Appendix K

Water Supply Demand Strategy

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Water Supply Demand Strategy 2006 to 2055

- Executive Summary – Final
- 6th February 2007

Executive Summary

Study Objectives

The basic objective of Western Water's Water Supply Demand Strategy (WSDS) is to set out the strategy that will sustainably achieve a balance between water supply and demand over the long term. The goals of the WSDS are to:

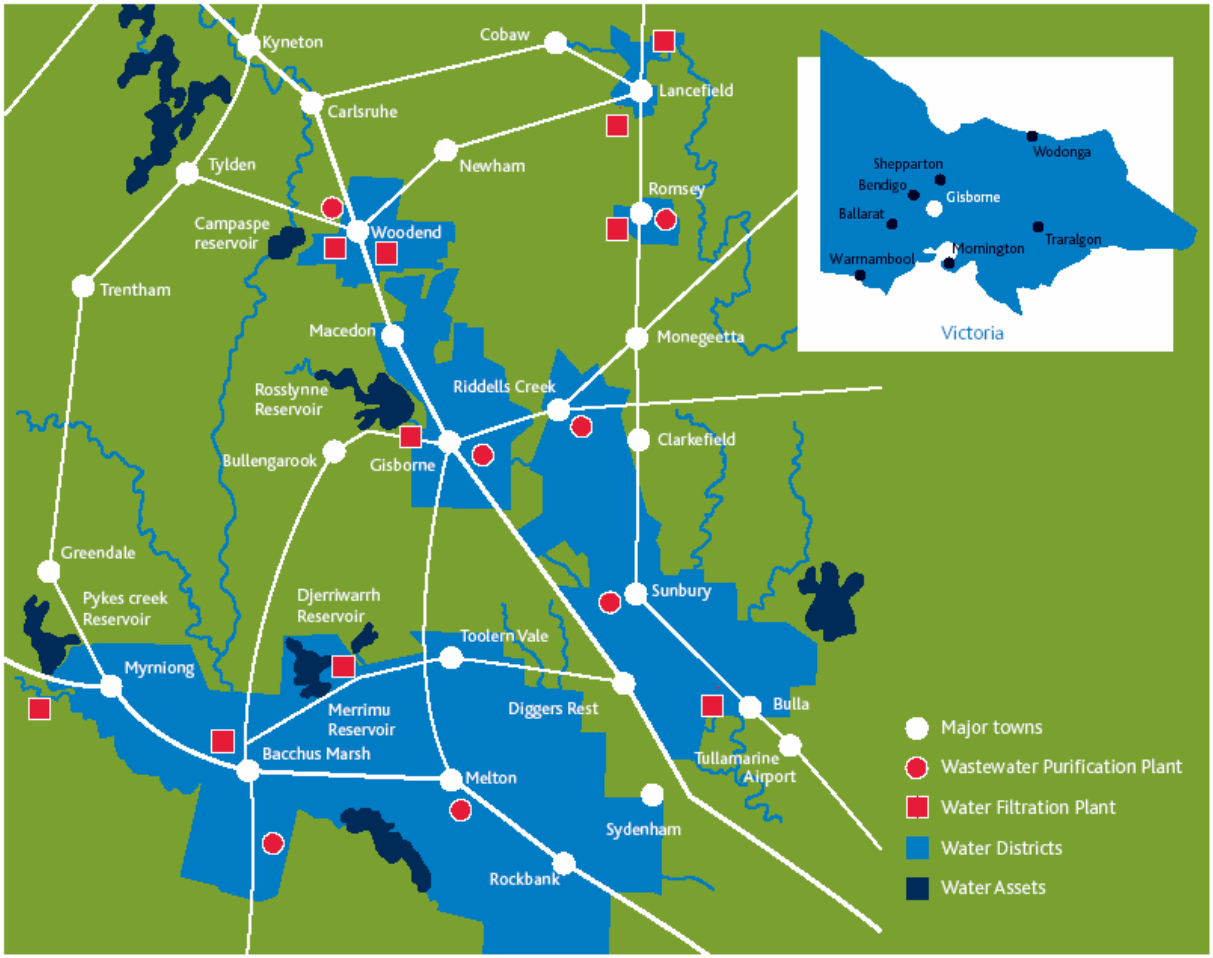
- Undertake water resources planning in an auditable framework that is common throughout Victoria and may be integrated into the Central Region Sustainable Water Strategy (CRSWS) currently being developed by the Department of Sustainability and Environment (DSE);
- Provide long-term (50 year outlook) water demand forecasts;
- Include climate change in the development of future supply and demand scenarios, and consider other risks that may influence the strategy;
- Provide a plan for reducing demand to achieve, at minimum, the targets set by Western Water's Board;
- Integrate alternate water supply options, such as recycled water and rain water with water demand measures and supply augmentation schemes into water supply planning;
- Provide a sound basis for water supply planning to be aligned with the Water Plan that sets out the capital and operating requirements of Western Water as well as the water tariffs charged to customers;
- Engage local communities in the planning of the long term sustainability of their water supplies and resources.

