CWBC Joint IWCM Evaluation Study

Job number A060

Section 3

Technical Note 3

Demand Projection

This technical note addresses our scope of work to develop water demand projections for Central Tableland Water (CTW) County Council and Cabonne Shire Council (CSC). It is a component of the joint Integrated Water Cycle Management (IWCM) Evaluation Study required by the General Manager of Central Tablelands Water.

The technical note provides a brief description of CTW and CSC's urban water supply systems and an analysis of these councils water supply usage including historical demand and future water demand needs.

The analysis utilises the application of three NSW Department of Water and Energy (DWE) models:

- Water Demand Trend Tracking and Climate Correction Model
- Demand Side Management Decision Support System (DSS) – Simplified Model
- Rainwater Tank Assessment

This technical note is provided to the CTW and CSC as review of the outputs. Subject to feedback this data has been used to assess key capacity constraints and water supply issues. Where data gaps have been identified these have been documented in this note and will be included in the data gaps technical note that is being developed.

1 Urban Water Supply

1.1 Central Tablelands Water

1.1.1 Water Sources

CTW water sources are summarised in Table 1.

Table 1: CTW Raw Water Sources

Raw Water Source	Capacity	Comments
Lake Rowlands Dam	4500 ML	Secure yield: see section 1.1.3
Bogolong Dam	295 ML	Not in use
Gooloogong Bore	▪ Bore pump: 3.8 ML/d ▪ Bore field rated: 5.0 ML/d	Secure yield (Long term yield) - 4.3ML/d. DWE licence specifies 400 ML/a. (average 1.1 ML/d)
Bangaroo Bore	▪ Bore field rated: 3.8 ML/d ▪ Northern pump: 0.8 ML/d ▪ Western pump: 3.0 ML/d	Not in use

Raw Water Source	Capacity	Comments
Cudal Bore	▪ Well: 4 L/s (0.35 ML/d) ▪ Bore pump: 0.35 ML/d	Stand-by source that is not normally used but must still be maintained in operating condition
Blayney Well	▪ Well: 0.6 ML/d ▪ Surface Pump: 0.6 ML/d	Stand-by source that is not normally used but must still be maintained in operating condition
Quandialla Bore	Bore Pump: 1.2ML/d Bore: 1Ml/d	Only supplies the town of Quandialla

1.1.2 Water Extraction Licences

A summary of the CTW water extraction licences for the above water sources are summarised in Table 2:

Table 2: Water Extraction Licence

Raw Water Source	Volume Extraction Licence	Date Licence Valid to
Lake Rowlands Dam	4,257 ML/a	3 May 2009
Bogolong Dam - Not in use	Unknown	26 January 2012
Gooloogong Bore (No 1)	400 ML/a - in total	12 January 2014
Gooloogong Bore (No 2)		11 December 2016
Bangaroo (No 1) - Not in use	472 ML/a	22 October 2012
Bangaroo (No 2) - Not in use	472 ML/a	10 August 2008
Cudal Bore	100 ML/a	24 July 2010
Blayney Well	250 ML/a	07 April 2013
Blayney Blue Bore	250 ML/a	8 February 2013
Quandialla Bore (No1)	266 ML/a – in total	6 August 2008
Quandialla Stand-by Bore (No 2)		8 January 2013
Total	**6,467 ML/a**	

Blayney Well is a stand-by structure that is not normally used but must still be maintained in operation condition.

Data gap: Bogolong Dam volume extraction licence

1.1.3 Secure Yield

In 1991, the NSW Public Works Department undertook a yield study of Lake Rowlands Dam to determine the secure yield of the dam, which is defined as the annual water supply which satisfies a number of supply conditions, assuming certain inflow and outflow characteristics. Full details of the yield studies are provided in the 1991 report; a summary of the storage volumes and estimated secure yields is included in Table 3.

Table 3: Lake Rowlands Secure Yield

Storage Capacity (ML)	Estimate Secure Yield (ML/a)
4 500	1 600 – 2 500
7 500	2 400 – 3 500
10 900	3 300 – 4 500
15 500	4 400 – 5 800

Based on sensitivity studies carried out during the yield study, and the experience of CTW staff, the estimated secure yield is considered to be approximately the middle ranges given. CTW staff have advised that the current Lake Rowlands Dam secure yield is approximately 1900 ML/a.

1.1.4 Treatment Process

CTW operates two water filtration plants, one at Blayney and the other at Carcoar. These treatment plants ensure that the water produced by CTW meets National Health and Medical Research Council (NHMRC) Drinking Water Guidelines, 2004.

The Grenfell filtration plant has not been in operation since Bogolong Dam was taken out of service due to poor water quality.

1.1.4.1 Blayney Water Filtration Plant (WFP)

The Blayney WFP is a manually operated dual media filter plant with a capacity to deliver 6 ML/day of water. Unit operations and processes adopted in this plant are:

- Coagulation with liquid alum dosing and flocculation
- Clarification
- Filtration
- pH correction
- Chlorination
- Fluoridation

1.1.4.2 Carcoar Water Filtration Plant

Carcoar WFP has a design capacity of 9.5 ML/day. The plant has been able to deliver volumes as high as 13 ML/day. Carcoar Water Filtration Plant differs from the conventional plant at Blayney as it is a DAF (Dissolved Air Flotation) Plant. Both treatment plants have the same coagulation process using liquid alum.

1.1.5 Condition of Assets

The conditions of CTW assets were described in the CTW Operations Management Plan (OMP), February 2008 report and in Appendix E of CTW's Strategic Business Plan (SBP), 2005.

Table 4 (below) lists assets, based on the above reports, that have been identified with some deficiencies and/or constraints that potentially affect water demand and may need to be further assessed in the IWCM Evaluation Study.

Table 4: CTW Condition of Assets

Component	Year Commissioned	Condition 1- poor 10 - perfect	Deficiencies and Constraints
Lake	1950	6	Uncontrolled catchment area

Component	Year Commissioned	Condition 1- poor 10 - perfect	Deficiencies and Constraints
Rowlands			
Trunk Main 'X'	375 mm – 1966 300 mm - 1966	5 5	Still in good condition, very few breaks occur, but if the main is ever operated at its theoretical maximum transfer capacity of 9 ML/d, the margin for failure due to pressure peaks, for example, will decrease. This combined with the loss of strength and reliability due to aging could prove to be a problem in the future.
Blayney Water Treatment Plant	1966	4	In theory, the plant's throughput rate of 6.0 ML/d is limited by the filter media. An increased throughput rate of 9.0 ML/d (in line with upgrades at Lake Rowlands Pump Station and Trunk Main 'X') could be attained by changing the filter material.
Blayney Well	Data not available	Data not available	▪ Poor water quality ▪ Uncontrolled catchment area ▪ Unpredictable water table level ▪ High chlorine dosing rate to cope with unknown and varying microbiological content of the water ▪ Ability to cope with sustained operation is unknown ▪ Consumers served off main from Blayney Well to Hill Street, Blayney Reservoir get undiluted water
Trunk Main 'A'	375 mm - 1955	4	▪ No booster facilities ▪ Transfer capacity is reliant upon available head
Carcoar Water Treatment Plant	2002 WFP Reservoir-- 1954	8 4	The throughput of Carcoar WTP is proportional to water levels in Lake Rowlands due to the fact that the main feeding the WTP is a gravity main. A decrease in hydraulic gradient between Lake Rowlands and Carcoar WTP caused by falling water level in Lake Rowlands results in a reduced flow to Carcoar WTP.
Trunk Main 'D'	200 mm – 1955	6	The main is susceptible breaks under the effects of water hammer when Browns Creek Reservoir is being fed overhead.
Trunk Main 'B'	250 mm - 1955	4	The assets details list in the CTW's SBP says that the condition of this asset is 4 due to

Component	Year Commissioned	Condition 1- poor 10 - perfect	Deficiencies and Constraints
			age.
Trunk Main 'P'	100 mm - 1955 100 mm - 1990	2 8	Main is 'Italia' AC pipe which has deteriorated and is in quite bad conditions
Trunk Main 'C'	200 mm – 1946 – 1955 225 mm - 1946 – 1955 250 mm - 1946 – 1955	3 3 3	▪ There is a theoretical shortfall in the pipeline capacity. However, in practice, inability to supply has only been a problem during very high demand periods or in event of main failure. ▪ Some sections of the main are unreliable and incur relatively frequent breakages
Trunk Main 'G'	100 mm - 2007	10	None
Trunk Main 'U'	150 mm - 1957 150 mm - 2004 100 mm - 1957	4 9 5	▪ Three stand pipes along the length of main immediately downstream from Canomodine Pump Station may cause enough water hammer to rupture the main when they are closed ▪ Sections of the main are unreliable and incur relatively frequent breakages
North Canowindra Rural Scheme	North Canowindra Pump Station Reservoir #1 - 1967 Reservoir #2 - 1967	7 6 6	▪ During high demands periods, consumers at the extremities of the scheme are starved of supply due to the large demands of downstream consumers ▪ CTW has responsibility for several long service connections made of inferior grade pipe that give continuous maintenance problems
Bangaroo Bores	1999 Stand-by bore - 1987	6 6	▪ No control over quality of bore water ▪ Unknown and varying water table may not sustain bore pump maximum output for lengthy, continuous operation
Gooloogong Bore Pump Station	System rebuilt - 1999	10	None
Gooloogong Bores	No 1 – 1993	7	▪ No control over quality of bore water ▪ Unknown and varying water table may not sustain bore pump maximum

Component	Year Commissioned	Condition 1- poor 10 - perfect	Deficiencies and Constraints
	No 2 - 1987	6	output for lengthy, continuous operation ▪ Sustained supply of bore water to consumers may result in high number of complaints of poor aesthetic quality
Trunk Main 'L'	150 mm - 1980	7	Use of standpipes along main during peak demand periods starves Eugowra of supply
Trunk Main 'K'	200 mm - 1946	1	The assets details list in the CTW's SBP says that the condition of this asset is 1 (poor).

1.1.6 Service Reservoirs

CTW owns and operates 46 reservoirs. Major CTW reservoirs and their capacities are as shown in Table 5.

Table 5: CTW Service Reservoirs

	Service Reservoirs	Capacity		Service Reservoirs	Capacity
Sub-system 1	Patrick's Reservoir	0.45 ML	Sub-system 4	Moorbel Reservoir	1.14 ML
	Plumb Street Reservoir	0.91 ML		Canowindra Reservoir	0.91 ML
	Hill Street, Blayney Reservoir	1.14 ML		South Canowindra Reservoirs	2 x 0.18 ML
	Carcoar Reservoir	0.68 ML	Sub-system 5	Bangaroo Bore Services Reservoir	3 x 0.18 ML
	Browns Creek Reservoir	0.23 ML	Sub-system 6	Gooloogong Bore Services Reservoir	0.18 ML
	Millthorpe Reservoir	1.36 ML	Sub-system 7	Trajere Reservoir	0.14 ML
Sub-system 2	Mandurama Reservoir	0.91 ML		Pyes Gap Reservoir	0.14 ML
	Lyndhurst Reservoir	0.68 ML		Eugowra Reservoir	1.36 ML
	Garland Reservoir	0.045 ML		Hill Street Reservoir	0.5 ML
	Service Reservoirs	**Capacity**		**Service Reservoirs**	**Capacity**
Sub-system 3	Cargo Reservoir	0.68 ML	Sub-system 8	Grenfell North Reservoir	4.55 ML
	Cudal Reservoir	0.23 ML		Grenfell East Reservoirs	0.14 ML
					0.45 ML
	Greys Hill Reservoir	2.27 ML		Grenfell South Reservoir	0.09 ML
	Manildra Reservoir	0.45 ML		Grenfell West Reservoir	1.36 ML

1.1.7 Pumping Stations

CTW owns and operates 27 pump stations. Major CTW pump stations and their capacities are as shown in Table 6.

Table 6: CTW Pump Stations

	Pump Stations	Capacity
Sub-system 1	Lake Rowlands Pump Station	Southern Cross pump operation - 6 ML/d
	Polona Street Pump Station	▪ Pump #1 0.22 ML/d ▪ Pump #2 0.22 ML/d
	Booster #1 Pump Station	▪ Pump #1 Operation – 1.6 ML/d ▪ Pump #2 Operation – 1.6 ML/d
	Browns Creek Pump Station	▪ Pump #1 Operation – 0.4 ML/d ▪ Pump #2 Operation – 0.6 ML/d
Sub-system 2	Mandurama Pump Station	▪ Pump #1 – 0.1 ML/d ▪ Pump #2 – 0.1 ML/d ▪ Pump #3 – 0.1 ML/d
	Garland Pump Station	Pump operation - 0.1 ML/d
	Newry Downs Pump Station	7.1 ML/d
	Sugar Loaf Pump Station	6.0 ML/d
Sub-system 3	Canomodine Pump Station	▪ Pump #1 Operation – 1.8 ML/d ▪ Pump #2 Operation – 1.8 ML/d
	Cargo Pump Station	▪ Pump #1 Operation – 0.16 ML/d ▪ Pump #2 Operation – 0.16 ML/d ▪ Pump #1 and #2 Operation – 0.32 ML/d
	Cudal Booster Pump Station	▪ Pump #1 (town) – 2.1 ML/d ▪ Pump #2 (Grays Hill) – 2.1 ML/d
	Greys Hill Pump Station (the pumps can be operated individually or run together in series)	▪ Pump #1 Operation – 0.35 ML/d ▪ Pump #2 Operation – 0.35 ML/d ▪ Pump #1 and #2 Operation – 0.6 ML/d
Sub-system 4	Canowindra Pump Station	▪ Pump #1 Operation – 1.0 ML/d ▪ Pump #2 Operation – 1.0 ML/d
	North Canowindra Pump Station	▪ Pump #1 Operation – 0.43 ML/d ▪ Pump #2 Operation – 0.43 ML/d
	Nyrang Creek Pump Station	0.1 ML/d

	Pump Stations	Capacity
Sub-system 5	Bangaroo Bore Pump Station	▪ Pump #1 Operation – 1.3 ML/d ▪ Pump #2 Operation – 1.3 ML/d ▪ Pump #3 Operation – 0.6 ML/d ▪ Pump #1 and #2 Operation: 3.0 ML/d (to Canowindra) 1.5 ML/d (direct to Grenfell) 2.0 ML/d (to Grenfell via McDonalds Lane Booster)
Sub-system 6	Gooloogong Bore Pump Station	▪ Pump #1 Operation: 1.8 ML/d (direct to Grenfell) 2.6 ML/d (to Grenfell via McDonalds Lane Booster) ▪ Pump #2 Operation: 1.8 ML/d (direct to Grenfell) 2.6 ML/d (to Grenfell via McDonalds Lane Booster) ▪ Pump #1 and #2 Operation – 2.4 ML/d (to Grenfell & Eugowra/Gooloogong) ▪ Pump #1 and #2 Operation – 2.6 ML/d (to Grenfell via McDonalds Lane & Eugowra/Gooloogong)
Sub-system 7	Trunk Main 'L' Booster Pump Station	2.1 ML/d
	Trajere Pump Station	0.1 ML/d
	Broad Street Pump Station	2.0 ML/d
Sub-system 8	McDonalds Lane Pump Station	Booster Pump – 2.6 ML/d
	North Street Pump Station	0.1 ML/d
	Quondong Road Pump Station	0.1 ML/d

1.1.8 Operation, Maintenance and Administration (OMA) and Typical Residential Bill (TRB) costs

The 2005/06 DWE TBL Water Supply performance report figures are shown in Table 7.

Table 7: TBL Performance Indicators

TBL Performance Indicators	CTW Result	Ranking
Operating cost (OMA) per 100 km of main ($'000)	512	1
Operating cost (OMA) per property ($)	465	5

TBL Performance Indicators	CTW Result	Ranking
Operating cost per kilolitre (cents)	109	5
Typical Residential Bill ($)	425	2

Note 1: Ranking of 1 indicates that CTW is in the top 20% of LWUs; ranking of 5 indicates it is the bottom 20%

Data gap: Current DWE TBL performance report

1.1.9 Distribution Pipelines

CTW has approximately 295 km of trunk mains and 245 km of reticulation mains. The lengths and sizes of CTW distribution pipelines are described in Appendix E of the CTW's SBP (2005) report.

1.1.10 Performance Reporting Information

CTW reported its performance in the DWE TBL Water Supply Performance report (2005/06) (See Appendix A). While CTW's performance is generally good the report indicates that the CTW water supply system is in the bottom 20% of LWUs (relevant for comparison with LWUs of similar sizes) in the performance indicators shown in Table 8. Out of all the parameters included in the TBL performance, only the bottom 20% parameters are presented below.

Table 8: TBL Performance Indicators

TBL Performance Indicators	CTW Result	State Wide Median
Peak week to average consumption (%)	205	155
Urban population without reticulated water supply (%)	9.8	0.9
Water quality complaints per 1000 properties	10	6
Average duration of interruption (h)	4	3
Average customer outage time (min)	19	6

Potential Issue: In 2005/6 CTW TBL performance below NSW state wide median for:
- **% Urban population without reticulated water (9.8 vs. 0.9)**
- **Water quality complaints per 1000 properties (10 vs. 6)**
- **Average customer outage time (19mins vs. 6)**

1.1.11 Existing Rainwater Tanks, Greywater Use and Council Policies related to these

CTW has registered 5 rainwater tank rebate applications submissions. CTW does not have data on the exact number and size of existing rainwater tanks.

Data gap: Number of tanks, rainwater tank policy, rebate and recommended size in CTW's area of operations.

CTW is a water supply LWU and does not set policy on greywater.

1.2 Cabonne Shire Council

As a water supplying Local Water Utility (LWU) CSC owns and operates potable water supply schemes at Molong and Delgany Estate (Mullion Creek). It also owns and operates non-potable schemes at Cumnock and Yeoval.

1.2.1 CSC Water Sources

CSC water sources are summarized in Table 9.

Table 9: CSC Water Sources

Water Source	Capacity	Comments
Molong Creek Dam	1000 ML	Secure yield – see section 1.2.3.
Borenore Creek Dam	230 ML	Back-up dam – Currently not in use. Poor water quality. Secure yield – see section 1.2.3
Molong Creek Weir	50 KL	It hasn't been in use since the construction of the Molong Creek Dam (CSC staff advice).

1.2.2 Water Extraction Licence

The CSC water extraction licences for the above water sources are summarised in Table 10.

Table 10: Water Extraction Licence

Raw Water Source	Volume Extraction Licence	Date Licence Valid to
Molong Creek Dam	The diversion pipe from the dam shall be operated so as to maintain a flow in Molong Creek downstream of the dam equivalent to the flow entering the storage of the dam or: ▪ A minimum flow of 2.7 ML/d (September to April) ▪ a minimum flow of 1 ML/d (May to August) Whichever is the lesser, provided that whilst ever the flow in Molong Creek immediately downstream of the confluence of Borenore Creek is: ▪ Not less than 2.2 ML/d (September to April) ▪ Not less than 0.5 ML/d (May to August) The flow required to be released from the dam is 0.5 ML/day or equivalent to the flow entering the dam, whichever is the lesser.	Licence date - 11 March 1995
Borenore Creek Dam	Borenore Creek Dam has no licence condition relating to extraction volume.	9 January 2009
Molong Creek Weir	Molong Creek Weir has no licence condition relating to extraction volume.	29 September 2009

1.2.3 Secure Yield

The "Cabonne Council Molong Water Supply 'Secure Yield' Study" was prepared in July 2007. The recommendation of this report was that a secure yield for the Molong Water Supply should be adopted at a rate no greater than 300 ML/year.

1.2.4 Treatment Process

Water from all the sources listed above is treated at the Molong Water Filtration Plant in Park Street, Molong. Raw water is pre-dosed with soda ash, aluminium chlorohydrate, poly electrolytes and powdered activated carbon before settling in an up flow clarifier and final polishing through a sand filter. The product is disinfected using gaseous chlorine. Clarifier sludge and backwash water is directed to settling ponds from which dried sludge is transported away for disposal.

Molong Water Filtration Plant's peak capacity is assumed to be 2 ML/day (as advised by Council staff).

1.2.5 Condition of Assets

The age and condition of the major components of the Molong Water Supply Scheme are summarized in Table 11.

