Western Water (WW) Forecast:
Victorian Essential Services Commission (ESC)

Document Number: F-130125-1214

	Document Author(s):	**Dr Don Perugini** **Dr Michelle Perugini** **Andrew Murphy**	
	Project Number:	**ESC-V-G.W-012013-SE.P.Po**	
	Issue Status:	**Draft**	
	Issue Date:	**January 2013**	

Intelligent Software Development Pty Ltd

Innovation House
Mawson Lakes Boulevard
Technology Park, Mawson Lakes
South Australia 5095
ACN 122 044 599
ABN 22 122 044 599

Phone: +61 (0)8 8343 8455
A/H: 0412 662 544
Fax: +61 (0)8 8260 8100

Email: info@intelligentsoftware.com.au
Web: www.intelligentsoftware.com.au

Table of Contents

1. Introduction

The Victorian Essential Services Commission (ESC) commissioned Intelligent Software Development (ISD) to utilise the SimulAIt and SimulAIt Online water behaviour model to configure a model for Western Water (WW), and produce future forecasts.

2. WW Validation

Figure 1 and Table 1 show the validation results, comparing the simulated and actual demand. Validation involves calibrating the simulated demand with actual demand for the first year (2005/06, calibrating garden and lawn areas), and then running the simulation (forecasts) forward for the following years given the schedule of restrictions, water conservation programs, product penetration, weather, etc. The accuracy for each year is above 90% except for 2007-08 and 2008-09 where there was a high level of restrictions on outdoor water use.

Table 1. Model validation comparison – simulated versus actual historical demand.

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Actual demand	232.3	181.4	182.0	176.0	166.0	158.0	169.0
Simulated demand	234.0	191.6	161.4	156.3	153.4	157.5	167.9
Accuracy	99.3%	94.4%	88.7%	88.8%	92.4%	99.7%	99.3%

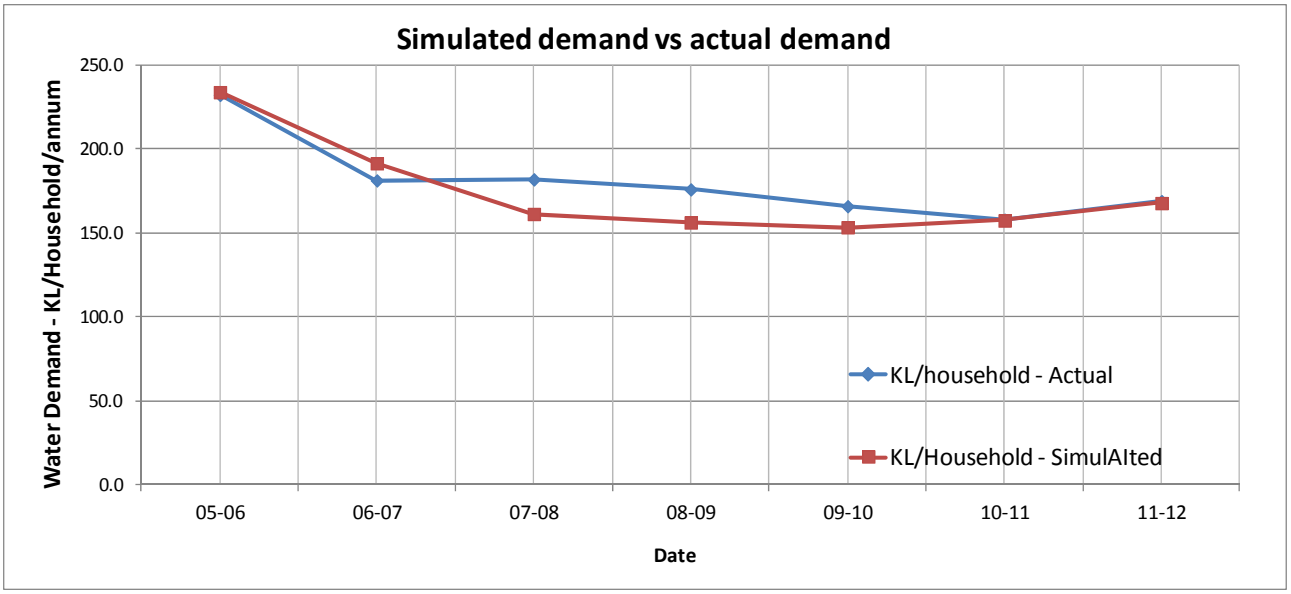

Figure 1. Simulated versus actual historical demand.