Status of current supplies

Figure 1 shows the layout of Western Water's supply area. The shading in the figure denotes the various water supply systems that Western Water operates.

- In a normal year the majority of Western Water's supply is purchased from Southern Rural Water's Rosslynne and Merrimu and Pyke's Creek storages. This supply is supplemented by water purchased from Melbourne Water Corporation and small storages at Romsey, Riddells Creek, Mount Macedon, Macedon, Woodend, and Lancefield.

n **Figure 1: Western Water Supply Area (source: Western Water)**



WSDS Communications

Western Water's planning associated with its growth, and the development of this WSDS, has as a major input, the views of its customers and the community that it serves.

In the recent past Western Water has commissioned major supply infrastructure to deliver water from Melbourne to Sunbury, Diggers Rest, Bulla, Melton, Rockbank, Toolern Vale, Bacchus Marsh, Riddells Creek, Gisborne, Macedon and Mt Macedon. Each of these supply augmentation projects involved liaison with and input from specially formed stakeholder, community and customer reference groups.

This style of communication is based on Western Water's model for community input into all of its programs and planning. Western Water has 3 major regional areas, or communities, each area has a Community Reference Group (CRG). Each group meets up to 4 times per year with representatives, including Board members, to examine plans and programs and receive input from the Group. The chairman of each Group meets quarterly with other representatives of state wide customer advocacy groups, in a peak Group known as Western Water's Customer Advisory Group (CAG). This process ensures coordination and communication from the community at the customer level. Each CRG and CAG member must apply for their position in the group, and all are active in their community, thereby obtaining general and grass roots feedback on the operations, plans and programs of Western Water.

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When major projects are planned special reference groups are established, the most recent being the Macedon Ranges Water Resources Review – Romsey, Lancefield and Woodend Community Reference Group which has dealt with the key WSDS need of augmenting supplies to Romsey, Lancefield and Woodend. This group has met five (5) times and consists of representatives from members of the Macedon Ranges Community Reference Group, Macedon Ranges Shire Council, Department of Sustainability and Environment and Southern Rural Water. The key options presented in the WSDS for these towns are the results of the work of this reference group in considering all issues and options for meeting the water needs for these towns into the future.

Forecast Demand and Adequacy of Existing Supplies

Western Water serviced 49,100 properties with an estimated population of 123,600 people in June 2005. The service area is experiencing Victoria's most rapid population growth rates, for example the growth recorded in 2006/07 was almost 4.2%. Two demand forecasts were prepared based on alternate population growth forecasts. The principal forecast utilises the statewide population growth forecasts known as the Victoria in Future Forecasts (VIF forecast) prepared by the demographic unit of the Department of Sustainability and Environment, and the alternate forecast

illustrates a high growth scenario more closely aligned with recent experience. The resulting forecasts of average annual demands are shown in Figure 2.