Table 11: CSC Condition of Assets

Component	Year Commissioned	Condition (1-5) 1=new 5=due for replacement
Molong Creek Dam	1985	3
Borenore Creek Dam	1928	2
Molong Creek Weir	1950	4
Raw Water Mains	1928-1994	2 - 5
Booster Pump Station	1979	To be demolished. The station has not been used for more than 25 years.
Filtration Plant	1960	3
Gidley Street Reservoir	1928	3
High Level Reservoir	1976	2
Gidley Street Pump Station	1976	2

1.2.6 Service Reservoirs

CSC owns and maintains two reservoirs as detailed in Table 12.

Table 12: CSC Service Reservoirs

Service Reservoirs	Capacity
Gidley Street Reservoir	0.91 ML
High Level Reservoir	1.60 ML

1.2.7 Pumping Stations

Water flows from all sources to the filtration plant and on to the Gidley Street Reservoir by gravity. The main pumping station is located at the Gidley Street Reservoir and it serves to lift water to the High Level Reservoir which provides pressure to the elevated high level zone reticulation.

Gidley Street Pump Station capacity is 666 ET's, which is approximately 1.7 ML/day.

1.2.8 Operation, Maintenance and Administration (OMA) and Typical Residential Bill (TRB) costs

The 2006/07 DWE TBL Water Supply performance report provides the following figures:

- Operating cost (OMA) per 100 km of main = $699,000
- Operating cost (OMA) per property = $557
- Operating cost per kilolitre = 186 cents
- Typical Residential Bill = $392 / assessment

TBL ranking is not available.

Data gap: Current DWE TBL performance report

1.2.9 Distribution Pipelines

Raw water from the dams gravitates to the WFP through two parallel gravity mains. These mains consist of:

- Raw water mains
  - 14320 m of 150 mm diameter
  - 18510 m of 200 mm diameter
  - 3890 m of 250 mm diameter

According to Cabonne Council – Molong Water Supply Capacity Study (August 1998), the gravity flow rate of these mains is approximately 4.1 ML/d.

Filtered water gravitates to the Low Level Reticulation system and it is pumped to the High Level Reservoir. The capacity of the reticulation mains is assumed to be no more than 2 ML/d, which is the maximum capacity of the WFP.

- Reticulation mains
  - 22150 m of varying diameters

1.2.10 Performance Reporting Information

CSC reported its performance in the DWE TBL Water Supply Performance report (2005/06) (See Appendix A). While CSC's performance is generally good the report indicates that the CSC water supply system is in the bottom 20% of LWUs (relevant for comparison with LWUs of similar sizes) in the performance indicators shown in Table 8. Out of all the parameters included in the TBL performance, only the bottom 20% parameters are presented below.

Table 13: TBL Performance Indicators

TBL Performance Indicators	CSC Result	State Wide Median
Urban population without reticulated water supply (%)	17	0.9
Water service complaints per 1000 properties	25	6
Average duration of interruption (h)	5	3

Potential Issue: In 2005/6 CSC TBL performance below NSW state wide median for:
- **% Urban population without reticulated water (17 vs. 0.9)**
- **Water service complaints per 1000 properties (25 vs. 6)**

1.2.11 Existing Rainwater Tanks, Greywater Use and Council Policies related to these

CSC has no adopted policy or rebate relating to rainwater tanks and grey water use at this stage. These issues are dealt with in the Draft Demand Management Plan. An estimate of rainwater tanks from the 2006/07 Annual Water Supply Report is as show in Table 14.

Table 14: Rainwater Tank Estimate

	Molong	Cumnock	Yeoval
Number of Residences	673	142	134
% of Residences with tanks (estimate)	40%	100%	100%
Number of Residences with tanks	270	142	134

2 Historical Demand Analysis

This section presents analyses of past and present water service demands for CTW and CSC to determine the peak day and climate corrected demand. This has been done to determine any trends or errors in the available data from Councils.

2.1 Water Demand Trend Tracking and Climate Correction Model

Climate has a significant impact on water demands. In examining long term past demand it is essential to understand the effect of climate on water demand. The DWE Water Demand Trend Tracking and Climate Correction model has been used to track the trends in water production on a climate corrected basis.

The model's approach involves two main phases. The first is to calibrate the model and track production against a defined baseline period. The second is the trend tracking phase, where the departures of the observed demands from those predicted by the baseline model are analysed.

The approach and methodology used to run this model was as outlined in DWE's Water Demand Trend Tracking and Climate Correction (Version 10) Manual, May 2002 (Reformatted June 2006).

Water demand analysis has been carried out for CTW's water supply system and for CSC's (Molong) water supply system. The data required to run the model and the steps taken to undertake the analyses are as shown in sections 2.1.1 and 2.1.2. The outputs of these analyses are shown in sections 2.1.3 and 2.1.4.

2.1.1 Data Required

The data required to run the model for CTW was provided as shown in Table 15. The data required to run the model for CSC's Molong system was provided as shown in Table 16.

Table 15: CTW - Available Data

Data required	How received	CTW Reference (file name)	
Observed Daily Water Production	From CTW – 5 years of data	R1	A060_CTW_Water_Production_Daily_ML_RevD
Population Data	From CTW – 2001 and 2006 Census Quickstats	R2	A060_CTW_CSC_Census_RevA

Daily Climate Data	From Bureau of Meteorology (BOM) - SILO	R3	CT_Data_Drill_from_1957-2008

Table 16: Molong - Available Data

Data required	How received	CSC Reference (file name)	
Observed Daily Water Production	From CSC – 5 years of data	R4	A060_CSC_Molong_Water_Production_Daily_RevB
Population Data	From CSC – 1986; 1991; 1996; 2001 and 2006 population Trend for Cabonne LGA	R5	A060_CTW_CSC_Census_RevA
Daily Climate Data	From Bureau of Meteorology (BOM) - SILO	R3	CT_Data_Drill_from_1957-2008

Until recently CSC has only gathered water consumption records as weekly totals, with weeks ending on different dates for different systems. The DWE model requires daily figures.

To calculate the water production for Cumnock and Yeoval using the data CSC has provided would be a very complex process and unlikely to be of value. For this reason it was decided that there was no significant benefit to include Cumnock and Yeoval water consumption data in this analysis. As the town of Molong is the main water consumer within CSC supply system it was decided to investigate CSC water demand analysis using Molong data only.

As with other CSC systems, Molong water consumption data was recorded on a weekly basis. The model requires daily data. To perform the trend tracking and climate corrected calculations for Molong's system, a synthetic data set was developed. It was assumed that daily distribution within each week was weighted identically to that in CTW's data. I.e. if 20% of the water consumption was on a particular day in CTW, then, 20% of Molong's weekly consumption was assumed to be used on the same day. Due the lack of data of satisfactory quality a decision was made by Council staff, of applying the synthetic data to Molong's water supply system climate correction model.

2.1.1.1 Further Input Data

The climate correction model also requires the identification and definition of three parameters:

- Period for index calibration,
- Start and end date for calibration, and
- Fixed baseline year water production per capita.

This data is identified and defined by the model user according to the data available/provided.

The selection criterion for the period for index calibration is a period that incorporates a hotter and drier than average summer period. Central Tablelands and Molong's regional daily climate data for the last 5 years is represented in the graph in Figure 1.

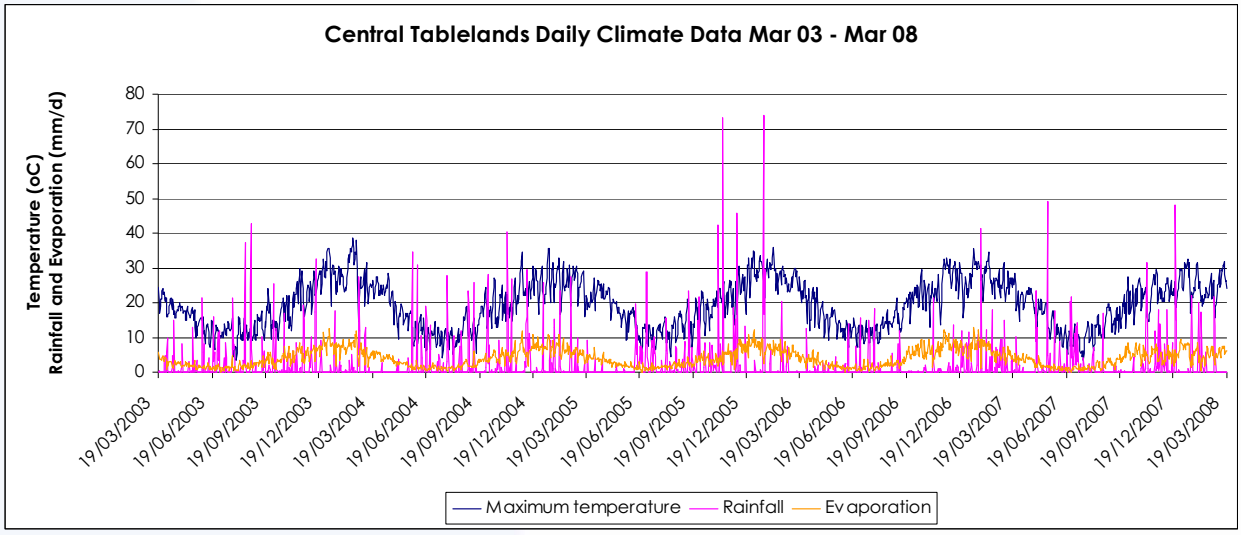


Figure 1: Central Tablelands Daily Climate Data for 5 Years. Reference: R3

The selection criterion for choosing the start and end date for calibration is a period of reasonable water consumption per capita. The fixed baseline year water production per capita is an average of the ten lowest daily records of water production within the period analyzed. CTW's daily water production is presented in the graph in Figure 2. Molong's daily water production is presented in the graph in Figure 3.

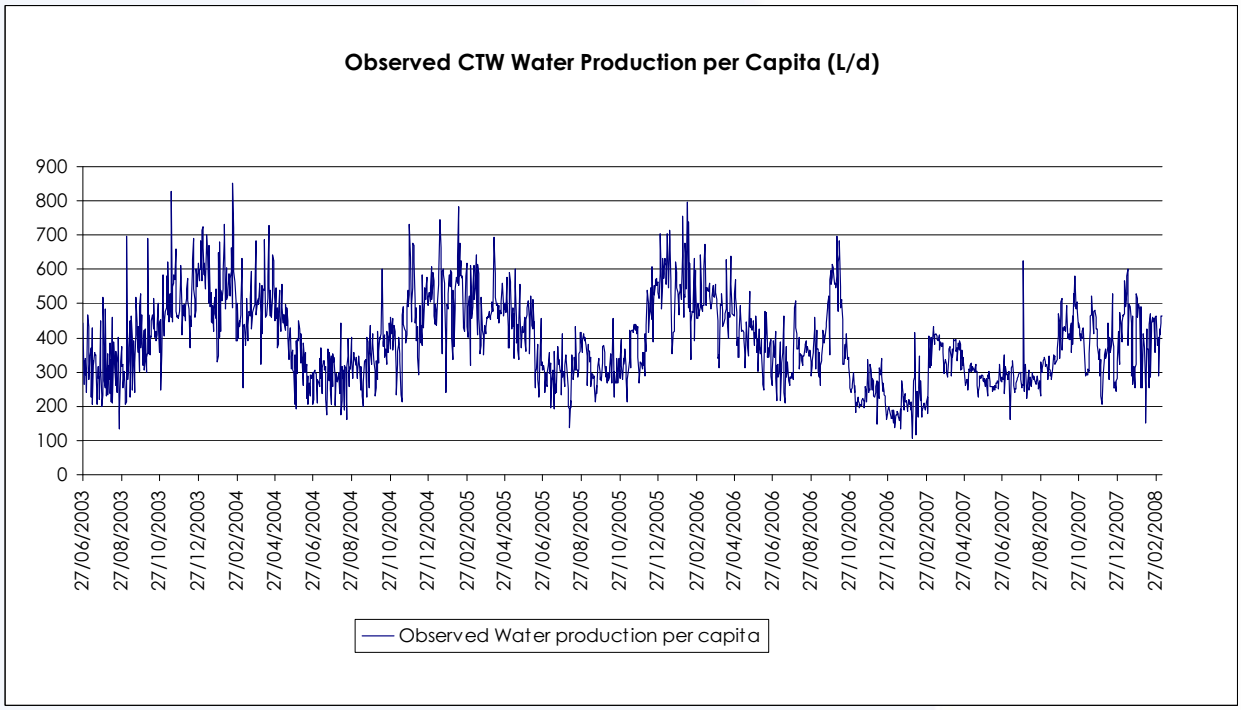


Figure 2: CTW Observed Daily Water Production per Capita. Reference: R1

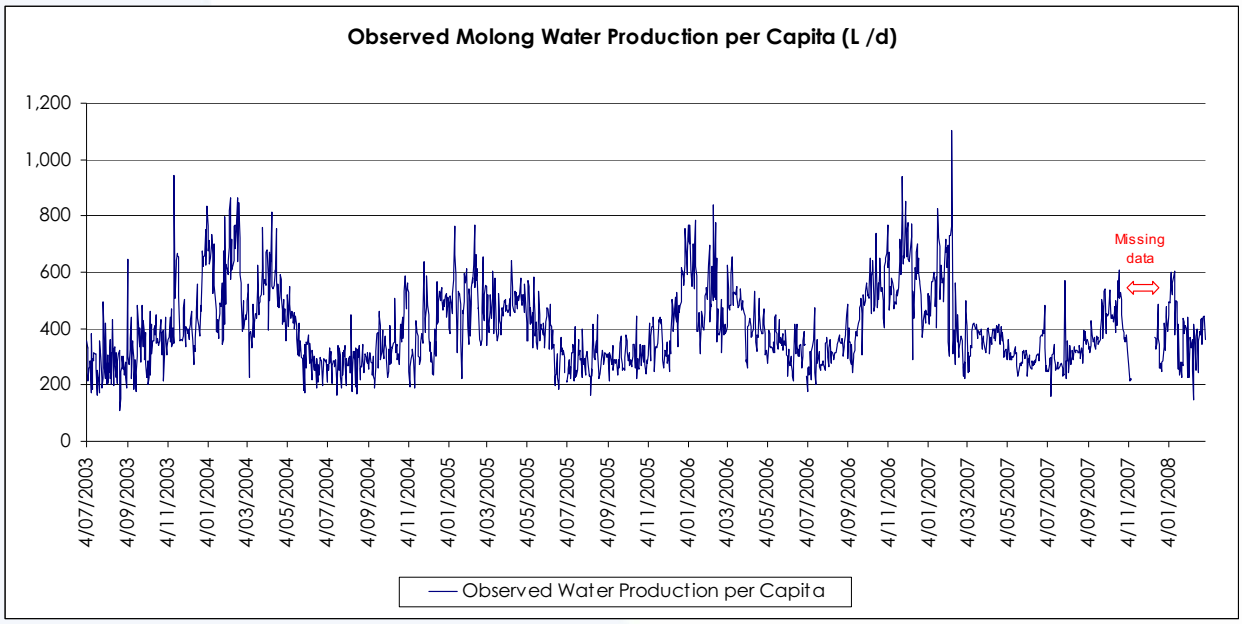


Figure 3: Molong Calculated Daily Water Production per Capita. Reference: R4

Data gaps:
- **Adequate daily water production data to Molong Water Supply system**
- **Adequate daily water production from 09 Nov 07 to 13 Dec 07**

2.1.2 Methodology Overview

The methodology for this analysis was performed according to the manuals for DWE's models. The steps in this methodology is represented in the diagram in Figure 4 and described below.

The data required to run the model was obtained from Councils and BOM - SILO. The model table's dates were defined according to the data available. The data provided was inserted into the model's tables and estimated population and observed water production per capita were calculated and soil moisture data was updated.

The model user defines the period for the index calibration and the model calibrates the soil moisture index. The model's user also defines the start and end dates for calibration and the variables that will be considered in the analysis. The model then calculates the maximum and minimum coefficients for each variable and runs a regression analysis. The variables of the regression analysis can be changed to best fit the model outputs.

When this fit is satisfactory, the model user defines the fixed baseline water production per capita. This is inserted into the model and the regression calculations are updated and water demand trends calculated. The output is a climate corrected water production per capita figure.

Each step of the model and references for the input data is described in Table 23 in Appendix B.

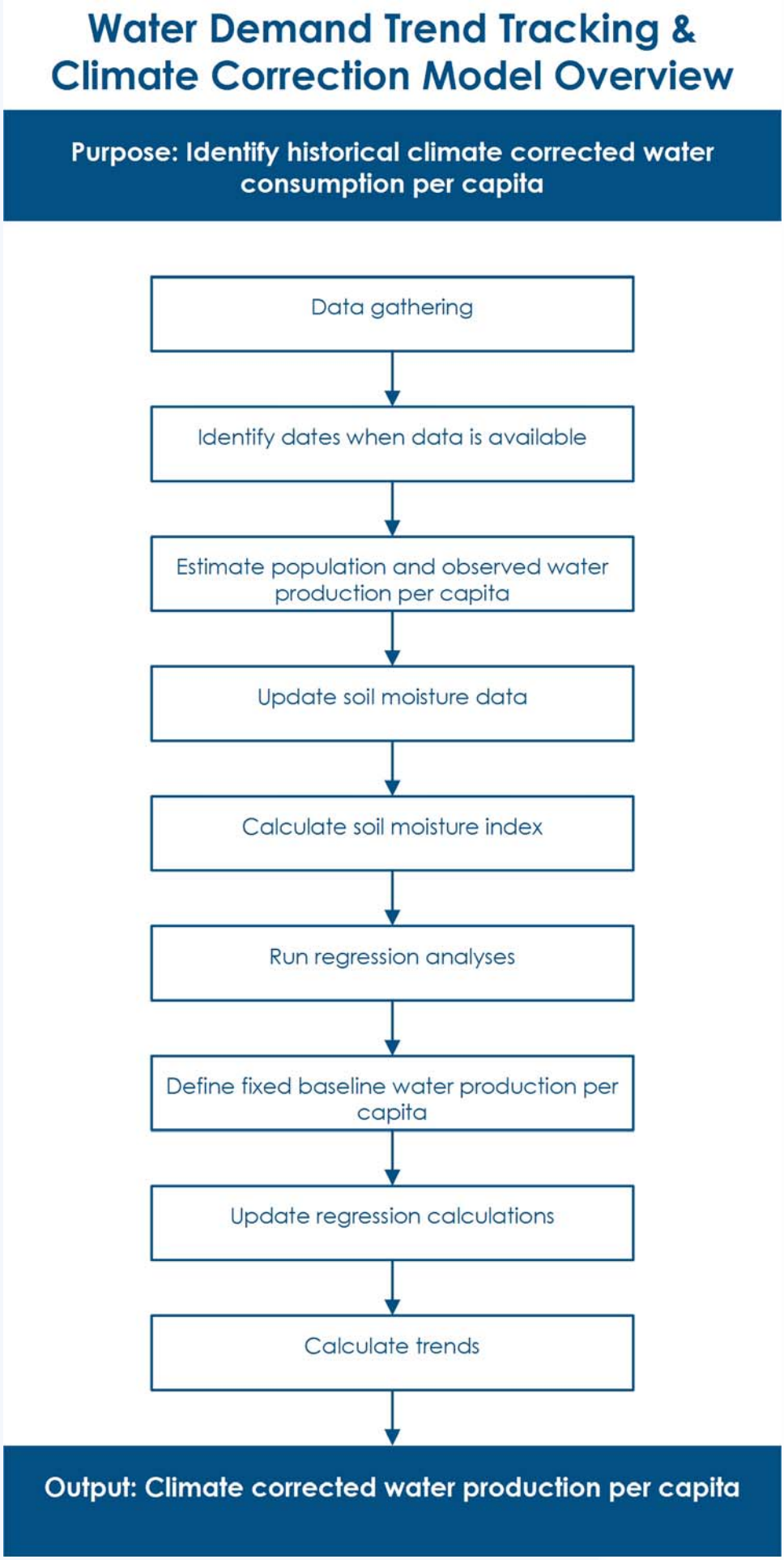


Figure 4: Trend Tracking & Climate Correction Model Diagram

2.1.3 CTW Model Outputs

To assist in understanding of water demand in the period determined in the model; the results of the analysis of the CTW water system are presented in the graphs in Figure 5, Figure 6 and Figure 7, where the model results are compared to the actual demand.

Figure 5 shows a good correlation between the predicted and the observed demand in the first 2 years of this analysis. The demand started to drop in October 2006 as water restrictions were applied. The climate data presented in Figure 1 shows that during the water restrictions period, the temperatures were high and the rainfall was lower than the average for that time of the year. The model has identified that climate conditions in that period were not typical compared with previous years and has calculated the predicted water production with climate corrected figures as shown in Figure 5.