3. Demand Forecasts – Behaviour Maintenance Ranges

The validated WW demand model was used to forecast and compare different scenarios and levels of permanent *behaviour maintenance* from 2008-2023 (refer Figure 2, Figure 3, Table 2 and Table 3). Permanent behaviour maintenance refers to the level of behaviour change that consumers persist with permanently as influences ease (e.g. restrictions, drought conditions and associated communications), due to consumers becoming accustomed to their changed behaviours which they have persisted with over a period of time[1]. The greater the level and duration of behaviour change by consumers, whether voluntary or enforced through policy, the greater the level of behaviour maintenance.

The demand forecasts compare a baseline scenario comprising a standard[2] level of behaviour maintenance, with scenarios comprising a 33% increase and decrease in behaviour maintenance. Additionally, the 'no influences' scenario represents the water demand that would likely have been seen if no restrictions or other influences were implemented in the past. The no influence scenario shows the natural gradual decline in water demand from population changes and uptake of efficient appliances. The no influences scenario represents the 'theoretical maximum' bounce-back in demand if consumers reverted back to their previous water usage behaviours. Therefore, the difference between the no influences scenario and the other scenarios represents the reduction in water demand from permanent behaviour maintenance/change.

The scenario forecasts show that the reduction in water demand due to behaviour maintenance/change is up to approximately 12 KL/household/annum from 2013-14 to 2022-23. Sensitivity analysis on behaviour maintenance shows that there is a greater likelihood for lower demand if consumers exhibit a higher level of behaviour maintenance rather than higher demand if consumers exhibit a lower level of behaviour maintenance. Forecasts show that the future water demand is expected to increase to 180-192 KL/household/annum in 2013-14, assuming climate conditions return to normal levels. The bounce-back is expected to be less than the pre-drought demand level of approximately 233 KL/household/annum. Figure 3 and Table 3 show the results for total residential consumption calculated by multiplying the per household (connection) forecasts with the number of residential connections (the assumed number of connections is shown in Table 4).

[1] Permanent behaviour maintenance is in addition to temporary behaviour maintenance which is the lag time for consumers to gradually revert back to their desired behaviour.
[2] Standard behaviour maintenance in the model is where for every 18 months that a customer persists with a given behaviour, there is a10% reduction in the effort to maintain that behaviour.