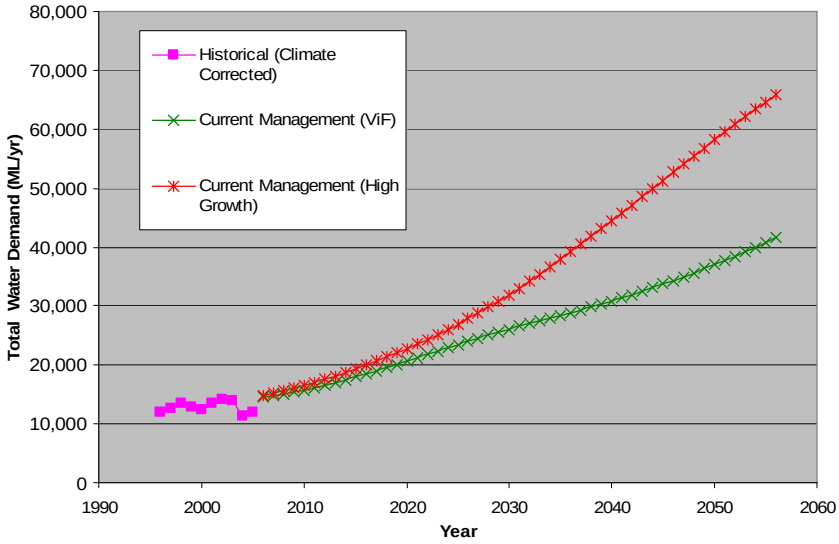

Figure 2: Historical and Forecast Annual Demands

The supply system capacities were calculated using the REALM water resource model based on Western Water's level of service objectives and the requirements of bulk water entitlements. They allow for the increases achieved by prioritising water drawn from the Yarra entitlement, which is a recent change in operational procedures. The results are shown in Table 1, which also shows the possible impact of climate change on those yields.

Table 1: Yield estimates (ML/year) for existing supply systems adopting operating protocol to prioritise Yarra entitlement as primary source, and under the impact of median climate change at years 2030 and 2055.

Supply system	Current	2030	2055
Rosslynne	8,549	7354	5910
Romsey	431	393	342
Lancefield	394	344	280
Woodend	375	356	322
Merrimu	12,090	10867	9572
Pyke's Creek	45	43	43
Total	**21,884**	**19,357**	**16,469**

A comparison of the yield estimates with forecast demands indicates the following, unless further measures to reduce demands are put into place:

- Improvements to the Romsey and Woodend supply systems are required with immediate effect;
- The Rosslynne system will not meet level of service objectives from about 2015 to 2018 onwards, depending on the rate of demand growth;
- The Merrimu system will not meet the level of services objectives from about 2015 to 2018 onwards, depending on the rate of demand growth. Changing the mode of operation to prioritise supplies drawn from the Yarra entitlement would extend those dates to 2020 and 2023 respectively;
- The Lancefield system has some spare capacity which should be sufficient to meet its water supply requirements until about 2030;
- New Bulk Water Entitlements will need to be purchased for Myrniong's supply before 2008.

Potential Water Demand Management Options

Western Water's current aim is to achieve a reduction in demand of 15% by 2010. Future targets, in line with the targets proposed in the CRSWS are as follows:

- 25% reduction in per capita water usage by 2015 compared to the 1990's average (375 L/c/d). This implies average water usage levels in 2015 of 281 L/c/d;
- 30% reduction in per capita water usage by 2020 compared to the 1990's average – implying usage rates of 262 L/c/d.

A wide range of water demand management and supply substitution options were investigated. In order for Western Water to achieve the revised targets a comprehensive program is recommended including:

- The mandatory water efficiency labelling scheme (WELS);
- Permanent low-level restrictions on water use;
- Inclining block tariff on residential customers indexed at CPI increase annually by an additional 1%;
- Introduction of pricing incentives for non residential customers (introduced in 2007);
- Continue and enhance the community education program;
- Non-residential water audits (program 2007 -2010);
- Leakage management program (enhance program of district metering, leak detection and repair and establishment of pressure management areas in 2008);
- Residential shower retrofit (program 2007-2009); and
- Source substitution as follows:
  - Recycled water for Greenfield development (Eynesbury Station, Melton South and Sunbury);

- Ø Incentives for installation of rain tanks for developments elsewhere.
- Control on water efficient fixtures in new development areas; and
- Incentives for home retrofit with water efficient fixtures and fittings at point of sale.

Potential Water Supply Augmentation and Water Recycling Options

Options for increasing supplies to each water supply system by either recycling water or providing new supplies (supply augmentation) were evaluated. The potential yield and cost (both capital and annual ongoing cost for operation and maintenance as well as the long run marginal cost) were estimated for each of these options and environmental impacts, including social impacts, assessed at a preliminary level. A triple bottom line (TBL) assessment was made of the options in order to assist in identifying the preferred options for further investigation and possible implementation when required. The TBL methodology follows that used for the Central Region Sustainable Water Strategy (see Table 2) which will encompass Western Water's Water Demand Supply Strategy. Two additional criteria have also been included that consider the scale and cost effectiveness of each option. These are the Long Run Marginal Cost (LRMC) and 'useful life'. Useful life refers to the estimated length of time before further augmentation would be required for that particular system, and provides an indication of the magnitude of the option in meeting the projected demand increase over time.