The climate corrected water production was calculated based on a fixed water production per capita in baseline year. The baseline water production is the minimum value of water production per year defined according to the CTW's observed water production per capita shown in Figure 2. The baseline water production is represented in the graph in Figure 6 by the 0.0% line. The difference between the baseline water production per capita and the current estimate of total water production per capita is represented by the "Total" line.

One of the key outputs of the model is the historical and climate corrected water production rate per capita. These are presented in the graph in Figure 7. This graph shows that the climate corrected water production follows the pattern of the historical water production. The climate corrected water production line represents the amount of water that would be produced if the weather conditions have been typical during the determined period of analysis.

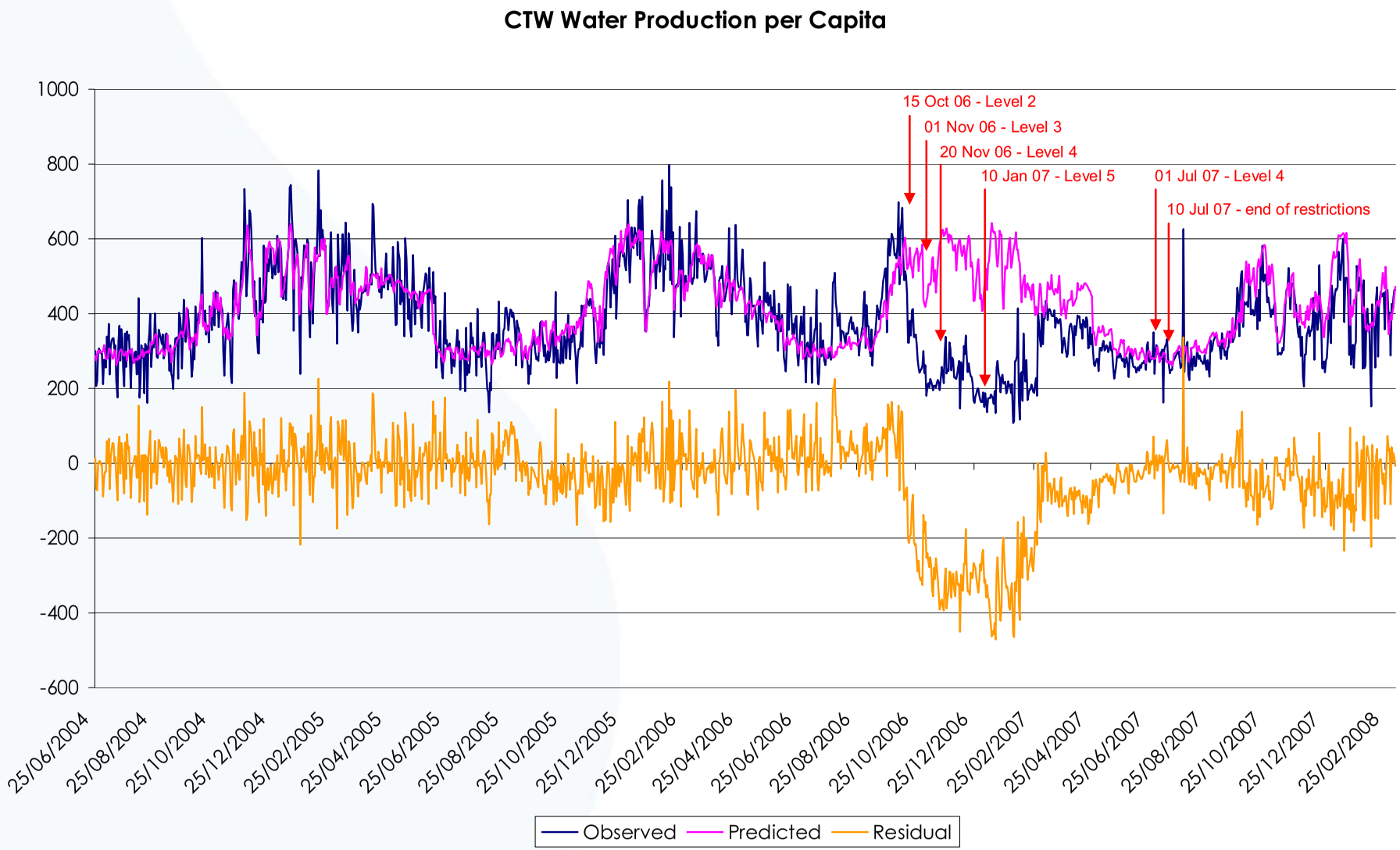


Figure 5: CTW Observed and Predicted Water Production per Capita

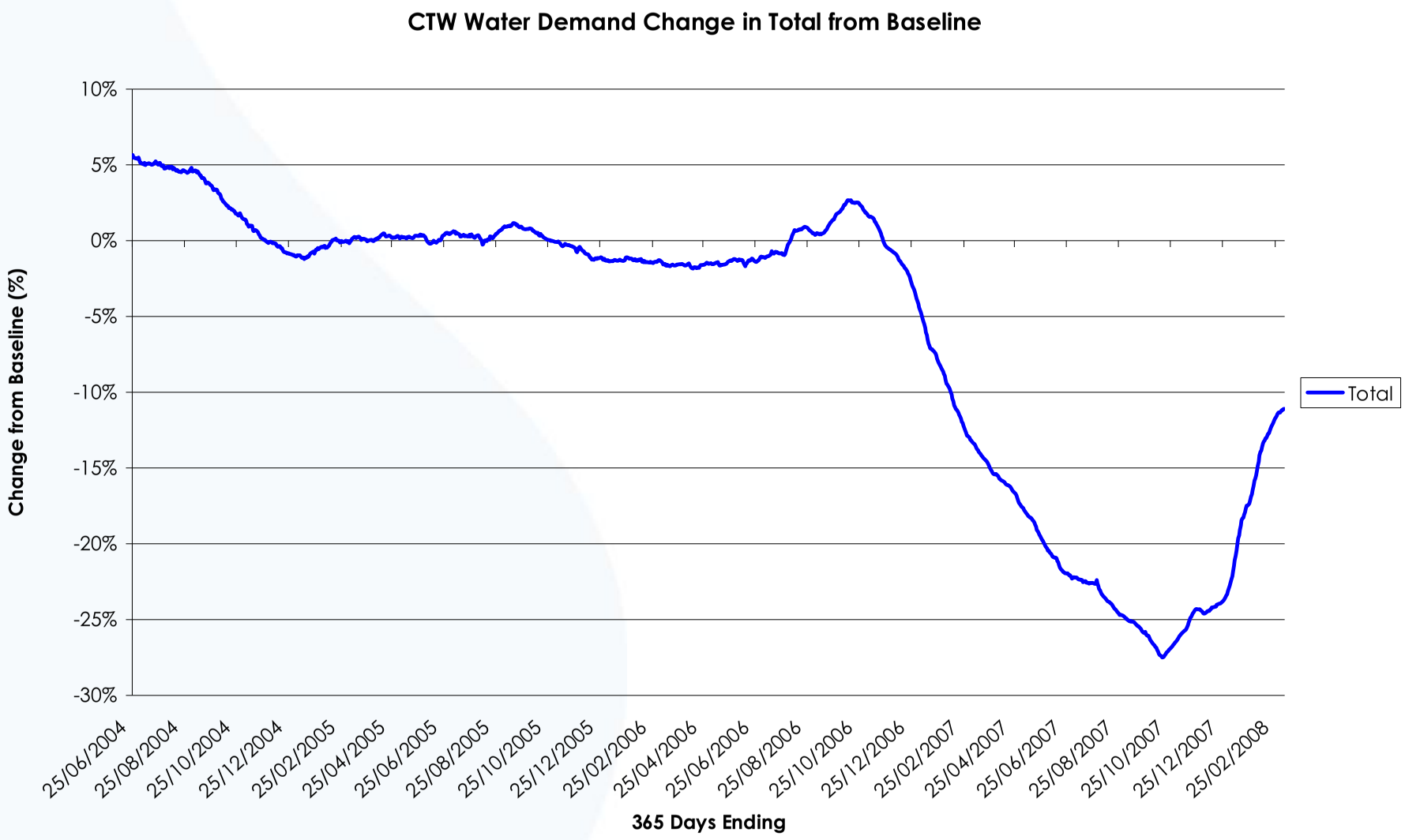


Figure 6: CTW Water Demand Change from Baseline

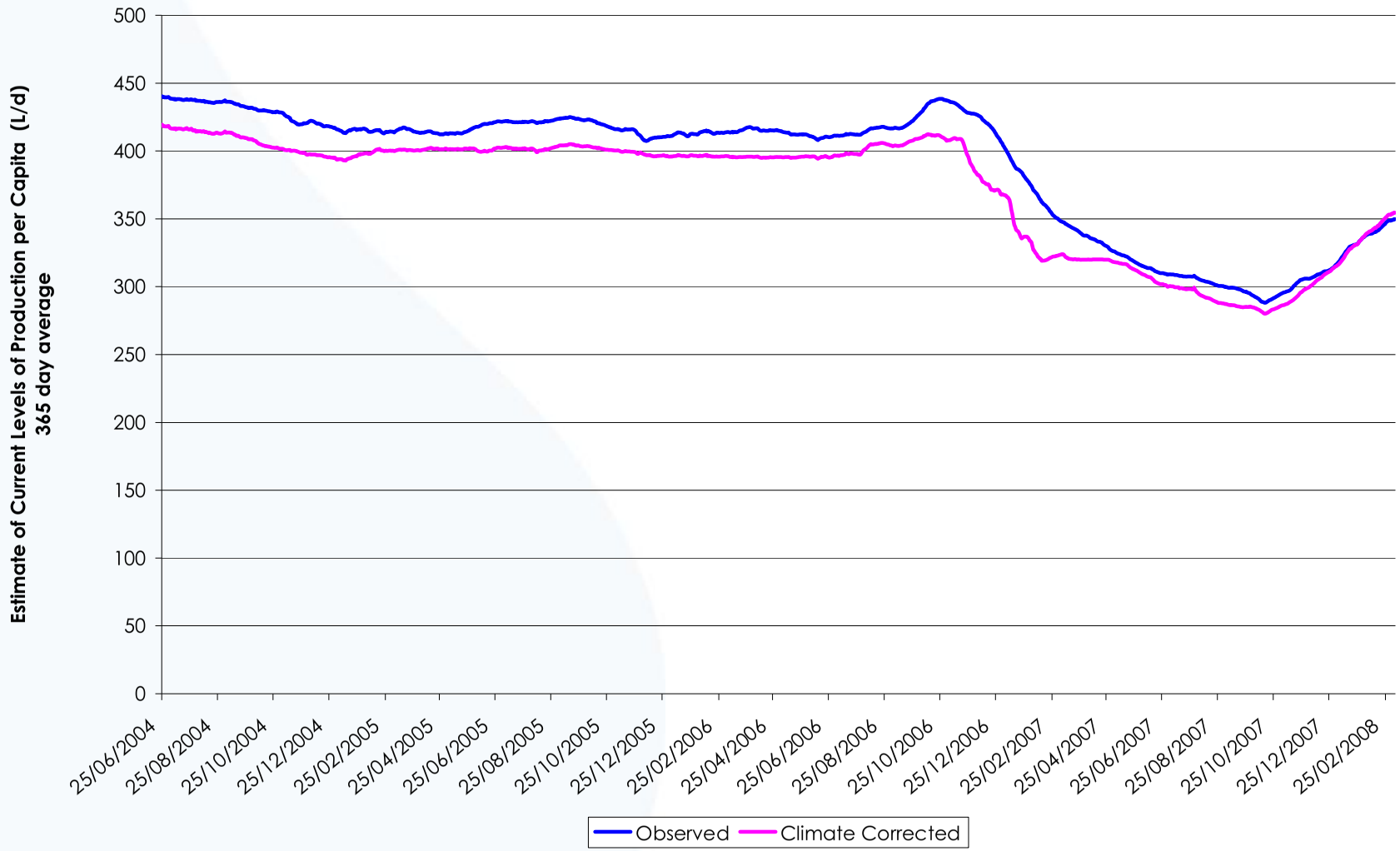


Figure 7: CTW Observed and Climate Corrected Water Production per Capita

2.1.4 CSC (Molong) Model Outputs

The results of the analysis of the CSC water system are presented in the graphs in Figure 8, Figure 9 and Figure 10, where the model results are compared to the actual demand.

Figure 8 shows that water demand pattern in the CSC Molong system more or less reflects the weather conditions throughout the 4 ½ years analysis period. Some events that had minor effect in the water production in the CSC Molong system are the implementation of "Pay-for-use" water charges after 2002/03 and the two periods when the Molong Creek Dam storage level fell below 78%.

During drought periods, Molong Creek Dam level was below 70% on one occasion only. Even though implementation of water restriction Level 1 would have been justifiable, Council did not consider the imposition of it as necessary. Thus, CSC has never had water restrictions applied over the last 4 ½ years.

The climate corrected water production was calculated based on a fixed water production per capita in the baseline year. The baseline water production is the minimum value of water production per year defined according to the Molong observed water production per capita data shown in Figure 3. The baseline water production is represented in the graph in Figure 9 by the 0.0% line. The difference between the baseline water production per capita and the current estimate of total water production per capita is represented by the "Total" line. No issue is identified in this model output.

The key outputs of the CSC – Molong model, the historical and climate corrected water production rates per capita, are presented in the graph in Figure 10. The climate corrected water production line represents the amount of water that would be produced if the weather conditions have been typical during the determined period of analysis. This graph shows that the climate corrected water production follows the pattern of the historical water production, except for the last couple of months of the analysis period. These are the winter months of 2007 which had several days of medium to high rainfall days that might have affected the climate correction calculations. Therefore, the climate corrected line shows slightly higher results than the observed water production. This appears to be a reasonable result.

The outputs presented above are the best outcomes of the DWE model that could be fitted using the data provided by Council. Water production records from CSC were provided in a weekly basis. Considering the model requires daily water production data, it is believed that the lack of data is affecting the model calculations. For these reasons it is considered that the climate corrected model calculations are not adequate for this specific study. The specific reasons are as follows:

- Lack of daily water production data.
- The drivers of water consumption in Molong that might have affected water demand in the last 4 ½ years may not be fully understood. For instance community attitude to drought or the impact of rainwater tanks.