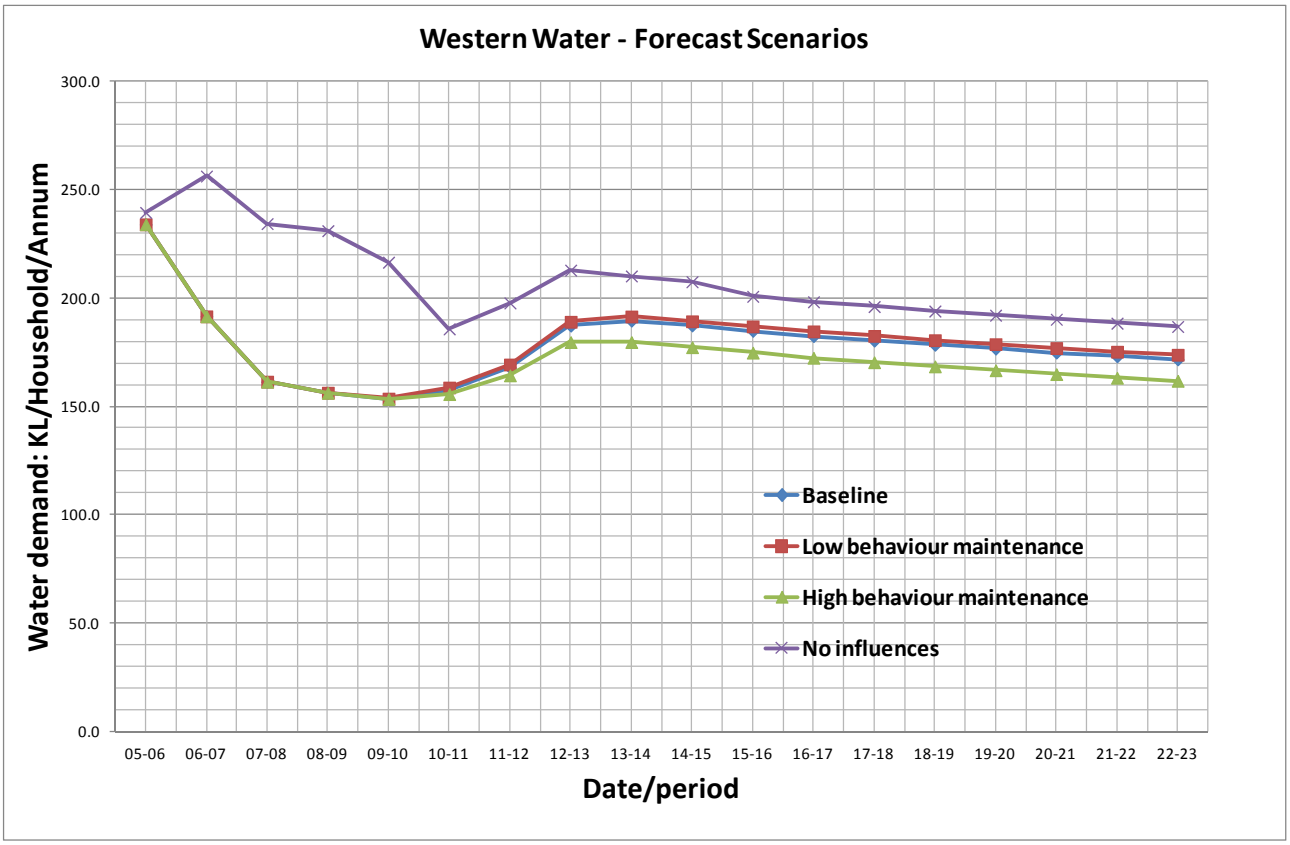

Figure 2. Comparison of baseline scenario with varying permanent behaviour maintenance – KL/Household/Annum.

Table 2. Scenario forecast results, in KL/household/annum.

Demand	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14
Baseline	234.0	191.6	161.4	156.3	153.4	157.5	167.9	187.2	189.5
Low behaviour maintenance	234.0	191.6	161.4	156.3	153.6	158.7	169.3	189.0	191.4
High behaviour maintenance	234.0	191.6	161.3	156.2	153.4	155.6	164.3	179.7	179.7
No influences	239.5	256.3	234.3	231.1	216.5	185.8	197.7	212.9	210.2
Demand	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Baseline	187.3	184.8	182.4	180.3	178.4	176.6	174.8	173.1	171.7
Low behaviour maintenance	189.3	186.9	184.6	182.5	180.5	178.7	176.9	175.2	173.8
High behaviour maintenance	177.3	174.8	172.4	170.3	168.4	166.6	164.8	163.2	161.8
No influences	207.5	200.8	198.2	196.0	194.0	192.1	190.2	188.4	186.8