Table 2 Assessment Criteria (based on CRSWS)

No.	Criteria	Measure
A	Useful life	Months
Economic		
B	Long run marginal cost (LRMC)	$/ML
1	Net Present Cost	$/ML
2	Effect on GDP (local) and development	Estimated effect on local GDP
Environmental		
3	Greenhouse Gas Emissions	Average Kg CO_2 equivalent per ML per Year
4	Impact upon environmental flow objectives	Estimated relative impact
5	Impact on surface, ground and marine water quality	Estimated relative impact
6	Impact on terrestrial ecosystems	Estimated loss or gain of significant ecological vegetation classes
Social		
7	Acceptability	Estimated degree of opposition or acceptance by the local community

Each criterion in the TBL analysis for each option has been given a rank in the range of -5 to +5. This range varies from extremely negative (-5) to extremely positive (+5) with 0 being neutral. The colour coding is summarised below:

-5	-4	-3	-2	-1	0	1	2	3	4	5

The summary of the TBL assessment for all supply augmentation options is presented in Table 3.

n Table 3: TBL Assessment Summary

					TBL Criteria						
					Economic		Environmental				Social
Supply System	Option No.	Supply Augmentation Option Name	A. Useful Life (months)	B. LRMC ($/ML)	1. NPC/ML ($)	2. Local GDP	3. GHG/ML	4. Enviro Flow	5. Water Quality	6. Terrestial Ecology	7. Community Acceptance
Rosslynne	WA1	Barringo Creek to Rosslynne Reservoir	6	790	0	0	0	-3	-1	-2	-1
	WA2	Barringo Creek - Local Treatment	6	1,247	-2	0	2	-3	-1	-2	-1
	WA3	Supply from Melbourne	126	1,013	0	0	-1	0	0	-1	0
	WA3a	Change Operational Mode of Rosslynne Reservoir	120	474	3	0	-1	0	0	0	0
Merrimu	WA4	Unallocated Inflows into Lake Merrimu	18	1,084	0	0	-1	0	-2	0	0
	WA5	Raise Lake Merrimu	30	2,049	-4	0	-1	-2	-1	-2	0
	WA6	Supply from Melbourne	114	1,668	-2	0	2	0	0	0	0
	WA6a	Change Operational Mode of Lake Merrimu	36	436	3	0	2	0	0	0	0
	WA7	Pykes Creek Reservoir to Bacchus Marsh - major scheme	72	2,322	-5	-5	-1	2	0	0	-5
	WA7a	Pykes Creek Reservoir to Bacchus Marsh - minor scheme	12	1,981	-5	-2	-1	1	0	0	-2
	WA24	Merrimu System: Melton Reservoir to Melton	108	2,025	-3	-5	-1	2	0	0	-5
	WR1	Dual Water Supplies	24	2,984	-5	0	-1	0	0	0	1
	WR3	Caroline Springs Sewer Mining + Pykes Creek to Bacchus Marsh	108	4,765	-5	0	-2	0	1	0	-1
	WR4	Recycled Water-BMID + Pykes Creek to Bacchus Marsh	66	4,964	-5	0	-2	2	1	0	-3
Romsey	WA8	Wellfield between Romsey and Lancefield	156	3,206	-5	0	-1	0	-3	-1	-1
	WA9	Raising Kerrie Dam	24	3,723	-5	0	2	-2	0	-2	0
	WA10	Former Supply Catchments (Bolinda, Charlie's and Main Creeks)	108	3,930	-5	0	-2	-2	-3	-2	-1
	WA11	Supply from Melbourne (Pipe Direct to Romsey)	264	3,801	-5	0	-2	0	0	0	0
	WA12	Supply from Melbourne (Via Sandy Creek Tank to Wrights Res.)	240	4,292	-5	0	-2	0	0	-1	0
	WA12a	Supply from Melbourne (Raise Kerrie Dam to act as storage balance)	90	2,758	-5	0	-2	0	0	-1	0
	WA13	Connect Romsey to Lancefield System	96	1,897	-5	0	-1	0	0	0	0
Romsey & Lancefield	WA14	Raising Garden Hut Reservoir	48	3,935	-5	-1	-1	-3	-1	-1	-1
	WA15	Raising Service Basin at Lancefield	12	5,483	-5	-1	-1	-2	-1	-1	0
	WA16	Wellfield between Romsey and Lancefield	114	3,154	-5	0	-1	0	-3	-1	-1
	WA17	Supply from Melbourne (Pipe Direct to Romsey)	180	3,464	-5	0	-1	0	0	0	0
Woodend	WA18	Raising Campaspe Reservoir	0	1,814	-5	-2	-1	-3	0	-2	-2
	WA19	Supply from Melbourne (new pipeline)	168	1,733	-4	0	-2	0	0	-1	0
	WA20	Increase Supplies from Macedon Storages	0	100	4	0	2	0	0	0	0
	WA21	Supply from Melbourne (existing pipeline)	12	1,002	1	0	-2	0	0	0	0
	WA22	Supply from Kyneton	180	2,315	-5	0	-1	0	0	0	-1
Myrniong	WA23	Water Trading - Pykes Creek Reservoir	240	942	1	-2	-1	0	0	-1	-2
All Systems	WR2	Recycled Water -Local	NA	NA	NA	0	0	0	1	0	1