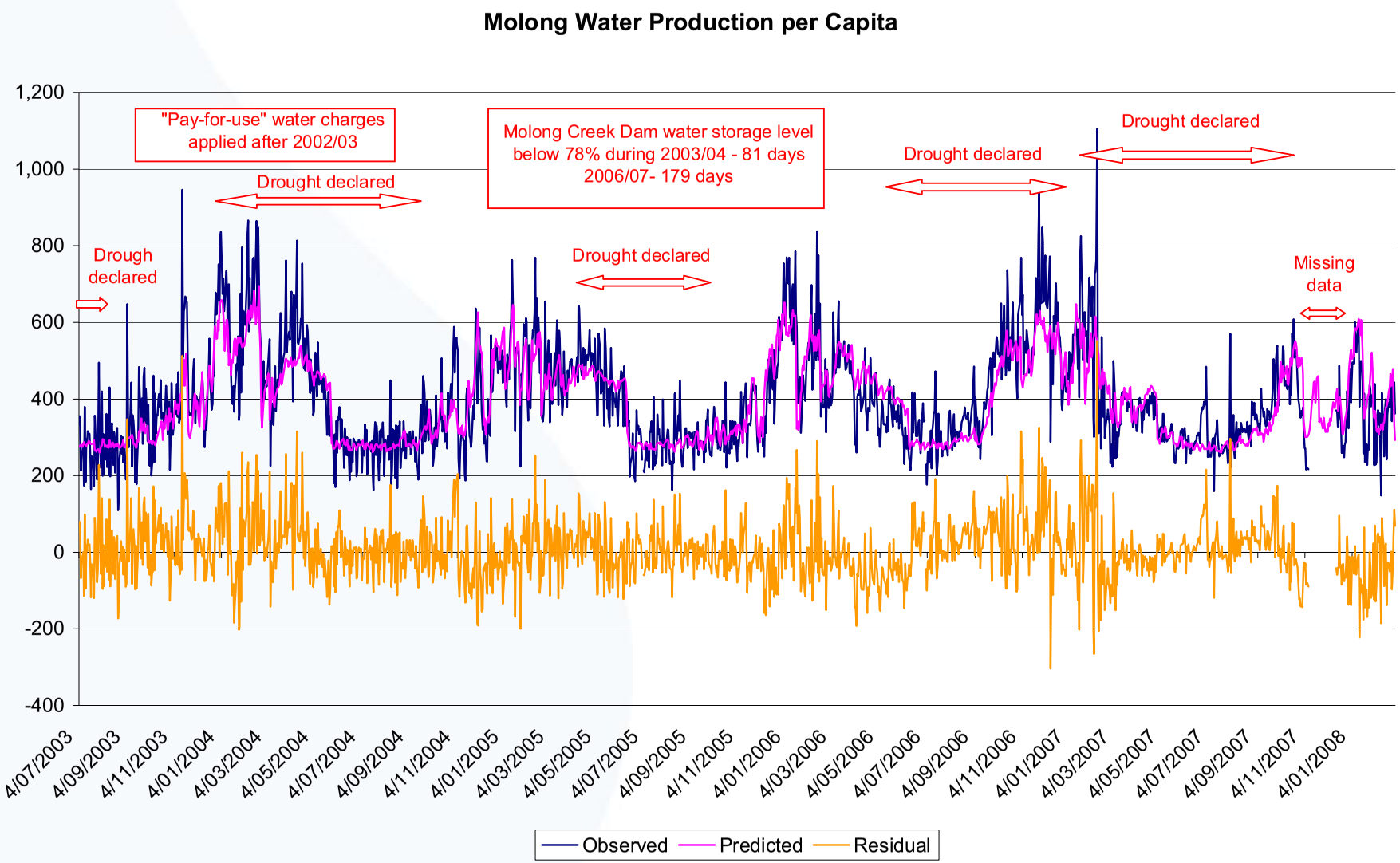


Figure 8: CSC Observed and Predicted Water Production per Capita

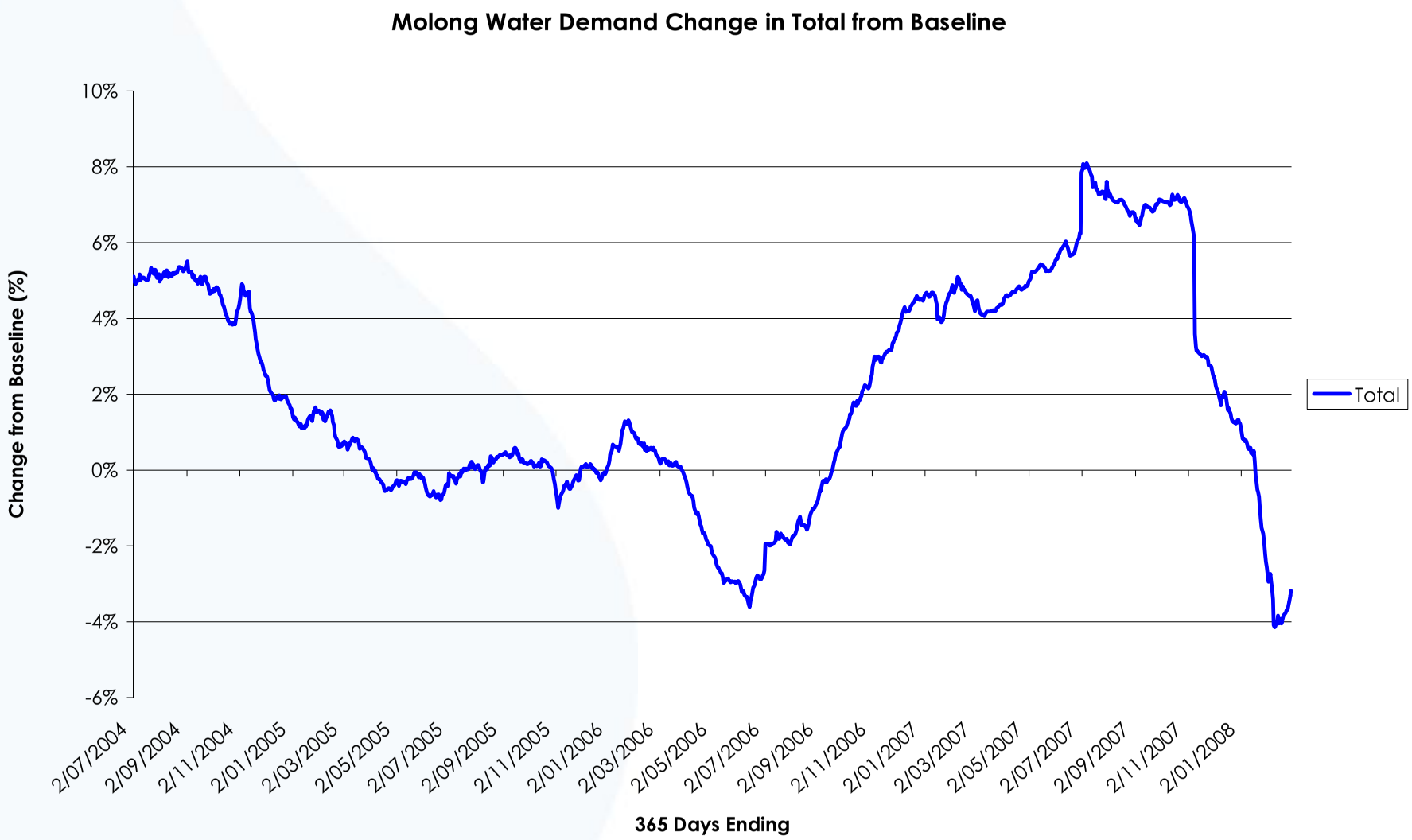


Figure 9: Molong Water Demand Change from Baseline

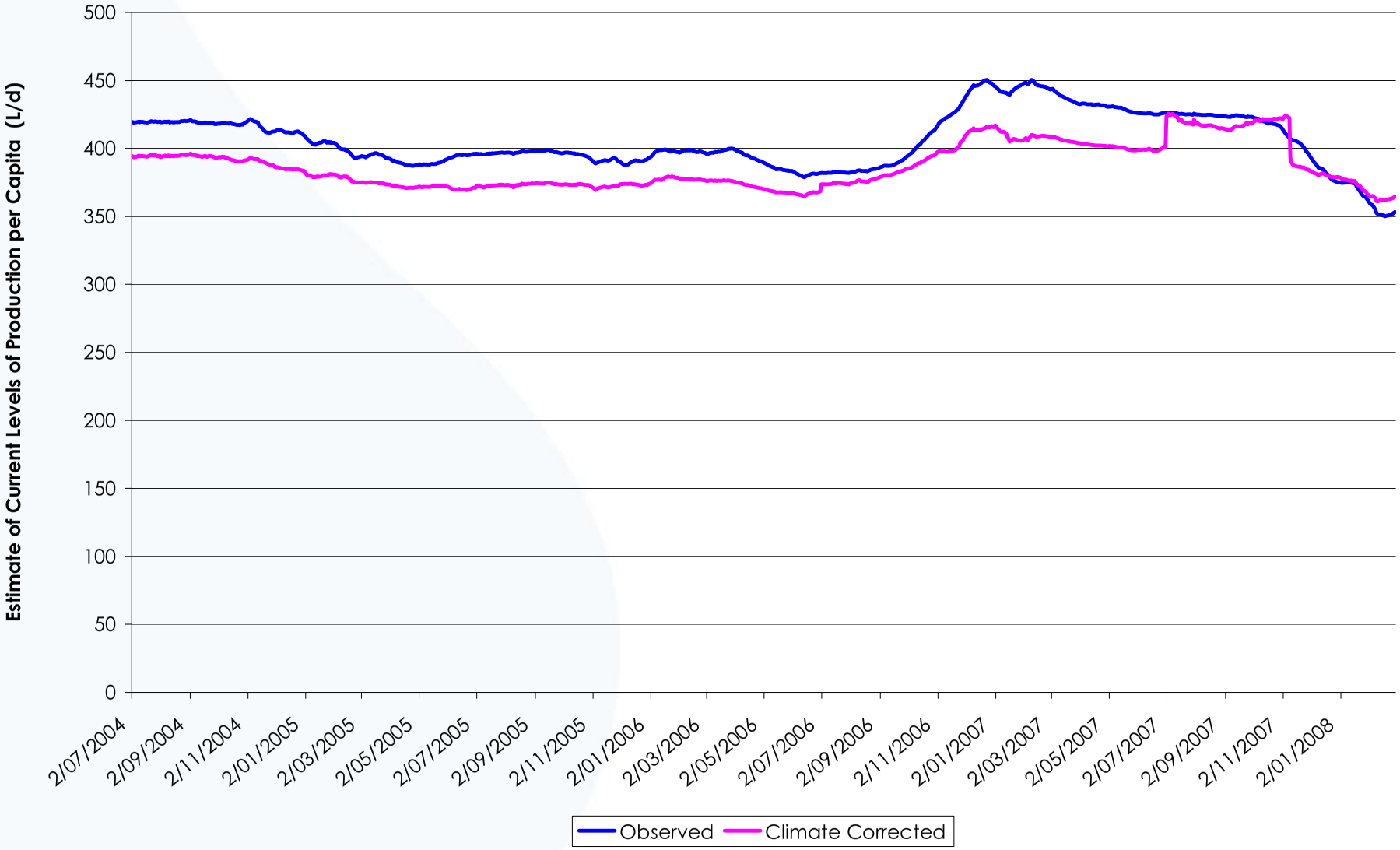


Figure 10: CSC Observed and Climate Corrected Water Production per Capita

2.2 Demand Side Management Decision Support System (DSS) – Simplified Model

The DSS simplified model is a tool to develop demand forecasts and preliminary evaluation of demand management measures as required in the NSW Government's Integrated Water Cycle Management planning framework. It provides 30 year forecasts for both water use and estimates of the savings associated with demand management initiatives.

The approach and methodology used to run this model is according to the Demand Side Management Decision Support System – Simplified (Version S1.1) Manual, July 2006, prepared by DWE.

A DSS model has been prepared for CTW and for CSC - Molong. These models were run to forecast the Councils water system demands and consequently identify future water demand issues. The data required to run the models and the methodology followed to undertake the analyses are as shown in sections 2.2.1and 2.2.2. The outputs of these analyses are shown in sections 2.2.3 and 2.2.4.

2.2.1 Data Required

CTW and CSC have provided data accordingly to the references shown in the DSS models (see A060_CTW_Background_Document and A060_CSC_Background_Document, respectively).

Table 17: CTW Data

Data required	Provided by CTW	Source
Current population served with water	13,493	CTW General Manager
Is the EP/ET expected to change in the future? If yes how much (%)	Assume no	CTW General Manager
Population growth rate	0.7%	CTW General Manager
Current annual water supplied	1960 ML	CTW 2006/07 Annual Report
Proportion of annual use attributed to system losses (%)	6.8%	CTW General Manager
Current peak to average day water demand ratio	2.37	CTW General Manager
What change in baseline per capita demands is expected over the next 50 years? (%)	0	Assumption accepted by DWE staff
Total length of water mains	550 km	CTW General Manager
Number of accounts breakdown into residential, commercial, industrial, public, parks and open space, rural, other, unmetered	▪ Residential – 4502 ▪ Commercial – 636 ▪ Industrial – 11 ▪ Public – 20 ▪ Parks and open space – 44 ▪ Rural – 660 ▪ Other - 38	CTW General Manager

Data required	Provided by CTW	Source
Proportion of residential customers with cooler (%)	Estimated at 46%	CTW General Manager
Assumed level of internal residential water use per person	Estimated at 153 L/P/d	CTW General Manager
Current annual water pumping costs	$243,000	CTW General Manager
Current annual water treatment costs	$486,000	CTW General Manager
Current sewage pumping costs	$ 174,738	Sewage costs from Blayney, Cabonne and Weddin Shire Councils
Current annual sewage treatment costs	$ 324,086	Sewage costs from Blayney, Cabonne and Weddin Shire Councils
Capital works program for water and sewerage (30 years)	▪ Renewal of Trunk mains - $28M ▪ Blayney WFP replacement/upgrade - $4M ▪ There is no planned major wastewater infrastructure projects in CTW	CTW General Manager
Current volumetric charge per kL	$1.35	CTW General Manager
Last year's volumetric charge	$1.25	CTW General Manager

Note 2: Residential figure includes the number of accounts from Cowra Shire villages (Gooloogong, Pierces, Woodstock and Westville). Rural figure includes 88 rural ETs that were taken over by CTW from Cowra Shire.

Table 18: CSC - Molong Data

Data required	Provided by CSC - Molong	Source
Current population served with water	1,569	2006 Census – Cabonne LGA (villages breakdown)
Is the EP/ET expected to change in the future? If yes how much (%)	No	CSC staff
Population growth rate	0.67%	CSC staff
Current annual water supplied	251ML	CSC staff
Proportion of annual use attributed to system losses (%)	10.06%	CSC staff
Current peak to average day water demand ratio	1.054	CSC staff

Data required	Provided by CSC - Molong	Source
What change in baseline per capita demands is expected over the next 50 years? (%)	0	Assumption accepted by DWE staff (this figure is unknown by Council)
Total length of water mains	58.8 km	CSC document - data required by technical note 1
Number of accounts breakdown into residential, commercial, industrial, public, parks and open space, rural, other, unmetered	▪ Residential – 906 ▪ Commercial - 140	CSC staff (Molong pro rata)
Proportion of residential customers with cooler (%)	10%	HSc estimate (this figure is unknown by Council)
Assumed level of internal residential water use per person	165 L/d	CSC staff
Current annual water pumping costs	$ 47,862	CSC staff (Molong pro rata)
Current annual water treatment costs	$ 72,644	CSC staff (Molong pro rata)
Current sewage pumping costs	$ 93,352	CSC staff (Molong pro rata)
Current annual sewage treatment costs	$ 111,548	CSC staff (Molong pro rata)
Capital works program for water and sewerage (30 years)	There is no planned major water infrastructure projects in CSC	CSC staff
Current volumetric charge per kL	$ 2.10	CSC Fees and Charges 2007/08 report
Last year's volumetric charge	$ 2.06	CSC Fees and Charges 2007/08 report

2.2.2 Methodology Overview

The DSS model is divided in three main sections:

- ❒ Input Information
- ❒ Future Demand Management Scenarios
- ❒ Historical Demands and Results Summary

The data provided by the Councils was inserted into the model's input information section. Some of the data was not provided or was unavailable. In these cases assumptions were made and the reference for each assumption was recorded in the model spreadsheet.

Once all fields of the model were filled an estimate of residential % of indoor use was updated and a baseline demand and water saving was calculated.

In the future demand management scenarios' section, four different water conservation scenarios (see Table 19) were built. The DSS model allows the model user to view summary

information on each of the standard water conservation measures which are used to build the scenarios. After building scenarios the scenario calculations were updated, adjusting all the calculations for the scenarios. The result of this calculation was the average water saving (ML/a) for each scenario, which was used to calculate the future water demand for each scenario. The results of these calculations are presented in section 2.2.3 and 2.2.4.

Table 19: Future Water Demand Management Scenarios

Water conservation measures	Scenario 1	Scenario 2	Scenario 3	Scenario 4
National Mandatory Water Efficiency Labelling Scheme (WELS)	X	X	X	X
Community Education	X	X	X	X
Residential Shower Retrofit		X	X	X
Residential Washing Machine Rebate		X	X	X
Permanent Low Level Restrictions on Water Use				X
Conservation Pricing for Residential Users			X	X
Fixture Code - Taps and Showers - New Development				X
Non-Residential Water Audits		X		
System Water Loss Management				
Rainwater Tanks for all New Residential Development				
Dual Reticulation for all New Residential Development				
BASIX - Fixture Efficiency with Rainwater Use	X	X	X	X
BASIX - Fixture Efficiency with Dual Reticulation				
System Water Loss Management				X
Evaporative Cooling Unit and Cooling Tower Audit				

The outputs of the water demand trend tracking and climate correction model, annual average (ML annum) and peak day demands (ML) were inserted with the historical demands and results summary section. This last section of the model provides a summary of future water demand.

2.2.3 Central Tablelands Water

2.2.3.1 CTW Model Outputs

The CTW projected water demand management calculations were based on 2006 water demand figures, instead of 2007. The reason for this assumption is that in 2007 water restrictions affected the CTW water production figures significantly.

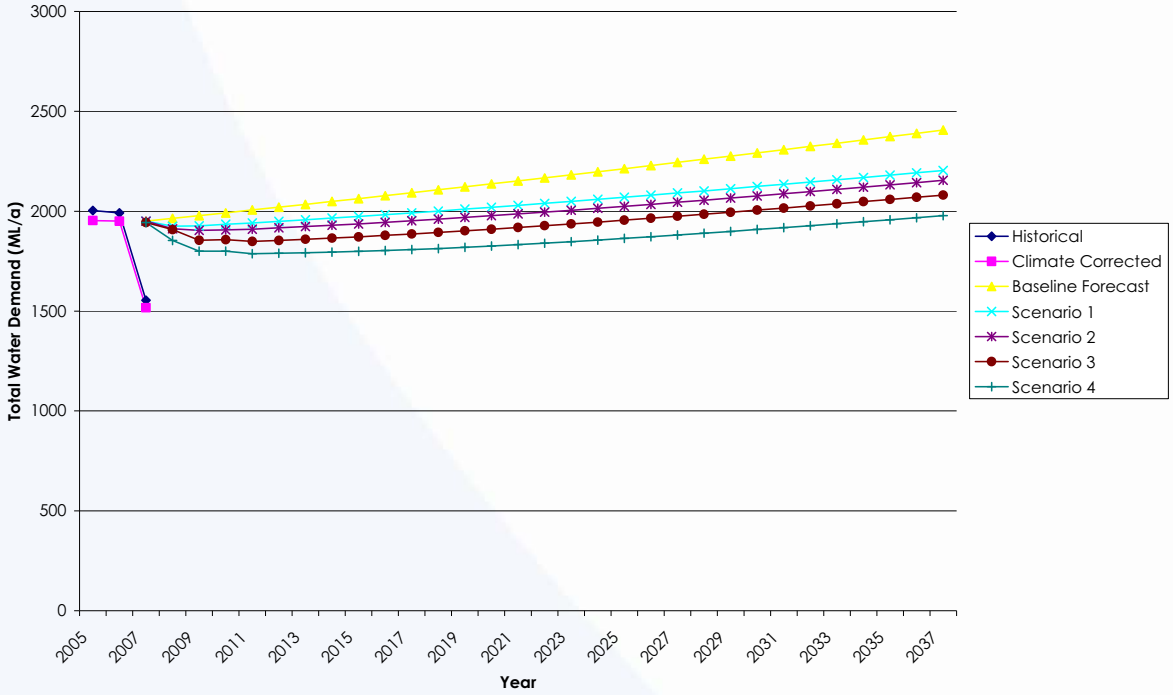


Figure 11: CTW Total Water Demand

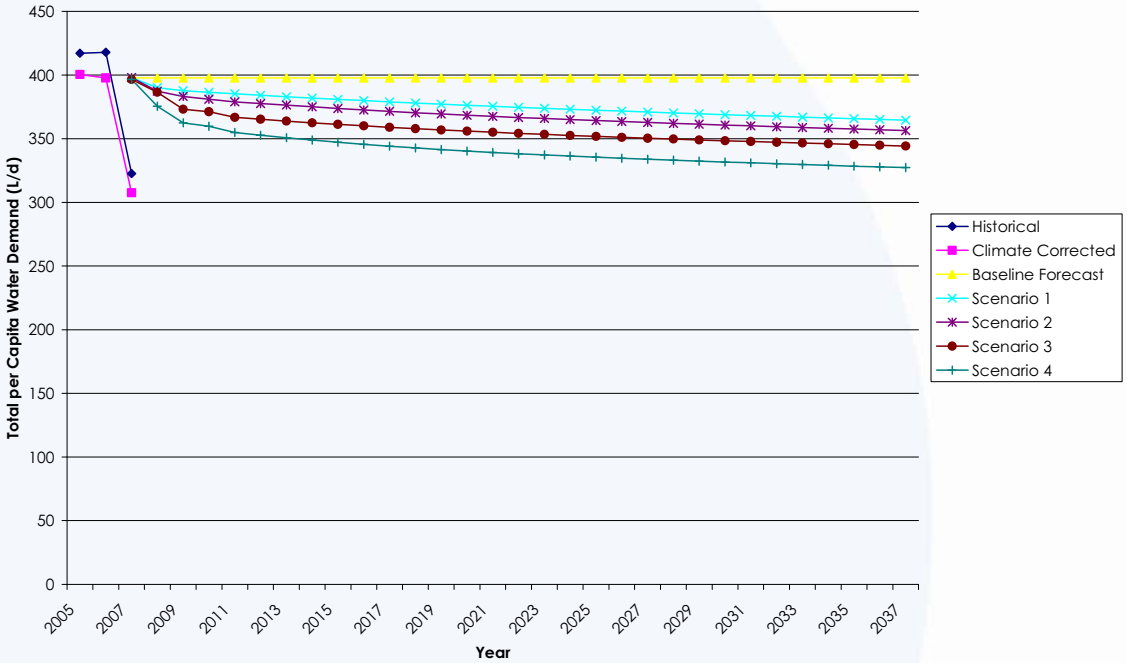


Figure 12: CTW Total per Capita Water Demand

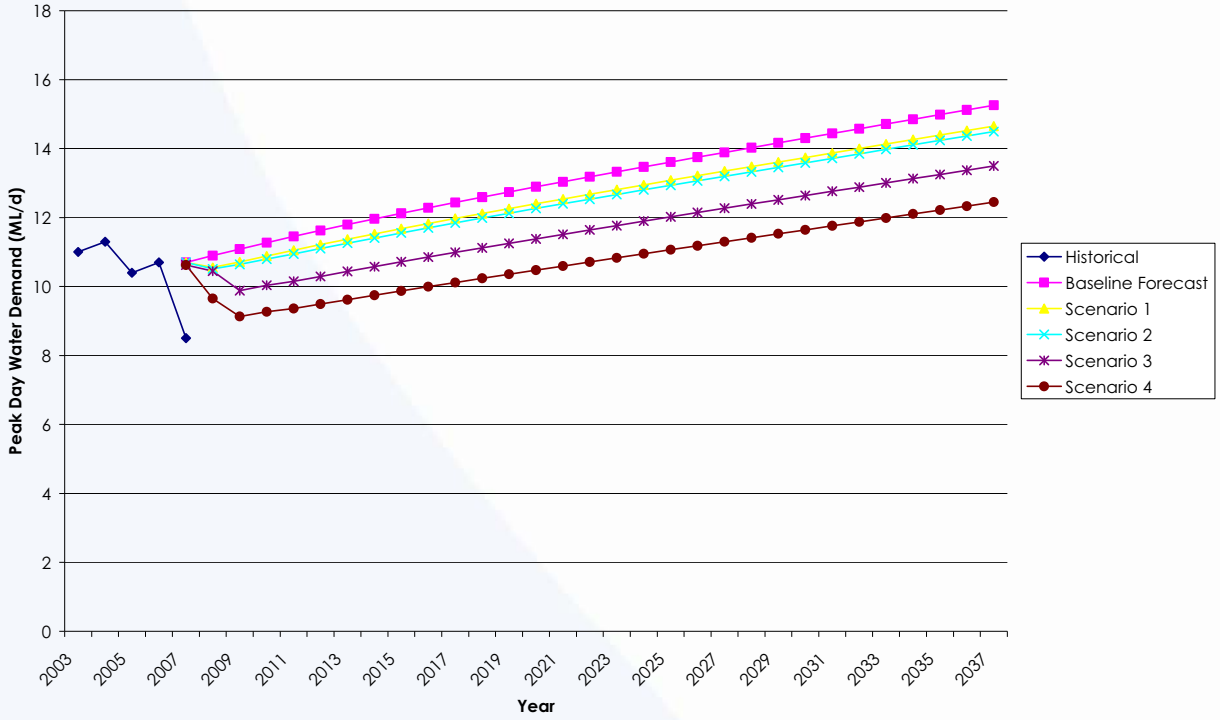


Figure 13: CTW Peak Day Water Demand

2.2.3.2 CTW Water Supply System Issues Identified

Annual Demand and Capacity

According to the yield study of Lake Rowlands Dam report (1991), the dam's secure yield is approximately 1900 ML/a. The Gooloogong bores DWE water extraction licence allows for pumping of up to 400 ML/a out of the bores. Thus, the total annual water system capacity is 2300 ML/a. Figure 11 shows that the baseline "worst case" forecast total annual water demand for 2037 is approximately 2400 ML/a. If the secure yield figure was certain this would represent a shortfall of 100 ML/a.

