to clean out sewers. The tankers have been instructed to fill up with Kincumber Treatment Plant effluent and Woy Woy depot groundwater tanker filling station.
Level 2b Water Management Plans – Gosford	432 ML/a (Based on pre restriction consumption)	Was introduced during Level 2b restrictions for large water users (>6ML/a) requiring them to implement a water usage reduction programmes. Current percentage reduction is 31.1% across group.
Smart Water Meters	0.2ML/a	<p>‘Water Guard Units’ have been installed on a range of properties:</p> <p>Duffy’s Rd Oval,</p> <p>Graham Park,</p> <p>Umina Childcare Centre</p> <p>Narara Valley High School</p> <p>Kincumber Primary School</p> <p>The units detect leakage and gather detailed water consumption data. This data will be used to monitor the results of water saving initiatives such as refitting water efficient devices, rainwater tanks and improving irrigation efficiency.</p>
Level 3 Water Management Plans – Gosford	29.9 (Based pre restriction)	Level 3 Water Management Plans objective is to save 24% on pre restriction consumption (2001). There are an additional 131 customers who are required to prepare Level



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
	consumption)	3 WMP's. Current achievement is <2.5% reduction.
Washing Machine Rebate	27.9ML	<p>The washing machine rebate programme came into effect on the 24th May 2006. The programme offers a \$200 rebate on 5A or 4 star (WELS) washing machines.</p> <p>The programme is expected to issue 1960 rebates per year for both Councils, which will save approximately 18.8ML/a across the region.</p> <p>As at 31st December 2007, 4459 rebates have been approved for Gosford Council.</p> <p>After nineteen months the uptake is more than double than the predicted uptake.</p>
Alternative water supply for Council sports facilities and amenities	35ML	<p>The programme provides for alternative water supplies to service Council fields and amenities through projects such as water tank installations for rain, recycled and ground water storage; internal connection of tanks to public amenities; installation of guttering and down pipes (to supply tanks); and bore, irrigation and amenity supply pumps.</p> <p>Nineteen playing fields have been retro fitted with rainwater tanks for irrigation/hand watering purposes.</p> <p>Rainwater tanks are progressively being retro fitted on to twenty-six (26) amenity blocks on sportsgrounds (tanks, guttering, toilets etc). To date 16 amenities blocks have been</p>



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
		retrofitted.
Community Water Grants - Round Two	10 ML/a (savings to date)	GCC was awarded with eleven (11) CWGs involving 30 individual sites. The total funds awarded was \$363,284
Duffys Reserve stormwater harvesting and groundwater project	9.3 ML/a (when fully commissioned)	Duffys reserve: Part 5 environmental assessment complete, turf management plan and irrigation system requirements being investigated. Application to DNR for a water harvest licence approved. Pending detailed design & construction.
Worthing Creek Stormwater Harvesting Project	51 ML/a (when fully commissioned)	Currently concept design is being completed by Storm Consulting. Awaiting outcome of enquiries with DWE regarding license requirements.
Community Water Grants: Round 3	32 ML/a (when fully implemented)	The Gosford City community has received over \$2.2 million in grants for round three of the Community Water Grants. The grants will fund 62 water saving projects across the Gosford area, including 27 projects from Gosford City Council. The water saving projects will by undertaken on a range of Council properties; such as amenities, surf clubs, youth clubs, childcare centres, senior citizens centres, neighbourhood centres, community halls, sports fields, recreation centres, Erina depot, Gosford/Edogawa gardens and Patonga camping ground.



Programme	Estimated Water Savings (ML/a)	Status as at 31/12/2007
Kincumber Water Recycling Project	75 ML/a (when operational)	Recycled water is reticulated to local sports fields, school and industry. Awaiting validation of water quality for regulator approval before use.