The key conclusions drawn from the TBL assessment are presented for each supply system below.

Rosslynne

- Changing the operational mode of Rosslynne Reservoir *(Option WA3a)* is the preferred option for immediate supply augmentation. In practice, because of the current drought, this mode of operation is already in effect and it is recommended that this operational mode be continued even after the drought breaks.
- Option *WA3 Supply from Melbourne* is the preferred option to further augment this system.

Romsey

- Further augmentation is required as soon as possible. The desired level of service conditions cannot currently be met.
- The existing practice of supplying water from Melbourne through the Sandy Creek tank should be continued;
- *Option WA8 – Wellfield between Romsey and Lancefield* is the preferred option to augment this system. The feasibility of this scheme should be investigated immediately and decisions taken as to timing of implementation and layout in consideration of Option WA13.
- Option *WA13 – Linking Lancefield and Romsey* is the recommended option to follow WA8 as this will make the "surplus" water currently available in Lancefield also available to Romsey's consumers and facilitate the interlinking of Western Water's water supply systems, thereby reducing risk overall. In view of the time required to investigate Option WA8 and the need to augment supplies as soon as possible it is recommended that Option WA13 be implemented immediately in tandem with the investigations (and implementation) of Option WA8.
- Option *WA12a – Supply from Melbourne (Raising Kerrie Dam to act as a balancing storage)* is the preferred option to follow these options. The supply from Melbourne should be upgraded initially with the raising of Kerrie Reservoir to follow when required.

Lancefield

No action is required, other than the completion of the water treatment works already in progress. In terms of the recommendations for Romsey it is envisaged that Lancefield's water will be connected with those of Romsey.

Woodend

- Further augmentation is required as soon as possible to ensure that the desired level of service , including the objective that restrictions should not occur more than once every ten years on average which cannot currently be met be reinstated.

- Option *WA18 – Increased supply from Macedon Storages* is the preferred option to augment this system. The increase in yield is minor and further immediate action is required.
- Option *WA21 – Supply from Melbourne (existing pipelines)* should be assessed further to determine whether the existing infrastructure can deliver the required supplies.
- Option *WA16 – Raising Campaspe Reservoir* should be investigated further to establish the feasibility of water trading and increasing water abstraction from this reservoir.

Merrimu

- The change in operational mode of the Merrimu system *(Option WA6a)* to prioritise supplies drawn from the Yarra Entitlement, as already implemented on account of the current drought conditions, is the preferred option to augment supplies.
- The recommendation in the CRSWS involving the reallocation of unallocated inflows into Lake Merrimu to Western Water is supported.
- In order to achieve targets for water recycling arrangements to establish third pipe recycled water supplies into new developments in Melton (*Option WR1-(Dual Water Supplies)* should proceed. This is however a less favourable option, from financial perspective, than *Option WA6 – Supply from Melbourne.*

Myrniong

Western Water should purchase water rights from Pyke's Creek Reservoir with a view to increasing the supply to Myrniong when necessary.