CTW's Current Perspective

CTW staff has advised the following:
"CTW's Strategic Business Plan (SBP) recognises the need to provide potable water supplies to villages within the three local government areas serviced by CTW.

In Blayney Shire, the villages of Newbridge, Neville and Barry are not serviced with a potable town water supply and the CTW SBP plans to address this issue within the next 5 to 15 years.

In Cabonne Shire, the villages of Cumnock and Yeoval are not serviced with potable water and in recent years have been under severe strain in maintaining the existing non-potable supply. CTW has had a number of discussions with Cabonne Council who have asked CTW to consider incorporating Molong, Cumnock and Yeoval into the CTW supply system. CTW's SBP addresses this issue in its future planning.

In Weddin Shire, the villages of Bimbi and Caragabal are listed in CTW's SBP to be supplied with a potable water supply. Both of these villages would be augmented with the Quandialla system. The secure yield study conducted by the Department of Public Works in 1991 indicated that the secure yield of Lake Rowlands was approximately 1,900 ML/a. CTW exceeds the secure yield of Lake Rowlands by approximately 100 to 200 ML/a and a further 400 ML/a can be extracted from a DWE groundwater licence at Gooloogong.

The extension of a potable supply from Lake Rowlands into the unserviced villages within Blayney and Cabonne Shire's would significantly increase the level by which the secure yield of Lake Rowlands is exceeded. As well, a commercial enterprise has commenced in Grenfell requiring an annual demand of 121 ML/a; this also adds pressure on the secure yield of the dam.

Whilst the DWE groundwater licence allows for the extraction of 400 ML/a from Gooloogong, CTW has no control over the quality of the bore water, the unknown and varying water table may not sustain bore pump maximum output for lengthy continuous operation and sustained supply of bore water to consumers may result in a high number of complaints of poor aesthetic quality. Failure of the groundwater supply would place further strain on the secure yield of Lake Rowlands."

Climate Impacts

Changes in climate theory since 1991 indicate that a revised secure yield study would be useful. A revised yield study would be based on historical data and would need to speculate about future scenarios.

CSIRO Sustainable Yield Study for the Lachlan River Valley

Recent studies by CSIRO on sustainable yield in the Lachlan Valley state
"The best estimate of climate change by 2030 would reduce surface water availability by 11% …" (http://www.clw.csiro.au/publications/waterforahealthycountry/mdbsy/lachlan.html). While this covers a very large catchment the implications of an 8% reduction on Lake Rowlands yield would be critical.

CSIRO Climate Change Drought Assessment

2007 and 2008 climate impacts (climate change, El Niño or other) on dam yields in other parts of the Murray Darling Basin (Murray and Murrumbidgee) have led to suspension of water sharing plans and 50% reductions in town water allocations. Such reductions in yield may be attributed to reductions and increased variability in annual rainfall and runoff.

Further to this, CSIRO and the Australian Bureau of Meteorology (BOM) long term climate change projections are presented below.

Key findings from: CSIRO, Australian Bureau of Meteorology. 2007. *Climate change in Australia: technical report 2007*.

"The key findings of this report include that **by 2030, temperatures will rise by about 1°C over Australia – a little less in coastal areas, and a little more inland** - later in the century, warming depends on the extent of greenhouse gas emissions. If emissions are low, warming of between 1°C and 2.5°C is likely by around 2070, with a best estimate of 1.8°C. Under a high emission scenario, the best estimate warming is 3.4°C, with a range of 2.2°C to 5°C.

Further, the report indicates there will be changes in temperature extremes, with fewer frosts and substantially more days over 35°C. It also predicts that decreases in annual average rainfall are likely in southern Australia - rainfall is likely to decrease in southern areas during winter, in southern and eastern areas during spring, and along the west coast during autumn. For 2030, there will be little annual rainfall change in the far north.

As with temperature, the report indicates that rainfall projections for later in the century are more dependent on greenhouse gas emissions. Under a low emission scenario in 2070, the best estimate of rainfall decrease is 7.5 per cent. Under a high emission scenario the best estimate is a decrease of 10 per cent.

The report indicates that although there will be more dry days, when it does rain, rainfall is likely to be more intense.

Other findings include:

- Droughts are likely to become more frequent, particularly in the south-west
- Evaporation rates are likely to increase, particularly in the north and east
- High-fire-danger weather is likely to increase in the south-east
- Tropical cyclones are likely to become more intense
- Sea levels will continue to rise."

From the possible scenarios CSIRO and BOM suggest for the 30 year planning horizon for the four councils this may mean:

- Minimum 1 degree rise in temperature with impacts on evaporation and soil moisture.
- More days over 35°C – this may mean increased peak day demands.
- Decrease in average rainfall – lower yields, higher external demand.
- More dry days – more frequent external demand.
- Rainfall more intense – capture will need to be more opportunistic and may require larges storages.
- Droughts more frequent – drought management a major issues, however demand hardening may lead to needs for an emphasis on water source security increases.
- Evaporation rates increase – increased demand, greater loss of water from storage surfaces.

Such uncertainty about future climatic conditions indicates the need for water supply planners to take a precautionary approach. This appears to be a major issue if not the major issue for the CTW water supply system, but also needs consideration for CSC's Molong system. The Evaluation Study identifies issues. However regarding this issue it appears that supply side options such as the expansion of Lake Rowlands and greater reuse will be central to this IWCM, alongside demand management options.

Issue: CTW system appears to have 100ML/y shortfall in supply at 2037 in the base case analysis based on historical information and a 1991 Lake Rowlands yield study. Uncertainty about future climatic conditions means that yield study and demand calculation scenarios should be developed to take into account possible climate change.

Peak Day Demand and Capacity

Peak day demand projections have been compared with system peak day capacities for major system components.

The two existing WFPs in the CTW system have the capacity to provide approximately 15 ML/d. Figure 13 shows that the baseline "worst case" forecast peak day water demand for 2037 is approximately 15 ML/d. This means that, even though any water conservation measures are applied, the current water filtration plants have the capacity to satisfy the future demand, subject to modifications in the distribution pipes. Currently, Blayney WFP provides water to Blayney reticulation system only.

Figure 13 shows the projections of CTW peak day water demand for various demand management scenarios. The baseline forecast results were apportioned on a pro rata basis to each main CTW village's population to assess potential water demand issues in different zones of the system.

Figure 14 represents CTW's current water systems, showing the location of the supply issues identified. These issues are related to the sustainable future water demand for CTW customers and the peak day demand (PDD) values presented in the diagram's boxes are the results of the water demand analyses. These values are, from top to bottom:

- The current peak day capacity of the specific section of the system
- Council's current peak day water production
- The projected peak day water demand for 2037, which considers Council's expected population growth (outputs of the DSS model for the baseline "worst case" forecast scenario)

The baseline forecast scenario results show that the current capacity of the distribution system will not satisfy baseline water demand in the whole CTW system in 2037 (specific capacity issues are annotated in red in Figure 14. It is important to note that Gooloogong Bores are not included in the calculations. Both bores can provide up to 400 ML/a to supplement Weddin's demand.

Analysis shows that the main issues identified are:

- If Gooloogong Bores are not operating, the PDD in 2037 will exceed the capacity of Carcoar WFP by 2.8 ML/d.
- Trunk Main 'F' (Millthorpe pipeline) current PDD already exceeds trunk main capacity by 0.2 ML/d. The PDD in 2037 will exceed the capacity of Trunk Main 'F' by 0.6 ML/d.
- Trunk Main "C" current PDD just satisfies trunk main capacity. The PDD in 2037 will exceed the capacity of Trunk Main 'C' (downstream of sub-system 9) by 3.1 ML/d.
- If Gooloogong Bores are not operating, the PDD in 2037 will exceed the capacity of Trunk Main 'K' (Grenfell pipeline) by 0.1ML/d.

The current CTW capital works program allocates approximately $28M to renewal of trunk mains in the CTW water supply system. Details of the capital works program for the trunk mains above are as follows:

- Renewal of Trunk Main 'F' Browns Creek to Millthorpe, 8.3km, $0.75M – commencing 2023. To be upsized from 150mm to 200mm.

- Renewal of Trunk Main 'C' Mandurama to Gooloogong, 72.9km, $10.85M – commencing 2017 to 2020. To be upsized from 225/250mm to 300mm.
- Renewal of Trunk Main 'K' Gooloogong to Grenfell, 35.3km, $5.3M – commencing 2011. To be upsized from 200mm to 250mm.

The detailed CTW's capital works program is provided in Appendix C.

According to this analysis, if Gooloogong Bores are not available, Carcoar WFP capacity would need to be addressed to satisfy demand in 2037. The modelling provides various scenarios representing different levels of water conservation measures that could be applied to reduce water consumption in the future. Implementation of such scenarios could reduce the need for capital upgrades.

Section 3 of this report covers the rainwater tank assessment which presents the benefits of rainwater tanks to the CTW water supply. It is worth examining these scenarios and their water demand outputs to assess options for the future.

2.2.3.3 The (proposed) Cowra Pipeline

To ensure the security of drought water supply a pipeline interconnecting CTW's Pipeline No.3 to Cowra is being developed.

This pipeline will connect Cowra on the Lachlan River downstream of Lake Wyangala with the Central Tablelands scheme. It is understood that the pipeline is only envisaged to be used to supply Cowra in high drought water restrictions. And can also be used to supply CTW if the situation is reversed. This is likely to reduce CTW's Lake Rowlands ability to service CTW customers during droughts and will necessitate earlier water restrictions being imposed on CTW consumers in order to assist Cowra.

The proposed Cowra pipeline is 33 km long, and 225 mm diameter.

Stage 1

Stage 1 has already been constructed in April / May 2008. It is 5 km long - the first 5 km from the existing Cowra reservoirs. It is DICL pipe.

Stage 2

Stage 2 is yet to be constructed. It is 28 km long - probably uPVC pipe (some small sections (1 or 2 km) in / near the village of Woodstock may be DICL).

The line will duplicate CTW's trunk main H, between trunk main C and Woodstock.
The main should be capable of delivering 3.5 ML/day of water.

It is gravity flow from Trunk Main C to Cowra (i.e. gravity from "C" to Woodstock; and gravity from Woodstock to Cowra.
To take Lachlan River water from Cowra WTP back to the CT Water system, pump stations would have to be constructed.

Stage 2 is likely to be constructed in 2009 and 2010.

The pipeline will have both a positive and negative effect on CT Water security of supply.
If there are problems at Cowra WTP then CTW's Carcoar WTP will have to provide supply and broad restrictions would need to be applied while actions were taken to restore normal operations. In other words CTW consumers would suffer for an event outside their system.

If Carcoar WTP had problems and emergency pumping could be arranged, then about 3.5 ML/day may be able to be pushed into trunk main C from Cowra. In that case Cowra consumers would suffer for an event outside their system but it would give added stability to CTW Water consumers (DWE, 2008)

Cowra shire's management was quoted in their press release in the excerpt that follows:

"Cowra Shire Council's 1c1 water project Emergency Water pipeline: Completion of the 1c1 water project will also see Stage One of the Emergency Water pipeline completed. Once completed, the pipeline will connect Cowra's supply to Trunk Main C of the Central Tablelands water supply."

"This will mean that if Cowra's supply became depleted in times of drought, water could be sourced from excesses in the Central Tablelands supply and vice versa," Mr. Bennett said.
The emergency pipeline is the first major step towards achieving the Transport and Infrastructure Futures 30 objective to 'drought proof Cowra."

"It is pleasing to see the realization of a 'drought proof Cowra' in our future and I expect many Cowra residents will be relieved by the extra security in the town's water supply," Mr. Bennett concluded." (Source: Cowra Shire Council – News Release 9 April 2008).

Issue: Connection of the proposed Cowra pipeline linking CTW's "pipeline C" to Cowra is expected to impact on restrictions in water supply for CTW and Cowra customers. Where Cowra needs emergency water supply this will reduce Lake Rowlands ability to meet supply levels of service during droughts and will necessitate earlier water restrictions being imposed on CTW consumers. If emergency pumping can be implemented it may offer the ability to pump water to CTW customers in the event of problems in CTW's system.

2.2.3.4 The CENTROC Study

The Central Region Organization of Councils (CENTROC) has won $500K funding from The NSW state government to perform a study into regional water security. The CWBC councils are member councils of CENTROC. It is understood that the CENTROC study is planning to look at a number of pipeline proposals; and some additional water resources.
The tentative proposals could include:

- An enlarged Lake Rowlands
- sourcing additional groundwater between Forbes, Parkes and Gooloogong; or both
- Pipelines Carrying potable water or raw water or both:
  - from Wyangala Dam to Orange;
  - from Orange to Blayney (Stage 1 of Wyangala to Orange);
  - from Lake Cargelligo weir to Lake Cargelligo township
  - from Forbes to Parkes to Gooloogong (connecting CT Water pipeline network to the Parkes/Peak Hill network to the Forbes-Tottenham pipeline system);
  - from Ben Chifley dam to Bathurst; from Bathurst to Orange;
  - and other possibilities that may be developed.

The ultimate results of the CENTROC Study, in the longer term (not the short term) may have a large impact on CTW operations; especially drought operations (or, it may have no effect at all).

CTW's financial planning/ pipeline augmentations proposed in this technical note may be impacted by these plans at some time in the future. However they are current plans with capital works funding identified.

CTW owns and runs a water distribution system across Central Western NSW. Information or strategies from the CENTROC study may enhance the CTW network to becoming a drought water grid in places - meaning a few of the pipe sizes identified in this technical note may need to be increased to supply emergency water during need.

It may be that if all the proposed pipeline size increases listed in this technical note are installed as stated, that CENTROC may then design its pipelines so that they have compatibility with the CT Water network, so that the CENTROC pipelines (if there are any) can be used in conjunction with the CT Water network.

Because the CENTROC study is not complete, the results are unknown. The CENTROC study will have a regional water needs focus, rather than just an individual utility focus.

Issue: The NSW Government is funding a $500K CENTROC Regional Water Security study covering all 17 CENTROC councils drought management on a regional basis. The ultimate results of the CENTROC Study, in the longer term (not the short term) may have a large impact on CTW operations; especially drought operations (or, it may have no effect at all).

CTW's financial planning and proposed pipeline augmentations may be impacted by these plans at some time in the future.