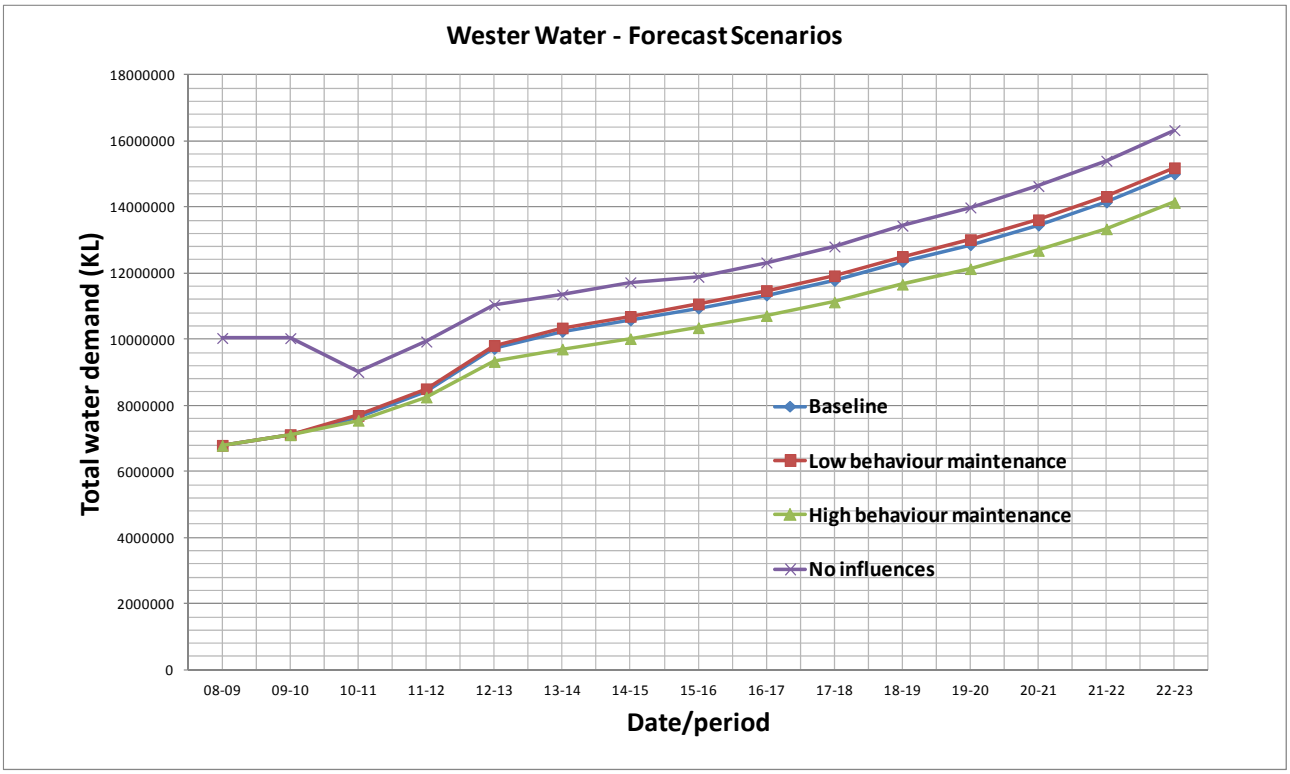

Figure 3. Water demand comparison: total water demand (KL).

Table 3. Water demand comparison: total water demand (ML).

Demand	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Baseline	6789	7110	7637	8431	9717	10236	10580	10941
Low behaviour maintenance	6790	7115	7694	8503	9811	10340	10691	11066
High behaviour maintenance	6786	7107	7546	8249	9326	9704	10016	10349
No influences	10038	10033	9008	9930	11049	11353	11723	11888
Demand	16-17	17-18	18-19	19-20	20-21	21-22	22-23	
Baseline	11336	11777	12354	12859	13449	14150	15001	
Low behaviour maintenance	11472	11919	12503	13016	13614	14324	15186	
High behaviour maintenance	10716	11127	11665	12135	12685	13339	14136	
No influences	12322	12804	13434	13987	14634	15399	16327	

Table 4. Projections for the number of connections.

Demand	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Baseline	43,438	46,339	48,487	50,219	51,908	54,013	56,488	59,209
Demand	16-17	17-18	18-19	19-20	20-21	21-22	22-23	
Baseline	62,152	65,317	69,252	72,826	76,951	81,752	87,385	