Strategy Implementation

The plan for implementing the strategy needs to allow for the risks which may be identified. These risks have been categorised and listed as follows:

- Risks which would require Western Water **to accelerate** the rate of introduction of new supplies:
  - Climate change, if more severe than the medium scenario used in the preceding evaluation, would further diminish yields and increase the levels of demand;
  - A continuation of the dry conditions and low reservoir inflows that have prevailed since 1997;
  - Farm dam development in the catchments supplying Western Water's dams could diminish catchment run-off into those dams and their yields;
  - Occurrence of bushfires in Western Water's water supply catchments and, in the medium to longer term, the ensuing reduction in reservoir inflows;

- Bush fires may cause severe water quality problems thereby curtailing available supplies;
- Increase in environmental flow allocations to sustain or improve river health and associated decreases in allocations to Western Water;
- Anticipated impacts of measures taken to moderate demands may be less successful than currently envisaged or hoped;
- The assumed permanent reduction in demand that follows the lifting of water restrictions may not be as large as estimated;
- Population growth may be higher than the ViF forecast.

- Risks which may allow Western Water to **slow down** the rate of introduction of new supplies:
  - Occurrence of bushfires in Western Water's water supply catchments. Burnt out areas provide increased catchment runoff for between five and ten years. Thereafter runoff diminishes below original levels as water demand of the growing vegetation picks up.
  - Population growth may be lower than ViF forecast;
  - Climate change, if less severe than the medium scenario used in the preceding evaluation, would tend to maintain yields leading to lower than envisaged increases in the levels of demand;
  - Future customer demands are lower than anticipated.

The most evident risk is climate change. Planning undertaken for the CRSWS included a scenario in which the low rainfall patterns experienced since 1997 continue. This scenario assumes that a marked change in rainfall patterns has already occurred.

The yields of Western Water's supply systems under this scenario would reduce as shown in Table 4.

Table 4: Comparison of yield estimates (ML/year) for existing supply systems between long term historical inflows and post 1997 average inflows

Supply system	Long term historical inflows	Post 1997 average inflows
Rosslynne	8,549	6,375
Romsey	431	210
Lancefield	394	274
Woodend	375	300
Merrimu	12,090	9,212
Pyke's Creek	45	43
Total	**21,884**	**16,414**

The outcome of the assumption of this step change in rainfall is that available supplies would be considered to already match those forecast under the median climate change scenario in 2055. This scenario would need to be managed by accelerating supply augmentation.

The consequences of planning to introduce new schemes at too slow a rate are considerably more severe than the reverse. The five yearly updates of the WSDS, coupled to the Water Plan cycle, mitigate the risk of providing schemes too early. The procedure adopted for the CRSWS to manage this risk (of late scheme provision) is to preserve a buffer between demand and supply availability of seven years growth in demand. This equates to planning for the implementation of new supplies seven years in advance. The adoption of this approach is recommended for Western Water.

In addition there are some further measures that are recommended:

- Measures taken to moderate demands should be closely monitored for their effectiveness and cost effectiveness. Further measures should be considered if it becomes evident that the measures employed are less effective than planned - for example by the introduction of tougher permanent water savings measures or increasing water prices;
- Below average rainfall in 2007 should trigger a review of the need to bring forward planning for the augmentation of supplies – namely Option WA3 to increase supplies which may be drawn from Melbourne to supply the Rosslynne system.
- In the event of large areas of catchments being burnt Western Water should reassess the implication of this on their WSDS. Although bushfires increase water availability in the short term the vegetation regrowth will reduce water availability in the longer term.
- Regular five yearly updating of the WSDS, together with monitoring of customer numbers and coupled where possible to the census data, will ensure that sufficient allowance can be made for variability in the demand forecasts arising from changes in population growth rates.

The strategies depicted above provide an implementation schedule and funding requirements as outlined in Table 5 and Table 6. All cost estimates are indicative and should not be used for budgeting purposes.