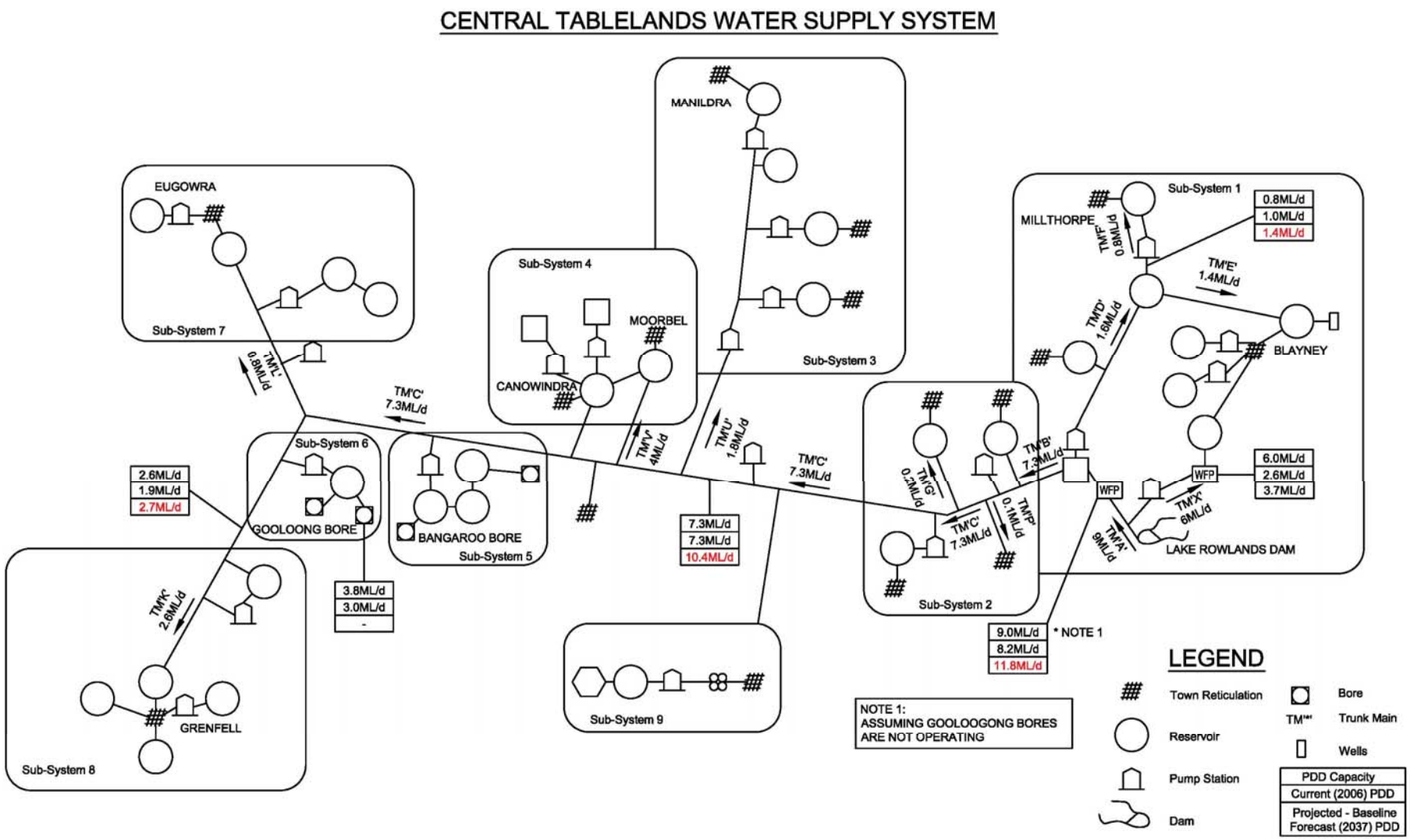


Figure 14: CTW Water Supply System

2.2.4 Cabonne Shire Council - Molong

2.2.4.1 CSC – Molong Model Outputs

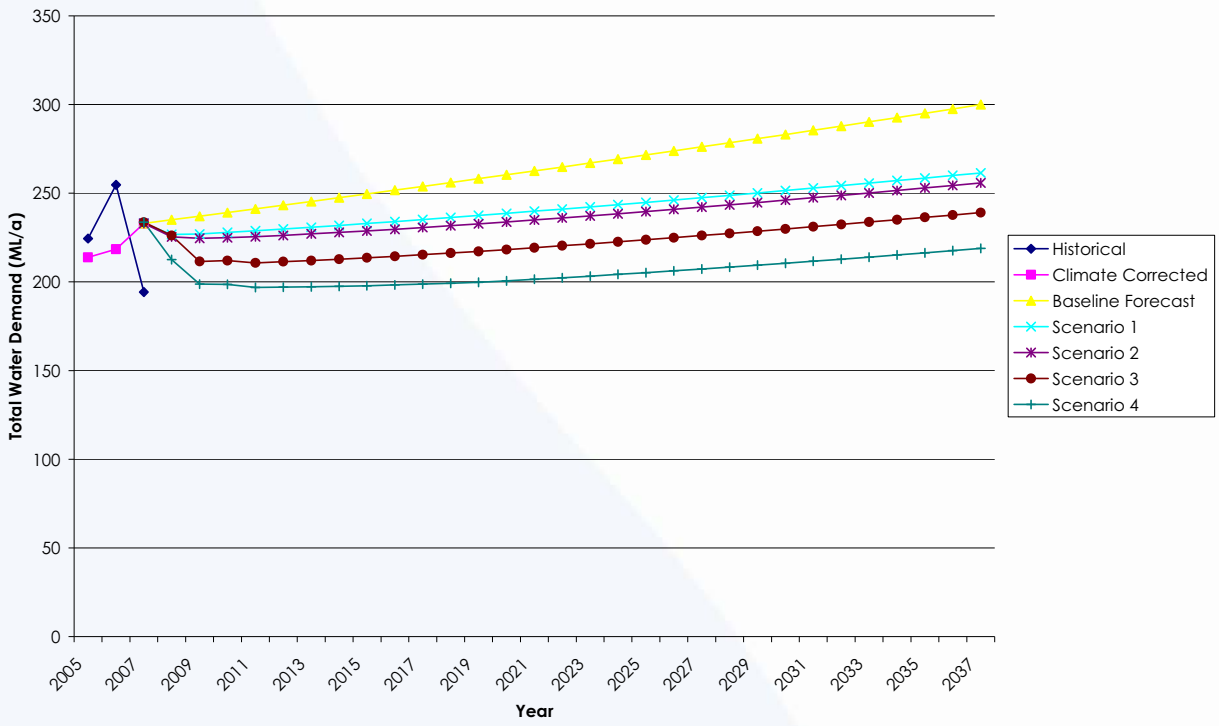


Figure 15: Total Water Demand

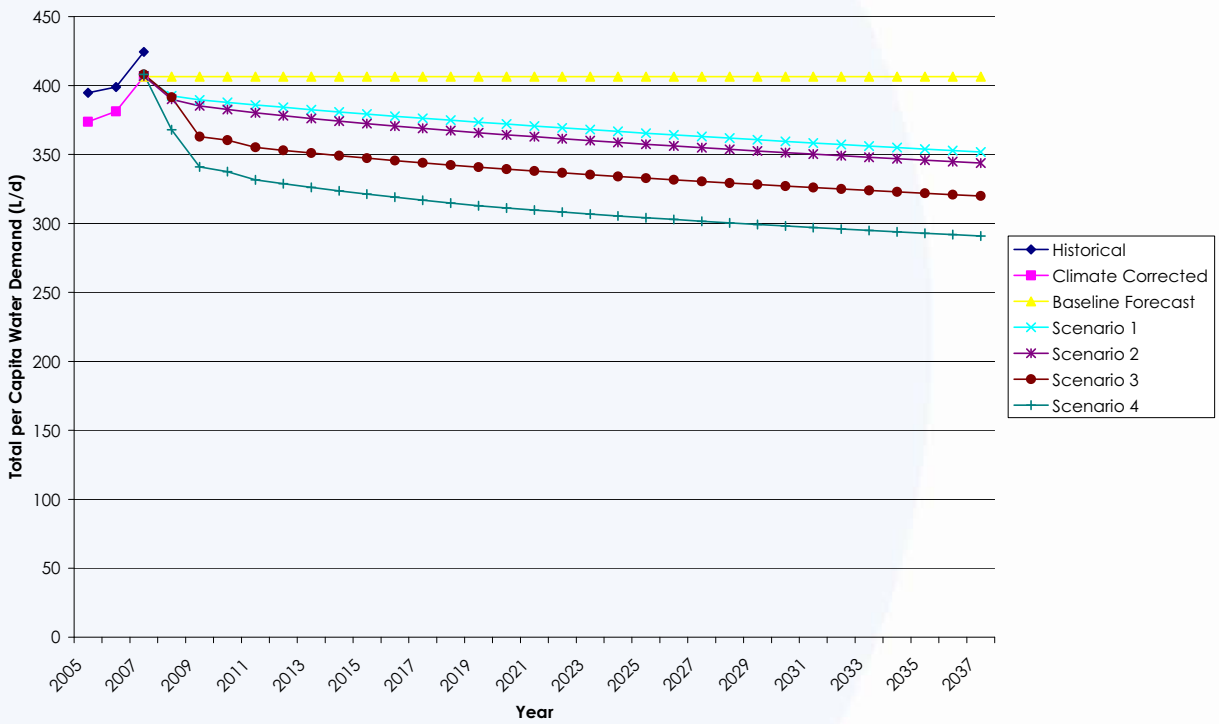


Figure 16: Total per Capita Water Demand

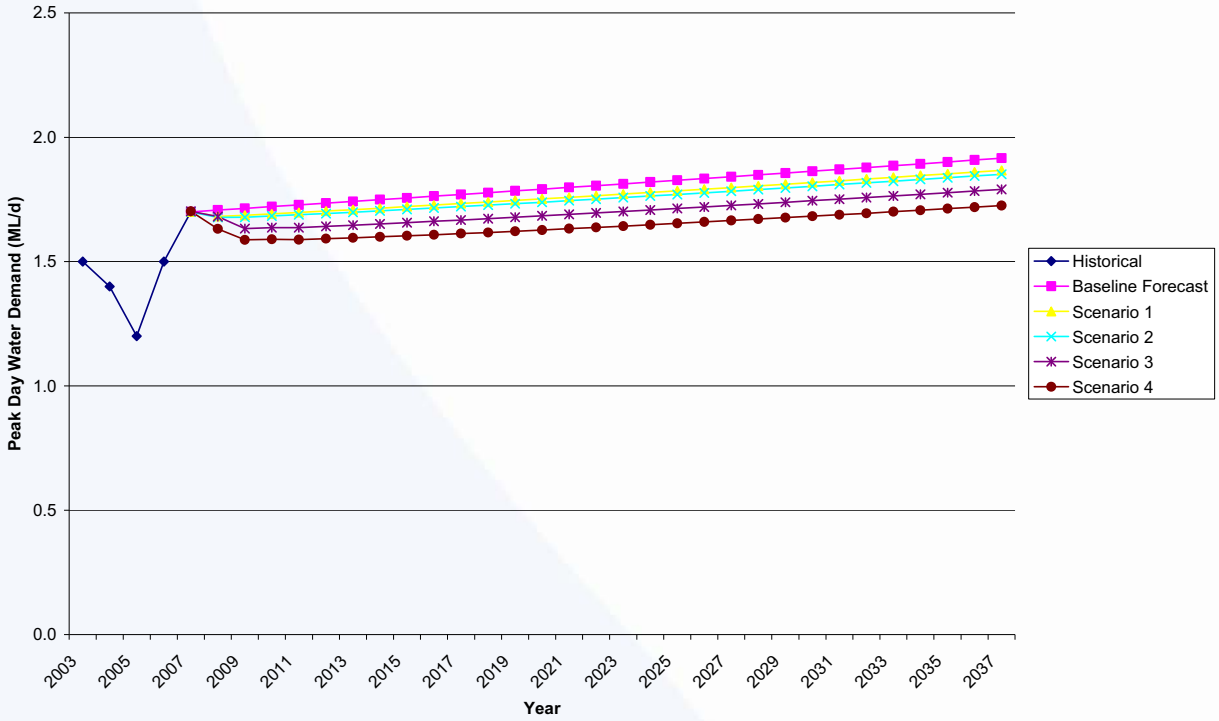


Figure 17: Peak Day Water Demand

2.2.4.2 CSC - Water Supply System Issues Identified

Annual Demand and Capacity

According to the recent yield study for Molong Creek Dam, the dam's secure yield is 300 ML/a. Figure 15 shows that the baseline "worst case" forecast total annual water demand for 2037 is approximately 300 ML/a. This appears to indicate that Molong's annual supply is adequate for the next 30 years.

CSIRO Sustainable Yield Study for the Macquarie Castlereagh River Valley

Recent studies by CSIRO on sustainable yield in the Macquarie-Castlereagh Valley state "The best estimate of climate change by 2030 would reduce surface water availability by 8% …" (http://www.clw.csiro.au/publications/waterforahealthycountry/mdbsy/macquarie-castlereagh.html). While this covers a very large catchment the implications of an 8% reduction in surface water on Molong Creek yield would be expected to impact on the long term dam yield.

Climate change and El Niño issues have led last year to 50% reductions in supply in the Murray Valley. Such uncertainty about future climatic conditions, combined with the uncertainties of the climate correction of the modelled historical data, indicates the need for water supply planners to take a precautionary approach. This appears to be an issue for this study. Refer to discussion about climate change in the CTW section above, which is relevant for CSC too.

Potential Issue: Although Molong System appears to be satisfactory based on historical information. Uncertainty about future climatic conditions means that yield study and demand calculation scenarios should be developed to take into account possible climate change.

Peak Day Demand and Capacity

Peak day demand projections have been compared with system peak day capacities for major system components.

Molong WFP has the capacity to supply approximately 2 ML/d. Figure 17 shows that the baseline "worst case" forecast peak day water demand for 2037 is approximately 1.9 ML/d. This means that, even though any water conservation measures are applied, the existing WFP has the capacity to just satisfy the future demand. Considering the current estimated number of

rainwater tanks installed in Molong (see section 0), this analysis should be reviewed in the future to ensure the sustainable capacity of the system.

Figure 18 represents Molong's current water system, including a breakdown of the Low Level and High Level Reticulation systems' current and future PDD. The PDD capacities of the pipes that carry water to the reticulation systems are unknown. It is assumed that the future capacity of the pipes will not exceed the current capacity of the Molong WFP, 2 ML/d.

The baseline "worst case" scenario forecast peak day results show that the current capacity of the raw water mains will satisfy water demand in Molong water supply system in 2037 and that the capacity of the distribution system (assumed to be approximately 2 ML/d) will only just satisfy future water demands (subject to accuracy of reticulation systems capacity).

Although no current system capacity issues have been identified, Molong WFP should be assisted with others water sources, such as rainwater tanks, to ensure the water demand in 2037 won't exceed the Molong WFP capacity.

The various scenarios present different levels of water conservation measures that, if needed, could be applied to reduce water consumption in the future. This will need further assessment.

2.3 Regional water demand

There are a number of regional issues regarding water security that may impact on the CWBC evaluation study. Due to recent drought experiences a number of LWUs within the CENTROC region are very concerned to secure their water supplies.

Orange City Council

Since 11 May 2008 Orange City Council has been on level 5 drought restrictions with nearly no external use.

Orange City Council is progressing the construction of a 200ML dam and weir, major components of the $4.9M Blackmans Swamp Creek stormwater harvesting project(source: OCC Press release 3October 2008). The supply to Orange of water from Lake Canobolas, upstream of Molong (but not in the catchment of Molong Creek Dam) is also being developed (source: OCC Press release 15 January 2008).

A number of projects are being promoted within the region including:

The augmentation of Lake Rowlands by enlarging the storage from 4500ML to 26500ML. Since 1998 CTW has been advocating for the enlargement of Lake Rowlands and has commissioned numerous studies over that time. The most recent being a 2006 economic needs study conducted by the Western Research Institute, Bathurst with engineering assistance from GHD.

The possibility of linking various water storages within the region including Lake Wyangala and Lake Burrendong.
A $500K CENTROC regional water security study has been awarded and will begin soon. This project may provide a context for region wide schemes. The feasibility of these projects is expected to be considered as part of this CENTROC study.

Issue: Impact of regional (beyond CWBC) water supply planning (e.g. CENTROC Water Security Study) may impact CWBC context

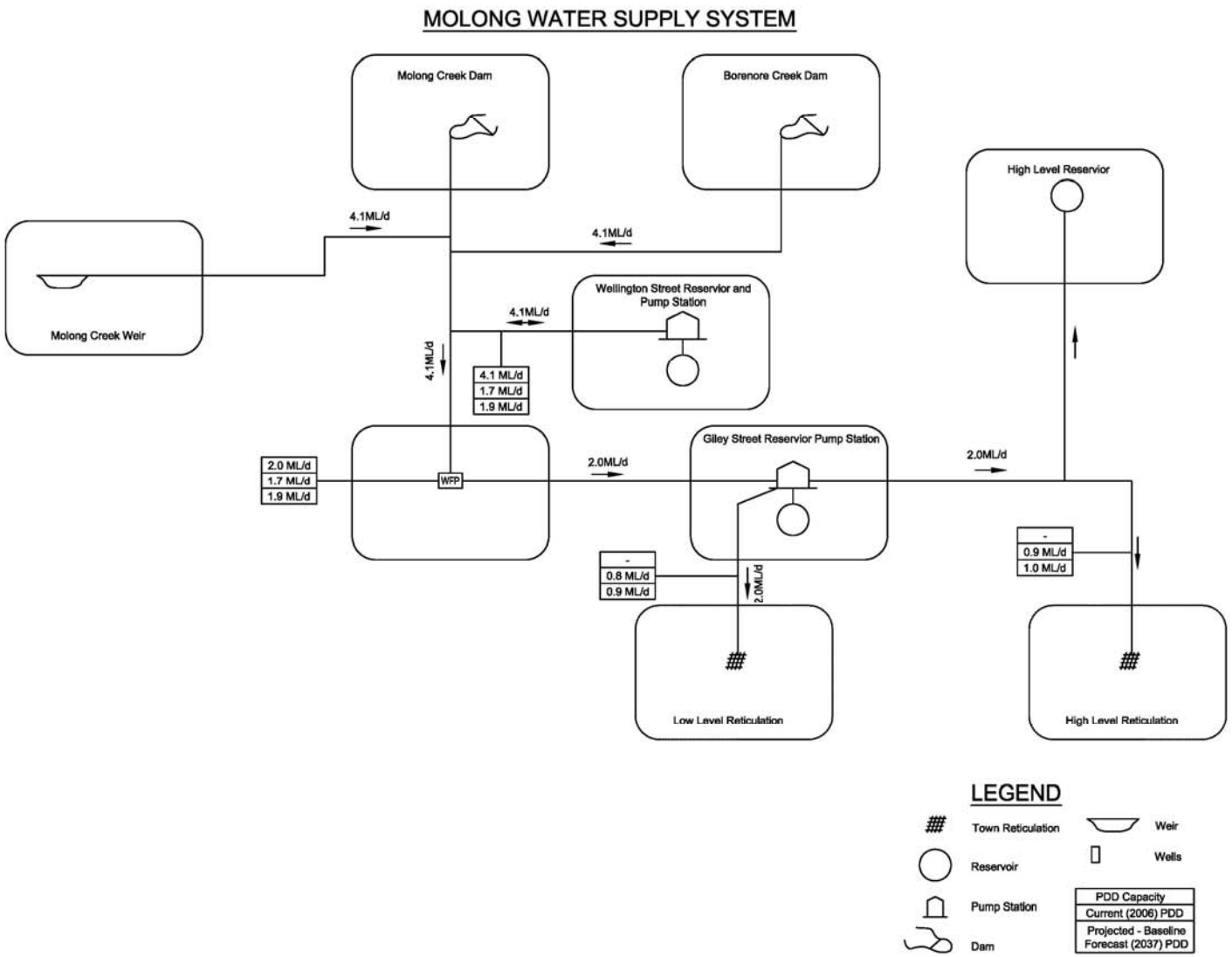


Figure 18: Molong Water Supply System

3 Rainwater Tank Assessment

3.1 Introduction

This rainwater tank assessment has been prepared using the Rainwater Tank Model provided by the DWE. The model was used accordingly to the Rainwater Tank Model (Version RTM 2.1) Manual, July 2006, prepared by DWE.

The rainwater tank model calculates the benefits to potable water usage and water bill savings per residential household. It assumes that a rainwater tank provides potable water substitution. The model uses historical climate data (20 years) to forecast the likely water savings per household and to allow assessment during periods of wet weather, droughts and to assess performance against real climate variability. This assessment provides a generic assessment of the benefits of rainwater tanks as a source of water.

CTW and CSC supply water for the villages and towns of Central Tablelands area. The model has been applied for the two water suppliers to assess the benefits of rainwater tanks in their water supply systems.

3.1.1 Central Tablelands Water

CTW provides potable water to approximately 5,476 assessments in 14 towns and villages around Central Tablelands area. CTW has registered 5 rainwater tank rebate applications submissions in Weddin Shire Council (WSC), from November 2007 to the present. The rainwater tank rebate for a 5 kL tank is $400.

3.1.2 Cabonne Shire Council

CSC supplies potable water to the town of Molong and Delgany Estate (Mullion Creek), and non-potable water for the villages of Cumnock and Yeoval. The town of Molong is the main water consumer; therefore for the purpose of this analysis data from Molong only was used.

3.2 Data Required

Some of the data provided by CTW to run the model has been used on the CSC rainwater assessment as well. Therefore the mains water savings (output) was the same for both analyses (see Section 3.4.1). It is expected that the local input values provided by CTW are more relevant and accurate for CSC than the typical values available as defaults from the model. CTW and CSC input data differs only in typical water charges as shown on Table 20.

Council is unable to provide some of the data required and typical values from the model have been used instead.

Table 20: Input Data

Data Required	CTW Data	CSC Data	Provided by
Historical climate data	20 years of daily rainfall and maximum temperature data		SILO – Bureau of Meteorology
Roof area draining to tank	150 m^2		HSc assumes it is an average roof area for CTW and CSC residential houses. The typical value from model (200m^2) is considered too high for the study area
First flush vol/day	20 L		Typical Value from model

Data Required	CTW Data	CSC Data	Provided by
Rainfall water lost due to wetting & evaporation / storm	0.5 mm		Typical Value from model
Roof runoff factor	90%		Typical Value from model
Tank starting volume when first installed	1 L		Typical Value from model
Annual average outside usage	106 L/day/house		CTW
Av. daily toilet usage	105 L/house		CTW
Av. daily washing machine cold water usage	97 L/ house		Typical Value from model
Av. daily hot water usage	140 L/ house		Typical Value from model
Av. daily household usage	425 L/ house		CTW
Maximum mains tank top up per day	600 L		Typical Value from model
Typical water usage charge	$1.35 /kL	$2.10 /kL	CTW & CSC respectively
Typical water access charge	$124 /yr	$182.20 /yr	CTW & CSC respectively

3.3 Options Scenarios

The model allows for variability in water usage and tank size figures. The water usage variability was used to determine the outcomes for the 2 different scenarios below:
Outside usage only,
Outside and toilet usage.
Each scenario has been assessed against four different tank sizes to determine their benefit to potable water usage and water bill savings.

3.4 Outputs

For the purpose of these analyses it was assumed that the rainwater tank life was 10 years. The rainwater tank costs including installation were assumed to be the same for CTW and CSC – Molong systems. Therefore the price per kL of water for each scenario was the same for both water systems.

The criterion selection for the tank analysis is the cost of water supplied from the tank. This calculation does not consider net present value (NPV). The results of the rainwater tank assessment shows that the preferred option for each scenario in both water systems is the 5kL tank size.

A summary of both rainwater tank assessments outputs is shown on Table 21 and Table 22.

Table 21: Summary of CTW Rainwater Tank Assessment

CTW			Rainwater tank life cycle – 10 years	
Tank Size (kL)	Tank and Installation Cost ($)	Mains Water Savings (kL/yr)	Total water bill saving ($ / 10 yrs)	Rainwater Cost ($ / kL)
	Scenario 1 - Outside usage only			
1	$ 3,705	18.3	246	$20.2
2	$ 3,825	28.7	388	$13.3
5	$ 4,175	35.7	482	$11.7
10	$ 4,995	38.3	517	$13.0
	Scenario 2 - Outside usage and toilet			
1	$ 3,705	27.3	369	$13.6
2	$ 3,825	44.2	597	$8.6
5	$ 4,175	59.9	809	$7.0
10	$ 4,995	67.7	914	$7.4

Table 22: Summary of CSC Rainwater Tank Assessment

CSC - Molong			Rainwater tank life cycle – 10 years	
Tank Size (kL)	Tank and Installation Cost ($)	Mains Water Savings (kL/yr)	Total water bill saving ($ / 10 yrs)	Rainwater Cost ($ / kL)
	Scenario 1 - Outside usage only			
1	$ 3,705	18.3	383	$20.2
2	$ 3,825	28.7	603	$13.3
5	$ 4,175	35.7	750	$11.7
10	$ 4,995	38.3	804	$13.0
	Scenario 2 - Outside usage and toilet			
1	$ 3,705	27.3	574	$13.6
2	$ 3,825	44.2	929	$8.6
5	$ 4,175	59.9	1259	$7.0
10	$ 4,995	67.7	1422	$7.4

3.4.1 Mains Water Savings

The outputs for mains water savings were the same for CTW and CSC rainwater tank assessments. The amount of potable water saved on each scenario was not proportional to tank size as can be seen from graphs in Figure 19 and Figure 20. The graphs show that for using tanks above 5kL the per kL / year mains water savings were not as significant.

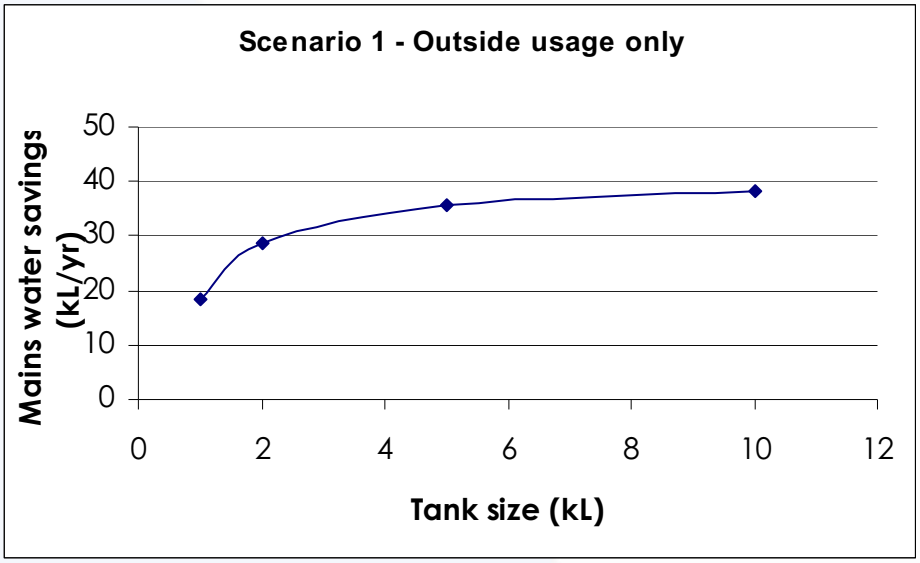


Figure 19: Scenario 1 – Mains Water Savings

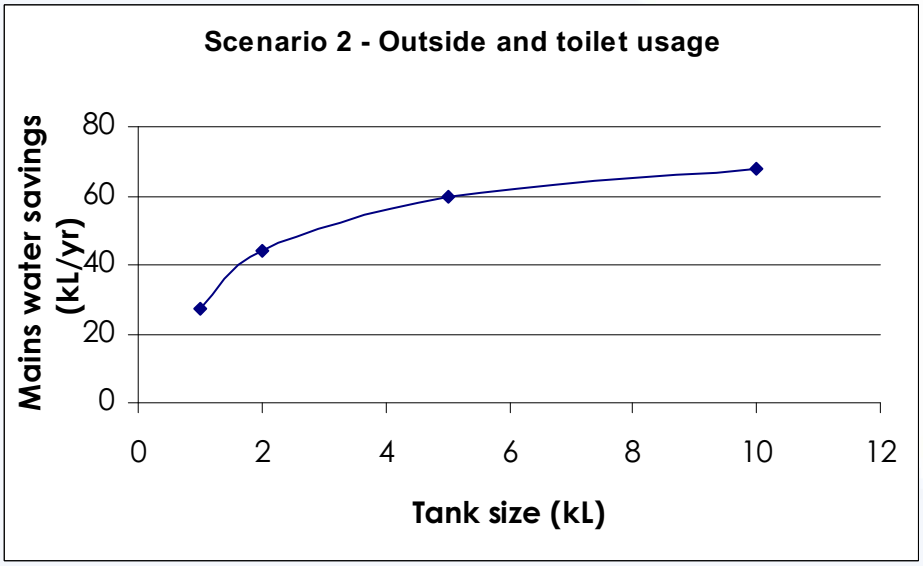


Figure 20: Scenario 2 - Mains Water Savings

3.4.2 Total Water Bill Savings

CTW and CSC have different typical water usage/access charges; therefore the outputs of total water bill savings for each water system were different (see Table 21 and Table 22).

3.4.3 Recommendation

Councils could, if they wish, further utilise rainwater tank rebates to encourage take up. The option of encouraging a percentage of customers to take up rainwater tanks may provide an approach to address annual and peak demand issues. To do this Council will need to consider the kind of rebates and the target take up percentage. This is likely to be considered as an option to address such issues in the latter part of the Evaluation Study process.

Molong has approximately 673 residences and an estimate of 270 rainwater tanks installed.

CTW does not have, at present, an estimate of total rainwater tanks currently installed in the CTW supply area. This would be important information to assess the effectiveness of this option.

For the reasons discussed above, on a cost per kL per year basis, the recommended maximum tank size for such an option would be 5kL.

Potential Issue: BSC, WSC, CSC and CTW rain water tank policies should be reviewed.

3.4.4 Discussion

The data in Table 21 and Table 22 indicate that there is no financial benefit for customers to install rainwater tanks. For example, for a 5 KL tank supplying outside usage and toilet, the capital investment of $4,175 far exceeds the saving of $809 over 10 years. A $400 rebate does not make this a viable financial proposition for the customers.

A benefit of rainwater tanks may be an increase in the secure yield, and possible the postponing of major capital works, in particular Lake Rowlands Dam upgrade. A preliminary assessment indicates that if all 5,476 customers in CTW utilised 5KL rainwater tanks, the annual supply from all the tanks in an average year would be in the order of 300 ML. However, this figure is not a secure yield as it is likely to be significantly lower in dry years. Further, the CSIRO and BOM forecasts (refer section 2.2.3.2) suggest future reductions in rainfall and yield.

If the secure yield from 5,476 rainwater tanks is in the order of 50-100 ML/a, it is not likely to impact on the needs for, and timing of, Lake Rowlands Dam upgrade. This is less than 5% of the current yield and so has very little impact.

Appendix A

DWE TBL Water Supply Performance Report

CTW-HC 20

Central Tablelands Water — TBL Water Supply Performance — 2005/06

WATER SUPPLY SYSTEM - Central Tablelands Water serves a population of 11,000 (5,330 assessments). Water is drawn from Lake Rowlands to supply Blayney, Canowindra, Grenfell, Eugowra, Millthorpe, Mandurama, Lyndhurst, Carcoar, Manildra, Cargo, Cudal, Woodstock and Gooloogong. The council has 2 dams with a total storage capacity of 4800 ML. The Central Tablelands Water system comprises 1 conventional treatment works (6 ML/d) and 1 DAFF works (9 ML/d), 46 service reservoirs (30 ML) 28 pumping stations, 22 ML/d delivery capacity into the distribution system, 254 km of trunk mains and 206 km of reticulation. With the exception of Quandialla, all the water supply is fully treated.

PERFORMANCE - Central Tablelands Water complied with 4 of the 6 Best Practice Criteria. The typical residential bill was $425 which was above the statewide median (Indicator 13). The economic real rate of return was 0.3% which was less than the statewide median (Indicator 41). The operating cost per property was above the statewide median (Indicator 47). Water quality complaints were above the statewide median (Indicator 23). Compliance with microbiological water quality was 100% with 2 of 2 zones compliant (Indicator 18), physical compliance was 100% (Indicator 16) and chemical compliance was 100% with 2 of 2 zones compliant (Indicator 17). Current replacement cost of system assets was $73M ($13,700 per assessment), cash and investments were $2M, debt was $5.7M and revenue was $3.8M (excluding capital works grants).

COMPLIANCE WITH BEST- PRACTICE MANAGEMENT GUIDELINES CRITERIA

(1) Complete Current Strategic Business Plan & Financial Plan	YES	(3) Complete performance reporting form (by 15 September)	YES
(2) (2a) Pricing (full cost-recovery, without significant cross subsidies)	Yes	(4) Sound water conservation implemented	YES
(2a) Complying Residential Charges	Yes	(5) Sound drought management implemented	
(2c) Complying non-Residential Charges	Yes	(6) Integrated water cycle management strategy commenced	
(2d) DSP with Commercial Developer Charges	Yes	COMPLIANCE WITH ALL REQUIRED CRITERIA	NO

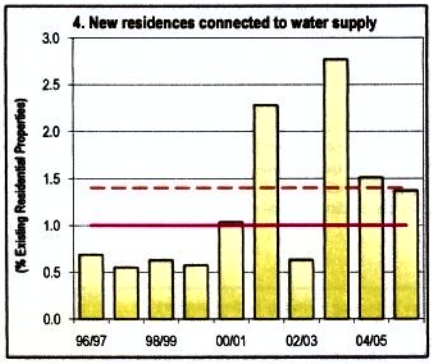
TRIPLE BOTTOM LINE (TBL) PERFORMANCE INDICATORS

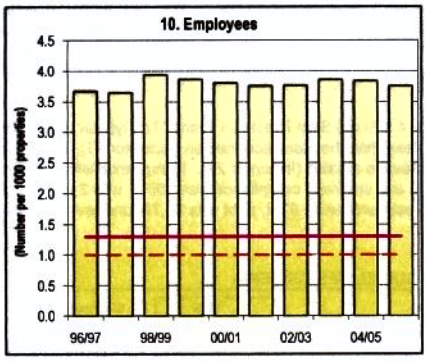
			LWU Result	Ranking 3,001 to 10,000 properties Note 1	Ranking All LWUs Note 2	Statewide Median Note 3
UTILITY CHARACTERISTICS	1 Population served: 11000	Number of connected properties: 5070				
	2 Number of assessments: 5330	0.95 connected properties per assessment				
	3 Residential assessments (% of total)		75			92
	4 New residences connected to water supply (%)		1.4	2	2	1.0
	5 Properties served per kilometre of main		11	5	5	33
	6 Rainfall (% of average annual rainfall)		94	3	3	86
	7 Total water supplied at master meters (ML)		2,160	3	3	7,400
	8 Peak week to average consumption (%)		205	5	5	155
	9 Renewals expenditure (% of current replacement cost of system assets)		1.3	2	1	0.0
	10 Employees per 1000 properties		3.8	5	5	1.3
SOCIAL — 2006/07 CHARGES & BILLS	Residential tariff structure:	inclining block; independent of land value				
	11 Residential water usage charge (c / kL) for usage up to 450 kL (Note 5)		125	1	1	105
	12 Residential access charge / assessment ($)		124	1	2	110
	13 Typical residential bill / assessment ($)		425	2	3	345
	14 Typical developer charge / equivalent tenement ($)		5,900	1	1	4,100
SOCIAL — HEALTH	15 Urban population without reticulated water supply (%)		9.8	5	5	0.9
	16 Physical water quality compliance (%)		100	1	1	100
	17 Chemical water quality compliance (%)		100	1	1	100
	18 Microbiological (E. coli) water quality compliance (%)		100	1	1	100
	19 Category 1 (minor) public health incidents per 1000 properties		0.0		1	0.0
	20 Category 2 (limited effects) public health incidents per 1000 properties		0.0		1	0.0
	21 Category 3 (major) public health incidents per 1000 properties		0.00		1	0.00
	22 Capital investment on improving public health performance per property ($)		1		3	6
SOCIAL — SERVICE LEVELS	23 Water quality complaints per 1000 properties		10	5	5	6
	24 Water service complaints per 1000 properties		2	1	1	6
	25 Customer interruption frequency per 1000 properties		79		4	38
	26 Average duration of interruption (h)		4	5	5	3
	27 Average customer outage time (min)		19	5	5	6
	28 Number of main breaks per 100 km		17	3	4	10
	29 Drought water restrictions (% of time)		0	1	1	3
	30 Total days lost (%)		2.9	4	4	3.2
ENVIRONMENTAL — MANAGEMENT	31 Average annual residential consumption per property (kL)		241	2	3	190
	32 Water losses (including leakage) (%)		8		1	10
	33 Energy consumption per Megalitre (kiloWatt hours)		920		4	660
	34 Renewable energy consumption per property (kiloWattt hours)		0		1	216
ENVIRONMENTAL — PERFORMANCE	35 Category 1 (minor) environmental incidents per 1000 properties		0.0		1	0.0
	36 Category 2 (limited effects) environmental incidents per 1000 properties		0.0		1	0.0
	37 Category 3 (major) environmental incidents per 1000 properties		0.00		1	0.00
	38 Capital investment on improving environmental performance per property ($)		0.0		2	0.9
ECONOMIC — FINANCE	39 Residential revenue from usage charges (% of residential bills)		75	1	1	67
	40 Non-residential revenue from usage charges (% of non-residential bills)		78	3	2	71
	41 Economic real rate of return (%)		0.3	5	4	1.4
	42 Return on assets (%)		0.7	5	4	1.6
	43a Net Debt to equity (%)		13	1	1	-11
	44 Interest cover		1	4	4	>100
	45 Loan payment per property ($)		115	1	1	23
ECONOMIC — EFFICIENCY	46 Operating cost (OMA) per 100km of main ($'000)		512	1	1	1040
	47 Operating cost (OMA) per property ($) (Note 6)		465	5	5	280
	48 Operating cost (OMA) per kilolitre (cents)		109	5	4	86
	49 Management cost per property ($)		201	5	5	110
	50 Treatment cost per property ($)		96	3	4	27
	51 Pumping cost per property ($)		48	4	3	24
	52 Energy cost per property ($)		37	5	4	17
	53 Water main cost per property ($)		59	4	3	49

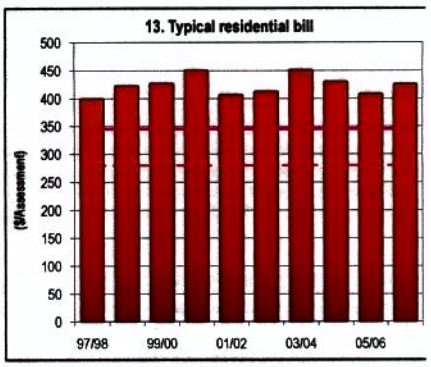
NOTES :

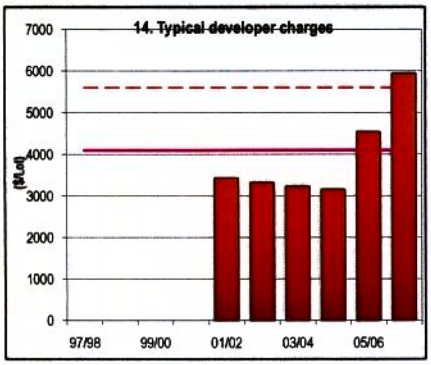
1. Ranking for LWUs with 3,001 to 10,000) connected properties is based on dividing the results for LWUs in this group into 5 equal divisions of 20%:
   ie. a ranking of 1 indicates the LWU is in the top 20% of LWUs; a ranking of 5 indicates the LWU is in the bottom 20% of LWUs. (Relevant for comparison with LWUs of similar size).
2. Ranking (1 to 5) for all LWUs is on a percentage of LWUs basis. (Relevant for comparing performance with all other LWUs).
3. The Statewide Median is on a percentage of connected properties basis (Table 1 of Monitoring Report) as this is the most appropriate for statewide comparisons.
4. Annual review of key projections and actions in LWU's SBP are required, together with annual updating of LWU's financial plan. The SBP should be updated after 3 years.
5. Residential and Non-residential Tariff: Access Charge based on Meter Size*(40mm:$496), Inclining Block.
   Water consumption by non-residential customers was 54% of potable water consumption excluding non-revenue water.
   2005/06 revenue from non-residential customers was 38% of annual rates and charges.
6. The operating cost (OMA)/property was $465. The components of operating cost were: management ($201), operation ($34), maintenance ($163), energy ($37) and chemical ($31).

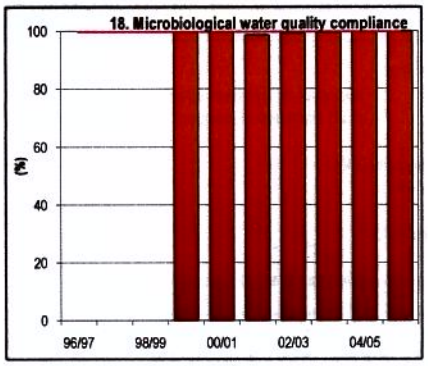
(Results shown for 10 years together with 2005/06 Statewide Median and Top 20%)

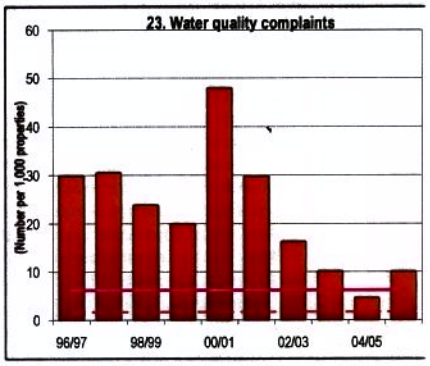


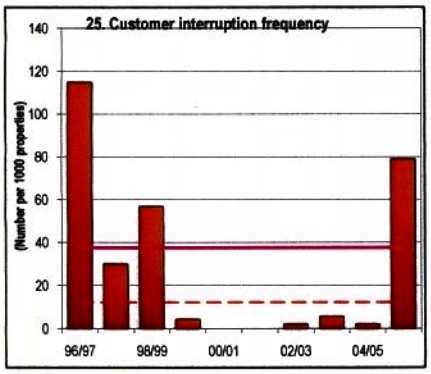


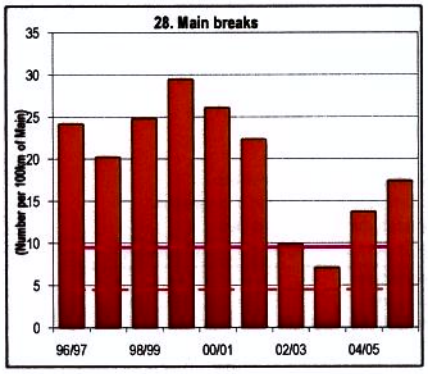


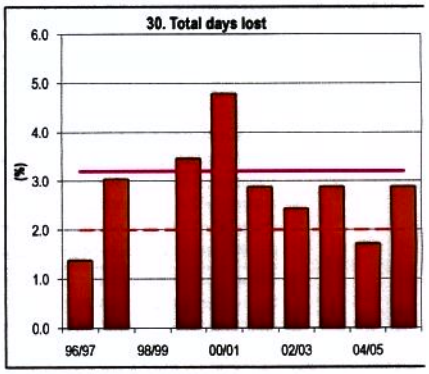


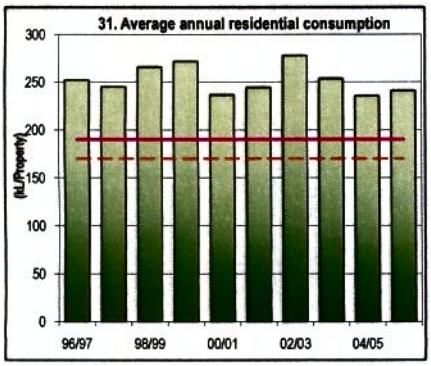


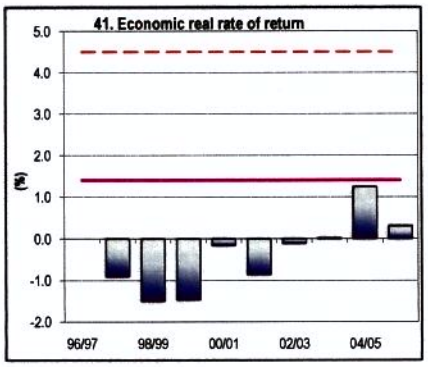


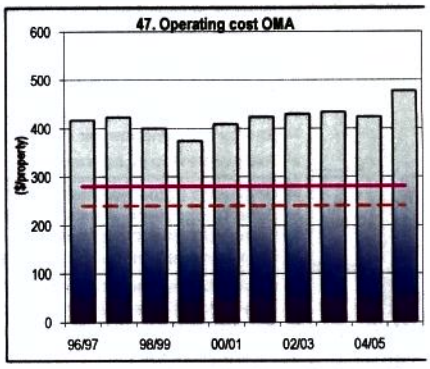


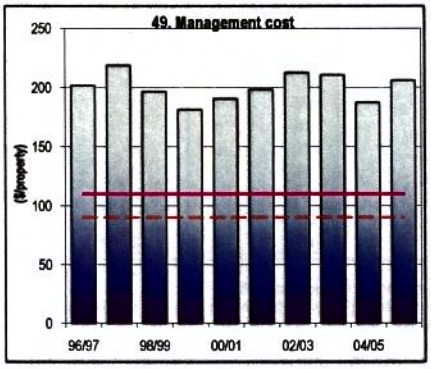


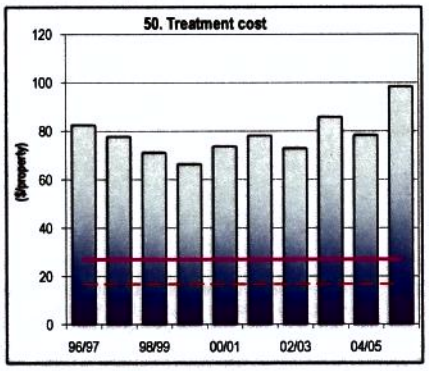


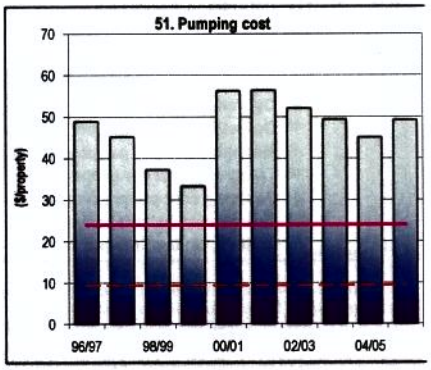












NOTES:

1. Costs are in Jan 2006$.
2. Microbiological water quality compliance 1998/99 to 2003/04 was on the basis of 1996 NHMRC/ARMCANZ Australian Drinking Water Guidelines for E. coli; from 2004/05 compliance was on the basis of the 2004 NHMRC/NRMMC Australian Drinking Water Guidelines.