- **Table 5: Implementation schedule – All Systems**

Option	Implementation period	Costs
Water Demand Management		
Water demand management study	2007	$100,000
Water Efficiency Labelling Scheme (WELS) – Total Program Impact	2007 – 2011	$5,000
Permanent Low Level Restrictions on Water Use	2006 – 2056	$107,000

Option	Implementation period	Costs
Community Education Program	2006 – 2056	$4,590,000
Non-Residential Water Audits	2007 – 2010	$6,000
Fixture Code for New Development	2007 – 2056	$64,000
Pricing Incentives for Non-Residential Users	2007 – 2056	$25,000
District metering, leak detection and repair, and establishment of pressure management areas	2008 – 2056	$8,000,000[1]
Showerhead Retrofit	2007 – 2009	$341,000
Incentives for home retrofit at point of sale	2007 – 2056	$260,000

Note 1: Includes expenditure that currently forms part of Western Water's leakage reduction program and mains renewal programs. Cost is indicative only, and will be modified as program is developed.

Table 6: Implementation schedule – Individual supply systems

Supply System	Option	Implementation year (allowing for buffer)		CAPEX cost ($million)	Ongoing / operational cost ($ million/year)
		VIF	High growth		
	Water Recycling				
Merrimu	WR1 Dual Water Supplies (Eynesbury and Melton South)	2007	2007	$26.1	$0.67
	Water Supply Augmentation				
Rosslynne	WA3a: Change of operational mode	2007	2007	Nil	$3.5
Rosslynne	WA3: Supply from Melbourne	2016[1]	2012[1]	$24.8	$2.0
Merrimu	WA6a: Change of operational mode	2022	2018	Nil	$1.7
Merrimu	WA4: Unallocated Inflow from Lake Merrimu	2007[2]	2007[2]	$3.5 [2]	$0.17
Romsey	WA 8: Wellfield between Romsey and Lancefield	2007	2007	$5.9	$0.14
Romsey	WA13: Connect Romsey to Lancefield System	2007	2007	$2.3	$0.05
Romsey	WA12a: Supply from Melbourne (Provide additional, local balancing storage when required)	2028	2022	$3.3	$0.07
Woodend	WA20: Macedon Storages to Woodend	2007 (immediately)	2007 (immediately)	Nil	$0.01
Woodend	WA19: Supply from Melbourne/Rosslynne	2007	2007	$5.3	$ 0.3

Supply System	Option	Implementation year (allowing for buffer)		CAPEX cost ($million)	Ongoing / operational cost ($ million/year)
		VIF	High growth		
Woodend	WA18: Raising Campaspe Reservoir	2007 (investigate feasibility)	2007 (investigate feasibility)	Investigation only	
Myrniong	WA23: Water Trading – Pyke's Ck Reservoir	2007	2007	$0.1	$0.01

Note

1: Persistence of current low inflows would require that this date be brought forward to 2009, in addition to other measures.

2: Whilst the transfer of allocation should be implemented as soon as possible any improvements to infrastructure (i.e. upgrading of the water treatment plant) would not be required before about 2028.

A summary of the actions required presented for each supply system and indicating the year that forecast demand exceeds supply is presented in Table 7.

Table 7: Summary of actions for next seven years

Supply System	Year that forecast demand exceeds supply		Actions to be taken over next 7 years
	Med. climate change scenario	Low inflows scenario	
All systems	Various –see below	Various –see below	1) Water demand management measures in accordance with Table 5
Rosslynne	2007	2007	1) Change of operational mode (2007); 2) Possible implementation of Option WA3: Supply from Melbourne (2009 to 2016)
Merrimu	2028	2007	1) Implement Option WR1: Dual Water Supplies (Eynesbury and Melton South) (2007) 2) Implement Option WA4: Unallocated inflow from Lake Merrimu (2007)
Romsey	2007	2007	1) Implement Option WA13: Connect Romsey to Lancefield system (2007) 2) Commence investigations of Option WA8: Wellfield between Lancefield and Romsey (2007)
Woodend	2007	2007	1) Implement Option WA 20: Macedon Storages to Woodend (2007) 2) Implement Option WA19: Supply

Supply System	Year that forecast demand exceeds supply		Actions to be taken over next 7 years
	Med. climate change scenario	Low inflows scenario	
			from Melbourne / Rosslynne (2007) 3) Commence feasibility investigation of Option WA 18: Raising Campaspe Reservoir (2007)
Myrniong	2010	2007	1) Purchase water rights when available (2007)