LEGEND

2005/06 State Median

2005/06 Top 20%

Blayney Shire Council — TBL Sewerage Performance — 2005/06

SEWERAGE SYSTEM - Blayney Council has 1 sewage treatment works providing advanced secondary treatment. The system comprises 7,000 EP treatment capacity (Intermittent Extended Aeration/Activated Sludge), 7 pumping stations (1 ML/d), 19 km of rising mains and 43 km of gravity trunk mains and reticulation. Treated effluent is discharged to river.

PERFORMANCE - Blayney Shire Council complied with 3 out of 4 Best Practice Criteria. The typical residential bill was $440 which was the statewide median (Indicator 11). The economic real rate of return was 2.5% which was greater than the statewide median (Indicator 41). The operating cost per property was close to the statewide median (Indicator 47). Sewage odour complaints were less than the statewide median (Indicator 18). 100% of treated effluent complied with DEC licence limits and 1 of 1 sewage treatment works were compliant at all times (Indicators 29 to 31). The current replacement cost of system assets was $10M ($6,800 per assessment), cash and investments were $2.3M, debt was $1.2M and revenue was $1M (excluding capital works grants).

COMPLIANCE WITH BEST-PRACTICE MANAGEMENT GUIDELINES CRITERIA

(1) Complete current strategic business plan & financial plan	**YES**	(2e) DSP with commercial developer charges	Yes
(2) (2a) Full cost recovery (without significant cross-subsidies)	Yes	(2f) Liquid trade waste approvals & policy	Yes
(2b) Complying residential charges	Yes	**(3) Complete performance reporting form (by 15 September)**	**YES**
(2c) Complying non-residential charges	Yes	**(4) Integrated water cycle management strategy commenced**	
(2d) Complying trade waste fees and charges	Yes	**COMPLIANCE WITH ALL REQUIRED CRITERIA**	

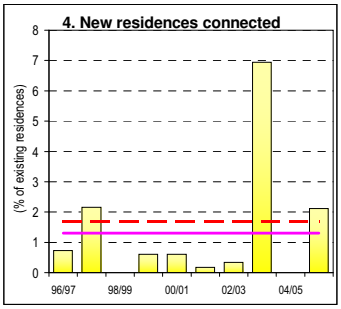
TRIPLE BOTTOM LINE (TBL) PERFORMANCE INDICATORS

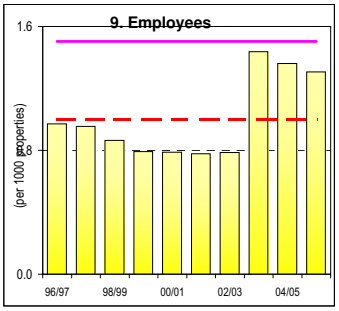
			LWU Result	Ranking: 200 to 1,500 properties (Note 1)	Ranking: All LWUs (Note 2)	Statewide Median (Note 3)
UTILITY CHARACTERISTICS	1	**Population served: 3600** — **Number of connected properties: 1530**				
	2	**Number of assessments: 1490** — **1.03 connected properties per assessment**				
	3	**Residential Assessments** (% of total)	86			90
	4	**New residences connected to sewerage** (%)	2.1	1	1	1.3
	5	**Properties served per kilometre of main**	25	4	5	41
	6	**Volume of sewage collected** (ML)	320		4	5,100
	7	**% Renewals expenditure of current replacement cost of system assets**	0.0	2	2	0.2
	8	**Employees per 1000 properties**	1.3	1	2	1.5
	9	**Employees undergoing 2 or more days of training** (% of total)	100		1	8
SOCIAL — 2006/07 CHARGES & BILLS		**Description of residential tariff structure:** access charge per property; independent of land value (Note 5)				
	10	**Residential access charge / assessment** ($)	440	4	4	385
	11	**Typical residential bill / assessment** ($)	440	4	4	400
	12	**Typical developer charge / equivalent tenement** ($)	1,980	1	3	3,500
	12a	**Non-residential sewer usage charge** (c/kL)	80	3	4	80
SOCIAL — HEALTH	13	**Urban properties without reticulated sewerage service** (%)	30.8	5	5	3.7
	14	**Category 1 (minor) public health incidents per 1000 properties**	0.0		1	0.4
	15	**Category 2 (limited effects) public health incidents per 1000 properties**	0.0		1	0.0
	16	**Category 3 (major) public health incidents per 1000 properties**	0.00		1	0.00
	17	**Capital expenditure on improving public health performance per property** ($)	59		1	68
SOCIAL — SERVICE LEVELS	18	**Odour complaints per 1000 properties**	0.0	1	1	0.8
	19	**Service complaints per 1000 properties**	11	3	3	14
	20	**Customer interruption frequency per 1000 properties**	0		1	15
	21	**Average duration of interruption** (hours)	1	1	1	2
	22	**Average customer outage time** (minutes)				1.5
	23	**Total days lost** (%)	0.0	1	1	3.3
ENVIRONMENTAL — NATURAL RESOURCE MANAGEMENT	24	**Volume of sewage treated per property** (kL)	209	4	2	200
	25	**Percentage effluent reclaimed for recycling**	70	2	1	9
	26	**Biosolids reuse** (%)				100
	27	**Energy consumption per Megalitre** (kiloWatt hours)	797		4	540
	28	**Renewable energy consumption per property** (kiloWatt hours)	1		1	148
ENVIRONMENTAL — ENVIRONMENTAL PERFORMANCE	29	**90 Percentile licence limits for effluent discharge:** BOD 30 mg/l; SS 30 mg/l; Total N 15 mg/l; Total P 1 mg/l				
	30	**Compliance with BOD in licence** (%)	100	1	1	100
	31	**Compliance with SS in licence** (%)	100	1	1	98
	32	**Sewer main chokes and collapses per 100 km of main**	27	3	2	49
	33	**Sewer overflows to the environment per 100 km of main**				8
	34	**Category 1 (minor) environmental incidents per 1000 properties**	0.0		1	5
	35	**Category 2 (limited effects) environmental incidents per 1000 properties**	0.0		1	0.1
	36	**Category 3 (major) environmental incidents per 1000 properties**	0.00		1	0.00
	37	**Capital investment on improving environmental performance per property** ($)	59		2	35
ECONOMIC — FINANCING	38	**Revenue from non-residential plus trade waste charges** (% of total revenue)				15
	39	**Revenue from trade waste charges** (% of total revenue)	3.0	1	1	1.5
	41	**Economic real rate of return** (%)	2.5	2	3	2.4
	42	**Return on assets** (%)	2.1	2	3	2.3
	43a	**Net Debt to equity** (%)	-10	2	2	-7
	44	**Interest cover**	72	4	4	>100
	45	**Loan payment per property** ($)	72	1	2	45
ECONOMIC — EFFICIENCY	46	**Operating cost (OMA) per 100 km of main** ($'000)	740	4	2	1200
	47	**Operating cost (OMA) per property** ($)	298	4	3	290
	48	**Operating cost (OMA) per kilolitre** (cents)	143	5	4	122
	49	**Management cost per property** ($)	127	5	4	100
	50	**Treatment cost per property** ($)	108	3	4	85
	51	**Pumping cost per property** ($)	38	3	3	48
	52	**Energy cost per property** ($)	20	4	4	20
	53	**Sewer main cost per property** ($)	25	3	2	31

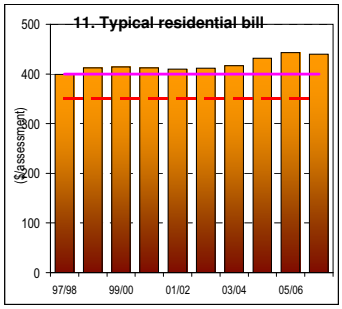
NOTES :

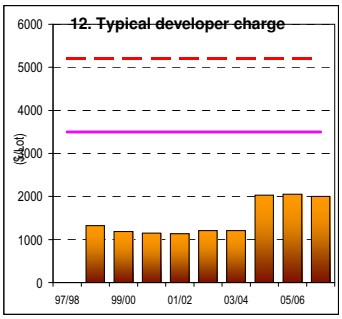
1 Ranking for LWUs with 200 to 1,500) connected properties is based on dividing the results for LWUs in this group into 5 equal divisions of 20% :
ie. a ranking of 1 indicates the LWU is in the top 20% of LWUs; a ranking of 5 indicates the LWU is in the bottom 20% of LWUs. (Relevant for comparison with LWUs of a similar size).
2 Ranking (1 to 5) for all LWUs is on a percentage of LWUs basis. (Relevant for comparing performance with all other LWUs).
3 The Statewide Median is on a percentage of connected properties basis (Table 2 of 2005/06 NSW Performance Benchmarking Report) as this is the most appropriate for statewide comparisons.
4 Annual review of the key projections and actions in LWU's Business Plan are required, together with annual updating of LWU's Financial Plan. The business plan should be updated after 3 years.
5 Non-residential: Access Charge based on size of service connection, sewer usage charge - 80c/kL.
6 Trade waste waste volume was 10% of total sewage collected.
7 Compliance with Total N in Licence was 100%. Compliance with Total P in Licence was 100%.
8 The operating cost (OMA)/property was $298. The components of operating cost/property were: management ($127), operation and maintenance ($151) and energy ($20).

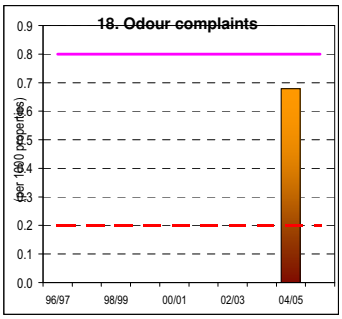
(Results shown for 10 years together with 2005/06 Statewide Median and Top 20%)

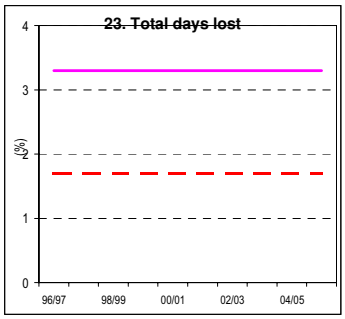


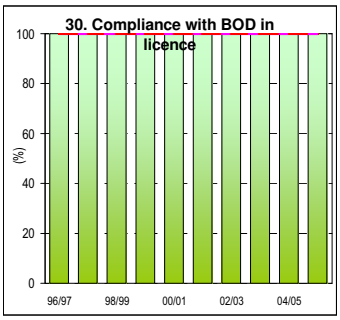


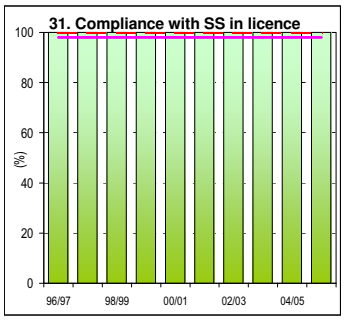


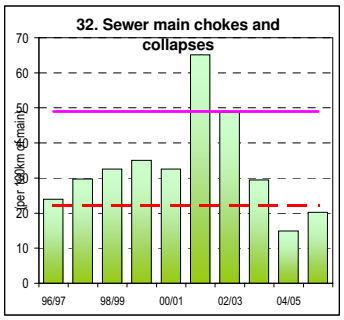


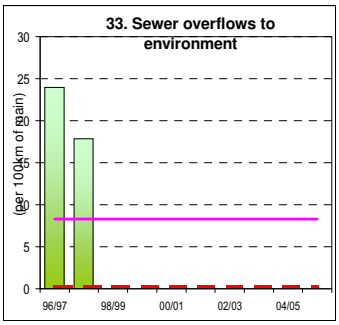


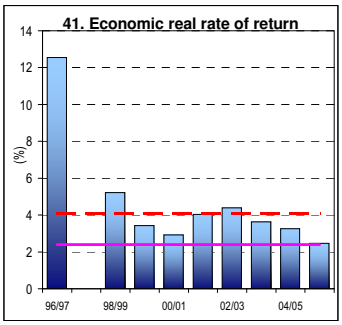


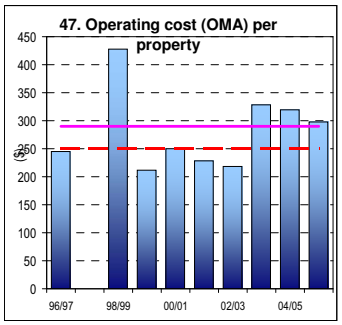


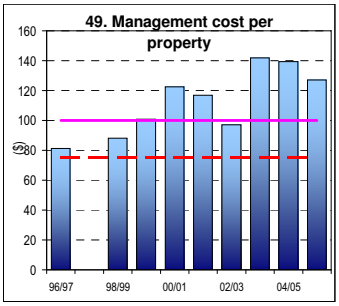


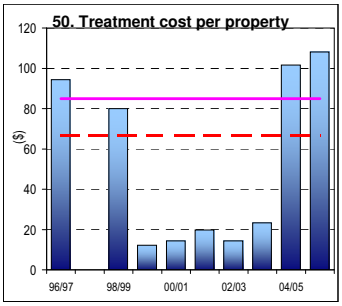


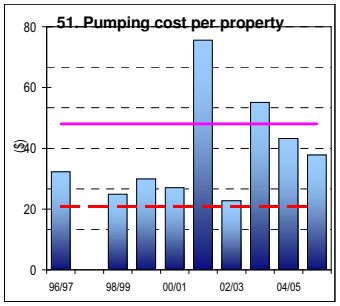












NOTES:

1. Costs are in Jan 2006$.

LEGEND

2005/06 State Median

2005/06 Top 20%

Appendix B

Water Demand Trend Tracking and Climate Correction Model Steps

Table 23: CTW and CSC - Molong Trend Tracking and Climate Correction Model Steps

Step	Model Sheet Name	Item	CTW Reference	CSC Reference	CTW Model - Comment	CSC Model - Comment
1	Setup	▪ Hindcasting	R3	R3		
		▪ Climate Data	R3	R3	50 years of climate data. Rainfall data is observed at 9am of the following morning. Thus rainfall data from SILO spreadsheet has been shifted to the day before.	
		▪ Trend Tracking	R1	R4	5 years of daily water production	4 1/2 years of estimated daily water production
2	Trend Tracking Data	▪ Observed Daily Total Water Production ML	R1	R4		
3	Population Data	▪ Population, Connections or other	R2	R5		
4	Trend Tracking Data				Press macro - Calculate population and Observed per Capita	
5	Climate Data	▪ Maximum Temperature, Rainfall and Evaporation	R3	R3	Press macro – Update Soil Moisture Data	
6	Soil moisture Control	▪ Period for Index Calibration	R3	R3	Period for Index Calibration is assumed to be 2 years of a hotter and drier than average summer (Sep 03 to Sep 05). Graph from Figure 1 is used to determine the years Press macro – Calibrate Soil Moisture Index	Period for Index Calibration is assumed to be 2 years of a hotter and drier than average summer (Sep 03 to Sep 05). Graph from Figure 1 is used to determine the years

Step	Model Sheet Name	Item	CTW Reference	CSC Reference	CTW Model - Comment	CSC Model - Comment
7	Regression Control	▪ Start to End Date for Calibration ▪ Variable Control	R1	R4	Date for calibration is assume to be 1 year of reasonable water consumption per capita (Mar 04 to Feb 05) – Graph in Figure 2 is used to determine the year Tick all variables	Date for calibration is assume to be 1 year of reasonable water consumption per capita (Dec 04 to Dec 05) – Graph from Figure 3 is used to determine the year
8	Regression Control				Press macro - Calculate Maximums and Minimums and Run Regression Analyses	
9	Variable Response Data	▪			Press macro – Create Variable Response Data	
10	Hindcast Data				Press macro – Update Hindcast	
11	Hindcast Frequency Data				Press macro - Calculate Frequency Distribution	
12	Trend Tracking Data	▪ Baseline Year Summary - Water Production per Capita L/d - Fixed	R1	R4	Data determine from graph in Figure 2 – Average of lowest 10 records of water production within the 5 years of data provided Press macro - Update Regression Calculations	Data determined from graph in Figure 3 – Average of lowest 10 records of water production within the 4 1/2 years of data provided
13	Trend Tracking Data				Press macro – Calculate Trends	

Appendix C

CTW Capital Works Program

Below is an extract from the minutes of the December 2005 meeting of Central Tablelands Water:

Included in the SBP is a 30-year financial plan, which the General Manager will expand upon at this meeting. In summary, the financial plan proposes to embark on probably the most challenging and exciting capital works program since the inception of the County in 1944. This program, estimated at over $50M in 2005-dollar terms and summarised below, will build upon the major capital works program that Council commenced in 2000. The estimated individual expenditures in the following summary are also expressed in 2005-dollar terms:

- An annual increase of 5% in the consumption tariff for the first 9 years over and above the general annual inflationary increase of 3%.
- Annual expenditure of $450,000 on reticulation mains renewal, including dead-ends removal.
- Renewal of Trunk Main 'K' Gooloogong to Grenfell, 35.325 kilometres, $5.3M – commencing 2011. Current condition poor. To be upsized from 200mm to 250mm.
- Renewal of Trunk Main 'U' from Trunk Main 'C' to Cudal, 33.8 kilometres, $3M – commencing 2014. Current condition poor. To be upsized from 150mm to 200mm.
- Renewal of Trunk Main 'C' Mandurama to Gooloogong, 72.92 kilometres, $10.85M – commencing 2017 to 2020. Current condition poor. To be upsized from 225/250mm to 300mm.
- Renewal of Trunk Main 'B' Carcoar Filtration Plant to Mandurama, 6.575 kilometres, $1M – commencing in 2020. Current condition fair. To be upsized from 250mm to 300mm.
- Renewal of Trunk Main 'D' Carcoar Filtration Plant to Browns Creek, 19.7 kilometres, $2.5M – commencing in 2022. Current condition fair. To be upsized from 200mm to 250mm.
- Renewal of Trunk Main 'A' Lake Rowlands to Carcoar Filtration Plant, 4.5 kilometres, $1.3M – commencing in 2023. Current condition fair. To remain at 375mm.
- Renewal of Trunk Main 'F' Browns Creek to Millthorpe, 8.325 kilometres, $0.75m – commencing in 2023. Current condition fair. To be upsized from 150mm to 200mm.
- Renewal of Trunk Main 'P' from Trunk Main 'C' to Somers, 3.387 kilometres, $0.16M – commencing in 2025. Current condition fair.
- Renewal of Trunk Main 'X' Lake Rowlands to Blayney, 14.94 kilometres, $3.1M – commencing in 2033. Current condition fair. To remain at 375/300mm.
- Administration Building refurbishment $100,000 in 2005/2006.
- Purchase new ditchwitch trencher $150,000 in 2005/2006.
- Carcoar Water Filtration Plant mechanical & electrical refurbishment $1M in 2016 and a further $1M in 2034.
- Blayney Water Filtration Plant - $50,000 each five years.
- Blayney Water Filtration Plant replacement/upgrade $4M – in 2024.
- Refurbishment of Gooloogong Bore $0.5M – in 2020.
- Additional new bore at Gooloogong $100,000 – in 2020.
- Major Pump Station refurbishment $1M in 2021 and a further $1M in 2034.
- Replacement/Refurbishment of Service Reservoirs $2.1M in 2034.
- Telemetry Renewal $200,000 every 10 years.

Capital Work	Estimated Cost ($2005)
Trunk Mains	$28 Million
Reticulation Mains	$13.5 Million
Blayney Water Filtration Plant	$ 4.3 Million
Carcoar Water Filtration Plant	$ 2 Million
Gooloogong Bore	$ 0.6 Million
Pump Stations	$ 2 Million
Service Reservoirs	$ 2.1 Million
Telemetry	$ 0.6 Million
Administration Building	$ 0.1 Million
Ditchwitch and Truck	$ 0.2 Million
Total	$ 53.4 Million

Document Control					
Revision	**Author**	**Reviewer**	**Approved for Issue**		
			Name	**Signature**	**Date**
5	ARA	AFR	Andrew Fraser	Andrew Fraser	11th November 2008